

ABSTRACT

PREPARATION AND STANDARDIZATION OF NOODLE RECIPES FROM CASSAVA (*MANIHOT ESCULENTA* L.) FOR LIVLIHOOD

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The present research work was carried out in the Laboratory of Department of Horticulture, North Eastern Hill University, Tura Campus, Meghalaya to standardize the different recipes for preparation of noodles. Cassava was procured from the local market of West Garo Hills. The methodology used for the physico-chemical analysis of fresh cassava and preparation of noodle recipe have been standardized. Organoleptic test and bio-chemical changes in processed products at ambient temperature regime was studied. The most acceptable recipe as well as the ultimate storage life of the selected products was finalized on the basis of sensory attributes. The Completely Randomized Block Design has been followed for statistical interpretations. The result showed that cassava contains high amount of carbohydrate (35.90%) and starch (26.50%). Cassava has TSS content of 10.33%, total sugars 2.935%, acidity 0.128%, protein 1.80%, ascorbic acid 31.48mg/100gm and 11.25 IU β - Carotene. As per the organoleptic test the treatments T2 and T3 were scored best with 3.901 and 3.591 respectively and benefit cost ratio of 1.64 % for T2 and 1.48 % for T3.

Keywords: Beta carotene, cassava, organoleptic test, treatment, TSS

EVALUATION OF BIOEFFICACY OF EMAMECTIN BENZOATE AGAINST POD BORER AND NATURAL ENEMIES ON CHICK PEA (*CICER ARIETINUM* L.)

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One of the most practical means of increasing chickpea production is to minimize losses caused by the biotic factors, which include insect-pests, diseases and weeds under field conditions. Gram pod borer, *Helicoverpa armigera* (H) causing 29% yield losses in chickpea at national level. A field experiment was carried out during 2012 at BSP farm, JNKVV, Jabalpur. The trial was carried out with eight treatments and replicated thrice following the Randomized Block Design (RBD). Plot size was kept 4m x 5m with row x plant spacing of 45 x 05 cm. Emamectin benzoate 05% WG @ 138 g/ha (6.9 g a.i/ha) was found to be the most effective dose against Bengal gram pod borer (*Helicoverpa armigera*) and which was at par with the higher doses of Emamectin benzoate 05% WG @ 188 and 162 g/ha (9.4 & 8.1 g a.i/ha). Also the treatments of Emamectin benzoate 05% WG did not show any adverse effects on the populations natural enemies observed in the treated plot viz, Lady bird beetle and Chrysopa.

Keyword: *Helicoverpa armigera*, Emamectin benzoate, Natural enemies and chickpea.

INTEGRATED PEST MANAGEMENT STRATEGIES TO MANAGE THE MAJOR PESTS OF RICE (*ORYZA SATIVA* L)

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Rice (*Oryza sativa* L) is the important food crop of India and the world. It is attacked by several insect pests at their different stages of growth and development but in the agro-ecological situations of Bihar the yellow stem borer (*Scirpophaga incertulas* Walker) and the rice leaf folder (*Cnaphalocrocis medinalis* Guenee) have been identified as the major threat to the rice crop causing substantial damage to the rice crop. The field efficacy of an integrated pest management module was compared with the other pest management strategies which are being adopted by the rice growing farmers of this region at different locations. Across the locations, IPM module was found most effective in reducing the pest incidence level caused by these pests and recorded 6.30 per cent dead hearts (DH) and 7.72 per cent white ear head (WEH) due to incidence of yellow stem borer (YSB) and 5.70 per cent damaged leaves due to rice leaf folder (LF). The pest incidence levels were higher in those fields where farmer's practices were adopted and recorded 7.32 per cent DH and 10.73 per cent WEH due to YSB and 7.70 per cent damaged leaves due to leaf folder. The grain yields were also significantly influenced and recorded higher grain yield (6.15 t / ha) with the IPM module as compared to farmers' practices (5.09 t / ha).

Keywords: Rice, major pest, stem borer

HYDROPONIC FODDER IS THE BEST LIVESTOCK FEED***¹A. K. PADHIARY, ²S. P. MISHRA, ³A NANDI, ⁴A PATTNAIK, ⁵S. BEHERA****¹Krishi Vigyan Kendra (OUAT) Chiplima, Sambalpur, Odisha, India, ²Krishi Vigyan Kendra, Jajpur, Odisha, India****^{3,4}Dept. of Vegetable Science, OUAT, Bhubaneswar, 751003, Odisha, ⁵Krishi Vigyan Kendra, Kalahandi, Odisha, India**

The Hydroponic Fodder as an alternative to conventional method of green fodder production, hydroponics technology is coming up to grow fodder for farm animals. Green fodders produced by growing seeds without soil but in water or nutrients rich solutions are known as hydroponics green fodder. Compared to conventional methods of growing fodder, hydroponic fodder requires lesser space and produces highly nutritious fodder than soil farming. The hydroponic fodder system is a temperature and humidity controlled growing room that is specifically designed to sprout grains that are very nutritious. A selection of grains are put into photo-chemically treated trays without soil and sprayed with nutrient rich water solution at predetermined intervals. The temperature and humidity inside the hydroponic fodder system are controlled using only a hydro-net and a hydro-cloth, to ensure higher growth and the best nutritional value possible. There is no electricity usage whatsoever. After only 7 days, the fodder is removed from the tray and can be fed to the animal. The animal eats everything (i.e. roots, leaves and nuts) therefore, the hydroponic fodder system is waste-free, 100% sustainable and cost-effective. Hydroponics fodder is young tender grass grown from a cereal grain mostly barley. In essence it replaces grains like dairy meal, pig's feeds and poultry feed concentrates. Globally, hydroponic fodder is considered to be the best livestock feed.

POTENTIAL OF CASHEW APPLE IN PROCESSING INDUSTRY**A. SOBHANA****Kerala Agricultural University, Vellanikkara-680 656, Thrissur, Kerala**

Processing of cashew apple is to be considered as a programme of agricultural waste utilization, adding income to the growers. The excellent qualities of cashew apple offer immense opportunities for its processing to various value added products. KAU has standardized the technologies for removal of tannin as well as preparation of 16 value added products from cashew apple. Commercial exploitation of cashew apple is the need of the hour considering its vast potential in enhancing the income from cashew plantations. It is one of the prime areas of utilizing the indigenous fruit and opens up wider market possibilities and hence tremendous scope for commercialization. The running of the cashew apple processing unit at CRS, Madakkathara under Kerala Agricultural University for the commercial production, clearly demonstrates the economic viability of cashew apple processing.

ENHANCING CASSAVA FARMERS FARM PROFITABILITY THROUGH INNOVATIVE PRODUCTION TECHNOLOGIES AND VALUE ADDITION TECHNIQUES IN TAMILNADU, INDIA**A. JANKI RANI****Dept. of Human Development and Family Studies, Community Science College and Research Institute, Tamil Nadu Agricultural University, India**

Cassava is an important tuber crop in India which is grown in 2.7 lakh hectares area and the production is 71 lakh tonnes. The average yield of cassava is 22 tonnes per hectare. It is a richest source of starch (25 to 35%) and mainly processed for starch and sago. In India, Tamilnadu state stands first in area, production and processing of cassava. Even though the area is more in TamilNadu the production is not sufficient to meet the growing demand of the food and textile industries. The farmers are cultivating cassava in larger area but the scientific method of cultivation is poor. Scientists are developing lot of varieties, new improved technologies etc., while seeing the knowledge and adoption of recommended practices were found to be least and facing a yield gap of 6.55 t/ac. Keeping this in view this study was conducted to enhance their profitability of cassava growers. In order to overcome this yield gap initial awareness campaigns and group discussions were conducted on the dissemination of improved cassava cultivation technologies and value addition techniques. 200 socially backward farmers were selected and various participatory approaches were used to update their knowledge. Hands on trainings on value addition were conducted for 500 women and 5 SHGs were formed. Free chipping machines were distributed to SHGs and Market linkages were arranged. The Impact showed that due to the interventions they gained 45.00 % more knowledge and skill in cassava production technologies and got 3.92 t/ac yield increase and on an average of Rs.16,160/-per acre income increase seen than the previous year. The fellow farmers were also started adopting the technologies. The cassava area has been expanded in the study area. Women SHG'S are doing value added products in a small scale. They got Rs. 420 for every Rs. 100 investment as additional economic benefit to improve the socio economic status of their family. The cassava growers opined that innovative approaches were the best for the technology transfer and for their livelihood security.

EVALUATION OF DROUGHT TOLERANCE INDEXES FOR IDENTIFICATION OF SUGAR BEET UNDER INDIAN SUB- TROPICAL CONDITIONS

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Drought, an abiotic stress, is one amongst the most harmful stress in respect to agricultural crops. In recent times, incidence rate of occurrence of drought has been increased with variation in intensity from moderate to severe which hampers the production and yield of crops. Sugar beet is an important sugar crop and an emerging bio-ethanol crop. In India, production of sugar beet is now taking pace due to development of indigenous varieties suitable for Indian agro-climatic conditions especially for sub-tropical conditions. Less water availability and increased frequency of drought have resulted in need of identifying and developing drought tolerant and susceptible sugar beet varieties. The aim of the study was to identify drought tolerant and susceptible sugar beet varieties for Indian sub-tropical conditions. In this study, thirteen indigenous varieties were planted under normal irrigation and drought condition. Drought susceptible indices (DSI) and tolerance index (DTI) were used for assessing the drought effect on juice quality parameters (Brix, sucrose %, Commercial beet sugars, Purity % and ethanol content). Results showed that range of DSI of brix lies from -2.16 to 6.71, sucrose % from -3.43 to 3.85, commercial beet sugars from -3.89 to 3.37, purity % from -2.81 to 3.64.

ECONOMIC FEASIBILITY OF SORGHUM CROP UNDER ORGANIC FARMING

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The economic feasibility is a key factor for technology adoption and sustainable production. Sorghum is especially valued in hot and arid regions for its resistance to drought and heat. It contains about 10-12% protein, 3% fat and 70% carbohydrate. Diversification of sorghum from the food chain to alternate uses particularly in brewing industries for production of ethanol and starch manufacturing is happening in India. An experiment is designed to assess the economic feasibility of sorghum under organic farming. This field experiment was conducted in the certified Organic farm, Navsari Agricultural University, Navsari, Gujarat in the year 2015-2018 to study the Economic feasibility of sorghum crop under organic farming in is south Gujarat .The experiment was conducted in *rabi* season as well as laid out in Factorial Randomized Block design (FRBD) with three replications and it comprised of three treatments with different levels. The treatments were, i) Varieties (V_1 : GJ 38 & V_2 : GJ 42), ii) Solid organic nutrient (M_1 :100% RDN through NADEP compost & M_2 : 50% RDN through NADEP compost) and iii) Liquid organic nutrient (L_0 : Control, L_1 : Seaweed 4%, three spray & L_2 : Enriched banana pseudostem sap 1%, three spray). All carried out operations and used inputs were recorded. Based on those records, the production costs for crop in all the three years were estimated. The costs include operations like seeding, ploughing, harrowing, spraying and harvesting, as well as inputs like seeds, inoculates, neem oil and organic manures. The benefits include the gross revenue obtained by multiplying the production amount with the market price and the BCR is calculated for treatment and the possible treatment combinations. From the experiment, it can be concluded that Organic farming can be a viable option, even if the producer prices are the same as that of conventional food. Double income of organic farmers can be ensured if the premium prices are available. Sorghum variety GJ 42 is more feasible under organic farming as compare with GJ 38. Sorghum had best economical performance under organic farming with the inputs as 50% RDN through NADEP (M_2) compost along with spray of Enriched banana pseudostem sap 1% (L_2) at three times (20, 40 and 60 DAS).

Key words: Economic feasibility, BCR, Benefit, Cost, Organic farming, Sorghum

TACKLING CLIMATE CHANGE THROUGH AGROFORESTRY TECHNOLOGY

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Agriculture and climate change, an interrelated process, both having their specific place in global scale. Climate change is already affecting agriculture as well as the ecosystem negatively and this situation is likely to worsen gradually. Agroforestry is one of the most conspicuous land use system which helps in reducing land clearing and maintaining carbon in existing vegetation. It is an innovative practice that is designed to enhance productivity in such a way that often contributes to mitigate the problem of climate change through enhanced carbon sequestration, strengthen the system's ability to muddle through the adverse impacts of changing climate conditions. Pines, fir, juniper, willow, poplar, etc. are the trees that are included under agroforestry system. Mitigation measures in the agriculture and forestry sectors are engendering much interest as a potential source for added income to the rural areas and as a means of fuelling adaptation to climate change. This system provides key ecosystem services like water conservation, improved micro-climatic condition, enhanced soil productivity, nutrient cycling, and conservation and control of pests and diseases. Abating the process of deforestation, this system involves more trees in farms that results in maintaining local climate, water resources and biodiversity and community livelihood; thereby increasing resilience to the impacts of climate

change. Owing to agroforests' ability to store carbon, it also has potential to create natural forests and maximizing economic benefits.

Keywords: Agroforestry, Climate change, Agriculture, Deforestation.

CRITICAL ROLE OF WATER IN ACHIEVING SUSTAINABLE DEVELOPMENT GOALS

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Water is one of the precious natural resources present on the earth and it is very important for survival of flora and fauna. Quality of water is equally important to the quantity available. While considering of total percentage of water present on earth as 97% in ocean and 3% as a fresh water with considering glacier. Out of which 2 % as fresh water in the form of surface and subsurface water bodies and it usable for the human consumption. "Water is at the core of sustainable development" and the latter is strongly connected to the availability and access to sufficient quantity and quality of water for the preservation of healthy ecosystems and is critical for socio-economic and human development. It is vital for reducing the global burden of disease and improving the health, welfare and productivity of populations. It is central to the production and preservation of a host of benefits and services for people. Water is also at the heart of adaptation to climate change, serving as the crucial link between the climate system, human society and the environment. So when we consume water its quality measurements are necessary and management should be done in systematic path. Water can pose a serious challenge to sustainable development but managed efficiently and equitably, water can play a key enabling role in strengthening the resilience of social, economic and environmental systems in the light of rapid and unpredictable changes.

Keywords- Water, Sustainable, consumption, Development

FIELD STUDY ON ALLELOPATHIC ASSESSMENT OF WINTER WEEDS ON GROWTH OF LITTLE CANARY GRASS (*PHALARIS MINOR* RETZ.) AND WHEAT (*TRITICUM AESTIVUM* L.)

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Medicago denticulata, *Chenopodium album* and *Melilotus indica* are the major annual weeds of cultivated wheat, other than *Phalaris minor* which is the most dominant one. In order to determine the allelopathic potential of these winter weeds, sole aqueous extracts of 10 % concentration and their combinations were tested on growth of little canary grass (*Phalaris minor* Retz.) and wheat (*Triticum aestivum* L.) in a field experiment. Application of different weed aqueous extracts showed non-significant effect on germination of wheat while germination and seedling emergence of *Phalaris minor* was reported lower under treatments containing *Melilotus indica* weed aqueous extracts as compared to other treatments leading to less number of shoots per square metre of *Phalaris minor* under these treatments initially. Inhibitory effect of weed aqueous extracts on growth and development of *Phalaris minor* reduced with subsequent stages of crop growth was recorded, being 75% at 15 DAS and 25% by maturity stage. Different weed aqueous extracts recorded non-significant difference in plant height of wheat while plant height of *Phalaris minor* was reported at par under different treatments at each crop growth stage (15, 30, 45, 60 DAS and at maturity) . *Medicago denticulata* (10%) + *Melilotus indica* (10%) + *Chenopodium album* (10%) and *Melilotus indica* (10%) + *Chenopodium album* (10%) were the best treatments in terms of dry matter accumulation of wheat and at all the stages significantly lowest dry matter accumulation was recorded under *Medicago denticulata* (10%) + *Melilotus indica* (10%) + *Chenopodium album* (10%) at par with *Melilotus indica* (10%) + *Chenopodium album* (10%) followed by *Medicago denticulata* (10%) + *Chenopodium album* (10%) at par with *Melilotus indica* (10%). This study validated the allelopathic potential of all three weeds and concluded that combination of aqueous extracts of *Medicago denticulata* (10%), *Melilotus indica* (10%) and *Chenopodium album* (10%) and *Melilotus indica* (10%) + *Chenopodium album* (10%) achieved significant control of *Phalaris minor*. Allelopathic potential of simultaneously growing weeds in wheat field can thus be utilized to manage the most problematic weed, *Phalaris minor*, of wheat in an eco-friendly manner without compromising growth of wheat.

NOTES ON STEINERNEMA ABBASI (RHABDITIDA: STEINERNEMATIDAE) STRAINS AND VIRULENCE TESTS AGAINST LEPIDOPTERAN AND COLEOPTERANS PESTS

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Three populations (DS4, DS6 and DS7) of entomopathogenic nematodes were isolated from the agricultural lands of district Meerut of western Uttar Pradesh, India. Morphological characters especially presence of horn like structures on labial region indicated that the strains were closely related to the "bicornutum" group of *Steinernema* spp. The nematodes were conspecific to *Steinernema abbasi* based on morphology, morphometric and molecular analysis. The morphology was similar to the type population with only difference being the presence of mucron in second generation male not observed in original population. The

analysis of ITS rDNA sequences revealed that at positions, 211 and 407, T and A are present in studied strains while in the type species, AY230158 two unambiguous sequences Y and R are present at same locations. No difference was observed in D2-D3 domain of 28S rRNA. The Indian strains were also tested positively for its virulence against four major pests, namely, *Galleria mellonella*, *Helicoverpa armigera*, *Spodoptera litura* and *Holotrichia serrata* with good efficacy on the virulence except *H. serrata*. Strain DS7 was more pathogenic compared with other two strains with LD50 values of 7.28, 5.65 and 17.65 IJs, respectively against *G. mellonella*, *H. armigera* and *S. litura*.

Keywords: Bicornutum, 28S rRNA, entomopathogenic nematode, ITS rDNA

DESIGN THERMAL COMFORT IN GREENHOUSES ENVIRONMENT

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The move towards a de-carbonised world, driven partly by climate science and partly by the business opportunities it offers, will need the promotion of environmentally friendly alternatives, if an acceptable stabilisation level of atmospheric carbon dioxide is to be achieved. This requires the harnessing and use of natural resources that produce no air pollution or greenhouse gases and provides comfortable coexistence of human, livestock, and plants. This study reviews the energy-using technologies based on natural resources, which are available to and applicable in the farming industry. Among these are greenhouses, which are necessary for the growth of some plants (i.e., vegetables, flowers, etc.) in severe climates. However, greenhouses require some air conditioning process to control their temperature and relative humidity to suit specific plants. To achieve this, a novel air humidifier and/or dehumidifier systems using mop fans had been designed and employed in an experimental greenhouse to evaluate its performance under a controlled environment. This device helped to reduce the energy consumption of the greenhouse whilst providing a pleasant environment for the plants inside the greenhouse. The system was designed taking into account the meteorological conditions, which affect the environment inside the greenhouse. The performance of the system was monitored over a period of time by measuring the temperature and relative humidity of the greenhouse. Results of the monitoring have shown that the system was able to provide comfortable conditions (temperatures of 16-26°C and relative humidity of 65%) suitable for the plants grown in the experimental greenhouse. It also enabled the minimisation of temperature variation and, hence, avoided the hazard of any sudden climatic change inside the greenhouse.

Keywords: Greenhouse environment; energy efficient comfort; ventilation; humidity: sustainable environmental impact.

FUMIGANT ACTIVITY OF ORANGE JASMINE, *MURRAYA PANICULATA* (L) JACK. ESSENTIAL OIL AGAINST ALMOND MOTH, *CADRA CAUTELLA*

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Plant secondary natural insecticides are chemicals extracted from plants called botanical insecticides and used as potential alternative to synthetic or chemical pesticides which is an excellent component of integrated pest management. Identifying and evaluating plant secondary natural insecticides is the important feature for developing novel botanical insecticides. Leaves of Orange Jasmine, *M. paniculata* (L) Jack were selected for current study. The essential oil of *M. paniculata* was obtained by hydrodistillation extraction method. The fumigant activity was investigated at different concentrations viz., 16, 20, 28, 36 and 60 µl/lit of air using gas-tight flat bottom flasks (250ml) against different stages viz., eggs (2-3 days old), larvae (5-7 days old), and adult (2-3 days old). The mortality was recorded after 24, 48 and 72hrs of exposure time. For eggs, mortality was evaluated based on hatchability after treatment. Studies revealed that *M. paniculata* essential oils exhibited good fumigant activity. After 24, 48 and 72 hrs of treatment at 60µl/lit dose the mortality for larvae were 23, 63 and 70%, and for adults were 33, 87, 100%, respectively. Similarly, the mortality for eggs was 52 and 55.67%, respectively, after 24 and 48 hrs of treatment at 60 µl/lit dose. Gas chromatography-mass spectrometry (GC-MS) analysis of essential oil revealed 32 volatile components. The major components were germacrene-D (23.9%), alpha-zingiberene (23.3%), beta-caryophyllene (17.2%), trans-nerolidol (13.2%), humulene (4.28%), delta-elemene (4.06%) and γ -Murolene (3.42%)

EVALUATION OF PROMISING GENOTYPES OF VEGETABLE PEA FOR WESTERN PLATEAU REGION OF JHARKHAND

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Pea (*Pisum sativum* L.) belongs to the family fabaceae having a chromosome number $2n=2x=14$. It is consumed as fresh vegetables or dry seeds throughout the world. In India, peas are grown as winter vegetable in plains and as summer vegetable in hills. In recent years, public sector and a number of private seed companies in India have been able to develop a good number of

commercial cultivars, which are not suitable to all the regions of the country. They are varying in various characters from one region to another. Now a day's large numbers of pea genotypes are available in the market but all these are not adapted and suited to all the regions. No specific recommendations about the suitability of genotypes for a particular area are available. Farmers are facing problems in selecting genotypes for a particular area for commercial cultivation. Considering the above mentioned facts, there is a need to compare some of the available genotypes to select high yielding, better adaptable genotypes for commercial cultivation. Therefore, the present project has undertaken to identify superior and promising pea varieties in respect to yield, disease resistance and quality of the produce under plateau condition of Jharkhand. An experiment was carried out during Rabi 2017-18 at Zonal Research Station, Chianki using seven promising genotypes with three replications in randomized block design. Observations on nine important characters were recorded. Analysed data revealed that out of seven entries of vegetable peas the variety Saloni-50 gave significantly highest yield (153.37 q/ha) followed by Sweet Rubi (150.17 q/ha) and HACP-2 (149.75 q/ha) which are statistically at par. With respect to earliness and pod diameter, Arkel Mutant-1 was found best genotype in desired direction. On the basis of these observations, it may be concluded that the genotype Saloni-50 was found most suitable vegetable pea genotype for rabi cultivation in the western plateau region (sub zone-V) of Jharkhand. **Keywords:** Vegetable Pea, Fabaceae, Genotype, Evaluation.

GENOME EDITING OF FRUIT CROPS IN THE SAPINDACEAE FAMILY: LYCHEE (LITCHI CHINENSIS) AND LONGAN (DIMOCARPUS LONGAN)

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The Sapindaceae family, enriched with about 2000 species spread in more than 125 genera, harbours several important subtropical and tropical crops, among them, litchi (*Litchi chinensis* Sonn.) and longan (*Dimocarpus longan* Lour.) are the most prominent. Environmental requirements for litchi and longan are largely similar but due to their limited environmental adaptation, cultivation is restricted to countries with subtropical climates with the asia-pacific region accounting for more than 90% of total world production. However, the cultivation is limited to only a few cultivars revealing limited genetic variability and CRISPR has the potential to be harnessed for allele-specific editing. The availability of genome information now makes possible studies on genetic diversity and high-density linkage maps, and the transcriptome information will be very useful to perform functional studies and develop additional DNA markers. Although the level of genomic work on longan is low compared to litchi, some transcriptomic works have also been carried out in this fruit crop. CRISPR-based genome editing is rapidly becoming the system of choice for targeted mutagenesis in a growing variety of woody species, including horticultural trees. Previous-generation methods for gene silencing in plants rely on expression of antisense RNAs, small interfering RNAs or microRNAs to base-pair with target mRNAs for degradation, often with unpredictable and unstable outcomes. The specificity and efficiency of CRISPR for targeted DNA mutations, and the ease of adoption in virtually any species are behind the current revolution in genomic editing. The simplicity, versatility and species-independent nature of the CRISPR system offers researchers a previously unattainable level of precision and control over genomic modifications. Successful applications have demonstrated the efficacy of CRISPR technology at generating null mutations in the first generation. This eliminates the lengthy process of multigenerational crosses to obtain homozygous knockouts.

ROBOTICS IN HORTICULTURE: A NECESSITY OF THE HOUR

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Availability of affordable, safe, high quality and nutritious food to the increasing population in a sustainable manner has become a huge challenge in present times. So, meeting the food demands from the limited resources available is the only option left with us. Here comes the role of robotics and automation in the food industry. The autonomous robots have potential to work on the principles precision farming with precised amount of inputs to get maximum output. Horticultural tasks are arduous and expensive. Till date some robots have been developed to work under the protected structures but robotic systems for horticultural field production must also be able to operate in unstructured agricultural environments without impairing the quality of the work that is achieved by current methods and means. In order to assimilate robotic systems into horticultural processes, technologies must be developed to overcome difficult problems such as continuously changing climatic and environmental conditions. Apart from this, reduction of agricultural workers constrains the farming system and the automated robots have potential to take off the load of labour shortage and perform labour-intensive works like grafting, harvesting and weeding, and thereby decrease the cost of cultivation and ultimately increase the productivity. Various technologies like machine vision, image processing, and mechatronics can be assembled in a single platform named agricultural robot which can provide optimal solution for horticultural operations. The cost of the robotic system must be low for it to be cost effective, but in addition, safety and reliability are in the priority.

Reliability on the machineries, ensuring the safety of people and conservation of the environment without compromising the yield of the crop are mandatory.

Key words: Sustainable, Automation, Precision farming, Machine vision, Mechatronics

SOIL COMPACTION INDUCED DUE TO MULTIPLE PASSES FOR DIFFERENT TILLAGE PRACTICES

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Soil compaction has become a threatening issue and is caused due to the various farm operations carried on the fields. The increase in subsurface soil compaction has led to reduced crop yields. A study for evaluating the sub soil compaction caused by different tillage practices was undertaken. The independent parameters for the study were 2 soil types, 6 tillage practices, 2 forward velocity ranges and 2 depth of operation ranges. The fields were irrigated and then soil compaction was also noted at optimum moisture level just after irrigation but before the tillage treatments. Cone index of both types of soils were found lesser after irrigation, than that of before irrigation conditions. After irrigation, dry bulk density of sandy loam soil(S1) was higher, whereas for silty loam soil(S2), dry bulk density was lower as compared to the before irrigation conditions. Tillage treatments were carried out at the optimum moisture content just after irrigation. Cone indices, at sub-soil depths (at 15 cm and beyond) for both the soil types, were found to be comparatively more than the initial soil compaction for most of the treatments in rotavator(P3 and P4) and spading machine(P5 and P6) tillage practices. Dry bulk density was observed to be lower after the tillage treatments as compared to the initial soil compaction in both the soil types. Mean weight diameter(MWD) of soil clods formed was more for the silt loam soil type(S2) as compared to the sandy loam soil type(S1) for all the tillage treatments. Rotavator and spading machine was found to cause sub soil compaction.

Keywords: Soil compaction, tillage, irrigation, rotavator, spading machine, bulk density, cone index.

ICT IN AGRICULTURE: A ROAD TO DOUBLING THE FARMERS' INCOME

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Information and communication technology in agriculture (ICT in agriculture), also known as e-agriculture, is developing and applying innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. ICT in agriculture offers a wide range of solutions to some agriculture challenges. It is seen as an emerging field focusing on the enhancement of agriculture and rural development through improved information and communication processes. In this context, ICT is used as an umbrella term encompassing all information and communication technologies including devices, networks, mobiles, services and applications; these range from innovative internet- era technologies and sensors to other pre- existing aids such as fixed telephones, television, radios, and satellites. E-agriculture continues to evolve in scope as new ICT application continues to be harnessed in the agriculture sector. More specifically, e- agriculture involves the conceptualization, design, development, evaluation and application of innovative ways to use ICTs in the rural domain, with a primary focus on agriculture. Provisions of standards, norms, methodologies, and tools as well as development of individual and institutional capacities, and policy support are all key components of e-agriculture.

Keywords: e-agriculture, ICT, rural development, innovative and institutional capacity.

CORRELATION AND PATH ANALYSIS IN WINGED BEAN [*PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC.] FOR TUBER YIELD AND ITS CONTRIBUTING CHARACTERS

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The present investigation was carried out for correlation and path analysis in winged bean for tuber yield and its contributing characters in twenty two accessions of winged bean. The experiment was conducted at Vegetable Research Farm of Banaras Hindu University, Varanasi, Uttar Pradesh during kharif season of 2015. The correlation study revealed that tuber yield per plant (g) had positive and highly significant association with total sugar content in tuber(g/g), tuber dry matter %, tuber length (cm), tuber breadth (cm), chlorophyll at 1st pod initiation (SPAD), chlorophyll at flower initiation (SPAD), days to tuber harvesting, LAI at 1st pod initiation. The association studied indicated that the tuber yield per plant (g) of winged bean can be improved by selecting genotypes having higher performances for these traits. The phenotypic path-coefficient analysis showed that the total sugar content in tuber (g/g) had maximum direct effect as well as indirect effect on the tuber yield per plant (g). It would be rewarding to lay stress on these characters in selection programme for increasing yield.

Keywords: Winged bean, Correlation, Path Analysis, Tuber Yield.

TRADITIONAL PRODUCTION METHOD VS MODERN PRODUCTION METHOD OF PADDY CULTIVATION IN SINDHUDURG DISTRICT OF MAHARASHTRA

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The present study was taken up in Sindhudurg district of Maharashtra to compare the economics of rahoo (traditional) and transplanting (modern) method. The data collected pertained to agricultural year 2014-2015. The study analyzed whether the rahoo method is profitable or not. Out of a sample 120 paddy cultivators 90 has rahoo cultivated paddy and 30 have transplanting method paddy cultivation. Per hectare cost of cultivation was also found more in transplanting method (60946.85) than rahoo method (51504.20). Per hectare gross returns obtained from paddy cultivation were (43525.60) and (48608.90) in rahoo method and transplanting method, respectively. Benefit cost ratio was observed 1:1.11 and 1:1.27 in rahoo and transplanting method. Thus, the transplanting method of paddy cultivation was found profitable in Sindhudurg District. As regards to inputs resource efficiency, seed was found to be excess utilized in the both the methods. This revealed scope for proper allocation of resources in paddy cultivation in both the methods.

Key words: CACP cost concept, traditional paddy cultivation, cost of cultivation

STUDY ON INNOVATIVE APPROACHES OF PEST CONTROL IN MODERN AGRICULTURE

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Now a days world population is increasing day by day but production of crops are decreasing. For getting of food to the world population, production of crops should be increase. So for this purpose farmers are following modern agriculture for increasing of production. But modern agriculture is intensive and mostly dependent on chemical pesticides for reduce of insect pests. More usage of these chemical pesticides are contaminating water, foodchain and polluting environmental ecosystem. Repeat use of this pesticides increasing the resistant and resurgence to the insect pest and also polluting the environment. IPM practices contain cultural, physical, mechanical, biological (predators, parasitoids, bacteria, virus, fungi, protozoa, rickettia and nematodes) finally chemical control. Among ipm practices cultural, physical, mechanical and biological practices follow first and later follow chemical control. Cultural, physical, mechanical and biological practices reduce the cost to the farmers for control of insect pest and also increase the productivity of crop. Cultural, physical, mechanical and biological practices not harmful to the ecosystem and not pollute the environment. If a pest is increasing above the economic threshold level, than only go for chemical control. In chemical control, botanicals prefer first followed by chitin synthesis inhibitors, insect hormones, inorganic, organic, orghano phosphates and carbamates. Biotechnology is also useful for control of insect pest through injection of resistant genes into the crops. National biosafety and regulatory system for better management of genetically modified organisms(GMOs) must be in place to enable the full exploitation of biotechnology.

Key words: IPM practices, cultural, mechanical, biocontrol, insect hormones, botanicals, entamopathogens and genetically modified organisms(GMOs)

TAXONOMIC STUDY OF A NEW SPECIES OF CAPINGENTIDAE TAPEWORM, SUDHAENA SHIKHAENSIS N.S.P. FROM CLARIAS BATRACHUS FROM PAHUJ DAM DISTRICT JHANSI (U.P.) INDIA

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Jhansi is one of the place famous on account of the gallantry nationalism exhibited by Veerangana Maharani Laxmi Bai, who sacrificed her life fighting against British rule, most well known historical important historic district of Bundelkhand regions of Uttar Pradesh. On 4th January 2018, we visited Pahuj dam district Jhansi (U.P.) India and collected the local fish with the help of fishermen. Thirty fish, Clarias batrachus caught and seven were found infected with ten alike tapeworms in their intestines which were preserved in 5% formalin in the laboratory these parasites were thoroughly washed, stained, mounted and ultimately identified as new member of family Capingentidae Hunter, 1930.

BIO-EDIBLE WAXES – A NOVEL METHOD FOR EXTENSION OF SHELF-LIFE AND PRESERVATION OF QUALITY PARAMETERS OF FRUITS**AESHNA SINHA* E.K. NAIK, AMANDEEP KAUR****Department of Fruit Science, Punjab Agricultural University, Ludhiana**

The current worldwide trend for a healthier lifestyle and increase in demand of fruits with high nutritional values has made a necessity to improvise natural and eco-friendly ways to enhance the storage life of fruits as well as to maintain their physico-chemical properties. Bio-edible films and coatings create a modified atmosphere inside the fruit and forms barrier to gases and moisture and also carry food additives that are antioxidant and anti-microbial in nature. These bio-edible films should be prepared from edible materials like polysaccharides, proteins and lipids like bee wax, shellac wax, carnauba wax, candellila wax, sugarcane wax etc. These bio-edible waxes improve the cosmetic appearance of fruits and are non-toxic and safe in nature. They prevent the fruit decay and improve the total soluble solid content, colour, TSS/Acid ratio of fruit, phenol content etc. and delays enzymatic activities like cellulase, Pectin methyl esterase (PME), Polyphenol oxidase activity (PPO) and thus maintains the quality of fruit for a longer period of time. Generally four principle methods of waxing of fruits are employed: Liquid Paraffin wax method, Slab wax method, Spray method and Dipping or cold wax method.

Keywords: Bio-edible waxes, TSS/Acid ratio, Cellulase, Pectin methyl esterase (PME), Polyphenol oxidase activity (PPO)

INFLUENCE OF AGRICULTURAL LAND-USES ON SEQUESTRATION OF CARBON AND ITS DISTRIBUTION IN DIFFERENT SIZED PARTICLES IN THE SOILS OF SEMI-ARID INDIA**AGNIVA MANDAL^{1,2*}, A S TOOR¹ AND S S DHALIWAL¹****¹Department of Soil Science, Punjab Agricultural University, Ludhiana-141004, India****²Department of Agricultural Chemistry and Soil Science, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia**

A study was conducted to assess the long-term influence of agricultural land-uses on sequestration of soil organic carbon (SOC), depth-wise distribution of carbon in different sized particles and their relations with mineralization loss of C. Soilsamples of semi-arid India (south-western Punjab) were collected from four depths (0-15, 15-30, 30-60 and 60-90 cm) around Dhanaula (30°18'N, 75°27'E); district Barnala, Bhuchio (30°15'N, 75°03'E) and Phul (30°19'N, 75°14'E); district Bathinda, Punjab, under three land-uses viz. croplands (cotton-wheat), horticultural lands (Guava and Kinnow) and uncultivated lands. Samples were analyzed for physico-chemical properties, SOC, SOC stock, coarse particulate OC (cPOC i.e. > 250 µm), fine POC (fPOC i.e. 53-250 µm), mineral associated OC (Min-OC i.e. < 53 µm), total POC (TPOC i.e. sum of cPOC and fPOC) and mineralized C (CO₂-C_{cum}). Orchards showed highest C sequestration potential imparting a trend of horticulture > croplands > uncultivated lands regarding SOC, fPOC, TPOC and CO₂-C_{cum}. Highest SOC stock was found in orchards (74.89 Mg ha⁻¹) followed by croplands (53.87 Mg ha⁻¹) and uncultivated lands (43.72 Mg ha⁻¹) upto 90 cm soil depth. A different trend of horticulture > uncultivated lands > croplands were noted regarding cPOC. This might be due to less disturbance under uncultivated lands than croplands. Highest Min-OC under cultivation was due to deterioration of soil stability due to tillage and other management practices that causes breakdown of aggregates into finer particles. Greater TPOC was found under orchards, as the fruit trees imparts a positive impact on stable C build-up by improving soil aggregation and stability. The studied pools were positively correlated with highest magnitude observed in between POC and SOC (r=0.831, p=0.01). Least positive linear relation with C mineralization was exhibited by POC particularly under horticulture. Greater amount of TPOC in horticultural land-uses are less susceptible to mineralization loss which provides stability of soil C for longer period than croplands. Hence, inclusion of horticulture in land-use system would be a positive strategy to maintain the sustainability along with the productivity of the studied area where intensive cultivation is prevailed.

Key words: Land-uses (Croplands, Horticulture, Uncultivated lands), SOC stock, C sequestration, particulate organic carbon, C mineralization loss.

NATURALLY HEAT CONSERVATION PROTECTED STRUCTURE FOR EXTREME COLD WEATHER REGIONS**¹AHMAD ALI*, ¹ROHITASHW KUMAR AND ²LIAQAT ALI****¹College of Agriculture Engineering, ²Division of Entomology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar – 190025**

Heat conservation become very crucial beyond tropic of cancer and tropic of Capricorn due to the inclination of solar rays. These region remain cold during winter. In these condition it is not possible to grow vegetable and fruit during the winter season. Protected structures are the feasible solution in these areas. There are many existing structure which are suitable for these areas. (High tech greenhouse, Chinese type greenhouse, Ladhaki type greenhouse, polyench greenhouse, double layered polycarbonate greenhouse). The diurnal fluctuation in temperature it is difficult to maintain temperature during night. It requires lot of energy to heat the greenhouse during night and to maintain temperature during day. Due to high input the cost of produce increases and effects the life of farmers and locals. To overcome these problem the surplus energy of the day can be harvested inside the

polyhouse and utilized for maintaining the temperature during night without the use of mechanical, electrical, and fuel energy but by the natural convection. As the thermal conductivity of the air is less than other material available in these areas. The conduction form the wall can be reduced by air insulation. This type of farming will be sustainable and profitable farming to the farmer in boosting their agricultural productivity and profitability. By introducing these type of greenhouses can lead to improved livelihoods for farmers and entrepreneurs of the northern and southern part of the world which are having extreme weather.

Keyword: greenhouse, solar rays, insulation, natural convection sustainable farming.

APPLICATIONS AND IMPLICATIONS OF NANOTECHNOLOGY FOR SUSTAINABLE VEGETABLE DEVELOPMENT

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Nanotechnology is a multidisciplinary technological and scientific field undergoing a rapid development. The importance of nanotechnology can be assumed by the fact that it is forecasted that over the next two decades, the 'green revolution' would be accelerated by means of nanotechnology. Nanotechnology has the potential to revolutionize different sectors of the agricultural and food industry with modern tools for insect pests management through the formulations of nanomaterials-based pesticides and insecticides, treatment of diseases, enhancement of agricultural productivity using bio-conjugated nanoparticles (encapsulation) for slow release of nutrients and water, DNA transfer in plants for the development of insect pest resistant varieties and use of nanomaterials for preparation of different kind of biosensors, which would be useful in remote sensing devices required for precision farming. Nanotechnology would provide green and efficient alternatives for the management of insect pests in agriculture without harming the nature. Nanotechnology can play crucial role in sustainable vegetable development by improving seedling growth, plant growth, reducing losses due to pathogens and insect pests and enhancing the nutritional and medicinal compounds. Nano-sized silica silver showed antifungal activity and controlled powdery mildews of pumpkin at 0.3 ppm in both field and greenhouse tests. Nanotechnology promises a breakthrough in improving our presently abysmal nutrient use efficiency through nanoformulation of fertilizers, breaking yield and nutritional quality barriers through bionanotechnology, surveillance and control of pests and diseases, development of new-generation pesticides, preservation and packaging of food and food additives, improving the shelf-life of vegetables and flowers.

Keywords: Nanomaterials; precision farming; bionanotechnology; nanotechnology

EFFECT OF BIOFERTILIZERS IN FRUIT CROPS PRODUCTION

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Biofertilizers can play a very significant role in improving soil fertility by fixing atmospheric nitrogen both in association with plant roots and without it. It solubilizes insoluble soil phosphate and produces plant growth substances in the soil. They are environmental friendly playing a significant role in fruit production. The soil lose its biological dynamism owing to repeated and indiscriminate use of inorganic source of fertilizer. The global mandate today is to use organic source of plant nutrients to restore the soil health. The fertilizers are not only short in supply but are costly too and produced at the cost of irreparable loss of non-renewable energy. They also help host plants to resist diseases and withstand stress conditions by different mechanism which vary depending upon the type of biofertilizer agent involved. Nitrogen fixing bacteria and phosphate solubilizer are the main biofertilizers for horticultural crops. Biofertilizers, like Azotobacter and PSB increase the availability of nutrients in soil. It is known that use of biofertilizers enriches the soil through biological N fixation (both symbiotic and non symbiotic) and helps to alleviate heavy demands of the various crops. These micro-organisms are either free living in soil or symbiotic with plants and contribute directly or indirectly towards nitrogen and phosphorus nutrition of the plants. They are the carrier based preparation containing beneficial microorganisms designed to improve the soil fertility and help the plant growth by their increased number and biological activity in the rhizosphere. Biofertilizer is a cost effective renewable energy source and plays a crucial role in reducing the inorganic fertilizer application and at the same time increasing the crop yield besides maintaining soil fertility. In the recent years, there is an urgent need to supplement the fossil fuel based inorganic fertilizers not only due to the hike in prices of chemical fertilizers but also a need is felt to maintain long term soil productivity and ecological sustainability.

Keywords: Biofertilizer, soil, Nitrogen fixation, fertility, productivity.

COMPARISON OF DIFFERENT WHEAT VARIETIES UNDER POPLAR BASED AGROFORESTRY SYSTEM**AKANKSHA BISHT¹, DR.PRAVEEN KUMAR SINGH²****Sam Higginbottom University of Agriculture, Technology & Sciences, Allahabad U.P¹****Teerthanker Mahaveer University Moradabad U.P²**

Spacing and planting design of the tree species influence growth and yield of annual crops. Suitable determination of tree and crop species helps to enhance yield, ameliorate soil fertility, promote land sustainability and resource use efficiency. The field experiment was carried out in Agroforestry Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar, Uttarakhand during the rabi season for two years 2014-16 to study the comparison of different wheat varieties under poplar based agroforestry system. Five wheat varieties (PBW-343, UP-2565, WH-711, DBW-17 and VL-907) were tested in randomized block design with three replications (under poplar plantation and in open field) during both the years. Among different wheat varieties, maximum germination count, plant height, dry matter accumulation was found in VL-907 during both the years. Higher value for yield attributes of wheat was found in variety VL-907. Biological yield of VL-907 was maximum 109.76 q ha⁻¹ in 2014-15 and 105.70 q ha⁻¹ in 2015-16 under poplar based agroforestry system, respectively. Grain yield of VL-907 was maximum 42.20 q ha⁻¹ in 2014-15 and 40.50 q ha⁻¹ in 2015-16 under poplar based agroforestry system. VL-907 had maximum straw yield 67.56 q ha⁻¹ in 2014-15 and PBW-343 had 65.53 q ha⁻¹ in 2015-16, respectively under poplar based agroforestry system. Harvest index was recorded maximum in wheat variety VL-907. Among the different wheat varieties grown with poplar, wheat variety VL-907 gave the better performance under agroforestry system as well as open farming system during both the years.

Keywords: agroforestry system, wheat varieties, yield attributes

IMPACT OF PHYSIOCHEMICAL FACTORS OF SOIL INSECT IN DISTURBED AREA OF CHOTANAGPUR PALTAUE, JHARKHAND**AKASH GARAIN , JYOTI PRAKASH SANYAL, ANUBHA KUMARI, AND KAMAL KISHOR PRASHAD**

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The area of disturbed area of Hazaribag under forest cover is 233.75 acres approx. The neighbouring Tapin coal mine, located at the distance of about 8 to 10 km from forest area. Tapin is about 26 km away from Hazaribag town. The eastern part of the forest is very denuded lock because of the heavy deforestation already taken place due to mining activities. Soil insect have great role in the Biogeochemical cycle of the Ecosystem as well as food chain. Present paper deal with common two order of soil insect (Coleoptera and Hemiptera) biodiversity fluctuation in disturbed area, Tapin, Hazaribag. Certain physiochemical factor were considered in these area and simultaneously species diversity index (H), species evenness (E) and species richness were determine to see seasonal variation of soil insect order (Coleoptera and Hemiptera). Study was made from February 2018 to January 2019. It has been shown from the present study that these two order of soil insect population exhibited a bimodal pattern of fluctuation in this disturbed forest area. From the above account it must be conclude that soil is a very complex habitat having its various physiochemical and biotic factor intermingle with each other in such a manner that it is difficult to consider their effects in isolation and to ascertain relative importance of one over the other but to draw a final conclusion further study is needed.

GROWTH AND MYCOTOXIN PRODUCTION BY CHAETOMIUM GLOBOSUM**AKASH PANDEY, RAMJI. SINGH, RAJESH SAINI AND SUMIT GUPTA****Department of Plant Pathology, S.V.P.Uni. of Agri. & Tech. Meerut. (250110)**

Over the last several years, mounting evidence has shown that fungal contamination within buildings is associated with SBS. The focus of this project is on a filamentous fungus called *Chaetomium globosum* which produces chaetoglobosins A (Ch-A) and C (Ch-C) when cultured on building material. Both metabolites belong to a group of toxins called the cytochalasins which exert their effects on mammalian cells by binding to actin. The production of Ch-A and Ch-C may contribute to the adverse health effects described by building occupants exposed to *C. globosum*. Therefore, examination of the growth of *C. globosum* and its mycotoxin production is important with regard to determining if there is a link between adverse health effects and exposure to Ch-A and Ch-C. This study had four major objectives: (a) to determine the frequency at which *Chaetomium* spp. are isolated in water-damaged buildings, (b) to examine the production of Ch-A and Ch-C in isolates of *C. globosum* obtained from different buildings, (c) to examine heat stability and water solubility of Ch-A and Ch-C, and (d) to examine the effects of ambient pH on growth and mycotoxin production by *C. globosum*. We found that *Chaetomium* spp. were commonly isolated from water-damaged buildings. Out of 30 *C. globosum* isolates, 16 produced detectable amounts of Ch-A and every isolate produced Ch-C. *C. globosum* grows best and produces the highest amount of Ch-C at a ix neutral pH. Ch-A and Ch-A were relatively stable when exposed to 50°C up to 3 days; however, decreased amounts were detected at longer exposure times. Exposure to 75°C and higher temperatures resulted in rapid breakdown of Ch-A and Ch-C.

ROLE OF BIOTECHNOLOGY IN GENETIC IMPROVEMENT OF NATURAL ENEMIES**AKSHAY KUMAR^{1**}, KRASHAN KUMAR², SACHIN KUMAR YADAV³ AND POPIN KUMAR⁴**^{1&2}Department of Entomology, N.D. University Agriculture and Technology, Narendra Nagar Kumarganj Faizabad U.P.^{3&4}Department of Pathology, N.D. University Agriculture and Technology, Narendra Nagar Kumarganj Faizabad, UP

Biological control has been accepted as an eco-friendly, technically appropriate, economically viable and socially acceptable method of pest management. Various technologies and methods have been adapted in order to genetically improve the performances of natural enemies (predators, parasitoids and pathogens). Artificial selection of various strains under different conditions, hybridization (heterosis) of different strains and rDNA technologies has been adopted towards these directions. Various traits like tolerant to pesticidal stress, tolerant to extreme abiotic stresses, shortening developmental rate, enhancing progeny production, altering sex ratio and altering host or habitat preferences could enhance the effectiveness of natural enemies Routray et al. (2016). The genetically improved natural enemies (predators, parasitoids and pathogens) might be the next level biological weapons against the pest populations in agricultural systems. Artificial selection of arthropod natural enemies for resistance to pesticides has been proposed as a method for improving the usefulness of natural enemies in integrated pest management programs (Roush and Hoy, 1981; Hoy, 1985). Jalaliet al. (2006) reported that involvement of large population >8.000 used for selection of resistance did not rule out the possibility that a single gene may determine resistance.

IMPACT OF POLLINATORS/VISITORS ON POLLINATION ON FENNEL, FOENICULUM VULGARE (MILL.) CROP IN FAIZABAD**AKSHAY KUMAR^{1**}, RAM VEER², KRASHAN KUMAR³ AND POPIN KUMAR⁴**^{1&2}Dept. of Entomology, N.D. University Agriculture and Technology, Narendra Nagar Kumarganj Faizabad U.P.^{3&4}Department of Pathology, N.D. University Agriculture and Technology, Narendra Nagar Kumarganj Faizabad U.P.

Fennel, *Foeniculum vulgare* (Mill.) commonly known as saunf, is one of the most important winter season seed spices, grown in northern India. Fennel belongs to the family Apiaceae (Umbelliferae). Fennel crop is cross pollinated in nature. This experiment was conducted in Complete Randomized Block Design in the cropping season of 2017-2018 at Faizabad region, Uttar Pradesh. Three different patterns of pollination i.e. pollination with honey bee (H), open pollination (O) and control without pollination (C) were tested for the seed set in fennel. Bees have many traits like numerous body hairs, foraging behavior and feeding habits which makes them good pollinators. *Apis dorsata* was the most abundant visitors of fennel flowers i.e. 4.23 followed by *Apis cerana indica* 2.13 throughout the period of observation. The *Mesembrius bengalensis* 0.76, *Epasymphys balteatus* 1.68, *Coccinella* spp. 1.64 and *Polistes hebraeus* 1.28 were significantly lower than the *Apis dorsata*, *Apis florina* and *Apis cerana indica* 4.23, 1.85 and 2.13 respectively during 12:00 hours of the day were at par each other. Foraging behavior of different bee species on fennel flowers. It was that all the three bee species viz., *Apis mellifera*, *A. indica* and *A. dorsata* while foraging on fennel flowers were found to be top workers. *Apis dorsata* initiated foraging activity on fennel flowers little earlier in the morning and ceased its activity little later in the evening when compared with *Apis mellifera*, bee population was absent during 12:00-13:00 hrs. of the day due to high temperature (≥ 40) and humidity ($\geq 60\%$).

ETHNOBOTANICAL STUDY OF MEDICINAL PLANTS OF HADOTI REGION OF RAJASTHAN**AKSHAY KUMAR, PRANAV PRINCE AND PRANAY P PANDEY****School of Agriculture Sciences, Career point University Kota (Raj.)**

Plants have been used for both in the prevention and cure of various ailments of humans and their pets from ancient time. With the advent of human civilization, many systems of therapy have been developed primarily based on plants. Ayurveda, Homeopathy, Siddha, Unani, etc. are our traditional systems of medicines. The plant-based traditional medical systems continue to provide the primary health care to more than three-quarters of the world's populace. In India, the use of plants for medicinal treatment dates back to 5000 years. It was officially recognized more than 2500 plant species have medicinal value while over 6000 plants are estimated to be explored in traditional, folk and herbal medicine. An important prerequisite for proper utilization of raw materials of the country is the survey of its natural resources and the preparation of an inventory. It is necessary that we should have full knowledge regarding the occurrence, frequency, distribution and phenology of various plants for their proper utilization. The forests and arid regions of Rajasthan have great potentiality both from the economic and botanical points of view.

Key Words: Ailments, Phenology, Medicines, Herbal, Ayurveda, Siddha

PRE-HARVEST APPLICATION OF SALICYLIC ACID REDUCES FRUIT DECAY DURING POSTHARVEST STORAGE OF LITCHI**ALEMWATI PONGENER*, S.K. PURBEY, VINOD KUMAR, AND VISHAL NATH****ICAR-National Research Centre on Litchi, Muzaffarpur 842002, Bihar, India**

Postharvest treatment with aqueous solutions of chemicals remains one of the most practiced methods to control decay pathogens during storage of litchi. Incomplete surface drying post treatment can, however, result in aggravated incidence decay due to presence of moisture on fruit surface. Salicylic acid as a pre-harvest application was tested with the hypothesis that it can be used as a prophylactic treatment to reduce fruit decay during postharvest storage of litchi. Application of salicylic acid, at concentrations ranging from 2-8 mM, was done two days before harvest. Harvested fruits were sorted before being packed in polythene bags, and stored under refrigerated conditions (5-8°C and 80±5% R.H.). Fruit quality parameters were monitored at weekly intervals. Pre-harvest application of salicylic acid resulted in significant reduction of fruit decay during storage compared to control. Untreated fruits recorded 10% decay incidence after 15 days, while the corresponding figure was 1.72% in fruits treated with salicylic acid @ 2 mM. Salicylic acid-treated fruits also retained higher Hunter colour 'a' (30.43) compared to control (21.96), thereby indicating the positive role of salicylic acid in reducing pericarp browning during postharvest storage of litchi.

CLIMATE-SMART AGRICULTURAL PRACTICES IN SUB-TROPICAL AGRO-CLIMATIC ZONE OF MEGHALAYA: A SOCIAL NETWORK ANALYSIS**ALETHEA DYMPEP1 AND R. J. SINGH2****1Research scholar, 2Asstt. Prof. (Agril. Extn. Edu.)****School of Social Sciences, College of Post-Graduate Studies, CAU (I), Umiam, Meghalaya**

Climate Smart Agriculture (CSA), a new approach to counter act climate change has been promoted to increase agricultural production without further increasing greenhouse gas emissions from agricultural activities. The study had been carried out in Sub-tropical Agro-Climatic Zone (ACZ) of hill state, Meghalaya, India to endeavour the farmers' social network system of transferring CSA information and their knowledge level on CSA practices. The most agriculturally vulnerable community & rural development Umsning block of Ri-bhoi district was selected purposively for the study in which 180 farmers from a cluster of four villages were selected using snowball sampling. On performing social network analysis (SNA), the network of receiving and obtaining CSA information of the farmers was identified and found to be fairly cohesive about 0.53, although it was highly fragmented. The E.I. homophily index indicated that the farmers tend to associate more with other farmers having similar operational landholding (-0.116), annual income (-0.271) and information communication behaviour (-0.313). The study concluded that prior to implementation of any farmers based CSA projects/programmes, SNA of farmers should be performed so that appropriate key nodes are identified for diffusion of innovations and its assimilations.

MYCORRHIZAL ACTIVITY UNDER SOIL AMENDED WITH VERMICOMPOST FOR IMPROVED GROWTH AND FLOWERING OF CHRYSANTHEMUM**ALI HAIDAR SHAH, NOMITA LAISHRAM*, ARVINDER SINGH, R.K. PANDEY AND SHEETAL DOGRA****Division of Vegetable Sciences and Floriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, India.180009**

Chrysanthemum is one of the most widely cultivated garden flowers. Chrysanthemum is highly suitable for cut flower, loose flower, pot culture and bedding purposes. Despite of large demand of this flower, their production is quite low. The production constraints in Chrysanthemum cultivation is poor soil fertility, high cost of chemical fertilizers, traditional system of crop management etc. Current development in sustainability involves a rational exploitation of soil microbial activities and the use of less expensive source of plant nutrients like superphosphate, which may be made available to the plants by microbiologically mediated process. AM fungi have been found to increase plant growth, increase chlorophyll content, phosphorus content, increase resistance to cultural and environmental stresses, and consequently improves plant growth. The spore count, root colonization, species diversity and dominant species, varies with the region and soil nutrient conditions. Artificial introduction of efficient strains of AM fungi into soils results in improving the growth and yield. To achieve high productivity based on a cost effective and native source of fertilizers, the combined application of vermicompost and VAM might be an alternative approach. Addition of vermicompost to soil has been reported to enhance plant biomass, mycorrhizal infectivity and proliferation of AM fungal hyphae in soil. It is a rich source of different essential nutrients which improve overall soil condition and promote yield and growth of plant. The effective fertilizer treatments for chrysanthemum will increase the quality of flowers and yield which will be helpful in achieving higher income. Further, biofertilizers hold a great promise in improving quality flower production and improving soil health on a sustainable basis.

LAND SUITABILITY EVALUATION FOR SOHAG-RED SEA ROAD SIDES, EASTERN DESERT, EGYPT**¹ALI R. A. MOURSY, ¹A. ABDEL GALIL, ¹M. S. IBRAHIM AND ²A. A. ABDELHADY****1. Soil and water Department, Faculty of Agriculture, Sohag University, Egypt****2. Soil Department, Faculty of Agriculture, Cairo University, Egypt**

The investigated area was a part of Sohag-Red sea road in Wadi Qena which considered a promising for horizontal agricultural expansion policy in Egypt. It lies between the 26°.75, 26°.65 latitudes (N) and 32°.7, 32°.9 longitudes (E) in an area about 204 km². The studied area was divided into six physiographic units viz., Wadifloor (WF), Low elevated sand sheet (LSS), High elevated sand sheet (HSS), Bajada (B), Piedmont (P) and Tableland (TL). Seventeen soil profiles were selected to be representative for the physiographic units of the studied area. Soil samples collected, prepared and analyzed for soil physical and chemical properties. Land suitability evaluation for different crops was applied using Agricultural Land Evaluation System (ALES) software which designed for arid and semi-arid regions. The obtained results showed that the studied area is moderate suitable (S2) for Sunflower and Olive crops, marginally suitable (S3) for Wheat, Barley, Maize, Peanut, Onion, Fig and Datepalm and not suitable (N) for Bean, Cotton, Potato, Tomato, Pepper and Alfalfa. The general dominant limiting parameters affecting land suitability are soil pH, EC, OM, CEC, CaCO₃, ESP and texture. Arc GIS 10.0 used for generating suitability maps for different crops in the investigated area. The obtained results and maps may be helpful for decision makers for best selection of cultivated crops to achieve efficient reclamation plans.

Key words: Wadi Qena, GIS, ALES, Land suitability, mapping.

STUDIES ON GENE ACTION IN FORAGE SORGHUM (*SORGHUM BICOLOR* L. MOENCH)**ALKA DEV¹, SK SINGH², LK.GANGWAR².****Department of Genetics & Plant Breeding, SVP University of Agriculture & technology, Meerut, U.P.**

Sorghum is the fifth most important cereal in total world production. It is able to grow and produced in the warmer temperatures and tropical regions of the world. Sorghum is the chief cereal grain consumed in Asia and Africa. It used to prepare foods for adults and children. The protein quality of sorghum grain is poor because of the low content of essential amino acid such as lysine, tryptophan and threonine. Malting improves protein quality of cereals because of an increase in lysine. Sorghum is poorly digested by infants, but if it is supplemented with foods high in lysine, can be a satisfactory weaning food. Sorghum, proteins become less digestible after cooking. Sorghum like the other cereals is a good source of B vitamins such as thiamine, riboflavin, vitamin B6, biotin and niacin, but refining produced losses of all B vitamins. The chief foods prepared with sorghum are tortillas, couscous, porridges and baked goods. Sorghum grain is mixed into dough and baked as flat, unleavened bread to produced tortillas. Tortilla dough differs from that of pan bread in the fat and moisture content and rheological properties. Tortillas are produced by cooking maize in alkali (calcium hydroxide), steeping and washing the cooked maize (nixtamal). It is estimated that the 60-70% of total cost in livestock production is due to feed and fodder. In India hardly 5% of the cropped area is utilized to grow fodder. India is deficit in dry fodder by 11%, green fodder by 35% and concentrates feed by 28%. The common grazing lands too have been deteriorating quantitatively and qualitatively. Sorghum (*Sorghum bicolor* L. Moench) is one of the most important fodder crops in the rainfed conditions of India as well as in Uttar Pradesh. Sorghum being a short duration, drought and salt tolerant, well adaptive to arid regions is considered promising crop to overcome the fodder shortages in uncertain barani areas. The total area, production and productivity of jowar are 5.30 million hectare, 5.05 million tones and 953 Kg per hectare respectively in India and the total area, production and productivity are 0.16 million hectare, 0.16 million tones and 994 Kg per hectare in U.P. respectively (Agriculture statistics at a glance, 2015). The area under high forage yielding varieties is negligible in western Uttar Pradesh.

Keyword: Cereal, lysine, thiamine, vitamin B6.

ORGANIC FARMING ENHANCE AGRICULTURE PRODUCTIVITY**¹ALKA*, ²MONU KUMARI AND ³KINJAL BHAMBHANIYA****¹Department of Floriculture and Landscape Architecture,^{2,3}Dept. of vegetable science, Navsari Agricultural University, Navsari (Gujrat)**

India has the largest number of organic producers in the world, according to the world of Organic Agriculture Report 2018 published in February, Organic farming is one of the ways to bring stability and sustainability to agriculture. It is an alternative to regular farming. Organic farming is an effective technology to improve agriculture productivity in a sustained basis and helps in coup up of world's hunger. In this natural balance desires to be maintained at all cost for existence of life and property. In organic farming "sustainable agriculture is the successful management of resources for agriculture to satisfy the changing human needs while maintaining and conserving natural resources." In organic farming biofertilizers are sustainable tool for modern agriculture. Application of biofertilizers results in increased mineral and water uptake, root development, vegetative growth and nitrogen fixation. Another approach of modern organic farming is use of biochar as a new soil amendment. Biochar is a charcoal used as a soil amendment. Biochar is also made from biomass but through pyrolysis process. It has an ability to increase and hold the soil

organic carbon level over long period of time. Good agriculture practices are also use in organic farming that provide logical guidance in implementing better management practices that will help to reduce the risks of microbial contamination of agricultural and horticultural produces.

Keywords: Organic farming, agriculture, bichor, bio fertilizers, productivity.

FRUIT THINNING FOR IMPROVING FRUIT SIZE IN LONGAN

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Longan (*Dimocarpus longan* Lour.), an underutilized specialty crop, is a relative of litchi under the family Sapindaceae. Its main production is concentrated in Asia pacific countries including China, Thailand, Vietnam and Laos. In India, the potential commercial of this fruit tree is only recently sought and its production is confirmed only to a localized pocket. However it has the potential in extending the availability of arillate sapindaceous fruits in the market since longan comes in the market just after the litchi season ceases. The Inflorescence of longan is compound dischasia and penicle. It contains approximate 200 to 1000 female flowers and 1000-4000 male flowers. In longan a panicle may carry up to 100-150 individual fruits which vary in weight from 5 to 10g. In order to improve the production potential of this crop, it is imperative to regulate fruit size in longan. Fruit thinning is essential after flower thinning because of the high rate of fruit set and greater competition for developing fruit. In this regard, fruit thinning studies was initiated in longan var. Gandaki longan-1. Fruits thinning was initiated about four to six week after fruit set when they are of the size of a pea or 6-12 mm in diameter at 10%, 20%, 30%, 40% and 0% and consists of removing one half to two third of the distal end of each panicle. Results revealed that removal of 40-50% fruits at 25-30 days after fruit set had a marked effect in increasing fruit size by 60-90% over control. Thinning of fruits not only increases size but also reduces biennial bearing tendency in longan.

Keywords: Longan, Fruit Thinning, Fruit Size

PLANT GROWTH REGULATORS: A TOOL FOR ENHANCING GROWTH AND YIELD OF PULSES- A REVIEW

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Pulses are a critical and inexpensive source of plant based proteins, vitamins and mineral for people around the globe. They have low fat content, zero cholesterol and are significant source of dietary fibre. From agricultural point of view, pulses enhance soil fertility, have low water requirement and also used as animal fodder, thus increasing the quality of animal diet. Area under pulses is less due to various reasons like high insect-pest attack, poor remunerative prices, low yield etc. Various environmental, physiological and pathological reasons are responsible for low yield realization of pulse crops. Major physiological constraints are low partitioning of assimilates towards reproductive structures, abscission of flowers or buds, also low pod set resulting in low yield of pulses. Growth regulators are known to improve the source-sink relationship, translocation of photo-assimilates and thereby improve photosynthetic ability of the plants and thus play a significant role in realization of high productivity levels and higher crop yields. Among the growth regulators, growth retardants have been reported to increase the productivity by reducing the shoot length, increase dry matter production, regulate the source-sink relationship and stimulate the better translocation of photo assimilates thereby helping in effective flower formation, fruit and seed development and ultimately enhance productivity in a desired way without changing the developmental patterns of crop plants. These compounds inhibit the gibberellins biosynthesis pathway in treated plants. So the use of growth regulators leads to increased productivity of pulses.

Keywords: Pulses, Growth regulators, Growth retardants

EFFECT OF SODIUM BICARBONATE ON QUALITY OF PEAR FRUITS UNDER LOW TEMPERATURE STORAGE

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The aim of study was to investigate the effect of sodium bicarbonate on physiological and enzymatic changes of 'Patharnakh' pear stored at low temperature. Pear fruits were dipped in different concentrations of sodium bicarbonate (0.0, 1.0, 2.0 and 3.0%) and stored at 0-1^o C and 90-95% RH for 70 days. Physical and biochemical attributes of the fruits were determined at 0, 20, 40, 60 and 70 days during storage. Exogenous application of sodium bicarbonate reduced cellulase, PME and PPO enzyme activities; while, effectively maintained higher fruit firmness (18%), sensory quality and total phenolic content (25%). Furthermore, sodium bicarbonate application effectively retarded the degradation of titratable acidity, ascorbic acid content, weight loss and total soluble solids. Thus, sodium bicarbonate was found to be useful for extending the shelf life and maintaining quality of pear fruits during low temperature storage.

Key words: Pear, sodium bicarbonate, storage, fruit quality, enzyme activity.

GENETIC VARIABILITY STUDIES IN FRENCH MARIGOLD (*TAGETES PATULA* L.) GENOTYPES USING MORPHOLOGICAL MARKERS**AMANJEET SINGH SODHI, NOMITA LAISHRAM*, ARVINDER SINGH AND M. IQBAL JEELANI****Division of Vegetable Sciences and Floriculture, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu, India.180009**

A field experiment was carried out at experimental farm of SKUAST-Jammu during 2016-17 to study to assess the nature and extent of variability, heritability, coefficient of variation, correlation and genetic diversity in 25 genotypes of French marigold (*Tagetes patula* L.) for 12 growth and flowering related traits. Analysis of variance showed highly significant differences among genotypes for all the growth and flowering related traits. Results revealed a high range in mean performance of different traits viz., plant height (34.33-94.33 cm), plant spread (31.33-73.43 cm), number of flowers per plant (53.33-104.67), carotenoid content (19.43-74.57 mg/100g), days required for 50% flowering (49.43-82.40 days) and flower yield per plant (142.56 g - 526.15 g). High coefficient of variation was observed for flower yield per plant, number of flowers per plant, number of primary branches and carotenoid content. High values of genetic advance as per cent of mean was recorded for flower yield per plant (161.57 %) followed by number of days to 50% flowering (67.88%) and plant height (63.91%). High heritability coupled with high genetic gain was observed for flower yield per plant, days to 50 % flowering and plant height. The magnitude of correlation coefficient at genotypic level was found higher than the corresponding correlation at phenotypic level. Flower yield per plant had a positive and highly significant correlation both at genotypic and phenotypic levels with number of flowers per plant, fresh weight of flower, plant height and shelf life.

EFFECT OF LINSEED (*LINUM USITATISSIMUM* L.) BASED INTERCROPPING SYSTEMS AND INTEGRATED NUTRIENT MANAGEMENT ON GROWTH, YIELD AND HARVEST INDEX UNDER RAINFED CONDITION**AMAR KANT VERMA AND P.N. YADAV**

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The field experiment was conducted during 2015-16 and 2016-17 on a sandy loam alluvial soil at Soil Conservation and Water Management Farm of C S Azad University of Agriculture and Technology, Kanpur. The treatments consisted nine cropping systems and three doses of integrated nutrient management. The experiment was laid out in split plot design with three replications. The results showed that plant height was increasing with increasing days after sowing in the relevant crop of linseed, lentil and barley, respectively. The tallest plants were obtained in sole cropping followed by linseed + lentil (3:1). The application of 75% RDN through inorganic + 25% RDN through vermicompost + biofertilizer (seed coating) + PSB @ 2.5 kg ha⁻¹ significantly improved the growth and yields of linseed + lentil (3:1) amongst different cropping systems during the period of observation.

Keywords: Rainfed, integrated nutrient management, plant height, yield, harvest index, vermicompost.**EFFECT OF NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF RAINFED PEARL MILLET [*PENNISETUM GLAUCUM* (L.) R.BR.]****AMIT KALALIYA****Department of Agronomy, College of Agriculture, CCS Haryana Agricultural University, Hisar (Haryana), India**

Macro and micro nutrients are the key inputs for realizing higher grain yield and quality in pearl millet. A field experiment is conducting at Dryland Agriculture Research Farm, CCS Haryana Agriculture University, Hisar, Haryana with an aim to find out the suitable nutrient combination for pearl millet crop under rainfed conditions. The field experiment is laid out in RBD having 13 treatments, with three replications, comprising four levels of nitrogen, phosphorous and potassium respectively viz. (0,40,50 and 60 kg N/ha) , (0,20,25 and 30 kg P/ha) and (0,10,12.5 and 15 kg K/ha) along with foliar spray of 0.5% of ZnSO₄ and FeSO₄ at 30 DAS. The effect of these combinations is going to be observed on crop growth indices, yield and yield attributes, quality parameters and economics of different combinations.

DOCUMENTATION OF PHOTOTACTIC BIO CONTROL AGENTS OF SOYBEAN ECOSYSTEM**AMIT KUMAR SHARMA, RAJESH AARWE, A.S. THAKUR, A. K. SAXENA AND HIMANSHU TEMBHRE****Department of Entomology, College of Agriculture, JNKVV, Jabalpur (M.P.)**

The experiment was conducted at experimental farm, JNKVV, Jabalpur during 2013-2014. To observe the “beneficial insect species-predatory and parasitic species as natural biocontrol agents collected in light trap in soybean ecosystem”. Documentation of taxonomic analysis revealed that 17 species of beneficial- predatory & parasitic species were recorded in soybean ecosystem. These insect species belongs to 6 insect orders and 13 families. Coleoptera was the biggest order with highest number of 6 insect species. Other orders were Hemiptera (5 species), Odonata (2 species), Hymenoptera (2 species), Neuroptera (1 species) and

Dictioptera (1 species). The present study gives the status of beneficial insects as bio control agents (predatory & parasitic species) their occurrence; activity and distribution in soybean ecosystem of this region which is very important in planning the IPM programme for different crops of this region with a view to conserve the biocontrol agents.

STUDY ON PHOTOTACTIC INSECT PESTS INTERCEPTED BY LIGHT TRAP IN SOYBEAN ECOSYSTEM

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The present taxonomic study was conducted to record the phototactic insect pests through light trap in soybean ecosystem at Jabalpur region during 2013. A total of 35 species were recorded. These phototactic insects belongs to 5 orders and 21 families. Lepidoptera was the largest order with 22 species. Other orders were Hemiptera (5 species), Orthoptera (4 species) and Coleoptera (3 species). Isoptera was the other order of minor significance. These harmful insect pests includes 8 major and minor pest species of soybean, major polyphagous pests, pests of pulses, cereals, oilseeds vegetables, fodder crops and forest trees etc. The present study reviles the valuable base line data on biodiversity of phototactic insect pests of soybean ecosystem and provides broader scope of using light trap as Integrated Pest Management tool in soybean

ASSESSMENT OF LOSSES DUE TO INSECT PESTS IN CHICKPEA

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Pulses are the best source of vitamins and medicinal value and acts as a blood purifier. Among pulses chickpea (*Cicer arietinum* L.) is the most important pulse crop of the world which is also known as gram or Bengal gram. It is cultivated and consumed in large quantities from South East Asia to India and in the Middle East and Mediterranean countries. Chickpea is a highly nutritious legume crop which is well accounts for rich and cheapest source of energy, protein and soluble and insoluble fiber. Mature chickpea grains contain 60-65% carbohydrates, 6% fat, and between 12- 31% protein higher than any other pulse crop (Kumar et al., 2015). India occupies first position in the world in accounts of area (66%) and production (70%). In India the crop was occupies 8.25 million ha area with production of 7.33 million tonnes and 889 kg ha⁻¹ productivity. In Madhya Pradesh chickpea is cultivated in 2.85 million ha with an annual production of 2.96 million tonnes and productivity of 1039 kg ha⁻¹ (Agricultural Statistics at a Glance, 2016). In the last four decades it has experienced that the area, production and productivity of chickpea fluctuated widely. One of the most practical resorts of increasing chickpea production is to minimize losses caused by the biotic constraints, which include insect-pests, diseases and weeds under field conditions. About 36 species of insect pests are attack on chickpea during different growth stage of the crop in India (Nayer et al., 1982). Among the insect pests the gram pod borer (*Helicoverpa armigera* Hubner) alone causes 29% yield losses in chickpea at national level. Gram pod borer is one of the most devastating and polyphagous pest in worldwide and feeds on more than 300 plant species and solely responsible for considerable damage to many field and horticultural crops (Arora et al., 2005). The attack of this alarming pest begins from early vegetative to maturity stage. At early stage the young larvae start feeding to leaflets, buds, flowers and pods of chickpea (Mandal and Roy, 2012). A reduction in yield ranging from 40-50% has been reported and may cause even total loss of the crop (Rai et al., 2003). A single larva of the gram pod borer alone can destroy 30-40 pods before its maturity. Annual losses due to insect pests are estimated to be 15 % in chickpea (Chandrashekar et al., 2014). The low yield of chickpea is attributed to the regular outbreaks of pod borer which is considered to be one of the major pests of chickpea crop. Crop damage by insect pests could be minimized and kept under economic threshold level effectively by adopting one of the important component of integrated pest management i.e., chemical control by selecting some newer insecticides which should have selective and less harmful to natural enemies. Scientific data based on toxicity, effectiveness and economics of chemical insecticide is very essential before the application in pest management. Thus, keeping the above facts in mind the present study was carried out to evaluate the efficacy of some most popular chemical insecticides against the gram pod borer in chickpea ecosystem.

TAXONOMIC DOCUMENTATION AND POPULATION DYNAMICS OF MAJOR PHOTOTACTIC INSECT PESTS OF MEDICINAL CROPS WITH SPECIAL REFERENCE TO EFFECT OF ECOLOGICAL FACTORS ON *HELICOVERPA ARMIGERA* HUB. AND *AGROTIS IPSILON* HUF

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The experiment was conducted during 2016-2017 at experimental field, JNKVV, Jabalpur by using the Jawahar light trap with 80 W. M.V. lamp to study the Seasonal incidence of prevalent phototropic insect pests of medicinal crops. A total of 13 phototropic insect pests were recorded from November 2016 to April 2017. As per the taxonomic documentation these species belongs to 4

orders and 10 families. Based on number of species collected, largest collection was represented by order Lepidoptera (5 species) followed by orders Hemiptera (3 species), Orthoptera (3 species) and Coleoptera (2 species). Major polyphagous pests of medicinal crops viz. *Helicoverpa armigera* and *Agrotis ipsilon* were active from November to April with peak catches during 5th & 8th and 49th & 8th standard week respectively. Correlation regression analysis with abiotic (weather) factors revealed that evening relative humidity and evening vapor pressure were significantly positive effect on *H. armigera* and *A. ipsilon* population while rest of the abiotic factors were non significant. The present findings will serve as valuable source of information for surveillance, monitoring and also in use of light trap as IPM tool against these pests of medicinal crops.

STATUS OF FARM MECHANIZATION UNDER ANIMAL FARMING IN CHHATTISGARH PLAINS AGRO-CLIMATIC ZONE OF CHHATTISGARH STATE (INDIA)

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This study was conducted in two district of Chhattisgarh plains agro-climatic zone of Chhattisgarh State. In which two blocks were selected from each district purposely (based on draught animal population and animal drawn implements). Three villages were selected from each block and ten respondents randomly selected from each village total of 120 farmers. The purpose of this study was to analyze the status of farm mechanization under the animal farming system, availability of draught animal population, identification of animal drawn and other farm implements and their utilization for agricultural production. The required data of the study were collected with the help of a detailed pre-tested proforma which was developed prior to survey, after consulting the literature available as suggested by the different researchers. It was found that the Chhattisgarh plains covered about 64% of the total draught animal population. Average draught animal power in Chhattisgarh plains was found that 0.172 kW/ha. Chhattisgarh plains have the highest utilization of animal power was 316 h/ha. The study reveals that the majority of the respondents about 96 per cent used country plough as a primary tillage implement, 99 per cent used wooden plank and Kopar as a secondary tillage implement in the zone. In case of traditional sowing methods majority of 98 per cent used broadcasting method for sowing and only 2 per cent of the respondents used seed drill as improved sowing implements.

Keywords: Farm mechanization, draught animal power, Chhattisgarh.

BENEFIT COST RATIO OF CAPSICUM GROWN IN DIFFERENT SOILLESS GROWING MEDIA UNDER PROTECTED CONDITIONS IN MID HILLS OF HIMACHAL PRADESH

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A study was conducted on *Capsicum annum* to know the effect of different soilless growing media and fertigation levels under protected conditions on the benefit cost ratio. The whole experiment was arranged over 15 modules consisting of 5 different growing media T₁ (Sawdust + Vermicompost + sand (2:1:1) + Azotobacter + PSB), T₂ (Vermicompost + sand (2:1) + Azotobacter + PSB), T₃ (Spent mushroom compost + Vermicompost + sand (2:1:1) + Azotobacter + PSB), T₄ (Pine needles + Pea husk (decomposed) + sand (2:1) + Azotobacter + PSB) and T₅ (Soil: FYM : Sand (2:1:1) + Azotobacter + PSB) and 3 different fertigation levels. F₁ (150kg NPK/ha), F₂ (200kg NPK/ha) and F₃ (250kg NPK/ha for two years). The results revealed that the treatment combination comprising of Vermicompost + sand (2:1) + Azotobacter + PSB + 250 kg NPK/ha. Recorded maximum selling price of Rs. 1253.00, benefit of Rs. 970.97 and benefit cost ratio of 3.44. Hence the treatment combination comprising of Vermicompost + sand (2:1) + Azotobacter + PSB + 250 kg NPK/ha must be recommended for sweet pepper production under protected conditions in mid hills as it will give farmer maximum benefit due to excellent quality of fruit and lesser losses due to insect pest and diseases.

Keywords: Capsicum, soilless, benefit, cost, vermicompost

GENETIC DIVERGENCE ANALYSIS FOR QUALITATIVE AND QUANTITATIVE TRAITS IN INDIAN MUSTARD (*BRASSICA JUNCEA* L. CZERN & COSS) UNDER NORMAL SOWN CONDITION IN BUNDELKHAND REGION

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The present experiment was carried out during rabi, 2018-19 using 25 germplasms namely; DRMRIJ-31, Basanti, LAHAR, Pusa Bahar, NRH-101, NRC-DR-2, Mutant Varuna, RH-749, NRCHB-101, Pusa Bold, RH-406, Vardan, Pusa Krishma, Ashirvadh, Nav Gold, Pusa Barani, Pusa Jai Kisan, Kranti, Vaibhav, PM-26, Urvashi, Maya, Agarani, NDR-8501 and RLM-198 of Indian mustard made available collected from the Section of Oilseed, Department of Genetics and Plant Breeding of Chandra Shekhar Azad University of Agriculture and Technology Nawabganj, Kanpur. The experiment was laid out in Randomized Block Design

with three replications. These lines were grown in single row plot of 5 meter length. The spacing between row to row and plant to plant was 45 cm and 15 cm, respectively maintained by thinning. Recommended agronomic practices were adopted to raise a good crop. Five competitive plants from each plot were randomly selected for recording observations for all the quantitative characters except days to flowering and days to maturity which were recorded on the plot basis. The data were recorded for thirteen characters namely; days to 50% flowering, days to maturity, plant height (cm), number of primary branches per plant, number of secondary branches per plant, length of main raceme (cm), number of siliquae per plant, number of seeds per silique, 1000-seed weight (g), harvest index (%), biological yield per plant (g), oil content (%) and seed yield per plant (g). Oil content was estimated using NMR method. D^2 analysis is done as per P.C. Mahalanobis (1928). All the 25 genotypes were grouped into 6 clusters based on D^2 analysis. The cluster-I with 9 strains had maximum genotypes among all the clusters followed by cluster-III, II, IV, V and VI. The inter cluster distance was recorded highest between cluster-III and cluster-IV (90.88). The minimum inter cluster distance was observed between cluster-I and IV (15.38) indicating their close relationship.

Key words: Clusters, Genetics divergence (D^2) and Indian mustard.

ADVANCE IN APPLIED SCIENCE AND SOCIO ECONOMIC MANAGEMENT MARKETING PARADIGM OF FISH IN VARANASI DISTRICT OF UTTAR PRADESH

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This study has been conducted in major fish markets of Varanasi for different fish species prevailing in the market. The total marketing costs of auctioneer, wholesaler and retailer have been found to be Rs. 0.90, Rs 7.75 and Rs 6.56 respectively. The four main marketing channels were identified in the market of study area. The marketing efficiency for Rohu fish was 451.18 per-cent in channel IV and 348.12 per-cent in channel I, for Hilsa fish it was 119.47 per-cent in channel I and 99.29 per-cent in channel II, in case of Pyasi fish it was 319.03 per-cent in channel II and 387.76 per-cent in channel IV and for Mahur fish it was observed 76.45 per-cent in Channel I and 72.59 per-cent channel III. The marketing efficiency has been found more in the case where less intervention of intermediaries was present. The study has device the need for increase in awareness of fishermen for prevailing prices so that the fishermen can get more shares in the consumer's rupee and there is need to introduce substitute inland fish like Dargar in place of Hilsa fish, due which the number of middlemen can be reduced by producing it domestically.

Keywords: fish, marketing, efficiency, middleman.

EFFECT OF COPPER SULPHATE ON REPRODUCTION OF "TAILLESS FRESH WATER FLEA" SIMOCEPHALUS VETULUS (CRUSTACEA-CLADOCERA)

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The "tailless fresh water flea" *Simocephalus vetulus* (Crustacea-Cladocera) is well established as a model for eco-toxicology. *S. vetulus* being the sensitive crustaceans, can serve as better bio-indicator of metallic pollution and also useful for investigating the effects of toxins on reproduction. Present study deals with the effect of copper sulphate (25%, and 10% of 96hr LC_{50} value i.e. 0.092, and 0.037 mg/l respectively) on physiology of reproduction of *S. vetulus* for 7, 14 and 21 day exposure. The means of neonates produced by *S. vetulus* in Sub-acute exposure (25% 96hr LC_{50}) were 7.83 ± 3.2 , 45.16 ± 8.5 and 15.66 ± 6.1 for 7, 14 and 21 days respectively, and in chronic (10% of 96hr LC_{50}) were 9.16 ± 4.08 , 44.16 ± 15.5 and 18.16 ± 8.5 for 7, 14 and 21 days respectively, comparing with control 14.33 ± 4.08 , 37.33 ± 13.4 and 25.16 ± 9.7 for 7, 14 and 21 days respectively. In general the decrease in number of neonates of *S. vetulus* was observed after copper sulphate exposure in all the exposure durations. Underlying physiological alterations in reproduction in reference to copper toxicity have been discussed.

Keywords: Copper toxicity, Reproduction, *Simocephalus vetulus*, Tailless fresh water flea

AN INVESTIGATION ON MOBILE AND INTERNET USE FOR AGRICULTURAL DEVELOPMENT IN RURAL AREAS: A CASE STUDY IN SAMBALPUR DISTRICT OF ODISHA

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Agriculture plays a vital role in the social and economic development of most Asian countries and is the main contributor to economic growth and stability. Information and Communication Technology (ICT like Computer, Mobile, Radio, News Paper) plays a substantial role in developing agricultural growth through the use of various devices to attain economic sustainability and

self-reliance. This study was conducted in Sambalpur District of Odisha, India, aimed at determining the familiarity of the people to Mobile, computer and internet technologies and for what purposes they use these technologies in rural areas of Sambalpur District of Odisha, India. How people approach these technologies and what socio-economic features affect their use, were also determined. The main data used in the study were collected from a face-to-face questionnaire administered to over 250 people. Based on the results of this study, 56.23% of the individuals in the questionnaire used Mobile Internet for entertainment and the major purpose of the computer's usage was to access the internet. It was determined that these technologies were not used efficiently to develop rural life, agricultural production and professional and personal development. Based on the findings, there was a strong relationship between mobile, computer and internet use and social and economic characteristics of the individuals. It was concluded that, computer and internet technologies to be used most efficiently in rural areas, fast and planned training should be implemented, necessary infrastructure should be developed and examples of successful uses in agricultural production should be shown to people. Studies also identified inadequate Information and Communication Technology (ICT) facilities, lack of personnel, insufficient infrastructure, harmonization of knowledge and language, power supply and farmers' perception are some of the challenges and issues that obstruct successful implementation of ICT like mobile, computer and internet in agricultural growth. It was concluded that more researches need to be conducted in order to draw relevant ideas and suggestions that will enhance fruitful implementation of ICT to develop agriculture.

Keywords: Mobile, Computer, Internet, Agricultural production, Rural Development, Information and Communication Technology

EFFECT OF ORGANIC MANURE AND INORGANIC FERTILIZERS ON GROWTH AND LEAF YIELD OF ALOE VERA (L.) AT FARMER FIELD

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

A STUDY OF MARKET INTEGRATION AND PRICE TRANSMISSION AMONGST THE SEVEN MAJOR PIGEON-PEA (CAJANUS CAJAN) PRODUCING STATES OF INDIA

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India has gained self-sufficiency in foodgrains but till today imports pulses to meet its domestic requirements. In 2008-09, the market was hit by supply shock of pigeon pea resulting in vigorous price hike. The present study was undertaken to analyse the decadal (2009-18) monthly wholesale prices of pigeon pea, in the seven highest pigeon pea producing states of India, namely, Madhya Pradesh, Maharashtra, Karnataka, Gujarat, Uttar Pradesh, Jharkhand and Odisha. Time-series analysis of monthly prices indicated that seasonal price index does not follow any particular trend in these states. Pigeon pea being a kharif crop showed high seasonality index (SI) during the lean months and low SI during the harvest season, except for Jharkhand state where SI was highest during December. None of the states out of the seven shared maximum/minimum SI. The coefficient of variation (CV), coefficient of average seasonal price variation (ASPV) and intra-year price rise (IPR) were found to be highest for Karnataka and lowest for Jharkhand. Johansen's cointegration test was used to analyse the existence of linear deterministic trend amongst the seven spatially separated state markets and Granger Causality test was used to determine the price transmission within these states. The maximum likelihood test indicated that three out of the seven states were cointegrated, with majority of the states showing bidirectional movement of prices. Only the state of Odisha showed unidirectional price relationship with other six states.

Keywords: Granger Causality, Johansen's cointegration test, India, Price Transmission, Pigeon pea

EFFECT OF DIFFERENT SPACING ON GROWTH AND YIELD OF PEA (*PISUM SATIVUM* L.) UNDER INDO-GANGETIC CLIMATIC CONDITION**ANIL KUMAR, B. MEHERA, YOGESH KUMAR AGARWAL, VEERBHAN SINGH****Department of Silviculture & Agroforestry, College of Forestry, SHUATS, Prayagraj, U.P, India, 211007**

The experiment was conducted at research farm, Department of Silviculture & Agroforestry, College of Forestry, SHUATS, Prayagraj, U.P, India, during Rabi season. The experiment was laid out in factorial RBD design with eight treatments and three replication combinations. The treatments comprised two varieties of pea and four levels of spacing (15×15, 20×20, 25×25 and 30×30 cm). Studies showed that, spacing 30×30 cm with variety AP-3 gave significant effect on the plant height (62.73 cm), number of leaves per plant (74.13), days taken to flowering (53.01), number of pods/plant (9.82), test weight (514.00), total pea yield (76.008 q/ha) under indo-gangetic climatic conditions.

Keywords: Spacing, Growth, Yield, Pea, Flowering.

SEASONAL INCIDENCE OF SHOOT BORER, *CHILO INFUSCATELLUS* ON SUGARCANE UNDER TERAII ZONE OF NORTHERN WEST BENGAL**ANIL KUMAR AND SUPRAKASH PAL*****Department of Entomology, UBKV, Pundibari, Cooch Behar, West Bengal*****Professor in Agril. Entomology, Directorate of Research (RRS-TZ), UBKV, Pundibari, Cooch Behar, West Bengal**

Sugarcane stem borer, *Chilo infuscatellus* Snellen is an important and destructive insect pest attacking sugarcane crop. In the present investigation, Seasonal incidence of C. was studied in Terai zone of Northern West Bengal during 2017-18 and 2018-19. The data reveals that the % incidence of shoot borer started to build up from the first fortnight of March, 2017. There was steady increase in the % incidence during next two months i.e. March (2.6 and 3.1) and April (5.9 and 9.6), thereafter gradually decreased trend was observed. The % incidence ranged from 1.3 to 9.6 during month March to June. The data indicated that the peak was observed in the second fortnight of April (9.6%). The data of % incidence of shoot borer during crop season 2018-19 are presented in Table 2 and illustrated in fig 2 and showed similar trend as crop season 2017-18. The % incidence varied 1.3 to 8.3 from 1st fortnight March to 1st fortnight July and peak was recorded 8.3% in the second fortnight of April. Simple correlation was worked out between weather factors % incidence of shoot borer during 2017-18 and It was observed that maximum temperature with maximum relative humidity showed highly significant positive correlation ($r = 0.8733$ and $r = 0.6784$) with % incidence of shoot borer of sugarcane and other parameter i.e. minimum temperature, maximum RH showed non significant positive correlation ($r = 0.0758$, $r = 0.1619$), respectively. While, the rainfall was non significant negative relation ($r = -0.2785$). Multiple linear regressions were worked by taking % incidence of shoot borer as dependant variable and climatic factors as independent variables, which revealed that coefficient of determination ($R^2 = 0.9285$) was significantly high representing 92.85 per cent correlation over the population. While, the data of % incidence of shoot borer during crop season 2018-19. It was observed that maximum temperature showed highly significant positive correlation ($r = 0.7877$) with % incidence of shoot borer of sugarcane and other parameter i.e. minimum temperature, maximum RH and minimum relative humidity showed non significant positive correlation ($r = 0.4679$, $r = 0.4521$, $r = 0.1347$), respectively. However, the rainfall was significant negative relation ($r = -0.5990$). This is clear that maximum temperature and RH maximum were the congenial weather elements for buildup of shoot borer incidence of sugarcane.

BIOINTENSIVE MANAGEMENT OF WOOLLY APHID, *CERATOVACUNA LANIGERA* ZEHNTNER (HOMOPTERA: APHIDIDAE) ON SUGARCANE: A REVIEW ON SUCCESS STORY**ANIL KUMAR AND PURAN POKHREL*****PhD Research Scholar, Department of Entomology, UBKV, Pundibari, Cooch Behar (W.B), India**

The sugarcane woolly aphid (SWA), *Ceratovacuna lanigera* Zehntner (Homoptera: Aphididae) became a threat to the sugarcane crop as well as sugar industry. In India C. lanigera has been reported as a serious pest of sugarcane in Maharashtra and Karnataka states during July and September, 2002, respectively. It was first reported by Zehntner 1897 from Java and it has been observed in 23 Asian countries of which Java, Philippine, Indonesia, Taiwan, and Malaysia etc are of importance. In India, Basu and Banerjee in 1958 reported it for the first time from West Bengal. During 2002, the pest epidemic was reported from Maharashtra and Karnataka. By the end of 2004 it had spread to almost all the sugarcane growing areas in the country. C. lanigera was recorded in 1905 on sugarcane in Sri Lanka and the outbreak of the pest were reported during 2006 causing heavy losses to the sugar industry. The crop of six to 12 months old was more vulnerable to the attack by this pest. Its infestation usually occurred in patches in the beginning and then spread into the entire field within a short span of two to three weeks. Both nymphs and adults of these aphids desap the undersurface of the leaves along the midrib and then they spread to the entire under surface, covering it with flocculent waxy secretion. These aphids excrete honeydew which often covers the entire upper surface of the leaves, leading to growth of sooty mould. Gupta and Goswami in 1995 assessed the effect of 25 and 100 per cent aphid infested leaves on some yield and quality parameters of the sugarcane and found that cent per cent infestation had detrimental effects on reduction of length

(11.6%), girth (3.5%), weight (16.6%), length of internode (18.4 %) and width of leaf (4.5%). Like other sucking pests, if we consider the SWA management, though several synthetic insecticides are effective against the aphid, they do not find place in sugarcane ecosystem for reasons like operational hazards during application of insecticides, improper coverage of crop canopy after seven months and difficulty in spray operation. Hence, the practices like wider spacing or paired row planting, proper water and nitrogen management, stoppage of movement of seed cane from infested areas, release of predators are some suggestions to suppress the pest. Over a hundred years since the discovery and description of the sugarcane woolly aphid in the year 1897, about 37 natural enemies including seven parasitoids, 27 predators and three pathogenic fungi have been reported to attack the SWA from the areas of its occurrence. *Encarsia flavoscutellum* Zehntner was the first parasitoid to be studied as potential agent for the control of SWA. General predators like *Synonca grandis* (Thunberg) and *Anisolemnia dialatata* (Fabricius) and *Chrysoperla carnea* (Stephens) have not been encountered in adequate numbers in sugarcane ecosystem to rely upon them. Though the pyralid predator, *Dipha aphidivora* (Meyric) has been reported to be a potent one to manage SWA, the *Micromus igorotus* Banks was reported to be a potent and amenable predator even for mass production and utilization in SWA management in India.

DISTRIBUTION DIVERSITY USES OF CULTIVATED AND WILD CUCURBITS

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Cucurbits are growing in tropical and subtropical region of the world. Its belongs to cucurbitaceae family. The genus cucurbits comprising both cultivated and wild spices considerable importance as values. Cucurbits has 110 genera and 640 species. In India 10 genera cultivated as a vegetable and fruit, about 25 species are endemic and eighteen species belonging to 10 genera more than 204 vegetable are grown in India of this family. cultivated i.e. cucumber (*Cucumis sativus*), muskmelon (*Cucumis melo*), Long melon (*Cucumis melo* var. *utilissimus*), watermelon (*Citrullus lanatus*), bottle gourd (*Legenaria sicearia*), bitter gourd (*Momordica charantia*), pointed gourd (*Trichosanthes dioica*), snake gourd (*Trichosanthes cucumerina*), sponge gourd (*Luffa aegyptica*) ridge gourd (*Luffa acutangula*), round melon (*Praecitrullus fistulosus*), pumpkin (*Cucurbita moschata*), winter squash (*Cucurbita maxima*), summer squash (*Cucurbita maxima*), ash gourd or wax gourd (*Benincasa hispida*) and less known and wild relatives species are Kakrol (*Momordica dioica*) sweetgourd (*Momordica cochinchinensis*), chow-chow (*Schium edule*), ivy gourd (*Coccinia indica*), *Cucumis hardiwickii* (*Cucumis hardiwickii*, *cucumis* var. *hardiwickii* is feral or progenitor from of the cultivars i.e. *C. sativus*) etc. The brief review deals with distribution, diversity and occurrence particularly of wild cucurbits 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 programme.

Keywords: Cucurbits, wild, Distribution, Survey, collection and Cucurbits sp.

HYDROPONIC: A NEED OF URBAN AND PERI-URBAN AREAS

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With an objective of feeding such an increasing population a large fertile area has already been under cultivation and due to the extensive use of chemicals the quality of soil has been deteriorated hence increasing the area under cultivation so as to increase the production is a difficult task and the other option is to increase the production per unit area that is the productivity but even this has reached a limit where productivity cannot be increased with normal agricultural practices hence new method or technology have to be adopted which are suitable for urban farming too and one such technique is the soil less culture. It is simply growing of crops without soil, it further comprises of the techniques like hydroponics, aquaponics, aeroponics. Hydroponics is a method of growing plants in the absence of soil by using mineral nutrient solutions in a water solvent. The term hydroponics was introduced by Gericke to describe all methods of growing plants in liquid media for commercial purposes. Gericke was also the first investigator who attempted to develop an economically feasible method of growing plants in water for commercial purposes. This technique avoids problems associated with ground such as soil-borne diseases, non-aerated soil, poor physical properties, etc. Various non-toxic porous materials are used as plant growth substances including rockwool, perlite, pumice, expanded clay, various volcanic materials, polyurethane foam, coir dust, etc. A balanced distribution of small and larger pores is required in a substrate to ensure adequate availability of water to the plants without affecting the supply of oxygen to the roots. The main concern in hydroponics is the quantity and quality of water, as the material used has minimum or none of the nutrients, the solution used as to be taken care that it contains all the required nutrients in optimum quantity, pH of the solution needs to be controlled according to the requirement of the plant. Asphyxiation may be a problem in stagnant water technique but this can be solved by introducing an oxygen pump. It can be used to grow vegetables inside the house to feed the family in urban and peri-urban areas where space is a major constraint. Hydroponics system not only gives an increased yield than the traditional agriculture but also the quality as the crop is free from soil born disorders, as the cultivation is in controlled environment the air borne problems can also be reduced but main problem arises with the solution which may spread the infection to all the plants if not treated properly. Even though hydroponics is a high investment technology there is a scope for development and is most suitable for the urban areas.

Keywords – Hydroponics, Aquaponics, Aeroponics.

SIGNIFICANCE OF PLANT PARTS IN HERBAL GULAL INDUSTRY IN INDIA

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Holi is a Hindu famous spring festival, also known as the "festival of colours". Synthetic colours are used during Holi festival in general. Prolonged use of synthetic dye based colour has shown symptoms of hair loss, greying of hair and even skin cancer. With safe and natural colours, people can plan an ecological Holi. Biodiversity based colours will not harm health. Thus, with a view to prepare herbal gulal (a traditional name given to the coloured powders used for the typical Hindu rituals, in particular for the Holi festival) from plant sources as an alternative to synthetic gulal available at present in Indian market, four different plants parts viz. Bixa orellana seeds, Lawsonia inermis leaves, Curcuma longa stem and Beta vulgaris roots were screened. The plants parts collection was done from Prayagraj district which lies between 24°47' and 25°47'N latitude and 81°9' and 82°21'E longitude at an elevation of 98 m at msl. The process was developed using five (05) base powders - Corn flour, Gram flour, Rice flour, Fine wheat flour and arrow root flour using two different methods- aqueous extraction and dry extraction method using standardized 20% concentration. The following colours were observed- Beta vulgaris (bright pink), Bixa orellana, (bright red) Lawsonia inermis (bright green), Curcuma longa (pale yellow). The arrowroot flour (aqueous extraction) and fine wheat flour (dry method) were the superior base material over others for gulal powder making, instead of sand or soil which are presently used in commercial products.

Keywords: synthetic colours, herbal gulal, Bixa orellana, Lawsonia inermis, Curcuma longa, Beta vulgaris

FAST-GROWING TREE CULTURE IN NORTH INDIA FOR GREEN ECONOMY

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Eucalyptus, Populus, Dalbergia, Bombax, Azadirachta, etc., are among the most popular agroforestry trees in north India. Despite this, several policy interventions are adversely affecting the interests of tree growers. Difficulties in obtaining felling and transit permits, absence of a favourable minimum support price mechanism, non-availability of soft bank loans, absence of agroforestry cooperatives, uncertainty about marketing/ sale of end produce, small landholding, poor technical knowhow regarding planting practices and suitable tree crop combinations, inadequate availability of superior planting material, etc., pose serious challenge to the grower in north India. Populus deltoides, in particular, witnesses large fluctuations in the price of wood which renders the planting rate of this species highly variable from year to year. A low level of technical knowledge about tree cultivation too sometimes results in losses to growers. Insufficient research grant is also proving a handicap in technical innovations in plantation forestry. Fast growing trees plantations of Populus deltoides, Eucalyptus sp., Gmelina arborea and Melia azedarach have been planted under different research projects in Prayagraj, Uttar Pradesh in northern India at 25° 28' 22.92" N latitude, 81° 52' 42.09" E longitude and 90 metre altitude. Quality planting material has been deployed comprising several clones of Populus deltoides and Eucalyptus sp., and seedlings of Gmelina arborea and Melia azedarach, procured from different sources in India. These trials will determine the best germplasm of these short rotation trees for agroforestry plantations in the study region to provide higher returns to farmers in shorter time.

Keywords: Agroforestry, fast growing trees, north India, clones, seedlings

UTILIZATION OF SPACE TECHNOLOGY IN RURAL DEVELOPMENT IN INDIA

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Affordable mobile telephone embedded with operationally compliant positioning device as well as photography couple with internet connectivity have added another dimension of digital access to every rural dweller. In such context, it is timely that ISRO has initiated web based geospatial information systems at the behest of departments dealing with Rural Development in a comprehensive manner. The Geo-spatial solutions contribute to development of rural areas to realize the objective of creating Digital India by minimizing the space between Technology and common man. ISRO is launching a National Mission - 'Space based Information Support for Decentralized Planning'. It would provide ICT enabled geo-spatial platform involving local bodies to carry out developmental activities under Panchayati Raj in a decentralized, speedy and transparent manner. The Mission aims to harness the space technology and the information systems at the local bodies to create information base and provide services. We also focus on capacity building at Panchayat level to use these space based inputs. We are sure, that if the human resources at Panchayat level are enriched with the knowledge of using space based inputs, many issues related to land use or reclamation of wastelands, agriculture, horticulture, infrastructure development, water harvesting, etc., specific to the local environment can be

solved. Governance of rural areas especially for improving employment potential has received a welcome boost through initiatives which have enable geo-tagging of all created assets, bringing in unprecedented level of transparency and verification by functionaries and citizens alike. Improving capability of remote sensing and positioning can bring in huge advantage of addressing micro-level concerns fully and satisfactorily. Web enable GIS applications can serve information to every corner of the country, hence throwing open the technology for use by common man.

Keywords: Space, Technology, Information and rural development.

GENETIC VARIABILITY AND CHARACTER ASSOCIATION STUDIES FOR YIELD ATTRIBUTING ECONOMIC TRAITS OF RICE. (*ORYZA SATIVA* L.)

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Rice (*Oryza sativa* L.) is one of the most important cereal crops. It is the most widely consumed staple food especially in Asia. 20 rice genotypes were evaluated for yield attributing traits at Agricultural farm of UBKV, in Terai region of West Bengal in two different environment Pre-Kharif and Kharif season following RBD with 3 replications. Statistical analysis was carried out for estimation of genotypic coefficient of variation (GCV), phenotypic coefficient variation (PCV), heritability (Broad Sense) and Genetic advance as percentage of mean for all the yield attributing traits. ANOVA revealed significant variation for different characters under study. High GCV, PCV were obtained for Harvest index, filled grain per panicle, days to 50% flowering indicating the characters are predominantly governed by additive gene action and through simple selection considerable improvement can be done. The study had revealed the potential of genotypes with high yield as Piolee, Haripowasali, Borosolpana and Satyaranjan.

Keynotes: Rice, GCV, PCV, h^2 , Genetic advance as percentage of mean.

CROSS ABILITY BETWEEN GENETICALLY DIVERSE LINES IN WHEAT (*TRITICUM AESTIVUM* L)

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Wheat botanically known as *Triticum aestivum* L., belongs to the family Poaceae. Its origin is believed to be the Middle East Region of Asia (Lupton, 1987). Wheat is one of the most important and widely cultivated crops in the world, used mainly for human consumption and support nearly 35 % of the world population (Mohammadi-joo et al., 2015). It is the second most important staple food next to rice in India. It has been described as the 'King of cereals' because of the acreage it occupies, high productivity and the prominent position it holds in the international food grain trade. The crossabilities of 20 genetically diverse lines namely, AKAW 4901, AKAW 4927, BRW 3723, CG 1013, DBW 39, DBW 71, DBW 93, DBW 107, DBW 110, DBW 173, DBW 187, GJW 463, HD 3043, HD 3086, HD 3171, HI 1609, HI 1609, HI 1612, HI 1620 and HUW 699 with testers NW 5054, KRW 19, KRL 210 and HD 2967 available at coordinating unit, were assessed during Rabi 2018-19 at Main Experimental Station of N.D.U.A.&T., Kumarganj, Ayodhya. The row to row and plant to plant distance was kept 50 cm and 15 cm, respectively. The total number of seeds set and total number of florets pollinated were counted. The seed setting in different crosses was influenced by the genotype(s) of the parents themselves. Cross combinations viz., DBW 88 x NW 5054, DBW 88 x KRL 19, HD 3086 x KRL 210, DBW 173 x KRL 210 and DBW 39 x NW 5054 showed better seed setting thereby better crossability. Thus, it may be concluded that (1) desirable genotype(s) expressing high number of seed setting may be further mated inter se in order to enlarge the genetic variability and (2) the genotypes showing high value of crossability may prove their worthy as best combiners with other genotypes.

STUDIES ON THE PATTERN OF CHANGES IN PHYSICAL AND BIOCHEMICAL CONSTITUTES OF BER (*ZIZYPHUS MAURITIANA* LAMK.) CULTIVARS DURING FRUIT DEVELOPMENT UNDER TARAI REGION

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The present investigation was conducted on existing 40 years old ber orchard at Horticulture Research Centre, Patharchatta, G. B. Pant University of Agriculture & Technology, Pantnagar, U.S. Nagar, Uttarakhand, India during the period from the season of 2017-18 and 2018-19. Eight ber cultivars viz., Chhuhara, Chinese, Kalagola, Nazuk, Sanaur-2, Sanaur-4, Umran and ZG-2 were selected for the study. The experiment was laid out in two factor Randomized Block Design (RBD) with three replications. Fruits were tagged at fruit setting stage and harvested at 28, 42, 56, 70, 84, 98, 112, 126, 140, 154 and 168 days after fruit set. Sampling dates and cultivars were considered as the treatments. Fruit physical and chemical parameters were recorded at 14 days interval beginning from 28 days after full bloom (DAFB) to 168 days after full bloom. The main aim was to study the changes in physico-

chemical attributes of ber cultivars at different growth periods. The physical parameters like fruit length, breadth, weight and volume increased with fruit growth and found maximum in Umran. The chemical parameters like total soluble solids, total sugars, reducing sugars, TSS: Acid ratio and Sugar: Acid ratio increased with fruit growth and were found maximum in Chhuhara while non-reducing sugars and ascorbic acid in Chinese. Titratable acidity decreased with fruit growth and were found maximum in Chinese. From overall observation it was concluded that Umran was best in terms of physical parameters, while Chinese was best in terms of chemical parameters.

TRICHODERMA: AN EMERGING BIO CONTROL AGENT FOR SAFE FOOD PRODUCTION AND ECOLOGICALLY SUSTAINABLE AGRICULTURE

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Trichoderma species are free-living fungi that are easily found in soil and root ecosystems. They are highly interactive in root, soil and foliar environments, and plays a very important role in production of safe food by avoiding the use of different fungicides and agro chemicals for the management of diseases of economic importance of agriculture with major goal of safe food production with least cost investment. In other hand Trichoderma spp produce a variety of compounds that induce localized and systemic resistance responses in plants against several kind of fungal diseases. Trichoderma have long been recognized as biocontrol agents for the control of plant diseases and for their ability to enhance root growth and development, crop productivity, resistance to abiotic stresses, and uptake and use of nutrients. Among different bio control agent, Trichoderma is most important, having many success stories. They are used for seed treatment, seed bio-priming, seedling dip, soil application and foliar spray. For the management of plant diseases, application of Trichoderma formulations with strain mixtures performs better than individual strains. Whatever limitations Trichoderma bio control agent products may have, it can be addressed by improving biocontrol through manipulation of environment, accurate strain identification by molecular approach, using consortium of beneficial organisms, physiological and genetic enhancement of biocontrol mechanisms. Many small and large entrepreneurs have entered into the commercial production of biocontrol agents, because of its ecological sustainability and huge demand for production of safe and quality products as well as in mixed farming and organic farming.

DEVELOPMENT AND QUALITY ASSESSMENT OF LOW FAT CHHANA

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Four different types of Chhana were prepared from skim milk with the addition of different levels of soy milk. The use of skim milk and soy milk as a source of high protein, low fat. The milk blends of soy beans, with skim milk were at replacement levels of T1 (85:15), T2 (75:25), T3 (65:35), % while the skim milk T0 (100:00) served as control Chhana. The qualities of prepared Chhana were evaluated by using physical and chemical parameters. It was observed that the addition of soy milk with skim milk decreased the organoleptic score of overall acceptability the prepared Low Fat Chhana T1 (8.32) followed by T0 (7.39), T2 (7.71), T3 (6.84). Various analysis parameters were analyzed by two way ANOVA to obtained a predicted optimum result prepared low fat chhana was subjected to chemical, microbial, and sensory analysis to evaluate the suitability of low fat chhana were T1 protein (17.12%), fat (3.10%), ash (3.72%), acidity (0.22%) and carbohydrate (24.00%) as comparable to control without adversely affecting the sensory parameters. Based on the result it was indicated that beneficial component of high protein in soy milk and low fat skim milk made them more favorable choice for dairy technologist to develop low fat chhana especially for healthy sweets.

PER SE PERFORMANCE OF PARENTS AND THEIR F₁ HYBRIDS FOR YIELD AND YIELD RELATED TRAITS IN TOMATO (SOLANUM LYCOPERSICUM L.) UNDER POLYHOUSE CONDITION

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The present investigation was carried out at Vegetable Research Center of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, with the objective to assess mean per se performance of parents and their F₁ hybrids for yield and yield related traits in tomato under polyhouse condition. The experimental material for the present study comprised of eight genotypes of tomato. From the eight genotypes, 28 crosses were evolved in a diallel mating design (excluding reciprocals). Thus, the experimental materials finally consisted of 36 treatments (28 F₁s and 8 parents) which were evaluated in a Randomized Block

Design (RBD). The genotypes were studied for fifteen yield related traits. The observations were recorded on five randomly selected plants. For days to 50 per cent flowering and days to first fruit set parents, PCT-1 and PBT-2 and the crosses, PCT-1 x PBT-4 and PBT-9 x PBT-2 showed minimum value. Minimum days to first fruit ripening were recorded in parents PCT-1 and PBT-10 and hybrids, PCT-1 x PBT-5, PBT-9 x PBT-5 and PBT-9 x PBT-2. Maximum values for number of flowers per cluster, number of fruits per cluster and number of fruits per plant were observed in parents, PCT-1 and PBT-2 and in hybrids, PCT-1 x PBT-5, PBT-5 x PBT-4 and PCT-1 x PBT-2. Maximum average fruit weight recorded in parents, PBT-2 and PBT-9 and in hybrids PBT-13 x PBT-10, PBT-9 x PBT-5 and PBT-2 x PBT-9. Among the parents, maximum mean values for plant height were recorded in PBT-2 and PCT-1 whereas, among 28 F₁s, PBT-13 x PBT-10, PCT-1 x PBT-4 and PCT-1 x PBT-9 has maximum values. Among the parents, maximum values for fruit yield were observed in PBT-2 and PCT-1 whereas, among hybrids, PCT-1 x PBT-5, PBT-2 x PBT-13 and PBT-9 x PBT-4 showed maximum values for fruit yield.

PERFORMANCE OF SOYBEAN VARIETIES UNDER DIFFERENT LAND CONFIGURATIONS

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Soybean [*Glycine max* (L.) Merrill] was introduced in 60's in India to supplement the oilseed crop to overcome the crisis of edible oil. It is basically a legume but it accounts for >50% of oilseed production and approx. 30% of the total supply of all vegetable oils. It is rich in protein and oil content i.e. 40% and 20%, respectively. It is a key component of global food security providing over half of the world's oilseed production. Though, it is a rainy season crop but is highly sensitive to water logging conditions as excessive moisture is detrimental to root and nodulation. Therefore, adoption of suitable land configuration can help in preventing the losses caused by excessive moisture and increase the farmers income. A field experiment was conducted at N. E. Birla Crop Research Centre of Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) in kharif season, 2017 to assess the performance of soybean varieties under different land configurations. Treatments comprises land configurations viz flat bed, ridge & furrow and raised bed and varieties viz PS-1092, PS-1225 and PS-1347 were set out in Split Plot Design with three replications. The soil was sandy loam in texture having medium soil organic carbon, available phosphorus and potassium but low in available nitrogen. Land configurations did not cause any significant difference in terms of dry matter/plant whereas variety differed significantly. Yield attributes like number of branches/plant, grains/pod, 100-seed weight, and harvest index were recorded to be non-significant whereas pods/plant was significant. Among varieties, all the yield attributes were recorded significant except number of branches/plant. In ridge & furrow, grain yield was recorded to be maximum which was significantly higher than raised and flat bed and var. PS-1225 was recorded with significantly higher yield than the other two varieties, lowest yield was recorded in var. PS-1092. Protein and oil content was not much affected by land configuration and varieties but protein and oil yield differed significantly because of significant difference in grain yield. Thus in tarai region, ridge & furrow method of sowing and variety PS-1225 should be adopted to obtain higher yield and economics from soybean crop.

RENEWABLE ENERGY: AN ASSESSMENT OF PUBLIC AWARENESS IN JHANSI

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India is one of the countries with the largest production of energy from renewable sources (solar light, bio gas, hydro, bio diesel, wind etc). Jhansi city has a very good scope to generate renewable energy due to their geographical situation and environmental factors. Diffusion methods are a key factor in promoting renewable energy production. Present time Indian government uses different types of effective extension education and diffusion method a deep gap which needs to be addressed in the area of energy education and awareness in India. This study aims to address the awareness of renewable energy and running Indian government different subsidy scheme like Jawaharlal Nehru National Solar Mission (JNNSM), Government Yojana: Solar Energy Subsidy Scheme, UDAY Scheme, SECI scheme, ROOFTOP scheme. Methodology used sample size was 250 respondents from Jhansi three different local area were chosen Shiva Ji Nagar, Veerangana, Kocrchabhawanr its duration from November 2018 to February 2019. Questionnaire based on self-structured questionnaires including demographic data that includes gender, age, income, education, area of residence, life quality, and interest of implementation. The statistical analysis used percentage and ratio, stated that middle class and rural respondents were more (76%) interested to use renewable energy, government launched different schemes but 96 % respondent had no knowledge. The government needs to improve its diffusion method that changes Indian people's view of renewable energy not only economically but eco-friendly and helpful in various type of health issues.

Keywords: Renewable Energy. Diffusion method, government subsidy, eco-friendly

STATISTICAL ANALYSIS OF COMBINED DATA –FOR MULTILOCATION TRIALS**ANKITA^{1*}, SAURAV SINGLA¹, SHASHI SHEKHAR²**¹Department of Farm Engineering, Institute of Agricultural Sciences, BHU, Varanasi, U.P., India²Department of Farm Engineering, Institute of Agricultural Sciences, BHU, Varanasi, U.P., India

Most of the large-scale experiments repeated over different locations, time and seasons to evaluate how treatments perform across changing environments are commonly referred to as analysis of combined experiments. In this paper along with a brief introduction, we have discussed step wise methodology for combined data analysis of multilocation trials with the help of an example. Advantages and pitfalls of the methodology have also been discussed. SAS code for combined data analysis has also been provided in this paper.

Keywords: Combined data analysis, Multilocation trial, Analysis of variance

CROP DIVERSIFICATION: AN IMPORTANT WAY-OUT FOR DOUBLING FARMERS' INCOME**ANKUR KUMAR, PALLAVI CHAUDHARY AND SUNIL MALIK**^{1&3} Department of Horticulture, Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.).²Assistant Professor Department of Agriculture, IIAST, Integral University, Kursi road Lucknow, Uttar Pradesh

The most important reason for the emergence of agrarian distress in the country during 1990s is the low level of absolute income as well as large and deteriorating disparity between income of a farmer and non-agricultural worker, which turned even more serious in latest years. In this background, the goal set to double farmers' income by 2022-23 can play crucial role to promote farmers welfare, reduce agrarian distress and bring parity between income of farmers. Introduction, adaption and acceptance of new varieties as well as new and upcoming production technologies can potentially strengthen farmers' cropping systems by increasing yields, improving drought resilience, boosting resistance to pests and diseases and also by capturing new market opportunities. There is a need to identify crops and varieties that may suit to a range of environments and farmers' preferences. Agricultural crop diversification is an important stressrelieving option for economic growth of the farming community. It provides better conditions for food security and enables farmers to grow surplus products for sale at market and thus help to obtain increased income to meet other needs related to household well-being. Diversification of agriculture in the first Green Revolution areas such as Punjab, Haryana and Western Uttar Pradesh seems need of the hour. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from valueadded crops with complementary marketing opportunities. Crop diversification and inclusion of the new varieties can be one of the important technologies in increasing the farmers' income to a certain extent, if not double. The aim of crop diversification is to increase crop portfolio so that farmers are not dependent on a single crop to generate their income. When farmers go for single crop type they are exposed to high risks in the event of unforeseen climate events that could severely impact agricultural production. Therefore, introducing a greater range of varieties in a particular agro ecosystem leads to diversification of agricultural production which can also increase natural biodiversity, strengthening the ability of the agro-ecosystem to respond to these stresses. It can also can enable farmers to gain access to national and international markets with new products, food and medicinal plants. Diversifying from the monoculture of traditional staples can have important nutritional benefits for farmers in developing countries and can support a country for becoming more self-reliant in terms of food production.

STUDIES ON INSECT-PESTS SUCCESSION IN PIGEONPEA (CAJANUS CAJAN) CROP***ANKUR PRAKASH VERMA^[1], PANKAJ KUMAR^[2], VINOD KUMAR^[1] AND PANKAJ BATHAM^[1]**¹Dept. of Entomology, Sardar Vallabhbhai Patel University of Agriculture & Technology, Modipuram, Meerut, U.P.-²Dept. of Entomology, Narendra Deva University of Agriculture & Technology, Kumarganj, Ayodhya, U.P.

The present investigations were carried out during the Kharif season, 2017-18 at Student's Instructional Farm, N. D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). Six insect-pest viz., pod borer (*Helicoverpa armigera*), plume moth (*Exelastis atomosa*), pod fly (*Melanogromyza obtusa*), spotted pod borer (*Maruca testulalis*), jassid (*Empoasca kerri*) and pod bug (*Clavigralla gibbosa*) were recorded during the cropping period. The incidence of pod borer and spotted pod borer commenced during 47th and 2nd SW respectively while pod bug occurred during 1st SW. Jassid commenced during 35th SW while plume moth and pod fly occurred during 4th SW. The population of Pod borer, plume moth and spotted pod borer ranges from 0.20 to 7.0, 0.12 to 1.76 and 0.12 to 4.0 larvae/5plants respectively. Pod fly population ranges from 1.44 to 13.04 maggot/5plants while jassid and pod bug population ranges from 0.20 to 1.6 and 0.40 to 7.0 bugs/5plants respectively. Correlation coefficient was worked out between the incidence of insect pests and abiotic factors. In case of jassid, the correlation was positive with minimum and maximum temperature as well as with RH and rainfall while in case of pod bug, pod borer and spotted pod borer, the correlation was negative with minimum and maximum temperature as well as with RH and rainfall. In case of plume moth the correlation was positive with maximum temperature while it was negative with minimum temperature, RH and rainfall while in case of pod fly the correlation was positive with RH while it was negative with minimum and maximum temperature and rainfall.

Keywords: Correlation coefficient, RH (Relative Humidity), Maggot

YIELD AND YIELD ATTRIBUTES OF PEARL MILLET-WHEAT CROPPING SYSTEM AS INFLUENCED BY SEWAGE SLUDGE APPLICATION UNDER SALINE WATER IRRIGATION

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The ever increasing urbanization has led to production of organic wastes like sewage sludge which is the residue obtained from domestic wastewater treatment. During session 2017-18, an experiment was conducted to study the effect of sewage sludge on yield and yield attributes of pearl millet- wheat cropping system under saline water irrigation. The experimental field was factorial randomly block designed with three replications. Three irrigation treatments i.e. canal water, 8 dS/m and 10 dS/m EC saline water; and five fertilizer treatments i.e. control, sewage sludge (SS)@ 5 t/ha, SS (5 t/ha) + 50% RDF, SS (5 t/ha) + 75% RDF and 100% RDF were undertaken. However, Application of sewage sludge was done in Rabi season during wheat crop which significantly affected crop yields. Application of sewage sludge significantly enhanced crop yields as compared to control. However, grain yield of both crops were registered significantly higher with 100% RDF treatment but it was at par with SS (5 t/ha) + 75% RDF. Yields of both crops were significantly affected with the application of saline irrigation water where crop yields were reduced upto 32 per cent with treatments receiving saline irrigation as compared to canal irrigated treatments. However, their interaction effects were non-significant.

IMPROVING THE MECHANICAL PROPERTIES OF STEELS FOR AGRICULTURE EQUIPMENT

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The most popular materials for agricultural soil cutting tools in our country are medium carbon steels with the addition of manganese and silicon. The alloyed steels with high abrasive and corrosion resistance are not applied due to high costs. The working elements of tools for the tillage of soil undergo wear mainly because of the abrasive influence on their surface of the hard mineral particles. The cutting device is a significant essential device required in the machining procedure of a section underway. It plays out the cutting activity as well as aides in getting required surface completion and precision of the part. So as to play out these errands the device must be sufficiently able to withstand wear opposition and serve for extensive stretch of time to create increasingly number of parts with a similar precision. In current machining procedure and utilizing the CNC machine apparatuses the cutting device will assume a fundamental job in machining process and in improving the surface completion. Many presumed cutting device fabricating associations universally with their rich experience of innovative work, imagined various methods for improving the life of slicing device so as to enhance the rate of the creation and to lessen the expense of generation, which is exceedingly worthy to the assembling Business. the methods for improving the device life by different coatings on tungsten based solidified carbide cutting device.

Keywords: agricultural, wear, abrasive, tillage

INFLUENCE OF INTEGRATED NUTRIENT MANAGEMENT ON VEGETATIVE, FLOWERING, BIOCHEMICAL AND YIELD CHARACTERS IN MARIGOLD (TAGETES ERECTA L.) CV. PUSA NARANGI GAINDA

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An investigation was carried out to study the combined effect of organic fertilizers and biofertilizers on the vegetative and flowering characters of marigold (*Tagetes erecta* L.) cv. Pusa Narangi Gaiinda at the experimental farm of Department of Horticulture, NEHU, Tura campus, Chasingre, Meghalaya during the year 2017-18. Out of the twelve treatments viz. T₁ (100% recommended dose of fertilizers), T₂ (Azospirillum + 75% recommended dose of N + 100% recommended dose of P & K), T₃ (Azotobacter + 75% recommended dose of P + 100% recommended dose of N & K), T₄ (FYM + 50% recommended dose of fertilizers), T₅ (Vermicompost + 50% recommended dose of fertilizers), T₆ (Azospirillum + FYM + 50% recommended dose of fertilizers), T₇ (Azospirillum + vermicompost + 50% recommended dose of fertilizers), T₈ (Azotobacter + FYM + 50% recommended dose of fertilizers), T₉ (Azotobacter + vermicompost + 50% recommended dose of fertilizers), T₁₀ (Azospirillum + Azotobacter + 50% recommended dose of N and P + 100% recommended dose of K), T₁₁ (Azospirillum + Azotobacter + FYM + 50% recommended dose of fertilizers) and T₁₂ (Azospirillum + Azotobacter + vermicompost + 50% recommended dose of fertilizers), it was observed that the treatment T₁₂ showed maximum number of leaves (176.67), secondary branches (22), leaf length and breadth (15.91 cm x 3.95 cm), leaf area (62.11 cm²) and plant spread (53.56 cm E-W and 46.03 cm N-S) per plant. T₁₂ was also recorded with maximum flower diameter (60.25 mm), number of flowers per plant (30.50), flower yield per plant (326.05 g), flower yield (293.44 q/ha) and seed yield (14.67 kg/ha). The treatment was found significantly in inducing early flowering and

prolonged duration of flowering. Maximum carotenoids content in fresh petals (11.65 mg/100 g fresh petals) and dry petals (11.37 mg/100 g dry petals) was associated with T₁₂ (Azospirillum + Azotobacter + vermicompost + 50% RDF), however, chlorophyll A (39.79 mg/g leaves) and chlorophyll B (61.92 mg/g leaves) content was recorded to be highest in the treatment T₁₁ (Azospirillum + Azotobacter + FYM + 50% RDF).

Keywords: marigold, FYM, vermicompost, Azospirillum, Azotobacter

CLONING AND EXPRESSION OF DENGUE VIRUS 2 NS3 PROTEIN, CONTAINING HELICASE DOMAIN

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Dengue is an intercontinental public health threat for human race transmitted by *Aedes aegypti* mosquitoes that endangers an estimated 2.5-3 billion people (approximately 40%-50% of the world's population) and represents a rapidly growing public health challenge. Dengue is an icosahedral, enveloped virus with a single stranded positive sense RNA genome. Dengue Virus (DENV) is a member of the flaviviridae family and has 4 antigenically distinct serotypes (DENV1-4). DENV causes a wide spectrum of clinical manifestations, from DF to dengue hemorrhagic fever (DHF), which may progress to dengue shock syndrome (DSS). The positive-sense flavivirus RNA genome of 11 kb forms a single open reading frame that is translated into a polyprotein precursor of ca. 370 kDa consisting of the structural proteins C, prM, and E and seven nonstructural proteins, nonstructural protein 1(NS1), NS2B, NS3, NS4A, NS4B, and NS5. The dengue non-structural 3 (NS3) is a multifunction protein, containing a serine-protease, located at the N-terminal portion, and Helicase, NTPase and RTPase domains present in the C-terminal region. Cleavage of the polyprotein is mediated by the serine protease N-terminal domain of NS3, with a hydrophilic segment of 40 residues from the trans-membrane NS2B protein acting as a cofactor necessary for this activity. In this context, the current study has been conducted to express, purify and characterize DENV2 full length NS3 protein along with NS2BH in *E.Coli* cells under native condition. For this, hydrophilic region of NS2B was amplified and fused with the amplified full length NS3. The resultant product was cloned into pQE30 expression host and expressed in BL21 cells. The purification showed a band at ~70 kD. However, there was some degradation in the purified protein. This could be due to the proteolytic activity of NS3. In the current study full length DENV2 NS3 protein was expressed in *E.Coli* cells along with NS2BH as cofactor. The purified NS2BH-NS3 protein needs to be characterized for its activity such as, protease, helicase and NTPase. This protein can be used to screen and identify novel inhibitors against helicase activity of NS3 and the selected inhibitor can be used as an antiviral compound against dengue.

Keywords –Helicase, Non- Structural Protein, RNA virus, Viral Replication

AGROFORESTRY PRACTICES IN BALLIA DISTRICT OF EASTERN PLAIN REGION OF UP, INDIA

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It is well known that western part of UP is more flourished than Eastern part for adoption of agroforestry. It is now urgent need of time to adopt tree plantations in massive way in districts of Eastern Plain zone of the country. The agroforestry is the only way for progress for farmers and rural people, leading to sustainable development, food and nutritional security. Agroforestry adoption with suitable species of economic value will improve country's forest and tree cover to the 33%. The study was conducted in selected villages (1%) of Ballia District of Eastern plain region of Uttar Pradesh in India during the year 2018 to record the crop combinations with tree species and their stratified arrangement to identify agroforestry practices. The report of FSI states that forest area in Ballia district is only 0.74 % of the total geographic area which is far behind the national target of 33 %. The socio-economic studies based on general village profile, land holding, land use pattern, tree species planting pattern and demand supply gap of existing species were performed to collect the data with structured questionnaire and Participatory Rural Appraisal (PRA) tools. The results demonstrated that a total of 08 different agroforestry practices, silvi-horticulture, agri-silviculture, agri-horticulture, agri-silvi-horticulture, agri-silvi-pastoral, silvi-pastoral, silvi-medicinal and homestead existed in different villages. Out of different categories, timber, fruits, medicinal, agriculture, flower and other plant species were recorded. The benefits from agro forestry practices in the villages was also assessed and ranked in their order of preferences in respective blocks of district. The different benefits as shade, fruits/vegetables, timber, protection, firewood, soil erosion, medicinal and fodder were scored from 1 to 8. It was concluded from the results that status of agro forestry in the studied zonal area of the region is in developing stage and needs to be improved by imparting technical knowledge about planting material, methods and sale of end produces of trees to the farmers and tree growers. The extension and training programmes are needed to be organized regarding selection of species, tree planting pattern, nursery raising, quality planting material, maintenance and management of plantations and most importantly, the marketing of trees as end produce. In marketing or sale of trees, transit and felling permit to be issued by forest department is very important. The unawareness of rules and fear of administration discourages farmers for adopting agroforestry widely at large level in this region. The foresters, researches, NGOs and tree growers & traders are needed to be coordinated on a common platform for successful implementation of agroforestry programme on massive level. Further, to enhance the efforts of farmers, sale of end products should be strengthened with the involvement of project planners and wood based industries.

Keywords: agroforestry practices, Socio-economic studies, species diversity

IMPACT OF RURAL YOUTH TRAININGS ON FRUITS AND VEGETABLE PRESERVATION ON THE KNOWLEDGE AND ADOPTION OF RURAL WOMEN

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India is the second largest producer of fruits and vegetables in the world, contributing 10.2 and 14.5 per cent of the total world production of fruits and vegetables, respectively. Women form the major work force in agriculture in general. In the food processing sector participation of women is substantial particularly in upstream activities. The objective of the present study was to impact of training on Knowledge and adoption of rural women on fruit and vegetable preservation in Deoria District of Uttar Pradesh. Total 150 Rural Youth were selected for this study. The data were collected personally from the respondents. Interview method was used for data collection. Frequency, Percentage, Mean weighted score and Rank were used for analysis of data. Finding of the study reveals that respondents had poor knowledge in fruit processing and preservation practices with overall mean percent score of 19.26. The outcome of the study divulges that the respondents possessed poor knowledge about different components of fruit processing and preservation namely- Critical examination of the knowledge score highlights that the respondents possessed average knowledge after training in different components namely – fruit selection (96.66 MPS), washing (93.33 MPS), grading (86.66 MPS), processing and preservation (85.33 MPS), marketing (76.66 MPS), storage (72.66 MPS) and packaging (70.00 MPS). This might be due to the reason that all these practices were performing by respondents independently or with male members. These findings revealed that there was great difference between pre and post training exposure, mean score of knowledge and adoption was highly significant.

Keywords: Impact, Rural Youth, Trainings, Fruits and Vegetable Preservation, Knowledge, Adoption.

FARMERS' PARTICIPATORY APPROACH FOR QUALITY SEED PRODUCTION AND TECHNOLOGY TRANSFER

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Availability of quality seed locally of food crops and vegetables is the most challenging task in general and in eastern part of the country in particular because of high humidity for longer period before and after rainy season. The high humidity during harvest of the crops and vegetable often leads in deterioration of seed quality. This is the reason that farmers of the region do not have access to high quality seeds of varieties/hybrids bred by public funded institutions. Quality seed has been considered as one of the most important component for ensuring optimum plant population that helps in attaining better crop growth and health. In case of pulses, quality seed supply of recommended varieties remain a major constraint in achieving higher production and productivity. To improve availability of quality seeds at district level, seed-hub concept has been supported by the DAC&FW and implemented through ICAR for enhancing quality seed availability in case of pulses, oilseeds and millet crops. The major advantage of the seed-hub concepts rest in the production of quality (certified) seed as such seed is to be produced through farmers' participation that helps in building confidence among farmers about performance of high yielding varieties/hybrids. Simultaneously, farmers are also exposed about the improved integrated crop management technologies well supported by trainings at their own farms/villages. Since, monitoring of seed crops has to be undertaken at different stages farmers gets trained automatically on quality seed production aspects/steps. Several young and energetic farmers have already started seed business and ensuring increased availability of quality seeds locally. In case of pulses, seed hubs program has created awareness about quality seeds and helped in increasing seed replacement rate and in turn pulses production has attained new height and increased to the level of 25.23 million tonnes during 2017-18. This clearly indicates that if quality seeds of recommended high yielding varieties can be made available to the farmers locally through seed-hubs; they will happily accept the worth of high yielding varieties and crop management technologies. Therefore, author is of opinion that concept like seed-hubs needs promotion in other crops and vegetables as well for improving farm output.

Keywords: -Seed-Hubs, Farmers' Participatory Approach, Quality Seed Production, Technology Transfer.

PHENOTYPIC DIFFERENCES IN RESPONSE TO SUBMERGENCE IN RAINFED LOWLAND RICE**ANURADHA SINGH****Dept.of Botany Meerut College, Meerut, India**

Phenotypic differences in response to submergence was studied in tolerant and intolerant rainfed lowland rice varieties. Increase in submergence duration, in general, induced shoot elongation, root porosity and decreased the plant survival, tiller number per plant, root and shoot dry weight. The survival was higher in tolerant varieties FR 13A (87%) and Vaidehi (80%) than in intolerant varieties Mahsuri (27%) and IR 42(13%). Tolerant varieties invariably had higher vigor (plant height and dry matter) before submergence though underwater shoot elongation was more in intolerant varieties. A correlation study between change in root porosity and plant survival showed a positive linear relationship with R^2 value of 0.57 and 0.88 for 5d and 10d submergence respectively. It is evident that root porosity has a significant impact on the survival behaviour of rice plants after submergence.

Keywords: Rainfed lowland (RL), rice (*Oryza sativa* L.), submergence, shoot elongation rate(SER),porosity

PERFORMANCE EVALUATION OF SELF PROPELLED REAPER BINDER FOR HARVESTING OF WHEAT CROP**ANURAG PATEL^{1*}, RAJKISHOR SINGH² AND S.C. MOSES³**

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In India harvesting of cereal crops is one of the major attentive agricultural operations in agriculture production, which demands considerable amount of labours. The availability and cost of labour during wheat crop harvesting season are serious problems. It is therefore, essential to adopt the mechanical methods so that the timeliness in harvesting operation could be ensured and field losses are minimized to increase production on the farm. The objective of this study was to evaluate the field performance of self propelled reaper-binder at farmer's field. The effective field capacity of the reaper binder was found as 0.17 ha h⁻¹ with a field efficiency of 78.49 per cent at an average operating speed of 2.55 km h⁻¹. The fuel consumption was observed as 1.12 l ha⁻¹. The harvesting cost and losses were Rs. 3235.11 ha⁻¹ and 25.42 kg ha⁻¹ respectively. The feedback of machine operation was collected by some farmer's at the time of harvesting and the performance of the reaper binder at the farm was satisfactory.

Keyword: Wheat crop harvesting, self propelled reaper-binder, fuel consumption, cost economics

EXPLORATION AND CHARACTERIZATION OF BRINJAL GERMPLASM FOR GROWTH AND FLORAL MORPHOLOGY IN TERAI REGION OF WEST BENGAL**APARAJITA DAS* AND BIMAL DAS****Department of Genetics and Plant BreedingUttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal**

Assessment of genetic resources is an important and starting point of crop improvement programme. The present study was taken up at the Instructional Farm of UBKV, Pundibari, Coochbehar, West Bengal during 2015-2018 for 17 different morphological, floral biology and biochemical parameters of brinjal. Thirty brinjal germplasm were collected from different parts of West Bengal. On field trial evaluation among the 30 germplasm some genotypes were resistant against fruit and shoot borer and also showing good yielding varieties in this region like UBB-8, Bholanath and Joshna. Biotic factor like bacterial wilt resistant some cultivar found better response viz. Singnath, Ashapuri Changa, Balasi, Pundibari local 2 and UBB-8. The better quality responses in terms of good size and shape, colour, anthocyanin content, total phenol, total soluble sugar and dry matter content. The genotypes like Balasi, Bholanath and Tufanganj were most promising and consumer preferences. The study of floral morphology revealed that genotypes like Ashapuri Changa, Jhuri begun, Black Beauty and Tufanganj were having long styled which is good for better fruit setting as compare to medium and short styled flower. Moreover the flowering biology of eggplant and the influence of flower heterostyly are directly proportionate to yield. Eggplants set fruits from flowers with long style in 49–100% and with medium style in 46–85%.

Key words: Brinjal, germplasm, floral morphology.

STUDIES ON GROWTH, YIELD AND QUALITY CHARACTERS OF CUMIN BLACK (*NIGELLA SATIVA* L.) UNDER INTEGRATED NUTRIENT MANAGEMENT IN TERAI ZONE OF WEST BENGAL**ARADHANA SEN*, AND J.C. JANA****Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal- 736165**

Cumin black (*Nigella sativa* L.) is a minor seed spice of immense medicinal values. This plant of Ranunculaceae family needs a cool and mild climate for its vegetative growth but hot weather conditions for a good harvest. The oil of cumin black is used in various medicinal product and the seeds have been an important member of Ayurveda, Siddha and Yunani. The recent development of agriculture has increased the yield by many fold but has also gifted us with numerous health hazardous chemicals.

These chemicals no doubt protects the plants from disease and pest attack and increase their feeding capacity, thereby forcing the soil and plant to give higher yield, but also has numerous health hazards to humans. Therefore, keeping in mind the ill effects of chemicals and the goodness and simplicity of our traditional manures this research work was framed and conducted during rabi months of the years for two consecutive season. The main target was to try and implement if any part of the chemical fertilizer could be substituted by the organic manure and also, to study the effects of various combination of different levels of inorganic, organic and biofertilizer (Azophos) on the vegetative growth of plant, yield and quality of seeds of cumin black (*Nigella sativa* L.) cultivation. The results revealed that the combination of 100% Recommended dose of fertilizer+ 15 t ha⁻¹ Farm Yard Manure + 4 kg ha⁻¹ Azophos significantly improved most of the parameters under study. But, for seed oil production 75% of chemical fertilizers+ Farm yard manure+ Azophos recorded better results. Along with that soil property also improved though not significantly but continuous organic practices will surely have more impact in future. Therefore, from the present study it can be suggested that for higher seeds production inclusion of organic manure and bio-fertilizer along with 100% (RDF) is the better but for seed oil production 25% RDF can be substituted with farm yard manure and Azophos for better and quality oil production in terai region of West Bengal.

Keywords: Azophos, bio-fertilizer, cumin black oil, Farm Yard Manure

EFFECT OF FERTILIZER ON BROWN PLANTHOPPER (BPH) NILAPARVATA LUGENS STAL. AND ITS HOST RICE PLANTS

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The macronutrient Nitrogen, Phosphorus, and Potash (N,P,K) is an essential element for growth and reproduction of plants and their consumers, including herbivorous insects. Numerous studies have shown that high level fertilizer application to crops can influence plant- insect interactions and potentially increase growth, food consumption, survival, reproductive rates and population densities of insect. The brown planthopper (BPH), *Nilaparvata lugens* Stal. (Homoptera: Delphacidae) is a phloem feeding insect and one of the most economically deleterious insect pests of cultivated rice. Applications of fertilizer may not affect insect biology directly, but they bring changes in host-plant morphology, biochemistry, and physiology, which can improve nutritional conditions for herbivores. Application of nitrogen fertilizer in rice increased survival, fecundity and egg hatchability of BPH nymphs and adults. But if phosphorus is supplied with higher nitrogen input, phosphorus significantly influenced several fitness traits of BPH. Phosphorus increased the concentration of P in rice plant tissues but not changed N, K, Si, free sugar and soluble protein contents, which indicated of P to the feeding of BPH and tolerance of plant against BPH. Potassium has no significant effect on any fitness traits of BPH either alone or combined with higher nitrogen input. K fertilization increased K content but reduced N, Si, free sugar and soluble protein contents in the plant tissues which resulted minimum reduction of relative water content (RWC) in rice plants after BPH feeding, thereby contributed to higher tolerance of rice plants to brown planthopper. Studied the effects of three major plant nutrients i.e. N, P and K on the biochemical compositions of both BPH and its host rice plants.

Keywords: Fertilizer, NPK, BPH, Host rice plant.

HETEROSIS AND COMBINING ABILITY STUDY FOR YIELD AND ITS ATTRIBUTING TRAITS IN TABLE PEA (*PISUM SATIVUM* SPP. *HORTENSE* L.)

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Table Pea (2n = 2x = 14) is a very common nutritious vegetable, with an important role in Indian agriculture. Besides the nutritional importance, it also helps in restoring soil fertility. In view of global food security and global warming, the existing germplasm has to be improved in terms of yield as well as resistance to biotic and abiotic stress for which it is necessary to study heterosis for yield and its components to find out better heterotic F₁'s and with good combining parents. In self pollinated crop like pea, the utilization of heterosis depends mainly upon the direction, magnitude and interrelationships of heritable and non-heritable components of variation of economic characters. Exploitation of heterosis is considered one of the outstanding achievements of plant breeding where it helps to understand breeding methodology for varietal improvement and also provide useful information about combining ability of the parents and their usefulness in breeding programmes (Singh et al. 2004). The diallele has contributed greatly to our understanding of the genetic basis of heterosis, selection of parents and prediction of the performance of selection in early segregating generations in a wide range of crops. The estimate of general combining ability effects and their relative magnitude of genetic variance provide guidelines for selecting the best parents for hybridization. The highly significant general and specific combining ability indicate the importance of both additive and non-additive gene action governing inheritance of characters under study.

WOMEN FARMERS ENHANCING FARMER'S INCOME IN INDIA**¹ARSHEED AHMAD MIR, ²NAWAZ AHMAD TEELI, ³MOHIT HUSAIN AND ⁴RAYEES AHMAD****^{1,2,4}Research Scholar, Faculty of Forestry, SKUAST-Kashmir-190 025****³Senior Research Fellow, Dept. of Silviculture & Agroforestry, College of Forestry, NAU-Navsari, Gujarat-396 450**

Women are the backbone of the development of rural and national economies. Women comprise 43% of the world's agricultural labor force, which rises to 70% in some countries and make the largest percentage of the workforce in the agricultural sector, but do not have access and control over all land and productive resources. The food and agriculture organization (FAO) estimates that women produce between 60% and 80% of the food in most developing countries and are responsible for half of the world's food production. Although the majority of the women workforce in India is engaged in agriculture but most of them do not have land rights. The rural women perform numerous labor intensive roles such as weeding, hoeing, grass cutting, harvesting of fruits and, flowers cultivation. Most of the women involved in the agricultural related activities like sowing, transplanting, weeding, plant protection, harvesting, winnowing storage of seed and in post-harvest management, processing and preservation of milk into cottage cheese, milk cake and kaladi (traditional type of cheese). Women also play an important role in cattle management, fodder collection and milking etc. Most of the farmer women are uneducated and unskilled but they are the invisible face of farm family income and are helping the farmers to market their produce. Thus women play a vital role in farming as they manage every aspect of farm work while performing household activities but are not considered as farmers. They toil in the fields- planting, sowing, weeding and harvesting but are not landowners. They harvest and process the produce but men largely control the market and income.

Keywords: Women, Agriculture. Production, Management, income.

SUSTAINABLE SOIL HEALTH AND PROFITABLE PRODUCTION WITH THE HELP OF DIVERSIFICATION AND INTENSIFICATION**ARUN KUMAR AND PRABHJIT KAUR****Department of Agronomy Punjab Agricultural University, Ludhiana-141004**

Crop diversification is a shift from less profitable and unsustainable crops or cropping systems to more profitable and sustainable crops/cropping systems. Diversification is one of the most reliable and suggested interventions for all holding size groups being a popular risk management strategy. Diversification / intensification / relay cropping results in higher profit in comparison to the conventional rice-wheat cropping system which is predominant in the IGP of India. The small and marginal farmers depends only one cropping system and can't aware about the mechanisation and intensification system. Crop diversification means to increase the total productivity in terms of quality, quantity and monetary value under specific and diverse agro-climatic situations. Crop diversification mainly depends on the land typology, farming experience, capital resources, location, access to agricultural technologies, market demand and price, transportation costs and general information access. In the case of marginal and small-land holders, bed planting of wheat along with vegetables like cucurbits as relay cropping in alternate furrows will yield higher profits in comparison to sole wheat cultivation. Farmers' income can be doubled by using the followings: Seed replacement and varietal replacement of improved wheat varieties, use of doubled haploidy and molecular tools in addition to proper policy interventions through maintaining a balance between input and output markets, soil-test based fertilizer application, use of more bio-fertilizers, vermi-compost and farmyard manure in addition to chemical fertilizers, supplementing soil with micronutrients like Mn, S, Zn and Fe, sowing the seeds after treatment for better germination and healthy seedlings, opting normal date of sowing to take advantage of the weather anomalies, adopting the region specific recommended package of practices, capacity building and skilling on special practices to improve economic efficiency.

Keywords: Sustainable, intensification relay cropping, profitable

CLINICAL EFFICACY OF VINCRISTINE SULPHATE AND THEIR SCAFFOLDS ON TRANSMISSIBLE VENEREAL TUMOR IN CANINE**ARUN KUMAR, N. S. JADON AND RASHMI SAINI****Department of Veterinary Surgery & Radiology, College of Veterinary & Animal Sciences, GBPUAT, Pantnagar - 263145, Uttarakhand, India**

The present study was conducted on twelve dogs of either sex affected with canine transmissible venereal tumour (CTVT). The animals were divided into two groups viz. A and B. The animals were administered with different drug viz. Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks and scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks. The physical appearance in relation to onoclytic effect, histopathological changes, ultrastructural (SEM) changes, biochemical (glucose, BUN, creatinine, AST and ALT) and haematological (Hb, PCV, TLC, DLC and platelets) studies were made at 0 week, first, second, third and fourth week by using standard protocol. On the

basis of parameter observed in this study, it is concluded that extent of apoptosis in CTVT cell at first and second week interval was more in the animals treated with scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks as compare to vincristine sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks as indicated by histopathological (H&E staining) examination and ultrastructural studies. Ultrastructurally, healthy cells had round to oval nuclei with large eccentric nucleolus and dispersed chromatin. Dilation of perinuclear space, clumped nuclear chromatin along the nuclear envelope and invaginated nuclear membrane was common in degenerating neoplastic cells. The cytoplasm of degenerating cell contained relatively swollen mitochondria with a few irregular cristae, abundant rough endoplasmic reticulum, fewer ribosomes, Golgi apparatus, occasional lipid droplets and numerous tubular and vesicular profiles. Vincristine sulphate is safe drug used in the present study as there was no adverse biochemical and hematological changes during entire period of study, however, the variable changes observed during these period were purely temporarily and were within normal physiological limits. The early and best regression of the CTVT was observed in the animals treated with scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks.

SOIL BIOLOGICAL PROPERTIES AS AFFECTED BY CONSERVATION AND WEED MANAGEMENT PRACTICES IN RICE-WHEAT SYSTEM

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Tillage in traditional rice-wheat system affects the health of soil microbes significantly either by use of chemicals or intensive tillage for control of weeds. It also has direct/indirect impact on the crop performance. However, to mobilize the nutrients with help of soil microbes, conservational practices should be followed with proper management of weeds. Thus, the present investigation was carried out at two consecutive years during 2015-16 to 2016-17 at N.E. Borlaug Crop Research Centre of Govind Ballabh Pant University of Agriculture & Technology, Pantnagar (Uttarakhand) with 5 establishments methods and 3 weed management practices under strip plot design, replicated thrice. Zero-till practice with retention of residues improved the soil health under weedy situation. Thus, the present investigation resulted conservational agriculture practice had significant effect on soil enzymatic activity.

FRUIT PRODUCTION AND EXPORT TREND ANALYSIS IN INDIA

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This study was attempted to examine production and export trend of Indian major fruit during the period 2001-2002 to 2013-2014. The compound growth rate analysis was carried out to ascertain the growth in area, production, productivity and exports of fruit from India. India is a front runner in many fruits with share in world production, 45.1% of Mango and Guava; 43.7% of Papaya; 27.8% of Banana. Out of the total production of fruits, nearly 76 per cent is consumed in fresh form, while wastage and losses account for 20 to 22%. The major destinations for Indian fruits are UAE, Bangladesh, Malaysia, UK, Netherlands, Saudi Arabia and Nepal. The fruits- mango, banana, papaya, guava, orange and pineapple production and export in India for the period of 2001-2013 showed increasing trends in production and declining trends in export except banana and papaya which showed increasing trend both in production and export. Due to unavailability of requisite infrastructure facilities in the production area, India was unable to export more fruits to the developed countries. To increase export to developed countries, facilities like Irradiation, V.H.T. Cold storage needs to be established in production zones. Growing more varieties of fruits, adopting better farming techniques, and better post harvest techniques and certification techniques would increase the Indian fruits exports to great extent.

Keywords: Fruit, Trend analysis, India.

EFFECT OF TEMPERATURE AND RELATIVE HUMIDITY ON WATER ACTIVITY OF GREEN GRAM STORED AT DIFFERENT MOISTURE CONTENTS IN DIFFERENT BAGS

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Green gram (*Vigna radiate*) grains were procured from local market, cleaned and graded by using two screen cleaner-cum-grader. Storage study was conducted by storing large sized green gram grains in 4 types of bags (jute, plastic, polythene, hermetic) without and with treatment (aluminium phosphide tablets) at 3 different initial moisture contents (12.34, 14.07, 16.04 % w.b.). Total 21 such bags having different treatment combinations were kept in laboratory for 33 weeks. Daily observation of ambient temperature and relative humidity was taken throughout the study period. Weekly observations of water activity were recorded for 20 weeks. It was observed that water activity goes on increasing with advancement of storage duration and decrease in temperature and RH across all 21 experimental combinations. The overall variation range for water activity was 0.551 to 0.959. Variation was more in case of untreated samples as compared to treated samples. Hermetic bags stored green gram was found better with minimum water activity uptake even after 20 weeks of storage duration. Water activity was increased from 0.551 to 0.787 only for green gram stored in hermetic bags across all three initial moisture contents. Temperature and RH along with other independent variables had significant effect on water activity of stored green gram. Hence the hermetic bag could be recommended for storing green gram safely for longer duration without affecting its quality.

IMPACT OF PARTICIPATORY VIDEO IN AGRICULTURE EXTENSION

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Video is a useful means of sharing knowledge with farmers, scientists, extension workers, agricultural journalists and other rural development professionals. The attribute ‘**participatory**’ with video refers to the idea that people should not only be receivers but also the active producers of the messages. Participatory video as an extension approach is bringing together the local communities with their own knowledge and capacity for research on one platform with the researchers and other professionals. In lieu with limitations of wider communication gap in agriculture extension to solve the production problems of a large majority of small farmers there is a frantic search for alternative approach to develop useful technologies. There is a need to make farmers more active partners in technology development process. It is a useful means of sharing knowledge with farmers, scientists, extension workers, agricultural journalists and other rural development professionals. The paper highlighted the impact of participatory video in specifically in agriculture through various cases. The functions and working of participatory video and its role in agriculture communication have also been studied. Finally, the study supports the use of participatory video as a means of knowledge sharing and information exchange among farmers and its future implication.

Keywords: Participatory extension approach; Participatory video; Communication development; Information Exchange

EVALUATE THE EFFECT OF SSNM ON YIELD AND YIELD ATTRIBUTING PARAMETERS OF RICE IN VERTISOL

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A field experiment was carried out during the kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), India to study the “Evaluate the effect of SSNM on yield and yield attributing parameters of rice in vertisol”. The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. RDF(100:60:40:5 NPK and Zn kg ha⁻¹), SSNM based on nutrient expert (120:60:60:5, NPK & Zn kg ha⁻¹), SSNM based on leaf color chart (60:60:60:5, NPK & Zn kg ha⁻¹, rest 50% N based on LCC), SSNM-N, SSNM-P, SSNM-K, Control (N₀, P₀, K₀) and Farmer Fertilizer Practices (N₈₀, P₄₀, K₀). The results obtained in this study showed that the T₂-SSNM based on nutrient expert performed significantly better than the other treatments for yield attributing characters viz. number of tillers 400, number of panicle 350, panicle length 24.30 cm, filled grain per panicle 145, test weight of 1000 seeds of rice 28.8gm, grain yield 50.2q ha⁻¹ and straw yield 82.8q ha⁻¹ and lowest was found under control treatments at harvest stage of rice. SSNM Treatment based on

nutrient expert (NE) recommendations proved superiority over applied different treatments on yield involved balance removal as required by rice as well sustaining soil available nutrient status.

Keywords: Rice, Nitrogen, Leaf Color chart, site specific nutrient management

EFFECT OF SITE SPECIFIC NUTRIENT MANAGEMENT ON UPTAKE AND NUTREINT USE EFFICIENCY OF RICE IN VERTISOL

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A field experiment was carried out during the kharif season (June–October) of 2016 at the Research Farm of the Indira Gandhi Agricultural University, Raipur (C.G.), India to study the “Effect of site specific nutrient management on uptake of nutrient of rice in vertisol”. The experiment was laid out in a Randomized block design with three replications and eight treatments namely i.e. RDF(100:60:40:5 NPK and Zn kg ha⁻¹), SSNM based on nutrient expert (120:60:60:5, NPK&Zn kg ha⁻¹), SSNM based on leaf color chart (60:60:60:5, NPK& Zn kg ha⁻¹, rest 50% N based on LCC), SSNM-N, SSNM-P, SSNM-K, Control (N₀, P₀, K₀) and Farmer Fertilizer Practices (N₈₀, P₄₀, K₀). The results was revealed that the highest nutrients uptake- nitrogen 114.3 kg ha⁻¹, Total phosphorus 21.5 kg ha⁻¹ and 185.9 kg ha⁻¹ potassium was recorded under treatment T₂ SSNM based (NE) similarly total uptake of Zn were reported 338 g ha⁻¹ under T₃-SSNM (LCC) and was also reported that nutrient use efficiency of rice (cv. Rajeshwari) recorded for nitrogen 40.4%, phosphorus 21.2% P, potassium 138 % under treatment T₂ based on SSNM (NE). Overall concluded that treatment based on nutrient expert (NE) recommendations proved superiority over applied different treatments on yield ,nutrients uptake (N,P,K & Zn) involved balance removal as required by rice as well sustaining soil available nutrient status.

Key words: Leaf color chart (LCC), Site specific nutrient management, Uptake, Nutrient Use Efficiency

EFFECT OF ROOT EXUDATES OF MUSTARD IN THE SPORE GERMINATION OF FUSARIUM OXYSPORUM F. SP. CICERI

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Chickpea is the most important pulse crop grown mostly in rainfed areas. The crop is damaged due to wilt. Mustard is used as intercrop could help in reducing losses caused by soil borne fungi. Root exudates of various crops are known to adversely affect the pathogens build up in the soil. The root leachates of mustard evaluated against the germination of conidia of *Fusarium oxysporum* f. sp. *ciceri* in laboratory conditions. Beaker method was followed to test the efficacy of root leachates. Twenty five ml of sterilized distilled water was filled in the beaker. Ten seeds of mustard were planted on blotter paper. The root leachates of mustard collected after 15 days of germination delayed spore germination of *Fusarium oxysporum* f. sp. *ciceri* by five hours while, that of seven days delayed by four hours. Increasing dilution of root leachates had considerable effect on the germination of micro and macro conidia of *Fusarium oxysporum* f. sp. *ciceri*.

YIELD GAP ANALYSIS AND CONSTRAINT OF GREEN GRAM CULTIVATION IN NAGOUR DISTRICT OF RAJASTHAN

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The present study attempted to estimate the yield gap and constraint in Greengram cultivation in the nagour district of Rajasthan. The multi-stage random sampling procedure was adopted to choose the sample farmers. In the first stage, nagour district was selected based on highest greengram area in Rajasthan. In second stage, tehsil having highest area under greengram were selected. Later two villages from each tehsil having highest area under greengram crop were selected in the third stage. For the collection of primary data, a sample of 80 farmers were randomly selected with probability proportion to number of farmers in each size group. Farmers were grouped into three categories such as (1) Small farmers holding land less than 2.0 ha, (2) Medium farmers holding land between 2.0 to 10.0 ha and (3) Large farmers holding land above 10.0 ha. The data pertained to the agricultural year 2015-16. The Total Yield Gap (TYG) is computed as the difference between the potential yields (Y_p) and the actual yield (Y_a). The results revealed that among the three categories of farmers the yield (gap-I) at overall level, was higher for green gram crop in the selected district, which implies that the technology developed at research station cannot be duplicated on demonstration plots to exploit the full potential of green gram. Maximum yield (gap – II) was observed highest on small farms followed by medium farms

and large farms in the study area. The farmers usually do not adopt a technology as package but take up individual practices suitably trimmed to fit into their budget and skills which lead to the variation in the adoption of cultural practices and consequently to the yield gaps. Its are constraints found from (over all farmers) that the Water shortage was ranked first followed by Weeds ,and Severity of disease and pest attacks were ranked third and soil fertility ranked fourth. Non- availability of input like was ranked fifth.

Keyword:- Multi-stage, Yield gap, Actual and Potential Yield, Farmers category

CONSERVATION OF PLANT GENETIC RESOURCES

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The potential and actual value of the different kinds of plants and their varieties is plant genetic resources (PGR). These resources play invaluable roles in different facts of life regardless of their source and origin. Conservation is the sustainable use of these resources to enable future generations benefit. They are utilized when they play roles that improve the wellbeing of humans. They can be sufficiently conserved through in situ and ex situ approaches. These are complementary and require an improved integrated approach. Conservation of plant genetic resources has developed into an important technical, socio-economic and political concern over the past forty years. Extensive expertise has been developed in this field by agencies and institutions involved with plant genetic resources over the past 30 years. Gene banks were established in almost every country based on a two tiered conservation concept that was developed for the storage of orthodox seed producing cereal crops. Focus should also be extended beyond existing crops and their wild and weedy relatives to cover all PGR on earth. Local efforts should be strengthened to play roles in conserving and utilizing these resources.

Keyword- PGR, Germplasm, Conservation, Gene bank

EFFICACY OF ORGANIC SOURCES OF NUTRIENTS AND WEED MANAGEMENT ON PRODUCTIVITY OF POTATO UNDER SUB-TROPICAL CONDITIONS OF JAMMU REGION

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An investigation to study weed management in combination with organic sources of nutrients in potato under sub-tropical conditions of Jammu region was conducted during rabi seasons of 2015-16 and 2016-17 at research farm of AICRP-IFS, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu. The experiment was laid out in split-plot design with six sources of nutrients treatments in main plots and four weed management treatments in sub-plots with three replications each. The main plot treatments consisted of six sources of nutrients, viz. 50% Rec. NPK through fertilizer + 50% N through FYM + inorganic source of micronutrients as per soil test, 100% organics (100% Rec. N through different organic sources each equivalent to 1/3 of Rec. N i.e. FYM + vermicompost + non edible oil cake), 100% organics+ marigold for potato on border as trap crop and bottle guard as trap crop for frenchbean, 50% Rec. N through vermicompost + biofertilizers for N + rock phosphate to substitute the P requirement + PSB, 100% organics + VAM, 100% Rec. NPK + secondary and micronutrients based on soil test through inorganic fertilizer and sub plots comprised of four weed management treatments, viz. weed free, mustard seed meal 5t/ha, rice bran 4 t/ha and weedy check. Among the sources of nutrients in potato, application of 100% organics + VAM recorded the highest plant height (19.80 cm, 20.20 cm), dry matter accumulation (3.34 g/plant, 3.40 g/plant) and tuber yield (130.38 t/ha, 131.89 q/ha) which was statistically at par with 100% organics + marigold for potato on border as trap crop and bottle guard as trap crop for frenchbean and 100% Rec. N through different organic sources each equivalent to 1/3 of Rec. N i.e. FYM + vermicompost + non edible oil cake during both years of experimentation. Among the weed management treatments, application of mustard seed meal 5 t/ha, rice bran 4 t/ha and weed free treatment though at par with each other not only significantly enhanced the plant height (19.62 cm, 20.20 cm), dry matter accumulation (3.25 g/plant, 3.35 g/plant) and tuber yield (138.35 t/ha and 140.69 q/ha) of potato but also lowered the total weed density and total weed biomass at 30 DAP during both the years of cropping (2015-16 and 2016-17).

IMPACT OF CLIMATE CHANGE ON AGRICULTURAL CROP PRODUCTION

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Agricultural crop production is directly depended on climate change and weather. Possible changes in temperature, precipitation and CO₂ concentration are expected to significantly impact crop growth. The effect of climate on agriculture is related to variabilities in local climates rather than in global climate patterns. The Earth's average surface temperature has increased by 1.5 °F (0.83 °C) since 1880. A 2008 study published in science suggested that, due to climate change, "southern Africa could lose more than 30% of its main crop, maize, by 2030. In South Asia losses of many regional staples, such as rice, millet and maize could top 10%". India experienced severe cold wave from December 2002 to January 2003. Some parts of jammu, Punjab,

Haryana, Himachal Pradesh, Bihar, Uttar Pradesh and North eastern states experienced unprecedented cold war. The crop yield loss varied between 10 and 100% in the case of horticultural crop and seasonal crops. However temperate fruits like apple, peach, plum and cherry gave higher yield due to extreme chilling. Changes in the frequency and severity of droughts and floods could pose challenges for farmers and ranchers and threaten food safety. Meanwhile, warmer water temperatures are likely to cause the habitat ranges of many fish and shellfish species to shift, which could disrupt ecosystem. The effects of climate change also need to be considered along with other evolving factors that affect agricultural production, such as changes in farming practices and technology.

Keyword: climate change, agricultural production, precipitation

ARID REGION FRUIT PLANTS OF RAJASTHAN

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Arid zone vegetation comprises a wide range of edible fruit bearing and food producing species viz. *Capparis decidua* (Ker), *Cordia dichotoma* (lasora), *Ziziphus mauritiana* (ber), *Ziziphus nummularia* (Bordi), *Salvadora oleoides* (Jal), *Balanites aegyptiaca* (Hingota), *Prosopis cineraria* (Khejri) etc. The wild plants assume significance as alternative food sources, predominantly in the areas receiving frequent droughts and famine. In many Indian states, majority of forest dwellers depend on forests for their annual food requirements. *Ziziphus mauritiana*, *Cordia myxa*, *Salvadora oleoides* are some of the important fruit bearing plant species found in hot arid region in India that provide food supplement and means of survival during time of hardships. Rural people in Rajasthan state of India have extensive knowledge about use of famine foods. The fruits of many plants are rich sources of protein and energy. For example, *Ziziphus mauritiana* is richer than apple in protein, phosphorous, calcium, carotene and vitamin C. However, they are often undervalued and underutilized. This article highlights the importance of some of these plants, their various end uses and nutritive values of their seeds and fruits.

Keyword: Arid region valuable plant, Nutritional value etc.

NON GENETIC FACTORS AFFECTING THE CULLING RATE AMONG FRIESWAL FEMALE CALVES

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The culling rates among Frieswal heifers up to AFC varied between 7.72% in second period and 19.23% in fourth period. The differences culling rates over different periods were found to be significant. The culling among the heifers is generally practiced as per the need of the herd and the type of stock available for replacement. Therefore, generally culling is not practiced uniformly over different years/periods, which may result into the significant variations in the culling of heifers. The average culling rates among heifers upto their AFC ranged from (10.56%) in Autumn season to (13.57%) in summer season. The differences in culling rates due to season of birth were observed to be non-significant. The heifer culling rates among dam's parity order ranged from 5.77% in sixth parity to 17.65% in fifth parity. However, these differences in culling rates due to dam's parity were found to be non-significant and there was no definite trend in culling rates among parity order.

SUSTAINABLE DEVELOPMENT GOALS AND SUSTAINABLE AGRICULTURE IN LAMJUNG: POSSIBILITIES AND CHALLENGES AHEAD

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Purpose: Sustainable development goals combine seventeen goals which set the tone and direction for development, they are aimed to form a development strategy which is sustainable. Promotion of sustainable agriculture has been included among these seventeen goals to terminate hunger, ensure food security and to get improved nutrition. In Nepal, 81% populations are living in rural areas and largely depend on agriculture for livelihood. Gross Domestic Product (GDP) from agriculture has been increasing significantly every year. In spite of having a lot of opportunities to flourish, sustainability in agri production is still a distant dream in Nepal. Sustainable agriculture is meant for efficient production strategy which is safe, high in quality and does not cause any negative impacts on the environment. **Methodology & Approach:** This research paper is thematic in nature which has been carried out with the help of a questionnaire using five-point Likert Scale. The farmers who are the sole stakeholders were the respondents for conducting the survey. **Findings:** This paper finds that most of the farmers are not conscious of sustainable agriculture and food security in Lamjung. They are deprived of proper schooling and training which can be considered as prime hindrance to implement sustainable agriculture. This paper also tries to find out the possibilities and challenges of sustainable agriculture in Nepal.

Practical Implications: Findings are based on the survey conducted on the farmers directly engaged in agri production which is meant to measure the awareness of sustainable production among them. Originality and Value: The paper contributes to create awareness about sustainable agriculture and food security among the farmers in Lamjung as well as in Nepal which is a must to bring out sustainable development. This paper also proposes a framework to improve the existing situation.

Keywords: Sustainable Agriculture, Lamjung, Awareness, Food security, Chemicals and Pesticides.

BOTANICAL INDUCED REGULATION OF DEFENSE IN PLANTS AGAINST CROP PESTS

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Pests are the serious problems in agriculture and there are many ways to kill or knock down the pests among which chemical control is the most widely used one with several drawbacks. Botanicals induced plant defence is an attractive and favourable alternative for pest management. Documented scientific literature also support the fact that plant secondary metabolites are involved in the interaction of plant with other species- primarily in the defence response of plant against pests. Botanicals represent a large reservoir of chemicals which directly exert anti pest activity or may induce plant defences by stimulating expression and activity of systemic acquired resistance (SAR) and induce systemic resistance (ISR). Plants produce diverse array of secondary metabolites which include phenolics, terpenes, alkaloids, lignans and their glycosides. These play significant role in plant defence system and offer an array of structural prototypes for development of lead molecules which can serve as new pest control agents. Some botanicals also increase phenylalanine ammonia-lyase (PAL), tyrosine ammonia lyase (TAL) chitinase and b-1,3-glucanase activities and enhanced accumulation of phenolic compounds which helps in inhibition of mycelial growth and spore germination of pathogen.

Keywords- Botanicals, Induce, Defence and Pest management.

CLUSTERED REGULARLY INTERSPACED SHORT PALINDROMIC REPEATS (CRISPR) AS A PEST MANAGEMENT TOOL FOR AGRICULTURE CROPS

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Crop losses are a major threat to the wellbeing of the farmers, to the economy of traders and governments, and to food security worldwide. The loss due to pests and diseases are reported in many economically important crops due to the lack of proper management strategies. Several strategies like the Cultural control, Mechanical control, Biological control and Chemical control are used either individually or as an integrated measure for managing these pests and diseases. Among these strategies some are “late effective with short duration” and some, like the pesticides are having adverse on ecosystem and may lead to the destruction of biodiversity. The clustered regularly interspaced short palindromic repeats (CRISPR) is a novel approach which is providing good result in pest management. CRISPR/Cas9 is skewed sex ratios, reduced fitness, or restored susceptibility to insecticides in target populations. (CRISPR)-based gene drives (GDs) could be used to spread desirable genetic elements through wild populations. With the imminent development of this technology in vertebrates, we believe that it is time to highlight two forms of sex-ratio distorting GDs that show potential as pest management tools. One potential application of GD is to distort the sex ratio of a population. By skewing the sex ratio away from the favored Fisherian ratio of 1:1 male to female, it is possible to manipulate the reproductive performance of a population. To further advance its utility, a novel CRISPR-based technology termed precision guided sterile insect technique (pgSIT) is described. The pgSIT mechanistically relies on a dominant genetic technology that enables simultaneous sexing and sterilization, facilitating the release of eggs into the environment ensuring only sterile adult males emerges. Using mathematical models, we predict pgSIT will induce substantially greater population suppression than can be achieved by currently-available self limiting suppression technologies. Taken together, pgSIT offers to potentially transform our ability to control insect agricultural pests and disease vectors. Hence, CRISPR mediated pest management can be considered as a newly emerging science which will play a potential role in pest management strategies in the near future.

Keywords- Pests management, CRISPR (GDs), CRISPR/Cas9 and pgSIT.

IMPACT OF SPACING AND ORGANIC MANURES ON DIFFERENT VARIETIES OF BABY CORN (ZEA MAYS L.) UNDER POPLAR (POPULOUS DELTOIDES L.) BASED AGROFORESTRY SYSTEM

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The present investigation entitled, “Effect of spacing and organic manures on different varieties of baby corn (Zea mays L.) under poplar (Populous deltoides L.) based agroforestry system” was carried out during two consecutive rabi seasons (2014-15 and 2015-16) at Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, India. The field experiment was laid

down in factorial randomized block design with three replications and eighteen treatments. On the basis of finding drawn from the present investigation, out of different treatment combinations, vermicompost along with plant spacing of 60x25cm were found more impressive in improving phenological characters, growth parameters, yield and yield attributes and even economical parameters over the rest of other treatment combination used in the present study. Appraisal of the pooled data showed that during both the years of investigation, corn yield was recorded significantly high i.e., 60.24 q ha⁻¹ in treatment T₁₄ (V₂+ S₂+ F₂) which consists of baby corn hybrid-DHM1107, vermicompost with plant geometry of 60 x 25 cm. The same treatment also recorded significantly highest net returns (Rs.2, 21,350 ha⁻¹) and benefit cost ratio (3.24) as compared to rest of the treatments. The second best treatment that showed significant influence among various phenological, growth, yield and yield contributing parameters was T₅ (V₂+S₂+F₁) which consists of baby corn hybrid-DHM1107, FYM, with plant geometry of 60x25cm.

Keyword: - Organic Manure; Poplar; Baby Corn; Agroforestry

KNOWLEDGE LEVEL OF FARMERS TOWARDS USE OF SOCIAL MEDIA FOR SEEKING AGRICULTURAL INFORMATION: A STUDY IN UDHAM SINGH NAGAR DISTRICT OF UTTARAKHAND

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The study entitled “knowledge level of farmers towards use of social media for seeking agricultural information : A study in Udhm Singh Nagar district of Uttarakhand” was undertaken with objectives to find the knowledge level of farmers towards use of social media as a source of agricultural information and to analyze the relationship between socio-personal characteristics and knowledge level of farmers towards social media. The study was conducted in two purposively selected villages Malsagirdharpur and Saijani of Kichha block in Udhm Singh Nagar district of Uttarakhand. Every third respondent was selected by systematic random sampling . Findings of the study revealed that majority of farmers had medium level of knowledge about “social media” viz. Facebook , Whatsapp , YouTube and Twitter. It was also noted that farmers had low knowledge about use of twitter for agricultural information. Further it was found that most of the farmers were linked with various social media platforms for exchange of agricultural information. Education, Social media exposure, Innovativeness, Achievement motivation had positive and significant relationship with knowledge level towards use of social media as a source of agricultural information. The findings of the study will be helpful to researchers and policy makers for creating farmer friendly content and develop farmer oriented platforms on social media that can be accessed with ease and will be reliable.

Keywords: Social media , Knowledge level , Agricultural Information

EFFICACY OF PLANT EXTRACTS AND CHEMICALS AGAINST ASCOCHYTA PHASEOLORUM, CAUSAL AGENT OF ASCOCHYTA BLIGHT OF VIGNA ANGUICULATA (L.) WALP.

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During survey, cowpea [*Vigna anguiculata* (L) Walp.] was found severely affected by ascochyta blight and the disease was found well distributed in the surveyed areas of Meghalaya. The per cent disease incidence was found maximum in Mawlai (52.34%) under East Khasi Hills followed by Umran (45.57%) under Ri-Bhoi district. In average, PDI was found highest in Ri-Bhoi district (37.50%) and least in West Khasi Hills district (15.47%). *Ascochyta phaseolorum* was consistently isolated from symptomatic leaves. Plant extracts and fungicides were evaluated *in vitro* against the growth of the pathogen. Among the fungicides, propiconazole and carbendazim at 0.1 and mancozeb at 0.2 per cent concentrations gave 100% inhibition of mycelial growth. Among the plant extracts, garlic extract at 5% showed the highest per cent inhibition (86.91±1.07%) of mycelial growth followed by turkey berry at 15% (82.33±0.44%). These could be further evaluated under *in vivo* condition to confirm its efficacy and could be included as components for integrated disease management for ascochyta blight.

Keywords: Cowpea, ascochyta blight, *Ascochyta phaseolorum*, disease incidence, per cent inhibition

WATER CONSERVATION AND REUSE OF WASTE WATER IN INDIA

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India supports 17 per cent of the human and 15 per cent of the livestock population of the world with only 2.4 per cent of the land and 4 per cent of the water resources. Out of the total annual precipitation of 4000 billion cubic meters (BCM), the utilizable water resources of the country have been assessed as 1123 BCM, of which 690 BCM is from surface water and 433 BCM from groundwater sources. It has been projected that population and income growth will boost the water demand in future to meet food

production, domestic and industrial requirements. The projected total water demand of 1447 BCM in 2050 will outstrip the present level of utilizable water resources (1123 BCM) out of which 1074 BCM will be for agriculture alone. The challenge in next four decades will be efficient as well as productive utilization of available water both in terms of food per unit of water and energy requirement, waste water utilization, sustainable and quality recharge of ground water, reduction in water use of crops and productive utilization of land and water resources in challenged eco-systems. Reuse of waste water to bridge the gap between availability and demand will become a more viable option in coming decades. Biotechnology and material science research are underway to develop new organisms, materials which can convert the waste water to usable one. These development/innovations would create a sea change in attitude/ technological options of using waste water of various qualities for food/fodder/timber production. A viable option for enhancing the use of existing utilizable water resource will be recharge of ground water from runoff water, i.e. storing runoff water in underground aquifers. However, for maintaining aquifer's health, it is essential that the quality of recharge water is maintained as per acceptable standards. This will be a major challenge in the planning and designing of groundwater recharge structures. Advancement in material science has potential for developing filters which can take care of this problem, and this will alter the paradigm of groundwater recharge research.

Keywords: Water, conservation, challenges, agriculture, recharge groundwater.

THE EXAMINE BUSINESS OPPORTUNITIES OF REAL TRIBUTE AGRO PRODUCT PRIVATE LIMITED IN SAMASTIPUR DISTRICT

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The research was conducted at 20 different blocks of Samastipur district in Bihar, during 2018-2019, to “examine business opportunities of real tribute agro private company”. Increasing is importance of the emerging markets in the global economy, There is growing interest among marketing researchers and managers to understand the difference between the consumer in the developed and emerging markets as well as challenges and opportunities. Where, the market assessment data collected from 200 vendors and 500 customers 100 distributors by primary data survey method and its analyzed by using with stratified sampling method. The results of the primary data indicated that identify the demand of product in the particular region and season, consumer needs, improving marketing channels and behavior, increasing availability of the product and advertisement about that product, these are the criteria to increasing the business opportunities of real tribute agro private company in Samastipur district of Bihar.

Keywords: Market assessment, business opportunities, primary data emerging and stratified sampling.

A COMPARATIVE STUDY OF VEGETARIAN AND NON VEGETARIAN FOOD HABITS DURING PREGNANCY

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Anaemia in pregnancy is associated with increased rates of maternal and prenatal mortality, premature delivery, low birth weight, and other adverse outcomes. Haemoglobin is expected to drop during pregnancy. It is normal for haemoglobin to drop to 10.5g/dl during pregnancy. Micronutrients like Iron, copper, pyridoxine, Vitamin-C, Vitamin-B12, the deficiency is may cause of low haemoglobin that is become a reason for Anaemia. Previous studies concluded vegetarian diets are at risk of nutritional anaemia during pregnancy. The aim was this prospective study observed the effect of food habits if vegetarian and non-vegetarian were taken well planned local available foods. The study was conducted on 35 pregnant women who were pregnant at in Attarsuiya at Allahabad city of Uttar Pradesh, India .the study time duration was 2017-18. Blood was collected from all the subjects to measure the haemoglobin (Hb) during 16-18weeks, 22-24 weeks, and 34-35 weeks of gestation. According to food habits, it is divided into 2 groups. The first group was vegetarian and the second group was non-vegetarian both groups were taken proper routine check-ups by the gynaecologist and consult a nutritionist. Result founded that BMI Mean $\pm$ SD of vegetarian pregnant women is 23.1 $\pm$ 4.1 and on vegetarians was 22.8 $\pm$ 2.9. Haemoglobin Mean $\pm$ SD of a vegetarian pregnant lady is 11.9 $\pm$ 0.4 and on non-vegetarians was 11.3 $\pm$ 1.3. There is no significant difference (p <0.05) was observed value of BMI and haemoglobin in both groups. The study concluded that pregnant women if taken proper diet and balanced food group, available in the local market they would not suffer anaemia during pregnancy.

Keywords: vegetarian diets, nutrition; pregnancy, anaemia, balanced diet.

BOLL WEIGHT QTL HOT SPOTS IDENTIFICATION AND AN INITIATION TOWARDS FIBER YIELD IMPROVEMENT IN UPLAND COTTON

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Cotton (*Gossypium hirsutum* L.), one of the major species of cash crop, is cultivated worldwide. India harbours larger cotton cultivation land, but it ranks 37th position in global cotton production. This attracts Indian cotton researchers to dissect cotton genome underlying fiber yield improvement. Cotton fiber yield is very complex trait with many components. Cotton Boll weight (BW) amongst all is believed to be the key and promising component for cotton yield. Although several studies have been conducted for underlying cotton fiber yield for last several years, still it is a matter of further exploration and concern. Various numbers of quantitative trait loci (QTLs) affecting BW classifying major and minor QTLs are reported in public domain. However, no study has been performed for the BW improvement using these QTLs. In addition, the genomics underlying BW is still unclear and underexplored. In present study, meta analysis was performed accessing 157 public domain BW QTLs for identifying BW QTL hotspots/ clusters with high stringency and resulted 2 meaningful BW QTL hotspots in the chromosome 22 (D04) and 25 (D06). The identified BW QTL hotspots was physically mapped on reference genome for finding the exact region and sequence coordinate information using flanking markers. The chromosome 22 and 25 contained BW hotspot region of 5.7MB and 2.67MB of the genome respectively. Targeted sequencing of dissected BW QTL hotspots in Indian germplasm and its association mapping using SNPs markers will further help in characterization of relevant haplotypes to be used for the Marker Assisted selection (MAS) programme aiming for cotton yield improvement. The same BW associated haplotypes will be validated in F₂ mapping population of contrasting parents (High BW X Low BW). Thus, the whole study results BW QTL hotspots with associated SNPs and haplotypes, those may be useful in fine mapping and precision breeding for BW traits.

Keywords: *Gossypium*, boll weight, fiber yield, haplotype, marker assisted selection (MAS), quantitative trait loci (QTL), single nucleotide polymorphism (SNP), targeted sequencing.

STUDY ON THE PRODUCTION, INCOME AND MARKETING OF MANDARIN ORANGE IN SALYAN DISTRICT

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The study on the production, income and marketing of mandarin orange was carried out in Salyan district at Sharada and Bagchaur municipality during January to April 2017. The main objective of the study was to access the information about production and market status of mandarin orange and its role in income generation. All together 100 respondents were selected, among them 15 respondents were from Khalanga, 20 respondents were from Peepalneta, 30 respondents were from Katmaula and the 35 respondents were from Dangigaun. In this study, 80 percent male and 20 percent female were involved in mandarin production. 67 percent of the respondents were literate and 33 percent were illiterate. 0.2-0.5 hectares of land holding was done by 44% of the respondents for mandarin production. 36% of the respondents used sprinkler irrigation. The status of mandarin production of 45% of the respondents was increasing. The annual income of 22% of the respondents was around Nrs.10, 000-50,000. The annual income of 92% of the respondents was increased after mandarin farming. Dang, Nepalgunj, Dhangadhi, Butwal and the local markets of Salyan were the main market for wholesaler, retailer and contractors.

Key words: Production, Income, Mandarin, Market.

IMPACT OF CLIMATIC FACTOR ON THE LIPID PROFILE OF SOME FRESH WATER FISHES

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Lipid profile deviation is analyzed according to seasonal variation. Fresh water fishes especially *Labeo rohita*, *Catla catla*, *Labeo calbasu*, *Wallago attu* were studied in this experiment of separating and analyzing the properties of lipids. Variation in fatty acid composition of marine and freshwater fish has been reported by several authors. A comprehensive account has been presented by Ackman (1967). It suggests that fresh water fishes have higher levels of ω -6 fatty acids than marine species. Marine species, in general contain more ω -3 than that of ω -6 PUFA and thus the dietary requirements of marine fish for ω -3 may be higher than that of freshwater (Halver, 2002). This may also be affirmed with the findings in some migratory species where difference in ω -6 / ω -3 ratio between freshwater and seawater is seen when the species migrate from ocean to freshwater and vice-versa (NRC, 1977). The reason has been attributed simply to difference in diet or it may be related to species specific physiological requirements. There are a number of reports demonstrating effect of environmental temperature on fatty acid composition of aquatic animals. All the four species selected were sampled in summer, monsoon, and winter season brought freshly to the laboratory for fat extraction by Soxhlet-extraction method. The fat extracted in patches were pooled and stored for further analysis. The fat content of *Labeo rohita* varied between 23-30% while the iodine value was in range of 90-102. The level of triglyceride could be measured

between 402-410mgm(%).The saponification value was recorded between 101-171.2 and acid value between 8.81 and 9.21. The fat contents of *Catla catla* was recorded between 24.6-26.7%, Iodine value in the range of 96-97, saponification value between 152.4-158.7 and acid value between 7.8-8.61. These values in *L. calbasu* was recorded as: fat content 25.6 - 27.1%; Iodine value 96-98; saponification value 133.4-140.3 and acid value 6.93-7.6. In wild fishes, *Wallago attu* the fat content was a little high ranging between 26.2-32.3% and Iodine value between 88-92. The triglyceride mgm(%) ranged between 398-410, saponification value 126.6 to 181.3 and acid value between 6.8-7.32. Another wild species *Clarias batrachus* had less fat than *wallago attu*. It showed a fat content variable between 17.5-28.6; Iodine value between 20-36; level of triglyceride mgm(%) between 167.4-172.7 and acid value 8.9-9.6. The findings suggest that the total fat content in all the major carps were comparable to each other. The study also suggests that in general the fat content of fish increases during winter season probably on account of availability of quality food. However with regard to ω_6 and ω_3 profile the *Labeo rohita* and *Labeo calbasu* the phytoplankton and detritus feeders respectively shows a better range of ω_3 fatty acids than *Catla catla*, a zooplankton feeder which appears to be rich in ω_6 fatty acids. Thus the investigation suggests that while the carnivorous fish are rich in ω_6 fatty acids the phytoplankton and omnivorous fish shows a good profile of ω_3 fatty acids during summer and winter season. It is altered during monsoon season due to fish physiological activities involving maturation and subsequent reproduction as the level of fat deplete drastically.

Keywords: Lipid profile, seasonal variation, ω_6 fatty acid, ω_3 fatty acid, PUFA, environmental temperature.

ENHANCING THE ECONOMY OF FARMER THROUGH PROCESSED MUSHROOM PRODUCTS

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Mushroom cultivation has been growing as one of the most emerging trend among the farmers of today. Thousands of farmers have been trained for the cultivation of mushroom and have been successfully running the business. However the cultivation have been mostly confined only for the purpose fresh vegetables. During favorable seasons, the production of mushroom increases but due to the lack of knowledge on post harvest management, the farmers are compelled to sell it in low cost or gets damaged. The post processing of mushroom not only saves the farmer from selling at low price but also increases the nutritive and economic value of the mushroom. The fresh mushroom can be dried or made powder for different use or even it can be used as fresh vegetable too. The mushrooms can be converted into pickles, cookies and many other products through value addition because of which not only fresh mushrooms get saved from damaging but also it increases its economic value. The processing of mushroom is economical and easy process. The proper handling and post processing of mushroom can even double the value of normal fresh mushroom which gives more benefit to the farmers and can have the good earning. The post processing products of mushroom amplifies the living standard of the farmer which automatically increases the national economy of the country.

Keywords: Mushroom, Post-harvest, Economy

BIODIVERSITY (PLANT/ANIMALS) AND NATURAL RESOURCES MANAGEMENT AND THEIR CONSERVATION

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Biodiversity refers to the variety and variability among living organisms, and the ecological complexes in which they occur. This includes diversity within species, between species and of ecosystems. Human being's life are heavily dependent on the natural resources provided by the earth including land, water, air, minerals, animals and plants. Biodiversity is an invaluable natural resource and of fundamental importance to human beings' survival, well-being and sustainable development and to the health of various ecosystems on the Earth. Biodiversity is the core value that generates the services. However, due to the human overexploitation and other drivers, people in the 21st century are facing serious problems of depleted and exhausted ecosystems and an increasing loss of animals and plants. The biggest threats are habitat destruction and fragmentation, direct harvest, various forms of pollution, and climate change. Current rates of extinction are about 1000 times the likely background rate of extinction. Therefore, it needs to be conserved. Conserving biodiversity outside the area where they naturally occur is known as Ex-situ conservation. E.g. Seed banks, Botanical, Horticultural, Recreational gardens are some important centres for their conservation. Conserving the animals & plants in their natural habitat is known as In-situ conservation. It includes National parks & Sanctuaries, Biosphere reserves, etc. Although there has been rapid progress in developing protected areas, such efforts are not ecologically representative, nor do they optimally protect biodiversity. Natural resource management specifically focuses on a scientific and technical understanding of resources and ecology and the life-supporting capacity of those resources.

Keywords: biodiversity, ecosystem, services, Climate change, extinction, conservation.

EFFECT OF VERMICOMPOST AND BIOFERTILIZERS ON SOIL HEALTH, FLOWERING AND YIELD OF STRAWBERRY IN CENTRAL PLAIN REGION OF PUNJAB

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The experiment was conducted at the research farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during 2017-18 to study the effect of vermicompost and biofertilizers on soil health, flowering and yield of strawberry (*Fragaria × ananassa* Duch.) cv. Chandler in central plain region of Punjab. The Experiment was laid out in Randomized Block Design with 9 treatments replicated thrice. Treatments consisted of vermicompost and biofertilizers (Arka Microbial Consortium, phosphate solubilizing bacteria and *Azospirillum*). Each treatment alone and their combination has shown significant effects on most of the parameters, but the combination of vermicompost, Arka Microbial Consortium, PSB and *Azospirillum* showed maximum number of flowers plant⁻¹, number of fruits plant⁻¹, yield plant⁻¹ and yield ha⁻¹. However, minimum number of days taken to produce first flowering was recorded in the plants which were treated with T₉ (AMC @ 7 kg/ ha + VC @ 5 tones/ ha + PSB @ 7 kg/ha + *Azospirillum* @ 7 Kg/ha). The maximum total microbial population in soil, soil pH (7.08), soil EC (0.380 dSm⁻¹), organic carbon (0.65 %), nitrogen content (307kg/ha⁻¹), phosphorus content (16.03 kg/ha⁻¹) and potassium content (180.00 kg/ha⁻¹) was recorded in treatment T₉ (AMC @ 7 kg/ ha + VC @ 5 tones/ ha + PSB @ 7 kg/ha + *Azospirillum* @ 7 Kg/ha). Hence, on the basis of overall findings of present investigation, T₉ (AMC @ 7 kg/ ha + VC @ 5 tones/ ha + PSB @ 7 kg/ha + *Azospirillum* @ 7 Kg/ha) significantly exhibited the maximum effect on higher flowering, yield and soil health.

Keywords: Strawberry, Vermicompost (VC), AMC (Arka Microbial Consortium), *Azospirillum*, PSB, Biofertilizer, flowering, yield and total microbial population.

BY-PRODUCT UTILIZATION OF APRICOT FRUITS AND KERNELS

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Apricot (means early ripe in latin) often familiar as zardalu, chulli and khubani belong to Rosaceae family of Rosacales set. Apricot fruit (*Prunus armeniaca* L.) is classified as “stone fruit” together with other fruits like plums, peaches, almonds, cherries because of the hard stone which encloses its seed. In India apricot is mostly cultivated in Jammu and Kashmir, Himachal Pradesh and Uttaranchal. Kernels present in apricot fruit ranges from 5-14% with 30% share of inner part in the kernel. Due to insufficiency in collecting and utilizing apricot kernels, the potential use of this by-product remains unexploited. Apricot kernels can be used as a substitute for almonds as they contain protein (28%) and oil (52%) while as almond have less protein content (21%) and oil (52%). This by product is considered to be a rich source of polyunsaturated fatty acids (linolenic and linoleic acid) and monounsaturated fatty acid (oleic acid). Apricot oil contain tocopherol in the range of 268.5-436.0 µg/g which is considered as an essential constituent for maintaining the stability and integrity of the cell membrane. Economically both the oil and meal obtained from apricot kernel can be used. This oil can be used for many purposes like blending with highly saturated edible oils to provide new oils with modified nutritional values, as surface coating and oleo chemicals, and as oils for cosmetic purposes. The possibility of mixing crude edible oil with crude fruit seed oils, such as apricot kernel oil and then processing the oil mixture by the conventional methods of refining and bleaching was also analysed. The meal obtained after extraction of oil known as press cake contain protein 50% that can be used for the preparation of protein isolate after removal of hydrocyanic acid.

Keywords: Apricot, kernels, polyunsaturated fatty acids, apricot oil, protein

RECIPE STANDARDIZATION AND PRESERVATION OF HONEY MALTA (*CITRUS SINENSIS* L. OSBECK) ICED TEA

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The present investigations were conducted at VCSG UHF, Bharsar, Pauri Garhwal during 2015-2016, to standardize recipe of functionally enriched Honey Malta (*Citrus sinensis* L. Osbeck) iced tea and to determine the effect of different preservation techniques on selected physicochemical parameters of Honey Malta iced tea during storage. The experiment was laid in completely randomized design with 4 treatments and 3 replication of each treatments and randomized block design for sensory analysis. Honey Malta iced tea was prepared by using different concentrations of honey evaluated for physical, bio-chemical and Antioxidant parameters, determine the effect of different preservation methods on selected physicochemical parameters of Honey Malta RTS.. The experiment was laid in completely randomized design with 3 treatments and 4 replication of each treatments and randomized block design for sensory analysis. Honey Malta RTS was prepared evaluated for physical, bio-chemical and Antioxidant

parameters after using different preservation technique. All physicochemical parameters are positively affected by different preservation methods pasteurization (65 °C for 30 minutes), preservative (sodium benzoate 120 ppm) and pasteurization with half preservative (65°C for 30 minutes with sodium benzoate 60 ppm). With advancement of storage period decreased TSS, total sugars, reducing sugars, pH, ascorbic acid and total phenols but slight increase in titrable acidity was observed. Overall, pasteurization with half preservative (65°C for 30 minutes with sodium benzoate 60 ppm) was recommended as best method of preservation among all three preservation methods with best sensory and nutritional value best treatment was All physicochemical parameters are positively affected by increasing concentration of honey except sensory parameters. With advancement of storage period decreased TSS, total sugars, reducing sugars, pH, ascorbic acid and total phenols but slight increase in titrable acidity was observed. Overall, Honey Malta RTS (10% Malta juice with 14 % TSS) was recommended as best with best sensory and nutritional value.

PRODUCTION OF NETTLE (*GIRARDINIA DIVERSIFOLIA*) IN UTTARAKHAND AND ITS POTENTIAL USE IN TEXTILE

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Himalayan Nettle (*Girardinia diversifolia*), is a grass species, which is found in the upper regions of Himalayas. Himalayan nettle is locally known as bichchhu buti, Nilgiri and Kandali. Uttarakhand has been recognized as one Indian state which has potential for nettle fiber development. The Himalayan nettle has been lately added to the list of possible commercial fiber producing plants having the advantage of being 100% sustainable. Himalayan nettle fibers have unique characteristics which make them an ideal clothing material for both winters and summers; the fibers of the plant are actually hollow and can accumulate air inside thus creating a natural insulation. Nowadays, the global textile industry is looking out for other natural fibres sources to reduce its heavy reliance on cotton and silk. The importance and potential of this naturally occurring nettle plant in the Himalayan regions has been realized. Production of nettle fiber in India is still under infancy stage and needs constructive efforts to help this wondrous fiber to emerge from the wilderness and occupy its rightful place in the field of textiles. Nettle is locally available natural resource which can be harnessed in a sustainable but high profit making end uses. Nettle plants were collected from hilly areas. Nettle stalks were subjected to running water retting, beating and washing, bleaching followed by carding and spinning. From one kilogram of nettle bark 400 g fibres could be extracted. Ultimately 300 g nettle yarn could be obtained from one kilogram nettle bark. Thus it can provide income to large number of rural population.

Keywords: Himalayan Nettle, Uttarakhand, Sustainable, Global textile

REVIEW OF BRUCELLOSIS IN INDIA

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This article describes the status and prevalence of brucellosis in India. Although many countries have eradicated *Brucella abortus* from cattle; in some areas, *Brucella melitensis* has emerged as a cause of infection in this species as well as in sheep and goats. Despite vaccination campaigns with the Rev1 strain, *B. melitensis* remains the principal cause of human brucellosis. *Brucella suis* is also emerging as an agent of infection in cattle, thus extending its opportunities to infect humans. The recent isolation of distinctive strains of *Brucella* from marine mammals has extended its ecologic range. Molecular genetic studies have demonstrated the phylogenetic affiliation to *Agrobacterium*, *Phyllobacterium*, *Ochrobactrum*, and *Rhizobium*. Human infections due to *Brucella canis* have also been reported. *Brucella pinnipediae* and *Brucella cetaceae* are the newly recognized marine mammal *Brucella* species that may also act as human pathogens. Polymerase chain reaction and gene probe development may provide more effective typing methods. Therapy of brucellosis is based on tetracyclines with or without rifampicin, aminoglycosides, or quinolones. Because each strain has distinctive epidemiologic features, with each new type, the complexity of the interaction with humans has increased. Moreover, new strains may emerge and existing types adapt to changing social and agricultural practices, the picture remains incomplete. Thus detailed research and review works are taking an upperhand for major advances in the knowledge of certain aspects of brucellosis-genetics, antigenic structure, mechanisms of pathogenicity, diagnosis, treatment, and prevention of the disease caused by the *Brucella* genus and its host interactions. Synonyms of the disease are brucellosis, undulant fever, Bang's disease, Malta fever, Mediterranean fever and rock fever.

Key words: Brucellosis, India, Prevalence, Zoonosis.

PERFORMANCE EVALUATION OF HAND OPERATED MARKING NUT CRACKER

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Marking nut cracking is done by beating with stone traditionally. This activity is very tedious, time consuming and health hazards due to splashing of oil. Therefore, marking nut cracker was developed for cracking the nuts. The marking nuts retained on sieve sizes of 15 mm, 13 mm and 11 mm, were found to be 15.21, 13.09 and 10.32 mm, respectively. Whereas for kernel screening through sieve sizes of 9, 7 and 5 mm; the kernel size obtained were 9.00, 7.01 and 5.02 mm, respectively. Fraction of nut in terms of kernel and shell was found 10.95% and 89.05%. The output of hand operated nut cracker was found to be 1.10 kg/h than traditional method (1 kg/h). The cracking efficiency was found 74.3% with 76.6 % whole kernel. It reduces the health hazardous due to indirect contact during cracking. The operating cost of machine was found to be Rs. 12.50 per kg. The work load of cracking of marking nuts with manual were comes under light category and the payback period of marking nut cracker is 3.5 months.

HYBRID BREEDING IN CAULIFLOWER (*BRASSICA OLERACEA* L. VAR. *BOTRYTIS* L.) FOR DEVELOPING UNIFORM AND NUTRITION RICH HYBRIDS

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Cauliflower (*Brassica oleracea* L. var. *botrytis* L.), one of the most important cruciferous vegetable, is considered most nutritious and economically important all over the world. Heterosis breeding in cauliflower is an important method of breeding for earliness, uniformity, higher yield, and resistance to biotic and abiotic stresses. Hybrid breeding in cauliflower is reported to elevate the yield levels and maximize the quality traits through the exploitation of heterosis. Cytoplasmic male sterility (CMS) is a maternally inherited condition which leads to pollen sterility and, is gaining importance for producing pure and uniform hybrids in cauliflower breeding programmes. In the present investigation, newly developed CMS lines of cauliflower were utilized and crossed with six testers in Line*Tester fashion to develop hybrid combinations. The hybrids so developed were evaluated with their parents and standard checks during 2017-18 over the locations. Data were recorded for nutrition related traits like total soluble solids, ascorbic acid, sodium, potassium, calcium, magnesium, iron and manganese. Analysis of variance (ANOVA) revealed significant differences for most of the traits studied. Crosses among good × good and good × poor could be attempted for developing uniform, high yielding and nutritionally rich hybrids in future breeding programmes.

Keywords: Cytoplasmic male sterility, cauliflower, floral traits, quality traits, yield

GENETIC VARIABILITY IN FENUGREEK (*TRIGONELLA FOENUM-GRÆCUM* L.) GROWN UNDER TARAI CONDITIONS OF UTTARAKHAND

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Fenugreek is a spice cum leafy vegetable and has an exceptional nutritional and pharmaceutical profile. It is an annual herb belonging to the family fabaceae and a self-pollinated diploid species. The present study was conducted for evaluation of genetic variability among forty genotypes of fenugreek. Various genetic parameters like variability, heritability and genetic advance were studied during *rabi*, 2017-18 at PCPGR, Pantnagar. Analysis of variance showed significant difference among the genotypes for all the traits except pod width. High genotypic and phenotypic coefficient of variance was observed for primary branches per plant, number of leaves per plant at 60 DAS, pod length, pod width, number of seeds per pod and seed yield per plant. High heritability coupled with high genetic advance was observed for primary branches per plant, number of pods per plant, pod length, pod width, number of seeds per pod and seed yield per plant indicating the existence of additive genetic variance and such traits could be improved by direct selection.

Keywords: Fenugreek, Analysis of variance, Genotypic and phenotypic coefficient of variation, Heritability, Genetic advance.

PRECISION HORTICULTURE THROUGH ROBOTIC TECHNIQUE**BHUDEO RANA YASHU*, UDAY PRATAP SINGH****Department of Plant Physiology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, U.P.**

In this emerging trend of the demand of the horticultural products and advancement of sciences and technology we could think the combined effect of the use of technology such as knowledge of agricultural practices, Robotic advancement and post harvest techniques. On this thinking we could emerge a new type of farming system where the chances of loss could may very less. The ongoing digitization of the farm is exploding long-held assumptions of cost effective farming. Planters of commercial tree fruits, citrus, nuts, grape, and vegetables can use increasingly affordable digital tools. In Precision farming yield in monitoring the fruits, Precision irrigation, check rates, start and stop fertilizer, and water from a fully automated drip irrigation system. Bluetooth used as digitally display real-time field data on a computer screen as equipment passes through the field, then store it in the cloud. Use of unmanned aerial systems (UAS) is moving from novelty to practical applications in agriculture. Plant-based sensors Which measures the thickness of leaves and electrical capacitance between the leaves shows a feasible techniques to support farmers when to use their irrigation systems, preventing both water waste and parched plants. Principal based on the measurement of the vegetation index, greenness index by counting irradiation reflected by the object in the form of short waves.

Keywords:- Robotic advancement, digitization, unmanned aerial systems.

A COMPARATIVE PHARMACOGNOSTIC STUDIES OF ADHATODA VASICA NEES., AZARDIRACHTA INDICA (LINN.) A. JUSS. AND CALOTROPIS PROCERA (AITON) COLLECTED FROM ECO-FRIENDLY AND NON ECO-FRIENDLY ENVIRONMENT

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Now a day's more demand of herbal drugs are common for disease treatment but lack of knowledge of proper methodology and availability of herbal drug are promoting the practices of adulteration and substitution. The objective of the present study was to evaluate the quality parameter of samples of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from the Eco-friendly and Non eco-friendly zone of Haridwar District. This study has been planned to observe physiochemical parameters like total ash content, acid insoluble ash, alcohol-soluble extractive and water-soluble extractive. The result of alcohol-soluble extractive and water-soluble extractive of Eco-friendly and Non eco-friendly zone has been found with a comparable difference. The Sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from eco-friendly zone showed alcohol-soluble extractive values 9.6%, 17.6% & 16% respectively and the sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from Non eco-friendly zone showed alcohol-soluble extractive values 8%, 22.4% & 23%. The Sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from eco-friendly zone showed water-soluble extractive values 23.2%, 24% & 25.6% respectively and the sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from Non eco-friendly zone showed water soluble extractive values 16%, 18.4% & 32%.

keywords: *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton), Pharmacognostic.

CORRELATION AND PATH ANALYSIS STUDIES IN DIFFERENT CULTIVARS OF CHRYSANTHEMUM (CHRYSANTHEMUM MORIFOLIUM RAMAT.)

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The present investigation, "Correlation and path analysis studies in different cultivars of Chrysanthemum (*Chrysanthemum morifolium* Ramat.)" was carried out in the experimental orchard, Department of Horticulture, CCS Haryana Agricultural University during 2007-08 in winter season on 30 genotypes of chrysanthemum to estimate the genetic variability, heritability, genetic advance and varietal characterization. The experiment was laid out in Randomized Block Design with three replications. Correlation studies were carried out to find the association at phenotypic and genotypic level among the flower yield and its contributing characters. The results of the correlation studies revealed that the flower yield per plant had a positive significant correlation with days to 50% flowering (0.37) and days to first flower (0.43) and highly positive and significant correlation with number of buds per plant (0.74), number of flowers per plant (0.75) and plant spread (0.55). The correlation analysis alone is not the true depiction of association among the different traits so the assessment of real contribution of each individual character towards flower yield per plant is an essential feature. Path coefficient gives clearer and unambiguous results of a complex situation and reflects at correlation level. Positive and direct effect towards yield was exhibited by number of flowers per plant (28.28) followed by fresh weight of flower (1.47) and day to 50% flowering (1.80). Number of buds per plant showed a negative value for

direct effect (-26.39) but indirect effect via number of flowers per plant (-26.34) was quite high. Thus, the characters responsible for improvement in flower yield per plant were number of flowers per plant, number of buds per plant, plant spread, days to first flower and days to 50% flowering indicating selection of these characters for crop improvement and breeding strategies.

Key words: Correlation studies, path analysis, variability, flowers yield and Chrysanthemum

BREEDING APPROACHES FOR ADAPTATION CLIMATE VARIABILITY

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Climate change is predicted to increase variability among existing individual. Developing variety types with high degrees of heterozygosity and genetic heterogeneity for adaptation traits helps achieving better individual and population buffering capacity. Traits that potentially enhance adaptive phenotypic plasticity or yield stability in variable climates include photoperiod-sensitive flowering, plastic tillering, flooding tolerance, seedling heat tolerance, and phosphorus efficiency. For sustainable productivity increase, improved cultivars should respond to farmer-adoptable soil fertility management and water harvesting techniques. Larger-scale, on-farm participatory testing will enable assessments of varietal performance under evolving climatic variability, provide perspective on needs and opportunities, and enhance adoption. Strengthening seed systems will be required to achieve sustainable impacts. 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. Drivers of climate change through alterations in atmospheric composition can also influence food production directly by its impacts on plant physiology. Biotechnology provides breeders with a number of new tools that may help to develop more drought tolerant varieties such as marker assisted selection (MAS), molecular breeding (MB), and transgenic plants.

Keywords: Climate change, productivity, biotechnology, breeding, marker.

DEVELOPMENT OF SUPERIOR SOMACLONES OF AROMATIC LOCAL CULTIVAR OF RICE (*ORYZA SATIVA* L.)

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The traditional local aromatic land races possess very low combining ability with the modern high yielding varieties and subsequently to development of transgressive segregants. Thus, there is strong need to develop suitable genotype(s) using biotechnological tools. Desirable somaclonal variation was created through matured seed derived callus induction and subsequently regeneration of plantlets. Somaclonal variation may be considered as alternative breeding tool for improvement of aromatic traditional rice. The somaclones, TC 4/8 had the maximum yield followed by TC 5-1, TC 4/4, TC 4/5, and TC 4/7. Yield increase of TC 4/8, TC-5-1 was 54.75% and 50.33% more over the yield of parental cultivar, respectively. The plant tissue culture thus may be recommended to create genetic variability in rice as a trustworthy biotechnological tool.

Key words: Local cultivars, aromatic rice, somaclones, biotechnological tool

AQUAPONICS: STEP TOWARD EFFICIENT FARMING

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Aquaponics is a combination of aquaculture, which includes rearing of fish or other aquatic animals, and hydroponics which involves growing plants without soil. It is a symbiotic combination in which plants get nutrients from the microbes and nitrogenous waste generated by the fish in the water whereas, plants help to clean the water for fishes. This prevents discharge of water containing fish waste into any other water source. The technique requires no chemical fertilizers for plant growth as the nitrogenous waste of fishes provides sufficient nutrients for the plant growth. Aquaponics is one of the trending technique in Nepal, as it helps to double farmer's income by rearing both crop and fish at a time. Mid-hill region of Nepal has a limited source of water as water resources are 300 meters below human settlements, which makes it insufficient for agriculture. Aquaponics mitigates the demand of water and helps farmers for efficient crop and fish production. The technique is a sophisticated way of farming as it requires high initial cost and continuous supply of electricity for smooth running but the benefits reaped from this system pays all the constraints to operate. As aquaponics is full organic it has benefits for both raising farmer's income and consumer's health. It is a big hope for sustainable organic crop production, aquaculture and water consumption.

Keywords: Aquaponics, aquaculture, hydroponics, organic, nutrients.

YOUTH TRANSFORMING THOUGHTS ON SUSTAINABLE AGRICULTURE AND RESOURCE MANAGEMENT TO CONNECT LOCAL AND GLOBAL COMMUNITY

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The population of the world is growing at rate 1.07% which has the devastating impact on people's lives leading to the deprivation of the basic need (i.e. food crises) and solution to this problem is Sustainable agriculture. With the prospect of a balanced agroecosystem, sustainable agriculture is the prerequisite that covers all aspects of resource and environmental management. It also leads us towards meeting our seventeen sustainable development goals (Sustainable development goals UN) and help in covering the triple bottom line concept of corporate sector with more initiative towards the environment, economic and social aspect of life. Problems such as salinity, climate change, and pollution have affected our environment and resulting resources depletion globally with tremendous rate and that's why there is the need for green economy in the modern economic world to maintain the global community balance. These lead us towards bringing new technology Internet of Things (IoT) on the field to control the depletion of resources and pollution in the environment. New technologies like the vertical farming, nanotechnology-based methods for detection of harmful chemicals in the environment, effective use of pesticides and fertilizers in the form of nanoformulation, green biotechnology, hydroponics will lead to sustainable use of resources and production in an efficient manner so that per capita need of food can be satisfied. Drip irrigation, geographic information system (GIS), the study of the individual plant need and going further towards the organic world by keeping the environment in mind including Integrated approach will take the community towards a developed world. This all leads to an increase in production pattern with limited consumption of resources, export, and import of these outputs will establish a good relationship among global communities. There is need of integrated farming technique with the mechanized world and implementing it will help in maintaining the resource management, check in the availability of input, the requirement of output and sustainable management of all the resources available. The role of youth can connect Information & Communication Technology (ICT) enabled journey into profitable farming. It will help the youth in investing in sector production resource management, community development and connecting the globalized community.

Keywords: sustainable agriculture (IoT) Internet of things, community development, sustainable development goals, technology, (ICT) Information and communication technology

EMPLOYMENT GENERATION THROUGH FORESTRY IN KASHMIR

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The total Forest area of the Jammu and Kashmir state as per working plans is 20,230 sq. kms. Forest resources are indispensable for human beings and have played the most significant role in the economy of the state. Eco-tourism, Turpentine and Resin Industry, Kashmir Willow Industry, Joinery, Pharmaceuticals, Ply and other wood based industries etc are some of the Forest based industries. Some important Minor Forest Products like Rasout, Katha, Bunafsha and Anardana are extracted/ collected from the forests of the State, through Commission agents / contractors. These minor forest products are being collected from various Forest Divisions and are dumped in minor forest produce godowns. These are exported mainly outside the state. During the year 2010-11, Rs.28.43 lacs on account of sale/royalty of different minor forest products and Rs.1028.65 lacs on account of Resin have been realized as revenue to the department. Revenues earned by forest departments from NWFP have been rising steadily, with more use of hitherto unknown plant species for human good. Forests provide a number of services to the people at large. Some of the important services rendered by forests are education, recreation, research and other social, religious and spiritual needs. Forests play an important role in ecotourism, particularly in protected areas, for both local as well as foreign tourists. These services provide a large number of employment opportunities for the people of the nearby villages and are a source of livelihood in the areas situated near the forests. Forestry sector can provide income generation possibilities for doubling the farmer's income till 2030.

Keywords: Forest, employment, livelihood, NWFPs, services.

DIVERSITY STUDY OF RICE (ORYZA SATIVA L.) IN THE TERAJ ZONE OF WEST BENGAL FOR YIELD AND YIELD ATTRIBUTING TRAITS

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India has a huge diversity of rice germplasm in the world. Among the states the state of West Bengal is termed as the rice bowl of India for its huge rice production. So the state is also home to a good diversity to rice genotypes. The present study concentrates on the diversity studies of 34 rice genotypes for 9 quantitative traits. Dhyapa showed good yield among all the genotypes followed by

Ayang Liema Phahou as per the experimental results. Annadhan had a dwarf structure and the earliest flowering among all the genotypes under study. The Mahalanobis D^2 was used to study extend of diversity. Inter cluster distance was observed for the genotypes under study. The present study can help us to take up hybridization programme for developing desirable varieties good yielding rice genotypes which is need of the hour.

ADOPTION OF EMERGING ZERO TILLAGE TECHNIQUE FOR THE SMALL AND MARGINAL FARMERS IN SUB- HIMALAYAN REGION

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Zero-tillage planting has been the most successful resource-conserving technology till date in the area of sub- Himalaya region due to its diverse climatic condition, soil fertility status and characteristic of eco-friendly in nature. Zero tillage which is found to be one of the cost effective technique for the small and marginal farmers in rural areas. A study was conducted to evaluate the perceived effect of Zero tillage cultivation technique to the rural farmer in the Cooch Behar district of West Bengal. The study was conducted through well design structure interview schedule. Purposively 80 nos. of respondent who are engaged with zero tillage cultivation practices are selected from the exhaustive list. Four villages were selected from two blocks namely Falimari and Chandamari under Cooch Behar I block and Gopalpur and Dakshin Kalarayer Kuthi under Cooch Behar II block. A Focus Group Discussion (FGD) was also conducted in each village to collect secondary information. The data was analyzed through statistical tools like frequency, percentage and ranking. The study revealed that zero tillage method is a cost effective and sustainable technique for cultivation of maize, jute and wheat for small and marginal farmers. The results shows that 81.25% of the respondents practicing zero tillage for increase their production of 0.6q to 0.8q/ *bigha* in wheat and maize, 88.75% of the respondents perceived that cost of production is decrease to ₹ 800 to ₹ 1200 per *bigha*. 85.00% of the respondents reported that the tolerance capacity of the crop was increased due to cyclone and hail storm. The quality of the product was improved as reported by 81.25% of the respondent. 83.75% of the respondents said that zero tillage method improves the soil fertility and soil health status. Therefore, extent of adoption of zero tillage technique among the rural farmers is increasing day by day in greater rate in the district. So, there is need to conduct more awareness programme for dissemination of the technology through participatory approach.

Key words: Zero tillage, small and marginal farmer, perceived, sustainable, eco-friendly.

FLOWER DRYING: AN ART TO PRESERVE THOSE BLOSSOMS

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Flowers are the part of a plant that is often brightly colored, that usually lasts a short time, and from which the seed or fruit develops. Fresh flowers are short-lived and available only during a particular season. Huge number of fresh flowers is also wasted due to lack of proper marketing and some unavoidable circumstances during blooming season. So, nowadays attention is shifted towards the storage practices for increasing shelf life. A laboratory experiment was conducted in the Department of Pomology and Post Harvest Technology, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, W.B., India, to investigate the storage life of loose chrysanthemum flowers after drying by embedding in self indicating silica gel at 45 ± 2 °C with 80% humidity. Stage of harvesting the flower was taken at 80-100% mature of the same size. Dried flowers were stored in different packaging materials i.e. without packaging (P_1), Polyethylene Pouch (P_2), Vacuum Packing (P_3), Air tight plastic box with silica gel (P_4) and Air tight plastic Box (P_5). The study revealed that the shelf life of the flowers stored in air tight plastic box with silica gel (P_4) was extended for 3 month with acceptable and marketable quality which was followed by vacuum packaging (P_3). On the other hand, flowers which were stored in Polyethylene Pouch (S_2) deteriorated early. Therefore, chrysanthemum flowers after drying could be used even after its season get over thus, making the flowers available when its demand rises. This will not only make the flowers available during off season but also meet the requirements in target occasions such as Valentine's day, Holi, Saraswati Puja etc., and also adds to income generation.

Key word : Chrysanthemum, drying, shelf life

CHEMICAL COMPOSITION AND NUTRITIONAL BENEFITS OF MILK FAT**BINOD KUMAR BHARTI^{1*}, ANAMIKA DAS², PRACHI K WASNIK³, SANDEEP KUMAR⁴ AND JOHN DAVID⁵**^{1*}Assistant Professor cum Jr. Scientist, Department of Dairy Chemistry, Sanjay Gandhi Institute of Dairy Technology (Bihar Animal Sciences University) Patna (Bihar)²Assistant Professor, Department of Dairy Chemistry, Warner College of Dairy Technology, SHUATS, Prayagraj (U.P.)³Ph.D. Research Scholar, Dairy Technology, Warner College of Dairy Technology, SHUATS, Prayagraj (U.P.)⁴M.Tech. Dairy Technology, Warner College of Dairy Technology, SHUATS, Prayagraj (U.P.)⁵Dean, Warner College of Dairy Technology, SHUATS, Prayagraj (U.P.)

Fat is a concentrated form of energy in the diet. Fat is useful for infants and children to meet their requirement of energy. It is vehicle for fat soluble vitamins (FSV) and essential fatty acids (EFA). Dietary fat provides 15% of total energy. Fat are present in cereals, pulses, vegetables (Invisible) and visible fat from the sources of ghee, oil, butter and Vanaspati. Excessive fat consumption is results in excess calorie intake is harmful. Milk fat is composed mainly triacylglycerol (97-99%), diacylglycerol (0.30-1.0 %), cholesterol (0.2-0.4%) and FFA (0.10-0.40%). The major fatty acids in milk fat are palmitic (25-28%), oleic acid (24-28%), myristic acid (13-14%) and stearic acid (10-12%). Polyunsaturated acid (PUFA) also occurs in milk fat about 1% level of linoleic acid and linolenic acid. Milk fat also contains some lactones which is responsible to flavour of milk fat. It is easily digested and absorbed; Milk fats puts relatively little strain on the body. So, it is valuable dietary constituent in diseases of stomach, liver, intestinal tract, kidney and disorders of fat digestion. Short chain fatty acid and medium chain fatty acid (4-12 Carbon) are relatively high concentration in milk fat and are reported to have antimicrobial activity, fungicidal and bacterial effect. Short chain fatty acid in milk fat also provide the growth of *Lactobacillus bifidum* (LB) in intestine.

Key word- Milk fat, saturated fatty acid, cholesterol, PUFA, free fatty acid**BIOSORPTION OF TOXIC METALS FROM AQUEOUS SOLUTIONS BY METAL RESISTANT BACTERIAL BIOMASS ISOLATED FROM ELECTROPLATING INDUSTRY EFFLUENT****BIPIN KUMAR AND JAIPAL GAUTAM AND *VIR SINGH****UP Council of Agricultural Research, Lucknow, Uttar Pradesh, India*****GB Pant University of Agriculture and Technology, Pantnagar, US Nagar, UK**

The heavy metal pollution of industrial wastewater is an immense environmental problem; various industrial processes, including metal mining, metal fining, dyeing, photography, electroplating, etc., are responsible for the release of heavy metals into the environment through their wastewater. In the present study the concentration of various heavy metal ions i.e., Cr (118.00 mgL⁻¹) and Cu (12.86mgL⁻¹) in electroplating effluents was found to be many times higher than the levels permitted by the Central Pollution Control Board, which result out that it is a serious environmental concern. Heavy metal resistant bacteria isolated from electroplating industry identified as *Bacillus* sp. based on 16S rDNA gene sequencing. This bacterial strain biomass was able to remove Cr and Cu at different contact time, pH, initial metal concentration, biomass doses and temperature up to 90.44 and 80.00%.

Key word: Heavy metals, biosorption,**EFFECTS OF WEED CONTROL TREATMENTS ON GROWTH AND YIELD OF WHEAT AND ASSOCIATED WEEDS****BISHAL KUMAR MISHRA, 1 MITHLESH KUMAR PANDEY, 2 SACHIN TIWARI, 3 AND BRIJESH DIXIT 4****1- Assistant, Professor, Department of Agriculture, IHGI, Jalandhar, Punjab.****2- 2- Assistant, Professor, Department of Agriculture, IHGI, Jalandhar, Punjab.****3- M.sc. (Ag) Soil science student of T.D.P.G.College Jaunpur. U.P.****4- M.sc (Ag) student, Department of Genetics and Plant Breeding, NDU&T, Ayodhya (UP).**

A field experiment was conducted during rabi season of 2017-18 on Sandy loam soil at Agricultural Research Farm, Department of Agriculture, Innocent Hearts Group of Institutions, Jalandhar, Punjab. The experiment was conducted with the aimed of evaluating the effect of different herbicides (alone and mixture) against complex weed flora in wheat crop. The experiment planed and laid out with eight treatment and three replications under randomized block design. The major weed flora infesting the wheat crop field were *Cyperus rotundus*, *Cynodon dactylon*, *Chenopodium album*, *Anagallis arvensis* and *Parthenium hysterophorus*. The post em- application of Sulfosulfuron @ 0.33 a.i. kg/ha at 33 days after sowing was most efficient in controlling the weeds (both grassy and non grassy), among the various applied herbicides. The weed growth suppression effect of Sulfosulfuron @ 0.33 a.i. kg/ha resulted least weed population and dry weight, maximum yield and yield attributes (number of effective tillers per plant, number of grains per earhead, test weight, grain yield and straw yield) with maximum net return (16011.44) and benefit cost ratio (1.43).

Keywords:- Herbicide, wheat, weed management

EFFECT OF INTIGRATED NUTRIENT MANAGEMENT ON SEED YIELD OF MUSTARD (*BRASSICA JUNCEA*) IN ASSAM

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Rapeseed- mustard group of crops is the third largest oilseed crops in India, after soybean and groundnut. This group occupies 6,646 thousand ha area and producing 7,877 thousand tones with an average productivity of 1,185 kg/ha. In Assam, rapeseed is predominantly grown as *rabi* oilseed crop under rainfed conditions which occupies an area of 279 thousand ha with an average productivity of 605 kg/ha, which is considerably lower than that of national productivity of mustard. The present experiment was conducted to study “Effect of irrigation and nutrient management in Indian mustard (*Brassica juncea*) in Assam” during two consecutive *rabi* (Oct- Feb) seasons of 2016 - 2017 and 2017-2018. The effect of nutrient management practices on seed yield of mustard was found to be significant. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced the highest seed yield in two years. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) was significantly superior to N₁ (Recommended dose of fertilizer nitrogen), N₃ (75% RDFN + 25% N through FYM) and N₄ (50% RDFN + 50% N through FYM) in two years but N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced statistically similar kind of results with N₂ (RDFN + FYM @ 5t/ha) in both the years.

EFFECT OF INTIGRATED NUTRIENT MANAGEMENT ON STRAW YIELD OF DIRECT SEEDED AUTUMN RICE (*ORYZA SATIVA*) IN ASSAM

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Transplanting is the most common method of rice cultivation but owing to increasing water scarcity, scarce labour coupled with higher wages during the peak periods, a shift towards less demanding alternative methods of rice cultivation aiming at higher water and crop productivity, is imperative. To overcome these problems, aerobic rice systems, wherein the crop is established through direct-seeding in non-puddled, non-flooded fields, are among the most promising approaches for the saving labour and water. “Effect of irrigation and nutrient management in direct seeded autumn rice (*Oryza sativa*) in Assam” during two consecutive summer (Feb-June) seasons of 2017 and 2018. The effect of nutrient management practices on straw yield of direct seeded rice was found to be significant in both the years. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced the highest straw yield in two years which was significantly superior to N₁ (Recommended dose of fertilizer nitrogen), N₃ (75% RDFN + 25% N through FYM) and N₄ (50% RDFN + 50% N through FYM). The results of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) was statistically at par with N₂ (RDFN + FYM @ 5t/ha) in two years. The lowest straw yield in two years produced by N₁ (Recommended dose of fertilizer nitrogen).

AN ECONOMIC ANALYSIS OF EXPORT PERFORMANCE OF PROCESSED VEGETABLES IN INDIA

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Indian Processed Vegetables in International markets accelerates the growth of Indian economy. Studying the changes in share of processed vegetables to different countries, improve the welfare of farmers, processors and exporters. In this regard, an attempt was made to quantify the changing structure of Indian processed vegetables exports. The main objective of the present study was to analysis the growth and the direction of trade in processed vegetables export. In this regard, secondary data, mainly quantity of processed vegetables exports from India was collected from APEDA, for a period of 1995-96 to 2017-18. Growth rates was estimated by using the exponential growth model and the Markov chain analysis model was computed through linear programming method to assess the transition probabilities for the major Indian processed vegetables export markets using Lingo Programming computer package. Accordingly, processed vegetables export market have positive double digit growth rate, UK retained 22.5 per cent, countries pooled under ‘others category’ retained 32.4 percent of share of Indian processed vegetables export. That the countries pooled under ‘others category’ and UK would be the more stable importers of the processed vegetables from India in future and country like Germany and Netherland was not found as the stable importer.

Key words: Export, Processed Vegetables, Markov Chain

QUALITY CHARACTERISTICS OF BANANA BASED MILK SMOOTHIES PREPARED FROM INDIGENOUS COW'S MILK

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Study was undertaken to assess the quality characteristics and suitability of milk of Hariana, Sahiwal and Cross breed cows for development of milk smoothie. The 125 g milk of Hariana, Cross breed and Sahiwal breeds of cow were taken separately for preparation of milk smoothies. Smoothies were prepared using 75 g of banana in each formulation. The sugar was standardized for all three variants of milk smoothies. Finally four percent sugar was used in subsequent experiments. At last sodium alginate @ 0.1 percent was added to the formulation to make the desired consistency. The standard protocol was followed for assessment of milk smoothies. Statistical analysis was performed using SPSS (version 16.0) software. In general all the formulations and recipes were liked by the panelists and showed more or less similar nutrient status. But four percent level of sugar was selected for formulation of recipes of banana based milk smoothies for each breed of cow based on sensory evaluation. On physico-chemical characteristics basis, non significant ($P < 0.05$) differences were observed in the smoothies of Hariana, Cross breed and Sahiwal milk smoothies except in mean values of moisture, protein and solid-not-fat. The percent mean values of moisture was significantly ($P < 0.05$) lower while solid-not-fat was significantly ($P < 0.05$) higher in Cross breed milk smoothies as compared to the smoothies of other breeds of cows. The sensory profile of all the smoothies prepared with banana and milk of all breeds standardized with two percent sugar level showed nonsignificant ($P > 0.05$) differences with other. However, banana and Sahiwal milk based smoothies were selected because of nonsignificantly ($P > 0.05$) higher scores of sweetness, acidity, consistency and overall acceptability scores than others.

BIO EFFICACY AND PHYTOTOXICITY OF DIFFERENT PARAQUAT DICHLORIDE FORMULATIONS IN GRAPES (*VITIS VINIFERA* L.)

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An experiment was conducted during summer season of 2016 and 2017 to study the effect of Paraquat dichloride 24 % SL at different doses of application for weed management in grapes at Regional Research Substation, Sekhampur, under Bidhan Chandra Krishi Viswavidyalaya, Birbhum, West Bengal, India. The comprising seven different weed control treatments viz. four different doses of Paraquat Dichloride 24% SL (Mahamaya) applied at 250, 500, 750 and 1000 g a.i. ha⁻¹, Gramoxone 24% SL (Commercial) at 500 g a.i. ha⁻¹, hand weeding at 20 and 40 DAP and unweeded control, replicated thrice in a randomized block design (RBD). It was revealed that so far as population of weeds, weed dry weight, weed control efficiency and grapes yield concerned, the treatment paraquat dichloride 24% SL @ 1000 g a.i. ha⁻¹ came out as the best one being statistically at par with rest of the treatment but paraquat dichloride 24% SL @ 500 g a.i. ha⁻¹ was cost effective among all. However, among the herbicidal treatments the highest grape yield (16.46 t ha⁻¹) was recorded with Paraquat Dichloride 24% SL @ 1000 g a.i. ha⁻¹ which were statistically at par with Paraquat Dichloride 24% SL @ 750, 500 g a.i. ha⁻¹ and Hand weeding (20 and 40 DAP). There was no phytotoxicity effect observed in any of the doses of the testing herbicide in grape crop.

Keywords: paraquat dichloride, weed, grapes & yield

FISHERIES STATUS IN GONDA DISTRICT OF EASTERN UTTAR PRADESH, INDIA

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Gonda District is one of the districts of Uttarpradesh bordering with Shravast district to the north, Balrampur and Siddharth nagar districts to the North east, Basti to the East, Ayodhya district to the south and Bahraich district to the North west. This district lies between 26°47' and 27°20' north latitude and 81°30' and 82°46' east longitude. This districts is endowed with an area of 4003 km² with natural rivers like ghagra, Saryu and tributaries. In this district fisheries contribute through conventional, composite fish culture as well as mono culture of Pangas culture. for the support of fisheries 3415 ponds covering 3021.85 ha area exist. Productivity in this district is 3.5 -3.6 tonnes per hectare shows the importance about the contribution of fisheries. Seed production through Chinese carp hatchery is being produced under private entrepreneurs. major contribution in fish production is of indian major carps and exotic carps followed by new candidate cat fish species Pangasius pangasius. However, present fish production exceeds to national average production of 3.4 ton/ha but this district has immense potential to enhance fish production and

productivity. some weed fishes and cat fishes viz. puntius, chela, channa spp. Lanchi and bagarius also contribute in fish marketing system of Gonda playing important role in common house hold nutritive diet. the percentage of these weed and cat fishes from natural as well as derelict water bodies is about 5-10% shows very miserable condition of contribution from these resources. In present condition fish farmers are following the scientific approach through the application pond bottom sanitizer, pelleted feed and growth promoters.

MORPHOLOGY CHARACTERIZATION AND *IN VITRO* STUDY OF BIO AGENTS, PLANT EXTRACTS AND CHEMICALS AGAINST *PESTALOTIOPSIS MANGIFERAE* IN MANIPUR

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A study was conducted *in vitro* condition to analyse the morphology and efficacy of bio agent, plant extract and some chemical against *P. mangiferae* which was collected from different districts of Manipur. The morphological characters under study consist of colony and conidial characteristics such as colour, shape, size and appendages. The cultural growth colour of *P. mangiferae* on PDA varied from concolour to versicolour fuliginous. The conidial shape varied from oval and spherical to elliptical with prominent appendages. The conidial length and widths were 22.9 and 5.7 μm respectively. The diseased sample which was collected from different district of Manipur consists of three septation and the number of conidial appendages was found 2-3 numbers. Among seven antagonists namely *Penicillium citrinum*, *Trichoderma atroviride*, *T. ovalisporum*, *Hypocrea lixii*, *T. harzianum* (69 & 131) and *T. asperellum* evaluated *in vitro*, *T. asperellum* showed the best in inhibiting the growth of the fungus (85.8%). Among three plant extracts viz. garlic, neem and sweet flag evaluated *in vitro*, garlic extract (3.0%) showed the best result (100.0%). Among the seven chemicals viz. carbendazim, thiophenate methyl, mancozeb, imidacloprid, fipronil, proflenophos and thiomethoxam evaluated *in vitro*, thiophenate methyl (0.05%) and carbendazim (0.05%) showed the best result with 100.0 per cent inhibition in fungal growth.

Keywords: Morphology, antagonists, plant extracts, chemicals, *P. mangiferae*, Mango.

CLIMATE SMART AGRICULTURAL TECHNOLOGIES: A WAY FORWARD FOR FOOD SECURITY

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In this era of climate change the major challenge in front of global community is to feed the growing population of human. The food demand of a global population expected to reach 9.1 billion in 2050 and over 10 billion by end of this century, which will require a major change in food production system. Climate smart agriculture (CSA) is an approach for transforming and reorienting the agricultural production system to ensure food security under the new realities of climate change. Climate change poses challenges to agriculture, particularly in developing countries through widespread changes in rainfall and temperature patterns which threaten agricultural production and increase the vulnerability of people dependent on agriculture for their livelihoods. Threats can be reduced by increasing the adaptive capacity of farmers as well as increasing resilience and resource use efficiency in agricultural production systems through adoption of climate smart agriculture technologies like direct seeded rice, ICT services to access weather and agro advisories, zero tillage, laser land levelling, residue management/mulching, crop diversification, nutrient expert decision support tool, precision nutrient management, Green Seeker etc. The CSA approach follows the triple objectives adapting to climate change, reducing greenhouse gas emissions and of sustainably increasing productivity and incomes. It seeks promote synergies by taking these objectives into consideration to inform decisions from the local to the global scales and over short and long time horizons, to derive locally-acceptable solutions and to reduce trade-offs.

Keywords: Climate change, Climate smart agriculture, Food security, Technologies

EFFICIENT CROP RESIDUE MANAGEMENT IN DRYLAND AGRICULTURE

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In India 94 million ha area is comes under dryland agriculture out of total arable area of about 144 million ha. The crop production in dryland areas is mainly limited by rainfall, temperature and some of the soil factors. Under this situation various practices are recommended to cope up with these constraints, such as- conservation tillage, watershed management, crop residue management etc. India is agriculture dominant country and produces 500 million tons of crop residue annually. It is mainly used as animal feed and source of domestic fuel, with large unused quantity which is burnt by farmers. This residue can be utilized efficiently for soil incorporation to increase the soil water holding capacity and its availability with improved structure, organic matter content, nutrient availability and microbial activity. Along with this it can help to reduce runoff, erosion and overall land degradation; when

used as mulches on soilsurface. Hence; the residue management is a long-term utilizable practice not only for dryland but also for all types of soil.

Keywords: Crop residue management, dryland agriculture, soil properties, land degradation.

INFLUENCE OF DIFFERENT APPROACHES AND FORMS OF FERTILIZERS ON NUTRIENT UPTAKE AND YIELD OF HYBRID MAIZE IN EASTERN DRY ZONE OF KARNATAKA

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A field experiment was conducted during *Kharif* 2014 at Zonal Agricultural Research Station, University of Agricultural Sciences, Bengaluru to study the influence of different approaches and different forms of fertilizers on nutrient uptake and yield of hybrid maize in eastern dry zone of Karnataka. The experiment was laid out in randomized block design comprising of ten treatments replicated thrice. The results revealed that Significantly higher total uptake of macro, secondary and micronutrients by maize crop was recorded in 100 per cent soil test crop response (STCR) dose applied through soluble fertilizer (SF) with three splits and three sprays. Similarly, higher grain (98.22 q ha⁻¹) and stover (130.96 q ha⁻¹) yield was recorded in 100 per cent STCR dose applied through SF at three splits and three sprays of 19: 19: 19 @ 1% concentration compared to recommended dose of fertilizer (RDF) through conventional fertilizer (CF). The present study evidently concluded that soluble fertilizer application based on STCR targeted yield approach with three splits at basal, 30 and 50 DAS along with three sprays of 19:19:19 at 20, 40 and 60 DAS was helpful for getting higher nutrient uptake and higher yield by maize crop, This increased higher nutrient uptake and higher yield might be due to its easy solubility and uniform distribution of nutrients in root zone leading to availability of sufficient available nutrients for uptake by the crop through soluble fertilizers. Split application of soluble fertilizers for three times along with three sprays of 19:19:19 at three stages helps in better translocation and uptake of these nutrients without fixation or any leaching losses.

SCREENING AND CHARACTERIZATION OF PUTATIVE MUTANT POPULATION IN RAPESEED-MUSTARD (BRASSICA) GENOTYPES FOR LOW MOISTURE STRESS TOLERANCE

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Moisture stress in rapeseed-mustard crop declines the production and productivity. The understanding of molecular mechanism will help in better and effective exploitation of genetic resources of *Brassica*. Four parent genotypes of rapeseed-mustard (*Brassica*) were screened for low moisture stress tolerance at different growth stages like germination, seedling and reproduction. Germination stage screening was done with induced PEG (Polyethylene glycol) 8000 stress in laboratory. Screening of seedling stage were done through hydroponics using Yoshida nutrient solution by inducing PEG stress in three different levels (low, moderate and high). Reproductive stage screening was done by pot culture with optimum moisture and low moisture conditions. The set of M₃ generation putative mutant lines of a single rapeseed mustard genotype were identified and screened for moisture stress tolerance by hydroponics with the moderate PEG stress. The characterization of four parent genotypes and the phenotypically different contrasting rapeseed mustard lines which were identified and selected from a M₃ putative mutant population was done using candidate gene based markers like *Br O3*, *BrLAS-1*, *BrLAS-2*, *BrERF4*, *Br-UBP 15*, *Br-Actin*, *BrBtvl1* *AFP* etc., which can be utilized for the further improvement of *Brassica*. Among the four rapeseed-mustard genotypes M 27 and its M₃ generation putative mutant lines can be further validated for low moisture stress tolerance and it enables the better exploitation of genetic resources of *Brassica* at morphological as well as molecular levels. Moreover the development of mutant populations of *Brassica* species aid to meet the global demand.

Keywords: *Brassica*, moisture stress, hydroponics, PEG, candidate gene.

MARIGOLD FARMING AS A POWERFUL TECHNOLOGY IN ENHANCING THE LIVELIHOODS OF RURAL WOMEN OF ASSAM, INDIA

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Evidences from all civilizations reveal that mankind has historical interest in gardening and culturing flowers to satisfy aesthetic needs. But, today, floriculture is recognized as a lucrative business since it has higher potential per unit area than most field crops and other horticultural crops, both for domestic and export market. Marigold (*Tagetes sp.*) is the most important commercial flower crop having its demand as loose flower, in landscape gardening, as pot plants, in industries, pharmaceuticals, as medicines, antiseptics, garland making, as intercrop etc. The state of Assam has both favourable agroclimatic conditions and suitable soil for

marigold cultivation. Almost every household of the state, specially the villages, has marigold plants in its homestead or entrances but is yet to limit from hobby growing to a commercial activity. Besides Hajo and Nagaon, there are only few places in the state which produces commercial flowers of quantity and quality, as a result of which 75 per cent of the flowers sold in the state are from Kolkata, Karnataka and even Thailand. In Assam, the total area under flower crops is about 600ha, out of which about 250ha is under marigold cultivation, producing 7.27tonnes of flower/year (National Horticulture Board, 2015), occupying 13th position among the states of the country. An estimated production of 2.5 to 4.5 and 6.0 to 9.0 million numbers of flowers/ha has been reported in French and African marigold respectively from Assam. Women have been playing a vital role in the agricultural scenario of the state since time immemorial. If all category of farmers particularly farm women devotes a little piece of land to flower cultivation, round the year, the economy of the family could be increased by leaps and bounds. Marigold cultivation in rural areas by farm women suits the most as it requires care and nurturing, picking and packing with care in which the female workers have an edge over the male counterparts. Marigold farming can play a significant role in making the rural women self-dependent. Everything, right from the plantation of seedlings, to making and selling garlands in the market, can be done by the women folk. Growing marigolds is comparatively easier than other commercial flowers. The flowers can be harvested for about 6-9 times, and with proper management and care, we can expect 125-150q/ha yield for African marigold and 80-120 q/ha in French marigold cultivation. There is a huge demand for marigold during the puja season and Diwali and to meet this demand, the vendors buy flowers from West Bengal. So, if more villagers adopt this cultivation, the state will also become self-sufficient. A single marigold flower contains more than thirty seeds in it that can produce many seedlings. Even, seedlings can be raised from cuttings. According to the flower markets in Jorhat, the price of a small marigold seedling is Rs.10-15 and that of a potted plant is Rs.20-30. The price of a marigold garland ranges from Rs. 30-50 depending upon the season and availability. Thus, marigold cultivation can be a profitable venture for the small and marginal farmers, as the traditional crops are becoming less remunerative and it can serve as an effective technology in improving the rural livelihoods, making women self-dependent and promoting their empowerment and the socio-economic rural upliftment as a whole.

Keywords: Floriculture, Marigold, Women empowerment, Rural technology, Marketing

RESISTANCE BREEDING AGAINST SUGARCANE BORER COMPLEX

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Sugarcane (*Saccharum spp.* hybrid) ranks among the top ten food crops and accounts for about 70% of the global sugar production. The sugarcane gets infested with more than 1300 species of pests globally (Box, 1953). Resistance breeding is an important component of any strategy aimed at reducing the economic impact of crop pests in sugarcane as such approach is environmentally safe and more stable. It is based on three factors: antibiosis, antixenosis, and tolerance. The basis of the germplasm for sugarcane breeding involves commercial varieties and *Saccharum*-related species. The reports of damage levels to sugarcane crops by different borers range from 10% to 80% (Masih *et al.* 1988). Already a number of resistant varieties have been developed and screened for resistant against the borers and some have shown the promising effects. Apart from these, a plant characters like plant odour, leaf surface, width and erectness of leaves, hardness of leaf midribs, dry matter in leaf spindle, length of leaf spindle, rind hardness, colour of stalks, leaf sheaths, fibre content of stalk, plant height, stalk growth etc, also provides the mechanisms for the resistance. Traditionally, the main focus on sugarcane breeding had been on sugar yield but the efforts to find out the sources and mechanisms of resistance against major insect pests of sugarcane had been inadequate. Most of the studies were restricted to causal screening of germplasm on limited scale without considering the bases and mechanisms of resistance in promising genotypes. For future research concerned efforts are needed to search promising sources of resistance in wild germplasm and related *Saccharum spp.* by utilising new resources and tools which are constantly been made available for sugarcane breeding such as better understanding of its genome, genetics, physiology, molecular biology, new markers associated with traits of agronomical relevance.

Key words: Resistance breeding, Resistance, Screening, Germplasm, Genotypes, Borers, etc.

GENETIC DIVERGENCE AND CLUSTERING OF SOME ELITE GINGER GENOTYPES IN TERAI REGION OF WEST BENGAL. (*ZINGIBER OFFICINALE* ROSC.)

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18 genotypes of ginger were collected from different regions of the states of India to evaluate the genetic potential and divergence of the genotypes and their suitability of growing in Terai region of West Bengal. The multivariate analysis by means of Mahalanobis D² statistic for estimating genetic divergence was done where D² statistical methods were applied for finding out the genetic divergence of the genotypes and all the genotypes were grouped into 8 clusters. Maximum number of genotypes were

accommodated in cluster-I followed by cluster-VII. Relative contribution of rhizome yield to the total divergence was highest (58.82) followed by rhizome thickness (25.49) and plant height (5.23). The more diverse the parents, within overall limits of fitness, the greater the chances of obtaining higher amount of heterotic expression in F_1 and broad spectrum of variability in segregating generations.

Keywords: Genetic divergence, multivariate analysis, clusters, variability, D^2 statistics.

MICROSATELLITE BASED DNA FINGER PRINTING AND STUDIES OF GENETIC RELATIONSHIP AND POPULATION STRUCTURE ANALYSIS OF INDIAN SOYBEAN VARIETIES

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Plant breeders have traditionally used morphological and biochemical markers for the genetic diversity analysis and the registration of varieties under PPV and FR Act. These are limited in numbers, highly influenced by the environment and are growth stage-specific. These traits create difficulty particularly in closely related cultivars. In plants with a narrow genetic base in their gene pool such as soybean, they may not be sufficient for the diversity analysis and identification of genotypes. So a more reliable and efficient method is required for characterization and identification of genotypes. In such cases, molecular markers can provide additional information about the genetic characterization, degree of diversity and genetic relationship of the existing genotypes. Plant protection office of USDA Agriculture Marketing Services now accepts microsatellite allelic profiles as supporting evidence for the uniqueness of a cultivar. Thirty-nine simple sequence repeat markers have been used to estimate the genetic diversity and population structure of 78 soybean varieties released in India. A total of 140 alleles were detected and an average of 3.59 alleles per locus was recorded. Polymorphism information content values for all the polymorphic markers across 78 soybean varieties ranged from 0.073 (Satt415) to 0.931 (Satt084), with an average value of 0.59. Mean similarity coefficient was recorded as 0.41 for all the genotypes. Marker index values ranged from 0.051 (Satt498) to 5.556 (SOYSH176) with an average value of 2.54. The resolving power value ranged from 0.102 (satt498) to 2.086 (GMABABE) with an average value of 1.64. Both the phylogenetic and population structure analysis classified soybean varieties into five main clusters and five subpopulations, respectively. Principal coordinate analysis results are in agreement with both of these methods, which grouped the varieties on the basis of their origin, pedigree and releasing centre.

MARKER ASSISTED GENE PYRAMIDING IN RICE TO DEVELOP BIOTIC AND ABIOTIC STRESS TOLERANCE

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Rice (*Oryza sativa*) is the 2nd most important cereal crop in the world, utilized as staple food for more than half of the world's population. Severe yield loss in rice is due to various biotic stresses like bacterial blight (BB), gall midge (insect) and Blast (disease) and abiotic stresses like drought, submergence and salinity are a serious constraint to the rice productivity throughout the world. The most effective and reliable method of management of the stresses is the enhancement of host resistance, through an economical and environmentally friendly approach. The main objective is to introgress multiple stress tolerant QTLs into a single line of rice variety. This can be achieved through the application of marker assisted selection (MAS) technique, and successful pyramiding of genes/QTLs to confer resistance/tolerance to blast (*Pi2*, *Pi9*), gall Midge (*Gm1*, *Gm4*), submergence (*Sub1*), salinity (*Saltol*), bacterial blight (*xa5*, *xa13*, *xa21* and *xa33*) and drought (*qDTY_{3.1}*, *qDTY_{12.1}*, *qDTY_{2.2}*) in rice variety. The molecular analysis revealed clear polymorphism between the donor and recipient parents for all the markers that are tagged to the target traits. The conventional backcross breeding approach is followed till BC_3F_1 generation and starting from BC_1F_1 onwards, marker assisted selection is employed at each step to monitor the transfer of the target alleles with molecular markers. The different BC_3F_1 s having the target genes/QTLs will be inter crossed to generate hybrids with all 13 stress resistance/tolerance genes/QTLs into a single plant/line. Homozygous plants for resistance/tolerance genes in different combinations were recovered. The BC_3F_3 lines are characterized for their agronomic and quality traits and promising progeny lines are selected. The SSR based background selection is done. Most of the gene pyramid lines show a high degree of similarity to the recurrent parent for both morphological, grain quality traits and in SSR based background selection. The study demonstrates the potential of MAS for pyramiding of several genes into a single line with a high degree of parental genome recovery for durable inbuilt resistance/tolerance. Developing a rice cultivar with multiple tolerances make it suitable to grow in any area under any stress conditions without any effect of disease with high yield. This will reduce the cost of cultivation, make the crop organic and reduce the labour for farmer.

RESPONSE OF BIO-FERTILIZERS FOR SUSTAINABLE CABBAGE PRODUCTION**DALVEER SINGH, GOPI CHAND SINGH, ROSHAN KUSHWAH AND MANVENDRA SINGH SOLANKI****Department of Horticulture R.B. S. College, Bichpuri, Agra U.P.**

Present investigation was carried out to standardize Bio- fertilizers for cabbage production. Result showed that integrated use of 70% recommended fertilizers along with organic manures and bio- fertilizers produced head yield at par with the previous recommendation (150:50:50 NPK +200 q/ha FYM) and improved soil organic carbon. Besides yield, integrated use of fertilizer, manures and bio- fertilizer increased TSS and total phenols content and decreased pyruvic acid as compared to inorganic fertilizer application alone. Combined application of fertilizers, organic manures and bio- fertilizers maintained initial soil available NPK status. We conclude that the combined application of inorganic fertilizer (105:35:35) kg NPK along with organic manures and bio fertilizers produced yield at par with previous recommendation, improved head quality and maintained soil fertility. Adoption of this practice saved 30% inorganic fertilizers and protect environment from pollution.

MOLECULAR EVALUATION OF MAIZE INBREDS FOR TURCICUM LEAF BLIGHT**DAN SINGH JAKHAR*, RAJESH SINGH, AND BIRINCHI KUMAR SARMA****Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi**

The present study is an attempt to evaluate 40 maize inbreds for Turcicum Leaf Blight (TLB) disease with the help of 75 SSR markers. During molecular evaluation a total of 212 alleles were detected at 75 marker loci and ranged from 2 to 5 with an average of 2.83 alleles per marker. A positive correlation for the number of alleles, polymorphism information content (PIC) values and gene diversity was observed. The UPGMA dendrogram grouped 40 maize inbreds into two distinct clusters, Cluster I (36 inbreds) & Cluster II (4 inbreds). Cluster I contained two sub clusters; first sub cluster contained 28 inbreds and second sub cluster contained 8 inbreds whereas cluster II contains four inbreds. This major cluster II was further classified into two sub clusters which contained two inbreds in each. In this study, PIC values indicated a good efficiency of markers for studying the polymorphism level available in studied inbred lines. High level of diversity among the inbreds detected with SSR markers indicated their suitability for further breeding program.

ASSIMILATED IMPACT OF BIOCHAR WITH POLYACRYLAMIDE TO REDUCE RUNOFF UNDER NATURAL RAINFALL CONDITION**DANIEL PRAKASH KUSHWAHA^{A,*}, ANIL KUMAR^B****^aDepartment of Soil and Water Conservation Engineering, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263145, India****^bProfessor, Department of Soil & Water Conservation Engineering, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand 263145, India**

The reduction of runoff from hills without affecting agricultural productivity using various soil amendments is one of the major environmental challenges faced by the world. Inorganic amendments have several adverse effects in soil and its productivity. In the present study, biochar which is an organic soil amendment, has been produced at 400 °C for 4 h under a slow pyrolysis process from rice husk and it represents a novel and promising results for achieving the above mentioned goals. Four treatments viz. control (C), biochar (B), biochar with gypsum (B+G) and biochar with polyacrylamide (B+PAM) with three replications have been used over average field slope of 11.71 %. Gypsum, biochar and polyacrylamide have been applied at the rate of 250 g/ m², 2 g/ m² and 800 g/ m² into plot size of 9 m² each. Natural rainfall was allowed to be occurred over the field in the months of August and September 2018 in the presence of 28.21% moisture contents prior to first reading. Total 12 rainfall events have been occurred during these periods. Result shows that B+PAM gives better results in comparison to B and B+G treatments to reduce the runoff volume, after few inches growth of vegetation over surface, notwithstanding, B+G have shown promising results in comparison to single B treatment. Soil physical properties prior and end of experiment, have also been studied and it was found that bulk density on dry basis of soil increases in all the four treatments, while in comparison to control treatment, B+PAM, B+G and B has too slow, slow and rapid increase of bulk density, respectively. Similarly, specific gravity of soil was reduced for B+PAM and increased for C, B, and B+G treatments. Overall result represents that B+PAM treatment is better than all three treatments to reduce runoff and to increase infiltration rate.

Keywords: Organic and inorganic soil amendments; Runoff; Soil physical properties; Natural rainfall condition.

DOUBLING OF INCOME OF THE FARMERS THROUGH INNOVATIVE IN FLORICULTURE**DARSHAN DARJI AND KIRAN KUMARI****College of Horticulture, Sardarkrushinagar Dantiwada University, Jagudan, Mehsana -384 460**

Horticulture is the most important sector of Indian economy to increase 8.89% (Ministry of Agriculture) more than food grains. The horticulture sector is doing well in India when compared to other food crops, since it fetches a good price because of its nature of the season based. Farmers are increasingly growing commercial horticultural crops due to a growing market and a quicker cash flow as this crop requires less time from sowing to marketing. Floriculture is an emerging area with great potential both in the domestic as well as export market. In order to achieve a doubling of a farmer's income, new approaches like nursery business, planting material multiplication, innovative farming like high value flower growing, seed production of flower crops. Seed production of flower crops due to the prevailing diverse weather condition of the country can be taken up by farmers in Punjab state. The net return in flower seed production is much higher than growing crops for flower production. Farmers can be trained in the production of quality flower seeds in large quantity so that they will be able to sell their quality seeds in the national as well as international market. Minimum Seeds Certification standards on seed propagated crops such as marigold, China aster annual flowers it should be followed to ensure the purity of the varieties. By value addition to flower crop like essential oils, flavor, garland, flower arrangement, pharmaceutical and nutraceutical compounds, pigments and natural dye, gulkand, rose water, dry flowers, its products farmers can earn higher income round the year in a shorter period of time.

DOUBLING FARMERS' INCOME THROUGH HORTICULTURAL INTERVENTIONS**DARSHAN DARJI AND KIRAN KUMARI****College of Horticulture, Sardarkrushinagar Dantiwada University, Jagudan, Mehsana -384 460**

To boost the agriculture sector and uplift the living standard of farmers, Indian government has set a goal to double farmer's income by 2022. For achieving this goal there is a need to adopt innovative methods of farming and diversification in crop choice. The horticulture section is doing well in India when compared with other food crops, since it fetches a good price because of its nature of seasonality. Horticultural sector have potential to provide better returns to farmers as it is diversified and involve subsectors namely vegetables, fruit crops, spices, ornamentals, plantation crops and mushrooms and processing of horticultural commodities. As educated youth are less interested to take up conventional agriculture, horticulture provide little more fascinating option to them to seek gainful employment. There are many horticultural technologies like high tech horticultural innovations, protected cultivation, hydroponics, aeroponics and aquaponics, mushroom cultivation, seed production and nursery production which can be opted to increase farmers income. This target of doubling income can be achieved by various ways like increasing productivity of crop with good production techniques, improving efficiency of inputs, increasing crop intensity, choosing high value crops, value addition in horticultural crops and adding alternative sources of income along with horticultural crops, like apiculture, where-in the bees helps in the pollination and also draws extra income for the farmers. Apart from these, the most important thing for doubling the farmer's income is to create a market for farmers and provide market access and links for growing their business.

HORTICULTURAL INNOVATION, FOOD PROCESSING AND VALUE ADDITION**DARSHANA YADAV¹, PRAVEEN MEENA¹, PUSHPANJALI², J.S. RANAWAT³**¹**Department of horticulture, MJRP college of agriculture and research, achrol,303002. Jaipur (Raj)**²**Department of Agronomy, SKN college of agriculture, jobner. Agriculture university, Jobner (Raj)**³**Department of Silviculture and Agroforestry, college of horticulture and forestry, Jhalawar, AU,Kota**

The horticulture sector is considered as the most dynamic and sustainable segment of agriculture all over the world. It covers pre and post-harvest management of a wide spectrum of crops, including fruits and nuts, vegetable, including potatoes, flowering and aromatic plants, tuber crops, mushroom, spices, plantation crops, edible bamboos etc. It is established fact that horticulture is one of the best option for improving the productivity of the land, ensuring nutritional security for mankind and for sustained the livelihood or the farming community worldwide in order to optimize the use of resources, hi-tech interventions light precision farming, which compares temporal and spatial management of resources in horticulture, is essentially required for improvement in cropping and crop production and return to farmer, hi-tech application and precision farming have to widely spread and adapted. Food processing is the set of method and techniques used to transform raw ingredient into food or food into other form for consumption by human or animals either in the home or by the food processing industry. The Indian food industry is poised approach for huge growth, increasing its contribution to world food trade every year. India, the food sector has emerged as a high growth and high processed sector due to its immense potential for value addition, particularly with in the food processing industry. Value addition is important factor in the growth and development of horticultural sector, both in India and around the world. It improve the profitability of farmer, to provide better quality, safe and branded food to the consumer, produce post- harvest losses, way of increase foreign exchange.

Keywords:– Hi-tech, Precision farming, Post-harvest technology, Industry, Food processing, Value addition.

EVALUATION AND CHARACTERIZATION OF BRINJAL GERMPLASM FOR GROWTH AND FLORAL MORPHOLOGY IN TERAI REGION OF WEST BENGAL

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Assessment of genetic resources is an important and starting point of crop improvement programme. The present study was undertaken at the Instructional Farm of UBKV, Pundibari, Coochbehar, West Bengal during 2015-2018 for seventeen (17) different morphological parameters as well as for studying floral biology and biochemical parameters of brinjal. Thirty brinjal germplasms collected from different parts of West Bengal evaluated under field trial revealed that some genotypes like UBB-8, Bholanath and Joshna were resistant against fruit and shoot borer while showing good yield. The quality response in terms of good size and shape of fruit, colour, anthocyanin content, total phenol, total soluble sugar and dry matter content was also assessed. The genotypes like Balasi, Bholanath and Tufanganj were found most promising. The study of floral biology revealed that in genotypes Ashapuri Changa, Jhuri begun, Black Beauty and Tufanganj the flowers were long styled which is considered good for better fruit setting as compared to medium and short styled flowers. Moreover the flowering biology of eggplant and the influence of flower heterostyly are directly proportional to yield.

Keywords: Brinjal, germplasm, floral morphology.

ESTIMATION OF GENETIC DIVERSITY OF YIELD ATTRIBUTING TRAITS AND BIOTIC STRESS RESPONSE IN BRINJAL

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Brinjal (*Solanum melongena* L.) is an important delicious vegetable which is a good source of minerals, vitamins, free reducing sugars and amide proteins. The crop is also considered to be a crop of promise in North Bengal too with considerable diversity existing among the species with variable plant type, morpho-physiological characteristics, reactions to diseases and pests and adaptability coupled with high demand by the consumers thereby necessitating the need to identify more suitable varieties of the crop particularly for high yield, quality, resistance to diseases and pests, tolerance to frost and acidity. For improving the yield potential of varieties and to develop hybrids the choice of parents is of paramount importance for hybridization. The present study was undertaken at the Instructional Farm of UBKV, Pundibari, Coochbehar, West Bengal during 2015-2018 with thirty different brinjal germplasms collected from different parts of West Bengal for seventeen (17) different morphological and biochemical parameters. Based on the observation and D² analysis the genotypes were grouped into seven clusters. Cluster VI and VII were comprised of a maximum seven (7) and eight (8) genotypes respectively. The inter cluster distances were higher than the average intra cluster distances, which indicated wide genetic diversity among the genotypes of different groups than those of same cluster. On the basis of the cluster means the important cluster was cluster VI for 50% flowering, fruit circumference, plant height, marketable yield plot⁻¹ and total yield plot⁻¹. The result of cluster mean clearly indicated that genotypes like UBB-8, Joshna and Bholanath could be selected as parents for future hybridization programme. Among all the genotype highest GCV and PCV were observed in unmarketable yield and dry matter content. High heritability coupled with high genetic advance was recorded for marketable yield and dry matter content. Fruit yield plot⁻¹ was found to be positively correlated with 50% flowering, number of fruit plant⁻¹, average fruit weight, fruit length, fruit circumference, dry matter content and marketable yield. Highest direct effect on fruit yield plot⁻¹ was exerted by marketable yield followed by average fruit weight. Screening of biotic stress against the bacterial wilt revealed some promising cultivar such as Singnath, Joshna, Ashapuri Changa, Bholanath, Balasi, Pundibari local 2 and UBB-8 showing resistance to the disease. On the other hand fruit and shoot borer infestation were also studied among all the collected genotypes and UBB-8, UBB-7 and Balasi exhibited good response.

Keywords: Brinjal, genetic diversity, cluster analysis, heritability

CLIMATE CHANGE AND AGRICULTURE: STRATEGIES FOR EFFICIENT NATURAL RESOURCE MANAGEMENT

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Climate and agriculture are vital for survival and well being of humankind. Both influence each other, though the impact of climate is very gradually visible on the performance of agriculture in the usual course. However, in recent times it is being realized that the climatic effects have become severe and frequent, affecting agricultural production adversely in various parts of the world.

Climate change has thus become a global event. The major facet of climate change is increase in concentration of greenhouse gases, chiefly carbon dioxide, methane and nitrous oxide. Increase in CO₂ from 280 ppm to 369 ppm, methane from 700 ppb to 1750 ppb and nitrous oxide from 270 ppb to 316 ppb between 1750 and 2002 has been reported. Perhaps the most prominent facet of climate change over the last century is global warming. The mean global annual temperatures increased between 0.4 to 0.7 °C during the last 100 years. The agriculture sector additionally contributes to gas emissions. Consistent with the Intergovernmental Panel on temperature change, the 3 main causes of the rise in greenhouse gases discovered over the past 250 years are fossil fuels, land use and agriculture. The IPCC (1996) estimates that globally agriculture emits about 30 per cent of the green house gases, which constitute approximately 50% of the total methane, 70% of nitrous oxide, and 20% of carbon dioxide. Sources of methane emissions include rice, ruminants and manure. Nitrous oxide emissions come from manure, legumes, and fertilizer use. Carbon dioxide emissions arise from fossil fuel usage, soil tillage, deforestation, biomass burning and land degradation. In view of agriculture being one of the sources for the enhanced greenhouse effect, it is conceivable that a paradigm shift in the conventional agriculture can bring about large reduction in the greenhouse gas emissions and thus prevent possible adverse environmental effects on food security of the country.

Keywords: Biomass, Conventional Agriculture , Climate Change, Global Warming

VARIOUS NOBLE APPROACHES TO IMPROVE PHOSPHORUS USE EFFICIENCY IN INDIAN AGRICULTURE

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Phosphorus is an indispensable element in plant nutrition and involved in wide range of metabolic processes. The unique property of phosphorus is slow diffusion and high fixation in soils. In India 5% of soils have adequate available P, 49.3% are under low category, 48.8% under medium and 1.9% under high category. The recovery of phosphatic fertilizers is merely 10-30% by crops and remaining 70-90% is adsorbed by Al/Fe oxides and hydroxides in acid soils, and in calcareous soils, P retention is dominated by adsorption on the surface of CaCO₃ and clay minerals, which causes major economic loss and limited crop yield. Moreover, the rock phosphate reserve in India is, yet, very finite and purely non-renewable as there is resource storage of only 260 million tones (0.19% of global level) with a predominance of low grade rock phosphate. Therefore, it is of paramount importance to enhance the phosphorus uptake of crops by adopting efficient, eco-friendly and cost effective approaches such as improving the solubility and availability of low grade rock phosphate (RP) by combining with farm yard manure, green manure, compost, partial acidulation of RP, blending with pyrite and/or elemental S, mixing with water soluble P by dry granulation, mixing of RP with zeolite saturated with monovalent cation, soil inoculation of phosphorus solubilizing (*Bacillus* Spp., *Pseudomonas* Spp. and *Aspergillus* Spp.) and mobilizing (Mycorrhiza) microorganisms. The recent developments to increase phosphorus recovery are polymer coated water soluble fertilizers, rhizosphere controlled fertilizers, organic complexed superphosphate, superabsorbent slow release fertilizers and nanophosphate fertilizers. The degree of efficacy of the aforesaid technologies and smart fertilizers has been discussed thoroughly. In conclusion, for maximization of the phosphorus recovery by crops, numerous advanced technologies have emerged up and these should be adopted by commercial farmers judiciously.

ASSESSMENT OF ASSOCIATED INSECT POLLINATORS' DIVERSITY FOR THE FLORAL REWARD OF WEED PLANT-*TRIDAX PROCUMBENS*

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Coat buttons plant, *Tridax procumbens*, which belongs to family Asteraceae, is a perennial herb. Inflorescence produced is terminal head with both white or pale yellow ray floret and bright yellow disc floret. Flowering in this plant is observed in almost round the year, resulting in a hub for pollinators' activity. Considering this observation, a study on pollinator diversity on *T. procumbens* plant was conducted at Honey Bee Research and Training Centre (HBRTC), Livestock production and management road and Beni village in Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Udham Singh Nagar Uttarakhand, during autumn season of 2018-19. A total of 13 insect pollinator species visiting *T. procumbens*, belonging to order, Hymenoptera, Diptera and Lepidoptera wererecorded to obtain pollen and nectar. As this plant exhibit explosive flowering throughout the year, it can support multiple of pollinator diversity even during the floral dearth period of the regioTaking this into view, this weed plant can be conserved on roadside or fallow lands to support pollinator fauna and also to ameliorate the beautification of roadside wasteland.

Keywords: Insect pollination, *Tridax procumbens*, Pollinator diversity, Floral reward.

APPLICATION OF DENSE PHASE CARBON DIOXIDE IN FOOD PROCESSING**DEEPA SAINI AND SK SHARMA****Department of Food Science and Technology, College of Agriculture,
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Dense Phase Carbon Dioxide (DPCD) is an emerging non-thermal process which evidently inactivates certain microorganisms and enzymes at lower temperature and high pressure combination thereby maintaining fresh like characteristics as well as providing convenient shelf life, nutritional value to the product. CO₂ at ambient pressure can inhibit microorganisms but, when it is applied at elevated pressures, it can effectively inactivate a number of spoilage and pathogenic microorganisms including bacteria, moulds, yeasts and some enzymes. DPCD also called as cold pasteurization uses CO₂ at 6-30 MPa pressure, 10-50°C for 10-30 min to treat liquid foods, mainly fruit juices in batch, semi-continuous and continuous systems. In a batch system, CO₂ and treatment solution are stationary, while, only CO₂ flows through the chamber in a semi-continuous system whereas, a continuous system allows flow of both CO₂ and liquid food through the system. Microbial inactivation by DPCD is dependent on different parameters like exposure time, pressure, temperature, initial pH of medium, water activity, cell growth phase or age, species of microorganisms and type of treatment system. It is presumed that the microbial cells inactivated/killed due to cell rupture because of the explosive expansion of high pressure CO₂ during flash depressurization or during pressurization when the cells are swollen by CO₂. Though many theories were developed to explain the bacteriostatic action of CO₂, the exact inactivation mechanisms still remain to be unraveled. However, the important mechanism of microbial inactivation include key enzyme inactivation, direct (inhibitory) effect of molecular CO₂ and HCO₃ on metabolism, disordering of the intracellular electrolyte balance, removal of vital constituents from cells and cell membranes. The combination of other non-thermal technologies such as pulsed electric fields, high pressure processing, high power ultrasound and irradiation with DPCD opens new possibilities of more reduction of microorganisms, better inactivation of enzymes at milder process conditions.

WATER CONSERVATION PRACTICES IN AGRICULTURE: A REVIEW**DEEPA TOMAR, NITY NISHANT, RUPA UPADHYAY****University of Delhi, New Delhi, India, Ph.D. Scholar, University of Delhi, ¹*Faculty, University of Delhi**

Water is an essential resource for life on universe. On earth, only 2.5% water is fresh water. India has 4% of world water resource. As India's economy is blooming and as population is soaring; enhanced demand of water has not matched with supply. Increase requirement of water for meeting domestic, industrial, and agricultural needs is quite understandable, but overutilization of water resources has already made India a "water stressed nation". On top of that we are not conserving it properly for future needs. There are various traditional practices of water conservation that are easily forgotten on the name of advancement. Water is an integral part of agriculture. Agriculture requires a large amount of water for irrigation to cultivate foodcrops. Irrigation is one of the main source of withdrawing fresh water. Demand of water for irrigation put pressure on water resources. Sometimes it leads to water scarcity for agricultural operations. It is also reported to increase water pollution, degradation of wetland ecosystem, soil degradation etc. In India various traditional practices have been performed to utilize at the same time conserve water for future. With time, few practices have become extinct and innovative techniques have developed to cater the need of water supply for agricultural purposes. This review paper is an attempt to explore traditional and modern water conservation techniques in use which are beneficial to achieve food security.

DROUGHT FORECASTING BASED ON STANDARDIZED PRECIPITATION INDEX OF RAINFALL FOR MEERUT AREAS**DEEPAK KUMAR MISHRA, RAM KUMAR AND ¹B.R. SINGH****School of Agricultural Sciences and Engineering, IFTM University, Moradabad (UP) -244102****¹Department of Agricultural Engineering, College of Agriculture, SVPUA&T, Meerut-250110**

The Standardized Precipitation Index (SPI) is an index widely used for drought monitoring purposes. Since its computation requires the preliminary fitting of a probability distribution to monthly precipitation aggregated at different time scales, the SPI value for a given year and a given month will depend on the particular sample of observed precipitation adopted for its estimation and in particular on the sample size. Furthermore, the presence of trend in the underlying precipitation will affect adversely the estimation of parameters, and therefore the computation of SPI. The proposed analytical approach appears particularly valuable from a practical stand point in light of the difficulties of applying a frequency approach due to the limited number of transitions generally observed even on relatively long SPI records. Also, an analysis of the applicability of a Markov chain model has revealed the inadequacy of such an approach, since it leads to significant errors in the transition probability as shown in the paper. Objective of the present paper is to investigate the variability of the SPI with respect to the size of the sample used for estimating its parameters, either in the case of stationary or non stationary precipitation series.

keywords: Meteorological drought, SPI, probability distribution

CHANGES OF VARIOUS CHEMICAL PROPERTIES OF TOMATO SOIL BY APPLICATION OF DIFFERENT DOSES GRAY WATER

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A field trial was taken in farm of Dr. Rajendra Prasad Central Agricultural University, Pusa to check out the result of different doses of gray water use on soil chemical properties of tomato soil. Treatments were irrigated with various doses of gray water includes, T₁= 100% Fresh Water (FW), T₂= 75% FW + 25% Gray Water (GW), T₃= 50% FW + 50% GW, T₄= 25% FW + 75% GW, T₅= 100% GW, T₆= Alternate irrigation by FW and GW, T₇= Two FW and One GW irrigation. Soil pH of T₅, T₆ and T₄ has found significantly higher pH compare to T₁, while, T₅, T₄ and T₃ has significantly higher EC compare to T₁, T₂ and T₇. T₅ shows highest organic value all the treatment followed by T₂, T₄, T₆, T₁, T₃ and T₇ varied from 0.332 to 0.471 g kg⁻¹. T₇ recorded lowest value of organic matter followed by T₃ and T₁. T₅, T₄ and T₃ has significantly higher potassium content compare to T₁. T₂, T₆ and T₇. Treatment T₁ has highest Phosphorus value of all the treatments followed by T₃, T₂, T₅, T₄, T₆ and T₇ varied from 354.937 to 275.723 kg/ha. Treatment T₅ highest nitrogen value all the treatment followed by T₄, T₃, T₇, T₆, T₂ varied from 240.400 to 389.067 kg/ha. T₂ recorded highest Sulphur presence among all the treatments followed by T₁, T₃ and T₅. T₇ recorded highest Boron content among all the treatments followed by T₄, T₅ and T₂.

Keywords: Soil chemical properties, Gray water, Tomato soil

WATER POLLUTION: A CASE STUDY OF SAHARSA DISTRICT RURAL AREA IRON EFFECT OF WATER)

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The standard of living in Saharsa district is very low. Here all people depend ground water for drinking water. Ground water is polluted due to seepage from sewers, pits, septic tanks, Irrigation of fertiliser in rich fields. Finally it can be concluded that a large number of people are migrants, most of them belong to the lower – Socio-economic groups and the villages of the district. Most of the places at Saharsa district where Iron minerals are highest. These areas have lack of drinking water. Government should pay attention to the pitiable condition of Saharsa. The research area is Saharsa District in Bihar, India. For highlight to polluted water supported diseases are increases. Over all 2352 water sample tested by PHED Saharsa under Bihar Govt. India. It is clear that to all sample who is collected from rural area household. All tested sample in 95% is up Iron in 0.5p PM, 20% is up in 1p PM some 2P PPM. The research work is deeply going on study in village and Panchayats. (PPM – PARTICLE PER MILLION)

TO STUDY THE INFESTATION OF *MELOIDOGYNE JAVANICA* IN OKRA

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Okra, *Abelmoschus esculentus* L. (Moench), belongs to the family Malvaceae is one of the warm season crop grown in the tropical and sub tropical regions of the world. Okra contains very high sodium content and is a rich source of vitamin A and B. Root-knot nematodes (*Meloidogyne* spp.) are major constraint in growing of okra crop successfully in tropical and subtropical regions, and infected plants remain stunted, exhibiting signs of nutrient deficiency and characteristics large irregular swellings on both primary and secondary roots. Root-knot nematodes are poikilothermic organisms and their development is usually dependent on temperature. Extensive research has shown that rates of *Meloidogyne javanica* embryonic and post-embryonic development, pathogenic level and life cycle are strongly influenced by temperature and relative humidity. The present investigation was conducted in screen house of Department of Nematology at Chaudhary Charan Singh Haryana Agricultural University, Hisar. Significant reduction in the plant growth parameters and increase of inoculum densities leads to increase in number of root-knots thereby increasing nematode population. The rate of nematode multiplication was reduced with the increase in the inoculum density of *M. javanica*. This might be due to the destruction of root system by the parasitism of root-knot nematode which led the competition for food and nutrition among the developing nematodes within the root system and also due to inability of juveniles to find out new infection sites for subsequent generation.

Keywords: poikilothermic, inoculum, *Meloidogyne* etc.

BEETROOT AND ITS BENEFITS

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Beet root (*Beta vulgaris L.*) commonly known as 'chukander', is mainly cultivated in India for its juice and vegetable value. It is biannual crop. The roots are blood red in colour with thin skin. Beetroot has several varieties with bulb colors ranging from yellow to red. The nutritional benefits of beet root are very well known. The nutritional contents include 7.96% sugar, 9.96% carbohydrate, 1.68% protein, and 6mg of vitamin C per 100g of pulp. It is also an excellent source of calcium, magnesium, copper, phosphorus, sodium and iron. The green leafy part of the beet root is also of nutritional value, containing beta-carotene and other carotenoids. The greens have a higher content of iron compared to spinach. Deep red-colored beet roots are most popular for human consumption, both cooked and raw as salad or juice. Beetroot contain different nutrients such as Vitamins, Minerals, Amino acids, Calories, Antioxidants, Anti-carcinogenic colour, Silica etc. Beetroot, also known simply as the beet, has been gaining in popularity as a new super food due to recent studies claiming that beets and beetroot juice can improve athletic performance, lower blood pressure and increase blood flow. Increasing consumption of plant foods like beetroot decreases the risk of obesity and overall mortality, diabetes, curing the anaemia, anti-cancer properties, heart disease, promotes a healthy complexion and hair growth and help to relieve chronic constipation, cholesterol lowering capabilities etc. Beetroots main benefits are that it contains no fat, very few calories and is a great source of fiber. Dried beetroots can be consumed directly in the form of chips as a substitute of traditional snacks, that are rich in trans fatty acids, or after easy preparation as a component of instant food.

Keywords: Antioxidants, Anti-carcinogenic, trans fatty acids.

ALOE VERA GEL: A NOVEL EDIBLE COATING

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Consumers around the world demand for food of high-quality, without chemical preservatives, and an extended shelf life. Therefore, an increased effort has been made to develop new natural preservatives and antimicrobials. One method of extending post harvest shelflife is the use of the edible coatings. Edible films and coatings have received considerable attention in recent years because of their advantages including use as edible packaging materials over synthetic films. Recently, interest has increased in using Aloe vera gel-based edible coating material for fruits and vegetables. Aloe vera is a well-known plant for its marvelous medicinal properties. It is a tropical and subtropical plant. Aloe vera prolongs the conservation of fresh fruits. Aloe vera gel has been proven one of the best edible and biologically safe preservative coatings for different types of foods because of its film-forming properties, antimicrobial actions, biodegradability and biochemical properties. Aloe vera gel has the ability to prolong shelf life of the fruits and vegetables by minimizing the rate of respiration and maintaining quality attributes (color, flavor etc.). It has antifungal and antibacterial property which provides a defensive barrier against microbial contamination of fruits and vegetables. This gel is tasteless, colorless and odorless. This natural product is a safe and environmentally friendly alternative to synthetic preservatives such as sulfur dioxide. This gel operates through a combination of mechanics, forming a protective layer against the oxygen and moisture of the air and inhibiting the action of micro-organisms that cause food borne illnesses through its various antibacterial and antifungal compounds. Aloe vera gel-based edible coatings have been shown to prevent loss of moisture and firmness, control respiratory rate and maturation development, delay oxidative browning and reduce microorganism proliferation in fruits such as table grapes, sweet cherries and nectarines.

Keywords: Aloe vera gel, Edible coatings, Nectarines.

QUALITY AND MICROBIOLOGICAL ANALYSIS OF BLENDED RTS BEVERAGE OF WATERMELON JUICE DURING STORAGE

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Watermelon (*Citrullus lanatus*), Bitter Gourd (*Momordica charantia*) and ginger juice (*Zingiber officinale*) were formulated to a blend in different proportion (v/v) as T1 (90:05:05), T2 (80:10:10), T3 (80:15:05) and T0 (100:00:00) respectively. Sensory analysis, Physico-chemical analysis and microbiological analysis were evaluated. Marginal changes in pH, total soluble solids, acidity and vitamin C. The results of the analysis of Vitamin C analysis content gave 74.91 mg/ 100 ml in standard watermelon juice, 58.11 mg/ 100 ml in T1, 53.72 mg/ 100 ml in T2, 40.62 mg/ 100 ml in T3 respectively. Titrable acidity of all blends increased (0.21-0.47) and pH of the juice decreased progressively during the storage period. This may be due to the fermentation

process which generally took place during storage period and presence of lactic acid reducing micro-organism in the juices. The mean overall acceptability scores up to 7 for T2 sample were observed. In microbial analysis, total plate count and total yeast and mould count, was analyzed up to 30 days with every 10 days interval. All samples were screened for total aerobic mesophilic bacterial counts and total yeast & moulds counts. Blends were of acidic pH ranging from 5-6.5 and decreased progressively during the storage period. Samples were found to harbor viable bacteria within range between 10^1 - 10^3 cfu/ml. Microbial activity was very low on first day of storage but it was gradually increased till 30 days of storage period to 27×10^2 . However these values were within acceptable standards for human consumption as they have not exceeded the standard values of 10^3 cfu/ml. This indicated that the pasteurization (80°C for 3 min.) of the samples was efficient and the product was safe for consumption. However the shelf life of prepared beverage was established within 30 days.

Keywords: Watermelon, Bitter Gourd, Physico-chemical, TSS, Titrable acidity and Total Bacterial Count

OCCUPATIONAL STRESS ON EMPLOYEES OF PRIVATE AND PUBLIC SECTOR BANKS

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Every walk of life have to face stress and it is a universal element . Stress can have negative impacts on both the employee and the organization. The concept of stress was first introduced in the life science by Hans Selye in 1936. It was popularly used in seventeenth century to mean hardship, strain, adversity or affliction. Present day researchers and practitioners visualize the phenomenon of stress in a new perspective. As Kets de Vries (1979) noted, each individual needs a moderate amount of stress to be alert and capable of functioning effectively in an organization. According to a study employees from private and public banks shows that occupational stress is found higher among private bank employees compared to public bank employees but according to other study employees of public and private sectors significantly not found differ in their occupational stress level. Impact of age and gender was also not found on occupational stress. Among different occupational stress variables role over load, role authority, role conflict and lack of senior level support contribute more to the occupational stress. Bank employees cannot afford the time to relax and "wind down" when they are faced with work variety, discrimination, favoritism, delegation and conflicting tasks. It may be concluded that there is significant difference in occupational stress in employees of public and private sectors but there is no significant difference in occupational stress employees along age in public and private sectors. Similarly some studies found that there is no significant difference in occupational stress in male and female employees of public and private sectors.

Keywords: Occupational stress, employees, private and public sector banks

SOCIO ECOLOGICAL PERSPECTIVES LANDSCAPE PATTERN HETEROGENEITY CHANGE FOR ECOLOGICAL GOODS AND SERVICES

DEEPIKA

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The concept of ecosystem services was originally developed to illustrate the benefits that natural ecosystems generate for society and to raise awareness for biodiversity and ecosystem conservation. Landscapes change constantly from natural and anthropogenic drivers, and land use and land cover changes by humans have been identified as a primary effect of humans on natural systems. These changes underlie fragmentation and habitat loss, which are the greatest threats to biodiversity and ecosystem services. Landscape ecology is the study of the pattern and interaction between ecosystems within a region of interest, and the way the interactions affect ecological processes, especially the unique effects of spatial heterogeneity on these interactions. Environmental heterogeneity has recently received increased attention due to its effect on biological diversity, ecosystem services and ecological resilience to disturbance and hazards. From a landscape perspective, the expansion of sites under human land use such as agricultural fields, pastures and urban areas at the cost of losing (semi-)natural land may lead to landscape simplification and fragmentation .In agricultural landscapes, for instance, arable fields provide the final service of crop production, but constitute disturbed and ephemeral habitats, while many species associated with intermediate services like pollinators or biocontrol agents depend on less disturbed habitats in the surrounding landscape such as hedges or uncultivated field borders; see also challenge .Wild bees are one such example), as these service providers maintain higher levels of crop pollination in the vicinity of semi-natural habitats .Such context dependency has also been shown for biological control, which is predicted to be higher in more complex landscapes.

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 evolution of Indian agriculture policy may be analyzed in the context of role of government policies in sustainable development process and the factors affecting agriculture growth. In the sustainable development process of country, agriculture serves mainly three functions (i) to provide initial surpluses for other sectors of the economy (ii) to provide wage goods to the industrial sector (iii) to promote growth through forward linkages. The first and the third function require a robust overall agricultural growth whereas the second requires adequate food supplies. Therefore, for sustained economic growth, both overall agricultural growth and growth in food production are indispensable. 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. The affecting factors for sustainable development of agriculture are these –natural, technological, economic and policies making by government. Natural factor is a climate factor, it includes rainfall, temperature and soils. In the technological factors it includes pest protection, seeds and fertilizing technology. The economic factor means that the profitability of agriculture and how it influences by other private sectors. The last factor is that the policies made by the government for the sustainable development for agriculture. The sustainable agriculture may be defined as any set of agronomic practices that are economically viable, environmentally safe, and socially acceptable. If a cropping system requires large inputs of fertilizer that leak from the system to pollute ground water, drinking supplies and distant coastal fisheries, the system may be sustainable economically as the long-term supply of fertilizer is stable and the economic cost of fertilizer is easily borne by larger grain production but it is not sustainable environmentally or socially, since it does not cover the cost of environmental damage or social costs. The organic agriculture focuses on “living soil”, on optimizing the use of biological processes and on avoiding the use of synthetic chemicals and fertilizers.

Keywords: Agricultural, Economics, Development, Government, Sustainable.

RESISTANCE DEVELOPMENT IN FUNGAL PATHOGEN AGAINST FUNGICIDE

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The use of chemical fungicides to control plant diseases is an integral component of crop management. Fungicides are used worldwide that provide protection of major crops from destruction by fungal plant pathogens. Negative impacts of fungicide on the membrane of microorganisms were found to alter the structure and function of soil microbial communities. The structure of lipids, the basic components of cell membranes, was modified by fungicides of the Aromatic Hydrocarbons (AH) group, impacting the functionality of microbial membrane system. Fungicide treatments are effective for disease control, but bear the risk of resistance development. Fungicide resistance continues to generate disease control problems in many crops. For example Mutations leading to changes in the target proteins that are still functional but less sensitive to the drugs are most common in plant pathogenic fungi. For example, rapid accumulation of mutations in the gene encoding β -tubulin have been observed in a variety of plant pathogens after introduction of the benzimidazole fungicides, leading to resistance against these fungicides. New fungicides can be discovered either within established mode of action groups, ideally with low resistance risk (robust modes of action), or in areas with completely novel modes of action. Compounds having a novel mode of action are of course of special interest, since they play a key role in resistance management strategies

Key Words: Fungicide, Pathogen, Crop protection, Resistance

EFFECT OF DIFFERENT DATE OF SOWING IN DIFFERENT STAGES OF WHEAT CROP AT ALLAHABAD CLIMATIC CONDITIONS

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Present study was focused on “Effect of different date of sowing in different stages of wheat crop at Allahabad climatic condition” conducted in Forest Nursery, College of Forestry, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, (U.P.). Study explore the Allahabad climatic condition and effect on Germination percentage, Plant Height, length of spike, No. of tillers, No. of Grains per Spike and Grain Yield (q/ha) in wheat crops. Study results indicated that maximum germination was 9-13% in 8-12 days, plant height observes during the period 7 to 14 days and minimum observation is 98 to 105 days. The decreasing trend observed during 14-42 days then slightly increment in plant height in 49 to 56 days. The important factors of increasing or decreasing in grain yield are time of sowing, solar radiation, temperature, atmosphere condition, rainfall, irrigation, humidity and soil moisture.

Keywords: Wheat, Climatic Condition, Growth, Yield, Correlation

EFFECT OF CHEMICAL TREATMENTS ON POSTHARVEST QUALITY OF LITCHI (*LITCHI CHINENSIS* SONN.)**DHAMI K. S* AND SAGAR V. R****Division of Food Science and Post Harvest Technology, ICAR-IARI, New Delhi- 110012**

Litchi (*Litchi chinensis* Sonn.) is an evergreen subtropical fruit crop belonging to family Sapindaceae, which is known for its translucent juicy aril, nutritive value and refreshing taste. Pericarp browning which occurs within 2-3 days after harvest is the most important postharvest problem in litchi which reduces the commercial acceptability and shelf life of fruit. Litchi fruit, cv Shahi was given combinational treatments with sodium hypochlorite (0.2%) + KMS (0.5%), sodium hypochlorite (0.2%) + KMS (0.6%), sodium hypochlorite (0.2%) + sodium chlorite (0.05%), sodium hypochlorite (0.2%) + sodium chlorite (0.06%) and control (water) by the immersion method. The treated fruits were packed in punnets and stored at 2 °C with 85-90 % relative humidity. Most remarkable effect was obtained with sodium hypochlorite (0.2%) in combination with sodium chlorite (0.05%) which was effective in delaying loss of total soluble solids, titratable acidity and ascorbic acid in fruits with minimum decay (6%) giving an extended shelf life up to 28 days. It was also able to delay anthocyanin degradation, reducing polyphenol oxidase activity and weight loss. However, fruits treated with sodium hypochlorite (0.2%) and KMS (0.5%) showed better texture and colour retention than the other treatments. These results confirmed that treatment with sodium hypochlorite (0.2%) in combination with sodium chlorite (0.05%) could be used as postharvest treatment to reduce the pericarp browning and fruit quality deterioration of litchi.

DEVELOPMENT OF IRON FORTIFIED SWEETENED STIRRED YOGHURT**DHARAIYA CN¹, PINTO SV², PRAJAPATI JB³**¹ Assistant Professor, Dairy Technology, SMC College of Dairy Science, AAU, Anand² Professor & Head, Dairy Technology, SMC College of Dairy Science, AAU, Anand³ Principal & Dean, SMC College of Dairy Science, AAU, Anand

The study was conducted to standardize a process for manufacture of iron fortified sweetened stirred yoghurt, prepared using *Lactobacillus delbrueckii* ssp. *bulgaricus* and *Streptococcus thermophilus* MTCC 5460 (MD2), fortified to contain 15 mg iron/kg. In preliminary screening using six iron salts, it was observed that yoghurt fortified with ferrous gluconate, ferrous sulphate and reduced iron were not sensorily acceptable. Fortification of fermented milk with ferric ammonium citrate, ferric pyrophosphate and ferric chloride did not influence the flavour, however, the body and texture was adversely affected resulting in lower overall acceptability of the product. Fortification of iron with ferric pyrophosphate and ferric chloride significantly lowered the viability of starter bacteria while ferric ammonium citrate resulted in microbial count at par with control. Therefore, in second phase, fermented milk was prepared using milk (1.5% milk fat, 11% milk solids-not-fat) fortified with 15 ppm iron using ferric ammonium citrate and added with pectin at 0, 0.05 and 0.1% (w/w) and maltodextrin at 0, 0.5, 1 and 1.5% levels in combination. All the samples reached the desired acidity after 5.5 to 6.0 h of incubation and showed average iron content in the range of 16-17 ppm and viable count of 10⁶ cfu/g of both the strains. The results suggested that acceptable quality low-fat (1.5%) iron fortified probiotic fermented milk can be prepared by fortifying milk with ferric ammonium citrate at a level of 15 ppm and using 1% maltodextrin and 0.1% pectin, without any adverse effect on probiotic count and acceptability of the product.

Key words: Iron fortification, stirred yoghurt, sweetened yoghurt, *Lactobacillus bulgaricus*, *Streptococcus thermophilus*, low-fat yoghurt.

IN-SITU STUDIES OF POLLEN VIABILITY, POLLEN GERMINATION AND POLLEN TUBE GROWTH OF PEA (*PISUM SATIVUM* L.) AFTER CROSSING IN THE SHILLONG, BARAPANI REGION**^{1,2}DHARMENDRA SINGH LAGORIYA, ¹VIJAY K. CHOWDHURY AND ¹V.K. KHANNA***¹School of Crop Improvement, College of Post Graduates Studies, CAU, Barapani- 793103²Dept. of Agricultural Biotechnology, Assam Agricultural University, Jorhat-785013

Pea (*Pisum sativum* L.) is a self-pollinated crop belonging to the family Fabaceae and is native to Mediterranean basin and Near East. Pea is a cool season vegetable grown commonly throughout India as *rabi* season crop. The experiment was designed to examine all the crosses by the study of pollen viability, pollen germination, size of pollen grain and pollen tube growth. Seven pea plants were randomly selected for the crossability studies. Pollen viability studies were done using 2 % acetocarmine stain to examine under the microscope, viable (stained) and non-viable pollen (unstained) pollen were observed. Pusapragati (98.78%) showed the maximum number of fertile pollen and minimum was recorded in VRP- 07 (96.22%). *In-situ* pollen germination and pollen tube growth studies were undertaken using a microscope after three different timings of pollination. Flowers were detached after 8 hr, 16 hr and 24 hr of pollination to study the pollen germination, pollen tube growth and abnormalities, if any. There was more difference in number of pod set (82-95%) among the accessions but less difference in the average pollen fertility (96-98%). The data was subjected to correlation studies which showed that there was no significant correlation between pollen germination, pollen tube growth, and pod set.

Key words: Acetocarmine, Correlation, Crossability, Pollen viability,

IDENTIFICATION OF YMV RESISTANT BREEDING LINES IN A DERIVED F_{2.7} POPULATION OF SOYBEAN USING MOLECULAR MARKERS

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Hybridization is an important breeding method to bring together the desirable genes from two parents into a single genotype. The experiment was conducted at two locations viz. Ludhiana and Gurdaspur. In the present investigation, 45 F_{2.7} lines derived from cross of SL 525 (a yellow mosaic resistant variety) and JS 335 (a widely adapted cultivar but susceptible to YMV) were evaluated with SSR markers. 120 SSR markers were applied to parents, out of which 17 markers resulted polymorphism in them. Then these polymorphic markers were applied in the population constituted of abovesaid 45 derived lines. The lines were evaluated on the basis of agronomic traits and parental contribution. Parental contribution of each line was calculated on the basis of behaviour of markers towards the parents. Molecular diversity analysis categorized the genotypes into 3 clusters. Cluster A consisted of 26 genotypes including parent JS 335 and cluster B consisted of 12 genotypes including parent SL 525 and cluster C of 9 genotypes. Genotypes present in cluster C had nearly equal contribution of both the parents. Genotypes SLJS 41-2 (32.1g/ plant) and SLJS 43-7 (32.4 g/plant) both are present in cluster C which had 62.5 and 52.94 per cent contribution of JS 335, respectively. These two lines were better yielder than JS 335 were also resistant to yellow mosaic virus.

A REVIEW ON DRIFT AND EMISSION OF DUST FROM PESTICIDE TREATED SEEDS DURING SEED DRILLING

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Seed plays quite a vital role in agriculture sector of developing countries like India where a large proportion of the population and GDP substantially depends upon agriculture sector. As evidenced from the history of mankind seed treatments have played and are still playing a major role in sustainable crop production. Various seed treatments help in ameliorating the yields of different crops by providing safeguard from pre and post-emergent insects and diseases and also assure a uniform stand across a variety of soil types, cultural practices and environmental conditions. Seed treatments also furnish an economical crop input that is applied straight on the seed using highly effective technology. Dressing seeds with pesticides to control pests is a prevalent practice with paramount advantages. Recent incidents of bee losses, however, have pointed attention to the emission of abraded pesticide-coated seed particles in the environment premises. Sowing with seed drill results in drift of pesticide dust leading to pollution of air, water and other natural resources. Seed treatment has many advantages when compared to other methods. When seed-dressing preparations are used, the substance is applied right on the seed, and smaller amounts of the active substance are required, which in turn reduces concentrations in the environment. Also, the potential subjection to non-target organisms is also reduced via planting of the seed in soil. Moreover, the applied products can provide protection from the time of seedling emergence well into the growing season, which limits the pesticides application by other techniques. For the above mentioned reasons, treating seeds is an important feature of integrated pest management. Whilst seed treatments have countless benefits, they also produce certain risks, like accidental exposure of the farmers and workers, food supply contamination, translocation of systemic pesticides to guttation drops, nectar and pollen and contamination of the environment by the emission of abraded seed particles during sowing..

Keywords: pesticides, seed treatment, crop protection; dust drift; seed coating.

COGNITIVE ABILITIES OF PRESCHOOL CHILDREN IN URBAN AND RURAL AREA OF HISAR DISTRICT

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The period of life from three to six years of age may be called early childhood years. It is an important period in the life of an individual because the rate of development is more rapid during these years and children at this stage are intrinsically curious and not only growing physically but also mentally. Cognitive development is "the psychology of learning which emphasizes human cognition or intelligence as a special endowment enabling man to form hypotheses and develop intellectually". Cognitive functioning or the process of knowing includes development of awareness and judgement. The main purpose of the study was to investigate cognitive abilities of preschool children across residential area. The study was conducted in Hisar district of Haryana state. For selection of rural data four schools having preschool unit were selected and to draw urban sample five preschools were selected at random. From selected schools 240 pre-school children from the age group of four to five years were selected randomly. The sample consisted of equal number of preschool boys and preschool girls. Cognitive abilities of pre-school children were assessed by using Pandey's Cognitive Development Test for Pre-schoolers by Hema Pandey (1992). The collected data was classified and tabulated as per the objectives. For analysis of data frequency, percentages, mean, standard deviation and

independent sample 'z' test were used. Results indicated that in urban as well as in rural area majority of the preschool children had moderate level of cognitive abilities and urban preschool children had better cognitive abilities as compared to rural preschool children.

Keywords: Cognitive abilities, cognitive development, preschool children.

A STUDY OF PERCEPTION AND IMPACT OF LEADS ON FARMERS AND EXTENSION OFFICIALS/PROFESSIONALS

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Agriculture is the backbone of Indian economy. In a vast and populous country like India efforts to develop agriculture alone will safeguard the interests of the nation equitably and sustainably. Many agricultural development programs are being planned and implemented in the country from time to time assuring the development of nation, but these development programmes failed to reach the small and marginal farmers. As the farmer- farmer extension is the major high lightening in case of LEADS, there are three lead farmers and around each lead farmer there are ten farmers in each panchayat. The group of ten farmers around these lead farmers are the satellite farmers. The pilot extension for the implementation during 2010-11 is proposed with the following objectives to utilize the potential of lead farmers for transfer of technology, to address field level problems of selected farmers through the support of regular field visit by technical officers. to introduce a regular and systematic field visit oriented extension system in the state, to intervene and advise farmers through the preparation of Monthly Technology Advice (MTA), with the support of KVK. In order to revitalize the system a concept of Frontier extension system revolved around lead farmer – Satellite farmer concept on an Agro Ecological Zone basis with in a district is proposed for pilot testing. The lead farmers are an important agent in the chain of transfer of technology in agriculture.. Regular field visits by the extension personnel is the salient feature of LEADS. Field assistants appointed with minimum a qualification of VHSE agriculture, performs the field visit as per the pre-determined visit schedule. One field assistant will cover two Krishi bhavan respectively.

Keywords: LEADS (Lead Farmer Centered Extension Advisory and Delivery Services)

PROBLEMS WITH REGARD TO INFORMATION AND COMMUNICATION TECHNOLOGIES (ICT)

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Language is one of the major barriers to the formation of perfect knowledge societies in developing countries. Each day over two million pages are added on the internet but there is a very small content representation on the net in the vernacular languages. The other barriers to adopt information technology in the developing countries include; Inabilities to recognize the knowledge they possess, put a value to it and use the power of knowledge to their growth. Lack of relevant and locally specific content constitutes the most critical element impeding the growth of knowledge societies after connectivity. Handling ICT, hosting of information and retrieving useful information from the net does require a fair amount of technical skills and netliteracy. In developing countries, the level of skills about computer use and internet navigation is extremely low which impedes their transformation to knowledge societies even when other factors are favorable. The shortage of the comprehensive general policies in the developing countries for expanding the Information and Communication Technologies for villagers, as a great power of the productive forces in societies, the lack of suitable tele communication infrastructures for exchanging information in villages, being unfamiliar and unable villagers in using the information technology devices, low population, scattered villages, the low income of villagers and not accepting high costs, are important challenges in expanding the ICTs in villages. Developing ICTs in villages without having roads, electricity and telecommunication faces serious problems. Making use of the experience of the pioneer countries in rural ICTs in removing these challenges can increase the rural of developing this technology in villages.

Keywords: Information and Communication Technologies.

INFLUENCE OF KNOWLEDGE ON SCHOOL VEGETABLE GARDEN BY STUDENTS**DILIP S.¹, ALLAN THOMAS² AND NAVINKUMAR³****1. Ph.D. Scholar, Dept. of Extension Education, CCS Haryana Agricultural University, Hisar****2. Asstt. Proff. Dept. of Extension Education, Kerala Agricultural University, Trissur.****3. Ph.D Scholar, Dept. of Agril. Extension Education, UAS, Raichur.**

India is the second largest producer of vegetables in the world, our productivity levels are abysmally low. Through the garden, students gain an understanding of ecosystems, an appreciation for food origins and nutrition, and knowledge of plant. At the same time, they learn practical horticultural skills that last a lifetime. A school garden is an innovative teaching tool and strategy that lets students incorporate hands-on activities in a diversity of interdisciplinary, standards-based lessons. The vegetables garden engages students by providing a energetic environment in which to observe, discover, experiment, nurture, and learn. It is a living laboratory where lessons are drawn from real-life experiences rather than textbook examples, allowing students to become active participants in the learning process. Hence from the total results it was summarized that majority of the school students had medium level of knowledge on vegetable gardening activities. This was presumably due to the high level of literacy and education among the students. The results also indicated the significance of charting a strategy for knowledge development regarding in school vegetable garden activities. The results also indicated the significance of charting a strategy for knowledge development regarding in school vegetable garden activities so that the percentage of teachers occupying the upper quartile range of knowledge distribution can be further increased. Knowledge level was medium for majority of students (71.00%).

Key words: Vegetables garden, knowledge.**GENETIC STUDIES OF YIELD AND QUALITY TRAITS IN AROMATIC RICE THROUGH HAYMAN'S APPROACH****DILRUBA A. BANO* AND S. P. SINGH****Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, BHU, Varanasi-221005**

Hayman's component analysis was employed to estimate genetic components of variation in aromatic rice genotypes for *yield, yield components and quality traits through Hayman's approach* by following 8x8 one way diallel mating design. Vr-Wr graphs were plotted for the traits viz., days to 50% flowering, days to maturity, plant height at maturity, main panicle length, effective tillers per plants, 100 grain weight and yield per plant, that exhibited significant deviation of regression coefficient 'b' from zero, irrespective of significance of 't²' or deviation of 'b' from unity. Vr-Wr graph revealed over dominance for the traits viz., plant height, main panicle length, effective tillers per plant and yield per plant. Traits like days to 50% flowering, days to maturity and 100 grain weight revealed partial dominance. Graphical and component analysis revealed over dominance type of intra allelic interaction for most of the yield and yield contributing traits. However, both additive and dominance types of genetic effects were observed for most of yield and quality traits.

POPULATION COMPATIBILITY AND NUTRIENT MANAGEMENT STUDIES IN CHICKPEA (*CICER ARIETINUM* L.) +MUSTARD (*BRASSICA JUNCEA* L.) INTERCROPPING SYSTEM**DIMPLE KAPARWAN, N.S RANA, B.P DHYANI, VIVEK, LALI JAT****Department of Agronomy, Sardar Vallabhbhai Patel University of Agriculture & Technology, Meerut, UP**

Chickpea + mustard is a prominent intercropping system in Indian sub continent under resource constraint conditions. The population ratio, plant geometry and nutrient management practices have significant bearing on performance of component crops and economic feasibility of the mixed stands. An investigation was therefore undertaken to optimize planting geometry and devise nutrient management practices in sandy loam soils, low in organic carbon (0.49 %) and available N, medium in available phosphorus and potassium with slightly alkaline reaction. Twenty treatments consisting of combinations of 04 intercropping systems viz., Chickpea + mustard in 3:1 and 4:1 row ratio and both in additive and replacement series and 05 nutrient management options viz., recommended dose (RD) to chickpea and mustard both (N₁), N₁ + biofertilizers, N₂ + FYM (N₃), N₁ but mustard with 150% RD (N₄) and N₄ with biofertilizers along with sole stand of component crops were tested in RBD with 3 replications. Recommended doses were 100 kg DAP +20kg S ha⁻¹ for chickpea and 120 kg N +40 kg P₂O₅ +20 kg S for mustard. Nutrient application to mustard was made as per population against sole stand. Chickpea seeds were inoculated with *Rhizobium* and mustard with *Azotobacter* while PSB was soil applied. Chickpea (BGM 547) and mustard (Kranti) varieties were used in the study. The results revealed that except plant height all other growth parameters of chickpea viz., number of branches, dry matter accumulation, number and dry weight of nodules, yield attributes like number of pods⁻¹ and number of seeds pod⁻¹, and yield were maximum in sole cropping. A reverse trend was however noted in mustard except for plant height. Similar findings in chickpea + mustard intercropping have also been reported by Tripathi *et al.* (2005) and Kumar and Singh (2006). Chickpea equivalent yield (2793kg ha⁻¹), land equivalent ratio(1.48), gross return (Rs. 1,41,557), net return (Rs.1,18,951), B:C ratio(5.3), were significantly higher in chickpea + mustard 4:1 additive series suggesting the intercropping a profitable venture. Nutrient uptake and residual soil

fertility were higher in chickpea + mustard 4:1 replacement series. Nutrient management options had significant effect on performance of component crops being best in chickpea with recommended dose of N to component crops along with biofertilizers & FYM and mustard gave its best when its recommended dose was enhanced to 150 % along with biofertilizers. Application of 100 kg DAP +20kg S ha⁻¹ to chickpea with *Rhizobium* inoculation and 30 kg N, 10 kg P₂O₅ & 5kg S ha⁻¹ to mustard with *Azotobacter* inoculation and soil application of PSB resulted in highest chickpea equivalent yield (2610 kg ha⁻¹), land equivalent ratio (1.37), gross return (Rs. 1,31,918), net return (Rs. 1,11,040), B:C ratio (5.31) and residual soil fertility. Yield and monetary advantages in chickpea + mustard intercropping have also been reported by Arya *et al.* (2007) and Abraham *et al.* (2011). Thus, chickpea yields got reduced under intercropping but mustard as intercrop not only compensated the chickpea yield losses but also gave additional yields and returns. Mustard raised in 4:1 additive series with chickpea proved to be remunerative with application of 100 kg DAP +20kg S ha⁻¹ to chickpea + *Rhizobium* inoculation and 30 kg N, 10 kg P₂O₅ & 5kg S ha⁻¹ to mustard + *Azotobacter* inoculation and soil application of PSB.

BIOMARKERS: A PRODUCT OF ADVANCED CLINICAL RESEARCH

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A Biomarker is a substance which is used in biological systems to study the inconsistencies in test results which could serve as an indicator of exposure, susceptibility, resistance, clinical disease, or effect of a treatment. The goal of using Biomarkers is to ease decision making in personalized cancer therapies. These personalized cancer therapies are helpful in treating unique tumors and thus improving survival and safety. Earlier cancer was considered as an untreatable disease, but the biomarkers have aided in the improvement of the clinical practices by early tumor detection, studying the behavior of tumors, sensitivity or resistance towards a drug. The various categories of biomarkers include predictive, diagnostic and prognostic biomarkers, etc. which are used to assess therapeutic response, early detection and stages of tumor & its potential malignancy, respectively. An example of predictive biomarker HER2 IHC is used to detect overexpression of HER2 which is seen in about 25% cases of breast cancer. Based on current study we see that a significant amount of work is been done towards a formalized biomarker developmental process. This will soon aid in the translation of predictive biomarkers from discovery to clinical implementation. Further progress could be found in time through alignment with regulatory processes. This study focuses on describing the various types of Biomarkers, the specific biomarkers for certain location, their development & criteria for their classification and how their finding can be enhanced. The need for the improvement is to advance the cancer therapies by detecting the disease before it reaches the complex stage and even when it is asymptomatic. The biomarkers will make the therapies more specific and will target the pathways involved in the spread of the tumor.

keywords: cancer, biomarkers, predictive, diagnostic, prognostic, therapeutic response.

INCIDENCES OF REPEAT- BREEDING OF ANIMAL AT ORGANIZED FARMS AT RANCHI, JHARKHAND

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The present study was conducted on the animal of Military Dairy and organized farms at Ranchi. A total of 144 cows were selected. The highest incidence of repeat breeding (23.52%) was recorded during the month of February and the lowest (11.90%) during the month of June. The overall incidence of repeat breeding out of total number of 483 cases examined was 16.82 percent. The highest incidence of repeat breeding was observed during monsoon (23.80%) and lowest during summer (13.63%) season. The highest incidence of (42.85%) was observed in first calvers.

Keywords: Incidences, Repeat breeding, Cattle, infertility and Season

ADOPTION OF URDBEAN PRODUCTION TECHNOLOGIES IN LALITPUR DISTRICT OF BUNDELKHAND REGION

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Lalitpur is one of the district of Uttar Pradesh state of India. Lalitpur district is a part of Jhansi Division. The district occupies an area of 5,039 km². The district lies between latitude 24°11' and 25°14' (North) and longitude 78°10' and 79°0' (East). The climate of the district is sub-tropical, which is characterized by a very hot dry summer and a cold winter. Among the agronomic crops, pulses are the dried edible seeds of certain plants in the Fabaceae family. Pulses are very high in protein and fibre, and are low in fat. Pulses are also nitrogen-fixing crops which improves the environmental sustainability of annual cropping system. Urdbean were grown in the district during last year of 2017 in the area of 1, 68, 284 ha, production obtained 76, 906 MT with productivity of

4.57 q/ ha. ClusterFront Line Demonstrations (CFLDs) on urdbean were undertaken by the Krishi Vigyan Kendra, Lalitpur in the district for 2018 during *Kharif* season in 9 villages spreading over 2 blocks for dissemination of improved technologies of urdbean (*Vigna mungo* L. Hepper) to increase productivity and to assess the economic viability and technological feasibility of the recent urdbean production technologies over the existing one. The average highest seed yield (720 kg ha^{-1}) was recorded under CFLD in the year 2018 over 500 kg ha^{-1} under farmers' practices. Forty four per cent increase in the yield were observed under CFLDs over farmers' practice. The economic viability and profitability showed that the benefit cost ratio (B: C) was higher in case of improved agro-technologies (CFLD) with 2.64 against 2.00 in farmers' practice (FP). The net return from improved agro-technologies (CFLD) was Rs. 25030 ha^{-1} which is significantly higher than farmers' practices (Rs. 14056 ha^{-1}). The variation in agro-climatic parameters as well as locations of CFLD programme was effective in changing the attitude, skill and knowledge of the farmers for adoption of improved technology/ HYV of urdbean and further wide scale diffusion to the other farmers. It also improved the relationship between farmers and scientists and built confidence among them.

NEERA COLLECTION AND ITS VALUE ADDITION" A NOBLE APPROACH TOWARDS DOUBLING THE FARMER'S INCOME

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Coconut a crop of small and marginal farmers plays an important role in the national economy. But now a day due to several reasons coconut farming is gradually becoming non-profitable. To make coconut cultivation profitable, extraction of Neera and its value addition are the latest addition which holds the potential to revitalize the prospects of coconut farmers as well as for diabetic patients. Neera is an oyster white or honey colored phloem sap with delicious taste, rich in sodium and potassium with considerable amount of other minerals and low in Glycemic content (35), which is ideal for diabetic patients. In west Bengal at present minimum 200 liters of Neera is being produced without hampering the nut yield with a gross return of Rs16000/ palm /year where as average return from harvest of nuts will be around Rs1000-1200 /palm/year. If 1% of the coconut palms of West Bengal are utilized for Neera production, then without hampering the nut yield, employment generation will be 5140 numbers /day, and average 102.92 lakh liters of sap will be produced /year with an annual return of around Rs. 6175.2 lakh. A farmer can also earn Rs 21 lakh per year from one ha area of land from Neera production which will be much higher than the nut income/ha (Rs185850). Even the non productive palms can also be utilized for Neera production .Neera based value added products like jaggery, sugar, and milk based coco sap sweets are also being prepared with high demand mostly among the diabetic patients. As a result Neera can generate a good daily return to the coconut farmer, the Neera tapper and sweet makers and will contribute to the Gross Domestic Production (GDP) of the state.

Key words: Neera, Jaggery, sugar, low Glycemic, Diabetic

SUSTAINABLE AGRICULTURE DEVELOPMENT IN INDIA

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Agriculture has been a way of life and continues to be the single most important livelihood of the masses in India, ensuring food security while also accounting for a significant share of India's GDP. It engages almost two-thirds of the workforce in gainful employment. Self-sufficiency in terms of food grains has always been emphasized by Indian government's policies, which doesn't coincide much with agricultural sustainability. The future of agricultural growth and productivity has to progress in parallel with environmental sustainability as recognized by the trajectory of Indian agriculture in context to the prevailing environmental problems. The environmental challenges recognized in the present day are land degradation, groundwater depletion, water logging, excessive use of chemical inputs, deceleration in total factor productivity, multi-nutrient deficiencies, stagnant farm incomes, lack of eco-regional approach and climatic variations are posing problems for the future of Indian agriculture. Thus, as a solution to existing problems, different governments policies and plans have been strategically designed with the objective of promoting sustainable agriculture. Policies under National Mission for Sustainable Agriculture (NMSA) is envisaged as one of the eight Missions (National Solar Mission, National Mission for Enhanced Energy Efficiency, National Mission on Sustainable Habitat, National Water Mission, National Mission for Sustaining the Himalayan Ecosystem, National Mission for Green India, National Mission for Sustainable Agriculture, National Mission on Strategic Knowledge on Climate Change) under the National Action Plan on Climate Change (NAPCC) devised strategies to make Indian agriculture more resilient to climate change and National Agricultural Policy (NAP) focused on management and conservation of resources. Farming conditions will continue to change, so capacity of farmers, fostering rapid, sustainable and broad-based growth in agriculture is the key to sustainable agriculture with the objective to increase the productivity, efficiency and level of employment while protecting and preserving the natural resources ensuring all-round sustainability.

Keywords: policies, sustainable agriculture, GDP, challenges, NMSA, NAPCC, NAP

SOIL AND CROP MANAGEMENT STRATEGIES TO ENSURE HIGHER CROP PRODUCTIVITY WITHIN SUSTAINABLE ENVIRONMENTS

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The rising population and reduction in the amount of land and some other resources have created tremendous pressure on current agricultural producers to meet the increasing food demands. To cope with this challenge, certain key inputs, such as fertilizers and other chemicals, are overused, which are worsening the surroundings. This intensive agricultural production without adherence to ecological sustainability has led to declining soil health, land degradation, and severe environmental problems. So, future efforts to feed the growing population should aim for greater agricultural production within sustainable environments. In this regard, innovative steps are needed, as business-as-usual policies lack the potential to cope with these challenges. The concept of agricultural sustainability and various soil and crop management strategies (SCMS) that have been designed to optimize crop yield under sustainable environmental conditions are discussed, including nutrient management, site specific nutrient management (SSNM), integrated nutrient management (INM), integrated soil fertility management (ISFM), integrated soil-crops system management (ISSM), ridge-furrow mulching systems (RFMS), sustainable water management (SWM), conservation agriculture (CA), sustainable land management (SLM), vertical/sky farming, and integrated crop management, and breeding strategies as well as other approaches combined with technological and behavioural changes. The present review suggests that a sustainable production system can be developed by combining the multifaceted effort under SCMS practices with short- and long-term preventive measures. Reducing chemicals' usage, such as that of fertilizers and pesticides, plus improvements in the crop input use efficiency could minimize greenhouse gas emissions while protecting the environment. Sustainable agriculture holds promise for humankind and the planet Earth, and it can be successful if all developed and developing nations stand together to seek 'our common future' to produce more food while generating less environmental pressure.

Keywords – agricultural sustainability; soil tillage; land degradation; soil erosion; greenhouse gas emissions

EFFECT OF DIFFERENT PRIMING TECHNIQUES ON QUALITY AND ITS ATTRIBUTES IN BABY CORN (ZEA MAIZE L.)

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This field experiment was conducted on Baby Corn during the year, 2018 in Agronomy Research Farm at Lovely Professional University Phagwara (Punjab). **Objectives:** To study effect of priming techniques on quality and yield parameters of baby corn. This experiment arranged on RBD design of different priming treatments viz. 1) Unprimed: T₀- (control), T₁ (Distil Water 12 hours), T₂ (Distil Water 24 hours). 2) Hydro priming, T₃ (KNO₃ 1% 12 hours), T₄ (KNO₃ 1% 24 hours). 3) Osmo priming, T₅ (CaCl₂ 1% 12 hours), T₆ (CaCl₂ 1% 24 hours), 4) Harmonal priming, T₇ (Gibberellin 150ppm 12 hours), T₈ (Gibberellin 150ppm 24 hours), T₉ (Gibberellin 100ppm 12 hours), T₁₀ (Gibberellin 100 ppm 24 hours). **Methods/Statistical analysis:** The priming techniques were studied under laboratory and field condition. In hydro priming method 100 grams of seed were soaked in 200 ml of double distil water in 500 ml of glass beaker for 12 hours and 24 hours. In case of osmo priming, 1 % KNO₃ was used as a solvent solution was prepared. Seed of 100 grams was soaked in that solution for 12 hours and for 24 hours. In case of halo priming 1 % CaCl₂ was used for this 2 gram of CaCl₂ was taken and 200 ml of distil water was used. After 100 grams of seed was soaked for 12 hours and 24 hrs. For hormonal priming two solution was taken in one solution 100 ppm of G.A3 was used and in another 150 ppm of G.A3 was used. **Findings:** The result revealed that highest yield was 81.3 q.ha⁻¹ recorded in T₈ (Gibberellin 150ppm 24 hours) in hormonal priming, followed by T₇- 80.0 q.ha⁻¹ (Gibberellin 150ppm 12 hours) and T₁₀ (Gibberellin 100 ppm 24 hours), while minimum was 61.3 q.ha⁻¹ found in treatment T₀ (Control).

INTRODUCTION OF KASHI ABHIMAN- A TOMATO VARIETY

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In India, the total vegetables production has crossed 169.1 million tonnes from an area of over 10.1 million hectare, with an average productivity 16.74 metric tonnes/ ha. Tomatoes are now the fourth most popular fresh market vegetable. It occupies 12 percent of total area under vegetable production. In Mathura cultivation of vegetable occupies around 20,000 hectare lands i.e. around 8% of the total arable land of Mathura. Tomato is important vegetable crop cultivated in Rabi season in Mathura and occupied around 1000 ha land. Despite best managerial practices and scientific technologies, the yield of tomato remained low due

to regular use of varieties released by private sector like US-4 and Himsona etc. The farmers were not aware of the varieties which were more potential in term of yield and released by IIVR Varanasi/public sector. For enhancing the productivity. The KVK Mathura conducted demonstrations on farmer's field in the year 2017-18 on 5 locations to showcase the yield potential of Kashi Abhiman, a tomato hybrid variety developed by IIVR Varanasi. It starts fruiting after 70 days of transplanting and the fruit of this variety are deep red colour and mature uniformity. The average fruit weight was 70-85 gram and the variety gave an average yield of 583 q/ha., whereas, the prevailing varieties like Himsona and US-04 produced an average yield of 505 q/ha. The Yield was found 15.45% higher over these varieties which are prevailing in the district.

BAMBOO AND ITS ECOFRIENDLY BEHAVIOR

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Bamboos some of the fastest growing plants on the earth, with reported growth- rates up to 91cm in 24hours. Bamboo: fast-growing bamboo regenerates rapidly without the use of pesticides. Material made from bamboo fiber is appealingly soft to the touch and naturally anti-bacterial (Smith, 2007). It has high mechanical and tensile strength. The tensile strength of plaited bamboo cables is as strong or stronger as a steel cable of the same size. Bamboo fiber is 2-3 times stronger than timber. Researchers have expanded their interest in the product development by using the usage of raw materials like bamboo fibre which is stronger as well as can be utilized in generating high end quality sustainable industrial products [Khalil H.P.S.A, Bhat I.U.H, Jawaid M, Zaidon A, Hermawan D, Hadi Y.S. 2012] Bamboo products are treated as Ecofriendly due to its germ free nature and there is no need of chemical processing during product manufacturing. Bamboo has been used widely for various purposes, from as building materials, home furnishing, handicrafts, foodstuffs, to medicine(Patel2005,Taming et. al. 2013,Honfo et. al.2015).Naturally, Bamboo as a plant is pest-resistant, 100% antifungal, antibacterial and biodegradable. Additionally, this plant is also used as a construction material because its culm is sturdiest among other species of bamboo and is resistant to parasites, such as fungi and borer insects determined by its chemical composition. Growth of bamboo is completed in 3-5 years. The best characteristics of bamboo is that it's extremely renewable and sustainable compared to cotton, wood and another similar plants. Bamboo products accept the global challenges and there are not any bad effects of these products against our ecology. Due to its biodegradable nature; nature has no bad response to use products of bamboo. It requires far less water than similar plants (eg. cotton). It absorbs 5-times more CO₂ than similar plants and produces 35% more oxygen than similar plants. Bamboo has a strong, natural fiber can become an alternative to the eco-friendly textiles. Bamboo is turned into a fabric in two different ways: mechanically and chemically.

Keywords: Bamboo medicinal, bamboo-fibre, eco-friendly, biodegradable

ASSESSMENT OF SOME RATIO TYPE ESTIMATORS USING LINEAR TRANSFORMATION THROUGH SECONDARY DATA

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In present paper we have to try the different types of linear transformation of the variable (x) in sample survey to reduce the bias and mean square error of usual ratio estimator. Prominent among them are Mohanty and Das (1971), Reddy (1974), Srivenkatramana (1978), Das and Tripathi (1980), Sisodia and Dwivedi (1981), Singh and Kakran (1993), Mohanty and Sahoo (1995), Upadhyay and Singh (1999) etc. An ample assessment of transformed ratio estimator is offered in this paper. In addition, when a prior value of y- intercept in the simple linear regression of y on x is available, a linear transformation of study variable y is suggested to find out another modified transformed ratio estimator. An observed study with some real populations is also carried out to highlight the precision of altered ratio estimator.

Key-words: Linear transformation, Transformed ratio estimator, Ratio estimator, Precision.

3D PRINTING OF FOOD: A NEW APPROACH TOWARDS SUSTAINABLE DEVELOPMENT THROUGH FOOD WASTE REDUCTION

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Anyone who has an apple tree growing in their yard knows how difficult it is to grow one that is worthy of eating straight off the tree. Most have bruises, wormholes, or bird damage that leaves most apples somewhat marginalized. They may be perfectly good on the inside, yet they don't look very good. As we shop for apples in the grocery store, we find ourselves looking for the "perfect apple." Only a small percentage of apples grown on the farm are worthy of making it into the major leagues of food – the fresh

produce section of our grocery stores. But what if we could take all of those bruised and damaged apples and turn them all into “perfect apples” – perfect size, perfect color, perfect crunch when we bite into them, and the perfect sweet juicy flavor and aroma that makes our mouth water every time we think about them. This is the promise of food printer technology as we move from simply printing ink on paper, to 3D printing of parts and objects, to next generation food printers. 3D printed food offers many possibilities to facilitate food activist efforts directed at improving environmental sustainability and nutrition for all social groups and the alleviation of world hunger. This technology can contribute to converting alternative ingredients such as proteins from algae, beet tops, or even insects into tasty products that are not only good for your health but also for the environment. A food printer also opens the way for fully customizable nutrition (Personalized Food) as it can make products that exactly fit the needs and preferences of individuals. In addition, the printer can make sure that your personal dish is made at exactly the right time to ensure that a fresh and healthy dish waiting for you when you get home. And finally, the printing of food provides enormous freedom in design. This applies not only to the 3D shape but also for the composition (the ingredients and their mutual relationship), the structure and texture, not to mention the taste. Moreover this technology may become an efficient means for waste food reduction in near future up to some extent, especially for high value fruit crops, damaged due to different factors and become almost useless.

Keywords: 3D, Printed food, environment, personalized food etc

IMPACT OF KRISHI VIGYAN KENDRA IN CHANGING THE KNOWLEDGE AND ATTITUDE OF THE FARM WOMEN IN COOCH BEHAR DISTRICT OF WEST BENGAL

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Krishi Vigyan Kendra (KVK) is an institutional project of Indian Council of Agricultural research (ICAR) for testing, training and transfer of agricultural technologies for the benefits of farmers, farm women and rural youths. Farm women play a crucial role in all farm-related activities from land preparation to marketing. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fibre and fuel (Swaminathan, 1985). Keeping these facts in view a study was carried out in Cooch Behar district of West Bengal to find out the impact of Krishi Vigyan Kendra in changing the knowledge and attitude of the farm women. The study covered one districts, two blocks (Tufanganj-I & Tufanganj-II) selected purposively and 12 villages and 140 respondents (70 KVK beneficiaries and 70 non beneficiaries) which were selected randomly. Descriptive research design was followed for the present study. The data were gathered by personal interview technique with the help of pre-tested, structured interview schedule. The collected data were processed, classified, tabulated and analysed by using descriptive and inferential statistical tests, interpreted and logical conclusions were drawn in the light of the objectives set forth. The study inferred that there was a significant difference between the socio-economic status of the KVK beneficiaries and non-beneficiaries. Majority of the beneficiaries had medium to high socio-economic status. There was a significant difference between the knowledge level of the KVK beneficiaries farm women and non-beneficiaries. There was a significant difference between the degrees of attitude of KVK beneficiaries and non-beneficiaries farm women.

AGRONOMIC BIOFORTIFICATION OF WHEAT VARIETIES WITH ZINC AND IRON THROUGH FERTILIZATION STRATEGY

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Field experiments were conducted during *Rabi* seasons of 2015-16 and 2016-17 at Students' Instructional Farm of Chandra Shekhar Azad University of Agriculture and Technology, Kanpur, Uttar Pradesh, India, situated at 125.9 meter altitude, 26.4148° North latitude, 80.2321° East longitude, to study “Agronomic biofortification of wheat varieties with zinc and iron through fertilization strategy”. The experiment consisted three varieties (PBW 550, DBW 17 and K 402), two FYM levels (FYM @10 t ha⁻¹ and without FYM) and three nutrient management treatments (NPK- 150:60:40 kg ha⁻¹ only, NPK+ ZnSO₄ @ 25 kg ha⁻¹ as basal + FeSO₄ 1% sprayed at tillering stage, NPK + ZnSO₄ @ 25 kg ha⁻¹ as basal + FeSO₄ 1% sprayed at flag leaf stage). The treatments were accommodated in Split-Split Plot Design with three replications. The soil of experimental field was sandy loam in texture having low organic carbon (0.36 %), medium in available Nitrogen (174 kg ha⁻¹) low in available Phosphorus (14.0 kg ha⁻¹), medium in available Potassium (154.0 kg ha⁻¹), low in available Zinc (0.68 mg ha⁻¹) and normal in available Iron (8.42 mg ha⁻¹) with normal P^H (7.92). Pooled results of two years experimentation indicated that highest value of grain yield (5017.6 kg ha⁻¹), harvest index (38.15 %), grain zinc concentration (41.70 ppm), grain Iron concentration (48.82 ppm) and net income (Rs.70978 ha⁻¹) was recorded under the variety K 402. Application of FYM @10 t ha⁻¹ + NPK (150: 60: 40 kg ha⁻¹) recorded maximum grain yield (4678.51 kg ha⁻¹), harvest index (36.97 %), grain zinc concentration (41.21 ppm), grain iron concentration (47.15 ppm), net

income (Rs.63918 ha⁻¹) compared to without FYM treatment. Application of NPK @ (150:60:40 kg ha⁻¹ + ZnSO₄ @25 kg ha⁻¹ as basal + FeSO₄ 1% sprayed at tillering stage recorded highest grain yield (4805.69 kg ha⁻¹), harvest index (37.13 %), grain zinc concentration (42.03 ppm), grain iron concentration (47.88 ppm) and net income (Rs.67774 ha⁻¹) compared to other nutrient management treatments. The interaction effect of varieties, FYM levels, and nutrient management treatments were found non-significant.

Key words: Wheat (*Triticum aestivum* L.), Biofortification, Zinc, Iron and FYM.

FALL IN AND RISES IN THE LEVEL OF AIR POLLUTION IN DELHIDURING PAST YEARS

INDU

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Delhi, the national capital of India, is the lagged as one of the most heavily polluted capital cities in the world. Delhi is the world's worst city in the terms of air pollution, with an unhealthy air quality index for majority of the years. The main causes of air pollution in Delhi are burning of crops, traffic pollution, the onset of winter, growth in population, lack of public infrastructure, contraction activity, industrial pollution and Diwali time. The present paper discusses the status of air pollution level in terms of air quality index measured by the amount of PM_{2.5} and PM₁₀ particles suspended in air during the past years. The air quality index in past years was recorded between the category 201 to 300 at most of the places in Delhi. This category belongs to very poor air. Report shows that the pollution level improved marginally between 2010 to 2014, but starting deteriorating again in 2015. According to WHO Global Urban Ambient Air Pollution Database 2016, Delhi was in sixth spot having recorded its highest level in six years. The city's PM_{2.5} annual average was 143 microgram per cubic meter, more than three times the national safe standards while PM₁₀ was 292 microgram per cubic meter more than 4.5 times than the national safe standards. November 8, 2017, is the red letter day in the history of Delhi. On Nov. 8 pollution surged so high and reported an air quality index of 999, way above the uppermost worst AQI category, Hazardous. The air quality index was recorded 1,010.

Keywords: Air pollution, Air pollution index, Delhi, etc.

DRUMSTICK LEAVES: A POTENTIAL SOURCE OF NUTRIENTS AND ANTIOXIDANTS

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Drumstick plant is indigenous to many Asian countries, and is abundant and cheap food source and contains high amount of polyphenolic content. According to National Research Council there are 13 species of drumstick plant out of which only two species are indigenous to India namely, *Moringa concanensis* and *Moringa oleifera*. The former is found rarely, but the latter is found in foot hills of Himalayan region and in north western, eastern and southern parts of the country. Several researches have revealed the wide potentiality both nutritionally as well as the antioxidant capacity of various parts of drumsticks. In the present investigation nutritional and antioxidant potential of the drumstick leaves in selected ready to eat foods was assessed. Drumstick leaves were freshly plucked from the plants grown in horticultural farm of Rajasthan College of Agriculture, MPUAT, Udaipur. After several trials with various ready to eat products, at different levels viz. 5, 10, 15 and 20 per cent were added and ready to eat foods were formulated and standardized. Sensory evaluation studies showed that the scores obtained by selected RTE food products prepared by adding dried drumstick leaves powder were liked by the panelists as well as nutritionally the value increased. The results of the present study conclude drumstick leaves, which is still in the category of underutilized, have great antioxidant and nutrient potential and can be easily used within organoleptically acceptable limits for the nutritionally enriching various ready to eat food products and help in combating several deficiency diseases.

EFFECT OF BY-PASS PROTEIN FEEDING ON MILK YIELD OF CROSSBREED COWS

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A field study was conducted in Ghaziabad district to observe the effect of Bypass-Protein Feeding on Milk yield crossbreed cows, milch animals were selected randomly from 5 villages of Ghaziabad (U.P.) (Muradnagar, Khorajpur, Rawali Milak, Noorpur, Badka). 20 cows were selected in their 2nd & 3rd stage of lactation and divided into two groups of 10 animals each. First group (T) was fed with 3 kilogram bypass-protein daily till 90 days of lactation. Other group (C) of 10 animals were fed normal feeding, which is farmers practice in that particular area. The farmers were not fed scientific method of feeding. They could not add proper quantity of bypass-protein in balance ration. To keep in mind a trial was conducted in Ghaziabad District since 2017-18. Milk yield of these animals was recorded by their owner and these values were averaged for fortnightly interval. Milk production parameters like average daily milk yield. Peak yield and total milk yield were compared between treatment and control groups. It was observed that average daily milk yield, peak yield and total milk yield were found significantly ($p < 0.05$) higher by 12.15,

13.57 & 11.92% in bypass protein fed groups, than control group. On the basis of this, it is recommended that continuous feeding of bypass protein bettered performance of milk yield in cross breed cows.

NANOPACKAGING – AN UNTAPPED RESOURCE FOR ENHANCEMENT OF FOOD SHELF LIFE

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The increasing demand for high food quality and safety, and concerns of environment sustainable development have been encouraging researchers in the food industry to exploit the robust and green biodegradable nano-composites, which provide new opportunities and challenges for the development of nano-materials in the food industry. Commodities are packaged and hygienically transported to protect and preserve them from any un-acceptable alteration in quality, before reaching the end-consumer. Presently, the modern consumers of competitive economies demands for food with natural quality, assured safety, minimal processing, extended shelf-life and ready-to-eat concept. Innovative packaging systems, not only ascertains transit preservation and effective distribution, but also facilitates communication at the consumer levels. The technological advances in the domain of food packaging in twenty-first century are mainly chaired by nanotechnology, the science of nano-materials. Nanotechnology manipulates and creates nanometer scale materials, of commercial and scientific relevance. Introduction of nanotechnology in food packaging sector has significantly addressed the food quality, safety and stability concerns. Besides, nanotechnology based packaging intimate's consumers about the real time quality of food product. Additionally, nanotechnology has been explored for controlled release of preservatives/antimicrobials, extending the product shelf life within the package. The promising reports for nanotechnology interventions in food packaging have established this as an independent priority research area. Nanoparticles based food packages offer improved barrier and mechanical properties, along with food preservation and have gained welcoming response from market and end users. In contrary, recent advances and up-gradation in this area have raised various ethical, environmental and safety concerns. Policies and regulation regarding nanoparticles incorporation in food packaging are being reviewed. Therefore, this presents the existing knowledge, recent advances, concerns and future applications of nanotechnology in food packaging sector.

HETEROSIS AND COMBINING ABILITY FOR CERTAIN METRIC TRAITS IN SPONGE GOURD (*LUFFA CYLINDRICAL* L. ROEM.)

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The study was conducted to understand the heterosis, combining ability, involving 9 parental lines viz., NDSG-1, NDSG-20, NDSG-22, NDSG-24, NDSG-26, NDSG-28, NDSG-30, NDSG-32 and PusaChikni of sponge gourd and their 36 F₁ hybrids N.D.U.A.&T. Faizabad during summer (*Zaid*) 2014 and 2015. Observations were recorded on parents and F₁'s for 14 characters viz. node number to first staminate flower anthesis, node number to first pistillate flower anthesis, days taken for anthesis of first staminate flower, days taken for anthesis of first pistillate flower, days to first marketable fruit harvest, vine length (m) at last harvest, number of primary branches per vine at last harvest, number of nodes per vine at last harvest, internodal length (cm), fruit length (cm) of marketable fruits, fruit diameter (cm), number of fruits per plant, average fruit weight (g), marketable fruit yield per plant (kg). Analysis of variance for set of 9 x 9 diallel set revealed that due to genotypes parents hybrids were found highly significant for all the characters in both the years. While variation due to parents/hybrids were found significant for node number to first staminate flower anthesis, node number to 1st pistillate flower anthesis, internodal length, vine length at last harvest, fruit length of marketable fruits, number of fruits per plant, average fruit weight and marketable fruit yield/plant in both the years and days taken for anthesis of first staminate flower and days taken for anthesis 1st pistillate flower in Y₂. Heterosis for marketable fruit yield/plant ranged from -17.92% (NDSG-24 x PusaChikni) to 61.10% (NDSG-22 x NDSG-30) over better parent and -37.92% (NDSG-24 x NDSG-26) to 35.81% (NDSG-1 x NDSG-20) over standard variety in case of Y₁ and it ranged from -25.39% (NDSG-26 x NDSG-28) to 62.02% (NDSG-20 x NDSG-32) over better parent and -40.98% (NDSG-20 x NDSG-26) to 42.09% (NDSG-1 x NDSG-20) over standard variety in Y₂. Out of 36 crosses five significant heterotic crosses for marketable fruit/plant, NDSG-20 x NDSG-32 (45.50 and 62.02%), NDSG-30 x NDSG-32 (38.66 and 58.75%), NDSG-1 x NDSG-20 (33.19 and 51.80), NDSG-1 x NDSG-32 (22.56 and 33.17%) and NDSG-30 x PusaChikni (20.99 and 27.25%) common in both the years over better parent. Significant heterotic over standard variety NDSG-1 x NDSG-20 (35.81 and 42.09%), NDSG-1 x NDSG-32 (24.98 and 24.65%), NDSG-30 x PusaChikni (20.99 and 27.25%), NDSG-1 x PusaChikni (15.78 and 17.15%) and NDSG-20 x NDSG-32 (15.30 and 15.98%) in both the years. Analysis of variance for combining ability due to GCS and SCA were found significant for all the characters during both the years except for fruit diameter in Y₂. NDSG-1 and PusaChikni were found top good general combiner for marketable fruit yield/plant, number of fruits/plant, primary branches per vine at last harvest, internodal length, days to first fruit harvest, days taken for anthesis of first staminate flower, node number to first pistillate flower anthesis and node number to first staminate flower anthesis. For earliness characters parents namely NDSG-22, NDSG-24, NDSG-1 and PusaChikni were found

good general combiners. Among 36 crosses the best five crosses were significant SCA effect for average fruit yield/plant, NDSG-1 x NDSG-20, NDSG-1 x NDSG-24, NDSG-22 x NDSG-30, NDSG-28 x NDSG-30 and NDSG-30 x NDSG-32 found common over both the year. Based on the above findings it may be suggested that crosses NDSG-1 x NDSG-20, NDSG-1 x NDSG-32, NDSG-1 x NDSG x PusaChikni, NDSG-20 x NDSG-32 and NDSG-26 x PusaChikni could be exploited as commercial hybrid and future.

Keywords: heterosis, combining ability, staminate flower, pistillate flower

STUDIES ON THE COST BENEFIT RATIO OF WINTER MAIZE UNDER PRAYAGRAJ CONDITION

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The data were analysed statistically and conclusion were drawn. As winter season is dominated with wheat crops yet farmers of the region were replacing with maize cultivation, land preparation, fertilization, breeding, irrigation and other input were significantly higher in comparison to wheat crop as maize crops is prone to drought and insect pest, which increase total cost of the cultivation. Yield per hectare in ideal condition was 80-100 quintal per hectare, which was much higher to wheat yield (50-60 quintal per hectare), mean output of maize was rupees 1.53 lakh per hectare, which was 40% higher than wheat crops. Net profit of maize cultivation was around rupees 80 plus minus 10 thousand per hectare. As duration of crop synchronised with the wheat crop, rental value and other contingency. Cost of the cultivation of both crops were same. Conclusively maize crop yield 1: 3.12, cost benefit ratio while in wheat crop it was 1: 2.31. Therefore the pattern of adopting maize crop in the region year over year, wheat crop was opaque.

DIVERSITY OF DOMINANT PLANT PARASITIC NEMATODES OF SUGARCANE IN MEERUT REGION

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Phytonematodes have been variously reported to be associated with decline in sugarcane production. In India, phytonematodes are reported to cause about 10-40 % yield loss in sugarcane. In India, Uttar Pradesh is the major sugarcane growing state, contributing about 48% of the area and 40% of the production. Temperature is an important environmental factor for organisms. Different organisms have their own optimal temperatures for normal activities and high and low temperature limits they can tolerate. Diurnal fluctuations in temperature vary in extent and depend upon soil type, texture, moisture, atmospheric conditions. A field survey of the sugarcane plantation in Meerut was conducted to identify the diverse phytonematodes species associated with the soils & roots of sugarcane and to determine their population densities on the sugarcane field. Nine species of dominant plant parasitic nematodes were found in association with the roots and rhizosphere of the sugarcane plants. They include *Hoplolaimus spp.*, *Rotylenchus reniformis*, *Helicotylenchus dihystra*, *Pratylenchus zea*, *Tylenchorhynchus nudus*, *Longidorus elongates*, *Xiphinema attenuatus*, *Scutellonema brachyurus* and *Tylenchus arcuatus*. *Hoplolaimus spp.* was the most ubiquitous, occurring at a 98% frequency rating in all the samples. The investigation observed a large diversity of important phytonematodes on the sugarcane field, thus there is a need the appropriate management tools and practices to control the population of plant parasitic nematodes by applying to the cropping patterns in the particular agriculture areas.

Key words: dominant phyto-nematodes, Diurnal fluctuations, disease complex, *Saccharum officinarum*.

DOUBLING FARMER'S INCOME THROUGH DIVERSIFIED FARMING WITH LOW VOLUME - HIGH VALUE CROPS

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Mizoram, the 23rd state of India has a total of nine Districts. It is located at 21°58' to 23°35' N latitude and 92°15' to 93°29' E longitude and surrounded by Tripura, Assam and Manipur in north frontier regions; Bangladesh in west; and Myanmar in east and south. In verse of global affects on changing climate, advances in agricultural practices and ever increasing population growth has imparted immense pressure on the jhum cycle of the state. This in turn has evolved as one of the causing factor for low soil fertility directly and indirectly in the region. Mizoram's agricultural land is composed of a magnificent dynamic slopy upland (Jhum & shifting cultivation) and low land valley (Settled agriculture). However, agriculture still remains under-developed and the primitive method of jhum (shifting cultivation) predominates. Both production and productivity are relatively low. Niti Aayog accorded that, doubling the real income of farmers till 2022-23 over the base year of 2015-16, requires annual growth of 10.41% in farmers' income. Hence therefore, calculative measures in different aspects of the region need to be harnessed in all possible sources of growth in farmers' income within as well as outside agriculture sector. \ keeping the above entities as a set goal, a judiciously designed need base agricultural technologies were imparted in a selected cluster of Sihphir village in Mizoram. Coupled

agricultural approach using HYVs of quality seeds ArkaRakshak in Tomato, Solan green Head in Broccoli, ArkaAishwarya in watermelon, Festival in Strawberry and local Anthurium was imparted with the concept of Per Drop More Crop. Further, INM practices with Soil-test based nutrient management (Distribution of soil-health cards); Post-harvest crop losses (zero energy cool chamber); and Promotion of ancillary like poultry, beekeeping and Mushroom production were introduced in the region. Mizoram being a region prone to heavy rainfall during on season, cultivation practices of low volume high value crops viz. indeterminate tomato, watermelon and capsicum under protected cultivation equip with low cost micro irrigation system as to ensure better quality produce by exploiting existing agro-climatic advantages and using protected structures. It also provides early nursery and early cropping as well as lucrative returns to the farmers. The demonstrated technology diversified farming with low volume high value crops gave an annual total income of 2.5 - 3 lakhs/ha in earlier years after implementation of the programme it has increased to about 3.5 – 3.8 lakhs/ha with average benefit cost ratio of 2.81 compared to benefit cost ratio of 2.24 under local checks. The results highlighted the fact that income of farmers can be double the income by the adoption of recommended technology.

DETERMINATION OF ‘ENERGY’ REQUIREMENT FOR COOKING IN RURAL HOUSEHOLD OF ORISSA, INDIA

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In rural areas, domestic cooking fuels emphasize the predominance of wood, animal residues, and bio-mass etc. These are also in short supply, because of quantum of energy input, those are locally available at zero-cost and manner of their use. This research study aims at determining actual fuel energy requirement to meet the cooking need of rural household in Orissa. The work was carried out in three steps; Data collection for determining the common food items of rural household, observation for determining energy requirement for cooking in field condition, and experiment for determining actual energy requirement in controlled laboratory condition. Households from both coastal and hilly region were selected for such purpose. The results revealed that available energy i.e. energy input per day was more in comparison to actual energy requirement for cooking common food items. The available energy expenditure was influenced significantly by family size and farm size, but useful energy expenditure was influenced by only family size. Size of landholdings, and types of location had a significant effect on determination of cooking energy efficiency. In the study coastal area household had a higher efficiency than hill households. Standardization of cooking for a standard meal in different Chula design and different pot design in controlled condition revealed that very less energy input was required for cooking in comparison to energy input measured in village condition. The efficiency was maximum 17.484% in improved Chula and 13.704% in traditional wooden Chula, against actual requirement cooking efficiency was found 3.25%, where loose bio-mass was used as fuel. (Maximum 5.305 MJ was required for cooking of a standard meal). Hence it indicate the wastage of energy during cooking in village condition against the actual requirement.

NUTRIENT MANAGEMENT IN FRUIT CROPS

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The need to enhance fruit production in the next decade and the role of nutrient management is of paramount importance. 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, excess supply or continuous use 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. 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.

Keywords: FYM, Biofertilizers, N:P:K, Vermicompost, Integrated Nutrient management.

NATURAL RESOURCES OF SOIL AND WATER CONSERVATION CURRENT ISSUES IN INDIA

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Soil and water are critical natural resources that must be kept in harmony with the environment for agro-ecosystems to be sustainable. Despite years of study and substantial investment in remediation and prevention, soil erosion continues to be a major environmental problem with regard to land use in India and elsewhere around the world. Furthermore, changing climate and/or

weather patterns are exacerbating the problem. Our objective was to review past and current soil conservation programmes in India to better understand how production-, environmental-, social-, economic- and policy-related issues have affected soil and water conservation and the incentives needed to address the most critical problems. We found that to achieve success in soil and water conservation policies, institutions and operations must be co-ordinated using a holistic approach. Watershed programmes have been shown to be one of the most effective strategies for bringing socio-economic change to different parts of India. Within both dryland and rainfed areas, watershed management has quietly revolutionized agriculture by aligning various sectors through technological soil and water conservation interventions and land-use diversification. Significant results associated with various watershed-scale soil and water conservation programmes and interventions that were effective for reducing land degradation and improving productivity in different parts of the country are discussed.

Keywords: Keywords: soil erosion control; conservation agriculture; cover cropping; environmental issues; economic issues; social issues

POST HARVEST TECHNOLOGY OF VEGETABLES AND FRUITS

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Harvested vegetables and fruits require adequate and advance post harvest processing technologies for minimizing the qualitative as well as quantitative losses after harvesting. Nearly fruits and vegetables 40 percent are wasted every year due to improper handling, storage, packing, and transportation. Wastage of vegetables and fruits in huge amount due to un - implementation of advance post harvest technological approaches also reduces the per capita availability of fruits and vegetables. Intensive emphasis is required to develop the advance post harvest technologies for improving the global food security by enriching the economy of agriculture produce of the world with minimum losses of consumable vegetables and fruits. The present article discusses the common yet important post harvest technologies to maintain the quality of vegetables and fruits.

Keyword: Transportation, Harvesting, Losses, Technologies etc.

NUTRITIONAL QUALITY ASSESSMENT AND VALUE ADDITION OF *MUNTINGIA CALABURA* L. (SINGAPORE CHERRY) FRUITS

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Muntingia calabura is also referred as Singapore cherry the sole species in the genus *Muntingia*, is a flowering plant belonging to the family Elaeocarpaceae. The fruits are abundant, red in color, round in shape, smooth, tender skin, juicy pulp with very sweet, musky, fig-like flavor, and filled with exceedingly tiny, yellowish seeds. Various parts of the tree have several documented medicinal uses i.e. it possess antiproliferative, antioxidant, antinociceptive, cardioprotective and antipyretic effects. The fruits has lot of health benefits and widely eaten by children. Keeping the above aspects in view, an experiment was conducted to assess the physicochemical, nutritional qualities and value addition of *Muntingia calabura* L. fruits at Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai, India. The results indicated that one hundred grams of fruits contains 77.83 % of moisture, 0.24 g of fat, 3.35g of crude fibre, 1.80 g of ash, 171.36 mg of vitamin C, and 1576.97 µg of total carotenoids. Also the fruits possess pH 5.8, acidity 0.241% and TSS 15.20%. Further, value added products such as fruit candy and jam were developed from the *Muntingia calabura* fruits and evaluated for the acceptability using nine point hedonic scale score card. The organoleptic characteristics such as color and appearance, flavor, texture/consistency and taste of the products were moderately acceptable and the overall acceptability scores of fruit candy and jam were 7.4 and 7.8 respectively. Since, the tree is very common in nursery, streets, residencies etc., and the fruits possess nutritionally good, there is a scope for preparation of these kinds of fruit based value added products and can minimize the fruits wasted unknowingly throughout the year. The fruits can be said as poor man's source of the vital nutrients since it is a good source of vitamin C and Carotene besides other nutrients. If processing and value addition of this fruits is possible it may help to improve the nutritional and economic status of weaker section.

GENOTYPE X ENVIRONMENT INTERACTION FOR GRAIN YIELD AND ITS COMPONENTS OF FINGER MILLET GENOTYPES UNDER RAINFED CONDITION OF JHARKHAND

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The present investigation was carried out to determine stability and adaptation range of 15 finger millet genotypes and identify superior types with excellent yield potential for use as cultivar or as germplasm source for future breeding endeavors. To find out requisite information, the experiment was laid out in Randomized Block Design with three replication during *Kharif* 2016, 2017 and 2018 at Zonal Research Station, Chianki, Palamau under rainfed condition. Data were collected on grain yield and its attributing characters. The linear component was significant as against the nonlinear component (Pooled deviation), which revealed that a large portion of G x E interaction was accounted for by the linear regression through pooled deviation was significant. None of the genotypes was stable for all the characters under studies. Based on estimated stability parameters (*i.e.* $b_i = \text{unity}$, $S^2_{di} = 0$) and over all mean performance of grain yield, genotypes BBM-10 and VR-708 were identified as superior, which were well adapted to all the environment, stable with above average yielding ability or highest grain yield (30.45, 26.74 q/ha, respectively) with non-significant b_i and S^2_{di} values. While genotypes A-404 and HR-374 were above average stable and two genotypes, namely, BBM-11 and JWM-1 were below average stable ones and as such they are suitable for cultivation in poor and rich environments, respectively. BBM-10 was also found stable across the environment for number of effective tillers per plant. The genotypes BBM-10, VR-708 and GPU-67 were also stable for 1000 seed weight, number of fingers per plant and days to 50% flowering. The entries BBM-10 and VR-708 are also showing stability and superiority for other component characters of grain yield, these genotypes may be utilized as variety or for developing high yielding stable finger millet genotypes.

Key words: *Elucine coracana*, genotype x environment, yield and its related characters

ESTIMATION OF HETEROTIC EFFECTS AND INBREEDING DEPRESSION IN LINSEED (*LINUM USITATISSIMUM* L.)

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Linseed is one of the important drought tolerant *rabi* oilseed crop. The productivity of this crop is low may be due to lacking of suitable high yielding drought tolerant cultivars. Heterosis is one of the options to increase productivity. Keeping in view the present experiment was conducted during *rabi* 2016-17 at Zonal Research Station (Birsa Agricultural University), Chianki, Palamau to estimate the heterosis over mid parents, better parents, economic varieties and inbreeding depression in different genotypes of linseed viz., Surbhi, R-552, PKDL-91, NL-260, Neelam and two checks (Shekhar and T-397) for different characters. A significant over better parent was observed in two crosses for days to 50% flowering, five crosses for plant height, two crosses for seed yield per plant, three cross for 1000-seeds weight and two crosses for oil%. The desirable significant economic heterosis over Check (Shekhar) was observed in three crosses namely NL-260 x Surbhi, NL-260 x R-552 and NL-260 x PKDL-91 for days to maturity, three crosses for technical height, and plant height, three crosses namely NL-260 x Surbhi, NL-260 x PKDL-91 and Neelam x Surbhi for number of capsules per plant, four crosses viz., NL-260 x Surbhi, NL-260 x R-552, NL-260 x PKDL-91 and Neelam x R-552 for number of seeds per capsule, All six crosses for seed yield per plant, five crosses namely NL-260 x R-552, NL-260 x PKDL-91, Neelam x Surbhi, Neelam x R-552 and Neelam x PKDL-91 for 1000-seed weight and oil%. Heterosis over check variety-2 (T-397) was observed significant and in desirable direction for one cross (NL-260 x Surbhi) for number of capsules per plant, three crosses (Neelam x Surbhi, Neelam x R-552 and Neelam x PKDL-91) for capsule diameter, all six crosses each for seed yield per plant and 1000- seed weight and five crosses for oil content. The cross combination Neelam x Surbhi exhibit desirable heterosis for maximum characters and minimum inbreeding depression, this cross may be advanced for desirable selection.

Keywords: Linseed, heterosis, inbreeding depression

ADVANTAGES OF CASHLESS TRANSACTION AMONG WORKING & NON-WORKING HOMEMAKERS

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Cashless is a word which literally means having no cash but in today's world, it refers to using digital form of payments instead of cash for payment of various expenses or transactions done by the individual. The present study was conducted in two districts i.e. Hisar and Bhiwani of Haryana state with objective to assess the advantages of cashless transaction among working & non-working homemakers of working and non-working homemakers. Two wards each were randomly selected from both district headquarter. From each selected wards 50 homemakers having their own bank account were selected purposively through snowball technique. 100 working & 100 non-working homemakers were selected thus, total 200 homemakers were selected. A pretested interview schedule was used to collect data. The results showed that in working respondents 83.0% were agree with fast advantages of cashless transaction at individual level, followed by 82.0% respondents agree with less stress at individual level. Whereas all non-working respondents were agreed with convenient advantages of cashless transaction, followed by 96.0% respondents agreed with fast advantages. In total sample, 90.0% respondents were agreed with convenient advantages of cashless transaction, followed by 89.55 respondents were agree with fast advantages. Among working respondents at National level, 60.0% respondents agreed with revenue collected advantages of cashless transaction, followed by 47.0% respondents agreed with reduces corruption. Whereas

among non-working respondents 63.0% who agreed with prevent money laundering advantages of cashless transaction, followed by 61.0% respondents who agreed with stimulates economic growth.

Key words: Cashless, working, non-working, homemakers.

ANTIOXIDANTS IN WHITE TEA

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White tea finds its origin from Fujiana province, China from the *Camellia senensis* plant. It differs from green and black tea due to processing method. The flavonoids found in tea, specifically catechins and tannins possess strong antioxidant properties. The antioxidant properties of white tea can be evaluated by measuring chain-breaking activity, oxygen scavenging capacity and redox potential. White tea involves only the buds and young leaves of the tea plant, which are then dried in either natural sunlight and are not fired or steamed. This kind of processing method increases the catechin levels in white tea but lower tannin levels as compared to other tea forms. However, because the total antioxidant content of white tea is richer as that of green and black tea, it is possible that the cardiovascular benefits of white tea are also higher than those of green and black tea. Also, white tea is effective in preventing cancer, heart stroke, lowers the occurrence of type II diabetes and pour benefits over other conditions including halitosis (bad breath) and skin rejuvenation.

Keywords:- Antioxidants, flavonoids, chain breaking activity, oxygen scavenging activity, redox potential and catechin levels

IMPORTANCE OF LEMON GRASS (*CYMBOPOGON FLEXUOSUS L*) IN DEGRADED LAND OF INDIA

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Lemongrass commonly known as “East Indian Lemongrass” is a perennial and multicut aromatic grass. Lemongrass is the source of Lemongrass oil, a good source of natural citral, which is used as a basic raw material for synthesis of β -ionone used for synthesis of a number of useful aromatic compounds and Vitamin- A. It is estimated that approximately 10 million hectares land of India is degraded due to salts in varying degrees of magnitude. The worst affected districts of U.P. are those located in lower valley of the Ganga-Yamuna and Ganga- Gomti Doaba with extension right up to Jaunpur and Azamgarh Districts. Big stretches of these problem soils are lying absolutely barren. Ballia district is a part of Azamgarh Division situated in eastern most corner of Uttar Pradesh, where farmers are streaming their nerves to fetch the stress situation. This region is homogenous for low productivity and high degree of poverty. About 17661 hectares of presently demarcated barren land and 1248 hectares of banger land (Suitable for the cultivation of salt tolerant crops) lying desolate in the district, which can be exploited properly after reclamation. With the point of view of profitable trend in comparison to traditional agriculture, introduction of some new plant type having sodicity tolerances and high benefit cost ratio (B/C) may attract the farmers to continue farming. It has been reported that salt tolerant aromatic crops e.g. lemon grass, palmarosa etc. are able to improve the fertility status of soil. Therefore, cultivation of high value aromatic plants may be a very good alternative for such problems for increasing the return to the growers as well as foreign exchange to country. In this way farmers of the district may also increase their income through the cultivation of aromatic plants. An integrated nutrient management and supply system will be an, important feature for the maintenance of soil fertility and proper utilization of uncultivated land for sustainable development of agriculture as well as industrial fate to improve the quality of lemongrass oil. Such type of high economic value aromatic crop will certainly improve soil health of waste land towards suitability for other crops.

Key Words: Lemon grass, degraded land

ECONOMIC COMPARISON OF NORMAL RICE AND BLACK SCENTED RICE (*CHAK-HAO*) IN MANIPUR

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The study investigates the comparison of normal rice and black scented rice in Manipur. Black scented rice, which has stronger aroma and kernel elongation than normal rice, has more demand in different countries of the world. India is one of the largest exporters of basmati rice in the world. The consumer demand has increased markedly to pay a premium price for fragrance. Scented rice cultivars constitute a small but special group of Indian rice cultivars and are considered best in terms of quality and aroma. These are rated best in quality and fetch much higher price than high quality non-aromatic rice in domestic and international. A survey was conducted and collected secondary data and primary data from 100 respondents. The profitability of normal rice and black scented rice was ascertained by means of various income measures. From the analysis it was observed that out of total rice area 237150 ha, black scented rice shared 0.06 per cent (150 ha). Total production of rice was observed 508500 MT of which black scented rice shared 0.07 per cent (360 MT). But it was found that black scented rice fetched comparatively higher price than normal rice as its price is three times higher (Rs 120-150 per kg) over normal rice (Rs 38-42 per kg) in the domestic as

well as international markets. With respect to the findings of the research study, it is concluded that policy issues should be aimed towards expansion of area and increasing the productivity of black scented rice for enhancing farmer's income.

Key words: Black rice, Chak-hao, Forbidden Rice, Manipur, Super food

DIFFERENTIATION OF SALINE AND HIGH-SODIC SOIL BY APPLYING DIFFERENT APPROACHES OF DIGITAL MAPPING

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An experiment conducted in Dinder area of Sudan to produce a digital soil map and to develop an interactive geodatabase with soil analysis (called soil salinity Map, and soil sodicity Map). Also, to develop a soil map that is able to provide a visual view of all potential areas within the district. The objective of research was to differentiate between saline soils and high-sodic (sodic) soil by applying different approaches to digital mapping and band mathematics techniques. Soil samples were collected to the depth 150 cm unless hard-cemented layer "duripans" were present. Summary statistics were calculated using geostatistical tools in ArcGIS 10.3. The maps of the soil profiles data (pH, ECe, and SAR) that were used to generate subsequent maps of the classes of salt-affected soils were validated using a leave-one-out cross-validation (LOOCV) procedure to assess the interpolation accuracy of the final maps. Soil profile descriptions data taken from 2000 soil samples revealed eighty six (86) soil profiles. Range of pH, ECe and SAR of top soil and sub-soil were found 6-8.4, 1.1-2.2 dsm⁻¹, 1.90-6.19 and 6.0-8.2, 1.1-2.4 dsm⁻¹, 1.24-6.5 respectively. Research revealed that out of a total area 273811 ha under moderate saline soils were 21062 ha which is 7.5% of total area and 2,52,749 ha are normal soil and no sodic soil detected in the region. Saline soils were generally found in lower elevated areas where easily salt accumulation takes place. The final developed helps to easily detect of soil resources in the region and further soil management can be taken based on that.

Keywords: Digital mapping, saline soil, high-sodic soil

PHYTOREMEDIATION OF HEAVY METAL POLLUTED SOIL OF COAL MINED AREA OF JAINTIA HILLS, MEGHALAYA

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Due to extensive coal mining, large areas of Jaintia Hills of Meghalaya had turned into degraded land, creating unfavourable condition for crop cultivation. Owing mostly to acidity-related fertility stress, average crop productivity in acid soil regions like Meghalaya is very low, coupled with increasing contents of heavy metals, productivity had dropped further. Phytoremediation is an aspect of bioremediation that uses plants for the treatment of polluted soils. Therefore, a pot culture experiment was conducted using heavy metal polluted from coal mined soil of Jaintia Hills in order to assess the phytoremediation effect of the two crops viz. sunflower and asparagus. From the pot culture experiment, it is observed that Sunflower was superior phytoremediating crop in comparison to Asparagus. The analysis of heavy metals in the soil after harvesting of phytoremediating crops indicated that the heavy metals content (mg kg⁻¹) reduced significantly in both the soils phytoremediated by Sunflower and Asparagus compared with non-phytoremediated soil. However, the soil phytoremediated by Sunflower recorded least heavy metals content indicating its superiority over Asparagus.

Key words: Heavy metal pollution, coal mined soil, Jaintia Hills, phytoremediation, Sunflower and Asparagus.

MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL RESPONSES OF GERMINATING CHILLI SEEDS UNDER MOISTURE STRESS CONDITIONS

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The study was carried out during 2017-18 at the Division of Basic Sciences and Humanities to improve the moisture stress tolerance during germination and seedling establishment through seed priming in chilli cv. Kashmir Long-1. Seed priming is simply the hydration of seeds by exposing them to aqueous solution and re-drying to original moisture level. To ascertain the role of seed priming for mitigating the adverse effects of moisture stress during seed germination, seeds of chilli cv. Kashmir Long-1 were primed in the above selected treatments wherein unprimed seeds were taken as control and tested for their germination potential under normal (no stress) and moisture stress conditions. For the germination test under normal and moisture stress conditions 50 primed seeds of each priming treatments were sown in nursery trays and supplied with distilled water and -0.5 MPa solution of PEG 6000, respectively. Data indicate that germination potential of chilli seeds was significantly declined under

moisture stress condition while as different priming treatments tend to improve the germinability of seeds particularly under moisture stress condition. Among different priming treatments melatonin priming resulted in highest germination as well as seedling emergence percent (90.66 % & 87.33 %), days to 50% of germination & days to 50% of emergence (G_{50} 10.0 & E_{50} 12.33), Timson's index (35.24), radical & plumule length (4.74 & 4.39 cm), seedling root & shoot dry weight (0.15 & 0.05 g/seedling), seedling vigour index I & II (810.59 & 17.50), leaf chlorophyll content and its stability (0.86 mg/g & 97.92 %) and proline content (33.77 $\mu\text{mol/g}$) followed by osmopriming against the minimum values in control with respect to germination as well as seedling emergence percent (83.33 % & 74.00 %), speed of germination & seedling emergence (G_{50} 11.67 & E_{50} 14.00), Timson's index (30.04) radical & plumule length (3.80 & 3.79 cm), seedling root & shoot dry weight (0.09 & 0.02 g/seedling), seedling vigour index I & II (632.71 & 10.80), leaf chlorophyll content and its stability (0.48 mg/g & 72.72 %) and proline content (17.14 $\mu\text{mol/g}$).

PHYSIOLOGICAL STUDIES ON MANGO

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low temperature is a major environmental stress for many crops worldwide. The relationship between low temperature stress and the response of some different mango cultivars was monitored on some physiological and biochemical events that occur following cold exposure of mango tree leaves. These changes were studied under in vitro conditions (Field, air ambient temperature) and in vivo condition (Laboratory, controlled temperatures). However, mango trees were tested to evaluate the ability of mango cultivars to acquire cold injury during exposure to low temperature to verify this objective, 12 popular commonly mango cultivars (13 years old) which grown in a private orchard in Fayoum governorate, Egypt were selected. The selected cultivars were: Alphonso, Balady, Spates, Bullock's heart, Helمند, Hindi Besennara, Mabrouka, Mestekawy, Nabeeh, Ewais, Spates, Taimour and Zebda. This study was carried out during the period of years 2012-2013. **The following trends were stated:** **1- Field condition:** the detected Physiological and biochemical changes were significantly differed among the tested cultivars and sampling times. in this respect, Leaf pigments (Chl.a, b, total, carotenoids and anthocyanin), F_v/F_m ratio, relative water content, membrane stability index and vitality of leaves were estimated in fresh leaves (except, anthocyanin in dry leaves). a similar was observed by electrolytes leakage (%), Na^+ , K^+ , in organic phosphorus (P_i), Ca^{+2} , total soluble sugars (TSS) and total free amino acids (TFAA) concentration were detected in leachate of fresh leaves. In dry leaves, Na^+ , K^+ , total phosphorus (P), Ca^{+2} , N, TSS and TFAA, protein and proline content recorded significant difference as affected by the cultivar and sampling times. However, according to the results of field study, the ordering of cultivars (as descending) in their tolerance to the condition of this study was: 1.Helمند, 2. Spates, 3. Balady, 4.Taimour, 5.Bullock's heart, 6.Mestekawy, 7.Ewais, 8.Zebda, 9.Alphonso, 10.Nabeeh, 11.Mabrouka and 12.Hindi Besennara. **2- Laboratory condition:** the same trend in the mentioned character under controlled temperature (storage mango leaves at 5°C and 10°C) was observed, the ordering of the tested cultivars was: **1-Storage at 5°C:** 1.Ewais, 2.Spates, 3.Mestekawy, 4.Mabrouka, 5.Zebda, 6.Nabeeh, 7.Alphonso, 8.Balady, 9.Bullock's heart, 10.Helمند, 11.Hindi Besennara and 12.Taimour. **2-Storage at 10°C:** 1.Balady, 2.Alphonso, 3.Taimour, 4.Ewais, 5.Bullock's heart, 6.Spates, 7.Helمند, 8.Hindi Besennara, 9.Mabrouka, 10.Mestekawy, 11.Nabeeh and 12.Zebda.

Key words: Mango (*Mangifera indica* L.), cultivars, cold tolerance, biochemical changes.

SYNTHESIS OF BIOSTABILIZED GOLD NANOPARTICLES USING FUNGUS BIPOLARIS TETRAMERA AND ITS ANTIMICROBIAL AND ANTICANCER PROPERTIES

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Chemical synthesis of nanoparticles produces toxic by-products, as a result of which eco-friendly methods of synthesis are gaining importance. The synthesis of nanoparticles using microbial mediated synthesis is economical, safe and ecofriendly. Biostabilized gold nanoparticles were synthesized using fungus *Bipolaris tetramera*. The gold nanoparticles were characterized using UV-Vis spectrophotometry and demonstrated a peak at 518 nm. The presence of microbial derived peptides was confirmed using the FTIR spectra. TEM analysis revealed formation of gold nanop triangles and nanorods. The gold nanoparticles demonstrated antibacterial and antifungal activity against *Staphylococcus aureus*, *Escherichia coli*, *Bacillus subtilis*, *Aspergillus niger*, *Trichoderma* and *Fusarium oxysporum*. The cytotoxic activity of gold nanoparticles was studied using J774 and THP1 α cancerous cell lines were observed using ROS activity. Thus, a simple and eco-friendly method for synthesis of biostabilized gold nanoparticles using fungus *Bipolaris tetramera* was developed and the nanoparticles had potent antibacterial, antifungal and anticancer properties.

Keywords: anticancer, *Bipolaris tetramera*, cytotoxic, gold nanoparticles, green synthesis

IMPACT OF CADMIUM UPTAKE AND BIOACCUMULATION ON MORPHOLOGICAL AND PHYSIOLOGICAL RESPONSE OF WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat (*Triticum aestivum* L.) is cultivated widely all over the world as it is one of the most important staple food crop. It is adversely affected due to the presence of heavy metals in the soil. Cadmium, a non-essential heavy metal and a potential toxic is retained in the soil well after the point source is removed. It is readily taken up and accumulated by the plants and inhibits plant growth even at lower concentrations. Cadmium uptake and accumulation causes toxicity which in turn affects various morphological and physiological aspects of wheat. The present study was carried out to assess the effect of cadmium uptake and accumulation on growth and physiology of wheat. The experiment was conducted in the earthen pots filled with soil and farmyard manure. The experiment was a factorial, completely randomized block design with control and four main treatments of Cd viz., 20, 40, 60 and 80 mg Kg⁻¹ soil. Growth, biochemical, physiological characteristics and cadmium accumulation in root and shoot were determined at 30 days after sowing (DAS). It was found that cadmium accumulation increased in plant with increased in soil cadmium concentrations and adversely affected the growth and physiology of wheat.

Key words: Cadmium, Growth, Wheat, physiology, bioaccumulation.

ELECTRONIC-NATIONAL AGRICULTURAL MARKET (E-NAM): INITIATIVE TOWARDS DOUBLING THE FARMERS' INCOME IN INDIA

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The Indian Government has introduced electronic trading under e-NAM in 585 Agricultural Produce Marketing Committees (APMCs) in 16 states and 2 Union Territories till 31st March, 2018 and linked them through uniform market platform so that farmers' can earn a higher income by selling their produce at the best prices available anywhere in the country. Approximately 1.64 crore farmers and 1.91 lakh traders and commission agents have been registered with e-NAM. Still about 11 per cent of the wholesale mandies (markets) in India has been covered under e-NAM. Intra-state and inter-state trading is one of the important features of e-NAM which remove barriers of movement of agriculture produce and to increase income through appropriate monetization of farmers' produce. Inter-state trade on e-NAM has been initiated in 8 markets of different states in India. Results of various studies clearly showed that both the positive as well as negative impact of e-NAM on prices received by farmers and market arrivals was observed in different parts of India. The most important challenge in front of Indian Government is to convert non e-NAM mandies into e-NAM mandies. e-NAM is still at nascent stage in India, therefore, it faces several challenges such as constitutional, assaying and storage infrastructure, unified trade licensing, single point levy, quality, capacity building of market participants, harmonisation of grades and standards, etc. The Indian government is in the right direction in attempting to bring all APMCs on national board, but doubling the farmers' income will be realized for the farmers-producers only when traders and buyers across states participate in online trading on e-NAM platforms. The creation of e-NAM with tagline 'One Nation One Market' for agricultural produce is a milestone initiative which certainly helps in strengthening the agricultural marketing sector and increasing farmers' income.

PUSH-PULL STRATEGY: NOVEL APPROACH OF PEST MANAGEMENT

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Agricultural production is limited by many factors like soil, water, genetic potential of crops and organisms that feed on or compete with food plants. Food crops are damaged by more than thousands of insect pest species. The new alarming facts have prompted efforts on the safer, reduced-risk and environmental compatible method of pest control with the objective to maximize crop productivity. The push-pull strategy, which is novel approach of pest management by combination of behavior-modifying stimuli to manipulate distribution and abundance of insect pests and natural enemies. Insect pests are repelled from the food crop and are simultaneously attracted to a trap crop where they are concentrated, facilitating their elimination. The push components include visual cues, synthetic repellents, non host volatiles, host volatiles, anti-aggregation pheromones, alarm pheromones, antifeedants, oviposition deterrents, oviposition deterring pheromones and pull component are visual stimulants, host volatiles, sex and aggregation pheromones, gustatory and oviposition stimulants are used to achieve the push pull effect. The push and pull components are generally nontoxic. The strategy is a useful tool for integrated pest management programs reducing pesticide input. Therefore, the strategies are usually integrated with methods for population reduction, preferably biological and cultural control.

Key Words: Attractant, behavioral manipulation, push-pull, repellent, semiochemicals, trap crops.

WORK OUT THE MARKETING COST, MARKETING MARGIN AND PRICE SPREAD UNDER SELECTED MARKETING CHANNELS FOR PIGEON PEA IN BUNDELKHAND ZONE

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Field pea is one of the important Rabi pulse crop belong to the family fabaceae and botanically knows as *Pisum Sativum*. Pea grown all over the world and area about 1190372 hectare producing 89, 24,951 mt according to Ministry of Agriculture Government of India 2015-16. In India field pea is grown over an area of 313.50 thousand hectares with a production of about 2560.00 thousand mt with a productivity of 8.2 quintal per hectare. Uttar Pradesh is the major field pea growing state .Uttar Pradesh alone produce about 60 per cent of total pea production in India. Besides, Uttar Pradesh, Madhya Pradesh and Bihar are the major field pea producing states. In Uttar Pradesh Pea is grown all over an area of 53.85 thousand hectare with production of about 534.06 thousand metric tons. and productivity 9.91 quintal per hectare, according to ministry of agriculture government of India 2015-16. The marketing channels for field pea are rather complex in the sense that they involve several stages of processing before it changed to the final consumable form. The channels involved certain amount of marketing cost and marketing margins. There are various marketing channels for calculating marketing margin, marketing producers share and Price spread.

Keyword:- Marketing Cost; Price Spread; Marketing Margin; Productivity; Pigeon Pea

ENVIRONMENT FRIENDLY FERTILIZERS FOR SUSTAINABLE AGRICULTURE

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There is a direct correlation between nutrient supply and crop yield. Fertilizers have played an important role since the start of commercial agriculture to supplement the plant requirement of nutrient element. These may be natural or artificial substance containing the chemical elements that improve growth and productiveness of plants and enhance the soil fertility. A significant amount of fertilizer applied is lost causing environmental pollution, wasting money and energy, increasing input cost which is challenge for sustainability of modern agriculture. To curb the environmental pollution caused by nutrient loss and reduce the wastage of money and energy environment friendly fertilizers (EFFs) are developed which improve the yield without compromising with the environment. EFFs are mostly coated fertilizers with natural degradable material as coating (e.g.: chitosan, sodium alginate, starch and its derivatives, cellulose, lignin, biodegradable SAP, biochar, polydopamine etc.) which reduce the rate of release of fertilizers in soil and improve NUE. Nanocomposites are prepared by extrusion from mixture of suitable polymeric components to form the coating of the fertilizer. These prevent loss of nitrogen, increase soil organic matter, the EFFs coating of SAP aids in buffering pH of soil and improve water retention and water holding capacity of the soil. Also, new compositions of biodegradable coating material can be taken in consideration for designing new type of EFFs to meet crop nutrient demand under various environmental conditions such as, temperature, soil type, soil pH, soil moisture etc. in near future.

PROBLEMS AND PROSPECTS OF WOMEN AGRI-PRENUERS IN SAARC COUNTRIES

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Heart of India beats in rural areas and situation is not different in SAARC countries till date all SAARC countries are toiling hard to become developed nation but this development is not possible without inclusive growth. In order to take strides towards becoming developed nation all SAARC countries have to work for the betterment of not only urbanized but ruralized also. Special case has to be given to women, minorities and weaker section of the societies. Similarly from mere agricultural activities we have to move toward agripreneurship. A woman plays a significant role in agriculture development she manages work both in agriculture field and also in maintaining household activities Women are using their creativity, ability and hard work to prove their capabilities. There is a substantial contribution of women agripreneurs in the growth of developed rural areas but a women agripreneurs are facing more challenges and problems in starting and running their own business due to sometimes family problems and responsibilities, poor degree of financial freedom for women, various norms & customs, lack of capital, lack of entrepreneurial skills, absence of self –confidence, problems of work with male workers these all are the major problems faced by rural women. This paper as an attempt to highlight the problems faced by women agripreneurs and prospects/potential in terms of opportunities they have with a view to improve their contribution to the economies of the respective countries and for true inclusive growth. This paper is conceptual paper and relies on the reports, researches and views of many others on the issue.

Keywords:- Agripreneurship, Toiling, Stride, Inclusive growth, Agripreneurs, Challenges

APPLICATION OF REMOTE SENSING, GIS AND ANALYTICAL HIERARCHY PROCESS (AHP) FOR PRIORITIZATION AND MANAGEMENT OF WATERSHED BASED ON MORPHOMETRIC PARAMETERS AND LAND USE/COVER CHANGE ANALYSIS

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A watershed primarily deteriorates due to improper utilization of natural resources and lack of conservation activities. An increase in the developmental activities as a result of an ever increasing population in the Kharun watershed in Chhattisgarh plains has over-pressurized the land resource causing changes in the land use/cover (LULC) in the recent times. Carrying out conservation at the watershed scale is considered to be the easiest and most acceptable approach. It is a proven fact that Geographical Information System and Remote Sensing are efficient tools for prioritizing the watersheds through morphometry and LULC. The present investigation is an effort to assess and understand the morphometric, Land use/Cover change and Terrain characteristics as well as to prioritize the sub-watersheds of the Kharun watershed. The database has been prepared in ArcGIS 10.0 for morphometric parameters analysis and ArcSWAT-2009 was used for delineating the boundaries of the watershed and sub-watersheds. SRTM 30 m data was used for preparing the DEM, slope and drainage networks. The Kharun watershed covers about 4143 km² of area and Vth order streams were precisely observed as per the analysis done in a GIS environment. LULC change analysis has been done on LANDSAT 8 image in ERDAS-2016 image processing software. After evaluating the compound factor, their corresponding prioritization ranks were assigned. A detailed prioritization map for the susceptible sub-watersheds based on morphometry and LULC was prepared. The suitable locations for soil erosion control structures in highly prioritized sub-watersheds were also identified for an appropriate land and water management plan. These studies are very useful for promoting soil conservation and help in preventing the soil from getting eroded from the highly prioritized sub-watershed.

Keywords: GIS; Watershed; AHP; Prioritization; Land use cover

IMPACT OF KISAN MOBILE ADVISORY SERVICES IN DINDORI DISTRICT FOR DISSEMINATION OF AGRICULTURAL TECHNOLOGY

GEETA SINGH, RENU PATHAK, HARISH DIXIT

KVK Dindori JNKVV, M.P.

ICT refers to technologies that provide access to information through telecommunications, or telecom, is the transmission of signals over long distances. It is similar to Information Technology (IT), but focuses primarily on communication technologies. This includes the Internet, wireless networks, cell phones, and other communication mediums. In the past few decades, information and communication technologies have provided society with a vast array of new communication capabilities. Dindori is still ranked in the backward districts of Madhya Pradesh with tribal population having poor literacy. Dissemination of Need based Agricultural Information to mass at appropriate time and in short duration so that information should be beneficial to them. Kisan Mobile Advisory Services which was started in the year 2008 with 74 members has presently 12000 members consisting of farmers, Agriculture based entrepreneurs, Field workers of Department of Agriculture, Horticulture Fisheries, NGOs and other organizations working in the field and Government administrative officers is now going to reach to approximate 3.7 lakh members of farming community. The major problem of our district Dindori is low efficiency of Existing Rural Information Delivery System, Remote location population and shortfall of Field Staff in Department of Agriculture. As a result overburden exists all time and performance was poor. In order to overcome the above mentioned problem Information Communication Technology played a vital role in spreading the desired information to appropriate person, at proper time. The methodology to spread our technology during the starting year in 7 blocks i.e. Dindori, Samnapur, Bajag, Karanjia, Mehadwani, Shahpura and Amarpur was by selecting 7 Agricultural Officer and 15 Farmers from Each Block. In spite of these members 25 members were from Agricultural Input Dealers and NGO's. After successfully completion of each year Assessment of KMAS were done by questionnaire method the result obtained were categorized in four different aspects i.e. understanding of the message- 78.23%, Need and time based message- 94.11%, Applicability of the Message- 81.17 % and Impact of the Technology – 77.05%. Similar methodology was adopted for each year starting from 2008-09 to 2017-18 and on the basis of four mentioned parameters results were evaluated. The district Collector Dindori who is directly reviewing the Agricultural activities in the District and also a member of KMAS. The display of KMAS in all Villages under NRLM, NIWCYD, TEJASWINI, BIAF and PRADAN on notice board of 4'x 5' further KVK had requested the field officials to maintain a directory of KMAS which will be useful for him any time, anywhere. The motto of KMAS is not only to disseminate agricultural technology but also various convergence activities of the District, Market Information, weather, Various Schemes for farmers welfare and upliftment. The activity will be further extended to all 870 habituated villages. Seeing the Impact and popularity of the technology members are rapidly increasing day by day. Messages which were being delivered bilingual (Hindi and English) depending upon the compatibility messages are received to the farmers. At present messages are being delivered in Unicode.

Keywords:- KMAS, Impact, Technology, Dissemination, ICT, KVK

RESPONSE OF MAIZE (*ZEAMAYS* L.) TO NITROGEN FERTILIZATION AND FOLIAR SPRAY WITH UREA AND ZINC**Gheith*, E. M. S. and Ola Z. El-Badry****Department of Agronomy Faculty of Agriculture, Cairo University, Egypt**

This study was

conducted over the two growing seasons 2016 and 2017 at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt to study the effect of soil application of nitrogen and foliar spray of urea and zinc sulphate on grain yield and its components of maize (*Zeamays* L.). The experimental design was randomized complete blocks having split plot arrangement with four replications. The main plots assigned for soil application of nitrogen levels and the sub plots consisted of urea and zinc spray. Both soil application of nitrogen fertilizer and foliar spray of urea and zinc significantly increased all studied characters (plant height, ear length and diameter, number of rows/ear, number of grains/ear, grain weight/ear, shilling percentage, 100-grain weight, grain yield and harvest index), except ear diameter and number of grains/ear under foliar application, in both seasons. The highest values for the previous traits were either at 120 kg N/fed or spraying urea in both seasons. The interaction between the two studied factors had significant effect on ear diameter in the first season, grain weight/ear and grain yield in both seasons. The highest grain yield (3.8 and 3.9 t/fed) was observed at 120 kg N/fed combined with urea, while the lowest yield (2.9 and 2.5 t/fed) was recorded at 80 kg N/fed without spraying either urea or zinc in both seasons, respectively. It could be concluded that application of 120 kg N/fed and spraying urea could be produced the highest grain yield under the experimental

Key words: Maize, N levels as soil application, urea and Zn spray.**EFFECT OF WEED CONTROL ON WEEDS, GRAIN YIELD AND ITS COMPONENTS OF MAIZE (*ZEAMAYS* L)****OLA Z. EL-BADRY* AND GHEITH, E.M.S.****Agronomy Department, Faculty of Agriculture, Cairo University, Egypt**

The present study entitled “effect of weed control on weeds, grain yield and its components of maize (*Zeamays* L.) cv. Single cross-10 was carried out at the Agricultural and Experiments Research Station at Giza, Faculty of Agriculture, Cairo University, Egypt. The experiment was conducted in the summer 2017 and was repeated in 2018 on the same piece of land to conform previous findings. The experiment design was Randomized Complete Block design (RCBD) having three replications. Six treatments include atrazin (1.0 kg/ha), glyphosate (0.8 kg/ha), atrazin + glyphosate, one hand hoeing after three weeks, hand hoeing twice after three and five weeks from sowing and weedy chick as control were used. Results indicated that glyphosate was found superior to atrazin for all studied characters. Moreover, lower weed dry matter accumulation and higher weed control % as well as higher values of ear characters (ear length, ear diameter, grain weight/ear and shilling %) and grain yield per unit area were recorded in tank mix application of atrazin + glyphosate followed by hand hoeing twice.

Key words: Maize, yield, yield component and weed control.**BROCCOLI – A POTENTIAL RESERVOIR FOR HEALTH MANAGEMENT****GHOSH, K.*¹****1. Ph.D Research Scholar, Department of Vegetable and Spice Crops, Uttar Banga Krishi Viswavidyalaya, Pundibari, Coochbehar, West Bengal, Pin- 736165**

Broccoli is considered to be one of the most nutritious and sustaining vegetable among the Cole crops. It has appreciable amount of Vitamin C (137 mg/100g fresh), Vitamin A (approx. 3500 IU/ 100g fresh), Protein (3.3 g/100g fresh), Vitamin K1, Folate (B9), Potassium, Manganese, Iron, Thiamine, Niacin and Riboflavin. Broccoli possesses various anti-oxidants and plant compounds which contributes to its health benefits. One of the most abundant and extensively studied plant compound is sulforaphane- an anti-cancer compound which helps in DNA repair and protection. Sulforaphane enables the formation of the network of detoxification enzymes which helps in the protection of the aerobic cells in the body and suppress inflammatory response. The amount of glucosinolates in broccoli ranges from 72-212 mg/100g. Broccoli contains carotenoids like lutein, zeaxanthin and beta-carotene which possess the chemo-preventive properties which may all contribute to a better eye health. Anti-oxidants mainly kaempferol and quercetin protects against cancer, heart disease, inflammation and allergy. Broccoli is loaded with heavy quantities of soluble fibres that draws cholesterol out from the body, reduces obesity and contains flavonoids which provides immunity. Broccoli is rich in three major compounds namely, glucoraphanin, gluconasturtiin and glucobrassicin which neutralizes and releases unwanted chemicals from the body. The presence of Vitamin K helps in fighting osteoporosis. Broccoli improves the functioning of heart, liver and digestive system and prevents colon cancer. The Vitamin K in broccoli helps to enhance the cognitive abilities, choline helps to improve memory, folic acid treats Alzheimer's disease and depression. Broccoli helps to slow down the ageing process by tightening the skin and also it imparts lustre to hair. Therefore, it can be concluded that broccoli, is a wonder crop as it aids in treating cancer, removes the toxic chemicals from the body, strengthens immune system, helps to

maintain a healthy heart, protects eye against macular degeneration and cataracts and so it can be a boon to rural economy and all set to become a winter money spinner.

Keywords: broccoli, health, anti-oxidant, anti-cancer, cholesterol, detoxification, anti-ageing

EFFICACY ON ANTIMICROBIAL ACTIVITIES OF THE INDIGENOUS HERBS AGAINST CANDIDA ALBICAN, AN OPPORTUNISTIC HUMAN PATHOGEN ASSOCIATED WITH COTTON FABRIC

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The intrinsic properties of the textile fibres provide space for the growth of microorganisms. Alongside, the structure of the fibres and the chemical processes may induce the growth of microbes. Humid and warm environment may also increase the problem. Infestation by microbes cause cross infection by pathogens and development odour where the fabric is worn next to skin. In addition, the staining and loss of the performance properties of textile substrates are the results of microbial attack. Basically, with a view to protect the wearer and the textile substrate itself, antimicrobial finish is applied to textile materials. The use of plant extracts and phytochemical is a cost effective and readily available method for common people to cope up with microbial contaminants. Assam, with its rich floral biodiversity has many plant species with antimicrobial activity. Therefore, we initiated this work to study different microorganisms that are associated with cotton fabrics and their remediation with herbal extracts from 30 selected plants. It was found that, most of the plant extracts studied had antibacterial and antifungal activities. The methanolic extract of leaf of the plant *Phyllanthus fraternus*, *Adhatoda vasica*, *Curcuma longa* and *Syzygium cumini* showed significant antifungal activity against the pathogenic fungi *Candida albican*. It was also found that the antimicrobial properties of the three plant extracts can remain till 11 washes and laundering procedures.

Keywords: Microorganism, Textile, Antimicrobial activity, Herbal extract, *Candida albican*

EFFECT OF HERBICIDES ON FEEDING ACTIVITY OF POLYPHAGOUS INSECTS

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The tobacco caterpillar *Spodoptera litura* () and Bihar hairy caterpillar *Spilarctia obliqua* () are two major polyphagous insect-pests damaging a variety of agricultural and horticultural crops in India. Dozens of weedicides are used to control weeds growing with these cultivated crops as pre and post emergence weedicides. The weedicides which are more commonly used in this region are Atrazine, 2,4-D, Imazethapyr, Metribuzin, Paraquat dichloride, Quizalofop ethyl, Ametryne and Clodinafop. The present investigation has been undertaken to study the effect of some of these weedicides on the feeding behavior of these polyphagous insects with the thinking that do they have any role in protecting the crops from insect feeding when sprayed on the crop as post emergence weedicides. Five weedicides at their recommended dose viz., Atrazine (0.2%), Paraquat dichloride (0.1%), Metribuzin (0.075%), 2,4-D (0.15%) and Imazethapyr (0.02%) were sprayed directly onto the body of 2nd instar larvae of *S. litura* and *S. obliqua* along with an untreated control and the feeding was recorded as mean leaf area consumed (cm²) of castor leaves. The larvae exposed to the recommended conc. of the weedicides showed a reduction in feeding over control. When 5d old larvae of *S. obliqua* (mean larval wt.=0.026g) were sprayed with the 0.1, 0.5, 1.0, 1.5 and 2.0% concentration of Imazethapyr, the MLAC values were 0.69, 0.53, 0.52, 0.28 and 0.07 cm², respectively as against 0.79 cm² in control. The feeding was significantly reduced at the concentration above 0.5% at p= 0.05%. Larvae of *S. litura* (10d old, Mean larval wt.=0.0784g) exposed to 0.5 and 1.0% concentration of Atrazine reflected MLAC of 13.63 and 12.91 cm² as against 19.05 cm² in control at 24HAE which increased to 79.24 and 77.60 cm² as against 87.28 cm² in control at 48HAE. The same experiment was conducted with *S. obliqua* and a significant reduction was observed in these concentrations as compare to control. The feeding in *S. obliqua* was far less than what was observed in *S. litura*. At the recommended conc. of Paraquat dichloride and Metribuzin the MLAC values were 1.60 and 6.10 cm², respectively as against 7.66 cm² in control. The larvae of *S. litura* (3d old) when fed on the leaves treated with recommended conc. (0.1%) of Paraquat showed a significant reduction in weight gain at 48, 96, & 120HAF and pupation (30.3%) was reduced as compare to control (67.68%).

TRADITIONAL KNOWLEDGE AND NATURAL RESOURCE MANAGEMENT IN THE FACE OF CLIMATE CHANGE**GOVIND¹, MOHIT HUSAIN² AND PUROHIT BHAVESHKUMAR KARSANBHAI³**^{1,3}Research Scholar, College of Forestry, NAU-Navsari, Gujarat-396 450²Senior Research Fellow, Dept. of Silviculture & Agroforestry, College of Forestry, NAU-Navsari, Gujarat-396 450

Climate change is one of the major driver of global biodiversity loss and its severe implications on food production, natural ecosystems, water supply and overall mankind. Natural resource based traditional societies are highly susceptible to climate change. The income and food security of the people depending on various sectors i.e. agriculture, animal husbandry and forestry practices such as fuel wood, fodder, medicinal plants, gum and resin collection which are interlinked with each other, has the great potential to reduce the food and nutritional security as well as income opportunities. People's perception and traditional knowledge of understanding of climate can be an important ability; however it is not taken very well into consideration for the policy planning and execution of mitigation and adaptation strategies by the government sectors. The knowledge of traditional communities for sustainable village landscape management and optimum use of natural resource is a key to cope up with the adverse effect of climate change. Therefore, the present attempt have been made to analyze the traditional knowledge of local people and their perceptions and adaptation approaches regarding climate change at local level. This review could be helpful to policy planners to develop suitable adaptation strategies to cope up with the impacts of climate change.

Keywords: Climate change, biodiversity, traditional knowledge, policy, natural resources.

GENETIC VARIABILITY AND ASSOCIATION STUDIES IN BC₁F₃ AND F₄ GENERATIONS OF PIGEONPEA**GURJEET SINGH^{1*}, INDERJIT SINGH, PANKAJ SHARMA, MAMTA GUPTA AND SARVJEET SINGH****Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana, Punjab-141004, India**

The present studied for yield and its component traits in BC₁F₃ and F₃ derived F₄ generation of an interspecific cross between *C. scarabaeoides* and *C. cajan*. In both generations, high values of phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were obtained for pods per plant, seed yield per plant and fruiting branches per plant. High estimates of heritability as well as genetic advance were observed for fruiting branches per plant, pods per plant and seed yield per plant. High heritability coupled with high genetic advance reveals the presence of lesser environmental influence and prevalence of additive gene action in their expression. Seed yield per plant had highly significant and positive association with pods per plant, fruiting branches, 100-seed weight and seeds per pod. Path coefficient analysis revealed high and possible direct effect of pods per plant, fruiting branches, 100-seed weight, seeds per pod and days to maturity on seed yield per plant and these were identified as main yield component traits.

Key Words: *Cajanus cajan*, Genetic variability, Heritability, Genetic advance, Correlation, Path analysis

COMPARATIVE STUDY OF MARKETING EFFICIENCY AND MARKETED SURPLUS OF CAULIFLOWER THROUGH DIFFERENT MARKETING CHANNELS IN PUNJAB, INDIA**GURLAL SINGH^{1*} AND DR. V.K. SHARMA²**¹Ph.D. Scholar, Department of Economics & Sociology, Punjab Agricultural University²Senior Economist, Punjab Agricultural University, Ludhiana-141004

The present study was undertaken in Hoshiarpur and Amritsar districts of Punjab, India. The study based on primary data, which was collected during the period 2015-16 through questionnaire. Total sample of 120 different sized cauliflower growers from eight villages were collected. In order to evaluate the marketing efficiency of cauliflower vegetable, 10 wholesalers and 15 retailers were selected randomly from each district market. The study identified three marketing Channels viz; I: Producer-wholesaler-retailer-consumer, II: Producer-retailer-consumer and III: Producer-consumer. The producer's share in consumer's rupee was highest in marketing Channel-III (Apni Mandi) because of direct sale to consumers by producers. Major share of marketed surplus was sold through channel I (71.16%) it was followed by channel II (24.61%) and channel III (4.23%). A comparative analysis of marketing efficiency shows that the marketing efficiency was much higher in channel III (29.01) than that of channel II (1.57) and channel I (1.11) in Hoshiarpur. Contrary to Hoshiarpur market the Amritsar market is less efficient with 27.13 marketing efficiency in channel III, it was followed by channel II (1.43) and channel I (0.96). The channel-III was observed comparatively profitable than other channels (channel-I and channel-II). However, the quantity handled through this channel was very low. In marketing of cauliflower serious problem faced by the growers was wide fluctuation in prices (96%), absence of minimum support prices (92%) high transportation cost (77%) while 68 per cent farmers opined that they do not get remunerative prices. Other problem reported were high cost of packing material (63%) and late payments (46 %).

Keywords: Cauliflower, Marketed surplus, Marketing efficiency, Marketing Channels and Punjab

PRODUCTION, EXPORT AND POST-HARVEST MANAGEMENT OF VEGETABLES IN INDIA**GURLEEN KAUR^{1*}, PARMINDER KAUR² AND ANIKETA HORO¹**¹**Ph.D. Scholar, Punjab Agricultural University, Ludhiana-141004**²**Senior Agricultural Economist, Punjab Agricultural University, Ludhiana-141004**

The present study thoroughly reviews the production, export and post -harvest management of vegetables in India based on the secondary data ranging from the period 1991-92 to 2017-18. The results revealed that the growth in area, production and productivity of total vegetables during the year 1991-2018 was 3.04 per cent, 4.60 per cent and 1.45 per cent, respectively. India is the second largest producer of vegetables in the world with its share in world production of about 10.8 per cent. The per cent share of India in the total world production of vegetables was highest in case of Okra (66.3%) followed by brinjal (27%), onion (21.5%), potato (12%), cabbages and other brassicas (12.5%) and tomato (11.1%). Uttar Pradesh, West Bengal and Madhya Pradesh are the leading vegetable producing states of India. Nepal, Bangladesh, Sri Lanka, United Arab Emirates, Malaysia and U.K. are the major export destinations for Indian vegetables. Nepal majorly imports cauliflower (80%), potato (77%) and peas (75%) from India. Onion continued to be the dominant exporting crop among Indian vegetables for the past few years. India is facing rejections and bans due to the presence of higher than maximum residue level (MRL) of chemicals, pest and bacterial infestation in the exported vegetables such as Okra and Brinjal. Tomato was observed to incur the highest degree of post-harvest loss i.e. 12.44 per cent during farm operations (sorting/grading and transportation) as well as in storage. Major focus should be emphasized on post-harvest management practices including better handling of produce and development of processing and cold-chain infrastructure.

Keywords: vegetables, post- harvest management, processing, cold-chain, India

RESPONSE OF NITROGEN SCHEDULING AND WEED MANAGEMENT ON WEED AND GROWTH ATTRIBUTES OF DIRECT SEEDED RICE (*ORYZA SATIVA* L.) IN CENTRAL PUNJAB**GURPREET SINGH, SANTOSH KUMAR, PARMINDER KAUR, RUPINDER SINGH, MANDEEP KAUR, CHANDANPREET KAUR****Mata Gujri College, Sri Fatehgarh Sahib, Punjab – 140406, India**

The experiment was conducted at Experimental Farm, Department of Agriculture, Mata Gujri College, Sri Fatehgarh Sahib, Punjab during kharif 2018 to study the effect of nitrogen scheduling and weed management on direct seeded rice (*Oryza sativa* L.) under irrigated conditions in central plain region of Punjab. Experiment laid out in split plot design comprised of eighteen treatments with three replications. The results indicated that the minimum weed density, total weed dry weight and highest weed control efficiency was recorded under nitrogen schedule of $\frac{1}{4}$ (at 2 weeks after sowing) + $\frac{1}{4}$ (at 4 weeks after sowing) + $\frac{1}{4}$ (at 6 weeks after sowing) + $\frac{1}{4}$ (at 8 weeks after sowing), which was statistically at par with $\frac{1}{3}$ basal + $\frac{1}{3}$ at 2 (weeks after sowing) + $\frac{1}{3}$ at 6 (weeks after sowing) and significant than other nitrogen schedules. Among nitrogen scheduling the maximum plant height and plant dry matter accumulation was recorded under nitrogen schedule at $\frac{1}{4}$ (at 2 weeks after sowing) + $\frac{1}{4}$ (at 4 weeks after sowing) + $\frac{1}{4}$ (at 6 weeks after sowing) + $\frac{1}{4}$ (at 8 weeks after sowing), which was statistically at par with $\frac{1}{3}$ (basal) + $\frac{1}{3}$ (2 weeks after sowing) and which was significantly superior over other treatments. In case of weed management, significantly lower weed density, dry weight and higher weed control efficiency were recorded under application of bispyribac-sodium @ 25 g ha⁻¹ fb carfentrazone @ 20 g ha⁻¹ and brown manuring + 2, 4-D @ 1 kg ha⁻¹, which were significantly superior over other treatments. In growth attributes the maximum plant height and plant dry matter accumulation were recorded under bispyribac-sodium @ 25 g ha⁻¹ fb carfentrazone @ 20 g ha⁻¹ which was statistically at par with brown manuring + 2, 4-D @ 1 kg ha⁻¹.

Key words: Direct seeded rice (DSR), Nitrogen schedule, Weed management, Interaction effect, Weed and Growth attributes.

DOUBLING FARMING INCOME THROUGH LINSEED WITH POPLAR BASED AGROFORESTRY SYSTEM**GYAN SHRI KAUSHAL*, RAJIV UMRAO AND YOGESH KUMAR AGARWAL****College of Forestry, SHUATS, Prayagraj (U.P)**

Farming in India is characterized by small, marginal, and fragmented land holdings about 86 per cent and is highly depended on monsoon showers. Agriculture and forest are always vulnerable to unfavorable climatic condition. Natural calamities, such as floods, drought, water logging etc. occur almost every year, combined with the effects of deforestation, forest degradation and erosion in Bihar. Agroforestry is an integrated self-sustained land management system, which involves deliberate introduction of materials like timber, fuel wood, food and medicine with agricultural crops on the same unit of land, meeting the ecological and socioeconomic needs of farmers. This system also provides to varied needs of the farmer enhance employment opportunities by spreading labor needs which otherwise are concentrated in the farming system. Fastgrowing power plant and trees such as poplar are characterized by short term growth and mass increase much new than the average growth of other plant during the growing age. It is the second most vital Rabi oilseed yield and stands by rapeseed-mustard in zone of development and seed generation in India. The class *Linum* is made out of around 230 species yet developed linseed/flax is the main types of monetary significance in the variety. Round the globe linseed crop occupies an area of 21.26 lakh/ha yielding out 18.67 lakh tones having an average

productivity of 877 kg/ha. Our national production of 1.57 lakh tones is realized from an area of 4.68 lakh/ha 2007-08 to 3.03 lakh/ha during 2013-14 with low productivity of 413 kg/ha to 462 kg/ha during the same period in world arena. Linseed is mainly cultivated in the states like Madhya Pradesh, Chhattisgarh, Uttar Pradesh, Maharashtra, Rajasthan, and Bihar. Chhattisgarh is one of the important linseed growing states of India, which accounts for nearly cultivated over 0.26 lakh hectare area with a production of 0.11 lakh tones and productivity of 423 kg/ha.

Keyword: - Doubling farming income; linseed; poplar; agroforestry; agriculture

BIODIVERSITY CONSERVATION AND CLIMATE CHANGE

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In the last 100 years average global temperature has increased by 0.74°C, rainfall patterns have changed and the frequency of extreme events increased. Change has not been uniform on either a spatial or temporal scale and the range of change, in terms of climate and weather, has also been variable. Biodiversity is crucial to human wellbeing, sustainable development and poverty reduction. Acknowledging the important role of biodiversity and its inextricable linkage to human survival in the face of significant impacts of biodiversity loss on the survival of human beings such that biodiversity can shape the path economic development takes in a country i.e. the plants, animals and ecosystems within a country influence the type of livelihoods available to people and the types of industries that emerge. Change in climate has consequences on the biophysical environment such as changes in the start and length of the seasons, glacial retreat, and decrease in Arctic sea ice extent and a rise in sea level. These changes have already had an observable impact on biodiversity at the species level, in term of phenology, distribution & populations, and ecosystem level in terms of distribution, composition & function. As species geographic ranges and ecosystem functions are altered in response to climate change, there is a need to integrate biodiversity conservation approaches that promote natural adaptation into land use planning. Successful conservation will need to embrace multiple climate adaptation approaches, but to date they have not been conveyed in an integrated way to help support immediate conservation planning and action in the face of inherent spatial uncertainty about future conditions. Instead, the multiple approaches are often conveyed as competing or contradictory alternatives, when in fact, they are complementary.

Keywords: biodiversity, climate change, adaptation, conservation, ecosystem

THE ROLE OF GREEN MANURING IN IMPROVING THE SOIL PHYSICAL AND CHEMICAL PROPERTIES

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Soil health loss is one of the most important problems faced by Indian Agriculture because of increased human population growth and decreasing per capita land availability and relatively the net cultivated area remains constant or decreasing. So, for the achieving higher yields the farmers mostly apply high dose of agro chemical, pesticides, herbicides etc. which has the bad impact on the soil health as well environment and ultimately human health. As far as soils physical properties is concern, the resulting B.D., P.D., Porosity, structure, water holding capacity, aeration, soil temperature etc. deviated from its normal condition and alter the production and productivity of the crop plants directly or indirectly. However most of the chemical properties such as P^H , CEC, available nutrients, ion exchange phenomena, redox reaction along with other pericyclic reactions that occur in the soil, electrochemistry of the clays etc. is drastically changing with the incorporation of the agro based chemical in the soil. There are various management practices by which these properties can be improved namely- introduction to organic manuring, bio-fertilizer, composting, bio-pesticide, bio-herbicides green manuring etc. which depends upon the availability of the natural resources. Out of these management practices green manuring is an important option for the improvement of the soil physical environment where the assured irrigation facility, seeds and other machinery along with raw materials are available. The green manure is best management practice to improve the organic matter in the soil. With the decomposition and mineralization of the organic matter, different nutrient element is released beside this there are number of nutrient present in chelating complexes of soil which usually converted into their available form resulting favorable changes in the P^H , CEC. The availability of the nutrients, ion exchange phenomena, redox reaction along with other pericyclic reactions that occur in the soil, electrochemistry of the clays and other chemical properties remains in the normal range for the optimum crop production. The plants which are used as green manuring are leguminous and having mostly tap root system that will improve the vegetative biomass in deeper layers of the soil and further it will help to cracks the cervices as well as reduce the soil compaction. It also helps to increase the microbial activity and their population. These microbial population secrete various types of gums polysaccharides etc. which acts as a binding force and improve soil aggregation hence reduces the erosion (water and wind). It had also been seen that some of the green manure plants have shallow root system which helps for the increasing the pores size, Porosity, structure, water holding capacity, aeration, thermal effect and other physical properties but reduce B.D., P.D. Therefore by the adoption of green manuring practices in intensive cropping system, the physical as well as chemical aspects of the soil can be improved.

COPPER SULPHATE INDUCED HISTOMORPHOLOGICAL ALTERATIONS IN HEPATOPANCREAS OF FRESH WATER PRAWNS, MACROBRACHIUM LAMARREI

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Hepatopancreas is pivotal organ of metabolism of crustaceans controlling various processes like digestion, absorption and storage of food. It is one of the important organs for detoxification of xenobiotics also. Copper, a “grey listed”, metal usually applied as weedicide in fish ponds and also an essential micro nutrient in lower concentration to many animals especially to crustaceans. Above certain level copper become highly toxic affecting various behavioural, physiological, biochemical and histomorphological changes affecting aquaculture production. *Macrobrachium lamarrei* was subjected to sub-acute concentration (25% conc. of 96 hr LC₅₀) of copper sulphate for 10, 20 and 30 day showed pronounced histomorphological changes like vacuolization, reduction of brush borders, breaking of tunica propria, infiltration of wandering cells in inter tubular spaces, necrosis and severe degenerative changes leading to disorganized hepatopancreatic tubules. Severity of histomorphological changes was found duration dependent. Most effected cells were B, F and R cells. At several places melanin deposition was also observed after 30 day exposure. Underlying mechanism of copper toxicity have been discussed.

Key Words: *Macrobrachium lamarrei*, Copper toxicity, histomorphology and Hepatopancreas

ROLE OF PUSH-PULL STRATEGY IN INTEGRATED PEST MANAGEMENT

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Push-pull strategies involve the behavioral management of insect pests and their natural enemies via the integration of stimuli that act to make the protected resource repellant or unsuitable to the pests (push) while attracting them toward an attractive source (pull) from where the pests are subsequently removed. Therefore, the strategies are usually integrated with methods for population reduction, preferably biological control. Push-pull strategies maximize efficacy of behavior manipulating stimuli through the additive and synergistic effects of integrating their use. By orchestrating a predictable distribution of pests, efficiency of population-reducing components can also be increased. The strategy is a useful tool for integrated pest management programs reducing pesticide input. The main target was a series of lepidopterous pests attacking maize and other cereals, present case studies reviewing work on the development and use of push-pull strategies in each of the major areas of pest control. Stimuli used for behavioral manipulation in push-pull strategies include visual and semiochemical cues or signals that work by nontoxic mechanisms. Strategies are therefore integrated with other population-reducing methods. Sustainable and environmentally sensitive components are favored, and the use of insecticides can be reduced. Changing attitudes toward replacing broad-spectrum insecticides with new technologies, particularly semiochemical tools, to manipulate the behavior of natural enemies for improved biological control will enable improved push-pull strategies to be developed and used more widely in the future.

Keywords: Push-Pull, management, semiochemical, pest

RESPONSE OF VARIOUS BASMATI RICE VARIETIES AGAINST LEAF AND NECK BLAST DISEASE IN HIMACHAL PRADESH

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Indo-Gangetic plain region is home to highly prized basmati rice having incredible grain and cooking qualities, characterized by long kernel, high elongation ratio after cooking, pleasant aroma and excellent taste. However, yield potential of basmati rice is very low. Whole of Himachal Pradesh has been included in GI for basmati, still the basmati cultivation in the state is confined to areas below 1000 m altitude owing to late maturity of traditional basmati varieties. Blast caused by *Pyricularia oryzae* Cavara (Telomorph, *Magnaporthe oryzae*) takes a heavy toll on the crop especially in basmati rice and it is a serious threat to rice productivity in the north western hills of India including Himachal Pradesh. Most of the elite aromatic rice cultivars are highly susceptible to blast. To assess the response of various basmati rice against leaf and neck blast disease, fifty basmati varieties were grown along with two checks, Kasturi and HPR 2612. These included leaf, neck blast susceptible and resistance genotype which were both grown in field, UBN (Uniform Blast Nursery) and controlled conditions. Cultured pathogen of *Pyricularia oryzae* was sprayed several times over those genotypes grown in different conditions. Data were recorded at the different growth stages of plant for leaf and neck blast disease. Out of fifty, seven basmati varieties such as Vallabh basmati 21, Vallabh basmati 22, Vallabh

basmati 24, Pusa sugandh 5, Pant basmati 1, Pant basmati 2 and Malviya basmati dhan10-9 showed complete resistance to both leaf and neck blast. Selected lines were separately harvested to develop a new resistant variety of basmati rice against leaf and neck blast in Himachal Pradesh.

Keywords: Basmati rice, UBN, Pyricularia oryzae, Leaf and neck blast

FLORISTICS, STRUCTURE, DIVERSITY, BIOMASS AND CARBON STOCKING DENSITY IN MOIST TROPICAL FOREST ECOSYSTEM OF CHHATTISGARH, INDIA

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Tropical forest ecosystem approximately covers 52% of total global forest area and two thirds of the plant species of the world. They are complex, rich, diverse and self sustaining ecosystem supplies valuable products and services, which are vital for sustenance of human societies. The treasure house of biological richness and diversity of tropical forests are depleting alarmingly due to continuous over exploitation in last few decades. The intrinsic ability of self sustenance of these pristine forests are gradually losing due to over grazing, increased activities of logging, mining, construction of dams, reservoirs etc. Tropical forests store a large amount of atmospheric C, thus play an important role in global carbon cycle. Tropical forests are now becoming sources C rather than sinks due to increased rates of deforestation and degradation. The periodical measurement and understanding the structure, diversity, biomass and carbon stocking are essential for devising sustainable management practices. However, only few attempts were made in the tropical moist ecosystem on characterization of vegetation communities and assessment of biomass and C stocking in relation to mitigation of climate change. Therefore, an attempt was made in the present study to understand the floristics, structure, diversity, biomass and Carbon Stocking Density in Moist Tropical Forest Ecosystem in part of Amarkantak Biosphere Reserve (ABR) of Chhattisgarh, India. The results revealed that the tropical moist deciduous forest comprise four broad vegetation types viz. Dense mixed forest, open mixed forest, bamboo brakes and forest encroachment. Five quadrates of 20x20 m size for trees, 2x2 m for shrubs and 0.5x0.5 m for herbs were randomly laid in each vegetation type for characterization of vegetation, biomass and carbon stocking density. The phyto-sociological analysis showed that the density varied from 160 to 500 trees ha⁻¹ and basal area from 3.41 to 22.05 m² ha⁻¹ and number of trees species from 8 to 25 in different vegetation types. Dense mixed forest recorded higher density, basal area and number of species compared to other vegetation types. The number of shrub and herbaceous species varied from 8 to 13. On the basis of IVI values, Shorea robusta (Roth), Mallotus philippinensis (Lam.), Muell.Arg. and Schleicheria Oleosa (Lour.) Oken, were recognized as predominant plant community in dense mixed forest. In tree layer, Shannon index values ranged from 1.8 to 3.34, Simpson index from 0.191 to 0.748, Beta diversity from 2.5 to 3.33. The greater species richness and diversity was found in dense mixed forest. The conversion of native forest land into agriculture (Encroachment) resulted in loss of species richness and diversity. The biomass in tree layer varied from 40.32 to 293.73 Mg ha⁻¹. For the total biomass contribution of different components followed the order: stem > branch > root > leaf. The dense mixed forest recorded more than 6-8 times higher biomass than bamboo brakes and forest encroachment. The carbon stocking density varied from 22 to 130 Mg ha⁻¹. The carbon storage was highest in dense mixed forest and the lowest carbon store in bamboo brakes and encroachment. The paper discusses potential causes of forest degradation and low carbon stocking density in open mixed and bamboo brakes. The paper also highlights the managerial implications for improving carbon stocking density in tropical moist deciduous forests to mitigate the impact of climate change.

Keywords: Bamboo brakes, Biodiversity, Biosphere reserve, Climate change, Ecosystem services, Forest encroachment

CONSTRAINTS IN AGRICULTURAL MARKETING IN INDIA

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Agricultural marketing system is an efficient way by which the farmers can dispose their surplus produce at a fair and reasonable price. Improvement in the condition of farmers and their agriculture depends to a large extent on the elaborate arrangements of agricultural marketing. The term agricultural marketing include all those activities which are mostly related to the procurement, grading, storing, transporting and selling of the agricultural produce. Agricultural marketing comprises all operations involved in the movement of farm produce from the producer to the ultimate consumer. Thus, agricultural marketing includes the operations like collecting, grading, processing, preserving, transportation and financing. Even though India is an agricultural country, still its agricultural marketing has been defective. The Indian farmers are unable to get reasonable price for the products even after their hard work and are fully exploited by the middlemen. In the agriculture industry, marketing function is very germane as it influence production decision and value addition activities. The infrastructure, procurement practices, marketing approaches and processing facilities are also observed as the major constraints in the rural marketing in India. The social and cultural taboos are also responsible to a large extent in not developing agro-industries in the region to provide better value addition to the horticultural crops. The agriculture industry plays a significant role in a country's growth and development. The necessary feedback and dynamism between the producer and the consumer in terms of product forms, quality, quantity and affordability are made possible

only through marketing efforts. There will be opportunity to interface with government with a view to encouraging policy formulation and implementation that will foster infrastructural development so as to achieve international competitiveness.

EXPORT PERFORMANCE OF GROUNDNUT IN INDIA

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Exports are the basis of the overall growth performance of any country. By increasing the rate of exports, any developing country can pave a way for the development by earning international liquidity thereby; sort out the problem of reserves to start-up of any project to come out the circle of poverty. So, it becomes a paramount importance for the country like India to start export promotion measures to boost up the pace of its exports and India has already taken many steps to increase the level of its exports. The intention of the study was to access the export scenario of groundnut in India. In the study, compound annual growth rate (CAGR) was used to analysed the growth rate performance in export of groundnut and it was found out that the growth rate for this crop for the time series data from 1987-88 to 2017-18 was 15.31% and the growth rate in value earned from the export of this crops was 23.9 per cent. The concept of Markov chain (MC) was also employed to analyse the dynamics export to different countries of the world. It was observed Indonesia was the most stable importer with 48.60 per cent retention of groundnut from India and Netherland shown low probability retention of 10.00 per cent. So, in changing economic scenario, government policy should aim at increasing productivity, reducing cost per unit of production, improving trade standards and meeting all the trade related barriers which are of greater concerns for the importing nations which in turn will enhance the exporting performance of groundnut in India.

Keywords: Export, performance, Groundnut, CAGR and Markov chain, retention

EFFECT OF TILLAGE PRACTICES AND INTEGRATED NUTRIENT MANAGEMENT (INM) ON PRODUCTIVITY, NUTRIENT UPTAKE AND STATUS OF SOIL IN LATE SOWN WHEAT (*TRITICUM AESTIVUM* L.)

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A field trial was conducted to study the Effect of tillage practices and integrated nutrient management (INM) on productivity, nutrient uptake and status of soil under late sown wheat (*Triticum aestivum* L.) at Students Instructional Farm (SIF), Department of Agronomy, Collage of Agriculture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002, (U.P.) for two consecutive years (2016-17 and 2017-18). The treatment consistent three tillage practices methods (Conventional tillage method- CT, Minimum tillage method- MT and Zero tillage method- ZT) in main plot and integrated nutrient management practices and six integrated nutrient management practices i.e. (rtilizerControl (No fe-T₁, Farmer practice-T₂ STR (Soil %100 (Test Recommendation NPK-T₃, STR %100 + tonnes FYM 5-T₄, STR %100 + PSB-T₅, STR %100 + PSB+ tonnes FYM 5-T₆ in sub plots, replicated trice in a split plot design. The longest spike length 8.76 and 9.15 cm were found in first and second year, respectively, under conventional tillage, which was significantly superior over the other tillage practices methods. Significantly more number of grains/spike, higher spike weight and higher test weight were recorded under conventional tillage methods as compared to minimum and zero tillage. Highest yields of grain and straw were recorded under conventional tillage followed by minimum over zero tillage practices. Conventional tillage practices resulted in significantly higher content and their uptake of NPK by wheat plants as compared to other tillage methods. Maximum NPK uptake was recorded under Conventional tillage followed by minimum tillage while minimum NPK uptake was estimated under zero tillage through grain straw and total during first year. The plant height, dry matter accumulation and number of tillers per plant significantly increased with application of 100% STR + PSB+ 5 tonnes FYM. The maximum height was recorded under 100% STR + PSB+ 5 tonnes FYM followed by 100% STR + PSB, which might have resulted due to increased leaf area, higher photosynthetic rate and more carbohydrate accumulation in plants, thereby increasing dry matter production. integrated nutrient management application at 100% STR + PSB+ 5 tonnes FYM and 100% STR + PSB level produced significantly higher number of grains/spike, more spike length, spike weight and more test weight of grains as compared to 100% STR and farmer practices INM practices. The highest grain yield 36.74 and 39.51 q ha⁻¹ and straw yield 45.56 and 48.83 q ha⁻¹ were recorded with 100% STR + PSB+ 5 tonnes FYM which was 20.38 % and 25.79 % and 24.11 % and 28.26 % higher than the yield of control. Maximum NPK uptake was recorded by 100% STR + PSB+ 5 tonnes FYM which was higher than 100% STR + PSB and 100% STR + 5 tonnes FYM during first and second year of experimentation.

Keywords: Conventional tillage, INM, Uptake, Zero tillage, tillage methods, grain yield, yield attributes

IMPACT OF TILLAGE PRACTICES AND INTEGRATED NUTRIENT MANAGEMENT (INM) ON SOIL HEALTH AND PRODUCTIVITY OF LATE SOWN WHEAT (*TRITICUM AESTIVUM* L.)

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A field experiment was conducted at Students Instructional Farm (SIF), Department of Agronomy, Collage of Agriculture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002, (U.P.) for two consecutive years (2016-17 and 2017-18) to study the productivity of wheat (*Triticum aestivum* L.) under different tillage practices methods (Conventional tillage method- CT, Minimum tillage method- MT and Zero tillage method- ZT) in main plot and integrated nutrient management practices and six integrated nutrient management practices i.e. (Control (No fertilizer- T_1 , Farmer practice- T_2 STR (Soil %100 (Test Recommendation NPK- T_3 , STR %100 + tonnes FYM 5- T_4 , STR %100 + PSB- T_5 , STR %100 + PSB+ tonnes FYM 5- T_6 in sub plots, replicated thrice in a split plot design. Conventional tillage method produced taller plants, higher dry matter accumulation and maximum number of tillers/m² at 90 DAS as compared to other treatment. Zero tillage produced shorter plant height, minimum dry matter and less number of tillers per m². tillage practices methods on yield contributing characters, spike length, spike weight, number of grains/spike, number of spikelets per spike, 1000 seed weight, were positively influenced (Table 2). The longest spike length 8.76 and 9.15 cm were found in first and second year, respectively, under conventional tillage, which was significantly superior over the other tillage practices methods. Significantly more number of grains/spike, higher spike weight and higher test weight were recorded under conventional tillage methods as compared to minimum and zero tillage. Highest yields of grain and straw were recorded under conventional tillage followed by minimum over zero tillage practices. Conventional tillage practices resulted in significantly higher content and their uptake of NPK by wheat plants as compared to other tillage methods. Maximum NPK uptake was recorded under Conventional tillage followed by minimum tillage while minimum NPK uptake was estimated under zero tillage through grain straw and total during first year. The plant height, dry matter accumulation and number of tillers per plant significantly increased with application of 100% STR + PSB+ 5 tonnes FYM. The maximum height was recorded under 100% STR + PSB+ 5 tonnes FYM followed by 100% STR + PSB, which might have resulted due to increased leaf area, higher photosynthetic rate and more carbohydrate accumulation in plants, thereby increasing dry matter production. integrated nutrient management application at 100% STR + PSB+ 5 tonnes FYM and 100% STR + PSB level produced significantly higher number of grains/spike, more spike length, spike weight and more test weight of grains as compared to 100% STR and farmer practices INM practices. The highest grain yield 36.74 and 39.51 q ha⁻¹ and straw yield 45.56 and 48.83 q ha⁻¹ were recorded with 100% STR + PSB+ 5 tonnes FYM which was 20.38 % and 25.79 % and 24.11 % and 28.26 % higher than the yield of control. Maximum NPK uptake was recorded by 100% STR + PSB+ 5 tonnes FYM which was higher than 100% STR + PSB and 100% STR + 5 tonnes FYM during first and second year of experimentation

MITIGATION AND ADAPTATION POTENTIAL OF BAMBOO TO CLIMATE CHANGE

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Globally more than 1,300 species of bamboo belongs to 75 genera are cultivated around 25 million hectares worldwide out of which 125 indigenous species found in India. It grows in diverse climates, ranging from hot tropical to cool mountainous regions and highland to moist forests mainly in China, Japan, Korea, India, and Australia and have gained world attention owing to supply raw materials to many industries viz. manufacturing handicrafts, packaging materials, fencing, paper industries food processing, medicines etc. Its rapid establishment and growth allow frequent harvesting which limits exposure to disaster and allows farmers to flexibly adapt their management and harvesting practices to new growing conditions as they emerge under climate change. Potential ability of bamboo to sequester large amount of CO₂ helps in mitigation of climate change. As climate change will likely have adverse effects on agricultural productivity and food security in much of the semi-arid region, there is need to develop and disseminate production technologies that provide a layer of resilience against such climate change effects on food security. Bamboo can sequester up to 62 tCO₂ per year compare whereas young forest sequester only 15 tCO₂ per year. It reduces up to 35% carbon dioxide and delivers more oxygen to the environment and it reduces the use of timber consumption. Bamboo helps avoid fossil fuel use by offering an alternative, highly renewable source of biomass energy. Studies show that bamboo charcoal has a calorific value similar to that of wood charcoal with far less pollution. However, due to environmental hazards, bamboo development has been reduced. In conclusion the use of bamboo plant as a raw or substitute material for construction could be help toward building a sustainable environment. Experiments were carried out at Research Farm College of Forestry, SHUATS; Prayagraj (India) to estimate the mitigation potential of *D. strictus* and *B. vulgaris*, and *B. balcooa*, *B. vulgaris*, *B. nutan*, *Mellocanabaccifera*, *B. tulda*, etc. Research result shows that production system has significant influence on growth performance / carbon sequestration found maximum in *Bamboosa* bamboo (22.35 t C /ha) and *Bambusabalcooa* (16.70 t C /ha) followed by *B. tulda* (15.64 t C /ha), *B. vulgaris* (11.52 t C /ha), *Mellocanabaccifera* (5.4 t C /ha), *B. nutan* (4.84 t C /ha), *D. strictus* (2.72 t C /ha), while minimum in *B. asper* (0.75 t C /ha). Bamboos due to their ability to grow in vast range of climates and ecological condition offer excellent option to be employed towards mitigation and adaptation in changing climate scenario.

Keywords: Socio-economical, bamboo, mitigation, adaptation, climate change and ecosystem.

UNDERSTANDING THE NATURE OF LINEAR MIXED MODEL (LMM) AND ITS APPLICATION IN APPLIED SCIENCES

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Classical technique such as linear regression and multiple regression analysis can be applied only when its ridged assumption holds. In case where observation are non- independent and in presence of random factor in experiment, the application of classic technique leads to misleading result. This paper describes the case where mixed model is needed and key idea for distinguishing fixed and random factor, model theory, software packages followed by pointing out few applications in applied sciences which will help in understanding the nature of linear mixed model.

Keywords: Linear mixed model, fixed and random factor, applied sciences

AGRICULTURAL ORIGINS: COMBINED USE OF MODERN AND ANCIENT DNA IN ARCHAEOBOTANY

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Neolithic revolution or first Agricultural revolution was the wide-scale transition of many human cultures from a life style of hunting and gathering to one of agriculture and settlement making an increasingly larger population possible. These settled communities permitted humans to observe and experiment with plants to learn how they grew and developed. However during the course of Agriculture revolution, domestication, selection and hybridization of the crops has led to significant changes in the appearance of plants, morphology, genetic architecture and their nutritional value. In order to comprehend these differences, an understanding of both past and present cultivation dynamics is required. In this project, we aim to use cutting edge scientific methods for e.g. Genomics, Stable isotopes and morphological measurements to reconstruct the history of a given crop. With the recent advancement in the field of genomics, one can isolate and sequence the DNA extracted from ancient charred grains and can directly go back the genetic makeup of given variety of crops. While genomes from modern crops can inform about present-day population structure, ancient genomes provide unprecedented insights into past demographic events that have shaped the present-day gene pool of crops. At the same time, the ability to measure the stable isotopes (d13C and d15N) of archaeobotanical grains and seeds, and to relate these values to those of living plants, has opened up a new field of isotopic research in archaeology. It allows the reconstruction of crop management practices, such as manuring and irrigation, and environmental conditions, such as aridity depends on being able to relate the measured d13C and d15N in the preserved archaeobotanical sample to its original value.

Keywords: Archaeobotany, carbonized remains, excavations, cropping pattern

EFFICACY OF NEW FUNGICIDES AGAINST LATE BLIGHT (*PHYTOPHTHORA INFESTANS*, (MONT.) DE BARY) OF POTATO UNDER FIELD CONDITIONS

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Late blight caused by *Phytophthora infestans*, is one of the most dreaded diseases of potato worldwide and causes 30-50 % yield loss. Globally, late blight of potato is managed through application of multiple fungicidal sprays. Second generation fungicides have proved as a new hope in better management of diseases under field conditions. Efforts made in the present investigation to know the efficacy of new fungicides against *Phytophthora infestans* under field conditions. For this purpose a survey was conducted at the research field of Deendayal Research Institute Krishi Vigyan Kendra, Satna (M.P.), during Rabi season of 2018-2019. Six treatments including control with three replications were taken up by using randomized block design (RBD). The fungicides viz; Sectin (fenamedone 10 % + mancozeb 50 % WG) @ 0.3 % (T1), Curzate M-8 (cymoxanil 8 % + mancozeb 64 % WP) @ 0.25 % (T2), Melody-Duo (iprovalicarb 5.5 % + propineb 61.25 % WP) @ 0.3 % (T3), Folio Gold (metalaxyl-m 3.3 % + chlorothalonil 33.1 % SC) @ 0.2 % (T4), Acrobat (dimethomorph 50 % WP) @ 0.2 % (T5), Revus (mandipropamid 23.4 % SC) @ 0.1 % (T6) and untreated control, respectively. The fungicides sprays were given twice. The first spray was given as soon as appearance of the disease symptoms and the second spray was given 10 days after the first spray and observations were recorded at 10 and 20 days after the spray. All the tested fungicides were found to be significantly superior over. The results revealed that, the lowest per cent disease intensity (PDI) was recorded in Fenamedone 10 % + Mancozeb 50 % WG @ 0.3 % (18.57 %), followed by Cymoxanil 8 % + Mancozeb 64 % WP @ 0.25 % (21.86 %) along with highest over controlled 73.48 %, respectively. The highest tuber yield (28.35 t / ha) was observed with Fenamedone 10 % + Mancozeb 50 % WG @ 0.3 %, followed by Cymoxanil 8 % + Mancozeb 64 % @ 0.25 % (27.42 t / ha), respectively. These treatments could be integrated in farmer practices.

Keywords: Efficacy, Fungicides, Phytophthora infestans, Potato, Rabi, Per cent, Yield

EFFECT OF HERBAL FEED ADDITIVES ON HEMATOLOGICAL AND BIOCHEMICAL PARAMETERS IN BROILER CHICKEN

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This study was conducted to find the effect of Ashwagandha, Ginger, Shatavari and Cardamom on hematological and biochemical parameters in broiler chicken. Three hundred and sixty, day old chicks (Cobb 400) were allocated randomly to six dietary treatments from 0–42 day of age with three replicates (20/birds/pen). The experimental diets were: (T1) control, (T2) 0.5% Ashwagandha powder, (T3) 0.5% ginger powder, (T4) 0.5% Shatavari powder, (T5) 0.5% Cardamom powder, (T6) 0.25% Ashwagandha + 0.25% Ginger + 0.25% Shatavari and 0.25% Cardamom powder. The result of different herbal feed additive extract stimulated the growth of the broiler chicken and treatment T₆ was found to have maximum body weight ($1700.616^d \pm 5.886$) which was significantly higher ($p < 0.05$) as compared to control group. Maximum PCV value was observed in T₆ and minimum in control group. The maximum value of glucose was found in T₆ supplemented group ($254.032^c \pm 1.185$) and minimum in control ($239.359^a \pm 0.908$). The value of serum albumin and globulin has been found to increase significant in all the supplemented groups. The value of serum cholesterol was lower in all the supplemented groups and the decrease was significant ($P < 0.05$) in T6 groups. Therefore, T6 group showed better weight gain and feed utilization as compare to control and this is due to the stimulant appetizer and immunomodulatory effect of supplemented herbal feed additive. Haemoglobin and PCV value was significantly higher ($P < 0.05$) in herbal feed additive supplemented group as compare to control group.

CARBON STOCK MANAGEMENT IN AGRO-SILVICULTURE IN NORTH-EAST INDIA

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Climate change has been ‘a hue and cry’ topic arising from every corner of the world. Scientific community are creating opportunities and mean of ways to curb the menace of reducing Carbon concentration in the atmosphere. In every parts of the world, there are special environmental behaviours to combat C concentration in its native way in relative to the environmental condition of the region. In North-East India, many native tree species have the capacity to obtain or reserve the carbon for longer period of time both above ground and below ground carbon stock. The region is enriched with diverse species of tree with their different capacity of carbon storage ability. Prominent species of Oak (*Quercus humboldtii*) shows different C storage capability with its different parts, the branches with diameters lower than 5 cm have the largest capacity of capturing C (40.3%) followed by wood contained in the trunk and in branches with diameters lower than 5 cm and the branches with diameters higher than 5 cm (38.75%) and fresh leaves and dead leaves show (35.95%) and (34.05%) of C retention respectively. Pine tree species (*Pinus kesiya*) also act as a major reservoir of carbon which is anonymously distributed in the region. *P. kesiya* trees grow rapidly and strong natural regeneration ability over degraded ecosystem. The average carbon sequestration rate of *P. kesiya* is $12.7 \text{ Mg C ha}^{-1} \text{ yr}^{-1}$. One of the most important vegetation which is also included in forestry is bamboo, which is known to be a largest reservoir of carbon due to its slow decomposition. Hence, consider as a carbon sink. Bamboo is mostly prevalent in the region and its importance also depends on its abilities to sustain moisture in the soil. Intercropping of bamboo with turmeric and ginger is prominent in Meghalaya in turmeric and ginger growing belt. The average carbon storage and sequestration rate in woody bamboos range from $30\text{--}121 \text{ Mg ha}^{-1} \text{ yr}^{-1}$ and $6\text{--}13 \text{ Mg ha}^{-1} \text{ yr}^{-1}$, respectively. In considering to the above carbon storage benefit of diverse tree species in the region and consider the “jhum cultivation” practiced, intercropping with such species brings about replenishment of the degraded jhum land and restore the original habitat of the ecosystem, thus enhancing carbon stock of the region.

Key words: Carbon, agri-silviculture, North East India.

MOLECULAR CHARACTERIZATION OF ADVANCED BREEDING LINES OF LOWLAND RICE AND THEIR EVALUATION FOR GRAIN QUALITY TRAITS

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The need for diverse and highly productive breeding lines combined with good quality traits for future breeding programs or for multiplication and better returns for farmers is necessary. Hence the investigation was undertaken to characterize twenty two

advanced breeding lines of lowland rice derived from nine pedigrees to ascertain genetic relationship and diversity among the genotypes using a set of SSR markers and random SNPs with gene specific SNPs followed by evaluation for grain quality traits. Maximum variation among the genotypes was observed for amylose content, seed breadth and gelatinization temperature which classified the breeding lines into three classes while the traits such as grain length:breadth ratio, linear elongation and protein content categorized the breeding lines into two classes, respective to the values recorded under each trait. Amylose content ranged from 18% to 27% among the breeding lines while the protein content ranged from 11% to 5.5%. CAUS122 and CAUS107 were found to contain highest amount of iron and zinc. Highest GCV was recorded for amylose content and grain length breadth ratio suggesting selection based on these traits would be effective. The heritability recorded for the quality traits was high. Population structure analysis using STRUCTURE revealed the ancestry share among the breeding lines. Sixteen breeding lines were categorized as admixtures as they showed less than 85% of the estimated ancestry. These admixtures or breeding lines having differences in ancestry share could be preferred for further breeding programs or multiplication. Divergence analysis showed that maximum Euclidean distance was observed between CAUS116 and CAUS117, whereas, the minimum was observed between CAUS110 and CAUS111. Ward's hierarchical clustering approach grouped genotypes into two major clusters that were further subdivided into sub groups. Therefore, based on these results the diverse breeding lines having higher yield with better grain quality could be considered for future breeding methods as parents or can be released as varieties after multi-locational evaluation.

Keywords: Rice, advanced breeding lines, grain quality, amylose content, SSR, SNPs.

ULTRASOUND ASSISTED OIL EXTRACTION OF BLACK SEED (*NIGELLA SATIVA* L)

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Nigella sativa L. also known as black cumin or black seed is an annual herbaceous plant belonging to the Ranunculaceae family. *Nigella* seed oil is considered as one of the newer and prospective sources of edible oils that have an important role to play in human nutrition and health. Black seeds are used for edible and medicinal purposes in many countries including India, Egypt and Syria. Mostly, the oil extracted from the black seeds is done by conventional extraction method i.e., pressing but the problem associated with this method is its much time consumption and poor yield. In order to overcome this problem newer technologies of extraction are in process like Ultrasound assisted extraction. In this context, a study for ultrasound-assisted oil extraction from black seed was conducted using three independent variables of three levels each. Best possible combinations of extraction variables was obtained with full factorial design. The variables were Ultrasound time (20, 30, 40 min), Ultrasound power (100%, 80%, 60%), and solvent to solid ratio (10:1, 15:1, 20:1). Maximum oil yield of 34.6% was achieved at the ultrasound power of 80%, ultrasound time of 30 minutes and the solvent to solid ratio of 20:1.

Keywords: Black seed, oil extraction, ultrasound assisted extraction.

LAYERING IN FRUIT CROPS

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Air layering, also called marcotting, marcottage, pot layerage, circumposition and gootee, is a vegetative method of plant propagation which involves the rooting of aerial stems while attached to the parent plant. Marcotting or air layering, an asexual or vegetative method of plant propagation, can be easily performed with less skill. Common Procedures in Marcotting is Plant and Shoot Selection, Girdling and Scraping, Marcotted Shefflera showing roots, Separation of the Marcot from the Parent Plant and potting. Types of layering are Simple layering, Compound layering, Tip layering and Mould or stool layering. Litchi Propagation although litchi can be propagated asexually by various ways the most common and easiest method adopted all over the world is air-layering. Stooling method of propagation is becoming popular due to higher success rate as compared to air layering. Air-layering Air-layering or 'gootee' is widely accepted method of propagation in India. In this method a healthy and vigorous, upright twig of about one year old and 2.5 to 4 cm in diameter is selected. A circular strip of bark about 2 cm wide just below a bud is completely removed from the selected twig. Pomegranates Propagation air-layering: Air layering is carried out in the month of May/June. In this method a 1-2 year old, healthy, vigorous, mature shoot of 45-60 cm in length and pencil thickness is selected. A circular strip of bark about 3 cm wide just below a bud is completely removed from the selected shoot. Rooting hormones like IBA & NAA 50mg each in Lanoline paste are applied over this portion. Moist sphagnum moss is packed around this portion and tied with polyethylene to prevent the loss of moisture.

Keywords: Air layering and marcottage

ATTITUDE OF FARMERS TOWARDS AGRICULTURAL WASTE MANAGEMENT IN BADE LOCAL GOVERNMENT AREA, YOBE STATE NIGERIA

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The study was conducted to assess farmers' attitude towards agricultural waste management, whereas factors such as farmer's attitude, socio-economic, demographic, generation and disposal method were investigated during the course of the study. Twenty (20) respondents were collected from each ward for the study and each household is being represented by a member resulting to a sample size of 120 respondents using schedule. The collected data were analyzed using simple descriptive statistics such as percentages/frequency and indicated that majority of the farming households were involved in indiscriminate waste disposal emanating from agriculture. From the results about (70%) of respondents had negative attitudes towards agricultural waste management, about (10%) had positive attitude towards agricultural waste management while (20%) had neutral attitude. This implies that the overall attitude towards agricultural waste management was negative in the study area. The farmers' attitude towards agricultural waste management across the selected wards is quite low and their participation is also negative. Therefore, It is recommended that efforts should be intensified towards training and awareness for the purpose of improving awareness as well as participation in agricultural waste management in bade local government area yobe state, Nigeria.

Keywords; Farmers Attitude, Waste Management, Participation, Nigeria

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON NUTRIENT UPTAKE BY WHEAT IN ALLUVIAL SOILS OF MADHYA PRADESH

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Wheat (*Triticum aestivum* L.) is one of the most important cereal crops globally and is a staple food for about one third of the world's population. It occupies second position both in terms of area and production in the world. 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 INM, and agricultural sustainability. Present investigation carried out during two consecutive rabi seasons of 2013-14 and 2014-15 to evaluate the effect of INM on nutrient uptake of wheat at Research Farm, College of Agriculture, Gwalior. The soil of the experimental field was sandy clay loam in texture, neutral in reaction (pH 7.50 and 7.64) with low in organic content (0.40 and 0.44) and available N (168.5 and 160.5 kg/ha) and medium in available P (14.2 and 15.2 kg/ha) and K (240.5 and 230.6 kg/ha) contents. The treatments comprised of twelve INM levels (T1 Control, T2 FYM @ 10 t/ha, T3 FYM @ 5 t/ha + Azotobacter + PSB, T4 FYM @ 10 t/ha + Azotobacter + PSB, T5 NPK (100% RDF) 120:60:40 kg/ha, T6 NPK (150% RDF), T7 NPK (100% RDF) + Azotobacter + PSB, T8 NPK (100% RDF) + FYM @ 2.5 t/ha + Azotobacter + PSB, T9 NPK (100% RDF) + FYM @ 2.5 t/ha, T10 NPK (75% recommended dose) + Azotobacter + PSB, T11 NPK (75% RDF) + FYM @ 2.5 t/ha and T12 NPK (75% RDF) + FYM @ 2.5 t/ha + Azotobacter + PSB) were laid out in RBD with three replications. The results revealed that the application of 100% RDF+ FYM 2.5t/ha + Azotobacter + PSB recorded maximum uptake of N, P and K by wheat grain, straw and its total, which were significantly higher over control as well as most of the treatments. The uptake of micronutrient e.i. Zn, Fe, Mn and Cu were also recorded significantly higher with application of 100% RDF+ FYM 2.5t/ha + Azotobacter + PSB over most of the INM treatments.

SHIFTING CULTIVATION AND SOIL MANAGEMENT

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Shifting cultivation practices extensively in the north-eastern hill region comprising the states of Assam, Meghalaya, Manipur, Nagaland and Tripura and the two union territories of Arunachal Pradesh and Mizoram and to some extent Andhra Pradesh, Bihar, M.P., Orissa and Karnataka states. It is called "Jhum" in the north-eastern hill region and "Podu" in AP and Orissa states and considered most destructive for forest areas. The shifting cultivation is an indigenously evolved age-old system of agricultural practices and used to be an appropriate and sustainable land use practices when the dependent human population was within the carrying capacity of a 10-15 year Jhum cycle. Jhum cultivation still practicing in through Govt. of Tripura banned this practices long ago emphasize the impact of Jhum cultivation in different aspect of natural and human environment and issues relating it. Now in India, about 5.0 million tribal families are practices in this system on 4.37 million hectare of land cover in 11 states Orissa (36.61%), Tripura (11.21%), Meghalaya (10.75%), M.P. (8.69%), Assam (7.09%), Manipur (5.94%), Arunachal Pradesh (4.80%), Mizoram (4.34%), Bihar (4.34%), Andhra Pradesh (3.43%), Nagaland (2.74%). in Jhum cultivation the soil fertility decreases and

soil pH increase. The combined production only 2-3 year then the soil fertility status declined making it unsuitable for crop. the problem of soil erosion due to shifting cultivation varies from 70-100 t/ha./ year and Loss of soil and nutrient due to erosion in Organic Carbon (1q/ha), N(0.12q/ha), P(0.05q/ha), K(0.32q/ha) per year in india.

Keywords: Shifting, cultivation, soil, erosion

CONCEPT AND OPPORTUNITY OF BIODYNAMIC FARMING IN HORTICULTURAL CROPS

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Use of current agro-technologies and varieties coupled with climate change will certainly aggravate impact on crop production, soil fertility, microbial population and quality of food in future. Unfortunately, due to green revolution coupled with intensive cultivation practices that results removal of nutrients from soil has increased in comparison to enhanced and the natural equilibrium has been skewed towards imbalance. The impregnable efforts made in our country towards IPNM and IPM is not being pursued strongly as per the expectations. So, Government of India thought of another alternative to sustain Indian agriculture and setup strategy for organic farming. Biodynamic farming (BD) is a holistic, ecological, and ethical approach to farming, gardening, food, and nutrition. Its preparations are capable of affording long- term sustainability to agriculture and particularly to the ecosystem. BD is based on sound principle of soil biotechnology and microscopic doses of BD preparations having profound effect on growth metabolisms, quality, yield and soil health. The sowing and transplanting of different crops based on RHYTHMS have also been observed critical for better germination and yield. This advance technology in combination with organic farming can be helpful in enhancing the export quality of vegetable and fruit crops. There is also a strong feeling that Steiner's instructions are occult and dogmatic and cannot contribute to the devolvement of alternative or sustainable agriculture. Therefore, strong research in this aspect is required to convince the people regarding the scientific aspect of this technology, so as to make the farming more interesting and charming.

Key words: Biodynamic, Horticultural crops, Organic Farming, Sustainability and Quality

ECOLOGICAL IMPACT ON BIODIVERSITY OF APTERYGOTA AND PTERYGOTA INSECTS OF UNDISTURBED AREAS OF THE CHOTANAGPUR PLATEAU

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In India total of 639182 km² under forest cover. In Jharkhand forest area is 23253.4 km² which is about 29.3% of total Jharkhand geographical areas. This work has been taken up for the purpose of enclosing our horizon of understanding of the forest ecological principle. The forest so far studied by various investigator in India have revealed that each forest has a characteristic feature of its own with regard to physical, chemical and biological condition. Soil surface insects have great role in the nutrient cycling of the ecosystem. Present paper deals with comparative study of Apterygota and Pterygota study of fluctuation in Hazaribag sanctuary in relations to certain physiochemical factor of soil. Species diversity index(H), species evenness(E) and species richness(D) has been estimated for twelve months .Correlation matrix and multiple analysis have been made to see edaphological effect of sanctuary on both apterygota and pterygota insect population dynamics. Besides these, insect community play an important role in the feeding behaviour of birds of the sanctuary. We can increase birds population in this particular forest but now the insect population will support existence of birds: it is question. Hence the detailed study of the seasonal variations insect in relation to certain edaphological factors of the forest areas of sanctuary has been taken up to access the potentialities of this forest for future management.

APPROACHES FOR EASY AND COST-EFFECTIVE HYBRID SEED PRODUCTION IN CAULIFLOWER

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Cauliflower (*Brassica oleracea* var. botrytis L.) is an important cole group vegetable crop in the world. In India and Nepal, the productivity of cauliflower is 19.9 t/ha and 19.04 t/ha respectively which is much lower when compared with countries like New Zealand (45.25 t/ha). To meet such productivity gap, hybrid breeding in cauliflower is the need of the hour. However, tedious hand emasculation and pollination methods adds to the cost of hybrid seed production. In late 90s, SI (Self- incompatibility) system in cauliflower was exploited by many researchers to reduce such costs but these SI lines become unstable and may break under high temperature in the era of climate change. To counter such problems, easy and cost-effective approach in cauliflower is cytoplasmic male sterility (CMS) system. This system is more stable than SI system even under adverse environmental conditions like high temperature etc. CMS system also eliminates the need of emasculation for hybrid seed production which is very laborious and time consuming. By the use of pollinators (honey bees) sufficient amount of hybrid seed can be produced when CMS lines are grown with required number of pollen parents in closed net houses. CMS system is more useful in hybrid seed production in species

where vegetative part is of economic value (particularly cauliflower). Higher productivity and low cost of production is just like hitting two birds with a single stone, when this system is utilized.

Keyword: brassicas, cauliflower, climate change, CMS, hybrid

PLANT ESSENTIAL OILS AS A MANAGEMENT FOR STORAGE INSECT PESTS

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Stored grains are ravaged by a number of insect pests. The stored grain pests infest grains to fulfill their food and shelter requirements resulting in qualitative as well as quantitative losses. The tropical climate of India is highly favourable for continuous occurrence of storage insect pests throughout the year. A number of insect pests gain access to the grain storage at various stages of processing of food grains/ seeds viz., during the process of development and maturation of seeds/ grains, processing in threshing yards, during transit or while in storage. Some insect pests initiate damage at the ripening stage of crops and continue during storage. Major sources of infestations are old bags, storage structure, old containers, and cross over infestation (Pruthi and Singh, 1950). The spread and distribution of stored product pests are facilitated by movement of grains from one area to another either passively or by active flight of insect pests as some of the adult insects are strong fliers. Nearly one thousand species of insects have been associated with stored products in different part of the world. These may destroy the grains and contaminate the rest with undesirable odours and flavours. Majority of insect stored grains are ravaged by a number of insect pests. The stored grain pests infest grains to fulfill their food and shelter requirements resulting in qualitative as well as quantitative losses. The tropical climate of India is highly favourable for continuous occurrence of storage insect pests throughout the year. A number of insect pests gain access to the grain storage at various stages of processing of food grains/ seeds viz., during the process of development and maturation of seeds/ grains, processing in threshing yards, during transit or while in storage. Some insect pests initiate damage at the ripening stage of crops and continue during storage. Major sources of infestations are old bags, storage structure, old containers, and cross over infestation (Pruthi and Singh, 1950). The spread and distribution of stored product pests are facilitated by movement of grains from one area to another either passively or by active flight of insect pests as some of the adult insects are strong fliers. Nearly one thousand species of insects have been associated with stored products in different part of the world. These may destroy the grains

AGROFORESTRY: A PROSPECT 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. and contaminate the rest with undesirable odours and flavours. Majority of insect stored grains are ravaged by a number of insect pests. The stored grain pests infest grains to fulfill their food and shelter requirements resulting in qualitative as well as quantitative losses. Stored-product insects can cause postharvest losses, estimated from up to 9% in developed countries to 20% or more in developing countries. The tropical and sub-tropical climate of India is highly favorable for continuous occurrence of storage insect pests throughout the year. In India, annual storage losses estimated to be 14 million ton of food grains worth \$ 16,000 million every year. Farmer store their produce for year one or two but are powerless to do so, without the pesticide use and due to injudicious use of insecticides, resistance in storage pests have increased. Occurrence of chemicals in human diet is an additional problem. Storage at farmer level can be secured for at least one year or more through the use of plant essential oils, many essential oils are proven to protect stored grains due to their fumigant property, only the current demand is to formulate or find a delivery method so that these essential oils can be exploited by farmer at small level, which will also reduce our dependency on deadly chemicals used injudiciously for the

control of storage pests. For that we have to consider three things hermetic storage (air tight containers) with the help of HDPE (High Density Polyethylene) etc., eliminate O₂ from air tight container (by burning something) and last but not the least use of plant essential oils in appropriate concentration instead of chemicals.

DYNAMICS OF MARKETING AND EXPORT POTENTIAL OF LITCHI IN MUZAFFARPUR DISTRICT OF BIHAR

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Present study was conducted to determine the current status of marketing and export of litchi. The present study based was on the primary data collected from 120 randomly selected Litchi growers from eight villages i.e. 15 from a village of Mushhari and Muroal blocks in Muzaffarpur district of Bihar state. More over the information related to marketing cost, and margin was collected from pre-harvest contractors, , harvest contractors, wholesalers, retailers market intermediaries from Muzaffarpur district, block and distant markets. The feasibility of export of litchi from Muzaffarpur to European markets has taken a new dimension with the fast changing technology in the exporting of fruits since 1993. The study also intended to find out marketing system and marketing channels followed by growers in domestic and overseas as marketing, marketing costs, marketing margin incurred price spread and marketing efficiency resulted in domestic markets. Along with, trend in area, production, productivity, export Four channels of marketing were identified viz, Channel I (Producer –consumer), Channel II (Producer – Retailer – Consumer), Channel III (producer – wholesaler- retailer–consumer) and Channel IV (producer –Commission agent -wholesaler – retailer – consumer). The producer's share in consumer rupee in channel Ist is highest since it is the shortest channel (83.64 percent) where as the producer's share in consumer rupee in channel I, channel II and Channel III are 72.72 percent 65.45 percent and 54.54 percent respectively. The price spread in channel I is the lowest because it is the shortest channel (Rs.900) where as the price spread in channel II, channel III and channel IV are Rs. 1500, 1900, and 2500 respectively. The marketing efficiency for channel I, II, III and IV were 5.11, 2.66, 1.89 and 1.09 respectively. It is observed from this efficiency index that channel I was the most efficient one. This is because of the fact that channel I does not involve intermediary. The growth rate analysis indicated that, the export of litchi from Muzaffarpur and from India increased by 1.64 and 6.34 percent per annum during the period of 2001-02 to 2015-16.

Keywords: Litchi, marketing channels, marketing efficiency, export potential and Muzaffarpur.

PREVAILING INSECT PESTS OF BER (*ZIZYPHUS MAURITIANA* LAMK) UNDER SEMI-ARID CONDITIONS

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The ber (*Zizyphus mauritiana* Lamk), 'Desert Apple' is a major fruit crop extensively cultivated in arid and semi arid regions of Rajasthan, Haryana, Punjab, Gujarat and other parts of India. The fruit is quite nutritious, rich in vitamin C, gaining popularity among the growers because of its adaptability to adverse climatic conditions and good returns in hot arid ecosystem with limited inputs. However the avoidable losses are more due to insect pests and diseases. Ber trees have been reported to be attacked by about 80 species of insect pests. The ber fruit fly, *Carpomyia vesuviana* (Costa) is one of the notorious monophagous pests of ber in India and causes severe yield loss up to 80 per cent. Besides fruit fly, the other insect pests also caused considerable losses to ber plants viz. defoliating beetles, Cow bug (*Oxyrachis* spp.), Fruit borer (*Meridarchis scyroides* Meyr), Hairy caterpillar (*Euproctis lunata*), Metallic shield bug (*Scutellera perplexa* Westwood), Lac Insect (*Kerria lacca*) and Hard gall mite (*Eriophyes cernus*). Different species of defoliating beetles were recorded and they caused 6.0-32.0 per cent infestation on developing foliage of ber during July to August. Cow bug nymphs exuded a honey-dew liquid and sucked cell sap from the plants. The fruit borer infestation was initiated during November as the moths laid eggs on fruits at pea stage and upon hatching the newly emerged caterpillars bored into fruits and feed on the pulp near seed. The hairy caterpillar activity period on ber was from July to September with an average of 1-2 larvae/branch. Metallic shield bug remained active from July to March and caused damage by sucking sap and reducing quality of fruits. Lac insect remained active from February to May and 2.0-4.0 per cent branches per plant were infested.

Keywords: Ber, Insect pests, Fruit fly, Damage

MARKET ARRIVAL AND PRICE BEHAVIOUR OF GINGER IN ASSAM

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In a predominantly agricultural economy like Assam, agricultural commodity prices play an important role. Due to heavy dependence on natural factors, the prices of the farm products fluctuate more than industrial goods. Lack of information on potential market as well as arrival and price behaviour of crops further worsen the situation for crop growers. The present study was an attempt to review the problems by analyzing the variation in arrival and price of ginger in Assam. The secondary data on

market arrivals and wholesale prices of ginger was collected from the database of National Horticultural Board of India. Data was analyzed with a view to compute periods, growth rate and relationship held in between them. The pattern of market arrivals and price behaviour of ginger over the period 2008- 2017 was analyzed in terms of mean value and the coefficient of variation for each month. The correlation coefficient was computed to find the degree of relationship between market arrivals and prices. The results from the study revealed that, the CAGR of ginger is found to be positive in terms of area (0.73%), production (4.19%) and productivity (3.43%) Seasonal variability in arrivals showed that mean arrival was more during the month of October (1224.70q) which may be due to harvesting time of the ginger. The relationship between market arrival and price was found to be negative in some months which may be due to perishable nature of the crop. From the results it can be concluded that with this trend, price forecasting can be done for months which will benefit the farmers to to sale their produce in future at a desirable price. Proper market information and price behaviour will also help to take decision and minimize the marketing risk of farmers.

Keywords: Market arrival, price, ginger, Assam

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

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Income is the most relevant measure to assess farmers' economic well being and sectoral transformation. The crises and distresses plaguing the sector endanger the very livelihoods and welfare of the farmers. Indian Government with the intention giving enough policy thrust on income security, proposed to double the farmers' income by 2022, platinum jubilee year of the Indian independence. The present study analysed the current status of farmers' income across holding size and regions and attempted to decipher the scope and pathways for doubling income through potential drivers. The spatial and temporal trends in farm household income from crop production, livestock farming, wages and non-farm activities have been analysed for better understanding of the present scenario. The study tracked the farmers' household income across regions and holding size between 2003 and 2013 using the country wide situation assessment survey data collected by the National Sample Survey Office (NSSO) and deciphered the scope and potential for doubling the farmers' income (DFI) by 2022. The findings from the NSSO data indicated that the share of income has increased drastically from 5 per cent to 12 per cent in the case of livestock farming, 45 per cent to 48 per cent in crop production, while that of the wages and non-farm have declined between 2003 and 2013. The challenges faced by the farming community in the coming years have been highlighted for devising relevant pathway and strategies to enhance the income. Yield enhancement followed by cost reduction, fair price realisation and risk adaption has been identified as the potential pathway for doubling income. Farmers' income from crop production, livestock farming, wages and non-farm activities is an outcome of synergy and convergence between technology, extension, institutions and policies to achieve the set target. Doubling of farmers' income must be attempted by creating a framework where all related agencies come together and work in harmony, with a maestro conducting that orchestra. In its initial years of reforms started by China between 1978 and 1986, witnessed growth of 14% per annum in farm income. This led to a reduction in poverty by half by generating demand for industrial products in rural areas. Doubling rural income in nominal terms is possible by increasing agriculture output & minimum support prices (while keeping inflation below 5%), doubling rural income in real terms would be a daunting task considering increasing agriculture output by 12% every year with no additional land likely to be utilized for agricultural activity. However, a long term solution remains faster execution of policies that could develop infrastructure to support irrigation system and reduce the dependency on rains. There is every possibility not only to double the income of farmers through enhancement in productivity, changes in cropping pattern, inspire additional income through many supplementary activities but also provide stability in farmers income. There is need to think beyond food security and give our farmers a sense of income security.

CLIMATE CHANGE AND GLOBAL WARMING: POLICIES, PLANING AND MANAGEMENT

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Global climate change, judging from the debate on the subject, is one of the major concerns of the world today. However, the concern of those closely following the debate is that it has created more panic than concrete strategies to abate and adapt to the global change. The situation seems to present a crisis where the uncertainties of predicted global change scenarios combine with the risk averse nature of decision makers to obstruct concrete action and encourage the "wait and see" approach. However, the cumulative nature of warming may not permit the luxury of "wait and see". Hence, there is a need for action, despite the uncertainties of predicted changes; but action requires concrete contexts to facilitate anticipatory measures by the decision makers. In order to resolve the problem, one should look for certainty components in the complex of uncertainties that characterize the whole problem. The paper illustrates this approach with reference to the semi-arid tropical region of India and, to a limited extent,

the Himalayan mountain region. Based on work on sustainable agriculture in fragile resource zones in South Asia, the paper identifies concrete current problems and their possible solutions. The current problems and their remedial measures are linked to the impacts of future climate change in the regional context. Because of such linkages, measures to solve current problems will have the potential to facilitate adaptation to future climatic impacts, without exclusively planning for "uncertain" impacts. Though not a substitute for direct action against global warming, this approach can help insofar as the problem is accentuated by cumulative types of changes such as deforestation and desertification. Its strong point is that it helps to integrate the concerns of current problems with those of the future impacts of global warming, and advocates dual purpose strategies to treat the two without being unduly obstructed by the uncertainties of global change-scenarios. This article reviews the economic impacts of climate change and the policy implications of the results. Current estimates indicate that climate change will likely have a limited impact on the economy and human welfare in the twenty-first century. In fact, the initial impacts of climate change may well be positive. However, in the long run the negative impacts dominate the positive ones. Negative impacts will be substantially greater in poorer, hotter, and lower-lying countries. Poverty reduction complements greenhouse gas emissions reduction as a means to reduce climate change impacts. These strategies can be grouped into four broad categories: land and water protection and management; direct species management; monitoring and planning; and law and policy. Tools for implementing these strategies are similar or identical to those already in use by conservationists worldwide (land and water conservation, ecological restoration, agrienvironment schemes, species translocation, captive propagation, monitoring, natural resource planning, and legislation/regulation). Although our review indicates natural resource managers already have many tools that can be used to address climate-change effects, managers will likely need to apply these tools in novel and innovative ways to meet the unprecedented challenges posed by climate change.

INTERACTIVE EFFECT OF DEFICIT IRRIGATION AND NITROGEN LEVELS ON BROCCOLI YIELD AND GROWTH PARAMETERS

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This study was conducted to determine the interactive effect of deficit irrigation and nitrogen levels on yield and crop growth parameters of broccoli grown in open field condition under trickle irrigation system. Two years research was carried out at Water Technology Centre Farm, IARI, New Delhi during rabi seasons 2016-17 and 2017-18. Experiment was laid out in split plot design method and trickle irrigation system was designed. Three levels of irrigation water and four levels of nitrogen were taken to determine response of broccoli. Broccoli seeds were sown in nursery inside polyhouse and seedlings of 30 DAS were established in the research plots. Depth of irrigation water applied under 50 % and 75 % irrigation strategy was 102 mm and 150 mm respectively in year 2017-18 and 104 and 156 mm respectively in year 2016-17 with full irrigation level of 209 and 204 mm, respectively. Effect of irrigation water regimes on the head yield, sprout yield, head height, head diameter, head weight and water use efficiency were found to be significant. The highest yield was recorded as 29.2 t ha⁻¹ in the year 2017-18. Cost of cultivation was worked out for both years and highest net returns found under full irrigation with highest nitrogen level treatment. Highest and lowest BC ratio found as 4.28 and 2.48 in year 2016-17 and 4.60 and 2.46 in year 2017-18. Statistical analysis revealed that yield and crop growth parameters were significantly influenced by irrigation and nitrogen levels.

Keywords: Broccoli, Evapotranspiration, water use efficiency (WUE), yield and quality parameters, irrigation scheduling, Deficit irrigation, Nitrogen levels

CONSERVATION AGRICULTURE- A POTENTIAL ALTERNATIVE TO SUSTAIN SOIL HEALTH AND CROP PRODUCTIVITY

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Agricultural intensification from intensive tillage based production systems generally had a negative effect on soil, water, biodiversity and the associated ecosystem services provided by nature. This degradation of land resource base has caused crop yields and other factor productivities to decline and has forced farmers and scientists to search for an alternative technology that is

ecologically sustainable as well as profitable. A set of soil-crop-nutrient-water-landscape system management practices known as conservation agriculture has the potential to deliver all of these goals. Conservation agriculture (CA) has steadily increased worldwide to cover about ~8% (124.8 M ha) (FAO, 2012) of the world arable land. In India over the past few years, adoption of zero tillage and CA has expanded to cover about 1.5 million hectares (Jat et al., 2012). The Indo-Gangetic Plains (IGP) of India is an important region for agricultural production and food security contributing to 50% of the total food grain production and supporting food security of more than 40% population. Conservation agriculture demonstrated its potential by promoting soil microbial population and activity as evidenced through microbial biomass, soil respiration, nodulation, BNF, pH, SOC, total nitrogen, porosity, reduced BD, reduction in runoff losses, soil water retention and increased productively. However, the soil improvement benefits and crop productivity of conservation agriculture practices become evident after at least seven years of practice and for some, it can take as long as 16 years.

Key words: conservation agriculture, soil microbial population, sustainable

VARIATION IN THE ESSENTIAL OIL YIELD AND CHEMICAL COMPOSITION OF PALMAROSA OIL UNDER DIFFERENT LOCATION IN SEMI ARID TROPIC REGIONS OF INDIA

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Palmarosa oil is an essential oil bearing aromatic grass, rich in geraniol and geranyl acetate with abundant pharmacological and aroma properties. This study encompasses variation in the essential oil yield and chemical composition of Palmarosa oil under different location. From the data, it is found that Palmarosa grown in RangaReddy district recorded highest herbage yield (3.9 t), oil yield (27.3kg) and oil content (0.7%) and was followed by Yadadri location (3.7t, 22.2 kg, 0.6 % respectively). Similarly, Geraniol content was significantly higher in RangaReddy district (76.1 %) followed by Yadadri district (75.8 %). However, Geranyl acetate content was higher in Nalgonda district (21.7 %) followed by Yadadri district (18.3 %). Whereas, Farnesol was higher in RangaReddy district (3.6 %) followed by Nalgonda district (2.4 %). The sample collected from Yadadri recorded higher linalool content (2.3 %) followed by Nalgonda district (1.8 %). However, Nalgonda district recorded higher Cis Beta ocimene (2.0 %) compared to rest of the places.

REPLANT PROBLEM IN FRUIT CROPS- ISSUES AND CONTROL

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Replant problem refers to the poor growth of replanted fruit trees on old orchard sites and widely distributed throughout the fruit growing areas of the world. The causes of replant problem are many and diverse. Replant problem is caused by biotic and abiotic factors. When the problem is caused by biotic factors, it is referred to as replant disease. Replant disease is one of the components of replant problem. Abiotic factors including phytotoxins, imbalance nutrition, poor soil structure, poor drainage, cold or draught stress and excess or lack of soil moisture contribute to the occurrence of replant problem. Among biotic factors various fungi, bacteria, nematodes and actinomycetes have been reported to be associated with replant disease. Various species of fungi like, *F. solani*, *Rhizoctonia* spp., *Cylindrocladium* spp., *Phytophthora* spp., *Puthium* spp., *Cylindrocarpum* spp., of bacteria like *Pseudomonas* spp. and *Bacillus* spp., and of nematodes like *Pratylenchus penetrans* and *Xiphinema* spp. have been found associated with replant disease. As there is no diagnostic test commercially available, it is wise to assume that an orchard to be replanted has a replant disease problem which needs to be treated. Commercially there are soil sterilants available that are effective against this disease. If it is not desired to use these chemicals then other practices such as fallow, cover crops and other treatments should be considered. It is comparatively easy to prevent the replant problem than to control it because of the fact that its exact etiology (cause) is difficult to understand as it vary from country to country and even region to region.

Keyword: Replant problem, Bacteria, Nematode, soil amendment

A STUDY ON ISOLATION AND CHARACTERIZATION OF BACTERIAL PATHOGENS OF VEGETABLE CROPS

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Pathogenic bacteria cause many serious diseases of vegetables. The studies on the bacterial pathogens based on taxonomy is least reported from North-Eastern region of India. Morphological, cultural, biochemical and molecular characteristics play important role in microbial classification and identification. The present investigation was made to isolate and determine the taxonomic position of the pathogenic bacterial isolates associated with vegetable crops. 18 samples of 7 vegetable crops were collected from farmer's field. Bacterial growth was confirmed in 3 diseased samples, which were then subjected to pathogenicity test in their respective host plants to satisfy the Koch postulates. Bacterial isolates could reproduce the symptoms in their respective hosts, viz.

Carrot (*Daucus carota*), Cabbage (*Brassica oleracea*), and Tomato (*Lycopersicon esculentum*). The three pathogenic bacterial isolates were subjected to morphological, cultural, biochemical and molecular characterization. The phylogenetic tree of the bacterial isolates were constructed to determine the similarity with related strains of respective genera. The bacteria isolated from Carrot, Cabbage and Tomato were confirmed to be *Erwinia carotovora*, *Xanthomonas campestris* and *Ralstonia solanacearum* respectively.

Keywords: Vegetables, Bacteria, Taxonomy, Biochemical characteristics, Molecular characterization, Phylogenetic tree,

QTL MAPPING – AN IMPORTANT TECHNIQUE FOR GENETIC MAPPING

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QTL mapping is a statistical analysis of the alleles (that occur in a locus) and phenotypes (physical form of traits that they produce). QTL mapping includes process of constructing linkage maps and conducting QTL analysis to identify traits associated genomic regions. The main principle is detection of an association between phenotype and genotype of markers. Quantitative Trait Loci (QTL) mapping is considered as a standard procedure for mapping of quantitative traits in quantitative genetics in these days. With the help of QTL mapping, one can determine the relative position of a gene on chromosome or plasmid and an association between phenotype and genotype of markers. Choice of mapping population, used for mapping, depends on many factors as plant species, type of marker system used and the trait to be mapped. Among many mapping populations, Backcross and F_2 populations are the simplest to use. Single-marker analysis, interval mapping by maximum likelihood, interval mapping by regression and composite interval mapping are some of widely used methods for detecting QTL.

GENETIC DIVERSITY ASSESSMENT OF PEARL MILLET MAINTAINER LINES

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Pearl millet [*Pennisetum glaucum* (L.) R. Br.] is a multipurpose cereal belonging to the family Poaceae and primarily grown for grain on more than 26 million ha in the arid and semi-arid tropical regions of Asia and Africa. The present investigation was carried out by taking 48 maintainer genotypes of pearl millet developed at CCSHAU, Hisar and of these, 29 belonged to A_1 , 11 to A_4 , six to A_3 , two each to A_2 and DSA and one to A_{egg} sterile cytoplasm. The material was evaluated in a Randomized Block Design (RBD) with three replications in Kharif season of 2014 and D^2 values were calculated as suggested by Mahalanobis, 1936. On the basis of 13 quantitative characters, the 48 maintainer lines were grouped into 7 clusters in such a way that lines within each cluster had smaller D^2 value than those between clusters. Cluster pattern revealed that cluster 2 and cluster 4 had highest number of genotypes (10 each) followed by cluster 1 and cluster 3 (9 each). Maximum intra-cluster difference among the maintainer lines within the same cluster was shown by cluster 7 (4.498). Clusters 1 and 7 showed maximum inter-cluster distance of (7.421) whereas the lowest inter-cluster distance was recorded between clusters 2 and 3 (3.742). The cluster means for the thirteen quantitative characters in pearl millet maintainer lines revealed considerable differences among all the clusters. For days to 50% flowering, highest mean value possessed by cluster 4 (49) and lowest mean value by cluster 1 (42). Spike length was the highest in cluster 7 (27.5) and lowest in cluster 1 (15.0). For spike girth, cluster 4 (2.39) divulged the highest mean value and cluster 6 (1.52) divulged the lowest mean value. Cluster 5 (3.52) also revealed the highest mean value for number of productive tillers/plant, whereas, cluster 1 had the lowest mean value (1.38). The crosses between the genotypes belonging to distantly located clusters are likely to produce good transgressive segregants and genotypes with higher mean values in a trait(s) can be used in crossing program to develop promising maintainer lines.

ROLE OF DAIRY COOPERATIVES IN EMPOWERMENT OF WOMEN IN INDIA

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A cooperative is an autonomous association of women and men, united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. Throughout the changes of history, women have collectively struggled against direct and indirect barriers to their self-development and their full social, economic and political participation. If women have equal access to productive resources, agriculture productivity of developing countries can increase by 2.5- 4 percent and can reduce number of undernourished people in the world by 12-17 percent (The State of Food and Agriculture, 2011: FAO). Women empowerment is the important factor for the uniform growth of a nation. Village dairy cooperative societies provide an important mechanism to connect these dispersed producers to the national dairy value chain and contribute to food security. In India, women typically perform most of the dairy-related production activities. Therefore, dairy cooperatives have a potential to benefit especially rural women and provide them with independent incomes and employment. It enabled them to interact with government and civil officials at various levels to market their products. They are determined to help

their villages grow and are the torch bearers of the change being brought about in the lives of other underprivileged rural women. As per a government press release, about 70 million rural households are engaged in dairying in India with 80% of total cow population. The strength of women in Dairy has reached to the 70% of the total work force (about 44 lakh) of which 3,60,000 women are in leadership roles in village dairy cooperatives and 380 women on the boards of Union and State Federations. Women engaged in cooperative activities were better off, in terms of productivity and economic wellbeing.

Keywords: Women, Empowerment And Dairy Cooperatives

PROTECTED CULTIVATION –AN ECO-FRIENDLY AND SUSTAINABLE APPROACH FOR MODERN AGRICULTURE

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Protected cultivation includes the techniques by which crop can be protected from factors which causes loss in yield both in terms of quantity and quality, by which per unit area production can be increased with premium quality produce. Unlike traditional agriculture, this technology opened all the doors of success for rural, semi urban and even urban youth with ample scope of employment and improves socio economic standards. Hundreds of farmers are leaving agriculture every day in our country and this is big challenge to retain farmers and increase the interest of youth towards agriculture. In this direction protected cultivation of vegetable crops is best entrepreneurship for modern agriculture, further increasing population and shrinking land is became a very big challenge for present agriculture scenario as we have to increase the production of agriculture from available land and limited resources. To bridge the gap of production, increasing productivity is only available option. There are several factors which affect productivity and important ones are varietal improvement, integrated nutrient management, integrated disease management, integrated pest management and standard package and practices which have already been explored and drastic changes will not be possible by these means for increasing production. Now increased productivity can be achieved only through controlling biotic and abiotic stresses. environmental factors viz. temperature and humidity and protect the crops from extreme climatic condition by providing congenial and favourable environment, potential yield can be taken, further seasonal variation and biotic factors are major causes of low production specially in case of vegetables, hence protected cultivation of vegetable can be a mile stone in olericulture, vegetables being a highly perishable commodity, its prices fluctuate with very high range. In main growing season prices of vegetables are remain literally on the ground, where even cost of production cannot covered, while in case of off season prices of vegetables are used to range on very high side, even 8-10 times more as compare to normal growing season. For getting higher prices of vegetable, farmers have to grow crops during off season, but due to specific requirement of environmental factors, cultivation of vegetable is not an easy job without protected structures, further vegetable belongs to either warm season or winter season and in Northern Indian condition, classical sub tropical condition, hence extreme low temperature in summer and high temperature prevails in summer season. Under such condition off season vegetables cultivation is not possible in open field cultivation.

IMPACT OF RISING TEMPERATURE ON THE FARMERS WORKING OUTDOOR

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India is primarily an agrarian economy as farming is one of the most important occupations in the country. It is generally perceived as a healthy outdoor occupation. However numbers of studies have classified farming as a risky and hazardous job because of the nature of farm work. Farm workers are particularly at higher risk of developing health problems. The drastic change in the world wide climate has created too much problems among farmers. Most of farm operations are still accomplished manually under direct heat of sun. These factors, makes farm operation quite dangerous. The exposure of farm workers to hot occupational environment remains a persistent impediment to improve productivity and problems affecting the health of the workers. The study was undertaken to find out the health problems experienced by farmers and to design, develop and disseminate PPE to safe guard the farmers from the impact of excessive heat. Heat disorders occur most often when heavy physical work is done in hot, humid environments and when the body consequently loses too much fluid and salt resulting in heat cramp, heat exhaustion, heat syncope etc,. Prevalence of the above factors is more common among the farm workers due to unawareness and lack of knowledge about associated heat exposure risks, resulting in poor adaption of preventive and protective measures. While disseminating the PPE, the acceptability among the farm workers was reported to be very high.

Keywords: Heat, climate change, Farmers.

PERFORMANCE OF NEW GLADIOLUS CULTIVARS UNDER THE GANGETIC PLATEAU OF WEST BENGAL CONDITIONS

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An experiment was conducted to assess the performance of gladiolus cultivars at the Horticultural Research Station, Moundori farm, Bidhan Chandra Krishi Viswavidyalaya, where was nine cultivars tested during two consequential year 2016-2017 and 2017-2018 under AICRP programme in West Bengal. Among the new cultivars tested, AC.No.7 and Punjab Glad-1 may be recommended for quality spike production along with Pusa Kiran, Pusa Subham, Yellow enterprise and Candy Man.

Keywords: Cultivar, Flowering duration, Gladiolus, Spike length, Vase life, corms and cormels.

A STUDY ON FISHERIES SECTOR IN NORTH EAST INDIA WITH SPECIAL REFERENCES TO MEGHALAYA

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North east India is considered as one of the hot spot of fresh water biodiversity in India which is blessed with copious water resources like ponds , reservoirs , lakes etc , fisheries sector in North East Hill Region India holds an important positions in socio economic and cultural contest of the people in this region, the annual growth rate of fish has been showing an positive trend and it is a vertebrate which influences the man in many ways , there are different types of aqua culture practices which are followed in different states of north east India by using different tools like descriptive analysis , tabular analysis , lin –log regression model and compound growth rate and triennium average. The objectives are to 1. To study the compound annual growth rate and trends of fish production in north east. 2. case study on a success story of a farmer under aqua culture mission 2.0 . among the different states of north east India, the production of fish is showing increasing trends Assam is showing highest fish production followed by Tripura , followed by Manipur , Mizoram , Nagaland , Meghalaya , Arunachal Pradesh , Sikkim . Tripura is showing the compound annual growth rate of 65.39% followed by 10.6% of Sikkim and Arunachal Pradesh is showing 4.67% and 4.29% of Assam 4.29% of Mizoram 3.37 % of Nagaland and Manipur is showing 4.67% of annual growth rate , Meghalaya is contributing 1% of annual growth rate before introducing aqua mission but now it is showing a positive trend in area and production with the annual growth rate of 5% . the percapita consumption is 5kg , the fish production is 11.34 '000 tonnes during 2016-17 but it is showing decreasing trends from 2018 because of the lack of knowledge on practices in fishing many of the farmers are facing challenges , marketing of fish also a major aspect which is taken into consideration . However to enhance the fish production in these area needs more pressure on water bodies which might be a threat

Keywords: Fish Production, CAGR% , trends in fish production , resources , aqua mission 2.0

STUDIES ON EFFICACY OF LOW DOSE OF CLOPROSTENOL THROUGH INTRAVULVO-SUB-MUCOSAL (IVSM) ROUTE ON ESTRUS INDUCTION AND CONCEPTION IN BUFFALOES

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A total 45 graded Murrah buffaloes that were selected for present study. The buffaloes included in this study had history of no visible sign of heat, but diagnosed as sub-estrus by per-rectum examination with palpable corpora lutea. The experimental animals were divided into two groups. Group 1 included 35 pluriparous buffaloes treated with 100 µg of cloprostenol (synthetic analogue of PGF₂ alpha, 0.4 ml, Pragna) through ISVM ipsilateral to the ovary containing corpus luteum. All the treated animals underwent fixed time insemination 72 and 96 hours after cloprostenol administration. Group 2 consisted of 10 buffaloes maintained under similar management condition without any treatment as control. The treatment response was assessed on the basis of estrus induction and pregnancy confirmed per-rectum 55-60 day post insemination. The percentage of animals that showed estrus response were 82.85 % (29/ 35) and 10 % (1/ 10) in group 1 and group 2, respectively. The estrus responses in group 1 buffaloes were intense, normal and weak in 27.58 % (8 / 29), 51.72 % (15/ 29) and 20.68 % (6/ 29) animals, respectively. However, control group of animals showed only normal heat signs. The conception rate in group 1 buffaloes was 100 (8/ 8), 53.33 (8/ 15) and 0 % (0/ 6) in intense, normal and weak estrus sign groups, respectively, with an overall conception rate of 55.17 % (16/ 29). In the group 2 (untreated, control) none of the animal conceived.

Keywords: Buffaloes, cloprostenol, conception, estrus induction

HORN CANCER IN BULLOCKS AND ITS SURGICAL MANAGEMENT**K.P.SINGH*, R.V SINGH, PRANEETA SINGH NIDHI ARORA AND RIAZ AHMED****Veterinary Officer, Government Veterinary Hospital Deoranian, Bareilly,
Department of Animal Husbandry, Uttar Pradesh**

The present study was conducted to evaluate the surgical correction of horn cancer with antineoplastic drug vincristin sulphate. Three bullocks of 7 to 9 years of age were presented to Government veterinary Hospital, Anand Nagar Bhitari, Faizabad with the history of previous trauma to broken horn followed by gradual swelling and bending of horn, cauliflower like growth at broken end and with foul smelling, purulent discharge from the base of affected horn. On clinical examination of the affected horn, there were pink soft cauliflowers like growths which were friable and bleed easily. All the affected animals were kept off feed for 24 hours prior to surgery. The surgical site was prepared for aseptic surgery. After aseptic preparation of site Xylazine @ 0.1 mg / Kg body weight was administered as a sedative followed by 8-10 ml of 2% Lignocaine hydrochloride was infiltrated in a fan pattern to desensitize the cornual nerve. After achieving of cornual nerve block and adequate analgesia dehorning was done by flap method as per standard surgical procedures described by Kumar (2005). Post operative treatment included administration of injection ceftriaxone (20 mg / Kg body weight, IM), injection meloxicam (0.5 mg / Kg body weight, IM), injection B₁, B₆ and B₁₂ (10 ml, IM) for 5 days, injection Revici (10 ml, IM) for 1 day and injection Vincristin sulphate (0.025 mg / Kg, intravenously) four doses at the interval of 7 days. Antiseptic dressing of suture line was performed with 0.1 % povidone iodine solution. The skin sutures were removed on 13th day post operation. The recovery was uncomplicated in all the cases.

PERSPECTIVES OF PLANT GROWTH PROMOTING RHIZOBACTERIA (PGPR) IN GROWTH ENHANCEMENT AND SUSTAINABLE PRODUCTION OF VEGETABLES**KAILASH CHAND KUMAWAT¹, SHARON NAGPAL¹, POONAM SHARMA² AND KUNAL³**¹Department of Microbiology, Punjab Agricultural University, Ludhiana 141004,²Department of Plant Breeding & Genetics, Punjab Agricultural University, Ludhiana 141004³Department of Soil Science, Punjab Agricultural University, Ludhiana 141004

Vegetables are one of the most important components of human foods since they provide vitamins, protein, carbohydrates, antioxidants and several other important dietary constituents required for human health. The indiscriminate use of agro-chemicals in agriculture to increase vegetables production, kill pathogens, pests and weeds have a big harmful impact on the ecosystem and soil health. Due to the decreasing soil health, major emphasis has been given to organic farming and application of microbial formulations for improving vegetables production with concomitant decrease in application of inorganic fertilizers. So, there is an urgent need of biological agent is accepted for sustainable agriculture and ecosystem stability worldwide. Past research documented the use of root associated microbial communities especially Plant Growth Promoting Rhizobacteria (PGPR) to improving in plant growth, productivity and suppression disease as of particular attention. The use of PGPR has been proven to be an environmentally sound way of increasing vegetables production by facilitating plant growth through either a direct or indirect mechanism. The mechanisms of PGPR includes i.e. regulating hormonal and nutritional balance, heavy metal detoxifying, pesticide degradation, salinity tolerance, resistance against pathogen besides the normal plant growth promoting properties such as phytohormone, siderophore, 1-aminocyclopropane-1- carboxylase, hydrogen cyanide, ammonia production, cell wall degrading enzymes, phosphate and zinc solubilization for easy uptake nutrients by crop plant. In addition, PGPR show antagonistic and synergistic interaction with micro-organisms with the rhizosphere and beyond in bulk soil, which indirectly enhance plant growth under stress conditions. Some of the notable PGPR capable of facilitating the plant growth of a varied range of vegetables such as potato, carrot, onion etc. belong to different genera viz. *Azotobacter*, *Azospirillum*, *Pseudomonas*, *Bacillus* and *Burkholderia* etc. The plant beneficial rhizobacteria may decrease the global dependence on hazardous agricultural chemicals which destabilize the agro-ecosystems during vegetables production.

Key word: Agrochemicals, Bio-control, IAA production, PGPR, P-solubilization and Siderophore**INVASIVE INSECT PEST SCENARIO IN INDIA: A THREAT TO BIODIVERSITY****KALPANA BISHT*, N.N. SINGH AND S.V.S RAJU****Department of Entomology and Agricultural Zoology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, 221005 (Uttar Pradesh), India**

Invasive insect species are non-native or exotic that occurs outside their natural adapted habitat and dispersal potential. Although invasive alien species have been identified as the second greatest threat to biodiversity after habitat loss, characterizing and quantifying their impacts on native species and habitats remains a fundamental problem in the conservation biology. These species are causing enormous damage to biodiversity and the valuable natural agricultural systems upon which we depend. Direct and indirect health effects are increasingly serious and the damage to nature and environment is often irreversible. The impact of invasion of insect pests can be minimized with international cooperation through exchange of information on invasive pests and

their natural enemies. The interdisciplinary coordinated work among researchers help in identifying and assessing their ecological problems.

Key words: Invasive insects, Environmental degradation, Biodiversity

FRUIT DIVERSITY FOR LIVELIHOOD AND FOOD SECURITY IN RURAL AREAS OF CHHATTISGARH

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A number of fruit plants, used by rural and tribal populations and contributing significantly to their livelihood and food security have escaped recognition and scientific inquiry. Their conservation in backyards and optimal use ensure food and nutritional security as fruit crop are rich in nutrition, vitamins and having medicinal value. A single fruit crop may not provide benefit to the household and grower due to uncertainty of climatic condition but combination of many fruit crops can provide benefit and ensure food security to the grower if one or two fruit crops fail. The growing and many fruit crops and vegetable are unique feature of rural areas in Chhattisgarh, India. Generally, kitchen garden or backyards encompasses many fruit crops such as Mango, Papaya, Citrus, Guava, Sapota, Jackfruit, litchi, Ber, Aonla etc and they are rich in nutrition. Mango fruit contains highest vitamin-A (4800 IU) followed by Papaya (2020 IU). Citrus fruit (sour orange) is richest source of citric acid (1.5-3%) and guava is rich in source of vitamins-C (260-300mg/100g) and contains highest fibre 6.9%, Sapota fruit contains 12-14 % sugar, Jackfruit rich in B-carotene 500-530 IU/100g. Litchi is rich in vitamin- C 40-90mg/100 g and Ber fruits are higher in calorific value. Aonla is very rich in vitamin-C (600mg/100g) with maximum in mature fruits. These fruit crops are important source of income in rural areas and ensure food security. The proper management of fruit diversity in backyards may improve the life standards in rural areas.

Key Words: Fruit, Diversity, Food, Nutrition, Backyards

INVASIVE PEST SPECIES: A MAJOR THREAT TO INDIAN AGRICULTURE AND BIODIVERSITY

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The agricultural economy in India is vulnerable to threat from many potential bio weapons mainly invasive pest species. Invasive pest species are exotic, introduced, foreign, non-indigenous or nonnative is one that has been introduced by humans intentionally or otherwise through human agency or accidentally from one region to another. Invasive pest species have potential to rapidly established and spread in a new area cause major crop loss and can adversely affect food security. The spread of Invasive pest species is now recognized as one of the greatest threats to the biodiversity and economic well being of the country. The numbers of invasive insect pests species are introduced in India last 20th and 21st century by unintentionally or accidentally and they have greater impact on agriculture crop production as well as Indian economy. The introduction of new pest species in a new area minimized by the basic knowledge of invasive pest species with international cooperation through exchange of information on invasive pests and their natural enemies. There is a need for interdisciplinary coordinated work among scientists, in identifying invaded organisms and in assessing their ecological problems, environmental concerns in different ecosystems, economic damage and sustainable management by prevention, eradication and control.

Keyword: Invasive pest species, Biodiversity, Agriculture, Indian economy.

RESILIENCE TO DROUGHT THROUGH ADOPTING NUTRIENT MANAGEMENT PRACTICE

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Drought is the most deleterious environmental factor affecting the crop plants right from seed germination up to maturity which result in low yield worldwide. Water deficit stress affects the morphological as well as physiological process of crop. The occurrence drought during critical stage of growth, severely affects the growth and yield of the crop like destroying the chlorophyll and other pigment, lowers stomatal conductance etc. Some important management strategies for drought mitigation include the application of fertilizer applied in split doses which is found to be beneficial then a single application. Soil and foliar application of nutrient has significant effect on the yield components since its efficiency of assimilation is increased by manifold. Adopting suitable method of planting and tillage practice improves the soil physical condition which enhances the root growth, and easily establishment of crop. Mulching of leguminous crop is highly effective to prevent evaporation and runoff, being the dominant loss components in most dryland ecosystems and add nutrient to crop. Biochar, the product of pyrolysis of biomass, increased the plant

growth, biomass, and yield under either drought and/or salt stress and also increased photosynthesis, nutrient uptake, and modified gas exchange characteristics in drought and salt-stressed plants. Biochar-mediated increase in salt tolerance of plants is primarily associated with improvement in soil properties, thus increasing plant water status, reduction of Na⁺ uptake, increasing uptake of minerals, and regulation of stomatal conductance and phytohormones.

Key Word: Nutrient Management, Strategies, Biochar, Drought mitigation, Mulching.

ORGANIC FARMING IN DEVELOPING COUNTRIES: NEED OF THE HOUR

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Agriculture is the major occupation in developing countries. Particularly in India and Nepal, agriculture contributes about 17% and 32% of total GDP, respectively. The traditional way of farming using low inputs provides opportunities to adopt organic farming for diversified crops for improving livelihood of marginalized farmers of mid-western hill of India and Nepal, with potential domestic markets and exports markets in Japan and Europe. Furthermore, farmers in both developing countries are small landholders (less than 0.5 ha, mostly hill farmers in India) hence provide opportune for organic farming. Sikkim in India is already tagged as organic state, while Kathmandu in Nepal is gaining popularity for its organic products. Farmers' are already working in partnership with organizations like Organic World and Kheti bazaar for promotion of their organic products. In India non-Government Organizations (NGOs) like AME, and OFAI, producer organizations like VDAI, TOFA, VOFA, and Eco-farms, and certification bodies like Indocert, Ecocert, SKAL, and APOF and bodies like National Organic Agriculture Accreditation body (NOAAB) and the National Coordination Committee for Organic Agriculture Production and Processing System (NCCOAPPS) are also actively engaged in promotion of organic agriculture. Thus we can conclude that organic farming is gaining importance in the hilly areas of developing countries on the account of smallholdings and better prices in the market. Still there is an urgent need to promote this venture to the plain areas also to counter the adverse effects of chemical use and climate change.

Keywords: climate change, farmer, organic, sustainable

TO STUDY THE BIOLOGY OF EARLY SHOOT BORER, *CHILO INFUSCATELLUS* SNELLEN ON SUGARCANE, *SACCHARUM OFFICINARUM* L.

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Biological studies of early shoot borer, *Chilo infuscatellus* Snellen (Crambidae; Lepidoptera) were conducted during March, 2017 to July, 2017 in laboratories of CCS Haryana Agricultural University, Regional Research Station, Karnal on sugarcane genotype CoH 119. Results on biology of *C. infuscatellus* revealed that freshly laid eggs were creamy white, transparent initially, later on turn to yellowish in colour with pin head size spot and chorion colourless and transparent. Incubation period varied from 3 to 5 days. The larvae of *C. infuscatellus* moulted four times and passed through five instars. Total larval duration of *C. infuscatellus* ranged from 18 to 26 days with an average of 22.31±1.16 days. The pupal duration of *C. infuscatellus* male varied from 4 to 5 days and duration of female pupae ranged from 4 to 6 days. The genital aperture was situated on the ventral side of eighth abdominal segment in the form of slit in female pupae. In male pupae, the genital aperture was situated on the raised oval sclerite with linear depression in the middle of ninth abdominal segment. Female pupae were slightly bigger in size than male pupae. Moths of *C. infuscatellus* were light straw to brownish straw in colour. Longevity of male moths ranged from 3 to 4 days with an average of 3.24 days whereas longevity of females varied from 3 to 5 days with an average of 4.07 days. The total life span of *Chilo infuscatellus* ranged from 29 to 42 days for male and 29 to 44 days for female.

Keywords: Biology, *Chilo infuscatellus* and sugarcane

EFFECT OF FOLIAR APPLICATION OF WATER SOLUBLE FERTILIZERS ON GROWTH AND YIELD OF CHICKPEA (*Cicer arietinum* L.)

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A field experiment entitled "Effect of foliar application of water soluble fertilizers on growth and yield of chickpea (*Cicer arietinum* L.)" was carried out at Experimental Farm, Department of Agriculture, Mata Gujri College, Fatehgarh Sahib at Shamsher Nagar during Rabi season of 2017-18. The soil was clay loam in texture with high organic carbon and medium in available N, P and K. The experiment was laid out in a randomized block design with three replications having eleven treatments viz., T₁ - Control, T₂ - 100 % RDF, T₃ - 75 % RDF + FA of 2 % DAP at 60 & 80 DAS, T₄ - 75 % RDF + FA of 2 % Urea at 60 & 80 DAS, T₅ - 75 % RDF + FA of 2 % WSF at 60 & 80 DAS, T₆ - 50 % RDF + FA of 2 % DAP at 60 & 80 DAS, T₇ - 50 % RDF + FA of 2 % Urea at 60 & 80 DAS, T₈ - 50 % RDF + FA of 2 % WSF at 60 & 80 DAS, T₉ - 75 % RDF + FA of 2 % DAP + 2 % Urea at 60 & 80 DAS, T₁₀ - 75 % RDF + FA of 2 % DAP + 2 % Urea + 2 % WSF at 60 & 80 DAS, T₁₁ - 50 % RDF + FA of 2 %

DAP + 2 % Urea + 2 % WSF at 60 & 80 DAS. The results revealed that higher growth parameters viz., plant height, number of branches and dry matter accumulation were recorded under T₁₀ which was at par with T₅ and T₁₁ and it was significantly superior over the other treatments at all stages except 30 DAS. Further, seed yield, stover yield and uptake of major nutrients (NPK) were higher under T₁₀ which was at par with T₅ and T₁₁. The maximum net return (66160.06 ₹ ha⁻¹) and B:C ratio (1.53) was recorded under T₁₀ while minimum under T₁.

EFFECT OF EDIBLE COMPOSITE COATINGS ON POST-HARVEST ANTIOXIDANT PROPERTIES OF GUAVA (*PSIDIUM GUAJAVA* L.) CV. SARDAR UNDER TARAI REGION

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The present investigation was undertaken in the Postharvest Laboratory of the Department of Horticulture, College of Agriculture, G.B.P.U.A&T, Pantnagar (Uttarakhand), India. The experiment was carried out under ambient conditions 21-25°C at 91% R.H in winter seasons guava, 2017-2018 consisting of sixteen coating treatments including olive oil, *Aloe vera*, xanthum gum, sodium alginate and CMC (Carboxymethyl Cellulose) with three replications for studying the antioxidant properties of guava. Data on various changing factors were depicted up to 15th day of storage during 0, 3, 6, 9, 12, 15 days. The experiment was conducted in Two Factorial Completely Randomized Design. The main aim of present experiment was to study the effect of different composite coatings on antioxidant properties of guava fruits at different storage periods. The parameters like total flavonoids content, Total antioxidant activity, total phenolic content were retained maximum in (T₃) olive oil + texture enhancer 0.5% (calcium gluconate) + antioxidant 0.1% (ascorbic acid) + sodium benzoate 0.1%. The enzymatic activity like polyphenoloxidase (PPO) and superoxide dismutase (SOD) were recorded maximum (T₃) followed by (T₂) olive oil + texture enhancer 0.5% (calcium gluconate) + antioxidant 0.1% (ascorbic acid) and (T₁₂) sodium alginate coatings. From overall observation it was concluded that the application of olive oil composite coatings followed by sodium alginate coatings as dip treatment slow down fruit ripening and maintained the quality of the fruit by retaining the antioxidant properties and scavenging the free radicals activity.

VERTICAL FARMING: FUTURE FARMING

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Traditional farming is taking a huge toll on the environmental problem that's set to worsen due to our ever-growing global population. Yet there are some high-tech solutions. Here's what you need to know about the burgeoning practice of controlled-environment agriculture and how it's set to change everything from the food we eat to the communities we live in. As a solution, an increasing number of horticulturalists and entrepreneurs are returning to controlled environment agriculture (CEA), and the related practice of vertical farming. While not a total panacea, these high-tech farms are doing much to address many of the problems associated with conventional farming practices. Vertical farming is the practice of producing food and medicine in vertically stacked layers, vertically in inclined surfaces and/or integrated in other structures (such as in a skyscraper, used warehouse, or shipping container). The modern ideas of vertical farming use indoor farming techniques and controlled-environment agriculture (CEA) technology, where all environmental factors can be controlled. These facilities utilize artificial control of light, environmental control (humidity, temperature, gases) and fertigation. Some vertical farms use techniques similar to greenhouses, where natural sunlight can be augmented with artificial lighting and metal reflectors. Vertical farms can help meet our growing population's needs by offering an additional way to produce food that does not share the same volatility and risk as conventional agriculture. While vertical farms require less water and arable land than conventional farms, they are not carbon neutral. Their climate footprint depends heavily on the source from which they draw their electricity to power lighting and control the indoor environment. As renewable energy sources become adopted more widely, the carbon cost of vertical farming will continue decreasing. From a market perspective, it may not bring down prices, but on a societal level, the hope is that vertical farming can help address gaps in overall food demand where conventional agriculture fails.

Keywords: Vertical Farming, Conventional Farming, CEA (controlled-environment agriculture), Fertigation

FEEDING AND MANAGEMENT OF NEONATES IN BOVINE

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Management and feeding of calves is an important investment in the future productivity of a daily herd. Calf feeding is aimed at providing required nutrient and encouraging rumen development. Colostrum is the single most important factor in determining health and survival of neonatal calf. Colostrum is a nutrient rich fluid which contains substances like immunoglobulins, lactoferrin, cytokines and vitamins. The specific gravity of colostrum, traditional milk and milk and found that the colostrum has highest specific gravity which is 1.056. Bovine colostrum imparts passive immunity to new born calves during the first 24 hours of life and generally is being fed for the first three days after birth. Surplus colostrum is unmarketable and available in quantities

sufficient to feed heifer calves through 28-35 days of age. During storage at ambient temperatures, pH decreases as acidity increases and total solids, protein, fat and lactose contents of colostrum decrease. The high quality colostrum should contain IgG > 50 g/l and it should be fed two times within 12 hours. New born animal is immune-incompetent and dependent upon timely absorption of colostrum. Apart from supply of high quality nutrients and immunoglobulins, colostrum also provides a number of hormones and growth factors necessary to stimulate growth and development of digestive tracts and other organ systems. The calf can be measured on the basis of serum IgG and an optimal IgG should be greater than 10 g/l. The two most important factors affecting the amount of IgG absorbed from colostrum are the time of first feeding and the amount of IgG consumed. Failure of passive transfer (FPT) occurs when the acceptable level of IgG or total proteins are not achieved by 24-48 hours after birth. In order to prevent mortality of calf there must be proper management and feeding of colostrum should be done as per standard and proper time. A surge in interest in calf management practices in the past 10 years has highlighted the importance of colostrum, sanitation, adequate nutrition and ventilation.

Key words: Colostrum, Immunoglobulins, Specific gravity, Failure passive transfer

SHARE OF AGRICULTURAL EXPORT AND IMPORT TO AGRICULTURAL GROSS DOMESTIC PRODUCT

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The present study was conducted to evaluate the impact of WTO on agricultural trade in India. The data was secondary in nature and collected from the different published sources like FAO trade yearbook, Handbook of RBI, World Bank and Niti aayog. The whole study period was divided into two groups Pre-WTO (1975-1995) and Post-WTO (1996-2016). The results showed that with the decline in the agriculture share to GDP i.e. 37.15 % (1975) to 25.36 % (1995), both the agricultural exports and imports share's to GDP and agricultural GDP were also declined. Highest and lowest agricultural export ratio to agricultural domestic product was recorded for the years 1995 & 1988 (6.05% & 2.53% respectively). Similarly the highest and lowest ratio of agricultural export to GDP was observed in the year 1976 (1.76%) and 1988 (0.74%), respectively. In case of agricultural imports to agricultural GDP and GDP, it was found to be lowest in year 1991 i.e. (0.93 % & 0.26 %, respectively). The share of India's agricultural exports in the total GDP was 1.55 % in the year 1996 after that it continuously declined till 2016 (1.17%), except the years 2012 (2.05%) and 2013 (2.20%). Similarly, the share of agricultural imports in the total GDP was 0.6 %, which increased to 1.06 % in 2016. The Post-WTO period showed increase in ratio of export as well as ratio of imports to AGDP & GDP. This showed that WTO has mixed impact on agricultural trade even after declined share of agricultural GDP.

Key words: World Trade Organization, Agricultural trade, Agricultural gross domestic product

EVALUATION OF ACTINOMYCETES FOR PLANT GROWTH PROMOTING AND BIOCONTROL ATTRIBUTES IN CHICKPEA (*CICER ARIETINUM* L.)

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Chickpea is grown globally on a very wide area of agricultural land. Asia accounts for 88% of global chickpea production whereas India is the largest producer accounting for 75% of Asia's chickpea production. However, global yields of chickpea have been relatively stagnant for the last two decades due to unpredictable climatic changes, incidence of diseases and application of inappropriate dosage of chemical fertilizers and pesticides. The microbes in rhizosphere help in plant growth-promotion and yield. Actinomycetes are one of the major components of rhizosphere microbial population and are useful in soil nutrient cycling as well as plant growth-promotion (PGP). Since last few years, studies on agricultural traits of actinomycetes regarding their use for plant growth promotion and biocontrol activities had opened new avenues for their applications in sustainable agriculture. In the present investigation, total 40 (AK1-AK40) actinomycete isolates were retrieved from different soil samples and chickpea nodules collected from CCS Haryana Agricultural University farms. All the isolates were assessed for different plant growth promoting (PGP) traits including IAA production and P solubilization. The IAA production varied in the range of 1.53-20.09 µg ml⁻¹ among different actinomycete isolates. Isolate AK34 was producing comparatively high amount of IAA (20.09 µg ml⁻¹) followed by AK20 (13.47 µg ml⁻¹). Total 47.5% actinomycete isolates were showing P-solubilization indices (P-SI) ranging between 2.17 to 3.42. Isolate AK37 was giving comparatively high P-SI (3.42) followed by AK3 (2.78), AK11 and AK34 (2.70 each). After assessing other PGP traits including biocontrol potential, actinomycetes can be proposed as promising candidates for integrated nutrient and disease management in sustainable agriculture for eco-friendly environment.

PHYSIOLOGICAL ATTRIBUTES OF SOME INDIAN MUSTARD (*BRASSICA JUNCEA*) GENOTYPES SCREENED FOR DROUGHT TOLERANCE IN BIHAR STATE, INDIA

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Drought, like many other environmental stresses, has adverse effects on crop yield. As water resources for agronomic uses become more limiting, the development of drought tolerant lines become increasingly more important. A field experiment was conducted to screen mustard genotypes for drought tolerance during 2017-2018. Nineteen genotypes were sown in a factorial randomized block design in plot size of 1.5m x 2.5m with three replications. Different physiological parameters related to drought tolerance viz, membrane stability index (MSI %), relative water content (RWC %), chlorophyll content (SPAD value), canopy temperature and yield (q/ha) were studied under drought and irrigated (control) conditions. The results revealed that there were statistically significant differences among the genotypes with respect to all the parameters tested. The values of MSI (%), RWC (%), SPAD and seed yield (g plot⁻¹) in different genotypes ranged from 62.9 to 78.2, 68.0 to 89.8, 30.2 to 48.1 and 365 to 620 under drought as compared to 71.0 to 82.9, 76.3 to 92.9, 35.6 to 50.8 and 425 to 680 under control conditions respectively. Genotypes LES 56, LES 57 and NPJ 210 maintained higher values of MSI (%), RWC (%), SPAD and seed yield (g plot⁻¹) under control and stress conditions. Less than 10% reduction in these parameters under drought as compared to control was recorded in these genotypes. Higher canopy temperature (°C) was recorded in drought condition ranging from 20.2 to 30.2 over control (19.5 to 24.2). Drought susceptibility index ranged from 0.69 to 1.28 and minimum value was recorded in NPJ 210 followed by LES 56. It was apparent that drought stress through disrupting the plant photosynthesis, decreased assimilates synthesis which is necessary for seed filling, and consequently it resulted in seed shrinkage and weight loss. The study revealed that genotypes LES 56, LES 57 and NPJ 210 had tolerance to drought conditions.

DECISION MAKING PATTERN OF FARM MEN AND WOMEN IN PADDY CULTIVATION TO ACHIEVE SUSTAINABLE AGRICULTURAL PRODUCTION

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Paddy is the staple food for two-thirds of the Indian population. India ranks second in the world next to China by producing 155.62 million metric tonnes from an area of 43.20 million ha. It accounts for 20 per cent of the total production in the world. "Our society thinks that men alone are farmers". But in reality women share abundant responsibilities and perform a wide spectrum of activities of household as well as farm hold. Food and Agriculture Organization estimates that "women produce between 60 and 80 per cent of the food in most of the developing countries and are responsible for half of the world's food production". In spite of the participation of farm women, their involvement in decision making in paddy cultivation activities are very meagre. This paper throws light on the Decision making pattern of farm men and women in paddy cultivation activities. A total of 120 respondents constituted the sample for the study from three talukas of Shivamogga district of Karnataka state having the highest area under paddy cultivation. Data were collected by personal interview method from an equal number of male and female members from the paddy growing family. Majority of farm men (60.00 %) and farm women (50.00 %) belonged to medium level decision making category. Age, Achievement motivation, Extension participation and farming experience are significant with decision making pattern of men. Likewise, Age and farming experience of women are highly significant with decision making pattern of women. Farm men are major decision makers compared to farm women. When designing and implementing a new policy or intervention should be designed and, invest in studying the social, economic and agro ecological context to understand gender roles, the extent and depth of gender inequality, which are the main barriers affecting women's decision making power in a family regarding farming. The extension agencies should educate the farm men to encourage women in the decision making process and thereby both of them can take decisions jointly on important aspects of cultivation for achieving sustainable agricultural production

Keywords: Decision making pattern, Sustainable agricultural production

DETERMINANTS OF SUSTAINABLE DAIRY FARMING IN KARNATAKA

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Study aimed at assessing the factors affecting sustainable dairy farming in Karnataka state, India. Since two districts namely Hassan and Mysuru have highest number of crossbred cattle population in the state. These two districts were selected for the study. Study identified seven variables that affected sustainable dairy farming index. Those variables were ratio of crossbred cows and buffaloes to local cow, milk productivity of milch animals of household, marketed surplus of households, per animal area under fodder crops, proportion of expenses on concentrates to total feed expenses, proportion of curative veterinary expenses to total veterinary expenses and education level of households. Variable that affected significantly were milk productivity, marketed surplus of household, per animal area under fodder crops, proportion of curative veterinary expenses to total veterinary expenses and education level. Focussing on these factors would help in improving sustainable dairy farming in the study area. Current study

would be helpful to policy makers while framing policies regarding augmenting farmers income through holistic dairy development.

Key words: dairy, milch animals, milk productivity

INDIGENOUS TECHNICAL KNOWLEDGE – A MEANS TO CLIMATE SMART AGRICULTURE

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Green revolution in India converted Indian agriculture into an industrial system due to the adoption of modern methods and technology .Though these technologies partly solved food problems but had several impacts on the environment and several living beings too .Modern farming methods demands anything that comes in the way of crop production needs to be uprooted and destroyed which to the loss of many wild species from their natural habitats .The chemicals used in the farm are becoming a greatest threat to environment and becoming responsible for climate change .Under these situations ITK's are the possible solutions to the problem at hand. Indigenous technical knowledge is a cumulative body of knowledge and practices maintained and developed by people with expanded histories of interaction with the natural environment. Climate smart agriculture (CSA) is an approach that helps to guide actions needed to transform and reorient agricultural systems to effectively support development and ensure food security in a changing climate .Sustainably increasing agricultural production, adapting to climate change and reducing emissions are the main points of climate-smart agriculture .Therefore reverting back to indigenous knowledge and practices can help us in achieving our objective of climate smart agriculture and also preserves and mobilizes local knowledge .The paper highlighted the various Indigenous technical knowledge systems prevailing in agriculture and fisheries .Finally the study supports the use of ITK's as a means of achieving climate smart agriculture.

Key words: Green revolution; climate change; Indigenous Technical Knowledge; Climate Smart Agriculture

ORGANIC FARMING IN VEGETABLE CROPS

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Organic farming is a production system which avoids or largely excludes the use of synthetic compounded fertilizers, pesticides, growth regulators and livestock feed additives. Organic farming is one of the ways to bring stability and sustainability to agriculture. The country at present is not in a position to completely eliminate the use of chemicals especially fertilizers. However, it would not be difficult and unrealistic to phase out the use of these chemicals systematically. For this on one hand, the doses of fertilizer need to be gradually reduce and be balanced by increasing the use of optimum quantity of organic manures and biofertilizers. Natural balance should be maintained at all costs for the productivity of land and raised yield. India grows more than 60 kinds of vegetable crops due to diversity of agro-climatic conditions. Madhya Pradesh is the largest promoter of organic farming. Sikkim is recognized as Organic State of India. To produce food of high nutritional quality insufficient quantity work with natural systems rather than seeking to dominate them and increase the long term fertility of soils and use, as far as possible, renewable resource in locally organized agricultural systems and avoid all forms of pollution that may results from agricultural techniques. To enhance the biological cycle with in farming system. Nutritional management through green manure, compost and FYM, vermicompost, biofertilizers, poultry manure, night soil. Disease Management in Organic Farming Addition of Organic Matter: Antibiotics and Phenols are released during decomposition which reduces inoculum density and induce disease resistance in host. Introducing antagonistic organisms: seed treatment, soil treatment, foliar spray with fungal or bacterial bio-agents. Seed and root bacterization: seed or seedling root treatment with bacterial culture .Cross Protection: for Viral diseases by pre-immunization technique. Botanicals: application of plant extracts like neem, onion, garlic, pongamia and dhatura etc. Use of Resistance varieties. Addition of Organic Matter: Antibiotics and Phenols are released during decomposition which reduces inoculum density and induce disease resistance in host. Introducing antagonistic organisms: seed treatment, soil treatment, foliar spray with fungal or bacterial bio-agents. Seed and root bacterization: seed or seedling root treatment with bacterial culture. Insect Management in Organic Farming, Cultural practices, Use of resistant varieties, Physical methods, Plant products like Nicotine, bio-agents.

IMPACT OF MODERNIZATION IN AGRICULTURE ON WOMEN: A REVIEW**KIRAN BALA****Ph.D Research Scholar, EECM, CCAS, MPUAT, Udaipur.**

Agriculture development is a complex process and a challenging one as well. There are four major systems namely, research, extension, support and client, which are supposed to work in harmony to bring about stable and sustained growth in agriculture. So far as the client system is concerned, it encompasses both men and women as equal partner. Unquestionably, women play a significant and crucial role in agriculture not only in India but throughout the third world. In addition to outside the home, farm work in which they are actively involved with men, the onus of almost the entire household chores falls on them. Swaminathan, the famous agricultural scientist describes that it was woman who first domesticated crop plants and thereby initiated the art and science of farming. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fibre and fuel. Women have played and continue to play a key role in the conservation of basic life support systems such as land, water, flora and fauna. They have protected the health of the soil through organic recycling and promoted crop security through the maintenance of varietal diversity and genetic resistance. On the other hand, transfer of technology is sine qua non for transformation of Indian agriculture to a modernized one. Participation of women in agriculture has been though recently recognized but 'invisible workers' have yet to be involved in the process of transfer of technology. There is already a big gap between the transferable technology and transferred technology as far as the men beneficiaries are concerned. Further, the amount of technology transferred to women, through being equal partner from hoe agriculture to most modernized agriculture and from seed sowing to harvesting, is very insignificant.

GAMMA IRRADIATION EFFECTS ON PHOTOSYNTHETIC PIGMENTS AND PLANT MORPHOLOGY OF GLADIOLUS (GLADIOLUS GRANDIFLORUS L.)**KIRAN KUMARI* AND SANTOSH KUMAR****Department of Floriculture & Landscape Architecture, College of Horticulture, S.D. Agricultural University, Jagudan Distt. Mehsana, Gujarat- 384 460 (India)****Department of Horticulture, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand-**

To determine the effect of gamma irradiation on photosynthetic pigments and morphological changes, uniform and healthy corms of eight gladiolus varieties were exposed to different doses of gamma rays viz. 0 (untreated), 25, 40, 55 and 70 Gy from ^{60}Co source. Effect was studied for two generations i.e. M_1 and M_2 . Irrespective of varieties, an inversely proportional relationship was recorded between gamma rays dose and photosynthetic pigments in both the generations. Maximum chlorophyll *a*, chlorophyll *b* and total chlorophyll content were recorded in untreated plants followed by 25 Gy gamma irradiated plants in both the generations. Carotenoid content was also inversely related to gamma rays dose as maximum carotenoid content (1.36 and 1.50 $\mu\text{g/g}$ in M_1 and M_2 , respectively) was recorded in untreated plants and minimum (1.02 and 1.06 $\mu\text{g/g}$ in M_1 and M_2 , respectively) at 70 Gy. Abnormalities and morphological changes like abnormal leaves (%), blind plants (%) and abnormal spikes (%) were directly related to gamma rays dose and were highest at 70 Gy, irrespective of varieties. Interaction of variety "Purple Flora" with 70 Gy gamma irradiation resulted in maximum percentage of abnormal leaves, abnormal spikes and number of blind plants which shows that amongst all the varieties "Purple Flora" was most responsive to gamma irradiation. Morphological changes were on initial growth as primary effect of gamma rays and the leaves formed later were less abnormal. In general, morphological changes and abnormalities were reduced in M_2 generation as compared to M_1 generation, which shows diminishing effect of gamma rays in successive generations.

Key words: Gamma irradiation, morphological changes, photosynthetic pigments, mutation, leaf abnormalities**EXPLOITING BRINJAL ROOT SYSTEM FOR ENHANCING YIELDS, NUTRIENT UPTAKE AND USE EFFICIENCY IN TOMATO THROUGH GRAFTING****¹KIRAN PILLI, ²NARESH PONNAM, ¹SAMANT P K AND ²ACHARYA GC****¹Department of Soil Science and Agricultural Chemistry, College of Agriculture, Odisha University of Agriculture and Technology Bhubaneswar 751003, India****²Central Horticultural Experiment Station (ICAR- IIHR), Bhubaneswar 751019, India**

Tomato (*Solanum lycopersicon*) is one of the widely grown vegetable and most important food crop in India. It is rich in minerals, essential amino acids, sugars and dietary fibres. A pot culture experiment was conducted in Central Horticultural Experiment Station, Bhubaneswar with Tomato grafted on brinjal and Non-Grafted Tomato with integrated nutrient management practices during 2017-18 in a Completely Randomized Design with six treatments. The results revealed that the treatment i.e. 100 % inorganic nitrogen (T_2) produced highest average fruit yield (1611.3 g/plant), nitrogen and potassium uptake and use efficiency which was significantly higher than other combinations. The yield performance due to 100 % organic nitrogen (1330.1 g/plant) was significantly lower than 100 % inorganic nitrogen. However, the yield, nutrient uptake and use efficiency increased with

incremental proportion of inorganic nitrogen. The tomato grafted on brinjal root stock gave highest yield per plant (1766.9 g) which is 51.8 % higher than non-grafted tomato. Nutrient uptake and use efficiency was high in grafted tomato compared to non-grafted tomato, often been attributed to the strong root system of brinjal root stock in root morphology and root characteristics including lateral and vertical development of roots, root length, density and number of root hairs which played an active role in nutrient uptake.

Keywords: Integrated Nutrient Management, Nutrient Uptake and Use Efficiency, Grafted Tomato

A STUDY ON EMOTIONAL STABILITY OF 8-10 YEARS OLD CHILDREN IN HISAR CITY

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The term “Emotion” is derived from the Latin word “Emotes” which means “to movere”, “to move” or “to put in motion”. In psychology the word “Emotion” is used to describe a state of excitement in the organism. Emotion is the part of a person's character that consists of their feelings, as opposed to their thoughts. Stability a situation in which something is not likely to move or change. Emotionally stable persons tolerate minor stresses and strains of day to day living without becoming emotionally upset, anxious, nervous, tense, or angry. Emotional stability is a state of equilibrium in which forces within the individual-his wishes, ambitions and needs are in harmony with themselves and with the stress of the environment. It is not only one of the effective determinants of the personality patterns, but it also helps to control the growth of children development. Main aim of the study was to assess emotional stability of children as per residential area and gender. The total sample consisted of 200 children. Out of total sample 100 were selected from rural area and 100 from urban area. One government senior secondary school and one private school were selected at random from each location. For data collection, four schools were selected at random. From each school 25 boys and 25 girls were selected. Tool used for the research was Emotional Stability Test for children by Gupta and Singh (1985). Major findings of the study revealed that most of the children had moderate level of emotional stability. Further findings showed significant mean difference was observed in residential area of children.

Keyword: Emotional stability, children, gender, school.

STATUS OF ENVIRONMENTAL POLLUTION IN RURAL PUNJAB AND ITS MANAGEMENT

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Punjab agriculture is predominated by rice-wheat monoculture due to its superior yields and better prize structure than other crops. After green revolution, use of fertilizer, pesticides and insecticides has increased which is not only affecting the human health but also the soil health. With the advent of new technologies, the crop residue management has become a problem causing farmers to burn crop residue leading to air pollution. Faulty agronomic practices are affecting the rural environment which along with pollution due to industrial and transport sectors is affecting the environmental quality. Keeping in view the above consideration the study was planned with the objective of studying status and factors causing environmental pollution in rural Punjab. For this purpose, various researches and literature from last 20 years were reviewed. The review of literature revealed that air, water and soil pollution are the challenges of rural Punjab. Air pollution was observed higher than soil and water pollutions. It is estimated that in Punjab more than 17 million tones of rice stubble is burnt every year. The paddy straw burning causes nutrient losses like 3.85 million tones of organic carbon, 59,000 tones of nitrogen, 20,000 tones of phosphorus and 34,000 tones of potassium. This also adversely affects the nutrient budget in the soil. The polluted soil is also causing contamination in drinking water and food we eat. The air, water and soil are loaded with toxic chemicals. Proper management of the environment is the only way to ensure continuous and sustained development of the society. There is a need to create an awakening on the problems arising due to faulty agricultural practices, related consequences and to suggest means to reduce the stress on environment in the rural areas.

Key words: Environment pollution; Rural Punjab; Management; Stubble burning; Soil nutrient; Crop residue

MORPHOLOGICAL AND MOLECULAR VARIABILITY OF *RHIZOCTONIA SOLANI* CAUSING SHEATH BLIGHT OF RICE IN MANIPUR AND ITS *IN-VITRO* MANAGEMENT

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Rice (*Oryza sativa*) is pre-eminent cereal crop around the world. Globally rice is consumed by more than three billion people. The consumption of rice is at utmost level by the world populace of tremendously developing low-income countries. Being most widely cultivated crop around the country and world, many fungal pathogens show their aggressiveness in attempt to inflict variety

of diseases to the crop. Sheath blight, caused by *Rhizoctonia Solani* Kuhn, one of the emerging disease of rice. The current investigations were done to understand morphological and molecular variability among 9 isolates of *R.solani* isolated from different rice growing valley areas of Manipur. Morphological characteristics of *R.solaniviz.*, radial growth were ranged from 45.0 to 18.95mm after 48h of incubation on PDA. Mycelial color were varied from creamy white to dark brown, growth nature of flat to fluffy mycelium was noticed among the isolates, the isolates had also shown regular to irregular growth at margins. The characters of sclerotia like color, growth pattern, shape, texture, size and diameter showed variation among the isolates. Mycelial compatibility studies were conducted by paring the isolates in all possible 45 combinations revealed 15 combinations compatible and 30 combinations incompatible isolates by having certain degree of aversion among pairings of Manipur isolates. Molecular variability studies were carried out by using RAPD and ISSR primers. The results of RAPD analysis revealed that isolates were clustered to two main clusters at 49% degree of similarity, where cluster I consists of 4 isolates and cluster II consists of 5 isolates. Similarly, ISSR analysis revealed that isolates were clustered to two main clusters at 39% degree of similarity, where cluster I consists of 2 isolates and cluster II consists of 7 isolates. Among fungicides tested Propiconazole showed highest percent (92.59%) of inhibition at a concentration of 120ppm. Propiconazole and Dificonazole combination and Metalaxyl and Chlorthalonil combination among the combination of fungicides viz., had revealed cent (100%) percent of inhibition at 180ppm concentration. Among the herbicide and insecticide, Glyphosate and Chlorpyrifos showed highest (100%) percent of inhibition at 0.2% of concentration each respectively. Among the plants extracts *Parthenium* spp. revealed highest (76.29%) percent of inhibition. *Hypocrea lixii* (KX0113223) result showed highest growth inhibition (75.5%) among the six tested bioagents

Keywords: *Rhizoctonia solani*, morphological and molecular variability, agro-chemicals, botanicals, bio agents.

LANDSCAPE DESIGNING AND ESTABLISHMENT

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Landscape gardening is art of beautifying the given area without disturbing the land and the soil drastically. All gardens need planning, whether informal, cheerfully chaotic or elegant and formal. A successful design in the result of careful planning. Some garden may have all the features but may not be good to look at, while some other may look casual or natural but actually well controlled so that all the element work together to form a synchronized/cohesive and attractive scheme. Formal garden is also called the Moghul style of gardening. In this style of gardening the element are set out in a very formal way. There are perfect symmetry in the design. The right has to be a replica of the left and almost all the features can be seen from one end of the garden. The boundaries will be of well-trimmed hedges and the inner borders will be demarcated with some kind of edgings. Some of the famous formal gardens are Taj Mahal garden and the Moghul gardens in New Delhi. Informal garden is also called the British style of gardening where the garden elements are set up in a informal styles, which make the garden look very natural. There is no symmetry anywhere in the design. There is always an element of surprise at place, which creates an urge in the mind of the visitor to walk through the whole garden. The variety of elements used in this style is much more and each part of the garden can look amazingly different. Element like umbrellas, seats, cascades, rockery, water pool etc. are used. Landscape architects use various elements to compose their landscape designs. Plants form a major elements of their palette. Water, stone, earth, terra cotta, bricks, tiles, tar, metals, glass, plastics, wood, sculpture, etc., form some of the other elements of the landscape architect's palette. However, there are various other elements that are also very important in the making of a garden or outdoor space. Ultimately, it is the details that make a space successful. The combination of these materials and how the materials work together is also important.

Key words: Landscape, Gardening, Informal, Formal.

AGRITOURISM: A NEW AGRIPRENEURIAL VENTURE FOR FARMERS' WELFARE

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Agritourism is a concept of developing and preparing villagers for creating an alternative source of earning and sustaining their livelihood. This kind of tourism develops where agricultural activities and tourist interacts. It involves various agricultural activities, animal rides and stay at rural surroundings with natural and fresh cuisines. Basically it develops as niche tourism in different parts of world. It could be a source of developing rural areas of developing countries like India. Agri-tourism may be seen as a segment within rural tourism. Rural tourism includes additional forms of tourism that exist in a rural setting, including eco-tourism and other nature-based forms of tourism, cultural tourism or rural adventure tourism. Agri-tourism Entrepreneurship may be new concept for farmers to get into enterprise and business system. Entrepreneurship development through Agri-tourism business is not yet found in Indian rural or farm areas. Indian Agriculture is still far away from its tourism exposure, few states of India like Rajasthan, Assam, Haryana, U.P., Kerala, and so on are attracting tourism for their villages. Agri-tourism Entrepreneurship may be a useful tool for the development of rural areas of India. The urbanization and rapid development of cities have kindled the desire amongst travellers to seek and explore new forms of tourism. Experiential travel is gaining ground across the world. The new age traveller is constantly seeking offbeat trails, the road less travelled, going back to roots. This

venture presents both opportunities and challenges in terms of the development of these theme-based tourist circuits based on agriculture and farms or farmlands. There is clearly a lack of primary research in the area of agritourism; this is an impediment; however, inferences can be drawn on the basis of the peripheral data and collaterals drawn based on the development in other geographies. This Greenfield opportunity can be curated and developed to realize the potential of agritourism and enhancing the welfare of farmers.

ECO-FRIENDLY AGRICULTURE: NEPAL'S RIGHT BET INTO THE FUTURE

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Nepal is at the centre of focus for the region as hydro resource gets scarce and growing population need space and food to survive. This mountainous region that has for centuries barely help sustain livelihood of millions will now have to be prepared to provide for the billions. Hydropolitics and sociodemographic engineering have ensured that the mountain and mid hills ecosystem gets time to heal from the last century underutilisation and mismanagement. The plains and low lands getting filled with urbanisation, the valleys overcrowded to the brim, the onus now lies in the hills and mountains to provide. Climate change, land availability, water source have already began to pull commercial poultry farming upward and other commodities are bound to follow. Horticulture and organic production is already taking its shape through various government and non government schemes. The huge surface that Nepalese hills and mountains provide is now being more seriously taken to produce, crop and livestock. The water bodies are to serve for the blue revolution. It is true that water had always been at the front of human evolution. The fertile plains of major rivers of the world started having settlements depending mostly on agricultural activities, later in its trade and business. The table is now turned towards the mountains where major rivers flow down. Nepal's population ~27 million from hundred of different castes and ethnicity live in the geographically and climatically diversified conditions. Nepalese agricultural practices are unique and we are considered living museum or setting to understand future of agriculture. Increasing prices for farm produces, driven in part by demand for biofuels, tit for tat political embargoes and trade tariffs are pushing up the price of food world-wide and unleashing a new source of inflationary pressure which is another area to look into. Nepal have serious issue with availability of manpower ready to be engaged in agriculture as foreign employment trap lures them. However, economic and ecological migrants continues to be pulled upward and agriculture is first activity they are pulled unto. Nevertheless, the baits of intensification and mechanisation is on rise and milking tax payers as we understand that major part of subsidy is skimmed by politico-beurocracy nexus as well most of the tools and equipments ends up as trash (dumpikaran). Nepal have an immediate need to reduce the trade deficit by internal production. However, we must understand that some areas are our strengths and we need to play on those in line with evolutionary steps. Patriotic changes in selecting food, enhancing sustainable agriculture (Ecofriendly) that stressed for meeting the Sustainable Development Goals is the right bet for Nepal.

Key Words: Ecofriendly Agriculture, Nepal, SDGs

EFFECT OF CONSORTIUM OF ENDOPHYTIC NITROGEN FIXING BACTERIA ON JUICE QUALITY OF PRE-SEASONAL SUGARCANE (SECOND RATOON)

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Field experiment conducted during the year 2016-17 at Post Graduate Institute Farm, Mahatma Phule Krishi Vidyapeeth, Rahuri (Maharashtra state, India) to study the effect of consortium of endophytic nitrogen fixing bacteria on juice quality of pre-seasonal sugarcane (second ratoon). The experiment laid out in randomized block design with four replications and six treatments. There were four levels of nitrogen 0, 25, 50, and 100% of recommended dose of nutrients (RDF) with 100% P₂O₅, 100% K₂O along with and without foliar spray of consortium of endophytic nitrogen fixing bacteria. The application of 250 kg N, 115 kg P₂O₅ and 115 kg K₂O ha⁻¹ (100% RDF) to second ratoon sugarcane significantly increased cane and CCS yield followed by 25% N with foliar application of consortium of endophytic bacteria (T₄). The juice quality of second ratoon sugarcane significantly higher in 25% N with foliar application of consortium of endophytic bacteria (T₄) (Brix - 21.43 degree, POL % - 20.57 %, CCS - 14.76%) than 50% N + *Acetobacter diazotrophicus* (Foliar application) (T₃) (Brix - 21.06 degree, POL% - 20.38%, CCS - 14.67%). Thenon-reducing sugar of sugarcane juice was ranged from 19.31% (T₁) to 20.56 % (T₄). The non-reducing sugar of cane juice in 100% RDF (T₂) (0.37%) was at par with foliar application of consortium of endophytic bacteria (T₅) (0.34%). The reducing sugars of cane juice in 100% RDF (T₂) was significantly higher over all treatments. However, Purity % of juice in 50% N + *Acetobacter diazotrophicus* (Foliar application) (96.74%) was higher over all treatments.

Key words: second ratoon, sugarcane, consortium, endophyte

POST HARVEST MANAGEMENT FOR RAISING FARMERS' INCOME**KSHITIJ PARMAR*, N.K.SINGH**, SWATI CHATURVEDI AND ANURAG SINGH*****Coromendel Fertilizers Ltd. , Noida; **Principal, B.V. Rural Institute, Bichpuri, Agra**

There are three ways to make farming profitable to increase production, reduce costs and **post harvest management**. There several ways well-known to the farmers to increase production. However, reduction in cost of cultivation is also equally important. But, the Indian farmers are most ignorant about importance of post harvest management. The major Postharvest activities include harvesting, handling, storage, processing/value addition, packaging, transportation and marketing. 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. In general, adding value is the process of changing or transforming a product from its original state to a more valuable state. Many raw commodities have intrinsic value in their original state. For example, field corn grown, harvested and stored on a farm and then fed to livestock on that farm has value. Value-added food processing is something that you do to help earn more money from your farm products. For example, as a farmer, you process raw fruits or vegetables into a finished product that you can sell. There are some ways to increase farmers' income rapidly by adopting proper post harvest technologies like, 1.To take precautions at the time of harvesting especially for horticultural crops. 2. Proper handling of the produce to save losses/damage of the produce. 3. To develop low cost, small and local storage facilities so that farmers can wait for good rates. 4. Before marketing, the grading of product also increases profit. 5. Processing/value addition of farm produce is very important because farmers can get just double/triple price by adding value to the produce. 6. The marketing has been a great problem to the Indian farmers since ever. Cooperative marketing can solve the problem up to some extent but our Indian farmers are mostly unorganized. So, they need to be aware about markets and marketing strategies and the possibilities of exports etc. Besides all above efforts, our farmers need some intensive support from government. Our government should- 1. Provide some storage facilities at local level. 2. Provide some special vehicles especially to the small/marginal farmers to take their produce especially perishable commodities to the Mandis. 3. Establish one marketing facility centre at Panchayat level having facilities like communication, internet, news papers/magazine, subsidized packing materials some regular method demonstrations and lectures on current market needs and overall one facilitator to coordinate these.

HYDROPONIC VEGETABLE CULTIVATION: A NEW ASPECT OF GLOBALIZATION**KSHOUNI DAS^{1*}, SATYA NARAYAN PRASAD², TRISHA SINHA²****¹Department of Vegetable and Spice Crops, Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal****²Department of Botany and Plant Physiology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar, India**

Hydroponics is a system of growing plants in nutrient solutions (water containing fertilizers), with or without the use of a growth medium (e.g. sand, gravel, vermiculite, rockwool, peat moss, sawdust). Now a Days, hydroponic crop production has significantly being popular throughout the world, as it provides a more efficient use of water and fertilizers, as well as a better control of climate and pest factors. Furthermore, it improves crop quality which fetches higher market price and also increases the productivity that ultimately results in higher profit. Hydroponic cultivation results in prevention or reduction of root diseases, recirculation of water to minimise emissions and better control of root zone to get higher yields and quality. Researchers have shown that 20-30% more plant growth can be achieved in hydroponic systems compared to soil bound cultivation. Different types of hydroponic structures include Nutrient Film Technique (NFT), wick, drip irrigation, aeroponics, ebb and flow method and deep watering system. Hydroponics is commercially explored in lettuce, celery, watercress, kale, Swiss card where fresh leaves growth and biomass are much higher compared to traditional practices. Commercially NFT technique has been used throughout the world for successful production of leafy as well as other vegetables with 70 to 90% savings of water. With the burning problem of increased population day by day and decreasing arable, productive land area due to poor land management practices, people are getting interested about the new technologies like hydroponics and vertical farming as a good solution of reduced horizontal land area as well as to create additional channels of crop production. Leading countries in hydroponic technology are Australia, Canada England, France, Israel, Netherland and USA. Scientists estimated that population will increase up to 9.2 billion by 2050, while land availability and food production will decline. To meet the increasing demand with shrinking land area, hydroponics cultivation might play major role in coming years. Awareness should be created among the vegetable farmers about the benefit and standardization of hydroponic systems.

Key words: Vegetable, Hydroponic, Production, Quality.

ECONOMICS OF PADDY PRODUCTION AND ITS PROCESSING IN MAU DISTRICT OF EASTERN U.P.**¹KULDEEP MAURYA, ²SHARAD YADAV, ³ARUN KUMAR RAJBHAR****^{1,2} Dept. of Agricultural Economics & Statistics, C. S. Azad University of Agriculture & Technology, Kanpur (UP)****³Department of Agricultural Extension, Suresh Gyan Vihar University, Jaipur**

Paddy is most prominent crop among the food crops of India and is likely to be continued to dominant in future also. The highest percentage of people engaged in processing and marketing of paddy. Mau district was purposively selected. One block namely Ghosi was selected randomly having higher concentration of paddy acreage. A list of villages from selected block was prepared along with acreage under paddy cultivation. Five villages were selected randomly using PPS considering acreage under paddy cultivation. They were categorized into three size groups i.e. (i) marginal-60 (below 1 ha), (ii) small-24 (1-2 ha), (iii) medium-16 (2-4 ha). Ultimately, 100 numbers of farmers were selected. Maximum total cost was recorded on marginal farms Rs. 229731.55. Gross income, family labour income and farm business income showed positive trend with the increase in the size of farm. Farm investment income and net income was found maximum in case of small followed by medium and marginal respectively. It was found that the manure and fertilizer and human labour have contributed significantly in the production of paddy in all size groups. Incorporation of irrigation and machinery input was not statistically significant in the category of all farms. The reasons might be excessive use of irrigation and tractor. The effect of seed was found to be significant for the any category of farms. However, all the variables together have not contributed significantly to the productivity of paddy and they were able to explain 86.20 to 94.92% variation of the total variation in the yield of crop under study. The value of M.V.P. of seed, manure and fertilizer, irrigation measures, tractor cost and human labour were found both positive and negative. The positive value of M.V.P. shows were less use of variable and negative value of M.V.P. shows the excessive use of the variable inputs. The total processing cost per quintal of coarse rice amounted to Rs 96.72, 89.70 and 96.05 in marginal, small and medium, respectively. In fine rice, the processing cost per quintal amounted to Rs. 103.64, 111.85 and 89.75 in marginal, small and medium, respectively

TO STUDY ABOUT DIFFERENT WEED MANAGEMENT PRACTICES ON CHICKPEA CRAP (*CICER ARIENTINUM L*)**KULDEEP SINGH* DR. K.B. ANAND*******M.Sc. (Ag) Agronomy Student**Assistant professor Udai Pratap College Varanasi**

A field trail conducted in institute of Agricultural Sciences, Department of Agronomy, Bundel Khand University Jhansi Uttar Pradesh During 2009-10 Bundel Khand University Jhansi Uttar Pradesh M.Sc. (Ag.) Agronomy Research Program. India is the largest pulses, Producing country of the world. It account for 34% globe pulse area but only 25% of the globe pulse production. The level of productivity of pulse in India is for the below than the average productivity in the world since past 4 decades. Chickpea accounting 38.5% of the production under pulses. The most important factor for steeping up the yield of the chickpea is weed infestation. Losses by weed reveal that weeds alone account for 45% at the annul lasses. Different treatment such as weedy check, weed free one hand weeding at 30 DAS, H.W. at 30 & 60 DAS, Pendimethiolin@1.0kg ha⁻¹ as pre.em, fluchloralin@1.0kg ha⁻¹ as ppi and Pendimethiolin@1.0kg ha⁻¹ as pre.em+ hand 30 DAS. next to weed free Pendimethiolin@1.0kg ha⁻¹ as pre.em+ hand 30 DAS recorded maximum yield and yield attributing character, with was mechanical weed control, Pendimethiolin@1.0kg ha⁻¹ as pre.em and fluchloralin@1.0kg ha⁻¹ as ppi

CLIMATE SMART AGRICULTURE***KULDEEP SINGH¹ AND MONU KUMARI²****¹Agronomy (M.sc), National Dairy Research Institute, Karnal , Haryana-132 001****²Department of vegetable Science, Navsari Agricultural University, Navsari -396 450**

Meeting the food demand of a global population expected to reach 9.1 billion in 2050 and over 10 billion by end of the century will require major changes in agricultural production systems. Improving cropland management is key to increase crop productivity without further degrading soil and water resources. At the same time, sustainable agriculture has the potential to deliver co-benefits in the form of reduced green house gases emissions and increased carbon sequestration therefore contributing to climate change mitigation. Climate smart agriculture focuses on contributing to economic development, poverty reduction and food security; maintaining and enhancing the productivity and resilience of natural and agricultural ecosystem functions, thus building natural capital; and reducing trade-offs involved in meeting these goals. Climate smart agriculture have three pillars viz., adaptation capacity, food security and mitigation. Climate smart agriculture include weather smart ,water smart ,carbon smart, nutrient smart, energy smart, knowledge smart so climate smart agriculture is sustainable and demand satisfied strategy .

Keywords: Sustainable agriculture, carbon sequestration, mitigation, resilience, GHGs.

INDIGENOUS TECHNICAL KNOWLEDGE: A CRUCIAL TOOL OF CROP MANAGEMENT IN ORGANIC FARMING**KUMAR SAMBHAV GIRI*, KOTA CHAKRAPANI AND IMMADISETTYBALAMANIKANTA****College of Agriculture, Central Agricultural University, Imphal**

In recent era “organic farming” is a trending terminology in agriculture. Indigenous technical knowledge is one of the most important tool of crop management in organic agriculture. The origin of ITKs are mostly local and rural in nature. The source of Indigenous technical knowledge is from the learning and experience of our forefathers. The role and scope of this is too vast. The practical implacability is higher than other technologies. The ITKs may be classified into pre-sowing practices, weed management practices, growth promoting activities, disease and pest management, and post-harvest management. For examples smashed and fermented snails are tied in the rice field during the milking stage to attract and kill the gundhi bugs, cultivation of sun hemp helps to control nut-sedge, 5% fermented coconut milk solution used as a growth promoter, use of dried leaves of tree as mulch minimizes the weed problem and adds organic matter to the crop are some commonly used ITKs. This technology has both easy implacability and cost effectiveness. The versatility can also be found in this case. Coming to the drawback side it has lesser efficacy than the chemical management techniques. Still it can be considered as the best crop management tool for organic agriculture.

Keywords- ITK, organic, crop management, weed management and tool.

REVALIDATION OF TOLERANT AND SUSCEPTIBLE GENOTYPES OF *BRASSICA JUNCEA* (L.) CZERN. & COSS.**KUMARI REKHA¹, CHANDAN KISHORE¹, DHARAMSHEELA THAKUR², SIMA SINHA¹, ANKITA KUMARI, KUNWAR SATYENDRA SINGH³, RAVI S. SINGH^{1*}**¹**Department of Plant Breeding and Genetics, Bihar Agricultural University, Sabour, Bhagalpur-813 210, Bihar, India**²**Department of Molecular Biology and Genetic Engineering, Bihar Agricultural University, Sabour, Bhagalpur, Bihar**³**Department of Agronomy, Institute of Agriculture Science, Banaras Hindu University, Varanasi, 221 005**

To re-confirm the tolerance and susceptibility of tolerant genotypes of *Brassica juncea*, IC-385686, IC-491089, IC-312545, IC-312553 and susceptible genotypes IC-399802, IC-264131, IC-426392, Laxmi were grown in Randomized Block Design (RBD) with three replications in the field conditions and the observations was recorded for days to 50% flowering, first incidence of aphid population, number of aphids at 15 days interval and then aphid infestation index was calculated. Days to 50% flowering for tolerant and susceptible did not show much significant differences and ranged from 63 days to 65 days. On first observation recorded for aphid population, it was lowest for tolerant genotypes, IC 491089 while highest for susceptible genotypes, IC 426392. On second observation, aphid Population was lowest in tolerant genotypes, IC 491089, while highest in susceptible in Laxmi. Finally, on the basis of aphid infestation index, tolerant genotypes were IC 491089, IC 312545, IC 385686 and IC 312553. The above observations reconfirm these genotypes to be tolerant and can be used as putative sources of aphid tolerant genotypes in future breeding programmes.

Keywords: *Brassica juncea*, Mustard aphid.

DESIGN AND DEVELOPMENT OF CUSTOMIZED AUTOMATED FERTIGATION SYSTEM FOR SOILLESS MEDIA IN PROTECTED CULTIVATION**KUSUM PANDEY¹ AND K.G.SINGH²**¹**PhD Research Scholar, Deptt. of Soil and Water Engineering, Punjab Agricultural University, Ludhiana, Punjab,**²**Senior Research Engineer, Deptt. of Soil and Water Engineering, Punjab Agricultural University, Ludhiana, Punjab,**

In recent years, the production of vegetables, flowers, and spices has been experiencing accelerated growth in protected cultivation. This can be achieved by application of water and nutrients through drip fertigation. Drip fertigation is an attractive concept, as it permits application of nutrients directly at the site of a high concentration of active roots and as needed by the crop. In the conventional drip irrigation system, the farmer has to keep watch on irrigation and fertigation timetable, which is different for different crops. Advantage of automatic drip fertigation system is that the nutrient will take place only when there will be intense requirement for them. Automated fertigation system is a highly advanced system in which drip automation for water and fertilizer administration can be achieved in agriculture. It promises the application of water in right quantity along with right fertilizer at right time, thereby reducing fertilizer loss and labour resulting in saving of money with the help of an automated mechanism. Therefore, this paper introduced the design and development of customized automated fertigation system for tomato grown polyhouse in soilless media. This system uses an EC and pH sensor to automatically check the concentration level of the nutrient solution. The developed systems powered by solar power and tested on its effectiveness to control the nutrient mixing process and injecting nutrient solutions according to plants growth rate and in the same time monitor all yield parameters, growth parameter and quality parameter in fertigation system. This system helps in lowering the risks of environmental hazards and various threats to the climate and paves a way for efficient use of natural resources and help in eradication of malnutrition.

Keywords: Automated, Fertigation, Mechanism, Nutrient solution, Environmental hazards

STUDY OF INSOLUBILITY INDEX OF READY TO EAT BREAKFAST CEREAL MIX

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Ready to eat cereal nutrimix was prepared with incorporation of ratios combination of aromatic black rice and glutinous white rice. In the present investigation treatment T₁, T₂, T₃, T₄, T₅ and T₆ were formulated of ready to eat breakfast cereal mix was prepared by using black rice and white rice in the ratio of (50:50, 60:40, 70:30, 80:20, 90:10 and 100:00). The average value of Insolubility index for experimental samples of ready to eat breakfast cereal mix of different treatments were T₁F₁(1.96), T₁F₂ (1.90), T₁F₃(1.82), T₂F₁(1.86), T₂F₂ (1.84), T₂F₃ (1.80), T₃F₁ (1.84), T₃F₂ (1.80), T₃F₃(1.76), T₄F₁ (1.76), T₄F₂ (1.72), T₄F₃ (1.70), T₅F₁ (1.72), T₅F₂ (1.68), T₅F₃ (1.64), T₆F₁ (1.66), T₆F₂ (1.64) and T₆F₃ (1.58) respectively. The highest average value for insolubility index was obtained in the treatment T₁F₁(1.96) and the lowest value of insolubility index was recorded in the treatment T₆F₃(1.58). The mean value of Insolubility index of ready to eat breakfast cereal mix of different treatments was recorded in treatment T₁(1.90), T₂ (1.83), T₃ (1.80), T₄ (1.73), T₅ (1.68) and T₆ (1.63) respectively.

Key words: Black rice, white rice, cereal, insolubility index, breakfast

EFFECT OF DIFFERENT DOSES OF ORGANIC MATERIALS AND CHEMICAL FERTILIZERS ON PERFORMANCE OF CUCUMBER UNDER POLYHOUSE CONDITION.

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An experiment entitled “Effect of Integrated Nutrient Management on Growth, Yield and Quality Traits of Cucumber (*Cucumis sativus* L.) Cv. Swarna Ageti under Polyhouse condition.” was carried out during *kharif* season of 2015 at Horticulture Farm, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi. The experiment conducted in Randomized Block Design (RBD) with three replications using cv. Swarna Ageti, with twelve treatments, two kinds of organic manures (FYM and Vermicompost) reduced doses of chemical fertilizers were tested in comparison with RDF. During the experimentation, observations were recorded on growth, yield associated traits and yield of cucumber. Results revealed that application of different combinations of fertilizers and organic manures significantly increased growth, yield and quality of cucumber as compared to control. The earliest first flower initiation (37.33 days), minimum number of node at which first male flower appeared (12.76), minimum number of days to 50 per cent male flowering (45.00 days), minimum number of days to 50 per cent female flowering (50.00 days), maximum number of branches vine⁻¹(6.03), maximum length of edible fruit (15.50cm), maximum diameter of edible fruit (4.40 cm), maximum number of edible fruits vine⁻¹(8.63), maximum TSS of edible fruit(°Brix) (2.10), maximum fresh weight of edible fruit (176.35 g), maximum edible fruit yield (56.27t ha⁻¹), were recorded with the integrated application of 25% Vermicompost + 25% FYM + 50% RDF. The equal germination percentage (86.66 per cent) were recorded with the three different treatments viz. 50% FYM + 50% RDF, 50% Vermicompost + 50% RDF and 25% Vermicompost + 25% FYM + 50% RDF, minimum number of node at which first female flower appeared(16.93), maximum vine length (426.00 cm) were recorded with the integrated application of 50% Vermicompost + 50% RDF, and maximum number of leaves vine⁻¹ (116.20 cm) were recorded with the integrated application of 100% FYM.

Keywords: Cucumber, NPK, FYM, Vermicompost, Growth, Flowering, Yield and Quality.

NUTRIENT MANAGEMENT IN WHEAT FOR IMPROVING FERTILIZER USE EFFICIENCY, PRODUCTIVITY AND SOIL HEALTH

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Wheat (*Triticum aestivum* L) is the second most important staple food and meets about 61% of the protein requirement of the India. The introduction of new high yielding varieties coupled with chemical fertilizer use and creation of irrigation infrastructure have led to green revolution during mid 1960's due to which India became second largest producer next to China, contributing about 35% in cereal basket of country. This can be done through all available nutrient sources, inorganic and organic, but the

bottom line is that any mismatch between nutrient input and output that depletes the soil or creates imbalance will adversely affect production potential. Among macro plant nutrients, nitrogen, phosphorus, potassium, and micro nutrient such as Zn and Fe are the most important. Their importance as a growth and yield-determining nutrient has led to large and rapid increases in nutrient application rates, but often with poor use efficiency. Site-specific nutrient management (SSNM) has been found especially useful to achieve the goals of improved productivity and higher N use efficiency (NUE) as reported by **Dobermann *et al.* (2009)**. **Mohanty *et al.* (2015)** working on precision nitrogen management in wheat observed significantly highest plant height, leaf area index, dry matter accumulation, CGR, RGR, and NAR with STCR approach against the lowest in absolute control. However it was closely followed by green seeker and recommendation based fertilizer management. A similar trend was noted effective tillers, grain/spike, 1000/grain and grain yield. STCR resulted in an increasing grain yield by 13.86 and 33.83 percent over SPAD and control respectively with remain at par with green seeker and RDF. Leaf color charts and chlorophyll meters assist in the prediction of crop N needs for rice and wheat, leading to greater N-fertilizer efficiency at various yield levels as reported by **Shukla *et al.* (2004)**. Remote sensing tools are also used to predict crop N demands precisely. At the same time, traditional techniques like balanced fertilization, integrated N management (INM), , among others, are also used to supplement recent N management techniques to attain higher productivity and NUE, and reduce environmental pollution through the leakage of N fertilizer. Site and crop specific fertilizer management, customized fertilizers, fortified fertilizers and Urea Briquette in UDP technology, fertigation, foliar spray, eco-fertilization and etc. farmyard manure improve the chemical and biological condition of soil by increasing cation exchange capacity and beneficial soil micro-organism which are involved in various biochemical processes and release of nutrients **Sharma *et al.* (2015)**. Thus, it can be concluded that wheat productivity, NUE and soil health can be improve with the use of SSNM and nutrient budgeting etc. Use of organic manures, biofertilizers in combination with fertilizers can increase the growth and yield of wheat crop. The maximum grain yield of wheat can be obtained with application of NPK Zn based on soil test + FYM @ 5 t/ha + Biofertilizer. Besides, soil fertility can also be improved with the use of balanced fertilization or use of organic sources of nutrients in wheat.

TRANSGENIC CROPS: THE NEED OF FUTURE

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Transgenic are the genetically modified organisms or individuals in which the gene has been artificially inserted. Transgenic technology enables plant breeders to combine useful genes in one plant from wide range of living organisms by techniques as Agro-bacterium method or gene gun method. Transgenic crops have played a significant role in crop improvement. Different characters have been improved as insect resistance, disease resistance, quality traits, and resistance to abiotic resistance as freezing and cold resistance while disadvantages include that it may lead to development of antibiotic resistance by insect pests and other pathogens. If we talk in context to India, the production of cotton has increased from 13 million bales in 2002 (when it was introduced) to 40 million bales in 2014. Transgenic potatoes have been developed by transferring a gene from amaranth by Indian scientists that contain 33% higher protein than non-transgenic potato. Golden rice has benefited millions of peoples who suffer from health problem caused by vitamin A deficiency which includes growth failure, night blindness, and corneal scars. High and natural iron content of it such as ferritin and plant haemoglobins helps in correcting iron deficiencies. Use of transgenic crops raises yields and reduces the necessity for pesticide use, thereby preventing gigantic ecological injury. Production of transgenic crops has increased the farm income by 8.9% in case of insect resistant cotton, 4.2% in herbicide tolerant soybean and 7.2% of total value of global production of crop. There is an issue with the consumable food crops at international markets due to its effect on health, but this is not a major issue if the harmless genes are isolated from the specific sources or if the toxicity is induced properly.

Keywords: Transgenic, Abiotic, Crop improvement, Resistance, Yield, Genes.

KVK: FOR TRANSFORMATION OF AGRICULTURE IN INDIA

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There is a large section of the farming community which is unaware of technological developments in the field of Agriculture, Horticulture and Animal Husbandry even today. For the rapid transfer and adoption of agricultural technology education of farmers through training programme is a crucial input. The agricultural production can be increased if the product development programmes focusing more on transferring the new technologies from research institutes to the farmer's fields. KVK is an innovative institution providing for (i) effective linkage among farmers, researchers 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. KVKs are working in close collaboration with District Line Departments, Lead Bank, NABARD, Radio/Doordarshan to disseminate KVKs activities to all corners of the district. The main function of the KVK is to provide technical knowledge of crop production to the farmers and to update them from time to time about improvement in technology. On-farm

testing under various farming systems to assess the location specificity of agricultural technologies is carried out by KVK. Frontline demonstrations are laid to establish production potential of technologies on the farmers' fields by KVK.

Keywords: KVK, technical knowledge, agricultural schemes

BASICS OF LEARNING AND TEACHING

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Learning is acquiring new or modifying existing knowledge, behaviors, skills, values or preferences and may involve synthesizing different types of information. The ability to learn is possessed by humans, animals and some machines. Learning is a process. It involves changes occurring over a relatively shorter period of time which enable the learner to respond more adequately to the situation. Humans are lifelong learners. From birth onward we learn and assimilate what we have just learned into what we already know. Educational psychologists and pedagogues have identified several principles of learning, also referred to as laws of learning, which seem generally applicable to the learning process. One of the basic truths in education is that the quality of education depends largely upon the quality of the teacher. Teaching is more than standing before a class and applying a few specific techniques. Teaching is an art in the sense that it relies heavily on intuition. In this approach teaching is more by subjective and spontaneous methods. Whether the teacher is teaching in the top levels of the university, in a school for adolescents or in a school for children, good teaching demands skill in the same basic elements of the good teaching. Teaching is a complex, multifaceted activity, often requiring us as instructors to juggle multiple tasks and goals simultaneously and flexibly. There are seven principles based on research on good teaching and learning in colleges and universities.

Key words: Learning, Teaching, Education

SCREENING OF CHILLI (*CAPSICUM ANNUUM* L.) GERMPLASM/VARIETIES AGAINST CHILLI THRIPS, *SCIRTOTHRIPS DORSALIS* (HOOD) AND APHID, *MYZUS PERSICAE* (SULZER) IN FIELD CONDITION

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Chilli (*Capsicum annum* L.) is one of the most important commercial vegetable crops of India, which belongs to the family Solanaceae. It is grown almost throughout the country. India is the largest producer of chillies in the world contributes about 39 percent of world production and earns valuable foreign exchange for the country. The chilli thrips *Scirtothrips dorsalis* (Hood) and chilli aphid, *Myzus persicae* (Sulzer) are serious pest on chilli and sweet pepper in India. The yield losses caused by chilli Thrips, *Scirtothrips dorsalis* (Hood) and chilli aphid, *Myzus persicae* (Sulzer) are ranges from 50-90 percent and 40-70 percent in chilli crop respectively. A screening of seventy chilli germplasm/varieties was carried out against Chilli Thrips, *Scirtothrips dorsalis* (Hood) and chilli aphid, *Myzus persicae* (Sulzer) in field condition at Vegetable Research Farm, Kalyanpur, C.S.A. Azad University of Agriculture and Technology, Kanpur during 2017-18. The investigation regarding the screening of chilli germplasm/varieties, it was observed that out of 70 germplasm, none of the gemplasms were found immune against the thrips and aphids. 5 lines of chilli viz. Pusa Jwala, NT-74, Selection-2010, G-4 and GS-15 were found highly resistant to have resistance index 0.01-0.30. The 10 lines viz. 810-45, selection long-1, M-7-1, selection-1, 67-1-1, selection-60, selection-2008, NA-11, Selection-16 and 7701 were moderately resistant with resistance index 0.31-0.60 and 12 lines viz. NT-74-1, 410-2 Selection-2011, 810-66-1, Raj-1, Achar-8 selection-12, selection-54, 35-30, selection 2017, selection-1 (yellow) and selection-2017-1 were found low resistant with resistance index 0.61-0.90. Nineteen lines were found low susceptible with resistance index 0.91-1.20 and 15 lines were found moderately susceptible with resistance index 1.21-1.50 and remaining 9 lines were found highly susceptible against thrips and aphids with resistance index >1.5.

SHIFTING TO ORGANIC FARMING BY ADOPTING INTEGRATED PEST MANAGEMENT

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Agricultural intensification can have negative impacts on the environment and there is increasing interest in the use of integrated pests' management (IPM) to improve sustainability. Cultural method, mechanical method, biological method and chemical method are an important components of all agricultural pest management systems and can affect the performance of crop pests and their natural enemies. This paper presents the results from a quantitative review of the literature on how integrated pests management (IPM) effects on pests and their natural enemies. A review from a series of laboratory and field experiments investigating the effects of IPM on Codling moth and their natural enemies are reported. The review demonstrates that crop pests and their natural enemies benefit from IPM and this is evident for natural enemies in farm scale experiments. The effect of IPM is far better than any

other method which we used individually earlier. Farther with IPM we also experience that it support to enhance natural enemies population and maintain environment as per nature. More studies investigating that in the field that the light trap and pheromone trap is highly successful, in the field the damage done by *Cydia pomonella* to *Prunus armeniaca* varies from altitude and temperature of that area. With the implication of cultural method and minimum use of chemical fertilizers/pesticide we experienced the increasing in population of natural enemies like *Trichogramma* species. Biological control play major role in controlling the codling moth.

Keyword: IPM, Bio control, Natural enemies, Chemical method, Cultural practice.

EVALUATION OF ANTAGONISTIC POTENTIAL OF NATIVE FUNGAL ENTOMOPATHOGEN *BEAUVERIA BASSIANA* (BALSAMO) VUILLEMIN AGAINST MAJOR SOIL BORNE PHYTOPATHOGENS OF TOMATO IN MEGHALAYA, INDIA

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Beauveria bassiana, being widely studied as an entomopathogenic fungi recently drawing attention worldwide as a potential biocontrol agent not only against insect-pest but also against plant pathogens. As potential alternative to injudicious chemicals use in crop protection, *B. bassiana* provides an excellent opportunity as biocontrol agent in plant disease management. The present investigation highlights endophytic colonisation behaviour of native *B. bassiana* in tomato and its ability to confer protection against soil borne pathogens of tomato viz, *Fusarium oxysporum*, *Rhizoctonia solani*, *Pythium ultimum* and *Phytophthora infestans* under *in vitro* studies. A total of 22 native *B. bassiana* isolates obtained from Meghalaya were screened on the basis of functional and biological attributes. About 80 % of colonisation was recorded by potential isolates in tomato and were also found to produce various enzymes viz, chitinase, cellulase, protease, lipase, amylase and caseinase and. The antagonistic potential of *B. bassiana* BP1.1 was found highest against *P. myriotylum* (77.41%), *P. infestans* (69.46%) followed by *F. oxysporum* (68.30%) and *R. solani* (64.07%). Also performed better in terms of germination, shoot length, root length of tomato as well as per cent disease incidence as compared to control. In addition to the entomopathogenic properties, the additional roles of *B. bassiana* as endophyte, plant disease antagonists, plant growth promoter and efficient rhizosphere colonizer provide opportunities for the dual purpose use of *B. bassiana* as biocontrol agent (BCA) in integrated pest management (IPM) as well as in integrated disease management (IDM) strategies.

Keywords: *Beauveria bassiana*, antagonism, enzymes, endophytic, phytopathogens, tomato

FOREST CONSERVATION FOR LIVELIHOOD SECURITY

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Forests have a central role to play as the world confronts the challenges of climate change, food shortages, and improved livelihoods for a growing population. If predictions prove correct, the world will need to shelter, feed, clothe, and provide livelihoods for another two billion people by 2050. This presents a staggering challenge, particularly given new research from the World Bank showing that world temperatures could raise by 4 degrees celsius this century, impacting water availability, agriculture, and severe weather events. For centuries, forests have served as a kind of natural safety net for communities during times of famine or other events that impact agricultural and food production; they provide fruits, leaves, gum, nuts, timber, and wood for fuel. Forests feed people and the animals they might depend on for trade or meals when crops fail. At the same time, many of the world's remaining forests are under increasing threat which negatively affects the lives of people. Although the pace of deforestation has slowed in some regions, the world still loses about 14.5 million hectares of forests each year. Therefore there is a need to make such policies and strategies that can help in conserving forests. This paper is prepared with the objective to study the linkage of forests with the livelihood of people. An effort is made to review the pattern of forest degradation and its impact. Some of the strategies to protect forests and recent initiatives of government of India are also mentioned in the paper.

Keywords: Livelihood, Deforestation, Forest conservation

STUDIES ON THE DEVELOPMENT OF PULSE BEETLE, *CALLOSOBRUCHUS CHINENSIS* IN DIFFERENT CHICKPEA GENOTYPES UNDER LABORATORY CONDITIONS

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Studies conducted on growth and development of the pulse beetle, *Callosobruchus chinensis* (L.) on 15 chickpea genotypes in Department of Entomology, Dr. Rajendra Prasad Central Agricultural University, Pusa during June- September, 2017 revealed

that the fecundity of the pulse beetle female varied significantly on different chickpea genotypes, minimum being on C1021 (46.82 eggs/100 seeds) and maximum on C1025 (97.22 eggs/100 seeds). The development period for eggs (4.33-6.67 days), larva (16.0-17.67 days) and pupa (4.57-6.74 days) on different genotypes did not differ significantly. However, significant variation in the total development period from eggs to adult (24.90- 30.06 days) was recorded in different genotypes. Similarly the growth index of the pulse beetle varied significantly on various genotypes (2.09-3.10). The results of study showed that the chickpea genotype C1120 was most suitable for growth and development of the pulse beetle which showed shorter development time and greater total oviposition reflecting the suitability of the host.

Key words: *Callosobruchus chinensis*, genotypes, chickpea

RESPONSE OF RABI PIGEON PEA TO DRIP IRRIGATION AND MULCHING

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The investigation entitled “Response of pigeon pea to drip irrigation and mulching” was conducted at college farm, CAET, NAU, Dediapada, during *rabi* season 2017-18. The experiment consisted of five irrigation treatments and it was laid-out with randomized block design taking four replications. There were three treatments based on surface drip irrigation method and irrigation schedules in the form of pan evaporation replenishment factors of 0.6 and were either kept constant throughout the crop life and two treatments consisted of irrigation through a furrow system of irrigation scheduled at an IW/CPE: 1 with an irrigation water depth of 60 mm was maintained. Growing of *rabi* pigeon pea resulted significantly higher yield due to 0.6 PEF through drip irrigation with sugarcane trash mulch @ 5 t/ha. Yield attributes as well as yields of pigeon pea were also produced higher through drip with sugarcane trash mulch @ 5 t/ha. The interaction effect observed between irrigation and mulch were significant in respect to plant height at harvest (182.66 cm), number of secondary branches (23.04), grain yield (3318.4 kg/ha), haulm yield (2615.24 kg/ha), fodder yield (2712.21 kg/ha), stalk yield (7749.17 kg/ha), dry root weight (1590.28 kg/ha), harvest index (24.26 %) and water use efficiency (6.84 kg/ha-mm) as compared to rest of the treatments. WUE decreased with increase in level of irrigation. Drip irrigation at 0.6 PEF with sugarcane trash mulch @ 5 t/ha recorded higher WUE with 34.79 per cent water saving as compared to surface irrigation (control). The interaction effect of drip irrigation 0.6 PEF + sugarcane trash mulch @ 5 t/ha, 56 per cent coverage recorded higher net returns (136475.99 Rs/ha) and benefit cost ratio (3.66). For getting potential production and profit from the *rabi* pigeon pea, scheduling of irrigation at 0.6 PEF through drip with sugarcane trash mulch @ 5 t/ha.

Keywords – Drip irrigation, Yield, Water use efficiency and Economics

SOIL HEALTH AND UNITED NATIONS SUSTAINABLE DEVELOPMENT GOALS (SDGS)

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The foundation of our ecosystems, food security and climate dynamics depend upon the health of our soils. The soil degradation (land degradation, soil erosion, and loss of organic matter) are deeply intertwined with decline in environmental quality and pose grave threat to the livelihoods of millions of people around the world. Thus, improving soil health was central to the Agenda 2030 or global goals launched by the United Nations in September 2015, the same year that is designated as International Year of Soils. The new set of 17 Sustainable Development Goals (SDGs) with 169 targets and 304 indicators that officially came into force on January 1, 2016 gave soil scientists an extraordinary opportunity to raise awareness on the role of soils in achieving SDGs. The global developments like increase in population, decrease in availability of resources (e.g., land, water, nutrients), and climate change restrict our capacity to increase food production while sustainably managing our natural resources. The Goals that universally apply to all nations, were aimed to mobilize efforts to end all form poverty, hunger, fight inequalities and tackle the alarming climate change and bring overall peace and prosperity as well as equitable and sustainable development of people on planet over next 15 years. Although there is hardly any goal which is not tied with soil health yet the goals on zero hunger (SDG 2), climate action (SDG 13) and life on land (SDG 15) are more closely linked to agricultural production hence soil health. However, soil preservation cannot succeed in isolation—it will require a multidisciplinary approach that goes beyond silo-thinking and incorporates consideration of other development objectives and priorities. In the present study an attempt has been made to evaluate the challenges and opportunities how to improve soil health and the role soils can play in achieving SDGs.

Keywords: United Nations, Sustainable Development Goals, SDGs, Soil health, Agriculture, Poverty, Hunger, Climate Change, Food Security, Natural Resources

BIOTECHNOLOGICAL INTERVENTION FOR INCREASING FRUIT PRODUCTION**M. FEZA AHMAD, SANJAY SAHAY AND RAJNI RAJAN****Department of Horticulture (Fruit & Fruit Technology) Bihar Agricultural University, Sabour, Bhagalpur, Bihar**

India is the second largest producer of fruit plants after China. Mango, banana, citrus, guava, grape, pineapple, and apple are the major fruit plants grown in India. India is the major fruit production and occupied second position in the world. However the productivity of the most fruit crops are very low as compared to advanced country. Over a few decades, technological developments have grown concomitantly. Advances in biotechnology have been used as a tool to increase food production. Specifically, advances in genetic engineering have made possible the manipulation of crops to increase production for the increasing world population. Fruits are one of the major sources of vitamins, essential nutrients, antioxidants and fibres in human diet. During the last two–three decades, genetic engineering methods based on the use of transgenes have been successfully adopted to improve fruit plants and focused mainly on enhancement on tolerance to biotic and abiotic stresses, increased fruit yield, improved post-harvest shelf life of fruit, reduced generation time and production of fruit with higher nutritional value, edible vaccines etc. However, the development of transgenic fruit plants and their commercialization are hindered by many regulatory and social hurdles. One successful example is transgenic papaya expressing coat protein of papaya ring spot virus (PRSV) against PRSV developing two cultivars ‘SunUp’ and ‘Rainbow’. Nowadays, for genetic modification of plants new genetic engineering approaches i.e. cisgenesis or intragenesis receive increasing interest. In this abstract, we attempt to summarize the recent progress achieved on the genetic engineering in fruit plants and their applications in crop improvement for increasing production.

Keyword- production, transgenic, fruit, improvement etc.

ESTIMATION OF INFILTRATION USING HORTON’S EQUATION: A CASE STUDY OF DEDIAPADA, GUJARAT**M. H. FADADU¹, P. K. SHRIVASTAVA² AND D. K. DWIVEDI³****College of Agricultural Engineering and Technology, Dediapada, Navsari Agricultural University, Dediapada (Gujarat), India****College of Forestry, Navsari Agricultural University, Navsari (Gujarat), India**

The design and evaluation of surface irrigation systems of a site requires reliable data of infiltration which could be provided by an infiltration model. In this study, Horton’s infiltration model has been estimated for the soil located in a field of College of Agricultural Engineering and Technology, Dediapada, Gujarat using the infiltration data obtained from several locations in the field using double ring infiltrometer. The decay constant of the Horton’s infiltration model was obtained using graphical method and also by using semi-log plot of t (time) vs. $(f - f_c)$, where f is the infiltration rate (mm/hr) and f_c is the initial rate of infiltration capacity (mm/hr). The potential of the Horton’s infiltration model so obtained was evaluated by least square fitting with the observed infiltration data. The Horton’s infiltration model was used to estimate infiltration rate (mm/hr) and cumulative infiltration (cm). The Horton’s model for infiltration rate obtained by semi-log plot method was obtained as $i = 20 + 94 e^{-1.02t}$, where i = infiltration rate (mm/hr) and t = time (min). The coefficient of determination obtained when the infiltration model was applied to observation data taken at various points in the field were found to 0.96. Therefore, it could be inferred that the Horton’s infiltration model could give a reliable estimate of infiltration for the soil of Dediapada.

PERFORMANCE OF CORIANDER (*CORIANDRUM SATIVUM* L.) CULTIVARS ON PHENOLOGY, YIELD AND QUALITY UNDER PROTECTED CONDITION**M. KARMAKAR, N. CHATTOPADHYAY, A. BAR, G. SAHA AND S. ROY****Department of Plantation, Spices, Medicinal and Aromatic Crops, Faculty of Horticulture,****Bidhan Chandra Krishi Viswavidyalaya, Mohanpur-741252, Nadia, West Bengal**

An investigation was carried out during 2017-2018 in the naturally ventilated arched saw teeth type polyhouse in the Faculty of Horticulture, BCKV, Mohanpur, Nadia, WB, India. The main objective of the investigation is to find out the suitable cultivar of Coriander for getting maximum yield as well as the quality parameters under protected condition of new alluvial zone of West Bengal. The Experiment was laid out in RBD with six replications and four cultivars (i.e. Debcore-88, Surabhi, Khusboo, Jyoti) as treatments in 1.5 m × 1.2 m plot size with spacing of 30 cm × 15 cm. Overnight soaked seeds were sown on 5th of October. It was revealed from the investigation that cultivar Khusboo seeds have maximum number of umbels/ plant (43.36), number of umbellates/ umbel (6.00), number of seeds/ umbel (21.55), seed yield/ plot (342.01 g) and projected seed yield (1075.62 kg/ ha) than other cultivars. In case of quality parameters, total chlorophyll content of leaves found to be maximum (7.28 mg/ 100g) under Debcore-88 cultivar. The highest β -carotene content (10.60mg/ 100g) and ascorbic acid content (126.56 mg/ 100g) was observed from the leaves of Debcore-88. Seeds of cultivar Surabhi showed the highest oleoresin percentage of 0.20. Khusboo cultivar of coriander seeds gave the highest net return of Rs. 59,937.60/ ha with a maximum benefit cost ratio of 3.30. From the above investigation it may be concluded that for maximization of yield of coriander under protected condition, the suitable cultivar is suggested as Khusboo followed by Surabhi and Debcore-88 under the new alluvial tracts of West Bengal.

Key words: coriander, cultivar, protected condition, umbel, yield, β -carotene, total chlorophyll, oleoresin

STUDIES ON GENETIC VARIABILITY AND HERITABILITY ANALYSIS IN RICE BEAN [*VIGNA UMBELLATA* (THUNB.) OHWI AND OHASHI] GERMPLASM

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The present investigation was conducted during *Kharif*, 2014 at Research Block, Department of Crop Improvement, V. C. S. G. Uttarakhand University of Horticulture and Forestry, College of Forestry, Ranichauri Campus, Tehri Garhwal, Uttarakhand. The 28 diverse genotypes of rice bean including three checks viz., PRR-1, PRR-2 and BRS-1 were evaluated in field conditions using Randomized Complete Block Design with three replications. The characters studied were days to 50 per cent flowering, days to maturity, plant height, stem thickness, number of primary branches per plant, leaflet size, number of pods per plant, number of seeds per pod, pod length, 100 seed weight and seed yield per plant. High magnitudes of phenotypic and genotypic coefficients of variation were noticed for stem thickness and number of pods per plant. High estimates of heritability coupled with high genetic advance in per cent of mean were observed for stem thickness, pod length, 100 seed weight and seed yield per plant.

Keywords: Genotypic coefficient of variance (GCV), Phenotypic coefficient of variation (PCV), Heritability, Genetic advance, yield, rice bean

TECHNIQUES IN HARVESTING, PROCESSESING AND STORAGE OF HONEY

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Honey is one of the world's best source of sugars, minerals and vitamins. Quality of honey is the key for its price in world market, which is purely depends on techniques followed from harvesting to storage. Harvesting can be done with centrifugation principle in honey extractor on sunny hours/days by maintaining moisture index and the enzymes (Invertase, Glucose and Oxidase etc...) in honey. Microbial growth in honey can be measured by plate count, MPN (most probable number) and thermotolerant coliforms, sometimes plate count vary from 0 to 10^4 per gram of honey sample. These can be better understood by microscopy of honey, knowledge about storage, storage materials like glass bottles and techniques used for it are important for maintaining original characteristics and final quality of the honey product.

Key words: Quality, Centrifugation, Simple staining, Microbial growth, Glass bottle, Moisture, Temperature.

THE ROLE OF NAC TRANSCRIPTION FACTORS IN REGULATION OF STRESS RESPONSES IN PLANTS

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The biotic and abiotic stresses trigger a wide range of plant response, which includes the alteration of gene expression and cellular metabolism to changes in plant growth and development. The different transcription factor and *cis*-elements of different stress-related genes function in the promoter region, and the over-expression or suppression of these genes may improve the plant's tolerance to stress. The NAC genes constitute one of the largest families of plant-specific TFs and are present in a wide range of species. They play an important role in transcription reprogramming associated with plant stress response. The NAC family proteins play important regulatory roles in plants including flowering, root formation, senescence, shoot branching, responses to diverse abiotic and biotic stress such as salinity, drought and chilling and interaction with fungal and bacterial pathogens. It can be used by various biotechnology approaches to developing stress tolerance genotypes. In transgenic rice, the *Os01g66120/OsNAC2/6* and *Os11g03300/OsNAC10* genes were found to enhance drought and salt tolerance, *Os03g60080/SNAC1* gene increased grain yield (21–34%) under drought stress and over expressing of *OsNAC6* exhibited tolerance to blast disease. A single NAC gene often responds to many stress factors and the protein encoded by them may participate in the regulation of several seemingly disparate processes as positive or negative regulators. The NAC genes can be induced by application of exogenous phyto-hormones, such as JA, SA, and ET in several species. The investigation of several complete plant genome sequences analysis has identified 117 NAC genes in Arabidopsis, 151 in rice, 79 in grape, 26 in citrus, 163 in poplar, and 152 each in soybean and tobacco.

Keyword: NAC gene, biotic and abiotic stress, regulation, phyto-hormones, biotechnology

A REVIEW ON THE CONTROL OF FEW ENDEMIC PESTS BY ENTOMOPATHOGENIC NEMATODES FOR SUSTAIN PRODUCTION OF CROPS BIOLOGICALLY

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Chemicals or pesticides have negative effects on soil fertility, soil health, environment and human health. Nematode is a tiny free-living organism. Being abundant in nature, it can be potentially utilize for a pest management. Entomopathogenic nematodes are excellent biological control agents although they help in environmentally sound production of crops naturally (without use of chemicals or pesticides). Utilization of these nematodes is developing rapidly with almost a doubling of newly described species in the past five years. Advances in molecular biology and phylogenetic reconstruction have revolutionized understanding of population structure, identification, genetic improvement, systematics and the symbiosis between entomopathogenic nematodes and their bacteria. Population structure provides the most fundamental information for reliable identification of species and unique genetic variants. Such information could be further assessed for nematode potential as biological control agents. Phylogenetic reconstruction is an important approach for understanding multitrophic interactions among entomopathogenic nematodes, symbiotic bacteria, and their insect hosts. Phylogenetic reconstruction is also important for the development of a natural and stable type of systematics, which can provide guidelines for selecting appropriate entomopathogenic nematode species for particular biological control programs. Nematodes are known to parasitize and kill the insects. Such type of nematodes is referred to as Entomopathogenic nematode (EPNs). EPNs carry specific bacteria in their guts which helps them to kill their target host. Thus they form nematode-bacteria complexes for which they are considered as a potential agents for the control of insect pest. EPNs carry specific bacteria in their guts which helps them to kill their target host. Thus they form nematode-bacteria complexes for which they are considered as a potential agents for the control of insect pest. We have a great scope in controlling insects biologically through entomopathogenic nematodes and sustain crop production therefore we can go for natural farming with sustainable production for filling requirements of gradually increasing population.

Keywords: Entomopathogenic nematodes, Phylogenetic, Sustainable production.

LIFE CYCLE AND PATHOGENICITY OF *APHELENCHOIDES SWARUPI* ON U3 STRAIN OF *AGARICUS BISPORUS*

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Life cycle and pathogenicity of *Aphelenchoides swarupi* were studied on U3 strain of *Agaricus bisporus*. The nematode took 5-6 days for completion of life cycle from second juvenile to adult at 30 °C, and prolonged to 13-14 days at 15 °C. Ten nematodes per plate as well as per kg compost in bags proved pathogenic. In plates, reproduction factor and population growth rate were minimum at one nematode per plate but they decreased when inoculum level increased from 10 to 40. Yield reduction increased at all inoculum levels when inoculated at spawning compared to casing. Similarly, final nematode population was also higher when inoculation done at spawning compared to casing. Reproduction factor decreased with increase in inoculum level and higher population growth rate was achieved when nematode inoculation was done during casing compared to when done at spawning.

Keywords: Mushroom, *Aphelenchoides swarupi*, *Agaricus bisporus*, life cycle, pathogenicity.

CORRELATION AND PRINCIPLE COMPONENT ANALYSIS (PCA) FOR YIELD AND RELATED TRAITS IN BABY CORN (*ZEA MAYS* L.)

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Speciality corn like baby corn, sweet corn and popcorn are getting importance in recent years. Baby corn is one of the important vegetable crops in Thailand and but in India baby corn is not much popular among farmers due to lack of potential varieties. To meet the nutritional security and climatic changes, baby corn can be grown as an alternate crop which serves both food as well as fodder. So it is necessary to screen the genotypes for potential baby corn production. Focusing these problems my study was conducted by using 12 genotypes in randomized block design (RBD) during *kharif* 2016, *kharif* 2017 and *rabi* 2017 in central agricultural university, Imphal. Totally nine quantitative characters were observed in all the three seasons and the pooled data were used for correlation and PCA analysis. Correlation studies revealed that there is positive significant association observed for days to 50% pollen shedding and days to 50 % silking. And also the number of cobs per plant and days to 50% silking were found positive significant association with yield without husk (baby corn yield). Principle component analysis helps in identifying the most relevant characters and presents them in more interpretable and more visualized dimensions through linear combinations of variables that accounts for most of the variation present in original set of variables. In the present study the total variation divided

into 9 principle components and the first 3 components explains more than 75% of variation with eigen value more than one. The first principle component accounted 33.92 % followed by the second (23.04) and third (19.36) principle components. It was therefore inferred that the essential feature of data set was explained by the first four principle components. The biplot depict the genotype distribution and the different characters. In the first quarter (+ ve PC1 and + vePC2), yield without husk, yield with husk and number of cobs were the influential characters, while, in the second quarter (+vePC1, - vePC2), cob weight and cob length are the most influential characters. Therefore it is assumed that genotypes which are falling in the first quarters are expected to have higher values of yield with husk and yield without husk while the genotypes in the second quarter are expected to have higher cob length and cob weight. The genotypes IMHB 1532 and BVM-2 followed by GAYMH-1 are the highest yielders but they were late in flowering so the relationship between high yielding and late flowering should be broken in future for further improvement.

SUSTAINABILITY OF AGRICULTURE THROUGH CARBON SEQUESTRATION

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Carbon sequestration is the process of capturing and long term storage of atmospheric carbon dioxide. Carbon dioxide is a greenhouse gas which is produced due to anthropogenic activities showing a higher level now a day which leads to increase temperature and cause global warming, this alarm to find the ways to reduce CO₂ from atmosphere. Hence one of the best way is carbon sequestration and luckily we can do it with the help of agricultural practice. These practice not only sequester carbon but also make our agricultural more sustainability and improves soil health radically to unsurpassed capstones. Soil carbon sequestration is the process of transferring carbon dioxide from the atmosphere into the soil through crop residues and other organic solids and in a farm that is not immediately remitted. Soil stores three times more carbon than any other source. A soil with high organic matter is more productive than management practice and transported by surface runoff and erosion. However, organic matter can be restored to about 60 to 70 % of natural levels with best farming practice. Gaining support for carbon sequestration will require engaging the interests and building the support of a variety of stakeholders, each with different perspectives and goals. Regulators want to know about the environmental impacts. Commercial developers need confidence in feasibility. The local community must get aware about the process and finally we agriculturalist must take interest and do support the vision of environments, so that agricultural sustainability with addition of organic matter to soil must be maintained and carbon problem persuading the environment can be mitigated. Finally this all process gave soil health as a boon to mankind.

Key Word: Soil, Carbon sequestration, global warming, organic matter and agricultural.

ASSESS THE EFFECT OF DIFFERENT PGRS AND MICRO-NUTRIENT ON SHELF-LIFE AND QUALITY OF AONLA CULTIVAR NA-7 AT ROOM TEMPERATURE

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The shelf-life of fruit is depended on the physiological process of the fruit. The fruits having longer shelf-life fruit are preferred by the consumers. The present investigation was conducted at room temperatures for 15 days, observations were recorded at 5 days interval. The fruits were collected from different treatments of the previously treated with the PGRs and micro-nutrient alone or in combinations. The present study revealed that the minimum physiological loss was noted in the fruits collected from treated with GA₃ (50 ppm) + NAA (50 ppm) during both the year at all three treatments. The total sugar content increases as the days of storage increases and maximum total sugar content was noted in fruit collected from plotted which was treated with GA₃ (50 ppm) + NAA (50 ppm) during both the year. The ascorbic acid content gradually decreases during the storage. The maximum ascorbic acid content was recorded in fruits collected from the plot which was treated with GA₃ (50 ppm) + NAA (50 ppm) during both the year. Finally it may concluded that fruits collected from the plot treated with GA₃ (50 ppm) + NAA (50 ppm) having long self-life at room temperature with high quality stagnation.

Key words: PGRs, room temperature, physiological weight loss and total sugar

MICROPROPAGATION OF (*WITHANIA SOMNIFERA*) (L.)

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Withania somnifera (L.) is well known for its medicinal properties. Metabolites of this plant contain various bioactive compounds that possess therapeutic potential. Tissue culture is an important approach for the multiplication of plants for improved agronomic performance using different concentration and combination of plant growth regulator. The aim of the present work to focus the

application of tissue culture to develop an efficient in vitro tissue culture protocol to obtain maximum plantlet regeneration that can have a huge impact in ex situ conservation of biodiversity. The present study focused on in vitro micro propagation of *Withania somnifera* through tissue culture, regenerated plants after acclimatization were transferred to soil, and they showed 80% survival. Murashige & Skoog (MS) media with different combinations and concentration of growth promoters viz. Indole Acetic Acid (IAA), 2, 4-D (2, 4 dichlorophenoxy acetic acid), and (Benzyl Amino Purine (BAP). The maximum callus induction was observed in the MS media supplemented with 2, 4-D (3mg/l) in internodal explant of *Withania somnifera*. The best response in shoots formation was observed in media supplemented with BAP (0.2mg/l). Root formation was observed in 0.3mg/l in half strength MS media.

Keywords: *Withania somnifera*, Micro propagation, Growth regulator, Tissue culture

INTEGRATED PLANT NUTRIENT SYSTEM FOR IMPROVING SOIL HEALTH AND CROP PRODUCTIVITY

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Expansion and intensification of cultivation are among the predominant global changes of this country. Intensification of agriculture by use of high yielding crop varieties, fertilization, irrigation and pesticides has contributed substantially to the tremendous increases in food production over the past 50 years. Land conversion and intensification alter the biotic interactions and patterns of resource availability in ecosystem and can have serious local, regional and global environment consequences. The use of ecologically based management strategies can increase the sustainability of agricultural production while reducing off-site consequences. Increased attention is now being paid to developing an Integrated Plant Nutrition System (IPNS) that maintains or enhances soil productivity through balanced use of all sources of nutrients, including chemical fertilizers, organic fertilizers, green manures and biofertilizers. The basic concept underlying the IPNS is the adjustment of soil fertility and plant nutrient supply to an optimum level for sustaining desired crop productivity through optimization of the benefits from all possible sources of plant nutrients in an integrated manner. IPNS relies on a number of factors, including appropriate nutrient application and conservation and the transfer of knowledge about IPNS practices to farmers and researchers, boosting plant nutrients can be achieved by a range of practices such as application of fertilizers, organic manures, biofertilizers, terracing, alley cropping, conservation tillage, intercropping, crop rotation. These IPNS practices are ecologically, socially and economically viable and environment friendly which can be practiced by farmers to derive higher productivity with simultaneously maintaining soil health and soil productivity.

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NITROGEN MANAGEMENT IN RICE (ORYZA SATIVA L.) UNDER VARIOUS CROP ESTABLISHMENT METHODS IN SOUTH BIHAR

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A field experiment was conducted at Research Farm, Bihar Agricultural university, Sabour during Kharif 2018 in Split Plot Design with three Crop Establishment Methods viz. System of Rice Intensification, Puddled transplanted Rice and Direct Seeded Rice and five Nitrogen Management Practices viz. 120:60:40, 75% inorganic + 25% organic(vermicompost), 180:60:40 ,LCC based N application, and 100:40:20. Analyzed data revealed that among the different rice establishment methods, system of rice intensification significantly increased all the growth attributes viz. no. of tillers, dry matter production, leaf area index, CGR at

different stages of crop growth. The yield attributing characters viz., effective tillers, panicle length, no. of grains per panicle, 1000 grain weight and grain and straw yield were also recorded maximum when crop was grown under system of rice intensification method. Nitrogen uptake was also recorded maximum under system of rice intensification. Grain yield of rice (42.68 q/ha) was maximum under SRI which was statistically at par with the grain yield with PTR (42.32 q/ha) and both were significantly superior over DSR method (35.61 q/ha). Application of 150% N, i.e. 180 kg N ha⁻¹ recorded maximum grain yield of rice (43.69 q/ha) which was significantly superior over all other nitrogen management practices. Grain yield under LCC based N application was marginally lower than the integrated N application and found promising in optimizing grain yield with higher internal utilization efficiency (IUE_N) and partial factor productivity (PFP_N) indicating great scope of N saving (20%). Maximum net return and B:C ratio was recorded in 150 % N treatment. However, B:C ratio estimated under application of 180 kg N ha⁻¹ was statistically at par with LCC based N application. The results of the one year study lead to conclusion that for realizing higher and sustainable yield, crop must be established following system of rice intensification and the nitrogen management must centre around 180:60:40 kg N : P₂O₅:K₂O/ha-1..

Keywords: Rice establishment methods, Nitrogen management, Rice, IUE_N, PFP_N

POST HARVEST MANAGEMENT AND VALUE ADDITION OF HORTICULTURAL CROPS: A SOURCE OF INCOME GENERATION FOR THE FARMERS OF EASTER UTTER PRADESH

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India is the second largest producer of fruit and vegetable in the world and merely contributed only 1% in global market of the fruit processing industry. Horticulture sector faces the several problem such as lack of skilled man power, poor cold storage facilities, inefficient post-harvest management and minimal technological interventions. In India, the wastage of fresh fruit, produce has been estimated to be of a very high which may be around 30-35% of the total production during harvest, storage, grading, transport, packaging and distribution. These percentages of wastage of the produce are not acceptable and adversely affect the growth of Indian economy. To prevent such amount of horticultural losses, various governmental organizations in India have been trying to find out the solution for the serious issue related to post-harvest management. Some efforts came with progress and achievements, other work didn't reflect to visible success as expected. So, in this study, our aim is to address and discuss the important ramified issues in post-harvest management and value additions. India harvested 223.089 million tonnes of horticultural produce from 20.876 million hectares of land in the 11th five year plan. The major crops contributing to it are fruits and vegetables (approx 204 million tonnes from 14.314 million hectares area). Horticulture sector contributing 30 percent to the India's agricultural GDP from 8.5 percent of cropped area. As the waste utilization technology are adopting in developed countries and the scales of economies of these technologies does follow in Indian conditions due to various factors. Therefore, there is a need for development of cost effective technologies for the production of value added products. Post harvest management of fruits and vegetables provides ample opportunities for value addition besides providing wealth from waste. Its effective utilization helps in reducing the cost of production of crops besides optimum utilization of biomass. A several process technologies used to utilize fruit and vegetables such as drying & dehydration, freezing, fermentation, extraction, etc., are some treatment examples that can be useful to recycling and upgrading waste of fruit and vegetable market.

Keywords: Harvest, Value Addition, Biomass, Treatment, Management, Economy etc.

MORPHOLOGICAL CHARACTERIZATION AND PATHOGENICITY OF *RHIZOCTONIA SOLANI* OF DIFFERENT HOSTS

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Rhizoctonia solani (Teleomorph: *Thanatephorus* spp.) is a plant pathogenic fungus with a wide host range and worldwide distribution causes severe damages in crops all around the world causing diseases on field and horticultural crops. *R. solani* is best known to cause various plant diseases such as collar rot, root rot, damping off, sheath blight, banded leaf and sheath blight, hypocotyls rot, stem canker, web blight and wire stem throughout the world. Cultural and morphological variability was studied in 10 isolates of *R. solani* having different hosts from 2 different places viz., Tripura and Assam. Colony size, colony growth, colour and sclerotia formation (central, peripheral, or scattered), location (aerial or surface) and texture (smooth or rough) varied in these isolates. Under microscopic study all of the isolates showed multinucleate branching. Number of nuclei per cell was examined by staining the hyphae with safranin-0, KOH and lactophenol blue where lactophenol blue gave the best result. Number of nuclei per cell was variable (7 to 37, n=20), providing evidence that the isolates belonged to *R. solani*. Mycelial compatibility was studied between the isolates of different hosts. Isolates when combined with same host gave compatible (+) reaction whereas isolates when combined with different host gave incompatible (-) reaction. Pathogenicity test was conducted on hypocotyl by mixing the soil with culture having *R. solani* and seeds were sown for germination. Fifteen days after the germination of seeds, seedlings showed symptoms, whereas controlled seedlings remained healthy. Pathogenicity test was conducted on leaves by inoculating mycelial

disc on healthy plants of different hosts, with non-inoculated plants serving as control. Few inoculated plants developed symptoms, whereas controlled plants remained healthy.

WEED MANAGEMENT IN WINTER GUAVA CV. L-49 THROUGH VARIOUS MULCHES

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Weed management is an important component in fruit crop production. The application of organic and inorganic mulches in orchard create an additive effect by restricting the nutrient removal through weeds. Keeping above in mind, the present study was carried out in the guava orchard of Department of Horticulture, Khalsa College, Amritsar during 2017-2018. Guava trees of cv. L-49 were selected having uniform size and vigour. The base of the trees was covered with various soil covers (paddy straw, sugarcane trash, grass and plastic mulches of varying thicknesses) in the first week of July. The experiment was laid out in Randomized Block Design with twelve treatments replicated thrice. Black polythene mulch (100 gauge) was most effective as compared to other mulches. Lowest number of weeds and weed dry biomass at all monthly intervals and highest number of fruits per tree and yield was recorded with black polythene mulch (100 gauge). Hence, black polythene mulch (100 gauge) was found to be the most efficacious among other mulches for decreasing weed growth and increasing yield of guava trees cv. L-49.

Key words: Guava, L-49, paddy straw, sugarcane trash, grass, plastic mulch, weeds.

SUSTAINABLE AGRICULTURE AND THE MANAGEMENT OF NATURAL RESOURCES

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Sustainable agriculture approach seeks to utilize natural resources in such a way that they can regenerate their productive capacity and also minimize harmful impacts on ecosystems beyond a field's edge. One way that farmers try to reach these goals is by considering how to capitalize on existing natural processes, or how to design their farming systems to incorporate crucial functions of natural ecosystems. By designing biologically-integrated agro ecosystems that rely more on the internal cycling of nutrients and energy, it is often possible to maintain an economically viable production system with fewer potentially toxic interventions. For example, farmers aiming for a higher level of environmental sustainability might consider how they can reduce their use of toxic pesticides by bringing natural processes to bear on limiting pest populations. This might happen, for example, by planting hedgerows along field edges, or ground covers between rows, thereby providing habitat for insects and birds that prey on the pests, or by planting more diverse blends of crops that confuse or deflect pests. Maintaining a high degree of genetic diversity by conserving as many crop varieties and animal breeds as possible will also provide more genetic resources for breeding resistance to diseases and pests. Conservation of resources critical for agricultural productivity also means taking care of soil so that it maintains its integrity as a complex and highly structured entity composed of mineral particles, organic matter, air, water, and living organisms. Farmers interested in long-term sustainability often prioritize caring for the soil, because they recognize that a healthy soil promotes healthy crops and livestock. Maintaining soil functioning often means a focus on maintaining or even increasing soil organic matter. Soil organic matter functions as a crucial source and sink for nutrients, as a substrate for microbial activity, and as a buffer against fluctuations in acidity, water content, contaminants, etc. Furthermore, the buildup of soil organic matter can help mitigate the increase of atmospheric CO₂ and therefore climate change. Another important function of soil organic matter is inducing a better soil structure, which leads to improved water penetration, less runoff, better drainage, and increased stability, thereby reducing wind and water erosion. Due to a high reliance on chemical fertilizers, agro ecosystem functioning has been disconnected from the internal cycling of key plant nutrients such as nitrogen and phosphorus. Phosphate minerals for fertilizer are currently mined, but global reserves are predicted to sustain food production for only another 50 to 100 years. Consequently, phosphate prices are anticipated to rise unless new reserves are discovered and innovations in recovery of phosphates from waste are developed. The recycling of nitrogen and phosphorus (at the farm and regional scale), improving efficiencies of fertilizer applications, and relying on organic nutrient sources (animal and green manures) are important elements of sustainable agriculture. Recycling of nutrients is facilitated by a diversified agriculture in which livestock and crop production are more spatially integrated. For these reasons, extensive mixed crop-livestock systems, particularly in developing countries, could significantly contribute to future agricultural sustainability and global food security. In many parts of the world, water for agriculture is in short supply and/or its quality is deteriorating. Overdraft of surface waters results in disturbance of key riparian zones, while overdraft of groundwater supplies threatens future irrigation capacity. Salinization, nutrient overloads, and pesticide contamination are widespread water quality issues. Selection and breeding of more drought- and salt-tolerant crop species and hardier animal breeds, use of reduced-volume irrigation systems, and management of soils and crops to reduce water loss are all ways to use water more efficiently within sustainable agroecosystems. Modern agriculture is heavily dependent on non-renewable energy sources, especially petroleum. The continued use of these non-renewable sources cannot be sustained indefinitely, yet to abruptly abandon our reliance on them would be economically catastrophic. In sustainable agriculture, the goal is to reduce the

input of external energy and to substitute non-renewable energy sources with renewable sources (e.g., solar and wind power, biofuels from agricultural waste, or, where economically feasible, animal or human labor).

STUDIES ON THE RESPONSE OF BIO-FERTILIZERS FOR SUSTAINABLE SUGAR BEET PRODUCTION.

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Present investigation was carried out to standardize Bio- fertilizers for sugar beet production. Result showed that integrated use of 75% recommended fertilizers along with organic manures and bio- fertilizers produced root yield at par with the previous recommendation (80:100:80 NPK +200 q/ha FYM) and improved soil organic carbon. Besides yield, integrated use of fertilizer, manures and bio- fertilizer increased TSS and total phenols content and decreased pyruvic acid as compared to inorganic fertilizer application alone. Combined application of fertilizers, organic manures and bio- fertilizers maintained initial soil available NPK status. We conclude that the combined application of inorganic fertilizer (60:75:60) kg NPK along with organic manures and bio fertilizers produced yield at par with previous recommendation, improved root quality and maintained soil fertility. Adoption of this practice saved 25% inorganic fertilizers and protect environment from pollution.

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Rashtriya Krishi Vikas Yojana 'National Agriculture Development Programme' is a State Plan Scheme of Additional Central Assistance launched in August 2007 as a part of the 11th Five Year Plan by the Government of India. Launched under the aegis of the National Development Council, it seeks to achieve 4% annual growth in agriculture through development of Agriculture and its allied sectors (as defined by the Planning Commission (India)) during the period under the 11th Five Year Plan (2007–11). This programme is essentially a State Plan Scheme that seeks to provide the States and Territories of India with the autonomy to draw up plans for increased public investment in Agriculture by incorporating information on local requirements, geographical/climatic conditions, available natural resources/ technology and cropping patterns in their districts so as to significantly increase the productivity of Agriculture and its allied sectors and eventually maximize the returns of farmers in agriculture and its allied sectors. A State is eligible for funding under the RKVY if it maintains or increases the percentage of its expenditure on Agriculture and its Allied Sectors with respect to the total State Plan Expenditure, where the Base Line (which will move every year) for this expenditure is the average of the percentage of expenditure incurred by a State Government for the previous three years on Agriculture and its Allied Sectors minus any funds related to Agriculture and its allied sectors that it may already have received in that time under its State Plan.

Key word- RKVY, natural resources etc.

WEED MANAGEMENT IN ORGANIC FARMING SYSTEM

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Weeds are often defined as plants growing where they are not wanted. Weeds are most damaging to crop yields if they have some advantage over the crop. Four factors are especially important: number, timing, vigour and chemistry. Of course, more weeds are generally more of a problem than few weeds, but weed density alone is not a satisfactory predictor of the outcome of competitions. Organic weed management is a holistic system involving an entirely different approach to managing a farming system. In spite weeds are a serious threat to promotion of organic farming, relatively less attention is given to research on weed management. This review article explores a scope of integration of conservation agriculture for weed control under organic farming system. Effective weed management on organic farms requires extensive planning and preventing measure coupled with cultural method and crop rotations are the basis for successful organic farming and are necessary for breaking weed, insect and disease cycles. Appropriate crop rotations and cover crops management suppress weeds populations with smothering and allelopathic effects. Bio control and understanding of allelochemical may help the organic farming. Thus, cultural approaches integration under organic farming could be an option for weed, pest and soil management which leads to sustainable organic plant production. Organic weed management relies on mechanical, biological and cultural methods, but these tools must be used in an integrated, multi-strand approach.

Keywords: Weed, organic farming, pest, crop, management.

STANDARDIZATION OF SEED DRYING METHODS FOR COWPEA CV. KASHI KANCHAN WITH ZEOLITE BEADS AND SILICA GEL

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Freshly harvested seeds of cowpea are highly prone to bruchids infestation and fast deterioration if the moisture content of seed is more than 12%. One of the best methods to manage the bruchids infestation and control deterioration is reduction of seed moisture. Bringing down the seed moisture to safer level by sun drying is a chief method in tropical countries. Use of seed dryer also a best alternative to bring down the moisture content. But it may affect the viability due to temperature fluctuation at the time of drying. Zeolite beads (aluminum silicate) and silica gel are desiccants, which can be utilized to ultra-dry the seeds. Sometimes ultra-drying of pulse seeds may induce secondary dormancy. By considering the above points, to standardize the drying method, vegetable cowpea cv. Kashi Kanchan seeds were mixed with Zeolite beads and Silica gel, separately, in the ratio of 1:0.5, 1:1, 1:2 and 1:3 (seed: desiccant, by weight) in an air tight container and kept at room temperature. Initial moisture content of seeds (12.4%) was estimated by hot air oven method. Seeds were separated from desiccant and weighed after 24h, 48h, 72h, 96h and 120h of drying. Weight of desiccants were also noted down at every 24h interval. At the end of the experiment final moisture content of dried seeds were estimated. It was observed that seed drying with zeolite beads was faster than silica gel. Significantly higher moisture content was removed from seeds (2.5 %) within first 24h by zeolite beads in 1:3 ratio. Final moisture content of seeds dried with zeolite beads reached 7.21% in 1:3 ratio and 9.6 % in 1:0.5 ratio of drying condition after 120h of drying. In all the treatments, maximum moisture content from seeds was removed within first 24h of drying. Gradual increase in weight of desiccants indicate continuous removal of moisture from the seeds during drying period. Seed germination test concluded that seed drying with zeolite beads reduced the moisture content without affecting viability of seeds. Further work is necessary to know the storability of ultra-dried seeds under air tight condition.

TOXICITY OF NEEM BASED PESTICIDES AS AN INSECT GROWTH REGULATOR (IGR) AGAINST LEMON BUTTERFLY, *PAPILIO DEMOLEUS*

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The lemon butterfly, *Papilio demoleus* is a destructive pest of lemon and various crops. Neem based insect growth regulator are highly selective and generally safe for non target and do not accumulate in the environment and less toxic to man and domestic animals. So in the current study, the toxicity effect of Rakshak on the larvae of *Papilio demoleus* was investigated. Eight doses 1.00, 0.50, 0.25, 0.125, 0.06, 0.03, 0.015 and 0.007 per larva had been topically applied onto 3rd instar larvae of *Papilio demoleus* and found 82.4%, 67.85%, 64.28%, 57.14%, 53.56%, 46.43%, 39.28% and 32.13% respectively. The result indicated that lethal effect of Rakshak might exhibit significant effects on the population of *Papilio demoleus* and can be used to its management without any toxic effect.

Key words: Insect growth regulator, toxic effect, rakshak, larva, *Papilio demoleus*

DEVISING SOIL ERODIBILITY INDEX MAP FOR RI-BHOI DISTRICT OF MEGHALAYA

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In the Revised Universal Soil Loss Equation (RUSLE), erodibility accounts for the influence of soil properties on soil loss during storm events in upland areas, which are represented by the soil erodibility factor (K). K-factor values were best obtained from long-term direct measurements on natural runoff plots; however, in the absence of field tests, these values can be estimated using relationships based on physico-chemical soil properties. Soil erosion by water is a major concern in Meghalaya, and the application of models such as Universal Soil Loss Equation (USLE) or RUSLE is limited due to the lack of information about erodibility factors. The K factors once determined are generally given in nomograph or map form so that the values can be picked up easily for estimating soil erosion. The present study was therefore planned to determine the erodibility factor of Ri-bhoi district of Meghalaya based on soil's physico-chemical properties and to prepare the erodibility map on GIS platform. The objectives of the study were: i) to determine the soil erodibility index for Ri-Bhoi District of Meghalaya and ii) to prepare the erodibility Index map for estimation of soil erosion. Ri-bhoi district has primarily four dominant land uses viz. agriculture, *jhum*, forestry and wasteland apart from the built-up areas. Hundred sampling points were taken according to the land uses, taking 25 sampling points for each land use, and the exact locations of the sampling points were recorded with GPS. The sampling points were then plotted

on the map of Ri-bhoi in the GIS. The K factor for each of the sampling points have been determined and recorded. In agriculture land use system (LUS) K factor values were observed in the range of 0.08 - 0.41 with an average of 0.24, *jhum* LUS 0.08 - 0.42 with an average of 0.19, forest LUS 0.09 - 0.40 with an average of 0.22, in waste land 0.10 - 0.34 with an average value of 0.22 and final map of soil erodibility was generated using Geographical Information System (GIS) tools for the spatial representation of the soil erodibility in the study area. Arc-GIS was used to interpolate the data.

Keywords: K factor, *RUSLE*, GIS, soil erodibility index map, Ri-Bhoi district, Meghalaya.

INTEGRATED NUTRIENT MANAGEMENT OF SOIL

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Although, chemical fertilizers are playing a crucial role to meet the nutrients need of the crop, the imbalance and continuous use of chemical fertilizers has adverse effect on soil health including soil physical, chemical and biological properties thus affecting the sustainability of crop production, besides causing environmental pollution. In this context, necessitating the need to develop a sustainable production system. This integrated nutrient management is very old concept. It is not new but it is an old practice. INM philosophy may be deemed as a triple balance among three securities: ecological, economic and capital resources. It measures the producer's endeavour to minimize ecological degradation and maximize economic value for the production costs to make it affordable for consumers.

Key words: INM, Soil health, Ecological balance, Sustainable.

BIODIVERSITY AND IPR ISSUES AND CURRENT CHALLENGES

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Biological diversity is the hallmark of life on earth. It is very backbone of sustainable development. IPRs are to be distinguished from physical property rights in the context of genetic resources and biotechnology, ownership of the physical resources –plant or animal – is governed by property laws while ownership of the genetic information contained in the plant or animal is governed by intellectual property laws. The current Intellectual Property Rights (IPR) regime is encouraging commercialization of seed development, monoculture, protection of new plant varieties, microorganisms, and genetically modified organisms. As a consequence, our rich biogenetic diversity is being eroded irreversibly. We must find out a path to make an alternative approach that will bring a balance in between formal Intellectual Property (IP) system and sustainable aspects of biodiversity.

Keywords:- Biodiversity, IPRs, Genetic Resources, sustainable.

ZERO BUDGET NATURAL FARMING

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This is a form of low external input sustainable agriculture (LEISA). Rather, an extreme form that does not shy away from suggesting that there is no need to use any external inputs. All inputs are to be locally resourced from in and around the village (or perhaps within the farm) in a symbiotic way. This is a dynamic system wherein outputs are likely to be inputs to at least one of the other outputs. More importantly, as none of the inputs are sourced from outside the system then there is no cost, and it is this that is referred to as zero budget natural farming (ZBNF). The benefits of ZBNF are little or no cost zero chemical usage (will restore soil organic matter and soil carbon and thereby facilitate greater productivity) use local seeds (less costly, resilient to climate change compared to hybrids); less water requirement (more crop per drop) zero budget (through poly crop and trees) facilitate income throughout the year and reduces risk protective irrigation better; climate friendly and carbon neutral agriculture; and increases consumer access to healthy food among others. Problem of indebtedness in Indian agriculture. Increased Risk and Vulnerability. Smaller proportion of marginal farmers have a greater share of credit. Impact has been positive and affirms the claims that the method can reduce risk.

Keywords:- Zero Budget Natural Farming, Sustainable Agriculture

INFLUENCE OF WEATHER ELEMENTS ON FLOWERING PHENOLOGY AND INSECT POLLINATORS DIVERSITY OF MUSTARD (*BRASSICA JUNCEA* L.)

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Influence of weather elements was studied in relation to flowering phenology and insect pollinators diversity of mustard (*Brassica juncea* L.). The studies were conducted in mustard crop by inducing the plant to flower early or late through different sowing dates. The crop was sown during two major seasons first from October- November (season 1) and second from February to March (season 2) in three different dates in each season at an interval of fifteen days. Season 1 and season 2 had significant effect on flower phenology, insect pollinators diversity and relative abundance of insects and seed set of mustard crop. Flower phenology characters like duration of flowering, days to flowering, longevity of flower, pollen viability and nectar sugar concentration have been found sensitive to change in weather conditions like temperature, relative humidity and rainfall. Flower bud development, longevity of flower was positively correlated with temperature during both the seasons. Nectar sugar concentration decreased with decreasing relative humidity due to water stress and had a direct correlation with air temperature. Cool temperature at the time of flowering favoured nectar flow. High temperature, heavy rainfall and low temperature had negative influence on abundance of insect visitors on mustard flower. Visits of *A. cerana*, *A. mellifera*, syrphids and other dipterans were negatively correlated with maximum temperature and relative humidity during both the seasons. Negative correlation was also observed between abundance of different insect visitors and relative humidity over the two seasons of investigations.

Keywords: weather elements, flower phenology, insect pollinators, mustard

VALUE ADDITION IN VEGETABLE CROPS

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India is the second largest producer of vegetable next to China. Most of the vegetables are highly perishable and have limited life, which need to be marketed immediately or processed into varied value-added products. Diversification of vegetable products for export and domestic consumption reduces the risk of loss due to price fluctuation. This increased demand for value-added products is due to the change in the market behaviour, changes in consumer preferences and emergences of supermarkets, which have resulted in the usages of more value-added, ready-to-use vegetable products and vegetable in consumer packs. These products also have a high demand in the defence sector of the different country. Among the different vegetable value-added products, dehydrated potato, peas, carrot, cauliflower, tomato-based processed products, pickles and chutney from different vegetables are the most important. Apart from these lycopenes from tomato and watermelon, tomato seed oil, frozen vegetables, organic vegetables, minimal processed vegetables, consumer-packed vegetables, etc., are also important.

Keywords:- Vegetables, Pickles, Value- added products etc.

VALUE ADDITION OF TOMATO AND THEIR NUTRITIONAL QUALITY

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In India, nearly 7.1 million tones of tomato are produced annually from an area of 5.4 lakh hectares. Tomato known as poor man's apple are cultivated on 70000 acres of land in the state with an average yield to 140000 tones of tomatoes a day being produced. Tomato is a good source of vitamins, minerals and other useful substances like fiber which are necessary for good health. Tomato contains lycopene and betacarotene pigment. Lycopene is one of the most important components in tomato as it has been found to have a vital role in protecting humans from various types of cancer including colorectal, prostate, breast, endometrial and lung. Value addition to tomato through processing can be brought about by converting them into value added products. Sun Drying is found to be one of the ways to provide antioxidant product at low price to the community. Hence, tomato was dried and developed the various products using dried tomato and dried peel.

Keywords: Tomato, Cultivation, Lycopene, Drying etc.

EFFECT OF SPACING AND PINCHING ON GROWTH, YIELD AND QUALITY OF AFRICAN MARIGOLD CV. PUSA NARANGI GAINDA

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An experiment was carried out to study the effect of different levels of plant spacing and pinching time as well on plant growth, yield and flower characters in African marigold cv. Pusa Narangi Gaiinda during the year 2018-19 under semi arid condition at

Agriculture Research Farm, Department of Horticulture, Suresh Gyan Vihar University, Jagatpura-Jaipur (Rajasthan). The experiment was laid down in Randomized Block Design (Factorial) with three replications which comprises of sixteen treatment combinations included different levels of plant spacing (Four spacings viz., 40 x 10, 40 x 20, 40 x 40, and 40 x 60 cm) and four stages of pinching (non-pinched and pinched at 20, 30 and 40 days after transplanting). The interaction effect of plant spacing (40 x 20 cm) and pinching (at 30 days after transplanting) significantly influenced the highest plant height (68.52 cm), maximum leaves (146.67), stem diameter (1.73 cm), primary branches (13.91), bud size (1.40 mm), flower diameter (7.60 cm), the heaviest fresh flower (11.66 g) and dry flower weight (4.80 g), longest pedicel length (8.16 cm), blooming period (71.67 days), vase life (7.42 days), highest flower yield plant⁻¹ (365.70 g), flower yield ha⁻¹ (132.83 quintal) and B:C ratio (1:3.03). It is, therefore, concluded from the present study that the treatment combination consists of plant spacing 40 x 20 cm and pinching time at 30 days after transplanting were found to be best and showed a significant effect on vegetative growth, yield and flower quality of African marigold.

TO EVALUATE THE PROTEIN DIGESTIBILITY'S OF NORMAL AND *IN VITRO* CONDITIONS OF SPROUTED MUNG BEANS

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This study was conducted to evaluate protein digestibilities of sprouted mung beans at different periods in normal and *In vitro* (24hr) conditions. Germination of legumes is an effective mean of improving nutritive value of legumes. Three mung bean cultivars were kept for sprouting at 0hr, 24hr, 48hr, 72hr and 96hr of germination. A significant ($p \leq 0.005$, $p \leq 0.001$) improvement in normal and in *in vitro* protein digestibility (IVPD) was observed as soon as the germination started. In Pepsin, Trypsin and *In vitro* protein digestibilities, *In vitro* pepsin digestibility has shown the highest digestibility than *In vitro* trypsin digestibility, trypsin digestibility and pepsin digestibility. Among the germination periods 96hr sprouts of SGC-20 cultivar has shown the highest digestibility of both *In vitro* pepsin digestibility and *In vitro* trypsin digestibility followed by 72hr, 48hr, 24hr sprouts.

Key words: Germination, *In vitro* pepsin digestibility, *In vitro* trypsin digestibility

IMPLICATIONS OF ELEVATED CARBON-DIOXIDE ON FLOWERING TIME.

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Carbon dioxide has been increasing uniformly worldwide since industrial revolution. Current CO₂ concentration is around 405 ppm which may increase up to 700 ppm in the near future. Carbon dioxide imparts various changes during the developmental stages of plant. Its increase leads to the overproduction of carbohydrates (sucrose) which not only act as a source of energy, but they also act as a signals in plants (Mohammed *et al.*, 2013). Increasing CO₂ and temperature are the main environmental factors that advances flowering time in the crops and other plants. Environmental stimuli such as temperature, photoperiod and elevated carbon dioxide [e(CO₂)] plays a critical role in flowering. A composite signalling network of flowering regulation with increase in temperature involving different transcriptional factors (PIF4, PIF5), flowering suppressors (HvODDSOC2, SVP, FLC), and the autonomous pathway (FCA, FVE) genes, mainly from *Arabidopsis*, provides an easy way to improve our understanding of the dynamics of flowering time under changing climate. The circadian clock fulfills a crucial role at the heart of cellular networks and the bilateral relation between sugar signalling and the clock (Jagadish *et al.*, 2016). An [e(CO₂)] badly affects the pollen apertures with disturbed exine ornamentation and wrinkled flowers.

Key words: flowering time, climate change, photoperiod, high temperature, circadian clock

COMBINING ABILITY FOR YIELD AND YIELD ATTRIBUTING TRAITS IN GENETICALLY DIVERSE GENOTYPES OF MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)

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Mungbean (*Vigna radiata* L. Wilczek) is an economically important short duration grain legume characterized by relatively more palatable, nutritive, cheap source of high quality and easily digestible protein, non-flatulent crop. Hence, to enhance present yield levels, and to breed a high yielding genotype, the information on the genetic mechanism controlling various traits in the material being handled, is a pre-requisite. Therefore, the present investigation was carried out to estimate the combining ability analysis

through crosses developed by Line x Tester passion using ten genotypes as line and three genotypes as testers. The study revealed that the gene action involved in controlling traits viz., plant height, number of pods per plant, number of seeds per pod and grain yield per plant was non-additive hence heterosis breeding will be rewarding; while the characters viz., number of branches per plant and 100-grain weight had additive gene action, indicating progeny selection will be beneficial. Genotype KM 2264 was found good general combiner for most of the yield attributing traits. Among testers, the genotype KM 2195 was found good general combiner for all the characters. Among the F₁ hybrid crosses KM 2312 x KM 2241, KM 2260 x KM 2241 and KM 2318 x KM 2241 exhibited highly significant positive SCA effects along with higher *per se* performance for yield contributing traits.

Keywords: Variability, Additive, Non-additive, GCA, SCA, Heterosis, Progeny Selection

GENETIC VARIABILITY, CORRELATION AND PATH COEFFICIENT ANALYSIS IN CHILLI (*CAPSICUM ANNUUM* L.)

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The present investigation was carried out during at Vegetable Research cum Demonstration Block of the Department of Vegetable Science, College of Horticulture, VCSGUUHF, Bharsar, Pauri Garhwal, Uttarakhand with 25 genotypes of chilli in a randomized block design with three replications to estimate the genetic variability, correlation and path coefficient for traits. On the basis of mean performance, genotypes LC-8, LC-1, LC-2, LC-6, LC-9, Byadgi dabbi and Byadgi kaddi were performed best for fruit yield per plant, plant height, fruit length and number of fruits per plant and took less number of days to first flowering and days to 50% flowering. The phenotypic coefficient of variation (PCV) and genotypic coefficient of variation (GCV) were high average fruit weight, fruit pericarp thickness and number of seeds per fruit content indicating that these traits had wide genetic variability and would respond better to selection. Correlation coefficients at genotypic and phenotypic levels indicated that fruit yield per plant was positively and significantly correlated with fruit length, plant stem girth, fruit pericarp thickness, average fruit weight, number of fruits per plant, number of primary branches, fruit breadth and plant height but negative and significant association was found with days taken for first flowering and ascorbic acid content indicating that early flowering and early picking might be associated with increasing the fruits yield per plant. Path coefficient analysis revealed that the highest positive direct effect on fruit yield per plant was exerted by average fruit weight followed by fruit length, fruit pericarp thickness, number of fruits per plant, fruit breadth, number of seeds per fruit, days taken for first flowering, number of primary branches, plant height and days to first fruit harvesting. Therefore, selection should be practiced for average fruit weight, number of fruits per plant, fruit pericarp thickness and fruit length for direct improvement of fruit yield per plant.

Key words: *Capsicum Annuum*, GCV, PCV, Correlation and Path coefficients

STUDIES ON THE EFFECT OF NAA ON FRUIT SET OF CHILLI (*SOLANUM FRUTESCENS*)CV. PANT C-1

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The experiment was conducted at department of horticulture, K A P G college, Prayagraj during 2017 -18. Different levels of NAA was tried to check the fruit drop and in hence fruit set of the chilli . 50 ppm of the hormone at twice application gave significant better result over all the treatment including control . Maximum fresh fruit yield (537gram/ Plant) was recorded with NAA 50 PPM twice application. Higher concentration approved detrimental to fruit set As it disturb the physiological process on the plant lowest yield was (267 gram per plant)recorded in control. NAA increase assimilation of calcium and deposited as calcium precipitate in the cell wall. calcium precipitate in the cell wall. Calcium precipitate decomposition prevent untimely flower drop higher number of flower where directly proportion to higher number of fruits hence yield.

EFFECT OF ORGANIC AND INORGANIC NUTRITION ON DEVELOPING LITCHI (*LITCHI CHINENSIS*SONN.) ORCHARDIN NON- CALCAREOUS SOIL OF PLAINS OF UTTAR PRADESH.

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A field experiment was carried out at Central Research Farm, Department of Horticulture , SHUATS during 2015-16 and 2016-17 to study the “ Effect of organic and inorganic nutrition on developing litchi (*Litchichinensis*sonn.)orchardin non- calcareous soil of plains of Uttar Pradesh.” with the following objectives-1.To find the effect of calcium application on growth and development of litchi plants. 2.To find out the most suitable combination of organic –inorganic for nutrition of newly established litchi plants. 3. To test the comparative performance of established cultivars in a comparatively newer growing zone o litchi crop. The experiment was laid out in split plot design with two cultivars viz. Purbi and EarlyBsedana in main plot. Two levels of calcium (control and 2 Kg slacked lime per plant in sub- plot and three levels of manure and fertilizers viz.100% through FYM, 50% organic source +50% inorganic sources and 100% inorganic source. The results revealed that cultivar - Purbi had an edge over Early Bedana in growth

parameters viz. girth of stem, no. of branches, leaf area and LAI. Application of calcium helped in increase in number of leaves, better expansion and micro-organism population in soil. The results also revealed that application of 100% nutrition in inorganic form was instrumental in better plant growth initially but later on plots getting organo-inorganic nutrition in equal proportion took a marginal edge and application of organic source indicated to have a better impact on physical, chemical and biological properties of soil. Plots getting calcium developed higher water stable aggregates (mean wet diameter-65mm) as against a value of 4.87mm for those raised without calcium. Pits receiving 100% nutrition through FYM had the maximum water stable aggregates (mean wet diameter 8.46mm) followed in descending order by those getting organo-inorganic source in equal proportion (7.05mm) and 100% inorganic source (mean wet diameter-4.13mm). No. of fungi was maximum when pits were provided 100% nutrition in organic form FYM (3.83×10^5) which reduced to 2.75×10^5 at F_2 organo-inorganic source. The pits getting nutrition only inorganic form had the maximum Actinomycetes (8.03×10^5 per g soil) followed in descending order by organo-inorganic sources in equal proportion (6.43×10^5 / g soil) and 4.88×10^5 / g soil in F_3 (100% inorganic source). These results are in conformity with the findings of Tirkey *et al.*, (2008) and Chauhan (2008).

Key words: Litchi, Farm Yard Manure, organic, inorganic, slaked lime, calcareous soils

ASSESSMENT OF CLIMATE SMART AGRICULTURAL PRACTICES IN NORTH EAST INDIA

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The domains of Adaptation, Mitigation and Food Security apropos of Climate Smart Agricultural (CSA) practices and its dimensions need to be ascertained before its dissemination and hence it requires appropriate examination. There need of appropriate study in order that research institutions and government mechanisms augur well in understanding farmer's behavioral intention to adopt CSA Practices, to disseminate information, ensure broad participation and harmonize policies. Therefore, considering the above essentials, the present study was conceptualized to assess and ascertain CSA practices in North East India into the domains of Adaptation, Mitigation & Food Security. The study followed descriptive research design. Multi-phase convenience sampling has been adopted in the study. The respondents in the study were agriculture and allied professionals having at least two years of experience in climate change research and extension services in the states Assam, Arunachal Pradesh, Manipur, Meghalaya, Nagaland and Tripura. The study unveiled that under the domains of Adaptation, Mitigation and Food Security, the CSA practices viz., '*Agri-horti-duckery-fishery based farming system, Farming system model for food & nutritional security and Fish-pig-tuber crops based farming system*' have been ranked the most important CSA practices respectively. On administering the *Jonckheere-Terpstra* Test for testing the conformity in the ranks given by respondents, it was divulged that the CSA practices in the domains of Mitigation and Food Security were significant @ 1% level of significance with *p*-values of 0.001 and 0.006 respectively; however CSA for the domain of Adaptation was found insignificant having *p*-value 0.786. The research strongly advocates that more research and refinement are needed to generate champion CSA options for effective adoption by farmers.

Keywords: Climate Smart Agriculture, Adaptation, Mitigation, Food Security, North East India

STAY GREEN: A POTENTIALITY IN AGRICULTURE

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An increasing human population necessitates improvements in crop productivity. Increasing yield has been always the major goal for plant breeders and geneticists which demands the search for more productive, efficient and stress adapted genotypes with improved physiological characteristics. In this regard, the objective was to study and review the importance of delay of leaf senescence, also known as stay-green character, as an important component in the genetic improvement of several crops to promote stress tolerance and yield gain. Various association studies including correlation, revealed stay-green trait to be associated with desirable traits such as greater number of fertile tillers, higher number of grains per ear, higher industrial quality, tolerance to abiotic and biotic stresses. Five distinct types of stay-green plants have been reported where the occurrence of distinct physiological and genetic modifications can be detected, but commonly two or more types of stay green can be observed combined. Based on inheritance studies, around four loci are found to be associated with the expression of stay-green in different plant species. Various plant breeding methods aided by molecular techniques like QTL mapping followed by MAS, MABB, mutation breeding etc., may assist in incorporation of this trait to commercial varieties, especially in drought prone regions. Such efforts of improving stay green characters may result in significant genetic progress for attributes such as high yield, better industrial quality, disease resistance, improved fodder quality, tolerance to abiotic stresses and increased shelf-life in horticultural crops for a successful crop improvement programme in agriculture.

ABIOTIC STRESS TOLERANT *TRICHODERMA ASPERELLUM* TVB1 FROM HOT SPRING AND ITS ANTAGONISTIC POTENTIAL AGAINST SOIL BORNE PHYTOPATHOGENS

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Trichoderma is widely used for plant disease management. However, its bio-control efficacy is affected by abiotic environmental parameters. The objective of this study was to indentify *Trichoderma* strains that could be stable at adverse environmental conditions including high temperature, pH and high salinity. For this, several *Trichoderma* isolates were collected from agroecological zone IIIA of Bihar, India. *In vitro* antagonistic potential of *Trichoderma* isolates against soil borne pathogens (*Sclerotium rolfii*, *Rhizoctonia solani* and *Fusarium oxysporum*) were evaluated. In all *in vitro* tests, *Trichoderma* isolate Tvb1 (isolated from hot spring soil) was found to be the most efficient tolerating high temperature up to 45°C for four days, 1750 mM salt (NaCl) concentration, and pH up to 11. In molecularly characterization, by 18S ribosomal RNA gene sequencing, the fungus was identified as *Trichoderma asperellum*. The study recognized a thermo, saline and high pH tolerant strain of *T. asperellum* Tvb1 that could be used as a potential biocontrol agent against soil borne plant pathogens in abiotic stress conditions.

SUSTAINABLE CONTROL AND MANAGEMENT OF MEALY BUGS INFESTATION

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Mealybugs are insects in the family *Pseudococcidae*, unarmored scale insects found in moist, warm climates. Many species are considered as pests, they feed on plant juices of greenhouse plants, house plants and subtropical trees and also act as a vector for several plant diseases. Mealy bugs found on both tops and bottom of leaves, on the flower buds, on the stem or anywhere else on the plant. These are bugs that spread from plant to plant. To eliminate a mealy bug invasion, a systemic pesticides and physical cleaning of the plant should be used. Like most pests, the best control for mealy bugs is defensive. Healthy; vigorous plants are less susceptible to infestation than weak, underpotted, and stressed plants. Plant protection products are of limited effectiveness against mealy bugs because of their habit of hiding in crevices and the presence of waxy covering of its body. On outdoor plants, cultural practices and biological control should be adequate for suppressing mealy bugs in most situations.

Key Words: *Pseudococcidae*, Mealybugs, Pesticides, Cultural and Biological control

UNDERUTILIZED VEGETABLES: FUTURE CROP FOR NUTRITIONAL SECURITY

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Rajasthan is rich in underutilized vegetable species, many of which belongs to desert area of Rajasthan. These species such as Khejri (*Prosopis cineraria*), Kundru, Lasoda (*Cordia myxa*), Kachri (*Cucumis callosus*) Drumstick (*Moringa oleifera*) and Ker (*Capparis decidua*) carries a great potential to provide nutritional and livelihood security. Presently the rural and tribal peoples of Rajasthan relies on these vegetables as a source of nutrition supplement in their diet. Interestingly, these vegetables also plays crucial role in curing of different ailments due to nutraceuticals property. With respect to their form of availability products such as pickles from immature fruits of Ker and Jharberi, gums and edible coating from lasoda, chutney from fresh pods of Khejri locally known as “Sangri” and dried vegetables, carries a vast potential for commercial processing. It is well evident that these products fetches higher price due to their presently high demand in restaurants and market. If these vegetables are properly utilized for processing then they can become boon for human nutritional security of not only Rajasthan but also for the drought prone regions of north India.

Key word; Underutilized vegetable, nutritional security, livelihood, processing, commercial demand

PATH COEFFICIENT ANALYSIS AMONG DIFFERENT DIVERSE OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH)) GENOTYPES**MEENAKSHI KUMARI¹, SAURABH TOMAR², MANOJ KUMAR³, D.P.SINGH⁴ AND ASHISH KR.SINGH⁵**^{1,2,3} Department of Vegetable Science, Chandra Shekhar Azad University of Agriculture & Technology, Kanpur, Uttar Pradesh – 208 002, India⁴Division of Vegetable Crops, ICAR, Indian Institute of Horticultural Research, Bangalore, Karnataka- 560089, India⁵Department of Vegetable Science, GBPUA&T, Pantnagar, US nagar, Uttarakhand, India- 263145

Path analysis were studied using 20 diverse okra genotypes along with four checks (Kashi Pragati (VRO 6), Kashi Kranti (VRO-22), Kashi Lalima and Arka Anamika). Observations were recorded on eleven quantitative morphological and qualitative biochemical traits on yield per plant in okra during Rainy season, 2015-16. Among them, number of primary branches, Plant height, Fruit diameter, number of fruits per plant, Average Fruit Weight and Moisture percentage has positive effect. Average fruit weight (0.716) exhibited maximum positive direct effect on fruit yield per plant followed by number of fruits per Plant (0.686) and fruit diameter (0.066). Path coefficient analysis carried out at genotypic level revealed that number of primary branches, Plant height, Fruit Diameter, Number of Fruits per Plant, Average Fruit Weight and Moisture percentage recorded positive direct effect on fruit yield/plant. The highest negative direct effect was found in Number of Seeds per Pod (-0.062) followed by Crude fibre (-0.044) content and Plant Canopy Width (-0.026).

Keywords: Okra, Path analysis, genotypic level, Positive effect**ESTIMATION AND STUDIES OF VARIABILITY PARAMETERS IN EARLY SEGREGATING GENERATION OF SOYBEAN (*GLYCINE MAX* (L.) MERRIL)****MEENAKSHI BISHT* AND KAMENDRA SINGH****Department of Genetics and Plant Breeding, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand,**

Soybean (*Glycine max* (L.) Merrill) is the world's most important and one of the oldest seed legume, which is also considered as miracle and premier oilseed crop with its 40 per cent protein and 20 per cent oil. The effectiveness of selection in any crops is dependent upon the nature, extent and magnitude of genetic variability present in material and extent to which it is heritable. Furthermore, heritability of a plant trait is very important in determining the response to selection because it implies the extent of transmissibility of traits into next generations. In addition, high genetic advance coupled with high heritability estimate offers the most effective condition for selection for a particular trait. Owing to the objective of the study, thirty six genotypes of soybean with twelve quantitative characters were analyzed for the variability parameters in Randomized Complete Block Design during *Kharif* 2015-16. In the study, the genotypes exhibited wide range of variability among the twelve characters. Generally the magnitude of PCV was found to be higher than the value of GCV and ECV. High value of PCV along with GCV was exhibited by yield per plant, harvest index, number of pods per plant, basal pod height, basal node height and dry matter weight per plant indicates the minimal role of environment and maximum role of genetic factors in expression of these characters. High heritability coupled with high genetic advance (%) was observed in dry matter weight per plant, plant height, basal node height, basal pod height, number of nodes per plant, number of primary branches per plant, number of pods per plant, yield per plant and harvest index, indicating the preponderance of additive gene action involved in the expression of these characters which could be highly rewarding during selection.

EFFECTS OF DRYING ON NUTRITIONAL CHARACTERISTICS AND PHYTOCHEMICALS IN PULICHAKKEERAI (*HIBISCUS SABDARIFFA*)**MEENAKSHI, V****Assistant Professor, Community Science College and Research Institute, Madurai, Tamil Nadu Agricultural University**

Hibiscus sabdariffa (family Malvaceae), commonly known as Roselle or Bissap, is a non-native species to the United States and has shown to exhibit nutraceutical properties, and this plant has been recognized in traditional medicines. The fresh and dried powders are consumed all over the world. Understanding the effect of drying methods on retention of nutrients and antioxidant activity is essential for assessing suitable processing methods for tapping its potential health benefits. In the present study *Hibiscus sabdariffa* leaf was dried using solar and cabinet drying method. The samples were dried till it reaches the safe moisture content of 4.6 %. The drying time of *Hibiscus sabdariffa* was 48 hours in solar drying and in cabinet 8 hours at 60 °C. The cabinet and solar dried powder samples was analysed for its nutritional and antioxidant components. The ascorbic acid content of solar dried *Hibiscus sabdariffa* leaf was high (64 mg %) than cabinet dried powder samples (56 mg %). The Beta carotene content was found to be high in solar dried *hibiscus sabdariffa* samples (7426 microgram %) than cabinet dried powder sample (5189 micro gram %). The total flavanoid content was found to be higher in solar dried powder samples (958.1 mg) than in cabinet dried samples (923.8 mg). The total phenolic content was found to be higher in solar dried samples (2448 micro g of GAE/g) than

cabinet dried *Hibiscus sabdariffa* powder samples (2284 micro g of GAE/g). The antioxidant activity of *Hibiscus Sabdariffa* was found to be higher in solar dried sample (62 mg %) than cabinet dried powder samples (58 mg %). It can be inferred from the findings that the highest antioxidant activity of solar dried powder might be due to the high content of flavanoid. The results of the study show the potential for retaining quality of *Hibiscus sabdariffa* leaf in solar drying process and value added products using solar drying can be explored for commercialization.

QUALITY EVALUATION OF PROBIOTIC FRUIT YOGHURT

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Yoghurt is part of the diet in south eastern Europe and middle east for millennia and is now part of the dairy counters even in smallest grocery stores in many countries. In the present study plain and probiotic fruit yoghurt by blending with fruits such as banana, papaya, sapota at a ratio of 5%, 10% and 15% was developed. Among the different fruits used banana, sapota incorporated fruit pulp secured higher sensory scores. Plain probiotic yoghurt was prepared using three different probiotic cultures such as *Lactobacillus plantarum* NCDC 25, *Lactobacillus casei* NCDC 298, *Lactobacillus rhamnosus*, NCDC 19 along with yoghurt culture @ 2 % level. Based on the sensory evaluation probiotic yoghurt prepared using *Lactobacillus casei* along with yoghurt culture was found to be highly acceptable. Similarly probiotic fruit yoghurt using *Lactobacillus casei* was prepared using the fruits such as banana and sapota @ 5%, 10% and 15% and stored at refrigeration condition for 14 days to study the physico-chemical and organoleptic changes over storage period. Probiotic yoghurt with 10% fruit pulp had secured highest value for sensory score. Acceptable level of acidity was maintained after 14 days of storage in banana (0.93 %) than control sample (1.30%). pH of probiotic banana fruit yoghurt (4.6) was higher than control (4.2) and other probiotic fruit yoghurts. Maximum TSS content after 14 days of storage was noted in probiotic sapota sample followed by banana and control yoghurt samples. At the initial day of the storage period the syneresis of probiotic banana yoghurt is low (6.2%) followed by probiotic sapota (21.4%) than control (30%). Syneresis was found to be decreased with the addition of fruit pulp. At the end of 14th day of storage, the probiotic banana (7000 cP) and sapota (1900 cP) had higher viscosity than the control (700 cP). Maximum viscosity was maintained in probiotic banana and sapota yoghurt. Probiotic banana yoghurt had maximum - probiotic count 21×10^8 than other samples at the end of 14 days of storage. Hence from the present study it can be concluded that fruit yoghurt @ 10 % level of incorporation can be recommended to children and adolescence.

ECOFRIENDLY DISEASE MANAGEMENT OF VASCULAR WILT OF CHICKPEA (*CICER ARIETINUM* L.) A USED BY *FUSARIUM OXYSPORUM* F. SP. *CICERIS* THROUGH BIOCONTROL AGENTS AND ARBUSCULAR MYCORRHIZAL FUNGI

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Chickpea (*Cicer arietinum* L.) is a vital source of plant derived edible protein in many countries. Chickpea also has advantages in the management of soil fertility, particularly in dry lands and the semiarid tropics. Chickpea (*Cicer arietinum* L.) is the world's third most important pulse crop, after dry beans (*Phaseolus vulgaris* L.) and dry peas (*Pisum sativum* L.). Chick pea are affected of many disease such as Ascochyta blight, Powdery Mildew, White Mold Stem and Crown Rot etc. Among these disease wilt is the major disease of chick pea caused by *Fusarium oxysporum* f. sp. *Ciceris*, reduced the production and quality of this crop. Consistent and indiscriminate uses of toxic and deadly killer chemical fungicide in soil is known to destroy biodiversity of pathogens as well as beneficial soil microflora. Biological control is the important practice for wilt disease management and reduce the environmental pollution. Used of different biological agents such as *Acaulosporasacro bioculata*, *Glomus intrardecas* along with *Trichoderma* spp. provide high rate of protection against *Fusarium oxysporum* f. sp. *Ciceris* and also released secondary metabolites and supplying valuable nutritive material. *Acaulosporasacro bioculata* and *Glomus intrardecas* are not only known to suppress the harmful micro-flora it is also making plant more tolerant by supplying a wide range of macro and micronutrient to plants from the soil. In addition, due to the nature of competition, *Trichoderma* is favoured and multiplied on dead mycelium of host pathogen *F. oxysporum* f. sp. *ciceri*. The present findings are also supported by the results of other workers that the fungal and *Acaulosporasacro bioculata* and *Glomus intrardecas* provided significantly higher disease control in several crops than that obtained by either any one alone. These treatments could be important components of organic farming for chickpea. The present study has demonstrated that the integration of *T. harzianum*, *T. viride*, *T. virens*, with *Acaulosporasacro bioculata* and *Glomus intrardecas* can be used for not only the managing wilt disease and disease complexes of chickpea also would be essential ingredients for sustainable quality organic farming.

QUANTITATIVE AND QUALITATIVE *IN VITRO* EVALUATION OF SOME BIOPESTICIDES MANUFACTURED IN ASSAM**MEHJEBIN RAHMAN*, P. K. BORAH, L.C. BORA****Department of Plant Pathology, Assam Agricultural University, Jorhat-785013, Assam**

In developing countries like India, environment friendly agriculture is necessary for sustainable development and conservation of natural resources and in this aspect biopesticides plays a major role in the inputs of agriculture. However, limited availability of quality biopesticides in the market is a hurdle to the farmers for organic conversion of their crop as well as their land. Therefore, there is a great need of institutional efforts to check the quality of biopesticides before releasing them in the farmer's field. In the present study we have made qualitative as well as quantitative evaluation of about fifteen biopesticides that are available in the agro-market of Kamrup and Jorhat, districts of Assam. Quantitative assessment was done by using standard protocol of serial dilution which is followed by calculation of colony forming unit of the bioagents and qualitative assessment was done by using dual culture method and calculating percentage inhibition. The highest population count of bioagent was found in Pseudomonas from Orgaman R & D Division, Jorhat where the population of *Pseudomonas* was 3.6×10^7 cfu/ml. Most of the biopesticides failed to show the presence of mentioned bioagents while some contained very less population count. The biopesticides mostly contained *Trichoderma* and *Pseudomonas* as active bioagents whose inhibition percentage was also checked. *Trichoderma* showed greater inhibition percentage against many phytopathogen than *Pseudomonas*. The inhibition percentage of these two biocontrol agents was checked against *Fusarium oxysporium*, *Sclerotium rolfsii*, *Collectotrichum lindemuthianum*. The highest inhibition percentage was shown by *Trichoderma* against *Alternaria sesami* i.e., 95% while the lowest inhibition percentage was 41% shown by *Pseudomonas* against *Collectotrichum lindemuthianum*.

A REVIEW: STUDY ON DIFFERENT MECHANISMS OF HERBICIDE RESISTANCE AND TOLERANCE BY DIFFERENT WEEDS.**MERAJUL HUSSAIN*, DR. JOGESH GOSWAMI****Department of Agronomy, Assam Agricultural University, Jorhat-785013, Assam**

Use of abundant herbicides though have contributed to increasing world food production but almost the entire natural weed population regardless of the type of chemical used in them have induce individual plants or the biotype to develop resistance. Repeated use of these herbicides with same mode of action will expose more to development of resistance. Thus it is necessary to study different mode of action of the herbicides as well as mechanism of herbicide resistant in different way. This study has been made with the goal to learn the mechanisms of herbicide resistance so that we select appropriate herbicides for controlling of the different weeds. Some of the mechanisms which have been studied while making the review are reducing uptake of the herbicides by the weeds, changing structure of the herbicides at its target site, reducing herbicide translocation etc.

Keywords: Weed, Herbicide mechanism, Herbicide resistance**GROWING POPULATION – ROOT THREAT TO BIODIVERSITY**¹MEVADA R.J., ²M.B. TANDEL, ³HK DESHMUKH AND ⁴MOHIT HUSAIN^{1,3}Research Scholar, College of Forestry, NAU-Navsari, Gujarat-396 450²Assistant Professor, Dept. of Silviculture & Agroforestry, College of Forestry, NAU-Navsari, Gujarat-396 450⁴Senior Research Fellow, Dept. of Silviculture & Agroforestry, College of Forestry, NAU-Navsari, Gujarat-396 450

Biodiversity is an amalgamation of variety of plants and animals living in a particular habitat, a high level of which is usually considered to be important & desirable. However this important component of earth is subjected to various threats. Increasing human population & consumption pressures are the root threats to diversity. Increasing population of humans and most importantly their increasing levels of consumption have created the conditions that endanger the existence of many species and ecosystem; habitat degradation and loss; overexploitation, spread of invasive species, pollution and global climate change. These conditions are the by-product of human activities. Over-hunting & over-transport of invasive species have led to numerous terrestrial & aquatic species extinct. Over-use of natural resources has also posed a threat to biodiversity. Climate change is also one of the important threats to biodiversity of the present era. In some cases infectious diseases also contribute as a threat to biodiversity, but human activities have posed the major threat. As human practices are unsustainable, better measures are required to prevent biodiversity from extinction. Hence these threats need to be curbed by various practices like fighting climate change by reducing carbon footprints, adopting best practices and refuse to use timber and paper like supplies that contribute to deforestation.

Keywords: Biodiversity, threats, population, overexploitation, extinct and species.

ROLE OF SACRED GROOVES IN BIODIVERSITY CONSERVATION**¹Mevada Ramabhai Jepabhai, ²MB Tandel and ³HK Deshmukh****^{1,3}Research Scholar, College of Forestry, ACHF, NAU, Navsari Gujarat-396 450****²Assistant Prof, Dept. of SAF, College of Forestry, ACHF, NAU, Navsari Gujarat-396 450**

The word sacred means: considered to be holy or 'connected with a god' and the word 'groove' means: a small area of land with trees of particular types grown on it. Conservation of biodiversity is an environmental philosophy of sacred grooves. In India, the practice of worshipping established dates back to 3000 B.C. to 5000 B.C. People learnt to cultivate plants and domesticate animals, about 10,000 years ago. Most of states of India covered from sacred grooves. There are 13,720 SGs has been reported which cover 39,063 ha area which is 0.055% of the total forest area of India. Thus, sacred grooves are the ideal centre for biodiversity conservation in India. Some important medicinal plants that are not to be found in the forest are which often concentrated in sacred grooves. SGs are full with rich biodiversity and harbor many rare species of plants and animals compared to other control site. These areas also provide habitat, water and nest-sites for many species of wildlife and birds. The religious belief, myths, deity and taboos are the constructive tools for conserving the rare, endangered, threatened and endemic species in sacred grooves. There is vast diversity among India's SGs, sometime grooves overlap with larger forest areas. In these patches, people do not cut wood for personal use. Thus, SGs play an important role in conservation of biodiversity and conservation of traditional knowledge. It has around 8% of all mammals, 13% of birds, 8% of reptiles, 6% of amphibians and 6% of all plant species population. Sacred grooves are playing importance role in conservation of Biodiversity through the conservation of medicinal, threatened, endangered, rare and endemic species flora and fauna.

Keyword: Biodiversity, sacred grooves, conservation, flora, fauna.

VERMICOMPOST: ROLE IN CROP PEST AND DISEASE MANAGEMENT**MINA KUMARI*****Department of Plant Pathology, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar, India**

Intensive use of several agrochemicals in agricultural practices and has shown harmful effects on soil and water ecosystems. Inefficient management for organic waste management also poses threat to human and environment. So, there is a need to develop such viable and ecofriendly sustainable management methods that may be helpful for both agricultural crop production and management of biodegradable organic waste into economically high valuable crop manure. Vermicompost is a beneficial organic fertilizers and effective biocontrol agents as it enhances plant growth directly by the production of plant growth promoting hormones and enzymes and indirectly by controlling plant pathogens, nematodes and other insect pests, and hence improving plant health and minimizing yield loss. Its application suppresses many plant diseases caused by *Rhizoctinia solani*, *Phytophthora*, *Fusarium*, *Plasmodiophora brassicae*, *Pythium*, *Gaeumannomyces*. There are two possible mechanisms for pathogen suppression, one depends on systemic plant resistance and the other is mediated by microbial competition, antibiosis and hyperparasitism as reported from various research findings. Vermicompost helped in suppression of various insect pests like Aphids, Scale insects, Thrips, Brinjal shoot and fruit borer, European corn borer, *Spodoptera litura*, *Helicoverpa armigera* etc. by increased phenolic production in plants. Phenolic content act as feeding deterrents and hence significantly affects pest attack by hampering their rate of reproduction and survival. Application of vermicompost also has shown suppression of plant parasitic nematodes, by stimulating the population of bacterial and fungal antagonists (eg. *Pasteuria penetrans*, *Pseudomonas* spp., *Bacillus* spp., *Trichoderma* spp.) of plant parasitic nematodes. These fungi are capable of trapping nematodes and destroy their cysts. So, vermicompost is an excellent organic amendment that acts as a panacea for enhancing soil fertility, plant growth, and inhibition of plant pathogens and pests and has great potential for crop production and protection in sustainable organic cropping systems.

Keywords: Vermicompost, Organic waste management, Pathogens, Pests, Nematodes, Sustainable management.

MITIGATION OF SPOT BLOTCH OF BARLEY (*HORDEUM VALGARE*) THROUGH DIFFERENT NITROGEN LEVELS AND PGPRS TO MAXIMIZE THE SEED QUALITY**MOHAMMAD AMIR¹, RISHABH SINGH, MANEESH KUMAR, RAJESH KUMAR² AND ROHIT KUMAR³****¹Seed Technology Section/ ²Department of Agronomy****N.D. University of Agriculture and Technology, Kumarganj, Ayodhya****²Department of Genetics and Plant Breeding, SVBPUA&T, Meerut, Uttar Pradesh**

Barley is one of the important cereal crops, widely grown in India and many other parts of the world. Barley is a valuable crop because it is grown for several purposes such as animal feed and fodder, malt and beer making and also as staple food for human consumption. In other countries barley is utilized for industrial uses. However in India, only 10 % is utilized as industrial raw material for manufacturing alcoholic drinks such as beer, whisky and various malted products for children and patients. Spot blotch caused by the fungus *Bipolaris sorokiniana* is one of the most important fungal diseases of barley. It is most serious in tropical areas where wheat and barley are grown. Yield losses caused by the pathogen have been estimated on average basis of

10% in barley. The fungus can limit the germination drastically, even to 25%, or the diseased seed gives rise to diseased and weak seedlings. Keeping in view, a field experiment was conducted at Research Station Masodha, NDUA&T, Kumarganj, Ayodhya, Uttar Pradesh during Rabi season of 2016-17 to evaluate the effect of different nitrogen levels and seed treatment with PGPRs on spot blotch and consequently on seed quality of barley. The experiment was placed in split plot design with three replications comprising three levels of nitrogen of recommended dose (N_1 -50%, N_2 -75% and N_3 -100%) in the main plot and seed treatment with four different PGPRs along with control (B_1 - Azatobater, B_2 - PSB, B_3 - Azatobacter+ PSB, B_4 - Biomix and B_5 - Control) in the sub plot. Results revealed that minimum disease severity (18.70%) and percent seed infection (6.5%) were recorded through 50% N of recommended dose and seed treated with Azatobacter plus PSB (N_1B_3). The interpretation of data revealed that there was highly positive and significant correlation ($r=0.984$) between disease severity and per cent seed infection. The maximum 1000-seed weight (44.07g) and yield 42.05 q/ha) was recorded in N_1B_3 (50% N of recommended dose and seed treated with Azatobacter plus PSB) due to low disease severity and per cent seed infection. The same treatment combination was also useful in maximizing the seed quality in terms of seed viability (96%), germination (92%), seedling length (28.43cm) and vigour index (2616.33).

ROLE OF ABIOTIC-FACTORS IN RELATION TO INCIDENCE OF BUFLY (*DASYNEURALINI*) AND GRAM POD BORER (*HELICOVERPAARMIGERA* HUB) ON LINSEED (*LINUM USITATISSIMUM* LINN.)

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The studies were conducted during *Rabi* season at the student's Instructional farm, of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad during 2012-13. The site is located at 42 km away from the district head quarter, Faizabad on Faizabad-Raibareilly road. The linseed genotype was sown in protected plot in Randomized Block Design with 3 replications. The plot size was 10x10 sqm. The sowing was done on the last November. In addition to this all normal recommended agronomical practices were followed. The meteorological data was collected from the Department of Agrometeorology, N.D.U.A&T., Kumarganj, Faizabad (U.P.). The study was carried out on the effects of various weather parameters like temperature (minimum and maximum), Relative humidity (%), Rainfall (mm) and Sunshine (hr) on incidence of budfly (*Dasyneuralini*) and gram pod borer (*Helicoverpaarmigera*) on variety Neelum of linseed. The incidence of budfly (*Dasyneuralini*) was positively correlated with minimum and maximum temperature (0.110) and (0.490), while it was negatively correlated with relative humidity (-0.590), rainfall (-0.319) and sunshine hours (-0.363) with regard to incidence of gram pod borer (*Helicoverpaarmigera*). All weather parameters were found different. It was positively correlated with maximum temperature (0.177), while it was negatively correlated with minimum temperature (-0.063), relative humidity (-0.447), rainfall (-0.396) and sunshine hours (-0.423) during *Rabi* 2012-13.

AN ADVANCED APPROACH FOR HYBRID SOLAR DRYING

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Drying is one of the most energy intensive processes in food engineering and any effort to reduce the energy needs or utilization of alternate renewable sources greatly affects the sustainable development. Solar drying is one of the most promising alternative sources of energy which can be directly harnessed and has potential use in one of the most energy intensive drying process in food processing. Albeit a lot of advancement has taken place in the field of solar photovoltaics, solar drying of food materials still lacks technological development in terms of precise conditional control, accurate and modern modeling approach and lastly large scale on farm utilization. A persistent problem with solar driers has been the slow rate of heat transfer at low temperatures and fluctuations in temperature during to cloudy weather, which results in the deterioration of product quality. In order to rectify the aforementioned problems, a precise temperature controlled hybrid solar tunnel dryer was developed at Department of Post-Harvest Process and Food Engineering, GBPUAT, Pantnagar. The drier was equipped with an infrared module controlled by a PID (Proportional Integral Derivative) controller which also controls one of the exhaust fans to remove the moist air from the solar drier. Besides controlling the temperature precisely, the PID controlled infrared unit enhanced the heat transfer from the food material besides retaining the quality of the food product. During the experimentation it was found that the temperature inside the solar dryer was maintained to $\pm 2^{\circ}\text{C}$. The results of the study showed that the initial and final moisture content of the cured turmeric ranged between 548.93 – 481.39 % (db) to 10.50 - 8.80 % (db) for fresh and dried turmeric rhizomes respectively. The drying time range for the entire experimentation varied from 300-500 min for temperature range between 50 – 70 $^{\circ}\text{C}$, which is very less as compared to the drying temperatures without auxiliary infrared heating (3 days). Also, the maximum drying time taken in the

innovative solar drier very less than open sun drying (8-9 days). The quality of the dried turmeric in terms of color and curcumin content was found to be comparable to the fresh turmeric.

IMPACT OF GRAZING ON PRODUCTIVITY AND CARBON STOCK OF AN ALPINE GRASSLAND IN KASHMIR

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The present investigation entitled “Grazing effect on Biomass production and carbon stock of an alpine grassland in Kashmir Valley” was undertaken in a high altitude temperate grassland of district Baramulla, Jammu and Kashmir, India during 2016-2017 at two sites viz., protected and grazed site. Grazing effect on the biomass production and total carbon stock was assessed in the three prominent seasons. During the study, dry aboveground biomass for all the three seasons was recorded highest 4.15 t/ha in summer at protected site and the lowest 0.39 t/ha in autumn at grazed site while dry belowground biomass for all the three seasons was also recorded highest 2.85 t/ha in summer at protected site and the lowest 0.59 t/ha in autumn at grazed site, which was more prone to overgrazing. However, in the present study, a higher concentration of soil organic carbon was noticed 2.96% in autumn season at the protected site and the lowest 1.15% in summer season at grazed site. Total carbon stock was recorded highest (59.86 t/ha) in autumn season at protected site and lowest 23.81 t ha⁻¹ in summer season at grazed site. Results of the present investigation have led to the conclusion that overgrazing decreases species diversity, biomass production as well as total carbon stock. Soil carbon stock appears to be a single parameter that can help effectively in prioritizing the area for restoring soil health and grassland productivity.

Keywords: Grassland, grazing, productivity, carbon stock, seasons.

HORTICULTURAL INNOVATIONS, FOOD PROCESSING AND VALUE ADDITION

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The challenge of feeding the population of the world has always been a sustainable key issue for human societies. The development of agriculture /horticultural produce has enabled greatly expanded food production and allowed rapid growth of human populations. After harvest, fruits and vegetables are liable to accelerated physiological, chemical and microbial processes that invariably lead to deterioration and loss of wholesomeness. The importance of fruits and vegetables on the basis of their nutrient content to ameliorate diseases are evaluated. Further examples of the processes carried out during post harvest operations are given. Food processing is the process of adding value to the agricultural produce by using various techniques like grading, sorting, packaging, etc., which enhances the shelf life of food products. Food production doubled during the second half of the 20th century as the population doubled from three to six billion. This article reviews on the changing scenario of Indian food processing industry. The growth, technical improvement, Research and Development, export opportunities and strategies for future growth of food processing industry are briefly dealt in this review article. Food processing sector in India is poised to be one of the largest in terms of production, consumption, export and growth prospects. Unprocessed foods are susceptible to spoilage by biochemical processes, microbial attack and infestation. The right post harvest practices, such as good processing techniques and proper packaging, transportation and storage (of even processed foods) can play a significant role in reducing spoilage and extending shelf life. The market for processed foods in India is growing significantly with its increased consumption by the present-day consumers. The survey shows that there are many opportunities at rural sectors under which they can add nutritional value to their food, enhance their livelihood and improve their standard of living. Horticulture requires specialized extension approaches and skills due to its dynamism and industry needs. There are private and public extension service providers in the horticulture industry. India is among the topmost vegetable and fruit producer in the world. India's food processing sector covers fruit and vegetables. After harvest, fruits and vegetables are liable to accelerated physiological, chemical, and microbial processes that invariably lead to deterioration and loss of wholesomeness. It is then necessary to institute some measure of processing such as reduction in moisture content, denaturation of endogenous enzymes and microorganisms, or packaging in order to curtail perishability. In the absence of such processing, massive post harvest losses can ensue. Overall economic set-up of a country would accelerate by a strong and dynamic food processing sector. Furthermore, food processing sector provides vital linkages and synergies between industry and agriculture, and also immediate potential for growth and employment has been identified in this sector. Our Indian food processing sector has experienced expansion during last five decades, starting with a handful of facilities, which were mainly operating at a domestic or cottage level. This article reviews on the changing scenario of Indian food

processing industry. The growth, technical improvement, Research and Development, export opportunities and strategies for future growth of food processing industry are briefly dealt in this review article.

ROLE OF AGRICULTURAL INSTITUTIONS IN DOUBLE INCOME FARMERS

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The strategy did not explicitly recognise the need to raise farmers' income and did not mention any direct measure to promote farmers welfare. The net result has been that farmers income remained low, which is evident from the incidence of poverty among farm households. Past strategy for development of the agriculture sector in India has focused primarily on raising agricultural output and improving food security. The net result has been a 45 per cent increase in per person food production, which has made India not only food self-sufficient at aggregate level, but also a net food exporting country. Low level of absolute income as well as large and deteriorating disparity between income of a farmer and non-agricultural worker constitute an important reason for the emergence of agrarian distress in the country during 1990s, which turned quite serious in some years. The country also witnessed a sharp increase in the number of farmers suicides during 1995 to 2004 - losses from farming, shocks in farm income and low farm income are identified as the important factors for this. The low and highly fluctuating farm income is causing detrimental effect on the interest in farming and farm investments, and is also forcing more and more cultivators, particularly younger age group, to leave farming. This can cause serious adverse effect on the future of agriculture in the country. It is apparent that income earned by a farmer from agriculture is crucial to address agrarian distress (Chand 2016) and promote farmers welfare. In this background, the goal set to double farmers' income by 2022-23 is central to promote farmers welfare, reduce agrarian distress and bring parity between income of farmers and those working in non-agricultural professions. Agricultural year 2022-23, which is seven years away from the base year 2015-16. And, if anything is to be doubled by the year 2022-23, it will require an annual growth rate of 10.4 per cent. It is obvious that if inflation in agricultural prices is high, farmers income in nominal terms will double in a much shorter period. In a situation where non-agricultural prices do not rise, or, rise at a very small rate, the growth in farmers' income at real prices tends to be almost the same as in nominal prices. The government's intention seems to be to double the income of farmers from farming in real terms. It is pertinent to mention that the latest data on number of cultivators is available only up to the year 2011-12.

AGRICULTURAL MARKETING, EXPORT, ENTERPRENEURSHIPS DEVELOPMENT AND AGRIBUSINESS MANAGEMENT OPPORTUNITY

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Agribusiness industry deals with the production, processing, marketing and shipments of agricultural produce. It covers a variety of industrial, manufacturing and processing activities based on agricultural raw materials as also activities and services that go as inputs to agriculture. The development of the agribusiness industry can help stabilize and make agriculture more lucrative and create employment opportunities both at the production and marketing stages. This paper tries to explore the opportunities and challenges of agribusiness sector in the country. There is no doubt that agribusiness industry has a lot of potential to improve rural incomes and can play a very significant role in creation of employment for rural youths. The present study focused on the need to critically look at how can people get the opportunities and how can alleviate the constraints faced by the agribusiness sector in the country. There is also need to review the technological supply chain and storage facilities for a wide range of commodities produced in the country. Agribusiness industry deals with the production, processing, marketing and shipments of agricultural produce. It covers a variety of industrial, manufacturing and processing activities based on agricultural raw materials as also activities and services that go as inputs to agriculture. Agribusiness is a generic term that refers to the various businesses involved in food production, including farming and contract farming, seed supply, agrichemicals, farm machinery, wholesale and distribution, processing, marketing, and retail sales. Agribusiness is widely used simply as a convenient portmanteau of agriculture and business, referring to the range of activities and disciplines encompassed by modern food production. The development of the agribusiness industry can help stabilize and make agriculture more lucrative and create employment opportunities both at the production and marketing stages. This paper tries to explore the opportunities and challenges of agribusiness sector in the country. There is no doubt that agribusiness industry has a lot of potential to improve rural incomes and can play a very significant role in creation of employment for rural youths. A well-developed agribusiness system in country can make enables millions of farmers and agripreneurs to capitalize the emerging opportunities of the agriculture and allied sector. The development of agribusiness sector is the need of future to strengthening rural employment, food security and living standard of peoples in the country. The outputs of such business have ready demand even in rural areas and hence the market opportunities are better. With a strong agrobased programme, non-farm activities can also be initiated when the entrepreneurs are more experienced and capable of taking

risk and can manage the programme better. Promotion of direct marketing by establishing close interaction between producers and consumers will further enhance the benefits, while encouraging a large number of unemployed rural youth to turn into micro-entrepreneurs and traders.

SIGNIFICANT IMPACT OF SIZE OF ANODE AND CATHODE IN PERFORMANCE OF MFC FOR GREEN ENERGY PRODUCTION BY USING SOLID WASTE

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One aspect of bioenergy production involves the production of electricity by anaerobic digestion of organic waste. Microbial fuel cell is a device which is based on the science behind of Leclanche cell (electrochemistry) and microbiology. In MFC waste products are used as substrate with cathode and anode of varying size .Domestic wastewater can be used for continuous electricity production. Fruit and vegetable wastes were employed as a substrate for microbes isolated from high Andean region in a single-chambered MFC. For enhancing the efficiency of Microbial fuel cell, different bio waste are used as substrate (Chhimwal. M et. al., 2017). Significance of surface area of anode in generation of electricity through microbial fuel cell fed with anaerobically digested distillery waste water (Deval. A et.al., 2014) , performance of microbial fuel cell in different anode and cathode electrode sizes(Lianhua. L et. al., 2011) and the surface areas of cathode and anode have been reported as an important factor which influence the performance of MFC. It was observed that the large surface area of anode and cathode found more effective than the smaller one. This study shows that by using carbon anode and cathode having an area of 74.18cm² produce 995mv electricity while anode and cathode with area of 9.98 cm² generate 75.76 mv only in same condition.

LEAF SURFACE MICROFLORA OF TOMATO (*SOLANUM LYCOPERSICUM* L.) AND THEIR ROLE AGAINST LATE BLIGHT DISEASE (*PHYTOPHTHORA INFESTANS* MONT. DE BARY)

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Leaf surface microflora (LSM) are important for agricultural and environmental functionality as they can affect ecological balance, plant growth, suppress or stimulate colonization and infection of the plant pathogens. LSM have not been fully studied and are still misused especially compared to rhizobacteria, root and seed endophytes and pathogenic microbes. Since the North eastern states are dependent on organic practices, therefore, eco-friendly management of crop diseases will help the local farmers to maintain the organic states in this region. The aim of the present investigation is to characterize and evaluate the effectiveness of antagonistic LSM of tomato against late blight disease. The late blight infected tomato leaves recorded the highest LSM than non-infected leaves. In total 320 LSM were recorded from both healthy and diseased infected leaves. LSM were isolated by three methods i.e., leaf impression, leaf washing and dilution plating and leaf washing and serial dilution plating techniques. The predominant bacteria species found were *Bacillus* sp., followed by *Xanthomonas* sp., *Pseudomonas* sp. and *Serratia* sp. And the predominant fungal species found were *Penicillium* sp., followed by *Aspergillus* sp., *Fusarium* sp., *Pythium* sp., *Trichoderma* sp., *Phoma* sp., *Cheatomium* sp., *Cladosporium* sp. and *Rhizopus* sp. Out of 250 bacterial strain isolated only five strains were found effective against the late blight pathogen. Among these five antagonists strain 2 (*Bacillus* sp.) were found more effective against the test pathogen. And out of 70 fungal isolates only one isolate i.e., *Trichoderma* sp. was found effective against the test pathogen. Therefore, the *in-vitro* (pot experiment) and *in-vivo* (field experiment) was conducted by strain 2 (*Bacillus* sp.) and *Trichoderma* sp. It was observed that among various types of treatment used in this investigation the combination treatment i.e., seed + soil + root dip + foliar treatment, showed the highest disease reduction.

RECENT TREND IN MODIFIED ATMOSPHERIC PACKAGING: A REVIEW**MONIKA SINGH DR. DEVINDER KAUR VINTI SINGH, RADHA KUSHWAHA****Research scholar, Center of Food Technology, IPS, University of Allahabad.****Assistant professor, Center of Food Technology, IPS, University of Allahabad.****Research scholar, Center of Food Technology, IPS, University of Allahabad.****Research scholar, Center of Food Technology, IPS, University of Allahabad**

Modified atmosphere packaging is a very common technique in preservation techniques in the food industry. Modified atmosphere packaging is becoming more popular for preserving freshness and extending the storage and shelf life of fresh fruits and vegetables. It may be defined as the enclosure of food products in gas-barrier materials, in which the gaseous environment has been changed. The success of MAP-fresh foods depends on many factors including types of fresh foods, storage temperature and humidity, gas composition, and the characteristics of package materials. So, the innovations and development of food packaging technology will continue to promote the development of novel MAP. This review paper highlighting therecent developments of film and gas on the quality of MAP fresh foods.

Key words – Modified Atmospheric Packaging (MAP), Gas-barrier, Gas composition

INTERACTION BETWEEN DIFFERENT DATE OF SOWING AND PHOTOPERIOD IN FARMERS' VARIETIES OF RICE (ORYZA SATIVA L.)**MONISH ROY*, PRIYANKA SHARMA AND BIDHAN ROY****Department of Seed Science and Technology, Uttar Banga Krishi Viswavidyalaya , Pundibari. Coochbehar, WB**

Photoperiod and sowing time play important role in rice flowering and productivity. Forty Farmers Varieties' of rice collected from different districts of West Bengal, Assam and Manipur, India formed the subject of the present study. These 40 Farmers' Variety of rice was sown at an interval of 15 days for a period of one year starting from 30th November, 2017 to 1st December, 2018 in the Research Farm of Uttar Banga Krishi Viswavidyalaya, Cooch Behar to access their days to 50% flowering, growth and yield under natural day length conditions. The different date of sowing showed significant alteration during the vegetative growth period of the Farmers' Variety. Plants remained in vegetative stage until they received the natural critical day length of more than 11 hours. The different sowing date interaction remained significantly different for all traits studied. The difference in yield response of varieties to various sowing dates was found to be due to their differential in photoperiodism, tolerance against high temperature at vegetative and reproductive growth phases. It was observed that plants sown during the months of November and December 2017 came to 50% heading in March 2018, and plants sown in January, 2018 came to ear emergence between April to May, 2018, plants sown during the months of February to July, 2018 came to 50% heading in the following October, plants of August and September, 2018 sowing came to 50% heading in November, plants sown in October came to 50% heading in December. In most of the Farmers variety grain yield was higher in the plants shown during the month of August and September and moderate grain yield was obtained when plants were sown during the months of November, December and January.

Keyword: Photoperiod, Sowing Dates, Ear Emergence, Productivity, Farmers' Variety

RECENT ADVANCES IN PROCESSING & VALUE ADDITION OF HORTICULTURE CROPS**MONU KUMARI*****Research Scholar, Department of Vegetable Science, Navsari Agricultural University, Navsari – 396 450 (Gujarat)**

Horticulture crops cover over 24.92 million hectares of area and 305.40 million tonnes of total horticulture production, horticultural crops including fruits, vegetables, flowers, plantation crops, spices and medicinal plants have emerged as a major economic activity in India. India is the second largest fruit and vegetable producing country accounting for 94.88 million tonnes of fruit and 178.17 million tonnes of vegetables. Owing to highly perishable nature, fruits and vegetables have very short shelf-life. During different handling and marketing operations there is 25-33% Post harvest loss of horticulture produce. These loss can only be minimized by proper handling, marketing, processing and value addition like Banana Pseudostem RTS, Banana central core jam, watermelon rind candy, Peel and kernel based biscuit, Sev, Chips etc. According to national level study conducted under AICRP on PHT, the post-harvest losses during different farm handling operations like harvesting, sorting grading and packing accounts for about 13%, during farm storage 6%, and during storage at godown, wholesale and retail level 12% of the produce goes waste. Only <2.4 % processing in India as compared to advanced countries (60-70%). So, post-harvest technology can play vital role in India prosperity.

Keywords: Horticulture, crops, PHT, processing, losses and AICRP.

ETHNIC FOODS OF NORTHEAST INDIA AND THEIR NUTRITIONAL AND NUTRACEUTICAL POTENTIAL: A REVIEW**MRIGANKA SHEKHAR BORAH¹ AND RICHI SIKHA²****Department of Horticultural (Food Science and Technology Programme) Assam Agricultural University, Jorhat**

The traditional foods processed and prepared by women of North-eastern region are intimately connected to their sociocultural, ecological, spiritual life and health. Looking to the diversities in ethnic foods, an attempt has been made to explore the ethnic foods made of local soybean, bamboo shoot, tree bean, lai patta (leafy mustard) and rai (*Brassica juncea*, Linn.) from different selected tribes of Northeast India. Tribal women of North-eastern region have a wide range of variability in the ethnic foods made of soybean, bamboo shoot, lai patta, tree bean and rai. In each state, the processing method of these foods is somewhat different based on the culture, variability in the materials used in the food, climate and overall knowledge of the processing and preparation. Indigenous and fermented foods are an intrinsic part of diet of these ethnic tribes. It is the oldest and most economical methods for development of diversity of aromas, flavours, and textures as well as for food preservation and biological enrichment by manipulation of different microbial populations. Wild fruits and vegetables have more nutritional value than cultivated fruits and contribute to sustainable food production and security. Fermented products are region-specific and have their own unique substrates and preparation methods. Ethnic foods prepared and consumed by women cannot be seen in the isolated mode, instead it is a complex dynamics in which nutrition, health, food security, culture and ethics subsistence economy and ecological sustainability are integral components. A policy framework with clear directives on recognition of traditional foods and associated knowledge systems is urgently needed. Detailed studies on nutritive and medicinal value of these products can provide valuable information and would prove beneficial in guiding the use of these products on a wider scale. Furthermore, the ethnobotanical field exploration, conservation of indigenous knowledge, and proper documentation of wild edible bio-resources are suggested for sustaining the livelihood of local communities.

KEYWORDS: Fermented foods, Nutritional, Nutraceutical, Ethnic foods, Traditional foods**SORGHUM HARVESTER: AN OPTION FOR REDUCING DRUDGERY IN HARVESTING****MRUDULATA DESHMUKH, S.H.THAKARE, S.K.THAKARE, SUCHITA GUPTA AND BHAGYASHREE PATIL****Department of Farm Power and Machinery, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola.**

The total harvesting of sorghum requires two stages cutting of plant, one at the top for separating cobs and second at the bottom for fodder. Hence double labour is required for harvesting of sorghum. Sorghum has created the possibility of mechanizing the harvesting of cobs due to the genetical property. The solution of this problem could be achieved by tractor with separate mechanism for cutting the cobs (i.e. nipping) and simultaneously cutting the plant from its bottom (i.e. reaping) The single row sorghum harvester with rotary cutting mechanism performs both the operation at one time. Electric drive system mounted on tractor was the major source to operate mechanism. The main components of the mechanism are main transmission system, plant holding mechanism, conveying unit and collection unit. The performance evaluation of rotary cutting mechanism was evaluated in different field of sorghum at an average speed of 2.03 km/h. Average cutting and conveying efficiency were found to be 96.95 and 88.18 per cent respectively. Average Effective field capacity and field efficiency of mechanical harvesting was found to be 0.134 ha/h and 82.57 per cent respectively. The average plant damage, wheel slip and fuel consumption was observed as 7.94 per cent, 8.66 per cent, 8.82 lit/ha respectively. The total saving in labour and cost of operation in mechanical harvesting over traditional harvesting was 90 per cent and 23.72 per cent respectively.

Key words: Rotary harvesting, conveying, nipping and reaping**STUDY OF EFFECT OF WEATHER VARIABLES IN THE PROGRESSION OF RAB (RHIZOCTONIA AERIAL BLIGHT) DISEASE IN SOYBEAN CROP****MUKTA NAINWAL, K.P. SINGH, SAKSHI KASHYAP, A. S. NAIN****Department of Agrometeorology, G. B. Pant University of Agriculture and Technology, College of Agriculture, Pantnagar- 263145, Uttarakhand, India**

Rhizoctonia Aerial blight (RAB) is considered as one of the most important diseases of soybean caused by *Rhizoctonia solani*. RAB of soybean was undertaken in direct relation to its occurrence, pathogenicity, progression, epidemiology of disease. The study was conducted in G.B.P.U.A.T. Pantnagar Uttarakhand in year 2017. The tarai region of Uttarakhand was considered as a hotspot for this disease. Sixteen cultivars were studied namely JS-7244, JS-7546, JS-7105, JS-72-220, PK-262, PK-472, MACS-58, JS-93-05, Pb-1, Bragg, Monetta, Khsb-2, NRC-7, VLS-58, JS-335 and Shivalik. The Infection rate of disease, PDI (Plant disease index) and AUDPC (Area under disease progressive curve) were calculated on the basis of disease rating. Disease progression of RAB (*Rhizoctonia* aerial blight) was started in the third week of September. The disease progression was quite high in the month of October; however it slowly declined later on. September and October are suitable months for initiation, development and progression of aerial blight disease. The PDI (Plant disease index) of all varieties exhibited negative correlated with temperature,

relative humidity, rainfall and wind speed but significant, it was positive only for bright sunshine hours and evaporation but non significance for weather data on same day of disease incidence. Different weather variables are positively and negatively correlated with the progression of disease.

Key words: RAB (Rhizoctonia aerial blight), PDI (Plant disease index), AUDPC (Area Under disease progressive curve), Epidemiology

ACCEPTABILITY SCORES OF BAKED PRODUCTS BY USING DEHYDRATED LOTUS STEM FLOUR

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Objectives:-To develop cake by incorporating dehydrated lotus stem flour, To determine organoleptic and nutritional attributes of prepared cake. **Introduction:-** Iron deficiency Anemia (IDA) has been recognized as the most common form of malnutrition in regions where people mainly rely on starch-based diets and cereal porridges. Scarcity of iron rich food and food supplements has been responsible for the recurring problems associated with malnutrition in children and lactating women in developing countries. Lotus stem flour posses a significant amount of Iron i.e 60.6mg/100g more than the recommended dietary allowances as given by ICMR 2010. **Methods:-** Sensory evaluation of cake with dehydrated lotus stem flour was done by semi- trained panel. Products were scored with help of “Nine point hedonic scale” score card especially prepared for the purpose. **Results:-** On basis of findings it was observed that average sensory scores of different parameters in control and treated sample of *cake with dehydrated lotus stem flour*, clearly indicates that treatments T4 (8.3) had the highest score followed by T0 (8), T1 (8.1), T2 (8.1) and T3 (8.2) which indicates that T4 was liked very much whereas treatment T3 was liked moderately regarding the colour and appearance of cake as the acceptability increased with increased in addition of dehydrated lotus stem flour. Overall acceptability increased as the amount of dehydrated lotus stem flour was increased to maximum of 30%. **Conclusion:-** Dehydrated lotus stem flour can be successfully incorporated in cake. Dehydrated flour had a significantly better nutrient content per 100g as compared to an equal amount of fresh lotus stem content with regard to moisture, ash, crude fibre, carbohydrate, calcium, iron and phosphorous. On the basis of sensory evaluation 30% of lotus stem flour and 70% wheat flour was found significantly most acceptable for “*cake with dehydrated lotus stem flour*”

Keywords:- Lotus stem, Cake.

ACCEPTABILITY OF CARROT SOUP WITH DEHYDRATED BARLEY GRASS POWDER

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Objectives:-To develop carrot by incorporating dehydrated barley grass powder, To determine organoleptic and nutritional attributes of prepared carrot soup powder. **Methods:-** Sensory evaluation of Carrot soup with dehydrated barley grass powder was done by semi- trained panel. Products were scored with help of “Nine point hedonic scale” score card especially prepared for the purpose. **Results:-** On basis of findings it was observed that average sensory scores of different parameters in control and treated sample of *carrot soup with dehydrated barley grass powder*, clearly indicates that treatments T2 (8.3) had the highest score followed by T0 (8), T1 (7.6) and T3 (7.3) which indicates that T2 was liked very much whereas treatment T3 was liked moderately regarding the colour and appearance of carrot soup as the acceptability decreases with increased in addition of dehydrated barley grass powder. Overall acceptability increased as the amount of dehydrated barley grass powder increased to maximum of 15% and decreased overall acceptability when the level of dehydrated barley grass powder incorporation was increased to 20%. **Conclusion:-** dehydrated barley grass powder can be successfully incorporated in vegetable soups. Dehydrated leaves had a significantly better nutrient content per 100g as compared to an equal amount of fresh leaves content with regard to moisture, ash, protein, crude fibre, carbohydrate, calcium, iron, vitamin C, energy, total carotene, folic acid, sodium and phosphorous. On the basis of sensory evaluation 15% of barley grass and 85% carrot was found significantly most acceptable for “*carrot soup with fresh barley grass*”

Keywords:- Barley grass, soup

EFFECT OF WATER POLLUTION ON PLANTS AND ANIMALS

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Today, water pollution has assumed alarming proportions. Excessive use of soap, soda, bleaching powder, detergents, acids at home and chemicals in the industries are primarily responsible for water pollution. Due to rapid industrialization, water pollution has already reached dangerous levels. Increased use of pesticides and chemical fertilizers in agriculture has also aggravated the situation. Polluted water lead to the worst effect on human health, a large number of diseases in India can be attributed to drinking of sewage mixed water. Various diseases like polio, cholera, patches, jaundice, fever, viral fever etc, art spread through polluted

water. Contamination of water has many negative effects on plants. Sometimes there is an excess of nutrient in the water, which causes an excess in plant growth. One harmful pollutant that damage plant is acid rain, it directly damages the plant, it damage leaves and make it harder for the tree to photosynthesize and regulate the exchange of gases. Keywords: Chemicals, Diseases, Acid rain, etc.

REDUCING COST OF CULTIVATION: A BETTER WAY

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When we are talking about a developing country like India, the goal of increasing the income of farmers and workers has gained national priority across the spectrum of ideological boundaries, is not it strange that excessive focus is on increasing prices and not on decreasing cost? Reducing cost requires triggering debate on sustainability, saving water, soil, seed and all inputs in such a manner that farmers improve his income by reducing the cost to oneself but also to Mother Nature. Reducing cost gives freedom to the farmers from credit loans and compromising to many other farm and non-farm activities. There are some ways to not only reduce cost of cultivation but to go for sustainable farming in India. 1. Use integrated pest management technology for long term benefits. 2. Integrated nutrient management requires fewer amounts of fertilizers and gives maximum utilization of available nutrients in the soil. 3. Reducing the cost of fertilizers by minimizing the amount through soil testing and modern methods of application. 4. Lower the seed cost by producing self seed and adopting improved sowing methods. 5. Changing crop rotations. 6. Select the crops requiring low investments and giving proportionately high returns. 7. Bio-fertilizer application as a long duration strategy. 8. Stay with older equipments instead of high investments and get rented by seeing cost effectiveness. 9. Reduce the cost of irrigation through application of advanced techniques and methods of irrigation for different crops. 10. Application of proper weed management technology. 11. Reduce the cost of field preparation through zero tillage technology etc. Besides above all, a new concept of Zero Budget Natural Farming can benefit to the Indian farmers especially to small and marginal farmers to cut the cost and ultimately increase the income. 'Zero budgets' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming *with* Nature and *without* chemicals.

LACTOBACILLUS: A NATURAL PLANT GROWTH PROMOTER

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Lactobacillus, a probiotic bacteria is a positive companion to biotic components by nature. Lactobacillus basically functions as fermentative bacteria in the human gut and also aids in decomposition of organic matter which prevents the loss of energy form excess heat and gas. Lactobacillus being beneficial helps to sterilize soil and remove by products that can build up and create a harmful environment. Lactobacillus aids in removal of undesirable microorganisms from soil due to which a balanced environment is created for plant growth. It acts as a growth regulator for fungi, yeast and aerobic bacteria. Lactobacillus can be used as organic manure. It is used in composting for stopping foul odor associated with aerobic decomposition. Such microbial based inoculants can act as a good source of nutrients and natural fertilizer for sustainable development of agriculture.

Key Words: Probiotic microorganisms, Lactobacillus, soil fertility, Sustainable Agriculture

ECO-FRIENDLY MANAGEMENT OF *ALTERNARIA SOLANI* (ELLIS AND MART.) JONES AND GROUT CAUSING FRUIT ROT OF TOMATO USING BOTANICALS AND BIOCONTROL AGENTS

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Tomato is the second most important vegetable crop and it is affected by many diseases among them is Fruit rot of tomato caused by *Alternariasolani* which is one of the most yield limiting factors in India. Three locally available botanicals namely, chaste tree (*Vitex trifolia*), garlic (*Allium sativum*), Sweet flag (*Acorus calamus*), two biocontrol agents viz. *Penicillium citrinum* and *Trichoderma harzianum* and a check fungicide mancozeb were evaluated against *Alternariasolani*, the causal agent of fruit rot of tomato, under field condition. Among all the treatments given as foliar spray on 10 day old fruits followed by second spray at 10 day interval, garlic extract at 3% concentration was found most effective in reducing the disease intensity to more than 40% and garlic extract also recorded the highest yield and other yield attributing characters followed by sweet flag at 10% concentration, *Penicillium citrinum* (2×10^8 cfu/ml), Chaste tree (10%) and *Trichoderma harzianum* (2×10^8 cfu/ml) respectively over untreated

control. Highest Benefit cost ratio was also observed by garlic (2.33) followed by Sweet flag (2.15), lowest by *T. harzianum*(1.45) and untreated control (1.2).

Keywords- *Alternariasolani*, botonicals, biocontrol agents, fruit rot

ECONOMIC EVALUATION OF KINNOW CULTIVATION UNDER DEFERENT IRRIGATION SYSTEMS IN RAJASTHAN

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The present study was conducted in Sri-Ganganagar and Bikaner districts of Rajasthan. Kinnow cultivation under different irrigation system viz.; solar, diesel and electric irrigation system was found to be popular in the state. Therefore, study on economic evaluation of kinnow cultivation under different irrigation system in Rajasthan has been conducted to evaluate kinnow orchard orchards under different irrigation system. Total 240 respondents were selected for the study. Standard techniques like NPV, BC ratio, IRR, Break-Even point and Payback period were employed. The investment in kinnow orchard has been seen as profitable business. In the study area, the net present value was work out to be ` 842521 per ha under solar irrigation system `798964 per ha electric irrigation system and `762808 per ha under diesel irrigation system. Internal rate of return was found to be 38 per cent, 37 per cent and 35 per cent under solar irrigation, electric irrigation and diesel irrigation system. Benefit-Cost Ratio was at 2.36, 2.23 and 2.08 under solar, electric and diesel irrigation system. Break-Even point was 5.82 ton, 4.79 ton and 6 ton under solar, diesel and electric irrigation system. Payback period estimated to be 7.1 years, 7.2 years and 7.3 year under solar, electric and diesel irrigation system. Hence, the kinnow orchard with solar irrigation system has been found to be very economic feasible and it should be realized to the farming community for attraction towards use of renewable energy in fruits production in the state.

Keywords: NPV, IRR, BCR, Kinnow, solar, and Rajasthan

PARASITOID FAUNA (HYMENOPTERA: CHALCIDOIDEA) OF THE EGYPTIAN CLOVER, *TRIFOLIUM ALEXANDRINUM* LINNAEUS, IN EGYPT

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A total of 23 species of Chalcidoidea in 20 genera and 5 families (Chalcididae, Eulophidae, Eurytomidae, Pteromalidae and Torymidae) were collected from the fields of Egyptian clover (*Trifolium alexandrinum* LINNAEUS) in Egypt. Five species represent new records for the Egyptian fauna, *Hockeria unicolor* WALKER and *Antrocephalus mitys* (WALKER) (Chalcididae), *Notoglyptus scutellaris* DODD & GIRAULT and *Homoporus fulviventris* (WALKER) (Pteromalidae), and *Eurytoma rosae* NEES (Eurytomidae). A simplified key is given to identify the 20 chalcid genera and known distribution and hosts are summerized for all the collected species.

Key words: Chalcidoidea, clover fields, faunistic list, new records, Egypt.

IN SILICO ANALYSIS OF WRKY TRANSCRIPTION FACTOR GENES AND PROTEINS IN *ORYZA SATIVASUBSP. INDICA*

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Rice (staple food crop of almost more than half of the world's population) cultivation is severely affected by abiotic stresses upto a reduction in 30% to 50% in plant productivity, depending on the length and severity of the stress. Enhancement of plant stress tolerance by manipulating expression of Transcription Factors (TFs) encoding genes has emerged as a popular approach since most of them are early stress-responsive genes and control the expression of a set of downstream target genes. WRKY is one such family of TFs which play pivotal roles in regulating many stress reactions in plants. At least 17 rice WRKY genes induced by drought stress were identified by Massively Parallel Signature Sequencing (MPSS). In the present study, a bioinformatics approach is used to analyze 15 WRKY TF genes and proteins from *Oryza sativasubsp. indica* to know their physiochemical properties, conserved motif structures and phylogenetic relationships. *Japonica* cv. Nipponbare and *Oryzanivara* had been found to display elite tolerance against drought. Hence, any differences in the WRKY family that are associated with the regulation of responses toward abiotic stresses, particularly drought stress, would be of interest. Out of the 15 WRKY genes 14 genes are in group II (one wrky domain) category and the rest 1 is in group I (two wrky domain) category. Two variants of WRKY domain viz. WRKYGQK and WRKYGQR are observed during the analysis of domain structure of WRKY proteins. Multiple alignments of WRKY domains revealed that Trp-420, Arg-421, Arg-435, Lys-422, Lys-552, Tyr-423, Tyr-437, Gly-424, Gln-425, Cys-440, Cys-448 residues are completely conserved among the rice WRKY proteins. In addition, it is also found that there are several residual substitutions and insertions which may affect the DNA-binding capacity of WRKY proteins. The analysis of the N-glycosylation sites of the WRKY

proteins showed that 10 of 15 proteins contained predicted N-glycosylation sites with varied numbers (1 to 11), whereas 5 proteins has no N-glycosylation sites. In WRKY proteins, the percentage of acidic amino acids (Asp and Glu) is found to be higher than the percentage of basic amino acids (Lys and Arg) and all the protein are hydrophilic in nature. The analysis of subcellular localizations revealed that all the WRKY proteins are predicted to be found in nuclear region. Phylogenetic analysis among WRKY proteins of *indica* and *japonica* revealed two main groups each of which are divided into two subgroups. The highest bootstrap value (100%) was observed between three WRKY genes of *indica* and *japonica* which are presumed to be paralogues. Thus, the conservation of WRKY genes in rice may be crucial for the crop to survive in drought stress conditions.

Keywords: Transcription Factors, Bioinformatics, Stress-responsive genes, WRKY, Phylogenetic analysis

STUDY ON THE ANTAGONISTIC EFFICACY OF FUNGAL AND BACTERIAL BIOCONTROL AGENTS AT DIFFERENT TEMPERATURE

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Antagonistic potential of fungal and bacterial bioagents was studied against three pathogens i.e. *Fusarium oxysporum*, *Rhizoctonia solani* and *Pythium ultimum* at four different temperature (20°C, 25°C, 30°C and 35°C). Antagonistic potential of all fungal and bacterial bioagents was found to be significantly influenced by different temperature. With regards to different temperature all fungal bioagents Th3 resulted maximum percent inhibition of the pathogens followed by An1 and po3 at 25 to 30°C. While as bacterial bioagents Ps5 exhibited their higher antagonistic potential followed by Ps2 and ps1 against all three pathogens at highest temperature i.e. 35°C.

NON-PESTICIDAL DISEASE MANAGEMENT OF YELLOW MOSAIC OF MUNG BEAN [*VIGNA RADIATA* (L.)]

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Mung bean (*Vigna radiata* L.) is an important pulse crop in India. Yellow mosaic of mung bean caused by *mung bean yellow mosaic virus*, is a major constraint to the growers. Due to disease plants show yellow mosaic spots on leaves and then spread to the other leaves and becomes chlorosis and shortening of internodes and plant produce small, immature and shriveled seeds. Disease intensity varied from 29.55% to 59.69% in four tehsils of Jaipur district of Rajasthan state. Maximum disease intensity was recorded in Phulera tehsil (59.69%) followed by Dudu tehsil (52.95%). The losses in grain yield ranged from 34.74 % to 65.81 %. Maximum per cent disease intensity (58.45 %) with maximum yield loss (65.81 %) were recorded when disease appeared 20 days after sowing. The results indicated that there is a progressive decrease in yield with increase per cent disease intensity. It was observed that in studies of sowing date, minimum per cent disease intensity (34.50 %) with minimum vector population (14.67 per plant) and maximum seed yield (5.53 q/ha.) was found when crop sown on 30th June. Cluster bean sown as the trap crop was observed to be the best for reducing per cent disease intensity (76.43%), vector population (7.35 per plant) and increasing seed yield (84.07%). Out of four mulches, Yellow polyethylene was found most effective in reducing per cent disease intensity (82.25 %), vector population (5.08 per plant) and increasing seed yield (82.34 %). Out of twenty two cultivars/germplasms only IPM 02-3 and IPM 0205-7 were observed to be highly resistant against yellow mosaic disease of mung bean.

Key word: Mung bean, Yellow mosaic, Yellow polyethylene, Disease and Phulera tehsil.

STUDIES ON THE INCIDENCE AND LOSSES CAUSED BY THE INSECT PESTS IN GROUNDNUT (*ARACHIS HYPOGAEA* L.)

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The incidence of Aphid, *Aphis craccivora* Koch; Jassid, *Empoasca kerri* Pruthi; Thrips, *Scirtothrips dorsalis* Hood and Tobacco caterpillar, *Spodopteralitura* Fab., were recorded in groundnut crop throughout the growing season. The study revealed that incidence of aphid, jassid and thrips commenced in the second week of August. Aphid, jassid and thrips touched peak in the third,

second and fourth weeks of September with a mean population of 8.60, 7.50 and 4.00, respectively. The incidence of tobacco caterpillar, *S. litura* was commenced in the first week of September and touched peak in the fourth week of September with a mean population of 1.25 larvae/plant. The aphid exhibited negative correlation with mean atmosphere temperature and rainfall, while positive correlation with average relative humidity. However, the correlation was non significant. The jassid exhibited non significant positive correlation with relative humidity and rainfall while, non-significant negative correlation with average temperature. The thrips exhibited positive and non significant correlation with average temperature and non-significant negative correlation with rainfall and relative humidity. The tobacco caterpillar exhibited negative and significant correlation with relative humidity, while with temperature, and total rainfall, the correlation was negative but non significant.

Keywords: Aphid, correlation, incidence, temperature and Groundnut

SYNTHETIC PLANT VIROLOGY FOR NANOBIOTECHNOLOGY AND NANOMEDICINE

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Nanotechnology is a rapidly expanding field seeking to utilize nano-scale structures for a wide range of applications. Biologically derived nanostructures, such as viruses and virus-like particles (VLPs), provide excellent platforms for functionalization due to their physical and chemical properties. Plant viruses, and VLPs derived from them, have been used extensively in biotechnology. They have been characterized in detail over several decades and have desirable properties including high yields, robustness, and ease of purification. Through modifications to viral surfaces, either interior or exterior, plant-virus-derived nanoparticles have been shown to support a range of functions of potential interest to medicine and nano-technology. In this review we highlight recent and influential achievements in the use of plant virus particles as vehicles for diverse functions: from delivery of anticancer compounds, to targeted bioimaging, vaccine production to nanowire formation.

Keywords: Nano-scale, VLPs, Virus

EVALUATION OF CHINA ASTER (*CALLISTEPHUS CHINENSIS* L. NESS) VARIETIES FOR GROWTH AND FLOWERING UNDER CHHATTISGARH PLAINS AGROCLIMATIC ZONE CONDITIONS

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The present investigation was conducted in the year 2015-16 at the Department of Floriculture and Landscape Architecture, IGKV, Raipur for evaluating the performance of China aster varieties. Among the eight varieties studied, the results showed a highly significant variation for various growth, flower, and flower yield parameters among the varieties. Varieties Phule ganesh pink recorded maximum plant height (65.20 cm), plant spread(13.95 cm), number of leaves plant⁻¹ (115.07), number of branches plant⁻¹ (18.80), number of flowers plant⁻¹ (46.87), flower stalk length (30.77 cm), flower diameter (5.54 cm), weight of flower (3.53 g) , duration of flower (52.33 days), flower yield plant⁻¹ (94.84 g) also flower yield. However flower yield recorded in Phule ganesh pink (14.23 t/ha) was at par with Phule ganesh white (12.22 t/ha), Arka poornima (12.61 t/ha) and Arka archana (13.94 t/ha). The variety Arka aadya (70.33 days) recorded earlier days to first bud appearance and days to 50 per cent flowering which was at par with Arka archana and Arka shashank. The variety Arka poornima recorded maximum vase life (6.00 days), which was at par with Arka kamini (5.67 days) and Phule ganesh pink (5.33 days).

Keywords: China aster, Growth, flowering, vase life and yield.

PHENOLIC ACIDS AFFECT THE GLYCATION-MEDIATED DNA DAMAGE

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The non enzymatic reaction between the carbonyl group of sugars and amino group of proteins, lipids and nucleic acids is termed as glycation. It has been linked to various diseases such as diabetes, cataract, Alzheimer's, dialysis related amyloidosis (DRA), atherosclerosis, Parkinson's as well as physiological aging. In the present study, the progress of glycation was assessed using methods for the measurement of browning, periodate, fructosamine and carbonyl content. It was found that phenolics (Gallic acid, cinnamic acid and ferulic acid) caused a significant decrease in both browning and carbonyl content of glucose-lysine mixture, standard glycation reaction. In a similar study the effect of these phenolics was also checked on the glycated DNA sample. It was observed that glycation-mediated DNA damage was reversed by ferulic acid. However gallic acid caused the DNA damage alone and did not enhance the damage of glycated DNA sample. Eugenol and bromouracil also prevented the metal-catalyzed DNA damage in the presence of methyl glyoxal (dicarbonyl) and lysine. These results indicate the significance of phenolics and antioxidants in the prevention of glycation mediated DNA damage.

Keywords: Glycation, Browning, DNA damage, Antioxidants, Phenolics

TO MEASURE EXTENT OF PERCEIVED LOSS OF GRAINS DURING STORAGE IN DIFFERENT METHODS IN TIKAMGARH BLOCK OF TIKAMGARH DISTRICT OF (M.P.)

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Agriculture is one of the strong holds of the Indian economy and accounted for 12.9 per cent of the country's gross domestic product (GDP) in 2014-2015, according to the central organizations (CSO) estimates. The post-harvest losses in India account to 12 to 16 million metric tonnes of food grains each year, an amount that the World Bank stipulates could feed one-third of India's poor. The monetary value of these losses amounts to more than Rs 50,000 crores per year. Keeping this fact in view the study's aims at evaluation of grain storage method which was carried out in six villages of Tikamgarh block of Tikamgarh district of Madhya Pradesh. Farmers from each village were selected by proportionate random sampling to make sample size of 120. Pre structured interview schedule was used for data collection by using personal interview method. The study revealed that grain loss in soyabean was maximum due to various factors when stored in gunny bag (6.63%) followed by gunny bags lined with polythene sheet (4.39%). Where as in case of wheat grains highest loss was seen in pucca kothi (4.97%) followed by gunny bags (4.17%), gunny bags lined with polythene (2.31%) and metal bins (1.71%). Among all storage methods less loss of food grain loss was observed in case of gunny bags lined with polythene sheet. However due to higher cost polythene lined bags these are used for small quantity. Hence it is suggested to use cheap and good storage method that will reduce grain loss and spoilage.

Keywords- Perceived loss and storage method.

INTEGRATED NUTRIENT MANAGEMENT STUDIES ON GROWTH & YIELD OF MUSTARD (BRASSICA JUNECEA L.)

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A field experiment was conducted to study the effect of integrated nutrient management on Growth & yield of Mustard (*Brassica juncea*) under timely sown irrigated conditions on sandy loam soil at Student Instructional Farm, C.S. Azad University of Agriculture & Technology, Kanpur. The experiment was laid out under Randomized Block Design with 10 treatments replicated thrice. The treatments consists of 100% recommended dose of N:P:K:S (RDF) at 120:60:40:60 kgHa⁻¹, 50% RDF at 60:30:20:30 kgHa⁻¹, Vermicompost @0.62, 1.25 tHa⁻¹, FYM@2.5, 5tHa⁻¹; Bio-fertilisers (Azatobacter + PSB) @7.5 KgHa⁻¹; ZnSO₄@10KgHa⁻¹. Simultaneously, 50% RDF were also tested with aforesaid doses. For comparison, two treatments viz. Bio fertiliser PSB+ Azotobacter @7.5kgHa⁻¹ and Vermicompost@1.25tHa⁻¹ and absolute control were also taken. The results of the present investigation revealed that among the various traits viz. the highest plant height (207.13cm), no. of branches at maturity (Primary 7.97; Secondary 9.84), Grain yield- A biomass yield obtained was 6.20 and 22.95 respectively. Dry matter accumulated at maturity was 45.48 gm⁻², LAI at 90 DAS was around 4.95 As a result no. of siliqua obtained were 281.98 (average) oil content was 40.45% oil yield was 987.28 kgHa⁻¹. In the following experiment the highest yield obtained was in the last treatment that was with 50% RDF+ 25% FYM+ 25% vermicompost + Bio fertilizers + ZnSO₄ followed by 75% RDF + 25% FYM (2.5 tHa⁻¹) + Bio fertilizers (Azotobacter + PSB) (7.5 kgHa⁻¹) and 75% RDF + 25% Vermicompost, fertilizers dosage given were basal dose mainly given to different treatments separately, another half dose was given after 1st irrigation. All the operations were perfectly on time thus give high yield. Low erucic acid (<2%) content was found in oil extracted, hence it is good for edible purpose.

Keywords: Bio fertilizers, yield, fertilizers, Leaf area index

A BRIEF REVIEW ON HYBRID SEED PRODUCTION AND ITS IMPLEMENTATION IN FLOWER CROPS

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Hybrid is a progeny obtained by crossing between two or more different strain. Hybridization is defined as the crossing of two or more plants which are genetically different from each other to produce a new crop. Hybridization is effective to combine all the good characters in a single variety to create genetic variation and to exploit the hybrid vigour. Hybrid seed can be produced by using male sterility, self-incompatibility, chemically-induced male sterility and manual emasculation and pollination. Although the use of heterosis through hybrid breeding has produced tremendous economic benefits in worldwide crop production. Strategies and

objectives in flower crop breeding remains entirely different from majority of other crops with the focus on end product as flowers and not fruit or seed as the case in most of the food crops. Flowers that can remain without senescence on plant for long duration and with longer shelf-life after harvest are the priority characters aimed in breeding of flower crops. With no functional pollen, male sterile flowers in turn are expected to have longer life. Male sterile line is advantageous and desired in flower crops not just as a parent for production of hybrid seeds; but as a variety itself provided the flowers are attractive. So the hybrid seeds of flower crops are good approaches for providing biotic and abiotic resistance varieties that ensure higher flower yield, growth, vase life/self life, better quality and enhance crop productivity.

Keywords: Emasculation, Flower Crops, Hybrid, Male Sterility

IN VITRO PROPAGATION OF BITTER GOURD (*MOMORDICA CHERNTIA* L.) AN ALTERNATIVE TECHNIQUE OF PLANT PRODUCTION

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Bitter gourd (*Momordica cherntia* L.) important vegetable medicinal and crop. It's grown for immature tuberculate fruit which rich have unique bitter taste. An efficient protocol for in vitro propagation by root, shoot, and nodal segment. The explants of bitter gourd like root, shoot, and nodal segment were cultured in MS supplemented with various concentration of BAP in combination of either 2,4-D and NAA. Roots callus were formed on IBA and 2,4-D respectively shoot as well as root differentiation was obtained of medium contained BAP+IBA/NAA, rooting and shooting grown occurred on medium containing IBA 40% of the plant. Nodal segment highest % (93.75%) of callus in MS supplements with 1.0%mg/l, 2, 4-D and 1.0mg/l BAP. A combination of 1.0mg/l, and BAP exhibited 75.00% shoot development from nodal segment. 90% root and shoot survived when transferred to green house and Subsequent to the field.

Keywords: Bitter gourd, in-vitro propagation, explants, Hormone

EFFECT OF ORGANICS AND BIOFERTILIZERS ON GROWTH AND YIELD OF WINTER SESON GUAVA

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A field experiment was conducted at experimental orchard, Department of Horticulture, CCS HAU, Hisar during 2017-18 with an objective to study the effect of organic manures and biofertilizers along with inorganic fertilizers on growth and yield of guava cv. Hisar Surkha during winter season. Experimental findings revealed that different treatments significantly increased plant height and number of flowers per branch. Vermicompost and FYM were used alone and in combination with biofertilizers at three RDF (recommended dose of fertilizers) levels i.e. 50%, 75% and 100%. *Azotobacter* + PSB inoculation along with 100% RDF + Vermicompost showed maximum plant height, flowers per branch, fruit set, number of fruits, average weight of fruit and yield, however, average plant spread was not significantly affected. The treatment significantly reduced fruit drop

Keywords: Guava, Hisar Surkha, Biofertilizer, *Azotobacter*, PSB.

GONADAL DEVELOPMENT AND MATURITY IN PREVIOUS YEAR BRED AND FRESH BROODERS OF *LABEO ROHITA* (HAM.)

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This study was conducted in the College of Fisheries, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand to observe the gonadal development histologically along with correlated factors in the previous year bred and fresh brooders of *Labeo rohita*. The Specimens of *Labeo rohita* were reared and collected from the Instructional Fish Farm of the College of Fisheries, Pantnagar, Gonadal development and production of gametes are critically reviewed and discussed in relation to maturation of gonads, oogenesis, spermatogenesis during the pre spawning and spawning phase. The observations on previous year bred fish did suggest that possibility for them attaining early ovarian and testicular development in subsequent breeding season. This study indicated that the stimulation of changes with regards to activities in testis, ovary and liver was comparatively more in previous year bred group.

Keyword: *Labeo rohita*, Gonadal development, GSI, HSI, oogenesis, spermatogenesis, breeding

IN-VITRO EVALUATION OF AGRO CHEMICALS FORMANAGEMENT OF *LASIODIPLODIA THEOBROMAE* OF TREE BEAN DECLINE

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Tree bean (*Parkia roxburghii* G. Don Syn. *P. timoriana* (DC.) Merr.) of leguminosae family (subfamily momosoideae) is an important tree vegetable of South East Asia, especially North Eastern India.. Tree bean decline is one of the important diseases caused by *Lasioidiplodia theobromae*. The present investigation is to know the *in-vitro* effect of different agro chemicals on the growth of *Lasioidiplodia theobromae* responsible for tree bean decline in Manipur. Three non-systemic and four systemic fungicides were tested with three different concentrations against the growth of the pathogen. It was observed that among the non-systemic fungicide tested thiram has shown to be the most effective with 68.24, 77.65 and 90.19 % inhibition at 0.05, 0.1 and 0.2 % concentration respectively whereas copper oxychloride was moderately effective. Among the non-systemic fungicide tested carbendazim and propiconazole gave equal and 100 per cent inhibition of growth of the fungus at 0.006, 0.012, 0.025 % concentration. Hexaconazole and triademefon were also moderately effective in inhibiting the mycelial growth of the fungus. All treatments had positive impact in inhibiting the growth of the pathogen. Higher the rate of concentration, higher the rate of inhibition per centage of the pathogen was observed with all the treatments used.

Key words: *Lasioidiplodia* spp., Agro chemicals, Inhibition per cent.

ADVANCES IN SEED QUALITY ENHANCEMENT

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Seed quality is the value of different attributes like genetic purity, physical purity, freedom from seed borne disease and insect damage, freedom from mechanical and heat damage, uniformity in size, viability, vigour of seeds which contribute for realizing the total value of seed for which it is used. It deteriorates in different stages like harvesting, threshing, processing and storage period. Poor seed handling condition gives rise to deterioration of seed quality and results in the loss of viability. This greatly affects seed vigour, which ultimately gives poor performance in field and the seed is not able to meet the quality standards prescribed for that crop. Environmental conditions not favorable at the time of seed formation, mishandling during harvesting, processing and storage and unfavorable storage conditions with high moisture and temperature which increases seed ageing. Hence, some physical and chemical operations are performed with the seeds between processing to storage time to overcome these problems. In order to improve early emergence and reduced time of emergence under stress conditions, reduced seed rate, supply of growth regulators, nutrients and beneficial microbes in adequate amount, weed competition for nutrition, uniform field stand, minimum exposure to toxicant, direct seeding of conventionally transplanted vegetable seeds and high seed quality there is a need to enhance seed quality. Seed enhancement techniques like seed priming, seed coating, seed pelleting, seed colouring improves physical properties, breaking of dormancy, synchronize germination, apply of nutrients and impart stress tolerance and improves market quality of seed. Therefore seed quality enhancements technology plays a significant role in improvising the seed performance.

EFFECT OF MULCHING IN FLOWER CROPS

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Mulching is an effective method in manipulating crop growing environment to increase yield and improve product quality by controlling weeds. Mulch is used to cover soil surface around the plants to create congenial condition for the growth. Using mulch found to conserve the moisture, control weeds, moderate soil temperature improves quality of flowers. There are different types of organic and inorganic mulches used in flower crops. Organic mulches are derived from plant and animal materials such as straw, hay, leaf mold, compost, sawdust, and animal manures. Organic mulch are efficient in reducing leaching of nitrates, improve soil physical, chemical properties and increase the biological activity by prevent erosion, supply organic matter, regulate temperature and water retention, improve nitrogen balance. Inorganic mulch accounts for the greatest volume of mulch used in commercial flower production, which includes plastic mulch. Among various plastic mulches, black plastic mulch is most commonly used in flower crops. Black plastic mulch is good radiator and absorber used for weed control in a range of crops under the organic system of crop production. Black plastic mulch conserves soil moisture, reduce infiltration rate, maintain soil temperature, which improve flower yield. Due to increase in soil warming characteristics, clear plastic mulch is being used in some of areas. White or aluminum reflective mulch also repels aphids, which spread some virus diseases.

Key word: Mulching, Organic mulches, Inorganic mulches, Black plastic mulch.

EFFECTS ON INTESTINE OF CATFISH *CLARIASBATRACHUS* EXPOSED TO AQUEOUS SILVER NANOPARTICLES.

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During the past development of Nano technology and the probably of its side effects on aquatic body organs, this study investigate the effect of nano silver administration on histology of intestine in catfish *clariasbactracus* following chronic exposure to sublethal concentrations of silver nanoparticles. When fish were exposed silver nanoparticles size (10nm), (N10) 1/15th of 96 h LC₅₀ value for 10 and 20 days. In the intestine, the epithelial cells as well as the villi showed signs of degeneration. The epithelial cells at places lost their cell walls. The epithelial cells became hypertrophied after an exposure to of 0.10 mg l⁻¹ of Silver nanoparticles for 10 days after 20 days of exposure the epithelial cells and basement membrane became further separated from the villi. The current findings indicate effect on *clariasbactracus* chronic effect on *clariasbactracus*; therefore preventing the entry of silver nanomaterials into the aquatic environment would seem to be essential.

Keywords: silver, *clariasbactracus* nano toxicology

EFFECT OF LEAF EXTRACTS ON MORTALITY OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* JUVENILES UNDER *INVITRO* CONDITIONS

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From ancient years agricultural production is affected by many insect pests including plant parasitic nematodes (PPNs), the crop losses caused by PPNs often go unobserved because of lack of clear cut diagnostic symptoms on plants. Among PPNs root-knot nematode, is most devastating, hidden enemy causing considerable yield losses in agricultural crops worldwide. Use of chemicals for control of nematodes is fraught with danger of residual problem in edible parts of the plant and cause extensive environmental pollution. So, nowadays interest is towards development of plant origin nematicides as a substitute to chemical based nematicides which are environmentally safe and ecologically cheap. In this view present study was carried out to assess the nematocidal potential of different plant's leaves at different concentrations at Department of Nematology, CCS HAU, Hisar during 2018-19. Second stage juveniles of most devastating root-knot nematode, *Meloidogyne incognita* were exposed to aqueous extracts of fresh leaves of *Azadirachta indica*, *Ricinus communis*, *Eucalyptus globulus* and *Citrus aurantifolia*. All the extracts of plant leaves increased the mortality of juveniles as compared to control (distilled water). Highest mortality (91%) of second stage juveniles was observed in leaf extracts of *Azadirachta indica* at 100 per cent concentration after 48 hours followed by *Ricinus communis* (78%), *Eucalyptus globulus* (63%) and least in *Citrus aurantifolia* (40%).

Keywords: *Invitro*, Plant extracts, root-knot nematode and mortality.

DOUBLING FARMER INCOME BY INNOVATIVE APPROACH

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Doubling of farmers' income must be attempted by creating a framework where all related agencies come together and work in harmony, with a maestro conducting that orchestra. In its initial years of reforms started by China between 1978 and 1986, witnessed growth of 14% per annum in farm income. This led to a reduction in poverty by half by generating demand for industrial products in rural areas. Doubling rural income in nominal terms is possible by increasing agriculture output & minimum support prices (while keeping inflation below 5%), doubling rural income in real terms would be a daunting task considering increasing agriculture output by 12% every year with no additional land likely to be utilized for agricultural activity. However, a long term solution remains faster execution of policies that could develop infrastructure to support irrigation system and reduce the dependency on rains. There is every possibility not only to double the income of farmers through enhancement in productivity, changes in cropping pattern, inspire additional income through many supplementary activities but also provide stability in farmers income. There is need to think beyond food security and give our farmers a sense of income security.

EFFECT OF IMPROVED WATER MANAGEMENT TECHNOLOGY ON WATER PRODUCTIVITY OF SOYBEAN + MAIZE INTERCROPPING SYSTEM IN CHAMBAL COMMAND AREA OF SOUTH EASTERN RAJASTHAN

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Soybean is an important oilseed crop as a valuable source of oil and protein for human nutrition in the world. Low productivity in Chambal command area of south eastern Rajasthan is mainly due to occurrence of intermittent dry spells, erratic rainfall during the growing season and improper water management practices. To stabilize crop production and to provide insurance against aberrant weather condition, intercropping could be a valuable agronomic means of risk minimizing and more profitable. Therefore, the study was undertaken during kharif 2016 and 2017 through on farm trials at farmer's field at 6 location under operational research programme to show benefit of intercropping of soybean + maize with water management practices. Improved water management practices (IWMP) includes one irrigation in soybean + maize intercropping system at pod development stage with 6 cm depth by border strip method (6 m x 50 m) using 80 per cent cut off ratio and compared with the farmer's practice (FP), i.e. flooding method of irrigation with no control over the depth of irrigation (usually about 10 cm) and without consideration of critical stages of the sole soybean. High yielding varieties (RKS 24) of soybean was used with 80 kg seed rate for demonstration. Data pooled over two years revealed that Maximum soybean equivalent yield (1522 kg/ha), net return (Rs. 32457/ha) and water productivity (Rs. 54.07/m³) were recorded in improved water management technology which were 14.17, 38.7 and 117.1 % higher than farmers practices, respectively.

QUALITY AND YIELD OF WHEAT AS A INFLUENCED BY IRRIGATION SCHEDULING AND ORGANIC MANURES

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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 to study the effect of irrigation scheduling and organic manures on growth, yield and quality 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 data results showed that irrigation applied at 0.9 IW/CPE ratio (I₂) recorded the maximum values of number of grains per ear and yield (grain and straw) proved significantly superior over I₁, I₄ and I₃ except treatment I₅. The treatment I₂ (Irrigation at 0.9 IW/CPE ratio) exhibited the maximum value of consumptive use (395 mm). But the treatment I₅ attained significantly highest WUE and excelled over rest of the treatments. Irrigation applied at 0.9 IW/CPE ratio (I₂) resulted in maximum chlorophyll content and was significantly superior over I₃, I₄ and I₅ except treatment I₁. However, that irrigation treatment failed to bring any significant variation in protein content and protein yield. Significantly higher number of grains per ear and yield (grain and straw) was recorded due to application of FYM at 7.5 t + VC at 3 t/ha (M₃) which was at par with VC @ 6 t/ha and superior over rest of the treatments. The highest consumptive use (409 mm) by crop was shown by the treatment M₀. The significantly highest WUE was recorded under M₃. The maximum chlorophyll and protein content were recorded under the treatment M₃ (FYM @ 7.5 t/ha + vermicompost @ 3 t/ha) which remained at par with M₂ but significantly higher over M₀ and M₁. However, treatment M₃ resulted in the significantly highest protein yield over rest of the treatments. 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 and straw) and quality parameter (chlorophyll content). 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. Manuring the crop either at 7.5 t FYM + 3 t/ha VC or 6 t/ha VC were the equally effective treatments with regard to yield (grain and straw) and quality parameters (chlorophyll content, protein content and protein yield).

Key words: FYM, Irrigation, Quality, Scheduling, Vermicompost, Wheat, WUE and Yield

HYDROPONICS AND AEROPONICS: FUTURISTIC WORLD OF SOILLESS FARMING

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In the current scenario of depleting water resources world over, Hydroponics and Aeroponics, are the technologies which can play a crucial role in 21st century towards soilless culture in commercial food production. In these techniques natural media is helpful to grow plants. The main principle involves the use of sprayers, nebulizers, foggers to create a fine mist of solution to deliver

nutrients to plant roots. Plants roots are suspended above a reservoir of nutrient solution or inside a channel connected to a reservoir. Plants will grow under optimum condition like temperature, aeration and pH. In these techniques oxygen is influenced into nutrient solution, allowing the roots to absorb nutrients quicker and more easily. This facilitates stimulating the rapid growth, preventing algae formation and resulting in higher yields. Hydroponics uses about 90% less water, requires lesser fraction of land area as compared to conventional agriculture systems. Besides this, these technologies allow a vertical farming system with increased yield per unit area, conservation of water and less or no use of agrochemicals which are dangerous for human consumption.

SOIL CONSERVATION FOR SUSTAINABLE AGRICULTURE

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The need of sustainable agriculture is universal and way to achieving it has been defined through intensive empirical research. Several indicators for the sustainability of agricultural systems have also been developed. Use of synthetic fertilizers and their effects on crop production, soil health, environmental quality, biodiversity conservation and self-reliance of farming system have been discussed in the context of agricultural sustainability. Degradation of soil fertility due to use of synthetic agro inputs is considered as one of the most important factors affecting sustainability of agricultural systems. Presence of soil organic matter and soil microbial population are primarily useful indicators of soil health and productivity of both crops and livestock. A long-term integrated approach will be an appropriate solution for standardizing fertility management in organic farming considering the complex interactions among different components of this system. A comprehensive and systemic review on different qualitative and quantitative changes of soil health parameters for improved nutrient management supports these observation. Organic farming system is based on the management of soil organic matter, which in turn maintains the physical, chemical, and biological properties of soil. Soil quality is often argued as an ecosystem concept that integrates diverse soil functions, including nutrient supply which leads to crop productivity. This understanding suites well to organic farming, since there are complex relationships between different system components and the system sustainability depends heavily on functioning of the whole system.

Keywords-Organic Farming, Soil Fertility, Soil Health, Sustainable Agriculture

BIOLOGICAL CONTROL OF FUSARIUM WILT OF CHILLI (*CAPSICUM ANNUUM* L.) BY PHENOTYPIC VOLATILE AND NON VOLATILE INHIBITORY COMPOUNDS OF RHIZOSPHERIC ANTAGONISTIC ORGANISMS

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Rhizospheric antagonists can act as potential biocontrol agents, showing antagonistic activity against phytopathogen by production of volatile and non-volatile metabolites. In vitro assessments revealed their antibiosis and mycoparasitic ability to affect growth pathogen *Fusarium oxysporum* due to production of toxic volatile and non-volatile metabolites. A total of 20 rhizosphere microbes were isolated from healthy rhizosphere soil samples of chilli collected from major chilli growing areas of Andhra Pradesh. Out of which (eight fungal antagonists, ten bacterial antagonists and two fluorescent Pseudomonads) were found to exhibit antagonism against chilli wilt pathogen. On further in vitro evaluation, nine isolates including four fungi, four bacteria and one pseudomonas sp. were found to be most efficient against chilli wilt pathogen. Among them four promising antagonists were tested RFA 2 showed the highest mycelial inhibition of the pathogen (24.35% and 74.5%) followed by RFA 4(17.29% and 60.47%) and RFA 1 (5.17% and 31.76%), whereas RFA 3 showed less inhibitory effect (2.35% and 22%) by production of volatile and non volatile inhibitory compounds respectively after seven days of inoculation. Thoserhizosphereic bacterial antagonists (RBA1, RBA 2, RBA 3 and RBA 4) and rhizospheric fluorescent pseudomonads (RFP1) which were found to be extremely efficient against Fusarium wilt pathogen of chilli in dual culture were further phenotypically identified based on the production of Siderophores, HCN and ammonia. Among them fluorescent Pseudomonads RFP 1 was positive to siderophore, HCN and ammonia production.

Keywords: HCN, biocontrol, Ammonia, phenotypic identification, siderophores

SOIL AND WATER CONSERVATION PRACTICES IMPACT ON CROP YIELD, RUN-OFF, SOIL LOSS AND NUTRIENT LOSS IN INDIA

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Soil degradation in India is a pervasive problem. According to the Government's harmonized database, around 120.7 Mha of land is degraded, 70% of which is due to water erosion. Other estimates of land degradation in India range from 53.28 Mha to 187.80

Mha, depending upon the methods used. The review and synthesis showed that most physical soil and water conservation practices such as soil bunds and stone bunds were very effective in reducing run-off, soil erosion and nutrient depletion. Despite these positive impacts on these services, the impact of physical soil and water conservation practices on crop yield was negative mainly due to the reduction of effective cultivable area by soil/stone bunds. In contrast, most agronomic soil and water conservation practices increase crop yield and reduce run-off and soil losses. This implies that integrating physical soil and water conservation practices with agronomic soil and water conservation practices are essential to increase both provisioning and regulating ecosystem services. Additionally, effective use of unutilized land (the area occupied by bunds) by planting multipurpose grasses and trees on the bunds may offset the yield lost due to a reduction in planting area. If high value grasses and trees can be grown on this land, farmers can harvest fodder for animals or fuel wood, both in scarce supply in India. Growing of these grasses and trees can also help the stability of the bunds and reduce maintenance cost. Economic feasibility analysis also showed that, soil and water conservation practices became economically more viable if physical and agronomic soil and water conservation practices are integrated. **Keywords:** Soil, productivity, economic,, conservation, erosion.

NITROGEN MANAGEMENT IN GRAIN AMARANTHS THROUGH ORGANIC SOURCE

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An experiment entitled “Evaluation of organic source for nitrogen management in grain amaranths” was conducted at the Centre for Crop Improvement, S.D. Agricultural University, Sardarkhrushinagar which comes under North Gujarat Agro-Climate Zone-I during seasons of the year 2014-15. The experiment consisted of six treatments comprised of six organic sources (viz. T₁. RDF, T₂. FYM 8 ton / ha, T₃. Vermi-compost 2 ton / ha, T₄. Castor Cake 1 ton / ha, T₅. FYM 4 ton / ha+ VC 1 ton / ha and T₆. FYM 4 ton / ha+ CC 0.5 ton / ha) and conducted in RBD with four replications. The soil of the experimental field was loamy sand in texture. Spacing between rows was maintained 45 cm x 10 cm with 1 kg/ha seed rate. The Results revealed that , the yield was influenced due to fertilizer management, among the different fertilizer management treatment -1 RDF gave higher grain yield (1555 kg/ha), followed by treatment -5 FYM 4 ton / ha+ VC 1 ton / ha (1018 kg/ ha). The highest Straw yield was recorded by treatment -1. RDF (5670 kg / ha), followed by treatment- 2 FYM 8 ton / ha (4840 kg/ ha). It is concluded that for higher organic grain amaranths production apply FYM 8 ton / ha.

Keywords: Grain amaranths, Organic, Nitrogen

COMPARATIVE STUDY ON ROOTING OF APPLE CLONAL ROOTSTOCK HARDWOOD CUTTINGS

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The study conducted with an objective for utilization of upper part of the hardwood cutting of apple after performing grafting/stooling which otherwise goes as a waste. The experiment consists of two types of cuttings viz; cutting with apical bud and without apical bud with single treatment of IBA @ 2500 ppm **on the rooting capacity of MM-106, MM-111, M9-T339, M9-T337 and P-22 apple clonal rootstocks.** The maximum rooting percentage was recorded from the cuttings of MM-106 (46.87 %) with apical bud as compared with hardwood cuttings without apical bud. The rooting percentage was also high in rootstocks of M9-T337 and M9-T339 with apical bud whereas rootstocks Pajam-1 and P-22 are statistically at par with each other. From this study, it may be concluded that the cutting with apical bud and the IBA 2500 ppm was found to be the best treatment for inducing better root system in different clonal rootstocks of apple in terms of rooting percentage, number of primary roots and total root length. Further, rooted cuttings shall be used either for direct sale or for further grafting/budding.

RNAI TECHNOLOGY FOR PAPAYA RINGSPOT VIRUS (PRSV) RESISTANCE IN PAPAYA

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The papaya (*Carica papaya* L.) belong to small family caricaceae which includes 35 species placed in six genera, Among all species, 32 are dioecious, two trioecious and one monoecious. Botanically papaya plant has three different sex type: staminate producing staminate flower, female plant producing pistillate flower and hermaphrodite plants producing bisexual flower. It is an important fruit crop grown in the tropical and subtropical region of the world. Now a days it is also popularly cultivated in india as a good source of iron, calcium, vitamins A,B&C. The papaya is severely damaged by the papaya ringspot virus (PRSV). So that plant biotechnologist is focuses on the development of PRSV resistant transgenic papaya through gene technology. Varieties of transgenic papaya were first introduced commercially in Hawaii in 1998.The genetic diversity of PRSV depends upon

geographical distribution and the influence of PRSV disease management on a sequence of PRSV isolates. The concept of pathogen-derived resistance has been employed for the development of transgenic papaya, using a coat protein-mediated, RNA-silencing mechanism and replicase gene-mediated transformation for effective PRSV disease management. The development of PRSV-resistant papaya via post-transcriptional gene silencing is a promising technology for PRSV disease management. PRSV-resistant transgenic papaya is environmentally safe and has no harmful effects on human health. Recent studies have revealed that the success of adoption of transgenic papaya depends upon the application, it being a commercially viable product, bio-safety regulatory issues, trade regulations, and the wider social acceptance of the technology. This review discusses the genome and the genetic diversity of PRSV, host range determinants, molecular diagnosis, disease management strategies, the development of transgenic papaya, environmental issues, issues in the adoption of transgenic papaya, similar approach to control cucumber mosaic virus (CMV). RNAi powerful tool for developed transgenic varieties resistant to this PRSV and CMV like virus effective tool in managing production and increasing yield of papaya and crop improvement of other agriculture crop .

Keyword: RNAi, PRSV, CMV, Papaya, gene technology

ADVANCES IN COMPOST CHEMISTRY AND SOIL CHEMISTRY AFTER APPLICATION

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The growing world population and the resulting higher consumption of goods and services has driven a rapid increase of organic wastes originating from households, industry and agriculture (Hoorweg *et al.*, 2013). This situation generates serious environmental issues, calling for safe and sustainable strategies to treat these wastes, from their production to their recycling or elimination. On the other hand, the organic fraction of wastes represents a valuable organic resource, which could be recycled and transformed into nutrient-rich fertiliser and/or soil conditioner. Biological degradation during composting and vermicomposting is one of these strategies to transform organic wastes into organic amendments. Compost and vermicompost are the end products of aerobic composting process, the later with using earthworms. Vermicompost possessed higher and more soluble level of major nutrients nitrogen, phosphorus, potassium, calcium and magnesium (Reddy and Okhura, 2004) compared to the substrate or underlying soil, and normal compost. During the process, the nutrients locked up in the organic waste are changed to simple and more readily available and absorbable forms such as nitrate or ammonium nitrogen, exchangeable phosphorus and soluble potassium, calcium, magnesium in worm's gut (Atiyeh *et al.*, 2002). These amendments can be applied on soils to increase soil carbon stocks and associated ecosystem services or used as potting media (Malinska *et al.*, 2017). Compost application leads to improved soil structure, reduced erosion and increased water holding capacity. However, compost production is associated with greenhouse gas (GHG) emissions such as NO, CH₄ contributing to global warming (Bernstad *et al.*, 2016). In addition, immature composts have negative effects on plant germination and more generally, on plant development and might cause environmental problems such as water pollution and odour emissions (Wang *et al.*, 2016). Composting is an aerobic process, performed at large scale in windrows or piles (Hobson *et al.* 2005) or at local scale with a home composter. Composting is used to treat manures, green wastes or municipal solid wastes and their fractions (Goyal *et al.* 2005). Vermicomposting, involving the presence of worms, is used for similar purposes. Various substrates might be added to waste during the composting process. They are either organic (Zhang *et al.*, 2017), mineral, biological or a mixture of substrates (Awasthi *et al.*, 2018). Some added substrates are considered as bulking agents, when they only act on the physical structure of the compost (aeration), but most of the time, these substrates have also direct or indirect effects on other composting parameters and can be considered as additives (Villasenor *et al.*, 2011). Additives are used to enhance the composting process by reducing leaching (Steiner *et al.*, 2010) and gas emissions, improving compost aeration or accelerating organic matter degradation and improving nutrient content and availability in the final product.

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,

EFFECT OF BURNING AGRICULTURE RESIDUES ON SOIL HEALTH

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Plant debris has many applications; including creating a sanctuary for terrestrial organisms, barrier against rain, animal feed, fuel consumption and improve soil can be outlined. It remains in cereal straw is called. Straw contains the remains of leaves, stems and remaining awn small grain after harvest, such as wheat, barley, rye and oats, which are typically packed field, is removed. Standing stubble to stubble after harvesting the land remains. Acute rapid fire action for the environment. It operates on natural ecosystems and ecosystem-based management of human, can be very destructive power and polluters or account management tool comes. In many parts of the world granary burnt remains of grain after harvest. There are different effects of agriculture residues burning and retention on a range of soil chemical and biological properties. The chemical properties included total soil carbon, nitrogen, phosphorus and sulphur (C, N, P and S). Soil biological properties included the size and activity of the microbial biomass, the microbial and metabolic quotient, the rate of cellulose decomposition and a range of information concerning the composition of the microbial population derived from fatty acid methyl ester analysis.

Keywords: Agriculture residue, Standing stubble, natural ecosystems

ROLE OF ECO-FRIENDLY PRACTICES IN INDIAN AGRICULTURE DEVELOPMENT

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Green revolution technologies have more than doubled the yield potential of rice and wheat, especially in Asia. These high input production systems requiring massive quantities of fertilizers, pesticides, irrigation and machines, however, disregard the ecological integrity of land, forests and water resources, endanger the flora and fauna and cannot be sustained over generations. To a great extent, future food security and economic independence of developing countries would depend on improving the productivity of biophysical resources through the application of sustainable production methods, by improving tolerance of crops to adverse environmental conditions and by reducing crop and post-harvest losses caused by pest and diseases. Indigenous agricultural practices can play a key role in the design of sustainable and eco-friendly agricultural systems, increasing the likelihood that the rural population will accept, develop and maintain innovations and interventions. In this context, those eco-friendly methods are being considered as environmentally safe, selective, biodegradable, economical and renewable alternative for use in organic farming system. Organic farming implies, that the use of organic nutrients and adoption of natural methods of plant protection in place of fertilizers and pesticides. To the maximum extent feasible organic farming system rely upon crop rotations, crop residues, animal manures, legumes, green manures, mineral bearing rocks and aspects of biological pest control to maintain soil productivity and till to supply plant nutrients and to control insects, weed and other pests.

INTEGRATED FARMING SYSTEM A ECO-FRIENDLY FARMING

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Integrated farming System isn't a new concept it's just a pattern where crops, animals, trees have been traditionally grown in small forms at past but in modern times these components are raised in larger forms. It is a farming technique for maximum production and optimal utilization of resources with minimum or very less external inputs applied in this farming system. Its 100% eco-friendly since there is proper utilization of residues and waste products that comes from various forms, so it creates pollution free environment situation in maintaining harmony in ecosystem. Waste products of one component could be useful for other component so there is proper recycling process and balance in system. It is a suitable farming system for sustainable food production with proper care of environment.

ROLE OF SALINITY ON GROWTH AND SURVIVAL OF POST LARVAE OF THE GANGA RIVER PRAWN *MACROBRACHIUM GANGETICUM* (BATE)

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Fresh water prawn *Macrobrachium gangeticum* is indigenous species available in the Ganga and Brahmaputra river system. *M. gangeticum* is considered to be a potential candidate for commercial farming through the development of seed production and grow-out culture technology. To overcome the problem of poor survival of prawn consequent to direct stocking of post larvae in grow out ponds. Stocking of prawn post larvae (PL) is felt desirable for better pond management, good survival and high prawn production. Experiments have been conducted in plastic tub 50 L for a period of 30 days using The ICAR Research Complex for Eastern Region, Patna hatchery produced post larvae of *M. gangeticum* at ICAR-RCAR. The post larvae (8 – 10 mm) size were stocked @ 50 per tub with 30 L of effective volume in different water media ranging from freshwater to a saline medium i.e. 0, 4, 8, 12. During the experimental period the water in the tubs were consequently aerated and post larvae were fed ad-libitum, as egg custard and mussel meat. All the experimental tubs were cleaned daily and water exchange 40 % level of alternate days. Water quality parameters have been recorded regularly. Small pieces of ½ dia plastic pipe as a hidden were provided in each tub. The details of the observations have been discussed in the present communication.

Keywords: *Macrobrachium gangeticum*, Post larvae, growth, survival, salinity

IMPACT ON AGRICULTURAL LAND BY DEGRADATION OF SOIL

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Soil degradation is a global process, but affects arid and semi-arid zones in the India. Soil degradation is increasing worldwide, especially in the countries within the tropics. Depletion of nutrients and soil organic matter and erosion are the principal forms of soil degradation. Among the land used for agriculture and forestry, soil is an important component. The intensive and increasing pressure on land leads to its degradation and pollution, which may result in a partial or complete loss of its productive capacity. Soil degradation can be either a result of natural hazards or due to unsuitable land use and inappropriate land management practices. The main causes of degradation due to direct/indirect human intervention are deforestation and removal of natural vegetation, overgrazing, converting forests to farms, cultivating steep slopes and degrading marginal lands, other agriculture related activities and over exploitation of the vegetation for domestic purpose. Major threats to the conservation of soil resources are soil erosion both by water and air, salinization/alkalinity, acidity, organic carbon losses, nutrient imbalance, pollution/contamination by toxic substances, and soil sealing and capping. Urgent measures are required to arrest the degradation process and to restore productivity of degraded soils so that more food could be produced to provide livelihood and environmental security to the increasing Indian population. This requires the systematic knowledge on the soils, characterization of basic resources like soil, water, climate and biodiversity problems and potentials for optimizing land use.

PER SE PERFORMANCE OF PARENTS AND THEIR F₁ HYBRIDS FOR YIELD AND YIELD RELATED TRAITS IN TOMATO (*SOLANUM LYCOPERSICUM* L.) UNDER POLYHOUSE CONDITION

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The present investigation was carried out at Vegetable Research Center of Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, with the objective to assess mean *per se* performance of parents and their F₁ hybrids for yield and yield related traits in tomato under polyhouse condition. The experimental material for the present study comprised of eight genotypes of tomato. From the eight genotypes, 28 crosses were evolved in a diallel mating design (excluding reciprocals). Thus, the experimental materials finally consisted of 36 treatments (28 F₁s and 8 parents) which were evaluated in a Randomized Block Design (RBD). The genotypes were studied for fifteen yield related traits. The observations were recorded on five randomly selected plants. For days to 50 per cent flowering and days to first fruit set parents, PCT-1 and PBT-2 and the crosses, PCT-1 x PBT-4 and PBT-9 x PBT-2 showed minimum value. Minimum days to first fruit ripening were recorded in parents PCT-1 and PBT-10 and hybrids, PCT-1 x PBT-5, PBT-9 x PBT-5 and PBT-9 x PBT-2. Maximum values for number of flowers per cluster, number of fruits per cluster and number of fruits per plant were observed in parents, PCT-1 and PBT-2 and in hybrids, PCT-1 x PBT-5, PBT-5 x PBT-4 and PCT-1 x PBT-2. Maximum average fruit weight recorded in parents, PBT-2 and PBT-9 and in hybrids PBT-13 x PBT-10, PBT-9 x PBT-5 and PBT-2 x PBT-9. Among the parents, maximum mean values for plant height were recorded in PBT-2 and PCT-1 whereas, among 28 F₁s, PBT-13 x PBT-10, PCT-1 x PBT-4 and PCT-1 x PBT-9 has maximum

values. Among the parents, maximum values for fruit yield were observed in PPT-2 and PCT-1 whereas, among hybrids, PCT-1 x PBT-5, PBT-2 x PBT-13 and PBT-9 x PBT-4 showed maximum values for fruit yield.

RENEWABLE ENERGY: AN ASSESSMENT OF PUBLIC AWARENESS IN JHANSI

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India is one of the countries with the largest production of energy from renewable sources (solar light, bio gas, hydro, bio diesel, wind etc). Jhansi city has a very good scope to generate renewable energy due to their geographical situation and environmental factors. Diffusion methods are a key factor in promoting renewable energy production. Present time Indian government uses different types of effective extension education and diffusion method a deep gap which needs to be addressed in the area of energy education and awareness in India. This study aims to address the awareness of renewable energy and running Indian government different subsidy scheme like Jawaharlal Nehru National Solar Mission (JNNSM), Government Yojana: Solar Energy Subsidy Scheme, UDAY Scheme, SECI scheme, ROOFTOP scheme. Methodology used sample size was 250 respondents from Jhansi three different local area were chosen Shiva Ji Nagar, Veerangana, Kocrchabhawanr its duration from November 2018 to February 2019. Questionnaire based on self-structured questionnaires including demographic data that includes gender, age, income, education, area of residence, life quality, and interest of implementation. The statistical analysis used percentage and ratio, stated that middle class and rural respondents were more (76%) interested to use renewable energy, government launched different schemes but 96 % respondent had no knowledge. The government needs to improve its diffusion method that changes Indian people's view of renewable energy not only economically but eco-friendly and helpful in various type of health issues.

Keywords: renewable energy, diffusion method, government subsidy, eco-friendly.

EFFECT OF DIFFERENT DATE OF SOWING AND MICROCLIMATE PARAMETERS ON POPULATION DYNAMICS OF MUSTARD APHID IN MUSTARD (*BRASSICA JUNCEA*) UNDER ALLAHABAD CONDITION

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The population dynamics of mustard aphid *Lipaphis erysimi* of mustard in relation to weather parameter was studied at college of forestry SHUATS Allahabad during the Rabi season October 2016 to March 2017 crop season. The aphid population started increasing gradually. From 3rd week of January and reach peak population around 1st week of February. The peak aphid population was found a maximum temperature 27.97 - 29.14°C and maximum temperature 11.66 - 12.60 °C, relative humidity 89.57 - 92.57% (max) and 42.29 - 43.29% (min), wind speed 0.64 km/hr, bright sunshine hours 7.486 - 8.571, cloud cover (0.286 - 1.143), Growing Degree Day (GDD) 14.81 - 15.87, Humid Thermal Ratio (HTR) (3.15 - 3.42) are highly conducive for population of aphid. In early sown 25th October and late sown 14th November crop the aphid population had a non-significant negative correlation with growing degree days (GDD), but positively correlated with humid thermal ratio (HTR). As the growth and development of insects mainly depends upon the accumulated amount of heat, GDD and HTR computation could be used for prediction of aphid population build up.

Keyword: Population dynamics, weather parameter, maximum temperature, maximum temperature

RENEWABLE ENERGY

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Renewable energy used natural resource such as sunlight, wind, tides and geothermal heat which are naturally replenished. Most forms of renewable energy are cheap to operate. But relatively expensive to install, as they have to take quite dispensed energy and convert it into a useful form. Solar thermal collectors can be mounted on the roof or the wall of building or in amount location that has exposure to sun. Solar thermal is any installation in which solar radiation is used to heat a medium such as water or air. Wind turbines the power of wind has been used for many years to produce mechanical power for milling grain and pumping water. In recent time wind turbines harness wind to generate electricity. Hydro-water turbines: the energy potential of water has been harnessed for thousands of years. Originally using water wheels to drain wine mills and machinery. However, over the past century it has instead been used to turn thermal that generate electricity. Demand resource: commercial hydro electricity used dam structure to limit the flow of existing rivers by selectively releasing water through turbine in the dam, the tremendous pressure of the water is converted to electrical energy. Bio mass bio fuel: using a process known as transesterification, naturally accruing oils or fats are transformed into liquid fuel that can be used in most diesel engines. Green diesel uses naturally accruing oils to

produce diesel fuel. Natural oil can be extracted from Canada, algae, Salicornia or fallow. Thermal energy storage of energy is a storage of energy in the form of heat. Some concentrated solar panels use liquid sodium or other thermal storage.

Types of renewable energy:

- 1-Solar energy: the solar energy obtained from the sun, the main technology of solar photovoltaic (using the light from the sun), solar thermal (using the sun heat)
- 2-Wind energy: the energy obtained from the wind.
- 3-Geothermal energy: heat energy from inside the earth.
- 4-Biomass energy & bio gas: energy entrusted from organic material.
- 5-Wave energy: energy obtained from ocean wave.
- 6-Biodiesel: organic fuel for vehicle on any other application obtained from vegetable oil.
- 7-Hydraulic energy: energy obtained from river and other fresh water current.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT AND BIO-REGULATORS ON GROWTH, YIELD AND ECONOMICS ATTRIBUTES OF SPROUTING BROCCOLI (*BRASSICA OLERACEA* (L.) VAR. *ITALICA* PLENCK)

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The field experiment was conducted at Horticulture Farm, S.K.N. College of Agriculture, Jobner, Jaipur during *Rabi* season 2016-17 and 2017-18. The experiment consisted of thirty five treatment combinations including seven INM (100 per cent RDF through inorganic fertilizer, 75 per cent RDF through inorganic fertilizer + 25 per cent through FYM (5 t/ha), 50 per cent RDF through inorganic fertilizer + 50 per cent through FYM, 100 per cent RDF through FYM, 75 per cent RDF through inorganic fertilizer + 25 per cent through VC, 50 per cent RDF through inorganic fertilizer + 50 per cent through VC and 100 per cent RDF through vermicompost and five bio-regulators levels [Control, Brassinoids @ 5 ppm, Brassinoids @ 10 ppm, Salicylic acid @ 100 ppm and Salicylic acid @ 150 ppm] were under taken in Split plot design with three replications. The results showed that the maximum weight of primary curd (222.51g), number of secondary curds per plant (6.58), weight of secondary curd (154.05 g), yield per plant (384.56g), yield per plot (7.69 kg), yield per ha (189.90 q), biological yield per ha (1081.85 q) and net returns (₹ 304019/ha) were recorded with the application of 50 per cent RDF through inorganic fertilizer and 3.5 t/ha vermicompost (F₅) in sprouting broccoli. Whereas, the maximum B: C ratio (4.39:1) was recorded under 75 per cent RDF supplied through inorganic fertilizer and 1.75 t/ha vermicompost. Harvesting index was found non significant. In the case of bio-regulators maximum weight of primary curd (213.17g), number of secondary curds per plant (6.20), weight of secondary curd (147g), yield per plant (362.57 g), yield per plot (7.42 kg), yield per ha (183.19 q), biological yield per ha (1002.18 q), net returns (₹ 287563 /ha) and B:C ratio (3.99:1) were recorded significant with foliar application of 5 ppm brassinoids. While harvesting index was found non significant to broccoli.

Keywords: Economics, Yield, Organic, Inorganic, Bio-regulators, Vermicompost and Sprouting broccoli.

A REMOTE SENSING APPROACH FOR ESTIMATION OF GROSS IRRIGATION REQUIREMENT IN BARWALA SUB BRANCH CANAL COMMAND AREA

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The present study was carried out with an objective to suggest the better water management for improving agricultural productivity in a water scarcity canal irrigation system of south-western Haryana, India. Assessment of Gross Irrigation Requirement (GIR) for Kharif and Rabi crops were carried out in the canal command area of Barwala, sub-branch of Sirsa branch, of Western Yamuna Canal using geo-informatics. Kharif and Rabi season cropping pattern was generated by classifying the LANDSAT-8 Satellite data while Hargreaves method was used for estimation of Reference Evapotranspiration (ET_o) and ET_o and Crop Coefficient (K_c) for different crops were used for the estimation of Crop Evapotranspiration (ET_c). Rainfall data was used for computation of Effective Rainfall (Pe_{ff}) and was integrated with the Crop Evapotranspiration (ET_c) for determining the Net Irrigation Requirement (NIR). Finally, the gross Irrigation Requirement (GIR) was calculated from the Net Irrigation Requirement (NIR) and Applied Irrigation Method Efficiency (IRR eff.). ET_o values ranged from 2.96 to 9.54 mm day⁻¹ and it was observed that ET_c values are higher in the months of May and June and lowest in December and January. In case of Pe_{ff}, maximum was observed in July month due to the onset of the monsoon season while maximum NIR for Cotton, Pearl Millet, Mustard, Rice and Wheat was observed in May, June, March, June, April, respectively and minimum NIR was recorded in August and January. Lowest Gross Irrigation Requirement (GIR) for Kharif crops i.e., Cotton, Pearl Millet and Rice was observed in the month of August with the onset of the monsoon season and for Rabi crops (Mustard and Wheat) in January. The highest value of GIR for Kharif season crops of Cotton, Pearl Millet, and Rice was observed in May and June months and for Rabi crops of Mustard and Wheat in the month of March and

April. Study results revealed that geo-informatics can be used as an efficient tool for the efficient water management and irrigation scheduling for different crops and cropping systems to enhance the water productivity of different canal commands in our country.

Keywords: Geo-informatics, Irrigation Requirement, Evapotranspiration and Agricultural productivity

STATISTICAL MODELING OF REDUCING SUGAR YIELD IN ENZYMATIC HYDROLYSIS ALKALI PRETREATED *IPOMOEA CARNEA* FEEDSTOCK USING RESPONSE SURFACE METHODOLOGY

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With growing concern of world's depleting fossil fuels and greenhouse gas emissions, there has been growing interest in developing alternative, sustainable and efficient sources of liquid fuels for transportation sector. *Ipomoea carnea*, a troublesome perennial shrub offers an inexpensive source of lignocellulosic feedstock for bioethanol production. Like other lignocellulosic biomass, it also requires pre treatment for increasing the enzymatic digestibility. In this study, a process of alkaline pre treatment of *Ipomoea* feedstock was developed followed by enzymatic saccharification. Process parameters such as alkali concentration, cellulase loading and hydrolysis time were studied using a one-factor-at-a-time (OFAT) analysis and their levels were optimized for maximum reducing sugars yield using central composite design (CCD) of response surface methodology (RSM). Under the optimum conditions, the predicted sugar yield was in good agreement with the experimental results. RSM approach can be quite efficient and useful for the optimization maximum reducing sugar yield for further scale-up.

Keywords: CCD, *Ipomoea carnea*, Sodium hydroxide, Enzymatic hydrolysis, Reducing sugar, RSM

TO STUDY THE PHENOLOGY OF URDBEAN VARIETIES FOR GROWTH AND DEVELOPMENT UNDER RAINFED CONDITION

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The field investigation entitled “To study the phenology of urdbean varieties for growth and development under rainfed condition” was conducted at Research Farm, J.N.K.V.V., College of Agriculture, Tikamgarh (M.P.) during *Kharif* 2016. The experiment was laid out in randomized block design with three replications. The field experiment was conducted with 10 different urdbean varieties viz. JU-3, IPU 94-1, LBG-20, PU-30, PU- 31, JU-86, NUL-7, PU-35, KU 96-3, Azad urd-1. Gross and net plot size viz., 4 m x 3.6 m and 3 m x 2.4 m, respectively. The soil was medium black, clayey loam in texture, alkaline in reaction and higher in total soluble salt concentration, low in nitrogen and rich in phosphorus, potassium and lime, alkaline in reaction with high base saturation. Sowing was done by manually. The seed was placed at 4-5 cm depth manually in furrows 30 cm apart drawn by manual labour with help of *kudal*. From the result of experiment it can be concluded that, among different varieties in urdbean, plant height, total dry biomass, leaf area index, number of primary and secondary branches, number of root nodules and crop growth rate were recorded significantly higher under PU-31 and found the lowest in cv. NUL-7.

Keywords: Urdbean, Phenology, Different varieties, Growth and Development.

ARID REGION FRUIT PLANTS OF RAJASTHAN

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Arid zone vegetation comprises a wide range of edible fruit bearing and food producing species viz. *Capparis decidua* (Ker), *Cordia dichotoma* (lasora), *Ziziphus mauritiana* (ber), *Ziziphus nummularia* (Bordi), *Salvadora oleoides* (Jal), *Balanites aegyptiaca* (Hingota), *Prosopis cineraria* (Khejri) etc. The wild plants assume significance as alternative food sources, predominantly in the areas receiving frequent droughts and famine. In many Indian states, majority of forest dwellers depend on forests for their annual food requirements. *Zizyphus mauritiana*, *Cordia myxa*, *Salvadora oleoides* are some of the important fruit bearing plant species found in hot arid region in India that provide food supplement and means of survival during time of hardships. Rural people in Rajasthan state of India have extensive knowledge about use of famine foods. The fruits of many plants are rich sources of protein and energy. For example, *Ziziphus mauritiana* is richer than apple in protein, phosphorous, calcium,

carotene and vitamin C. However, they are often undervalued and underutilized. This article highlights the importance of some of these plants, their various end uses and nutritive values of their seeds and fruits.

Keyword: Arid region valuable plant, Nutritional value etc.

STATUS AND ROLE OF MECHANIZATION OF RICE IN INDIA

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Mechanization is needed to raise productivity in rainfed upland and rainfed lowland and to increase cropping intensity in irrigated farms. Improved tillage implements reduce cost of tillage and prepare better seed bed. Seed drills give better plant population, reduce cost and give higher yields of rice. Use of pre germinated paddy seeders in puddled wetland give similar yield like manual transplanting but reduce labour requirement by 75-80%. The manual and self-propelled transplanter reduces cost of transplanting by 45-50% and labour requirement by 75-80%. Uses of improved weeders reduce weeding cost by 79-90%. Walking type vertical conveyer reaper, power tiller and tractor front mounted reaper save 50-60% labour and harvesting cost by 60-70% as compared to manual harvesting. Use of pedal operated thresher, motorized hold on thresher reduce time, labour, cost of threshing to a great extent. Combine harvesting save 40-50% cost as compared to manual harvesting and threshing by power thresher.

Keywords: Mechanization, Tillage, Puddling and Rice Transplanting etc.

EFFECT OF BIOCHAR, CARPET WASTE, FYM AND PGPR ON CHEMICAL PROPERTIES OF SOIL

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Present investigation was aimed for improving the chemical properties of soil using waste products of different activities and also useful in ecological stability of soil environment. The experiment was conducted in the organic farming plot of the Institute of Agricultural Sciences, BHU, Varanasi during kharif season of rice crop (*Oryza sativa* L.) in 2017. The field experiment was laid out in Randomized Block Design with 10 treatments and three replications. It is evident that there is increase in Nitrogen content in soil from 281.29 to 319.6 in Control to T₁₀. It was higher in treatment T₁₀ (Biochar + carpet waste + FYM (2+1+1 t) ha⁻¹ + PGPR) 319.60 kg ha⁻¹ followed by T₉ (BC1 + CW1 + FYM1 t ha⁻¹ + PGPR) 312.75 kg ha⁻¹. Significant differences were found between the treatments after application of PGPR in plot. There was a significant increase in the Phosphorus content in the soil in the post harvest soil. The maximum P content in soil was found in T₁₀ (Biochar + carpet waste + FYM (2+1+1 t) ha⁻¹ + PGPR) i.e. 22.09 kg ha⁻¹ followed by T₉ (BC1 + CW1 + FYM1 t ha⁻¹ + PGPR) 20.03 kg ha⁻¹. It is evident that there is increase in potassium content in soil from 224.16 to 244.07 in Control to T₁₀. It was higher in treatment T₁₀ (Biochar + carpet waste + FYM (2+1+1 t) ha⁻¹ + PGPR) 224.16 kg ha⁻¹ followed by T₉ (BC1 + CW1 + FYM1 t ha⁻¹ + PGPR) 244.07 kg ha⁻¹. Similarly, organic carbon content of soil increased from 0.49 % in T₁ to 0.61% in the T₁₀ (Biochar + carpet waste + FYM (2+1+1 t) ha⁻¹ + PGPR). But there was not much significant difference found in the pH and EC of the soil. Application of graded level of biochar, carpet waste FYM and PGPR was found to significantly enhance the Nitrogen, Phosphorus, Potassium and Organic carbon content of the post harvest soil. It can be concluded that using of these organic sources has good impact on the soil health under long term.

Keywords: Biochar, Carpet waste, FYM, PGPR, rice, N,P and K.

ENHANCED APPLICATION OF THE RANGELAND HYDROLOGY AND EROSION MODEL (RHEM) FOR DISTURBED LANDS FOR ASSESSMENT OF HYDROLOGY AND EROSION PROCESSES

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Land managers need enhanced process-based knowledge and predictive tools to evaluate and target conservation and restoration practices that address these broad-scale ecological changes. This study highlights findings from decades of field hydrology and erosion experiments and recent enhancements to the Rangeland Hydrology and Erosion Model (RHEM; Nearing et al., 2011). The field experiments provide an enhanced process-based knowledge to address broad-scale changes in vegetation, disturbance regimes, and runoff and erosion processes on disturbed non uniform rangelands. The experimental data further provide a basis for enhancing and evaluating the RHEM tool for predicting rangeland hydrologic and erosion responses to disturbance and management practices. Collectively, the field data and regression analyses have resulted in new representative equations and parameter estimation procedures for runoff hydraulics, flow concentration, and soil erodibility in the RHEM tool specific for rangeland applications (Al-Hamdan et al., 2015, 2017). These enhancements have made RHEM an excellent tool for predicting landscape ecohydrologic and erosion responses to disturbances (Al-Hamdan et al., 2015), such as plant community transitions and

wildfire, and for targeting and predicting potential hydrologic and erosion responses to management across diverse rangeland ecosystems (Williams et al., 2016b). RHEM predicts runoff and associated soil loss using a risk assessment approach based on erosion event return intervals. Regression analyses of the noted field data have supported our field observations of the drivers of runoff and erosion processes on rangeland ecosystems. Our analysis of data pooled across our extensive dataset clearly demonstrate that ground cover and soil texture are primary predictors of soil erodibility on rangelands (Al-Hamdan et al., 2017). Further, our analyses demonstrate that the velocity and hydraulics of overland flow and the likelihood for flow to become concentrated are strongly regulated by the percentage of bare ground, hillslope angle, and the amount of runoff available (Al-Hamdan et al., 2015).

Keywords: RHEM tool, velocity, runoff, soil erodibility, hydraulics of overland flow, non uniform

STUDY OF MORPHO-PATHOGENIC VARIABILITY OF *MACROPHOMA PHASEOLINA*, INCITING STEM AND ROOT ROT OF SESAME

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Macrophoma phaseolina shows high degree of variability which increase its adaptability to diverse environmental conditions. In order to study the morpho- pathogenic variability of *Macrophoma phaseolina*, ten isolates were collected from sesame fields of ten agroclimatic zones of Odisha such as Mp₁, Mp₂, Mp₃, Mp₄, Mp₅, Mp₆, Mp₇, Mp₈, Mp₉, and Mp₁₀. In cultural studies, a Significant differences among 10 isolates were observed on the basis of radial growth, colour, aerial mycelium, growth pattern, biomass accumulation, size and abundance of aerial mycelium as well as size, shape and colour of microsclerotia. Out of all the isolates, Mp₆ and Mp₁₀ were diversified from all other giving off white colour, fluffy colony with large aerial mycelium, fast growing and dense. The isolate Mp₅ was distinct from rest with respect to large sized microsclerotia, less abundance and slow growing nature. Rest 7 isolates were recorded less variable with colour ranging from grey to black and similar in growth and microsclerotia characteristic. Aggressiveness study of *M. phaseolina* on sesame by both soil and seed inoculation method revealed a variation exists within the isolates and Isolate Mp₂ registered most aggressive in both soil and seed inoculation methods. It is observed that smaller the microsclerotia size, the larger its abundance which resulted into more radial growth rate and hence the isolate witnessed more virulent.

A COMPARATIVE STUDY OF VEGETARIAN AND NON VEGETARIAN FOOD HABITS DURING PREGNANCY

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Anaemia in pregnancy is associated with increased rates of maternal and prenatal mortality, premature delivery, low birth weight, and other adverse outcomes. Haemoglobin is expected to drop during pregnancy. It is normal for haemoglobin to drop to 10.5g/dl during pregnancy. Micronutrients like Iron, copper, pyridoxine, Vitamin-C, Vitamin-B12, the deficiency is may cause of low haemoglobin that is become a reason for Anaemia. Previous studies concluded vegetarian diets are at risk of nutritional anaemia during pregnancy. The aim was this prospective study observed the effect of food habits if vegetarian and non-vegetarian were taken well planned local available foods. The study was conducted on 35 pregnant women who were pregnant at in Attarsuiya at Allahabad city of Uttar Pradesh, India .the study time duration was 2017-18. Blood was collected from all the subjects to measure the haemoglobin (Hb) during 16-18weeks, 22-24 weeks, and 34-35 weeks of gestation. According to food habits, it is divided into 2 groups. The first group was vegetarian and the second group was non-vegetarian both groups were taken proper routine check-ups by the gynaecologist and consult a nutritionist. Result founded that BMI Mean± SD of vegetarian pregnant women is 23.1±4.1 and on vegetarians was 22.8 ±2.9. Haemoglobin Mean± SD of a vegetarian pregnant lady is 11.9±0.4 and on non-vegetarians was 11.3±1.3. There is no significant difference (p <0.05) was observed value of BMI and haemoglobin in both groups. The study concluded that pregnant women if taken proper diet and balanced food group, available in the local market they would not suffer anaemia during pregnancy.

Keywords: vegetarian diets, nutrition; pregnancy, anaemia, balanced diet.

IN VITRO EVALUATION OF DIFFERENT FUNGICIDES AGAINST WILT OF PIGEONPEA INCITED BY *FUSARIUM UDUM* BUTLER

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Pigeon pea (*Cajanus cajan*) is one of the important leguminous crop of the tropics and subtropics and is infected by the wilt pathogen *Fusarium udum*. Plants get infected at an early stage, symptoms; however, appear at different growth stages depending

on the severity of infection. Generally, wilt symptoms appear 4-6 weeks after sowing but become common and pronounced at reproductive stage. The wilt incidence may range 69-99% and 31-63% in susceptible and moderately susceptible cultivars, respectively. Therefore, the present study was conducted to assess the ability of eight fungicide viz., Captan (0.1g), Blue copper (0.3g), Carbendazim (0.1g), Carbendazim + Mancozeb (0.25g), Mancozeb (0.25g), Fipronil (0.1ml), Thiophanate Methyl (0.1g) and Pyraclostrobin (0.02g) along with control against *Fusarium udum* by following the poisoned food technique under *in vitro* condition. All the fungicides inhibited the radial growth of *Fusarium udum* *in vitro* after 168 hrs of incubation. Thiophanate Methyl, Carbendazim and Carbendazim + Mancozeb were found most effective fungicides which completely inhibited the radial growth and sporulation of *Fusarium udum*. Pyraclostrobin, Captan, Mancozeb and Blue copper were second next in order of toxicity resulting, respectively 87.18, 81.90, 70.02 and 58.70 percent inhibition of radial growth. Least inhibition was recorded in Fipronil (38.97%).

THE EFFECT OF FLUORIDE TOXICITY ON GERMINATION, PHYSIOLOGICAL AND PHENOLOGICAL PARAMETERS

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Fluorine is an element of the halogen family. Inorganic and organic fluorine compounds are called fluorides. Fluorine does not occur in the elemental state in nature because of its high reactivity. The fluoride ion oxidation state is -1 and it represents about 0.01 to 0.3 g kg⁻¹ of earth's crust. Fluoride is a toxic substance present in air, water and soil and Industrial growth as well as human actions are responsible for increasing its level in the environment which prevent the plant growth and productivity. Fluorides are metabolic inhibitors and affects a wide range of plant developments process. The increasing concentrations of sodium fluoride shows phytotoxic effects on physiology and biochemical parameters of seedling growth. Sodium fluoride might inhibit carbohydrate metabolism of germinating seedlings. Fluoride also, causes areduction in the chlorophyll content. The fluoride toxicity effects on seed germination and plant growth. Different levels of sodium fluoride repressed seedling germination percentage, length of root, length of shoot, dry weight and fresh weight of shoot and root of seedling, vigour index, germination relative index, mean daily germination, tolerance index, plant height, number of leaves, size of leaf, number of flowers per plant, yield and yields attributes. Physiological developments are known to be affected by fluoride, decreased plant growth, chlorosis, leaf tip burn, and leaf necrosis. Fluoride is absorbed by plant roots and then transported via xylemic flow to the transitory organs, mainly leaves, where it can be accumulated with adverse effects. Significant reduction was found in protein content and catalase activity at increasing fluoride concentration. Total soluble sugar content, proline content, peroxidase activity, ascorbic acid oxidase activity increased along with steady increment of fluoride concentration.

Keywords: Fluorides, sodium fluoride, germination, plant growth and yield

REVIEW OF BRUCELLOSIS IN INDIA

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This article describes the status and prevalence of brucellosis in India. Although many countries have eradicated *Brucella abortus* from cattle; in some areas, *Brucella melitensis* has emerged as a cause of infection in this species as well as in sheep and goats. Despite vaccination campaigns with the Rev1 strain, *B. melitensis* remains the principal cause of human brucellosis. *Brucella suis* is also emerging as an agent of infection in cattle, thus extending its opportunities to infect humans. The recent isolation of distinctive strains of *Brucella* from marine mammals has extended its ecologic range. Molecular genetic studies have demonstrated the phylogenetic affiliation to *Agrobacterium*, *Phyllobacterium*, *Ochrobactrum*, and *Rhizobium*. Human infections due to *Brucella canis* have also been reported. *Brucella pinnipediae* and *Brucella cetaceae* are the newly recognized marine mammal *Brucella* species that may also act as human pathogens. Polymerase chain reaction and gene probe development may provide more effective typing methods. Therapy of brucellosis is based on tetracyclines with or without rifampicin, aminoglycosides, or quinolones. Because each strain has distinctive epidemiologic features, with each new type, the complexity of the interaction with humans has increased. Moreover, new strains may emerge and existing types adapt to changing social and agricultural practices, the picture remains incomplete. Thus detailed research and review works are taking an upperhand for major advances in the knowledge of certain aspects of brucellosis-genetics, antigenic structure, mechanisms of pathogenicity, diagnosis, treatment, and prevention of the disease caused by the *Brucella* genus and its host interactions. Synonyms of the disease are brucellosis, undulant fever, Bang's disease, Malta fever, Mediterranean fever and rock fever.

Keywords: Brucellosis, India, Prevalence, Zoonosis.

CARBON SEQUESTRATION IN GRASS-BASED CROPPING SYSTEMS TO IMPROVE SOIL HEALTH UNDER CHANGING CLIMATE A REVIEW

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Carbon sequestration (CS) is the process of removal of carbon dioxide (CO₂) from atmosphere in to green plants where it can be stored indefinitely. The rate of carbon sequestration depends on the net balance between carbon inputs and carbon losses per unit time. Climate change, together with other megatrends population growth, rapid urbanization, food insecurity and water scarcity increases competition for resources and heightens tensions and instability. Global climate change has already manifested itself through increase in global temperature by 0.6 to 0.8°C during the 20th century and increase in frequency of extreme events like very high intensity precipitation, frequent drought, heat waves etc. carbon in the form of methane (CH₄) and CO₂ is the major player in contributing to this global climatic shift. Global warming potential, methane (25), nitrous oxide (298) and Chlorofluorocarbons (10,900) are equivalent to units of CO₂. Mitigation of CO₂ emission from agriculture can be achieved by increasing carbon sequestration in soil which implies storage of carbon as soil organic matter as minimum soil disturbance (*i.e.* tillage), increasing the mass and quality of plant and animal inputs to soils, improving soil microbial diversity and abundance and maintaining continuous living plant cover on soils year-round. Grasses based cropping system (GBCS) provides a quick way to apart from its potential to offset anthropogenic emissions, soil carbon sequestration has numerous other benefits viz. stabilization of soil aggregates, food for beneficial organisms, slow-release source of nutrients, increased water holding capacity, increase in nutrient holding capacity by improving cation exchange capacity, binding of toxic material build carbon for several reasons viz. where perennial species growing continually rather than seasonally, minimal disturbance relative to cropping, no erosion, if well managed. Alternatively, soil carbon losses can be minimized by reducing soil tillage, maximizing plant water use efficiency and application of surface mulches that shade the soil. Incorporation of perennial grasses can be effective to allocate a higher percentage of plant biomass carbon to belowground soil carbon sequestration, extend the growing season, better utilize soil water, and reduce tillage disturbance compared to annual crops. Grasses based cropping system (GBCS) help in increasing the fodder yield and resource use efficiency through their vegetation cover, greater root production ability especially in the top 15 cm soil profile thus bind soil particles, help in soil conservation, sustainable fodder production, adapting to mitigating global climate change, improving water quality, availability and ensuring food security.

Keywords: Carbon sequestration, climate change, soil health and cropping system

A COMPARATIVE PHARMACOGNOSTIC STUDIES OF *ADHATODA VASICA* NEES., *AZARDIRACHTA INDICA* (LINN.) A. JUSS. AND *CALOTROPIS PROCERA* (AITON) COLLECTED FROM ECO-FRIENDLY AND NON ECO-FRIENDLY ENVIRONMENT

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Now a day's more demand of herbal drugs are common for disease treatment but lack of knowledge of proper methodology and availability of herbal drug are promoting the practices of adulteration and substitution. The objective of the present study was to evaluate the quality parameter of samples of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from the Eco-friendly and Non eco-friendly zone of Haridwar District. This study has been planned to observe physiochemical parameters like total ash content, acid insoluble ash, alcohol-soluble extractive and water-soluble extractive. The result of alcohol-soluble extractive and water-soluble extractive of Eco-friendly and Non eco-friendly zone has been found with a comparable difference. The Sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from eco-friendly zone showed alcohol-soluble extractive values 9.6%, 17.6% & 16% respectively and the sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from Non eco-friendly zone showed alcohol-soluble extractive values 8%, 22.4% & 23%. The Sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from eco-friendly zone showed water-soluble extractive values 23.2%, 24% & 25.6% respectively and the sample of *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton) collected from Non eco-friendly zone showed water soluble extractive values 16%, 18.4% & 32%.

Keywords: *Adhatoda vasica* Nees., *Azardirachta indica* (Linn.) A. Juss. and *Calotropis procera* (Aiton), Pharmacognostic.

EFFECTS OF WEED CONTROL TREATMENTS ON GROWTH AND YIELD OF WHEAT AND ASSOCIATED WEEDS**¹BISHAL KUMAR MISHRA, ¹MITHLESH KUMAR PANDEY, ²SACHIN TIWARI, ³BRIJESH DIXIT****¹Assistant, Professor, Department of Agriculture, IHGI, Jalandhar, Punjab.****²M.sc. (Ag) Soil science student of T. D. P. G. College, Jaunpur, U.P.****³M.sc (Ag) student, Department of Genetics and Plant Breeding, NDUAT, Ayodhya (UP).**

A field experiment was conducted during rabi season of 2017-18 on Sandy loam soil at Agricultural Research Farm, Department of Agriculture, Innocent Hearts Group of Institutions, Jalandhar, Punjab. The experiment was conducted with the aimed of evaluating the effect of different herbicides (alone and mixture) against complex weed flora in wheat crop. The experiment planed and laid out with eight treatment and three replications under randomized block design. The major weed flora infesting the wheat crop field were *Cyperus rotundus*, *Cynodon dactylon*, *Chenopodium album*, *Anagallis arvensis* and *Parthenium hysterophorus*. The post em- application of Sulfosulfuron @ 0.33 a.i. kg/ha at 33 days after sowing was most efficient in controlling the weeds (both grassy and non grassy), among the various applied herbicides. The weed growth suppression effect of Sulfosulfuron @ 0.33 a.i. kg/ha resulted least weed population and dry weight, maximum yield and yield attributes (number of effective tillers per plant, number of grains per ear head, test weight, grain yield and straw yield) with maximum net return (16011.44) and benefit cost ratio (1.43).

Keywords: Herbicide, wheat, weed management**EFFECT OF INTIGRATED NUTRIENT MANAGEMENT ON SEED YIELD OF MUSTARD (*BRASSICA JUNCEA*) IN ASSAM****BOLLA VENI SATHISH KUMAR AND J.C. DAS****Assam Agricultural University (AAU), Jorhat, India**

Rapeseed- mustard group of crops is the third largest oilseed crops in India, after soybean and groundnut. This group occupies 6,646 thousand ha area and producing 7,877 thousand tones with an average productivity of 1,185 kg/ha. In Assam, rapeseed is predominantly grown as *rabi* oilseed crop under rainfed conditions which occupies an area of 279 thousand ha with an average productivity of 605 kg/ha, which is considerably lower than that of national productivity of mustard. The present experiment was conducted to study “Effect of irrigation and nutrient management in Indian mustard (*Brassica juncea*) in Assam” during two consecutive *rabi* (Oct- Feb) seasons of 2016 - 2017 and 2017-2018. The effect of nutrient management practices on seed yield of mustard was found to be significant. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced the highest seed yield in two years. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) was significantly superior to N₁ (Recommended dose of fertilizer nitrogen), N₃ (75% RDFN + 25% N through FYM) and N₄ (50% RDFN + 50% N through FYM) in two years but N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced statistically similar kind of results with N₂ (RDFN + FYM @ 5t/ha) in both the years.

EFFECT OF INTIGRATED NUTRIENT MANAGEMENT ON STRAW YIELD OF DIRECT SEEDED AUTUMN RICE (*ORYZA SATIVA*) IN ASSAM**BOLLA VENI SATHISH KUMAR AND J.C. DAS****Assam Agricultural University (AAU), Jorhat, India**

Transplanting is the most common method of rice cultivation but owing to increasing water scarcity, scarce labour coupled with higher wages during the peak periods, a shift towards less demanding alternative methods of rice cultivation aiming at higher water and crop productivity, is imperative. To overcome these problems, aerobic rice systems, wherein the crop is established through direct-seeding in non-puddled, non-flooded fields, are among the most promising approaches for the saving labour and water. “Effect of irrigation and nutrient management in direct seeded autumn rice (*Oryza sativa*) in Assam” during two consecutive summer (Feb-June) seasons of 2017 and 2018. The effect of nutrient management practices on straw yield of direct seeded rice was found to be significant in both the years. Application of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) produced the highest straw yield in two years which was significantly superior to N₁ (Recommended dose of fertilizer nitrogen), N₃ (75% RDFN + 25% N through FYM) and N₄ (50% RDFN + 50% N through FYM). The results of N₅ (50% RDFN + 50% N through FYM + Bio-fertilizers) was statistically at par with N₂ (RDFN + FYM @ 5t/ha) in two years. The lowest straw yield in two years produced by N₁ (Recommended dose of fertilizer nitrogen)

NITRATE POLLUTION WITH MODERNIZATION OF INDIAN AGRICULTURE

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Modernisation of agriculture makes use of hybrid seeds of single crop varieties, high-tech equipment's, fertilizers, pesticides and water. The increased concentrations of nitrogen, phosphorus and potassium contained in most of the fertilizers that are used in modern agriculture pollute the ground water quality thereby affecting the wellbeing of human and animal population. Nitrogen is both an essential nutrient and a major pollutant in terrestrial ecosystems. As an integral component of essential plant nutrients, nitrogen plays an important role in increasing crop yields and crop quality. However, excess nitrogen used in fertilization has undoubtedly disturbed the biogeochemical nitrogen cycle of natural ecosystems, resulting in various global, regional, and local environmental problems such as stratospheric ozone depletion, soil acidification, and especially NO_3^- pollution of ground and surface waters. Maximum permissible limits of nitrate concentration in water prescribed by ICMR is 10 as $\text{NO}_3^- \text{N}$ (mg/l) and 45 as NO_3^- (mg/l). The production of food grains in Punjab has increased by 2% in last 5 years as against 8.6% rise in population. There are many sources of nitrate accumulation in water and hence food, viz., over fertilization of crops, intensive agricultural rotation cycles and increased urbanization etc. Encourage the use of bio fertilizers instead of chemical fertilizers. It is suggested to Shift into organic agriculture for the management of pest and disease.

Keywords: nitrate; nitrogen; ground water pollution; environment; crop yield; crop quantity; human health and water depletion.

ASSIMILATED IMPACT OF BIOCHAR WITH POLYACRYLAMIDE TO REDUCE RUNOFF UNDER NATURAL RAINFALL CONDITION

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The reduction of runoff from hills without affecting agricultural productivity using various soil amendments is one of the major environmental challenges faced by the world. Inorganic amendments have several adverse effects in soil and its productivity. In the present study, biochar which is an organic soil amendment, has been produced at 400 °C for 4 h under a slow pyrolysis process from rice husk and it represents a novel and promising results for achieving the above mentioned goals. Four treatments viz. control (C), biochar (B), biochar with gypsum (B+G) and biochar with polyacrylamide (B+PAM) with three replications have been used over average field slope of 11.71 %. Gypsum, biochar and polyacrylamide have been applied at the rate of 250 g/ m², 2 g/ m² and 800 g/ m² into plot size of 9 m² each. Natural rainfall was allowed to be occurred over the field in the months of August and September 2018 in the presence of 28.21% moisture contents prior to first reading. Total 12 rainfall events have been occurred during these periods. Result shows that B+PAM gives better results in comparison to B and B+G treatments to reduce the runoff volume, after few inches growth of vegetation over surface, notwithstanding, B+G have shown promising results in comparison to single B treatment. Soil physical properties prior and end of experiment, have also been studied and it was found that bulk density on dry basis of soil increases in all the four treatments, while in comparison to control treatment, B+PAM, B+G and B has too slow, slow and rapid increase of bulk density, respectively. Similarly, specific gravity of soil was reduced for B+PAM and increased for C, B, and B+G treatments. Overall result represents that B+PAM treatment is better than all three treatments to reduce runoff and to increase infiltration rate.

Keywords: Organic and inorganic soil amendments; Runoff; Soil physical properties; Natural rainfall condition.

HORTICULTURAL INNOVATION, FOOD PROCESSING AND VALUE ADDITION

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The horticulture sector is considered as the most dynamic and sustainable segment of agriculture all over the world. It covers pre and post-harvest management of a wide spectrum of crops, including fruits and nuts, vegetable, including potatoes, flowering and aromatic plants, tuber crops, mushroom, spices, plantation crops, edible bamboos etc. It is established fact that horticulture is one of the best option for improving the productivity of the land, ensuring nutritional security for mankind and for sustained the livelihood or the farming community worldwide in order to optimize the use of resources, hi-tech interventions light precision

farming, which compares temporal and spatial management of resources in horticulture, is essentially required for improvement in cropping and crop production and return to farmer, hi-tech application and precision farming have to widely spread and adapted. Food processing is the set of method and techniques used to transform raw ingredient into food or food into other form for consumption by human or animals either in the home or by the food processing industry. The Indian food industry is poised approach for huge growth, increasing its contribution to world food trade every year. India, the food sector has emerged as a high growth and high processed sector due to its immense potential for value addition, particularly with in the food processing industry. Value addition is important factor in the growth and development of horticultural sector, both in India and around the world. It improve the profitability of farmer, to provide better quality, safe and branded food to the consumer, produce post- harvest losses, way of increase foreign exchange.

Keywords: Hi-tech, Precision farming, Post-harvest technology, Industry, Food processing, Value addition.

GROWTH AND YIELD OF URDBEAN AS INFLUENCED BY FOLIAR APPLICATION OF SALICYLIC ACID UNDER RAINFED CONDITION

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The experiment was conducted in the department of Crop Physiology C S Azad University of Agriculture & Technology. Kanpur in field during *khari* 2017 adopted Randomized Block Design with 3 treatment and Azad 3 variety including control and each treatment were replicated three (3) times. The treatment comprised of control, three level of salicylic acid i.e. 50, 100 and 150 ppm at the time of 20 DAS, 40 DAS and 60 DAS which was given through foliar application. Maximum increase in yield attributes viz., number of pods/plant, number of seeds/plant, 100 seed weight and yield/plant was recorded under the treatment of salicylic acid @ 150 ppm followed by 100 and 50 ppm of salicylic acid over control. Thus, in general it may be concluded that the foliar application of salicylic acid @ 150 ppm was found optimum concentration in enhancing yield of Black gram over rest of treatment under rain fed conditions.

Keywords: salicylic acid @ ppm, urdbean and rainfed condition

CHALLENGES OF VEGETABLE CULTIVATION UNDER CHANGING CLIMATE SCENARIO

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India is second largest producer of vegetables in the world next to China. Area under vegetables 10.29 million ha and total production 176.17 million tonnes. These are the products of herbaceous plants which are annuals, biennial and perennials whose plant parts such as leaves, fruits, roots, stems, petiole, flower etc. are used for culinary or consumed as raw. Dieticians supporter intake of 300g of vegetables every day to make our diet balanced along with other diets. There are 125 g leafy vegetables, 75 g other vegetables and 100 g root and tuber vegetables. With the projected inhabitants of 133 crores in 2020 and 165 crores in 2050, we have to produce at least 190 and 240 million tonnes respectively. Vegetables are productive foods are carbohydrates, protein, roughages and rich source of vitamins and mineral i.e. called protective food. Climate change may be negative impacts upon for the present vegetable production. There is mounting evidence that smaller farmers in developing countries are experiencing increased climate variability and climatic change include more extreme events like average means of temperature and precipitation which is clearly linked to increased greenhouse gas (GHG) emissions as well as climate change such as global warming, changes in seasonal and monsoon pattern and biotic and abiotic factors. Potential of yield majority of vegetable crops is affected by various climatic factors like temperature, solar radiations, humidity, rainfall, wind, drought, salinity etc. Drought and salinity are the two important consequences of increase in temperature decline vegetable cultivation. Anthropogenic air pollutants such global warming and dioxides of nitrogen and sulphur are causing depletion of ozone layer and permitting the entry of harmful UV rays. India is second largest producer of vegetables in the world because there are various diverse climatic conditions, available across the country provide ample opportunity to grow almost all types of vegetable crops.

Keywords: Climate, Vegetables, Productive foods, Protective food, Global warming, Salt

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 evolution of Indian agriculture policy may be analyzed in the context of role of government policies in

sustainable development process and the factors affecting agriculture growth. In the sustainable development process of country, agriculture serves mainly three functions (i) to provide initial surpluses for other sectors of the economy (ii) to provide wage goods to the industrial sector (iii) to promote growth through forward linkages. The first and the third function require a robust overall agricultural growth whereas the second requires adequate food supplies. Therefore, for sustained economic growth, both overall agricultural growth and growth in food production are indispensable. 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. The affecting factors for sustainable development of agriculture are these –natural, technological, economic and policies making by government. Natural factor is a climate factor, it includes rainfall, temperature and soils. In the technological factors it includes pest protection, seeds and fertilizing technology. The economic factor means that the profitability of agriculture and how it influences by other private sectors. The last factor is that the policies made by the government for the sustainable development for agriculture. The sustainable agriculture may be defined as any set of agronomic practices that are economically viable, environmentally safe, and socially acceptable. If a cropping system requires large inputs of fertilizer that leak from the system to pollute ground water, drinking supplies and distant coastal fisheries, the system may be sustainable economically as the long-term supply of fertilizer is stable and the economic cost of fertilizer is easily borne by larger grain production but it is not sustainable environmentally or socially, since it does not cover the cost of environmental damage or social costs. The organic agriculture focuses on “living soil”, on optimizing the use of biological processes and on avoiding the use of synthetic chemicals and fertilizers.

Keywords: Agricultural, Economics, Development, Government, Sustainable.

EVALUATION OF SPAWNING RATE ON YIELD OF PL-16-04 STRAIN OF *PLEUROTUS* SPECIES.

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Mushroom are macro fungi, achlorophyllous in nature and show saprophytic nutrition. It belongs to Division: Basidiomycotina, typically an oyster shaped mushroom. *Pleurotus* species of mushroom requires lignocellulosic substrate along with spawn for its cultivation. Spawns are developed in mushroom research station under highly aseptic condition. Proper sterilization and packing of spawn is also important. Spawning rate is an important criteria, as it directly influence the growth of mycelial mat and production of fruiting bodies. Spawning rate contributes to the production and biological efficiency of mushroom. Spawning and packaging of spawn is important rate should be balanced and maintained in such a level that it can be used to in yield maximization. Maximum production of *Pleurotus* species is found in 16 % spawn rate i.e., 60g/ 500g of dry substrate with 381.60g yield and 76.32% biological efficiency in 17.20 days. Whereas minimum yields was recorded in 4 % spawn rate i.e., 20g/ 500g of dry substrate with yield as 305.6g and 61.12 % biological efficiency in 21.40 days. With these findings mushroom growers are provided with the knowledge that proper spawning rate must be maintained during production of *Pleurotus* species, in order to obtain maximum returns with least losses.

Keywords: Spawn, Spawning rate, *Pleurotus* species, mycelial mat, yield, biological efficiency.

COGNITIVE ABILITIES OF PRESCHOOL CHILDREN IN URBAN AND RURAL AREA OF HISAR DISTRICT

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The period of life from three to six years of age may be called early childhood years. It is an important period in the life of an individual because the rate of development is more rapid during these years and children at this stage are intrinsically curious and not only growing physically but also mentally. Cognitive development is "the psychology of learning which emphasizes human cognition or intelligence as a special endowment enabling man to form hypotheses and develop intellectually". Cognitive functioning or the process of knowing includes development of awareness and judgement. The main purpose of the study was to investigate cognitive abilities of preschool children across residential area. The study was conducted in Hisar district of Haryana state. For selection of rural data four schools having preschool unit were selected and to draw urban sample five preschools were selected at random. From selected schools 240 pre-school children from the age group of four to five years were selected randomly. The sample consisted of equal number of preschool boys and preschool girls. Cognitive abilities of pre-school children were assessed by using Pandey's Cognitive Development Test for Pre-schoolers by Hema Pandey (1992). The collected data was classified and tabulated as per the objectives. For analysis of data frequency, percentages, mean, standard deviation and independent sample 'z' test were used. Results indicated that in urban as well as in rural area majority of the preschool children had moderate level of cognitive abilities and urban preschool children had better cognitive abilities as compared to rural preschool children.

Keywords: Cognitive abilities, cognitive development, preschool children.

DEVELOPMENT AND ERGONOMICAL EVALUATION OF MANUAL FRUIT HARVESTING DEVICE**DIVAKAR CHAUDHARY****Department of Farm Machinery and Power Engineering, C.T.A.E. MPUAT, Udaipur**

Harvesting is one of the most important activities in fruit production, handling and preservation cycle. Fruits are generally damaged due to lack of a suitable harvesting device. Presently, fruits harvesting operations is being done traditionally by hand picking or by climbing on ladder on tree directly. These traditional methods are labour, time and drudgery oriented and also affects the quality of the fruit and reduced margin of profit for the farmers. Moreover, acute neck and shoulder pain to the workers has been reported during fruit harvesting at the upper periphery of the tree that restrict them for continuous work. Workers also got injuries during operation either falling from the tree or ladder. Hence an ergonomically designed manual fruit harvester is required to overcome these problems. The machine developed was tested in the orange orchards and comparison was made on the basis of ergonomics and cost economics between traditional and developed method. Overall discomfort score, body part discomfort score and rapid upper limb assessment was done for ten subjects for both methods, score for the developed method was found satisfactory as compared to traditional method, as it was 1.9 for ODR, and 4.0 was RULA score for developed method. Comparison was also made on the basis of output (kg/h) and damage (kg/h). The average output of traditional and developed technique were 52.33 kg/h and 47.50 kg/h respectively. Though the output of traditional method of harvesting was high but the damage of fruit was also high as compared to developed method. The fruit damage was almost negligible in developed method as compared to other method studied. Traditional harvesting method resulted highest fruits damage i.e. 6 kg/h.

Keywords: Overall discomfort score, rapid upper limb assessment, body part discomfort score.

IMPACT OF KRISHI VIGYAN KENDRA IN CHANGING THE KNOWLEDGE AND ATTITUDE OF THE FARM WOMEN IN COOCH BEHAR DISTRICT OF WEST BENGAL**DIPAK KR. BOSE* AND HIRA BOSE****

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Krishi Vigyan Kendra (KVK) is an institutional project of Indian Council of Agricultural research (ICAR) for testing, training and transfer of agricultural technologies for the benefits of farmers, farm women and rural youths. Farm women play a crucial role in all farm-related activities from land preparation to marketing. While men went out hunting in search of food, women started gathering seeds from the native flora and began cultivating those of interest from the point of view of food, feed, fodder, fibre and fuel (**Swaminathan, 1985**). Keeping these facts in view a study was carried out in Cooch Behar district of West Bengal to find out the impact of Krishi Vigyan Kendra in changing the knowledge and attitude of the farm women. The study covered one districts, two blocks (Tufanganj-I & Tufanganj-II) selected purposively and 12 villages and 140 respondents (70 KVK beneficiaries and 70 non beneficiaries) which were selected randomly. Descriptive research design was followed for the present study. The data were gathered by personal interview technique with the help of pre-tested, structured interview schedule. The collected data were processed, classified, tabulated and analysed by using descriptive and inferential statistical tests, interpreted and logical conclusions were drawn in the light of the objectives set forth. The study inferred that there was a significant difference between the socio-economic status of the KVK beneficiaries and non-beneficiaries. Majority of the beneficiaries had medium to high socio-economic status. There was a significant difference between the knowledge level of the KVK beneficiaries farm women and non-beneficiaries. There was a significant difference between the degrees of attitude of KVK beneficiaries and non-beneficiaries farm women.

DOUBLING FARMER'S INCOME THROUGH DIVERSIFIED FARMING WITH LOW VOLUME - HIGH VALUE CROPS**SANTOSH KUMAR*, JOTISHNONGTHOMBAM*, K. P. CHAUDHARY** AND OM PRAKASH*****

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Mizoram, the 23rd state of India has a total of nine Districts. It is located at 21°58' to 23°35' N latitude and 92°15' to 93°29' E longitude and surrounded by Tripura, Assam and Manipur in north frontier regions; Bangladesh in west; and Myanmar in east and south. In verse of global affects on changing climate, advances in agricultural practices and ever increasing population growth has imparted immense pressure on the jhum cycle of the state. This in turn has evolved as one of the causing factor for low soil fertility directly and indirectly in the region. Mizoram's agricultural land is composed of a magnificent dynamic slopy upland (Jhum & shifting cultivation) and low land valley (Settled agriculture). However, agriculture still remains under-developed and the primitive

method of jhum (shifting cultivation) predominates. Both production and productivity are relatively low. Niti Aayog accorded that, doubling the real income of farmers till 2022-23 over the base year of 2015-16, requires annual growth of 10.41% in farmers' income. Hence therefore, calculative measures in different aspects of the region need to be harnessed in all possible sources of growth in farmers' income within as well as outside agriculture sector. \ keeping the above entities as a set goal, a judiciously designed need base agricultural technologies were imparted in a selected cluster of Sihphir village in Mizoram. Coupled agricultural approach using HYVs of quality seeds Arka Rakshak in Tomato, Solan green Head in Broccoli, Arka Aishwarya in watermelon, Festival in Strawberry and local Anthurium was imparted with the concept of Per Drop More Crop. Further, INM practices with Soil-test based nutrient management (Distribution of soil-health cards); Post-harvest crop losses (zero energy cool chamber); and Promotion of ancillary like poultry, beekeeping and Mushroom production were introduced in the region. Mizoram being a region prone to heavy rainfall during on season, cultivation practices of low volume high value crops viz. indeterminate tomato, watermelon and capsicum under protected cultivation equip with low cost micro irrigation system as to ensure better quality produce by exploiting existing agro-climatic advantages and using protected structures. It also provides early nursery and early cropping as well as lucrative returns to the farmers. The demonstrated technology diversified farming with low volume high value crops gave an annual total income of 2.5 - 3 lakhs/ha in earlier years after implementation of the programme it has increased to about 3.5 – 3.8 lakhs/ha with average benefit cost ratio of 2.81 compared to benefit cost ratio of 2.24 under local checks. The results highlighted the fact that income of farmers can be double the income by the adoption of recommended technology.

APPLICATIONS OF BIONANOTECHNOLOGY IN AGRICULTURE: AN OVERVIEW

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Bionanotechnology has evolved an exhilarating field of research and it exhibits tremendous revolution in agriculture and food industry by novel techniques such as precision farming techniques, improving the ability of plants to imbibe nutrients, detection of disease, and disease control. Nanotechnology is being grown in agriculture to overcome the disadvantages of conventional farming and it is used to increase the use of soil nutrients by plants. Nanofabricated materials containing plant nutrients in aqueous suspension and hydrogels have been studied for the growth of crops. Zerovalent iron nanoparticles can be used to remediate soils that can be contaminated by heavy metals, pesticides, and radionuclides. Nanotechnology is used to enhance the effectiveness of applied fertilizer with the help of zeolites and nano clays. Nanotechnology intervention in farming has dazzling prospects for increasing the effectiveness of nutrient use by nanoformulations of fertilizers, control of pests and diseases, understanding the mechanisms of host-parasite interactions, removal of contaminants from soil and water, preservation and packaging of food and food additives. Nanotechnology may act as sensors for monitoring soil quality of agricultural field and thus it control health of agricultural plants. The present challenges of climate change, food security and sustainability are attracting researchers for investigate the field of nanotechnology in agricultural field. Applications of bionanotechnology are tremendously widespread and it promises to recreate biological pathways and mechanisms. This study covers the advance challenges of sustainability and food security that are investigating by researchers in the field of nanotechnology for improvement of the agriculture technique.

CANOPY ARCHITECTURE MANAGEMENT IMPROVES LIGHT INTERCEPTION IN FRUIT TREES

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Improvement of light penetration within tree canopies has been a constant objective of fruit tree architecture manipulation through the setting up of training systems. Light is a critical resource needed by plants for growth and reproduction. A major portion of the fruit tree's canopy is subjected to shade during most daylight hours. As light levels drop below 30 per cent of full sunlight, flower-bud formation is reduced and vigour of fruitful branch is lost which fail to set fruits or fruits, if produced, are of poor quality. With time, fruiting branch in this zone become photo synthetically inactive and production declined. Because photosynthetic carbon fixation depends mainly on the light microclimate and total light interception by the canopy, canopy management practices that encourage better aeration and sunlight exposure to foliage is critical to improve the photosynthetic efficiency, fruit bud differentiation, fruit set, growth and quality *vis-a-vis* reduced microclimate build up for pests and disease. Canopy management practices influence carbohydrate partitioning between source and sink, alteration of biochemical processes, improved light interception, growth parameters, fruit yield, early flowering and regular bearing. While managing tree architecture, the diurnal variation in light interception, leaf position in the canopy and degree of leaf clumping, tree architectural behavior, nature of vegetative and reproductive growth and training and pruning are essentially kept in mind as these factors influence the overall tree physiology, photosynthetic performance, flowering and fruit yield. Light interception is low when the orchard is planted and increases as the orchard develops in relation to total leaf area index. Hence, practices that increase light exposure of the canopy as well as light distribution within the canopy calls for optimization of tree shape, standardization of planting distances and training procedures and a sound knowledge of the response of trees to training methods, specifically shoot orientation and pruning. Therefore, manipulation of tree skeleton and vigour for ensuring efficient use of the available sunlight and temperature to increase fruit productivity and quality, largely determines the success of canopy architecture management.

Keywords: Light interception, Canopy management, Training, Flowering and Yield

CLIMATE CHANGE AND GLOBAL WARMING: POLICES, PLANNING AND MANAGEMENT

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Climate change, global warming and agriculture are interrelated processes, all of which take place on a global scale. Global temperature is drastically rising and has gone up average of about 0.6-0.8 degree centigrade since early 20th century that cause corresponding change in climate. Climate change affects agriculture in a number of ways, including through changes in average temperatures, rainfall, and climate extremes. Climate change is already affecting agriculture, with effects unevenly distributed across the world. Animal agriculture is also responsible for greenhouse gas production of CO₂ and a percentage of the world's methane, and future land infertility, and the displacement of local species. According to central action plan on climate change (CAPCC), it was observed that India has been identified as one of the most vulnerable country specially the desert area comprises a very dry place and uneven distribution of rainfall, which is highly affected by this unpredictable climate pattern. On the other side, it would defiantly affect the demand and crop price change scenario. Climate change is defiantly one of the biggest and toughest factors responsible for the food insecurities all around the world. India is one of the country which is badly affected from food insecurities for a large population and this is all because climate changes. It's time to change the way agriculture affects the environment, and vice versa. For climate change and global warming, the world community has to accept the need to limit their participations in raising the temperature and have to initiate the change to achieve this objective. This will require move them away from burning of fossil fuels and deforestation and reach a stage of zero carbon emissions. If the world make such change this will be the best way to humanity lives.

ZERO BUDGET NATURAL FARMING (ZBNF) IS A WAY FORWARD TO SUSTAINABLE AGRICULTURAL PRODUCTIVITY AND ENVIRONMENT MANAGEMENT

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Indian farmers increasingly find themselves in a vicious cycle of debt, because of the high production costs, high interest rates for credit, the volatile market prices of crops, the rising costs of fossil fuel based inputs, and private seeds. Debt is a problem for farmers of all sizes in India. Under such conditions, 'zero budget' farming promises to end a reliance on loans and drastically cut production costs, ending the debt cycle for desperate farmers. The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming with Nature and without chemicals. Subhash Palekar, the discoverer of ZBNF, gave many theories, principles and methods of ZBNF. Zero budget farmers use mulching, soil protection techniques, natural pesticides and fertilizers. The principal methods of ZBNF include crop rotation, green manures and compost, biological pest control, and mechanical cultivation. There are, most popular, 4 pillars of ZBNF i.e. Jivamrita, Bijamrita, Acchadana and Whapasa, which we will discuss later.

Keywords: ZBNF, Jivamrita, Bijamrita, Acchadana and Whapasa

EFFECT OF TILLAGE PRACTICES AND INTEGRATED NUTRIENT MANAGEMENT (INM) ON PRODUCTIVITY, NUTRIENT UPTAKE AND STATUS OF SOIL IN LATE SOWN WHEAT (*TRITICUM AESTIVUM* L.)

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A field experiment was conducted at Students Instructional Farm (SIF), Department of Agronomy, Collage of Agriculture, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002, (U.P.) for two consecutive years (2016-17 and 2017-18) to study the productivity of wheat (*Triticum aestivum* L.) under different tillage practices methods (Conventional tillage method- CT, Minimum tillage method- MT and Zero tillage method- ZT) in main plot and integrated nutrient management practices and six integrated nutrient management practices i.e. (Control (No fertilizer-T₁, Farmer practice-T₂ STR (Soil %100 (Test Recommendation NPK-T₃, STR %100 + tonnes FYM 5-T₄, STR %100 + PSB-T₅, STR %100 + PSB+ tonnes FYM 5-T₆ in sub plots, replicated trice in a split plot design. Conventional tillage method produced taller plants, higher dry matter accumulation and maximum number of tillers/m² at 90 DAS as compared to other treatment. Zero tillage produced shorter plant height, minimum dry matter and less number of tillers per m². tillage practices methods on yield contributing characters, spike length, spike weight, number of grains/spike, number of spikelets per spike, 1000 seed weight, were positively influenced (Table 2). The longest spike length 8.76 and 9.15 cm were found in first and second year, respectively, under conventional tillage, which was significantly superior over the other tillage practices methods. Significantly more number of grains/spike, higher spike weight and

higher test weight were recorded under conventional tillage methods as compared to minimum and zero tillage. Highest yields of grain and straw were recorded under conventional tillage followed by minimum over zero tillage practices. Conventional tillage practices resulted in significantly higher content and their uptake of NPK by wheat plants as compared to other tillage methods. Maximum NPK uptake was recorded under Conventional tillage followed by minimum tillage while minimum NPK uptake was estimated under zero tillage through grain straw and total during first year. The plant height, dry matter accumulation and number of tillers per plant significantly increased with application of 100% STR + PSB + 5 tonnes FYM. The maximum height was recorded under 100% STR + PSB + 5 tonnes FYM followed by 100% STR + PSB, which might have resulted due to increased leaf area, higher photosynthetic rate and more carbohydrate accumulation in plants, thereby increasing dry matter production. integrated nutrient management application at 100% STR + PSB + 5 tonnes FYM and 100% STR + PSB level produced significantly higher number of grains/spike, more spike length, spike weight and more test weight of grains as compared to 100% STR and farmer practices INM practices. The highest grain yield 36.74 and 39.51 q ha⁻¹ and straw yield 45.56 and 48.83 q ha⁻¹ were recorded with 100% STR + PSB + 5 tonnes FYM which was 20.38 % and 25.79 % and 24.11 % and 28.26 % higher than the yield of control. Maximum NPK uptake was recorded by 100% STR + PSB + 5 tonnes FYM which was higher than 100% STR + PSB and 100% STR + 5 tonnes FYM during first and second year of experimentation. Maximum NPK uptake was recorded under Conventional tillage followed by minimum tillage while minimum NPK uptake was estimated under zero tillage through grain straw and total during first year. The plant height, dry matter accumulation and number of tillers per plant significantly increased with application of 100% STR + PSB + 5 tonnes FYM. The maximum height was recorded under 100% STR + PSB + 5 tonnes FYM followed by 100% STR + PSB, which might have resulted due to increased leaf area, higher photosynthetic rate and more carbohydrate accumulation in plants, thereby increasing dry matter production. integrated nutrient management application at 100% STR + PSB + 5 tonnes FYM and 100% STR + PSB level produced significantly higher number of grains/spike, more spike length, spike weight and more test weight of grains as compared to 100% STR and farmer practices INM practices. The highest grain yield 36.74 and 39.51 q ha⁻¹ and straw yield 45.56 and 48.83 q ha⁻¹ were recorded with 100% STR + PSB + 5 tonnes FYM which was 20.38 % and 25.79 % and 24.11 % and 28.26 % higher than the yield of control. Maximum NPK uptake was recorded by 100% STR + PSB + 5 tonnes FYM which was higher than 100% STR + PSB and 100% STR + 5 tonnes FYM during first and second year of experimentation.

Keywords: Conventional tillage, INM, Uptake, Zero tillage, tillage methods, grain yield, yield attributes

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT ON DRY HERBAGE AND ANDROGRAPHOLIDE YIELDS OF KALMEGH [ANDROGRAPHIS PANICULATA (BURM. F.) WALL. EX NEES] IN INDO-GANGETIC PLAINS

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A field experiment was conducted during *kharif* seasons of 2017-18 and 2018-19 at Medicinal Plants Research & Development Centre (M. R. D. C) of the G. B. Pant University of Agriculture & Technology, Pantnagar, District Udham Singh Nagar (Uttarakhand) to study the effect of organic manures and fertility levels on yield and quality of the *kalmegh* [*Andrographis paniculata* (Burm. f.) Wall. ex Nees]. The soil of the experimental site was sandy clay loam in texture having high organic carbon, low available nitrogen, high available phosphorus and medium in exchangeable potassium with slightly alkaline in reaction. The experiment was laid out in split plot design with three levels of organic manure and four fertility levels replicated thrice. The organic manures [no organic manure (control), vermicompost @ 5 t/ha and poultry manure @ 5 t/ha] were taken in main plots while the fertility levels [0: 50: 50, 50: 50: 50, 75: 50: 50 and 75 (37.5 + 37.5): 50: 50 kg N, P₂O₅ and K₂O per hectare] were taken in the sub plots. Application of the organic manures and fertility levels influenced the growth characteristics, yield attributes, quality of the crop significantly during both the years of experimentation. Significantly higher dry herbage and andrographolide yields were recorded with application of vermicompost @ 5 t/ha along with 75 kg N/ha in two splits during both the years of study. On the basis of the two years study, it can be concluded that vermicompost shall be applied @ 5 t/ha along with 75 kg N/ha in two splits (37.5 kg as basal + 37.5 kg as top dressing at 25 days after transplanting), 50 kg P₂O₅ and 50 kg K₂O per hectare for getting higher herbage yield of *kalmegh* along with quality in terms of andrographolide yield.

MANAGEMENT OF GREEN LEAF HOPPER (NEPHOTETTIX VIRESCENS) AND BROWN PLANT HOPPER (NILAPARVATA LUGENS) THROUGH ECO-FRIENDLY APPROACH

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A field experiment was conducted to study the effect of various Eco-friendly insecticides viz., Camphor oil @ 1000 ml/ha, Cedar wood oil @ 1000 ml/ha, Eucalyptus oil @ 1000 ml/ha, Lemongrass oil @ 1000 ml/ha, Neemazal @ 1000 ml/ha,

Dinotefuran 20SG@ 200 ml/ha and Rynaxypyr 20SC@ 100 ml/ha against the population of Green Leaf Hopper (*Nephotettix virescens*) and Brown Plant Hopper (*Nilaparvata lugens*). The results revealed that all the plots treated with Eco-friendly insecticides had significant influence on the population of the insect pest. The lowest population of *N. lugens* and *N. virescens* was recorded in the plot treated with Rynaxypyr 100 ml/ha with a lowest mean population of 7.79% and 8.03% respectively as compared to 18.19% and 17.05% recorded in the control plot. The percent reduction of *N. lugens* and *N. Virescens* population over control recorded was 57.17 and 52.90 respectively. The lowest mean population was also recorded in the plot treated with Dinotefuran 20SG@ 200 ml/ha with a mean population of 8.69% and 9.03% respectively. The plot treated with Cedar wood oil @ 1000 ml/ha recorded the highest mean population of *N. lugens* and *N. Virescens* of 11.00% and 11.79% respectively. The highest grain yield of 5.9 ton/ha was recorded in the plot treated with Rynaxypyr 20SC@ 100 ml/ha which was at par with Dinotefuran 20SG@ 200 ml/ha with a yield of 5.68 tons/ha as compared to 3.27 tons/ha in control plot.

Keywords: *Nephotettix virescens*, *Nilaparvata lugens*, Rynaxypyr, Dinotefuran

ECO-INDIGENOUS KNOWLEDGE AND CLIMATE SMART AGRICULTURE

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There is now a growing recognition that indigenous Technical knowledge could somehow respond to the greatest threat of climate change. ITK is cumulative body of knowledge and practices maintained and developed by people with expanded histories of interaction with the natural environment. ITK or traditional ecological knowledge is unique to a particular culture or society. Eco-indigenous agricultural knowledge is designed to preserve biodiversity, natural resources which in turn promote food security. Climate smart agriculture refers to the development that meets the needs of the present generation without compromising the ability of future generations to meet their sustainable development. It should be pro-poor, pro-nature, pro-livelihoods and pro-women. Climate Smart Agriculture means production of food, feed & fiber, Protection of environment & health, conservation of land & resources, development of rural communities, maintenance of agricultural heritage. A practical climate smart agriculture should take into consideration the long and short term effects of current actions common concerns, Inter and intra -generational equity, gender equity justice and moderate production and consumption habits. Efficient communication knowledge and its transfer between and within generations. Therefore most effective policy for promoting climate-smart agriculture or sustainable agriculture is global shift to eco-indigenous agriculture. Scientists believe that agriculture has the potential to change from being one of the largest green house gas emitters to a net carbon sink. This indicates that there are number of eco-indigenous farming practices which are easy and less expensive to implement and can reduce the contribution of Green House Gases. The international panel on climate change (IPCC) has proposed carbon capture and storage (CCS) as an effective method for removing carbon gases from the atmosphere. However, recent research findings show that ecological agriculture sequesters carbon from the atmosphere more cheaply and more effectively than CCS. The eco-indigenous knowledge is an essential factor for solutions to the problems of preserving biodiversity, promoting sustainable development and mitigating climate change effects.

DETERMINATION OF CHLOROPHYLL CONTENT AND STOMATAL DENSITY IN DIFFERENT ROOTSTOCK SCION COMBINATION OF PEAR

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A field study was conducted to determine the chlorophyll content and stomatal density in different rootstock scion combination of pear at Experimental Farm, Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar (J & K) during 2017. Treatments consisted of four levels of scion cultivars (Carmen, Abate Fetel, William Bartlett and Chinese Sandy Pear) and five levels of rootstocks (Quince C, BA-29, Quince, Kainth and Pear Sucker) constituting twenty treatment combinations. It was found that highest chlorophyll content (3.71 mg/g) was observed in Chinese Sandy Pear/Quince. Maximum stomatal length (27.11 μm) was recorded in Abate Fetel/Kainth, Maximum stomatal width (9.96 μm). Maximum stomatal density (20.63 $\text{no}/\mu\text{m}^2$) was recorded in Carmen/Quince. The highest survival percent (86.67 %) were recorded in Abate Fetel/Quince, Chinese Sandy Pear/BA 29 and William Bartlett/Quince C. Maximum saleable plants were achieved in William Bartlett/Quince (86.33 %). On the basis of foregoing summary, the results may be concluded as follow: determination of chlorophyll content and stomatal characters on different rootstock-scion combinations in pear in the present study. Among the different rootstock-scion combinations Quince performed better with respect to all the studied parameters followed by Quince C.

ASSESSMENT OF DIFFERENT LEVELS OF WATER APPLICATION FOR WHEAT IRRIGATION

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An experiment was conducted at farmer's field in Jehanabad district of Bihar during Rabi season 2014-15 and 2015-16 for assessment of different levels (depth) of water application for wheat irrigation and to find out its effect on water saving, time saving, yield and economics. The experiment was laid out in Randomized Block Design with 10 and 6 replications (no. of farmers) in two respective years along with three technological options: Farmer's practice-Irrigation on eye experience basis till water stagnation in the field for more than 12 hours, TO1- Applying measured quantity of water for 5 cm irrigation and TO2- Applying measured quantity of water for 6 cm irrigation in wheat. In order to apply measured quantity of water, stream flow rate of irrigation pump was determined using a container of known volume (litre) and time taken (second) in filling it. Accordingly, pump was allowed to run for time required for application of 5 cm and 6 cm depth of irrigation water in TO1 and TO2, respectively. Three irrigations were applied in each treatment by making 5 m wide border strips in wheat field. Result revealed that in year 2014-15, applying 6 cm irrigation in wheat (TO2) yielded 16.3 % more with B: C ratio 2.07 along with saving of 16.9 % irrigation water and 16.7 % saving of irrigation time whereas in case of TO1, 7.69 % increased yield with saving of 30.5% irrigation water, 30.6 % time with B: C ratio of 1.92 was observed as compared to B:C ratio of 1.84 in farmers practice. In 2015-16, again TO2 yielded 15.31 % more wheat with B:C ratio as 1.92 and saving of 16.94 % irrigation water along with 16.7 % time saving than farmer's practice plot and TO1 gave 4.12 % increased yield along with a saving of 30.55 % irrigation water, 30.63 % time with B: C ratio 1.87 as compared to B:C ratio of 1.84 in farmers practice plots. Findings of the study indicated that TO2 (applying measured quantity of water for 6 cm irrigation) in wheat performed best in terms of yield and B: C ratio followed by TO1 as compared to farmer's practice.

Keywords: Depth of irrigation, Technological options, Water saving, Wheat

ECO-FRIENDLY MANAGEMENT OF ALTERNARIA LEAF BLIGHT (*ALTERNARIA HELIANTHI* HANSF.) OF SUNFLOWER

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Alternaria leaf blight incited by *Alternaria helianthi* (Hansf.) was first reported from Uganda in 1943 and later found worldwide. The *Alternaria* leaf blight reduces the seed yield by 27 to 80% and oil yield by 17 to 33%. *Alternaria* conidia are spread by wind and splashing water. The conidia germinate over a wide range of temperatures and penetrate the epidermis directly or enter through stomata and wounds. The disease affects seed germination, vigour of seedlings and the loss in germination varies from 23 to 32%. The disease causes reduction in plant height, stem girth, head diameter, seed yield, number of seeds per head, seed weight, hull percentage, kernel weight and oil content. The most affected components due to the disease are number of seeds per head, followed by the seed yield per plant. *Alternaria* leaf blight resulted in identification of resistance in nine perennial species i.e., *H. maxmiliani*, *H. divaricatus*, *H. decapetalus*, *H. pauciflorus*, *H. simulans*, *H. resinosus*, *H. occidentalis*, *H. tuberosus* and *H. Mollis*. Inter specific hybrids from these identified sources are expected to give *alternaria* resistant cultivars. Removal and burning of crop residues of previous crop, deep summer ploughing, crop rotation for 3-4 years reduces soil borne inoculum, healthy and clean seed, early planting, spacing of 60 x 30 cm or 45 x 30 cm is optimum in reducing the build up of *alternaria* leaf blight. Intercropping sunflower with groundnut in the ratio of 6:2. *Trichoderma*, *Gliocladium*, *Bacillus*, *Pseudomonas* species were evaluated against *Alternaria* leaf blight of sunflower under glass house conditions. Among them, *Trichoderma harzianum*, *T. viride* and *P. fluorescens* showed maximum control of *alternaria* leaf blight. Application of optimum dose of N, P₂O₅ and K₂O fertilizer and organic nutrition of sunflower recorded the low disease incidence. Seed treatment with captan (3g/kg) or chlorothalonil or carbendazim @ 2g/kg was found effective. Four sprays of mancozeb 0.3% at 10 days interval starting from 35 DAS, Spraying of iprodione 0.05%, Spraying of hexaconazole or propiconazole (1 ml/l) when the initial symptoms was found effective in controlling the disease.

THE ROLE OF REMOTE SENSING IN AGRICULTURAL

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Remote sensing has an important role to play in supporting agricultural development and poverty alleviation. However, deployment of the best technology will always require careful analysis of the capability of the specific remote-sensing technology; the features of agro-ecological zone of interest; the capacities of the relevant decision makers; and the wealth of the country of interest. The most promising opportunities for remote sensing in agricultural development and poverty alleviation relate to the potential for identifying and reducing these constraints and inefficiencies. Recent advances in remote sensing and geospatial technologies have created new ways of solving some long-standing problems. Crop production forecasting for remote sensing is used to forecast the expected crop production and yield over a given area and determine how much of the crop will be harvested

under specific conditions. Researchers can be able to predict the quantity of crop that will be produced in a given farmland over a given period of time. Remote sensing also allows farmers and experts to predict the expected crop yield from a given farmland by estimating the quality of the crop and the extent of the farmland. This is then used to determine the overall expected yield of the crop.

Keyword- Remote sensing, agricultural development and forecasting

ROLE OF DAIRY COOPERATIVES IN EMPOWERMENT OF WOMEN IN INDIA

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A cooperative is an autonomous association of women and men, united voluntarily to meet their common economic, social and cultural needs and aspirations through a jointly owned and democratically controlled enterprise. Throughout the changes of history, women have collectively struggled against direct and indirect barriers to their self-development and their full social, economic and political participation. If women have equal access to productive resources, agriculture productivity of developing countries can increase by 2.5- 4 percent and can reduce number of undernourished people in the world by 12-17 percent (The State of Food and Agriculture, 2011: FAO). Women empowerment is the important factor for the uniform growth of a nation. Village dairy cooperative societies provide an important mechanism to connect these disperse producers to the national dairy value chain and contribute to food security. In India, women typically perform most of the dairy-related production activities. Therefore, dairy cooperatives have a potential to benefit especially rural women and provide them with independent incomes and employment. It enabled them to interact with government and civil officials at various levels to market their products. They are determined to help their villages grow and are the torch bearers of the change being brought about in the lives of other underprivileged rural women. As per a government press release, about 70 million rural households are engaged in dairying in India with 80% of total cow population. The strength of women in Dairy has reached to the 70% of the total work force (about 44 lakh) of which 3,60,000 women are in leadership roles in village dairy cooperatives and 380 women on the boards of Union and State Federations. Women engaged in cooperative activities were better off, in terms of productivity and economic wellbeing.

Keywords: Women, Empowerment and Dairy Cooperatives

REJUVENATION AND CANOPY MANAGEMENT IN LITCHI ORCHARD

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Canopy management is one of the most important fruit plant management practice. This forms the basis of precociousness and longevity of the fruit trees in an orchard. The old and senile litchi orchards are not able to boost the productivity of crop vis a vis the demand of fruits in the country. Poor selection of planting material, indiscriminate plantation and poor management over the year has made many orchards unproductive or less economical. Perennial fruit trees notice decline both in quality and quantity of produce after some period of time due to improper canopy and orchard management. As a result of which orcharding becomes economically non-viable and non-remunerative. It has been observed in general that litchi orchards after attaining the age of 50-60 years, turns dense with compact top canopy covering most of the branches at the bottom and bearing fruits only on the high-tops. Such plants yield less vis-à-vis pose problems in proper management such as annual pruning, pest control and harvesting. To overcome the problem of unproductive or uneconomic of litchi orchards which is existing in abundance particularly in traditional litchi producing states like Bihar, Bengal, Uttarakhand, Jharkhand the farmers left with options of large scale uprooting and replacement with new plantations which will be a long term and expensive enterprise or go for rejuvenation of senile trees and utilize the existing established root system and capacity of plants to rebuild the canopy by activating latent buds present on main limbs and trunk which is comparatively cheaper and environmental friendly too. Therefore research efforts were initiated to standardize a technology for restoring the production potential of existing litchi plantations by a technique called 'Rejuvenation' at ICAR,NRC on Litchi and perfect protocol have been developed and demonstrated at large scale not only in Bihar but other states successfully.

Keyword – Rejuvenation, Canopy management, Litchi

TIME SERIES ANALYSIS MODEL TO FORECAST TEMPERATURE FOR JAGDALPUR REGION

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This study has been conducted on the monthly maximum and minimum temperature data (1990-2016) for jagdalpur region .Time series analysis and forecasting is one of the major tools used by scientists in meteorological and environmental fields to study

phenomena like temperature, rainfall and humidity. The aim of this research is to build a time series ARIMA model and use this model to analyze and forecast the maximum and minimum air temperature for jagdalpur. The appropriate orders of models are picked based on the results of ACF and PACF plots and evaluated using the AIC criterion. The best forecasting ARIMA model for maximum temperature is (2, 0, 0) (0, 1, 0) and for minimum temperature is (1, 0, 1) (0, 1, 1). The results show that the minimum temperature is gradually increasing over years supporting the fact that global warming is real.

Keywords: Maximum Temperature, Minimum temperature, ARIMA, (ACF), Partial auto correlation function (PACF).

NUTRITIONAL EVALUATION OF TAMARIND LEAF POWDER

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A large number of underutilized foods are rich in nutrients which can be used to improve the health status of the community. Tamarind (*Tamarindus indica*) leaves are one among those foods. Tamarind leaves contain good amount of nutrients and phytochemicals, so it can be effectively used to manage a large number of non-communicable diseases. As these are underutilized and localized (well known to public) using tamarind leaves to improve the nutritional status would become cost effective and acceptance would be high. Based on literature survey it was found that much was not done on tamarind leaves. So, present study was aimed to evaluate the nutritional composition of tamarind leaves. Tamarind leaves were collected from in and around Hyderabad, leaves were shadow dried, powdered. This powder was analyzed to find nutritional composition by using standard methods. Nutritional evaluation of 100grams of tamarind leaves powder indicated the presence of moisture: 9.61%, protein: 12.47%, fat: 3.03%, ash: 5.05%, fiber: 1.89%, zinc: 160.21%, antioxidant activity: 16.68 µg/g, total phenols: 245.37 mg of GAE /100g, flavonoids: 215.17 mg of QE/100 grams, phytates: 120mg/100g, tannins: 145.27 mg TAE/100g. Hence tamarind leaves possess good nutritional profile and various health protective properties.

MEDICINAL AND NUTRITIONAL POTENTIAL OF LENTIL SEEDS

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Lentils are available in many forms, such as whole grain, split, and with or without skins. In any form, they are highly nutritive and have a range of health benefits. Lentils can be eaten along with rice or as a soup; their nutritional properties can be attributed to the carbohydrates, dietary fibre, protein, thiamine, calcium, folate, iron, magnesium, phosphorus, potassium, and zinc in them. Some of the health benefits of lentils includes- *Lentils maintain a healthy immune system and selenium-rich lentils are believed to benefit people suffering from chronic arsenic poisoning. *The folate present in lentils protects against coronary heart disease as it lowers homocysteine in the blood. *The dietary fibre content in lentils provides low sugar levels and also provides energy for a longer time. Lentils reduce the risk of heart problems and help in the functioning of the digestive system, keeping away constipation at bay. *Lentils are also helpful in lowering cholesterol levels. *Lentils are rich source of iron, and it is a good alternative for vegetarians and vegans. *Protein content in lentils is as high as 26%, which means they can adequately meet protein requirements. *Although lentils include all these beneficial nutrients like fibre, protein, minerals and vitamins, they are still low in calories and contain virtually no fat. Thus, it helps in reducing body weight. Lentils have a long shelf-life and can be consumed either cooked or sprouted. Sprouted lentils can be eaten in salads.

Keywords: Lentil; Seeds; Nutritional; Medicinal; Protein.

CLIMATE CHANGE AND AGRICULTURE PRODUCTION

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Agriculture and climate change are inextricably linked with crop yield, biodiversity and water use, as well as soil health, are directly affected by a changing climate. Climate change, which is largely a result of burning fossil fuels, is already affecting the Earth's temperature, precipitation, and hydrological cycles. Continued changes in the frequency and intensity of precipitation, heat waves, and other extreme events are likely, all which will impact agricultural production. Moreover, compounded climate factors can decrease plant productivity, resulting in price increases for many important agricultural crops. Agriculture is a major driver of climate change. According to IPCC 5th Assessment Report, Agriculture, Forestry and Other Land Use (AFLOU) contribute 20–24

percent of anthropogenic GHG emissions. IPCC estimates that agriculture accounts for 13.5 percent of GHG emissions. These measured emissions are largely the results of synthetic fertilizer use, methane from large-scale animal operations, and methane release from rice paddies (IPCC 2014). It is projected that climate change will put around 49 million more people at risk of hunger by 2020. About 65 percent of farm-related emissions come from methane caused by cattle belching and soil treated with natural or synthetic nitrogen fertilizers, according to the World Resources Institute. Agriculture and climate change pose complex challenges for scientists trying to improve crop yields on smallholder farms in developing countries. Sustainable intensification based on conservation agriculture principles, including minimal soil disturbance, permanent soil cover, economical and diversified crop rotations, is an important strategy to combat the negative impact of agriculture on the climate and other natural resources while improving the income of smallholder farmers. Agriculture is the second biggest emitter of greenhouse gases after the energy sector (IPCC, 2014).

EVALUATION OF ACTINOMYCETES FOR PLANT GROWTH PROMOTING AND BIOCONTROL ATTRIBUTES IN CHICKPEA (*CICER ARIETINUM* L.)

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Chickpea is grown globally on a very wide area of agricultural land. Asia accounts for 88% of global chickpea production whereas India is the largest producer accounting for 75% of Asia's chickpea production. However, global yields of chickpea have been relatively stagnant for the last two decades due to unpredictable climatic changes, incidence of diseases and application of inappropriate dosage of chemical fertilizers and pesticides. The microbes in rhizosphere help in plant growth-promotion and yield. Actinomycetes are one of the major components of rhizosphere microbial population and are useful in soil nutrient cycling as well as plant growth-promotion (PGP). Since last few years, studies on agricultural traits of actinomycetes regarding their use for plant growth promotion and biocontrol activities had opened new avenues for their applications in sustainable agriculture. In the present investigation, total 40 (AK1-AK40) actinomycete isolates were retrieved from different soil samples and chickpea nodules collected from CCS Haryana Agricultural University farms. All the isolates were assessed for different plant growth promoting (PGP) traits including IAA production and P solubilization. The IAA production varied in the range of 1.53-20.09 $\mu\text{g ml}^{-1}$ among different actinomycete isolates. Isolate AK34 was producing comparatively high amount of IAA (20.09 $\mu\text{g ml}^{-1}$) followed by AK20 (13.47 $\mu\text{g ml}^{-1}$). Total 47.5% actinomycete isolates were showing P-solubilization indices (P-SI) ranging between 2.17 to 3.42. Isolate AK37 was giving comparatively high P-SI (3.42) followed by AK3 (2.78), AK11 and AK34 (2.70 each). After assessing other PGP traits including biocontrol potential, actinomycetes can be proposed as promising candidates for integrated nutrient and disease management in sustainable agriculture for eco-friendly environment.

IMPACTS OF CONSERVATION TILLAGE ON SOIL, CROP AND THE ENVIRONMENT

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There is an urgent need to match food production with increasing world population through identification of sustainable land management strategies. However, the struggle to achieve food security should be carried out keeping in mind the soil where the crops are grown and the environment in which the living things survive. Conservation agriculture (CA), practicing agriculture in such a way so as to cause minimum damage to the environment is being advocated at a large scale world-wide. Conservation tillage, the most important aspect of CA, is thought to take care of the soil health, plant growth and the environment. This paper aims to review the work done on conservation tillage in different agro-ecological regions so as to understand its impact from the perspectives of the soil, the crop and the environment. Research reports have identified several benefits of conservation tillage over conventional tillage (CT) with respect to soil physical, chemical and biological properties as well as crop yields. Not less than 25% of the greenhouse gas effluxes to the atmosphere are attributed to agriculture. Processes of climate change mitigation and adaptation found zero tillage (ZT) to be the most environmental friendly among different tillage techniques. Therefore, conservation tillage involving ZT and minimum tillage which has potential to break the surface compact zone in soil with reduced soil disturbance offers to lead to a better soil environment and crop yield with minimal impact on the environment.

THE LOSSES AND PROTECTION FROM SALINITY STRESS IN WHEAT USING TISSUE CULTURE METHOD

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Salinity is an abiotic stress that causes serious yield losses in various crops among wheat is one. Subjection of the plants to salt stress can lead to serious injury to the plants. Salinity is one of the major factors responsible for low yield and

restricted economic utilization of land and water resources both in arid and semi-arid regions of the world. Therefore, new techniques should be developed to produce salt-resistant genotypes. Selection and improvement of desirable genotypes for this objective require suitable screening methods. Tissue culture can help in the efforts to produce new cultivars against environmental stress factors. In addition, in vitro culture studies permit relatively faster responses, shorter generation time, and regular environmental conditions as compared to classical breeding methods. The success of anther culture ability in wheat, as other crops, is found to be influenced by genotypedonor plant growth conditions, the developmental stage of microspores, pre-culture treatments, and media components. The multiple shoot meristems used as explants, high regeneration, and transformation efficiency were reported in relatively genotypes-independent manner. Salt stress usually inhibits the plant growth. When plants are exposed to different abiotic stresses, some reactive oxygen species (ROS) removing enzymes such as superoxide dismutase (SOD), peroxidase (POD), ascorbate peroxidase (APX), and catalase (CAT) are produced. The antioxidant enzyme activity is positively associated with salt tolerance in plants. Many researchers have indicated that the salt resistance mechanism is activated during the entire plant stage and this has been tested in both in vitro and ex vitro situations.

Keywords: Salinity, SOD, POD, APX, CAT, Culture

INNOVATIVE APPROACHES FOR LAND USE PLANNING

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Land is a limited resource and yet an indispensable resource for meeting the social, economic and environmental demands and targets. Land is essential to human well-being. How a country values, manages, uses, and protects its land resources and the ecosystem services these provide, will have a huge impact on that country's economy, environment, and society. The growing development associated by the growing population and the associated urbanization and industrialization is increasing pressure on land resource. The concerns can even become more serious in an emerging country like India, which has at present over 17% of world's population living on 2.6% of the world's geographical area. Land use planning and management is a known strategy for achieving sustainable development. A properly prepared land use plan based on sound scientific and technical procedures and land utilization strategies can summarize rationally the future demands. This accompanied by a strong planning process, where communities and various stakeholders are involved, can strengthen the decision making process on allocation and utilization of land resources. Increase of soils' quality in the demo farms: organic matter +10%; water aggregate stability and microbial activity +50%; soil compaction -10%; soil nitrate -25%. Increase of the ecosystem status and related services from inadequate to favorable. Evaluations of the soil ecosystem services and indirect effects on the landscape value of the proposed solutions in the study area. The objective of planning land use is to influence, control or direct changes in the use of land, so that it is dedicated to the most beneficial use, while maintaining the quality of the environment and promoting conservation of the land resources.

Keywords: Land use planning, ecosystem, organic matter and urbanization

GROWTH OF COTTON AND JUTE INDUSTRY IN INDIA (FROM 1858 TO 1947)

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Cotton is sustainable, renewable, and biodegradable fibre, making it an excellent choice as an environmentally-friendly fibre throughout its entire product life. Cotton is most popular Eco-Friendly fibre in the world. Jute an amazing fibre became more popular in the accessories department. However, the world uses jute for many other applications and experts expect it to become a widespread material in the nearest future because of its benefits. So jute is Eco-friendly. It is! Let's see what makes jute and cotton so valuable from this point of view.

Keywords: - jute, cotton, eco-friendly, development, world scenario.

GLUCOSE OXIDASE: A NOVEL TARGET FOR INDUSTRIAL APPLICATIONS

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Glucose oxidase is a discharged catalyst delivered transcendentally by the growths *Aspergillus* and *Penicillium* species. D-glucose can be oxidized by Glucose oxidase, utilizing other oxidizing substrates other than sub-atomic oxygen, which may incorporate quinines and one-electron acceptors. D-glucono-1,5-lactone would then be able to hydrolyse precipitously to create gluconic corrosive. Glucose oxidase is a dimeric protein involving two indistinguishable subunits. Every subunit, or monomer, folds into two spaces: one area ties to the substrate, α -D-glucose, while the other space ties non-covalently to a cofactor, flavin adenine dinucleotide (FAD), which it utilizes as an amazing oxidizing specialist. The basic segment in natural oxidation-decrease (redox)

responses is FAD, in which there is an addition or loss of electrons from a particle. In glucose oxidase, FAD goes about as an electron acceptor, which makes it be decreased to FADH₂; the FADH₂ is then oxidized by the last electron acceptor, atomic oxygen, with the oxygen being diminished to hydrogen peroxide (H₂O₂). The dynamic site of glucose oxidase contains three significant amino acids associated with catalysis: His516, and Glu412, which is hydrogen-clung to His559. Glucose oxidase normally happens as a glycoprotein, with a mannose-type sugar substance of around 16%. A noteworthy use of the glucose oxidase is in the expulsion of glucose from egg-white before drying for use in the preparing business. Different utilizations are in the expulsion of oxygen from the head-space above packaged and canned beverages and diminishing non-enzymic sautéing in wines and mayonnaises.

ORGANIC FARMING IN JHALAWAR DISTRICT OF RAJASTHAN IN INDIA

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At present Highly use of chemical fertilizers, pesticides in cultivation disturbed the nature of soil, animals and humans health. We have a single way to prevent from this problem which is known as organic farming. Jhalawar is located in the Hadoti region of Rajasthan in India. Farmers of Jhalawar district involving day by day in organic farming. The schemes of Government of Rajasthan is also supporting them and they are also using the schemes. Heart attacks, Cancer and stroke this kind of diseases are happening due to higher use of pesticides and chemical fertilizers. Farmers of Jhalawar district started a new journey which is for saving nature and environment. They are also attending training programmes related organic farming from the established and authentic training centres of Government of Rajasthan. They are also working on the organic products segments it is also increasing exporting possibilities by Jhalawar to another countries. Carbon source in the soil can be increased by using compost and other organic material. They are making fertilizer with cow products is called instant compost. Wood scrapings, gram flour, turmeric powder, fallen leaves, jaggery, soil from under a banyan tree are poured in pits along with the cow products to make this instant compost.

Keywords- Chemical, Organic, Export, Farmer, Nature etc.

PERFORMANCE OF DIFFERENT VEGETABLE CROPS IN POPLAR BASED AGROFORESTRY IN SUB TROPICS OF JAMMU

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Agroforestry is an old practice of agriculture which is being practiced all over the world. It is found beneficial for the protection of environment and biodiversity. Ancient agriculture was started after felling of trees, but due to human's greed and demand for the industrial purpose trees were cutted without thinking of the demand of future need. Due to climate change the emphasis was given on agroforestry. But the problem was of low productivity under trees across the globe. To increase the production under agroforestry, different crop models were developed with cereals, pulses and vegetables crops. To assess the best performing vegetable crop in poplar-based agroforestry a trial was laid out in the university farm, SKUAST Jammu. In this trial three vegetable crops were sown between the rows of poplar. The poplars were sown at the spacing of 5X4 m. In the kharif season 3 vegetable crops Tomato, Brinjal and Okra were planted as per the package and practice recommended by the university, while in Rabi season Potato, Spinach and Cabbage were planted. Based on plant characters and yield, the best performing crop was selected for the plantation under Poplar.

ROLE OF EXPORTING ORGANIC FOOD PRODUCTS IN INDIAN AGRICULTURE ECONOMICS

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The demand for Indian organic food products is constantly increasing day by day in another countries. According to APEDA report USA, European Union member countries were the biggest buyer of the Indian organic food products. The major demands under the organic product category are for cereals, millets, sugar, fruits, oil seeds, pulses, dry nuts and medicinal plant products. It is also creating interest in organic food products in many countries like Mexico, Israel and Vietnam. Highly demand of Indian

organic food products is attracting farmers for organic farming. The area of organic farming in India also increasing day by day and many states of India like Madhya Pradesh, Rajasthan, Maharashtra and Uttar Pradesh are giving good feedback of their related to organic farming. The land of Sikkim has already certified under organic certification, it is proud for India. Major domestic markets for organic products available in metropolitan cities – Mumbai, Delhi, Kolkata, Chennai, Bangalore and Hyderabad. It is one of the fastest growing agribusiness in the world and contribution of India for it is in top numbers. Major Key players of it are NGOs, farmer organizations, traders and exporters which leads the whole marketing strategy for organic Indian food products. These whole will surely create a wide market and exporting opportunities for Indian organic food products in another countries.

Keywords- organic products, interest, APEDA, export, domestic

DRY MATTER ACCUMULATION AND YIELDS OF BABY CORN AS INFLUENCED BY INTEGRATED NUTRIENT MANAGEMENT (INM) SOURCES

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A field experiment was conducted to evaluate the integrated nutrients effect on growth, yield and profitability of Baby Corn (*Zea mays .L*) during the spring season 2015, at Agronomic field of Institute of Agriculture and Animal Science (IAAS) Lamjung Campus, Nepal. The experiment was laid out in Randomized Complete Block Design (RCBD) having three replication with the following treatments T₁ (100% Urea), T₂ (50%urea + 50% FYM), T₃ (50% urea + 50% vermicompost), T₄ (50% Urea + 25% FYM + 25% vermicompost), T₅ (75% Urea + 25% FYM), T₆ (75% Urea + 25% Vermicompost). As the field experiment shows that T₅ (75% urea + 25% FYM), T₆ (75% Urea + 25% vermicompost). Among different nitrogen sources T₆ (75% Urea + 25% vermicompost) recorded maximum plant dry weight and yield of the Babycorn as compared to the others treatments. However, incorporation of the nutrient enriched vermicompost along with inorganic N sources is preferred to maintain the soil fertility status and higher baby corn production.

Keywords: Baby corn, nitrogen, yield

MAPPING OF GROUNDWATER VULNERABILITY ZONE USING DRASTIC MODEL IN UPPER SEONATHSUB-BASIN OF CHHATTISGARH PLAINS

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Groundwater is vital water resource for meeting the various water demands. Groundwater quality plays an important role in its suitability for various uses. An application of remote sensing and GIS tool has proven for assessing, monitoring, conserving, and managing ground water resources. Therefore, attempt has been made in this study to compile the most recent continental information of Kharun watershed of upper Seonathsub-basin of Chhattisgarh plain on soil, land use/cover, geology, slope etc in a GIS environment. SRTM 1 Arc Digital Elevation Model and GIS software ArcGIS 10.4 was used for terrain analysis whereas the ERDAS IMAGINE 2016 were used for the image processing and pixel based supervised classification of Landsat satellite data. The ground water vulnerability map was prepared by adopting the DRASTIC method. DRASTIC Index map is classified in four classes low, moderate, high and very high depending on the Index values. The DRASTIC vulnerability Index values vary from 56 (minimum) to 168 (maximum). The result shows that on the basis DRASTIC Index ranging 8.10%, 70.78%, 20.61% and 0.51% area of Kharun watershed lies in the low, moderate, high and very high vulnerability zones, respectively. More than 75% of the area of Kharun watershed was found to be under low and moderate zone of vulnerability.

Keywords: DRASTIC, GIS, Groundwater, Remote Sensing, Watershed

CONSERVATION OF PLANT GENETIC RESOURCES FOR FOOD AND AGRICULTURE

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Plant genetic resources” are any genetic material of plant origin of actual or potential value for human use. The most important plant genetic resource for food and agriculture are the seeds of crops and their wild relatives. In the recent years, plant genetic resource conservation has become increasingly important as more plants have become threatened or rare. At the same time, an exploding world population and rapid climate change have led humans to seek new resilient and nutritious crops. Future progress in crop improvement and our food security depends, to a great extent, on immediate conservation of the rapidly depleting crop gene resources and their effective utilisation by plant breeders. In this context, humanity and government institutions should therefore take great care to understand and safeguard overall plant biodiversity for nutrition we all especially depend on the crop species and their genetic diversity. However, much still remains to be done in improving the conservation strategies and upgrading

the collections, which encompass a wide range of diversity comprising wild relatives, primitive cultivars and landraces, weedy forms, unimproved and modern cultivars, and cytogenetic stocks. Crop genetic diversity should be conserved through various complementary method such as *in situ*, on-farm and *ex-situ* conservation through seed gene banks (international, national and regional gene banks), field genebanks, cryogenic preservation, DNA banks etc. The adoption of the International Treaty on Plant Genetic Resources for Food and Agriculture in 2001 was a major milestone in raising the value and need for plant genetic resources conservation and use. In 2004, FAO, together with Bioversity International acting on behalf of the international research organizations in this field (CGIAR), founded the Global Crop Diversity Trust to ensure the conservation and availability of crop diversity for food security worldwide.

Keywords – plant genetic resources, conservation, *in situ*, seed gene bank, genetic diversity, wild relatives

NANOTECHNOLOGY IN AGRICULTURE AND APPLIED SCIENCES

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Nanotechnology can be defined as the science and engineering involved in the design, synthesis, characterization and application of materials and devices whose smallest functional organization in at least one dimension is on the nanometer scale. Nanotechnology has opened up by rapid advances in science and technology, creating new opportunities for advances in the fields of medicine, electronics, foods and the environment. It offers potential developments in pharmaceuticals, medical imaging and diagnosis, cancer treatment, implantable materials, tissue regeneration, and multifunctional platforms combining several of these modes of action. It provides new agrochemical agents and new delivery mechanisms to improve crop productivity and it promises to reduce pesticide use. Its applications include: Nanoformulations of agrochemicals for applying pesticides and fertilizers for crop improvement; the application of nanosensors/nanobiosensors in crop protection for the identification of diseases and residues of agrochemicals; nanodevices for the genetic manipulation of plants, plant disease diagnostics, animal health and postharvest management. In recent times, some packaging materials integrated with “nano-sensors” to detect the oxidation process in food. In such packaging materials when the oxidation occurs in the foodstuffs, nano-sensors indicate the color change and inform about the contamination of the foodstuffs like milk and meat. This property of metal nanoparticles is very helpful in increasing the shelf-life of foodstuffs. Nano-pesticides may have key role in the control of pests and insect and host pathogens due to its properties like enhanced solubility, specificity, permeability and stability. Thus, synthesis of nontoxic, ecofriendly and promising nano-pesticide delivery systems for increasing agriculture production is mandatory; On the other hand, helps in reducing the destructive environmental impacts to ecosystem. In past few years nano-fertilizers are spontaneously accessible in the market. Nano-fertilizers may contain zinc, silica, iron and titanium dioxide, gold nano-rods etc.

Keywords: Nanotechnology, nano-sensors, permeability, foodstuffs and pharmaceuticals,

VARIATIONS OF PHYTOPLANKTON AND ITS WATER QUALITY OF FRESH WATER CANAL IN WESTERN U.P

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Phytoplankton are floating microscopic autotrophic whose movement are more or less dependent on currents. These consist of algae mainly members of Chlorophyceae, Cyanophyceae, and Bacillariophyceae and algae-like green flagellates. They impart green colour to water. Phytoplankton, are the primary producers in an aquatic ecosystem. Their estimate provide good indices of water quality and capacity of water to sustain heterotrophic communities. Phytoplankton also play a vital role in the biological treatment of organic wastes in water, as during mineralization of organic matter by bacteria the oxygen is supplied by them. The work was done from Feb 2010 to 2011. Result shows that the total of 20 species were recorded at station A and 18 species at station B. The important groups of phytoplankton i.e. Chlorophyceae, Cyanophyceae and Bacillariophyceae were present in the samples obtained from both stations during entire period of study. In terms of number Chlorophyceae was the most abundant, and Cyanophyceae was least represented group. Various parameter like temperature, transparency, pH, dissolve oxygen, freeCO₂, total dissolved solids, alkalinity, nitrate-nitrogen, phosphate-phorous and silicates were analyzed from surface water of canal. The study shown that the water quality of freshwater canal lies between low to moderately productive range and the population structure of phytoplankton community also correlates with the water productivity.

Keywords: water quality, phytoplankton community, moderately productive and fresh water.

UTILIZATION OF SEMI TROPICAL AND TROPICAL REGION TREES AND BASED FOODS**MAHENDRA KUMAR, ANKIT BHARTI****Department of Food Science & Technology, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur (MP)**

The semi tropical and tropical regions trees based food are very important food which providing the specific nutrient for the body and the body of human can be easily maintain the function at very low temperature in winters and very high temperature in summers. These types of foods are having good quality protein as well as carbohydrates. The background of study is enlisted the special characteristics of desert foods and the utilization of the tropical and semi tropical tree products. The product based on the trees of desert having many important characteristics such medicinal value, nutritional value, therapeutic properties, insecticidal properties, appetizing characteristics etc. Main focus of study is about to increase the utilization of desert based trees and provide the economic benefits to the desert people. In this study we mainly focus on the five very important tropical and semi tropical trees which are in general source of burning fuel and animal feeding in this study we mainly focus on these five species.

IMPACTS OF GLOBAL WARMING ON AGRICULTURE AND THE RELATED SECTOR**MAHENDRA SINGH¹, BASANT KUMAR DADRWAL AND JYOTI CHAUHAN****1 M.Sc. (Entomology), Department of Entomology, SKNAU, Jobner, 324005****Research Scholar, Department of Plant Physiology, I.Ag.Sc., BHU, Varanasi 221005**

The IPCC (The Inter governmental Panel on Climate Change is an intergovernmental body of the United Nations) has released its Report that titled Global Warming of 1.5°C. Human induced global warming in 2017 has already reached 1°C above pre-industrial levels. Impacts of global warming at 1.5°C that is greater sea level rise, increased precipitation and higher frequency of droughts and floods, hotter days and heat waves, more intense tropical cyclones, and increased ocean acidification and salinity. Influence of shift from 1.5°C to 2°C, more extreme temperature and precipitation prevent crops from growing. Extreme events, especially floods and droughts, destruction crops it reduce crops yields. Drought in areas where rising summer temperatures cause soils to become drier. Heat waves, which are increase under climate change, could directly threaten livestock. Fisheries also affected by changes in water temperature of ocean. Climate change is very likely to affect food security at the global, regional, and local level. Climate change can disturb food availability, reduce access to food, and affect food quality. The climate sensitivity of agriculture is uncertain, there is regional variation in rainfall, temperature, crops and cropping systems, soils and management practices. The inter-annual variations in temperature and precipitation were much higher than the predicted changes in temperature and precipitation. The crop losses may increase if the projected climate change increases the climate variability. Different crops respond differently as the global warming will have a complex impact. The tropics are more dependent on agriculture as 75% of world population lives in tropics and two thirds of these people's main occupation is agriculture. With low levels of technology, wide range of pests, diseases and weeds, land degradation, unequal land distribution and rapid population growth, any impact on tropical agriculture will affect their livelihood. Rice, wheat, maize, sorghum, soybean and barley are the six major crops in the world grown in 40% cropped area, and contribute to 55% of non-meat calories and over 70% of animal feed.

Keywords: Global Warming, Climate change, Temperature and Drought**IMPACT OF EDUCATIONAL STATUS ON HEALTH RELATED QUALITY OF LIFE AMONG TYPE 2 DIABETES SUBJECTS****MANJU YADAV^{1*}, K. UMA MAHESWARI¹ AND KAVITHA KIRAN²****¹Post Graduate & Research Centre, Professor Jayashankar Telangana State Agricultural University, Rajendranagar, Hyderabad ²Scientist AICRP Home Science-CD PG&RC PJTSAU Rajendranagar, Hyderabad 500 030**

Quality of Life (QOL) is defined by the World Health Organization (WHO) as “an individual's perception of his/her position in life in the context of the culture and value systems” diabetes mellitus (DM) has profound effects on the social, psychological and physical well being of a person making the management of diabetes mellitus complex and tedious process for both the patient and the health care professionals. Before the development of QOL tools, biochemical or clinical assessment were the only indicators of disease outcome. These measures do not reflect the psychological and social state of the patient. Psychosocial impact of DM is one of the five strongest predictors of mortality in diabetic patients, surpassing the importance of clinical and physiological variables. Various studies revealed that education appeared to affect prognosis in diabetes, by improved understanding and preventive measures, or as a reflection of better economic status. It also indicate that diagnosis can be delayed by 3-7 years in the less and uneducated sections of the population. In present study 300 (150 male and 150 female) with type 2 diabetic subjects were selected from Jhansi and Lalitpur districts of Uttar Pradesh. The results on impact of educational status at different levels on HRQOL health related quality of life revealed that there were significant differences in HRQOL with regards to educational status of the respondents. Significant difference was found at 1% level in role limitation due to physical health, physical endurance, general health, financial worries and emotional / mental health, whereas significant difference was observed at 5% level in symptom botherness, domains of the health related quality of life. Results on over all HRQOL with regards to educational status showed

significant difference at 1% level. With these results it can be conclude that education can be a helpful tool to delay the onset of diabetes and better management of diabetes.

Keywords: Diabetes, HRQOL, educational status.

EFFECT OF BOTANICALS ON GROWTH AND FUSARIUM WILT SUPPRESSION OF GLADIOLUS GRANDIFLORUS L.

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The present investigations were conducted on open field grown pot plants of cv. Jacksonville Gold in the University Nursery of Punjab Agricultural University, Ludhiana from September 2016 to April 2017 and September 2017 to April 2018. Gladiolus is one of the top ten famous cut flower crops of the world and *Fusarium* wilt is the most devastating disease of this crop in all over world. The most important and interesting problems encountered by scientists in their attempts of improve yields in sustainable way is to drastically reduce or wholly prevent the plant diseases by using eco friendly chemicals. Environmentally non-hazardous control measures are needed to safeguard the agricultural sustainability. The statistical design adopted for conducting the experiment was CRD. Pot plants were grown by using the growing media soil: FYM (2:1) and *Fusarium oxysporum* f sp. *gladioli* spores were inoculated in the sterilised growing media. The botanicals were prepared from the leaves of five locally available plants, viz. *Aegle marmelos*, *Callistemon lanceolatus*, *Tagetes erecta*, *Azadirachta indica* and *Eucalyptus tereticornis* and allelopathic effect was tested under *in vivo* condition. The 20% and 40% aqueous extracts were used for pre-planting treatment of corms and subsequently drenching of soil during crop growth period, till harvesting of spikes. *Fusarium* inoculated control showed devastating disease incidence as well as significant reduction in plant height, root length, number of roots, corm weight, cormel weight and spike length. Different botanicals showed variable effects on growth and incidence of disease. Among all the botanicals tested in pots, 40% concentration of *E. tereticornis* was found most effective with best quality spikes, minimum days for sprouting, highest corm weight per plant and highest cormel weight per plant. Physiological parameters including chlorophyll content, carotenoid content, relative water content, starch content and proteins content were also determined. Although all the botanicals had disease suppressing effects, 40% concentration of *E. tereticornis* was found the best among all. Qualitative analysis of botanicals was done to know the presence of active compounds present in botanicals which were helpful for growth and suppression of disease. The best active botanical (*E. tereticornis*) was analysed through GC-MS chromatography to know presence of chemical compounds that have role in providing resistance against *Fusarium* wilt infection.

Keywords: Botanicals, Gladiolus, *Fusarium* wilt, Morphological changes, Physiological changes, GC-MS analysis

WEED MANAGEMENT IN SESAME WITH SEQUENTIAL APPLICATION OF PRE AND POST EMERGENCE HERBICIDES

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Effect of herbicides on weed suppression and yield of sesame was evaluated at Til Research farm, Tikamgarh during *kharif*, 2016 in randomized block design with ten treatments consisting of pre emergence herbicide; pendimethalin 750 g/ha, post emergence herbicides; quizalofop-ethyl 40 and 50 g/ha, fenoxaprop ethyl 75 and 100 g/ha, pendimethalin 750 g/ha *fb* quizalofop 40 and 50 g/ha, pendimethalin 750 g/ha *fb* fenoxaprop 75 and 100 g/ha, pendimethalin *fb* one hand weeding at 20 DAS, two hand weeding at 15 and 30 DAS and weedy check. Results revealed that hand weeding twice at 15 and 30 DAS recorded the lowest density and dry weight of total weeds. Pendimethalin *fb* one hand weeding significantly reduced the intensity and dry weight of total weeds over other herbicidal treatments and weedy check. Pre-emergence application of pendimethalin *fb* post emergence; quizalofop and fenoxaprop significantly reduced the density and dry weight of weeds over alone application of pendimethalin.

Keywords: Pendimethalin, Quizalofop ethyl, Fenoxaprop, hand weeding, Weeds

EFFECT OF INSPECTION ERROR FOR THE ERLANG-TRUNCATED EXPONENTIAL DISTRIBUTION ON CUSUM

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In statistical quality control the cumulative sum control charts (CUSUM Charts) have found importance as a parallel process control technique to the well-known Shewhart control charts. An alternative method for testing statistical hypothesis parallel to Neyman's theory is the popular sequential probability ratio test (SPRT) due to Wald (1942). Page (1954, 1961) suggested the cumulative sum charts which are more effective than Shewhart control charts in detecting small and moderate size departures from a simple acceptable quality level. In this paper, a mathematical investigation has been done for Cumulative Sum control Chart

(CSCC) of Distribution (ETE) under inspection error. Average Run Length (ARL), d and ϕ is calculated for different values of parameter.

Keywords: SPRT, CUSUM, ARL, ETE distribution

CURRENT STATUS OF RED ROT DISEASE IN SUGARCANE VARIETY COS 8436 IN BIHAR (INDIA)

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Sugarcane covers an area of 2.47 lakh ha having a cane production of 14.27 m tones with a cane yield of 57.8 t ha⁻¹ in Bihar. Red rot of sugarcane, caused by *Colletotrichum falcatum* Went, is a serious fungal disease affecting sugarcane stalks, the economical part of sugarcane. During survey in Bihar, 2016-17, 2017-18 and 2018-19 from different farmer's fields, large scale red rot infection was found in CoS 8436 variety. Red rot disease is highly spread year after year in farmer fields through seed transmission, flooding, water logging etc. During survey of seven sugar mills (Jay Shri Sugar Mills, Majhauriya; New Swadeshi Sugar Mills, Narkatiaganj; Harinagar Sugar Mills, Harinagar; Tirupati Sugar Mills, Bagha; Vishnu Sugar Mills, Gopalganj; HPCL, Sugauli and Riga Sugar Mills, Riga of Bihar, red rot incidence in Cos 8436 was severely observed. Three years data showed that in 2016-17, incidence of red rot in this variety was maximum in HSM with >55% in 284 ha followed by VSM with >33% in 188 ha, NSSM with >22% in 215 ha, TSL with >14% in 178 ha, JSM with >8% in 124 ha, HPCL with >3% in 79 ha. In 2017-18, incidence of red rot was maximum in HSM with >39 % in 171 ha area and minimum in HPCL sugar mills with >2% in 32 ha. During last year, similar incidence was recorded for red rot in HSM and HPCL sugar mills. Present study indicated that CoS 8436 was susceptible with red rot during 2016-17 while, this variety found highly susceptible in some areas of farmers fields during 2017-18 and 2018-19. The study concluded that variety CoS 8436 has been severely infected with red rot in different sugar mills of Bihar due to which heavy losses faced in production, productivity and sugar in Bihar.

ECONOMIC IMPORTANCE OF INSECT PEST CONTROL MEASURES IN CROP PRODUCTION

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Insect and Pests are living organisms that cause physical damage to man, animals and crops. In other words, pests can be described as any organism capable of causing damage to crop plant. Few insects are beneficial which produce honey, wax, lac, dyes and silk are commercially and other category is harmful insect pests like flies, grasshoppers and caterpillars, some of which are injurious to crop. The pests again may include mites, aphids, nematodes, rodents, birds, slugs and snails whereas plant pathogens include fungi, bacteria and viruses. Pests and diseases have serious negative impact on the economic output of a farm. The most common way to control insects is to use pesticides. Pesticides are chemicals that kill insects or other infectious agents. Pesticides specifically use to control insects are called insecticides. These chemicals can be toxic to humans, both the farmers working with them and people. Pesticides are also harmful to the ecosystem, polluting environments and water sources. The present need is to increase the use of biological insecticides and pesticide at priority level to save environment and judicious recommended dose of chemical to save crop production cost of farmers.

PERFORMANCE OF QUINOA IN A WATER STRESS CONDITION

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Quinoa (*Chenopodium quinoa*) is one of those psuedocereal which shows tolerance to frost, salinity and drought and has the ability to grow on marginal soils. In a water stress condition, the duration of crop is very important. There are differences in achieving the physiological maturity with differences in transplanting date. The experimental design used was RBD with 4 treatments and 3 replications. The treatments were transplanting 7th day after emergence, 14th day after emergence, 21st day after emergence and 28th day after emergence. In this experiment the crop was grown in alkaline soil of 8.5 pH with deficit irrigation. Irrigation were given 4 times i.e. just after transplanting, one week after transplanting, flowering and early grain filling stage with amount reduced to half the normal requirement. The performance of quinoa in all the treatments were assessed by measuring total seed yield, seed size, harvest index (HI) and water use efficiency (WUE). Best result was observed in treatment of 21 day old seedling transplantation.

Keywords: transplanting, deficit irrigation, harvest index, water use efficiency.

LACTOBACILLUS: A NATURAL PLANT GROWTH PROMOTER**N. MURUGALATHA KANNAN****School of Agricultural Studies, Quantum University, Roorkee**

Lactobacillus, a probiotic bacteria is a positive companion to biotic components by nature. Lactobacillus basically functions as fermentative bacteria in the human gut and also aids in decomposition of organic matter which prevents the loss of energy form excess heat and gas. Lactobacillus being beneficial helps to sterilize soil and remove by products that can build up and create a harmful environment. Lactobacillus aids in removal of undesirable microorganisms from soil due to which a balanced environment is created for plant growth. It acts as a growth regulator for fungi, yeast and aerobic bacteria. Lactobacillus can be used as organic manure. It is used in composting for stopping foul odor associated with aerobic decomposition. Such microbial based inoculants can act as a good source of nutrients and natural fertilizer for sustainable development of agriculture.

Keywords: Probiotic microorganisms, Lactobacillus, soil fertility, Sustainable Agriculture

ROLE OF BIOTECHNOLOGY IN AGRICULTURE**NABRAJ KHANAL AND SAROJ PANTHI****Agriculture and Forestry University, Rampur, Chitwan, Nepal – 44209**

Biotechnology is the application of scientific techniques to modify and improve plants, animals, and microorganisms to enhance their value. Agricultural biotechnology is the area of biotechnology involving applications to agriculture. Modern biotechnology represents unique applications of science that can be used for the betterment of society through development of crops with improved nutritional quality, resistance to pests and diseases, and reduced cost of production. Biotechnology has vast application than genetic engineering; it also includes genomics and bioinformatics, markers-assisted selection, micro-propagation, tissue culture, cloning, artificial insemination, embryo transfer and other technologies. However, genetic engineering, mainly in crop sector, is the area in which biotechnology is most directly affecting agriculture in developing countries and in which the most vital public concerns and policy issues have arisen. Society should be provided with a balanced view of the fundamentals of biotechnology and genetic engineering, the processes used in developing transgenic organisms, the types of genetic material used, and the benefits and risks of the new technology.

Keyword- Biotechnology, Genetic engineering, Agriculture, Crop resistance

EFFICACY OF DIFFERENT BIO CONTROL AGENTS AGAINST MELOIDOGYNE INCOGNITA AND FUSARIUM OXYSPORUM ON TOMATO**¹NARESH KUMAR, ²JAYANT BHATT AND ³SATYADEV PRAJAPATI****^{1,3}, Department of Plant Pathology, SKNCOA (SKNAU)- Jobner, Jaipur, Rajasthan (India)****²Department of Plant Pathology, College of Agriculture, Jawaharlal Nehru Krishi Vishwa Vidyalaya Jabalpur, MP**

Biological control is considered as new efficient method that becomes widely used for controlling plant parasitic nematodes, as aim to decrease the extent of environment degradation and the effect of the excessive toxic nematicides. So, this study was done to investigate the role of some bacterial genera as biocontrol agent against *Meloidogyne incognita*. The results of in pot house experiments indicated that, all tested bacteria have a greatly significant effectiveness for suppressing *M. incognita*. Pot house results showed that significantly increased (80.32 cm) plant height was recorded with *Pacilomyces lilacinus* followed by *Bacillus subtilis* (72.23 cm), *T. harzianum* (68.77 cm) and *P. chlamydosporia* (64.52 cm) over control. The effects of *T. viride*, *T. harzianum* and *Pacilomyces lilacinus* tills were though non-significant but superior over control (52.54 cm). Maximum root length (20.67 cm) was recorded with *Pacilomyces lilacinus* followed by *Bacillus subtilis* (17.63 cm) and *T. harzianum* (14.67 cm).

Keywords- Biological control, *Meloidogyne incognita*, *Pacilomyces lilacinus*

GENETIC DIVERSITY ANALYSIS FOR SELECTING BETTER VARIETY OF TURMERIC (CURCUMA LONGA)**¹NARESH PRATAP SINGH, ²VAISHALI, ²HIMANCHAL KANNAUJIYA, AASTHA, ²VISHAKHA BURMAN, ²KHYATI LEHRI, ³NEELES KAPOOR, ¹REKHA DIXIT****¹Department of Commercial Biotechnology, COB, SVPUA&T, Meerut, ²Department of Agriculture Biotechnology, COA, SVPUA&T, Meerut, ³Department of Finger Printing, COB, SVPUA&T, Meerut**

Curcuma longa (turmeric) is a small rhizomatous perennial herb of Zingiberaceae (Ginger family) originated in India and now is cultivated in tropical and subtropical parts of the world. While originated in South East Asia, India has the predominant position as the largest producer of turmeric in the world. Besides India, it is also grown in China, Taiwan, Indonesia, Srilanka and other tropical countries. The highest diversity is concentrated in India and Thailand. In India, *Curcuma longa* has been in use as a culinary ingredient since 3000 BC. the genetic variation in the turmeric germplasm is essential to increase the efficiency of

selection in breeding programs, as well as to direct conservation strategies in germplasm collections. The genetic diversity of turmeric germplasm were studied using RAPD markers. The polymorphic information content and resolving power are in the range 0.00 to 1.00 and 0.00 to 1.1 respectively were found to be most informative with higher resolving power. Genetic similarity find through jacquard's coefficient in range 0.30 to 0.76. The results also demonstrate the efficiency and reliability of RAPD markers in for genetic diversity and relationships among the turmeric germplasm.

TRANSGENIC PLANTS AND ITS APPLICATIONS

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Before the creation of transgenics, the alteration of crops to improve their production was performed through the basis of selection. This selection has been going on for thousands of years. By the year 2050, world population may reach nine billions. Food production will need to increase at the high rate in order to satisfy the needs of such an enormous number of people in some older centuries. So, there is a need to use the genetic techniques to improve crops over the recent decades. Through the use of transgenics, one can produce plants with desired traits and even increased yields. The transgenics would allow for more crops that last longer and offers opportunities for the creation of insect, virus and herbicide-resistant plants by insertion and expression in planta of various genes. Abiotic stresses, especially salinity and drought, are the primary causes of crop loss worldwide. Transgenes protect and maintain the function and structure of cellular components and enhance tolerance to stress and also help in reducing micronutrient malnutrition among people at highest globally by enriching major staple food crops with micronutrients like amino acid, lipid, vitamin and iron through genetic engineering techniques. Transgenic plant production will allow us to feed the growing population and to produce more desirable products like secondary metabolites as antibodies and also help in preparation of edible vaccines. Genetic engineering also allows delayed ripening in fruits and helps to reduce fruit wastage, eg. Flavorsavar Tomato. Molecular farming allows cost effective production of therapeutic products such as antibodies, blood products, cytokines, growth factors, hormones, recombinant enzymes and human and veterinary vaccines. The future of GM crops remains a vital debate, as its applications have several advantages and disadvantages.

Keywords: Transgenics, Genetic engineering, Resistance.

MODULATION OF GROWTH AND BIOCHEMICAL PARAMETERS IN FENUGREEK (*TRIGONELLA FOENUM-GRACUM* L.) EXPOSED TO SALINITY STRESS

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Understanding and eventually shortening crop susceptibility to abiotic stresses such as salt, heavy metal, heat etc., could permit for elevated yields throughout stress environment in the cultivated areas of the world including arid and semi arid areas of the planet. Such research support sustainable yields and profitable crops. To moderate these effects, current biotechnological approaches are useful which 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 with this objective current investigation was carried out on fenugreek (*Trigonella foenum-graecum* L.), a valuable medicinal plant to find out the physiological and biochemical basis of salinity tolerance. Different concentration of NaCl viz. 0 (as control), 50, 100, 150 and 200 mM were used to induce salinity. Results showed significant differences in evaluated indices. Results revealed a significant correlation between physio-biochemical indices under salinity stress. Salinity triggers antioxidative activity and rate of lipid peroxidation increased. Thus, results suggest that antioxidative enzymes play a significant role in detoxification and redox homeostasis during salt stress in fenugreek plant.

Keywords: Antioxidative mechanism, Growth parameters, Salt tolerance, *Trigonella foenum-graecum* L, vigour index.

ANAEMIA IN CHRONIC RENAL FAILURE PATIENTS UNDERGOING HAEMODIALYSIS: A CROSS SECTIONAL STUDY

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Chronic renal failure disease is frequently associated with anaemia and the level of anaemia correlates with the stage of chronic kidney disease (CKD). A cross-sectional study was conducted in 44 chronic kidney disease patients in the department of

medicine, M.L.B. Medical College, Jhansi during the period January to June, 2018. The study was evaluating the profile of anaemia and to find the association between the severity of anaemia and CKD-5 patients time period of taking on haemodialysis. Haemoglobin, blood urea, serum albumin, serum creatinine levels were examined using standard techniques. There was a significant difference in the haemoglobin of CKD patients taking 30 days regular interval 3 times values ($P < 0.05$). All 44 patients (100%) were anaemic there was no significant correlation between the severity of anaemia and serum creatinine levels ($P > 0.82$) the most frequent anaemia in chronic kidney disease patients was a malnourished type of a moderate degree anaemic (7-10mg/dl). A significant correlation was not found between the severity of anaemia and serum creatinine levels 30 day interval of CKD of patients on haemodialysis.

Keywords: - haemodialysis, anaemia, serum creatinine, haemoglobin, malnutrition.

CHANGES IN AMINO ACID PROFILE OF HARD AND SOFT SHELL BLUE SWIMMING CRAB (*PORTUNUS PELAGICUS*) HAVING EXPORT POTENTIAL

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In the present study, the amino acid profiling of the hard and soft shell blue swimming crab (*Portunus pelagicus*) was examined. There are a total of sixteen amino acids in the hard shell crabs and seven amino acids in the soft shell crabs. Among the 17 amino acids, all the eight essential amino acids (EAAs) are present in the hard shell crabs in the order of leucine>phenylalanine>lysine>isoleucine>valine>threonine>methionine>histidine in hard shell crabs, while in soft shell crabs, there are only three EAAs in order of methionine>threonine>valine. Leucine is the major essential amino acid in the hard shell crabs, while valine is the major one in the soft shell crabs. Non EAAs present in the hard shell crabs, are glutamate (16.34mg/100mg), arginine, glycine, aspartate, alanin, tyrosine, proline, and serine. In the soft shell crabs, cystine (4.91 mg/100mg) is the major non EAAs followed by proline, glutamate and alanin. Sulfur containing amino acids viz. methionine and cystine present in the soft shell crabs in appreciable high concentration of 3.47 and 4.91 mg/100mg, respectively is a unique distinct feature as cystine is totally absent in the hard shell crabs. Nevertheless, hard shell crabs contain more amino EAAs and non EAAs than that of the soft shell crabs. Our study emphasizes that soft shell crabs are the good source of sulfur containing amino acids of nutritional importance.

Keywords: Blue swimming crab, Hard shell crabs, Soft shell crabs Amino acid profile,

EXPRESSION ANALYSIS OF PR PROTEINS-CHITINASE AND β -1, 3-GLUCANASE IN *SESAMUM INDICUM* L. DURING INTERACTION WITH *MACROPHOMINA PHASEOLINA*

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Pathogenesis related (PR) proteins are the most important defense proteins in the interaction of plants with pathogens. In this study, the role of chitinase and β , 1-3 glucanase was evaluated in the defense responses of *Sesamum indicum* L. against *Macrophomina phaseolina*, the causal agent of charcoal rot disease. GT-10 and Rama genotypes were used as resistant and for susceptible genotypes; RT-373 and AT-306 were used. For the experiment, at the post flowering stage, leaves and roots of the infected and non infected sesame plants were collected at 24 h, 48h and 72h after the inoculation of the pathogen. The specific activity of chitinase was increased to 5.59 and 4.61 fold in leaves and 5.18 and 3.06 fold in roots of resistant genotypes GT-10 and Rama at 48 h, respectively. Whereas, in susceptible genotypes RT-372 and AT-306, it was increased to 2.27 and 2.13 fold in leaves and 1.75 and 1.38 fold in roots, respectively, compared to their control. Similarly, the activity of β , 1-3 glucanase was increased to 1.3 and 1.29 fold in leaves and 1.39 and 1.41 fold in roots of resistant genotypes. Whereas in susceptible genotypes it was increased to 1.7 and 2.29 fold in leaves and 1.6 and 1.09 in roots as compared to their control. Then enzyme activity of both the enzymes was declined significantly in infected and non infected tissues of both resistant and susceptible genotypes at 72 hai compared to 48 hai. The activation of chitinase and β -1, 3-glucanase was more rapid and to a greater extent in the resistant genotypes as compared to susceptible. The expression scripts of the *chitinase* and *β , 1-3 glucanase* were calculated by quantitative Real-Time PCR (qRT-PCR). Results showed that the expression rate of both the genes in the resistant genotypes was higher than that of the susceptible genotypes. The results of this study suggest that the investigated genes are involved in the resistance responses of sesame against the charcoal rot disease.

PRELIMINARY STUDY OF GROUND BEETLES (COLEOPTERA: CARABIDAE) OF PAKISTAN

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A collection of ground beetles was randomly carried out in two regions of Pakistan. Forty one species has been collected in which 5 subspecies and 36 species belongs from various subfamilies. Eleven species and three subspecies reported first time, belonging to the six subfamilies of Carabidae. ; *Brachinus* (*Aploa*) *nobilis* (*Brachininae*); *Planetes* *bimaculatus* and *Zuphium* *testaceum* (*Dryptinae*); *Caphora* *afghana* (*Jedlicka*, 1956), *Eucolliuris* *fuscipennis*, *Masoreus* (*Masoreus*) *orientalis*, *Platytarus* *faminii* *faminii* (*Dejean*, 1826) and *Tetragonoderus* (*Tetragonoderus*) *intermedius* (*Lebiinae*); *Chlaenius* (*Chlaenites*) *spoliatus* *spoliatus*, *Diplocheilala* *aevigata* (*Licininae*); *Sphodrus* *leucocephalus* (*Platyninae*) and *Bembidion* (*Notaphocampa*) *niloticumbatesi* (*Terchinae*).

Keywords: Coleoptera, Carabidae, ground beetles, new records, Pakistan.

ENHANCING METACOGNITIVE SKILLFULNESS OF ADOLESCENTS**PARUL KALIA****Research Scholar, Punjab Agricultural University, Ludhiana (Punjab)**

Metacognition refers to one's "thinking about thinking" and is often defined by its accompanying skills such as monitoring and evaluation. Often researchers use metacognition as an overarching umbrella term but cognitive and educational theorists argue as to whether metacognition is a single construct or made up of distinct, differentiable factors. Metacognition has also been acknowledged as an abstract thinking ability known to enhance learning outcomes. The present research has made an attempt to assess the metacognitive skills among the students of the constituent colleges of PAU Ludhiana. The sample included 200 college students, in age range of 17-19 years. Metacognitive Awareness Inventory developed by Schraw and Dennison (1994) was used to measure the metacognitive skillfulness of the selected subjects and subsequently an attempt was made to prepare guidelines for parents and teachers to create a metacognitive environment since early years through daily interventions to strengthen their learning outcomes.

SEASONAL ABUNDANCE AND MANAGEMENT OF APHID, RHOPALOSIPHUMMAIDIS (FITCH) ON BARLEY, HORDEUMVULGARE LINN.****PAWAN KUMAR CHOUDHARY*, RATANLAL SHARMA AND PINKI SHARMA*****Department of Entomology and plant pathology SKNAU, Jobner (Jaipur)**

The investigation entitled, 'Seasonal abundance and management of aphid, *Rhopalosiphum maidis* (Fitch) on barley, *Hordeum vulgare* Linn.' was conducted at the Agronomy farm of SKN College of Agriculture, Sri Karan Narendra Agriculture University, Jobner (Rajasthan) in Rabi, 2014-15. The aphid, *R. maidis* was found to be the major insect pest causing damage to the barley crop. The population of aphid started in the first week of January, increased and reached to peak (114.02 aphids/ tiller) at 22.0 °C maximum temperature, 6.3 °C minimum temperature, 65 per cent relative humidity and 9.5 sunshine hours in the first week of February, thereafter, the population declined gradually and completely disappeared in the fourth week of February. The maximum temperature had significant negative correlation ($r = -0.76$) and relative humidity had significant positive correlation ($r = 0.80$) with aphid population, other abiotic factors were non significant. The population of ladybird beetle, *Coccinella septempunctata* Linn. on barley crop reached to maximum (5.98 per five plants) in the third week of February at 31.1 °C maximum temperature, 12.7 °C minimum temperature, 55 per cent relative humidity, and 9.0 sunshine hours. The maximum temperature and sunshine hours had significant positive correlation ($r = 0.92, 0.91$), and relative humidity and rainfall had significant negative correlation ($r = -0.92, -0.93$) with the population of *C. septempunctata*. The genotypes viz., RD-2035, RD-2552 and RD-2794 were found as least susceptible; RD-2503, RD-2508, RD-2793, PL-426, RD-2592, RD-2660, RD-2668, RD-2715 and RD-2786 and RD-2849 as moderately susceptible; whereas, RD-2052 and RD-2624 as highly susceptible. The bioefficacy of the treatments evaluated against aphid on barley crop showed that lowest population of 19.32, 20.81, 20.88, 20.95 and 21.13/ tiller was recorded in acetamiprid (0.004%), imidacloprid (0.005%), fipronil (0.01%), thiamethoxam (0.005%) and dimethoate (0.03%), respectively and were found statistically at par in their efficacy. The *Beauveria bassiana* (1 g/ l), NSKE (5.0%), imidacloprid (8 g/ kg), thiamethoxam (8 g/ kg) and acetamiprid (8 g/ kg) registered 42.57, 42.97, 48.47, 49.26 and 51.60 aphids/ tiller, respectively. The highest aphid population was recorded in untreated control (81.23/ tiller). The data of seed yield revealed that maximum yield of 34.25 q ha⁻¹ was recorded in the plots treated with imidacloprid (0.005%) followed by acetamiprid (0.004%), thiamethoxam (0.005%), fipronil (0.01%) and dimethoate (0.03%) which gave 33.85, 33.01, 32.90 and 32.58 q ha⁻¹ seed yield, respectively and all these found statistically at par each other and proved significantly superior over rest of the treatments. The maximum net profit (Rs. 11444 ha⁻¹) was recorded from plots treated with imidacloprid (0.005%) which gave benefit cost ratio of 7.43 followed by acetamiprid (0.004%), imidacloprid (0.005%), thiamethoxam (0.005%) and dimethoate (0.03%) with benefit cost ratio of 8.66, 7.43, 5.42 and 8.04, respectively. The first instar larva of ladybird beetle, *C. septempunctata* consumed on an average 23.30 ± 1.10; while second, third and fourth instar larva consumed on an average 34.60 ± 1.91, 102.50 ± 11.49 and 194.20 ± 8.61 aphids, respectively. The total number of aphids consumed during whole larval period averaged 354.60 ± 15.00 aphids. On an average, a male consumed

2409.50 aphids in 25 days with an average of 96.38 ± 3.42 ; whereas, a female consumed 2936.90 aphids in 25 days with an average of 117.48 ± 4.63 aphids per day.

DIAGNOSIS AND RECOMMENDATION INTEGRATED SYSTEM (DRIS): NUTRIENT MANAGEMENT IN HORTICULTURAL PLANTS

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Diagnosis and Recommendation Integrated System (DRIS) was developed by Beaufils in 1973 for nutrient management. DRIS is more promising than the earlier approaches -Critical value approach (CVA) and the Sufficiency range approach (SRA). This method involves dual relation between a pair of nutrients (N/P, P/N, N/K, K/N...) instead of univariate approach like the use of sufficiency range or critical level in which the individual concentrations of the nutrients in leaf tissue are taken into consideration and no information about the nutritional balance emerges. DRIS as a comprehensive system, which identifies all the nutritional factors limiting the crop production and in doing so increases the chances of obtaining high yields by improving fertilizer recommendation. DRIS index values measures how far specific nutrients in the leaf or plant are from optimum range. Since India's independence, there has been significant improvement in horticultural production; but still there is need to further increase production and quality produce to meet domestic and international market. One of the most limiting factors to achieve these targets is lack of balanced nutrient management. DRIS norms already have been developed in perennial and annual crops like grapes, pepper, 'Valencia' orange, coconut, pomegranate, mango, apple, peach, kinnow fruit, cauliflower, Arabica coffee, rose, papaya, 'Nagpur' mandarin, banana, gerbera and Coorg mandarin, corn, soybean and wheat, sugarcane, potato, sunflower and rice etc. DRIS norms are developed through survey-based approach of the population. The DRIS norm once established, it is further used to develop DRIS chart and NII (Nutrient Imbalance Index).

DIURNAL FORAGING PATTERN OF INSECT POLLINATORS ON RIDGE GOURD AND IMPACT OF XYLOCOPA FENESTRATA F. POLLINATION ON RIDGE GOURD

PREM PRAKASH GAUTAM AND NEERAJ KUMAR

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The insect pollinator diversity was studied in terms of species richness and abundance in ridge gourd in Apiary Dr. Rajendra Prasad Central Agricultural University Pusa, Samastipur. A total of 8 insect species were recorded in ridge gourd ecosystems. The species constituted five hymenopterans, two dipterans and one from odonata. Among these *Apis mellifera*, *Apis dorsata*, *Apis florea*, *Xylocopa fenestrata* and *Polistes* sp. were found to be most frequent pollinators. The relative abundance (no. of insect/m²/10 minutes) revealed that *Apis mellifera* was most dominant species and followed by *Apis dorsata*, *Xylocopa fenestrata*, *Apis florea*, *Eristalinus* sp., *Polistes* sp., *Paragomphus* sp. and *Musca domestica*. Irrespective of species, the mean population was maximum at 0700-h and minimum at 1300-h of the day. The coefficient of correlation between mean population of pollinator's species and temperature was found positive and significant while negative correlation was found with relative humidity indicating that temperature plays an important role on activity of insect pollinators.

INFLUENCE OF PLANTING METHOD, MULCHING AND NAA APPLICATION ON YIELD AND QUALITY PARAMETERS OF BELL PEPPER (*CAPSICUM ANNUM* L.) VAR. SOLAN BHARPUR

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An experiment was conducted to evaluate the effect of different cultural practices on yield and quality parameters of Bell Pepper (*Capsicum annum* L.) using variety Solan Bharpur during Kharif 2017 at the Experimental Farm of the Department of Vegetable Science, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, (HP). An experiment was laid out in a randomized block design factorial with three replications and twelve treatment combinations involving a spacing of 60x45cm. The treatments comprised of two planting methods i.e. P₁ (raised-bed), P₂ (flat-bed), three mulch systems i.e. M₁ (black mulch), M₂ (silver/black mulch), M₃ (no-mulch) and two NAA application levels i.e. N₁ (NAA @ 15 ppm at 30 and 45 days after transplanting) and N₂ (no NAA application). The treatment T₁₂ (flat bed + no mulch + no NAA application) resulted in highest TSS (4.85°Brix) whereas, ascorbic acid content (179.90 mg/100 g) was highest in T₉ (flat bed + silver/black mulch + NAA application). The treatment T₃ (Raised bed + silver/black mulch + NAA application) was performing best for capsaicin content (0.10 mg/100g) and shelf life (13.79 days). The treatment T₃ was also resulted highest fruit yield i.e. 393.00 quintals per hectare. Therefore, raised-bed planting in combination with silver/grey mulch and NAA application @ 15 ppm may be recommended for commercial production of bell pepper by the farmers as it is cheaper and eco-friendly practice.

Keywords: Bell pepper, *Capsicum annuum* L., Mulch, Quality parameters, Yield.

DOUBLING THE FARMERS INCOME THROUGH INNOVATIVE APPROACH

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Doubling farmers income by 2020 is a holistic approach would be required some specific policies and institutional reforms that take into account identification and targeting of low-income farmers particularly from the regions that were bypassed by green revolution. The targeted period to double the farmers income in real terms has been fixed as seven years that is from 2015-2020. Hence, considering the past trend, it will require a minimum annual growth rate of 10.4%. The government has setup National Commission on Farmers, headed by Dr. M.S. Swaminathan aiming at faster and inclusive growth. The key recommendations were: I) Improving farmer income from farm and non-farm sources II) Enhancing efficiency in the use of resources III) Minimizing expenditures on non-renewable inputs, and remunerating price to farmers at 50% higher than the minimum support price (MSP). The present government has taken many new initiatives for increasing the farmers income such as: I) “Per drop, more crop” II) Availability of quality seeds III) Soil test based nutrients management-distribution of soil health card IV) Post harvest crop losses-large investments in warehousing and cold chains V) Value addition by the farmers VI) Creation of a national agricultural market VII) Pradhan Mantri Fasal Bima Yojana VIII) High priority to diversification towards high value activities like horticulture, dairying, food processing, poultry, sericulture and fisheries etc. For doubling the farmer's income some strong strategies need to be adopted that is investments in agricultural research, adaption of GAP, conservation agriculture technology, implementation of farmer friendly policies. Credit supporting and smart farming is one of another possible strategy for doubling the farmers income.

Keywords- national commission on farmers, MSP, GAP (good agricultural practice), Conservation agriculture, Sericulture

APPROACH FOR SUSTAINABLE NATURAL RESOURCE MANAGEMENT IN RELATION TO CROP PRODUCTION AND ORGANIC FARMING

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When diet is wrong medicine is of no use. When diet is correct medicine is of no need. Ayurvedic Proverb “Intensive use of synthetic fertilizers and pesticides cause severe environmental and health problems due to heavy metal content in most of agricultural food products and in drinking water. The modernization of agriculture over the last one hundred years has been fuelled by the idea that we can produce more food faster, with technology, to supply the ever-growing population. It is estimated that more than a quarter of a million Indian farmers have committed suicide in the last 16 years the largest wave of recorded suicides in human history. A great number of those affected are cash crop farmers and cotton farmers in particular. The global agriculture system we have in place today has gone awry on almost every level. We have taken the natural and systemized it into an industrialized mechanism. We need a more systemic approach to agriculture in order to regain control of the foods we eat while combating the cost of transportation, and quality. Diversity in the crops is essential in creating a natural sustainable environment. This brings us to the topic of sustainable agriculture and three most effective practices; Aquaponics, Permaculture and Certified Naturally Grown (CNG) farming. “Aquaponics is an integrated aquaculture (growing fish) and hydroponic (growing soilless plants) system that mutually benefits both environments. “Certified Naturally Grown (CNG) is a non-profit organization offering certification tailored for small-scale, direct-market farmers and beekeepers using natural methods.

Keywords: Sustainable Agriculture, Organic Farming, Environment, Diversity, Approach.

BIO-EFFICACY OF SOME NEWER INSECTICIDES AGAINST MITES (TETRANYCHUS URTICAE KOCH)

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The results of the present investigation showed that Propargite 50%+ Bifenthrin 5% SE (2.3 ml/L.) was most effective and superior over the other insecticidal treatments, after first and second spray. Propargite 50%+ Bifenthrin 5% SE (2.2 ml/L.) stood second in order of effectiveness followed by Propargite 57%EC (2.2ml/L.), Propargite 50%+ Bifenthrin 5% SE (2 ml/L.), Propargite 50%+ Bifenthrin 5% SE (1.8 ml/L.), Fipronil 200 SC and Lambda Cyhalothrin 4.9% CS. Similar results was obtained by Singh and Singh (2010). The result showed that maximum reduction in population of yellow mite with propargite 57 EC. Sood et al. (2015) also reported the effectiveness of propargite in controlling the mite population in tomato crop. Propargite is also reported to be an efficient acaricide in suppressing mite population in grapevine (Veerandra et al. 2015). The efficiency of propargite in

controlling mite can be attributed to the fact that it is organosulfur, non-systemic insecticide that acts as an inhibitor of magnesium stimulated ATPase (Anonymous, 2014).

FRACTIONATIONS OF SURFACE SAMPLES FOR ZN, FE, MN AND CU & THEIR RELATIONSHIPS WITH SOIL PROPERTIES IN DIFFERENT SOIL SERIES OF HARYANA

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This study was conducted to determine the fractionations of surface samples for Zn, Fe, Mn and Cu i.e. exchangeable, organic bound, CaCO₃ bound, residual and total in different soil series of Haryana. Soil samples were collected from surface of each soil series using Global Positioning System (GPS). These processed soil samples were used for the determination of different fractions of zinc, iron, manganese and copper. Results of laboratory analysis showed that with regard to distribution of these micronutrients in soil fractions, total amounts of the elements ranged from 36.02 to 72.45 mg kg⁻¹ for Zn and 689.47 to 1560.56 mg kg⁻¹ for Fe, and 329.75 to 427.50 and 18.15 to 49.20 mg kg⁻¹ for Mn and Cu, respectively. A sequential fractionation showed that 0.4-1.9% of total Zn was exchangeable, 2.1-7.7% was OM-Zn and 3.5-17.6% was CaCO₃-Zn. The corresponding values for Fe and Mn were 0.01-0.4, 0.3-1.3, 0.2-0.3% and 0.6-1.0, 3.0-11.9, 0.8-4.6%, respectively. The amounts of soil Cu in Ex-, OM- and CaCO₃-, comprised 1.0-2.5, 0.9-2.2 and 8.5-28.7% of total Cu, respectively. The different forms of Zn, Fe, Mn and Cu were mainly associated in the residual fraction. Amount of these micronutrients bound to any fraction give an idea about their plant availability. The coefficients of correlation (r) for Ex- fractions responded significantly with clay and OC content. Resi-bound fractions were positively and significantly correlated with most of the soil properties.

Keywords: GPS; soil samples; soil series; OM.

A PHARMACOGNOSTIC STUDY OF VITEX NEGUNDO LINN. AND RICINUS COMMUNIS LINN. LEAF COLLECTED FROM ECO-FRIENDLY AND NON ECO-ECOFRIENDLY ZONE OF HARIDWAR DISTRICT. OF UTTARAKHAND

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Medicinal plants and herbal remedies have used in all over the world for thevarious diseases problem in human beings, since ancient period. The selected medicinal plants' species has been of interest to researchers due to its medicinal plant employed in the Indian traditional system of medicine. These plants are rich in therapeutically valuable phytoconstituents and used in different healing system of medicine. The present investigation deals with the comparative pharmacognostic, morphological and qualitative study of Vitex negundo Linn. and Ricinus communis Linn. leaf. Physiochemical parameters like determination of total ash content, acid insoluble ash, alcohol soluble extractive and water soluble extractive were observed. The observed values of the physiochemical test of total ash content and acid insoluble ash of Vitex negundo Linn. and Ricinus communis Linn. collected from eco-friendly zone were 7.0 & 0.5% and 17.05 & 1.0% respectively and the values of both the parameters of the plant collected from non-eco-friendly zone were 6.5 & 0.5% and 18.5 & 1.0% respectively. This study might be useful to supplement information with regard to its identification parameters, which are assumed significant in the way of acceptability of herbal drugs, in the present scenario, which lacks regulatory laws to control the quality of herbal drugs.

Keywords: Vitex negundo Linn., Ricinus communis Linn., Leaves, Pharmacognostic, Physiochemical.

INSECT AND PEST MANAGEMENT STRATEGIES IN ORGANIC AGRICULTURE- AN OVERVIEW

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Modern agriculture is highly input intensive and greatly dependent on chemical pesticides for the control of insect pests. Excessive use of pesticides in agriculture has played havoc with agro-ecosystem by polluting water and food chains and causing the emergence of pesticide resistance both in target and non-target pests. During the last two decades, there has been a significant sensitization of the global community towards environmental preservation and assuring of food quality. The promoters of organic farming consider that it can meet both these demands and become the mean for complete development of rural areas. While there is continuum of thought from earlier days to the present, the modern organic movement is radically different from its original form. It now has environmental sustainability at its core in addition to the founders concerns for healthy soil, healthy food and healthy people. For ease of understanding and their effective application for management of insect pests and diseases under organic farming, pest and disease management strategies are classified into following categories like modification of cultural practices including crop rotation, soil health management, use of insect resistant plants, etc., conservation practices to restore the natural enemies through provision of hedge rows, shelter belts, etc., use of biological control agents such as insect predators, parasitoids, insect pathogens by applying or releasing the agents through inoculate and inundated methods, use of botanicals and

their mixtures such as Panchagavya, Dasagavya and mineral oils as curative control measures, use of pheromones and other attractant, use of organic pesticides and other permissible pesticides

A STUDY ON THE EFFECT OF SALINITY CONDITIONS ON SOME PHYSIOLOGICAL PARAMETERS OF CHILLI PEPPER (CAPSICUM ANNUM)

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Background: Stress is a condition where physiology of plant get affected as well as plant affected at molecular level also. Crop yield are exaggerated by different types of stress like flood, drought and salinity. In salinity, accretion of salts started near the root cells which make harder to extract water from soil. In the condition of stress plant produce some reactive oxygen species for defence mechanism against salinity or other stress conditions. As stress affect plants and not all plant species are able to grow in saline conditions, plant species that can optimally grow in salt stress generally termed as halophytes. *Capsicum annum* is considered as second most consumable vegetable in world belongs to the family solanaceae. **Materials and methods:** Assessment of viability of seeds, percentage of germination and estimation of fresh weight, dry weight and moisture percent were measured at different salt concentrations ranges from 0-20 gm L⁻¹ NaCl. **Results:** This study showed that different concentrations of NaCl had significant effect on all physiological parameters like germination percentage, germination time and viability of seeds. As the concentration of NaCl increased, it induce delay in germination of seeds and also recorded fall in germination percentage. In pot experiment, with increasing NaCl concentration, induced a significant decrease on plant height, root length, fresh and dry weight of plant. Root length, plant height as well as the amount of chlorophyll was reduced in a concentration dependent manner.

Conclusion: Results of this study demonstrate that NaCl affects major of the physiological process in pepper which directly affect the crop yield. There is a pattern in this study that with increasing salinity level there are depletion in all studied parameters recorded. **Implication:** During the condition of stress plant illustrate numerous responses at physiological, cellular and molecular level. This study put forward the potent candidature of *C. annum* towards salt tolerant which further could be beneficial where concentration of salts remains higher like near the coastal areas.

Keywords: *Capsicum annum*, salinity, germination, NaCl.

EPIDEMIOLOGY AND MANAGEMENT OF ALTERNARIA BLIGHT OF TOMATO (SOLANUM LYCOPERSICUM L.)

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Tomato (*Solanum lycopersicum* L.) is the world's second most consumed vegetable after potato. Alternaria blight of tomato caused by *Alternaria alternata* is one of the most important fungal disease prevalent in tomato growing areas of India including Rajasthan it is considered as one of the limiting biotic factors for successful cultivation of tomato. Typical disease symptoms were angular brown spots with concentric rings and surrounded by discolored tissues. Disease intensity varied from 46.63 to 55.75 per cent in four surveyed districts of Rajasthan. Maximum disease intensity was recorded in Jaipur (55.75%) and minimum in Tonk (46.63%). *Alternaria alternata* isolated from infected samples of tomato leaves, purified and its pathogenicity was proved. The pathogen produced dark brown to black colony with septate mycelium and acropetal chain of ellipsoidal brown or muriform conidia. Morphological, cultural and pathogenic variability were observed among eight isolates of *A. alternata* collected from Jaipur, Alwar, Dausa and Tonk districts. Among these, both isolates of Jaipur were found more virulent followed by Alwar isolates. Rate of disease progression was significant and positively correlated with maximum and minimum temperature and negatively correlated with maximum and minimum relative humidity during 2017 and 2018. Maximum disease intensity was recorded on 49 days old plants (63.35 %) followed by 42 days old plants (60.00 %). Maximum growth of *A. alternata* was observed at 90 per cent relative humidity (88.70 mm) and 25°C temperature (90.00 mm). Among seven nutrients tested, copper sulphate gave maximum inhibition of mycelial growth (52.22 %) at all concentrations. In field experiment, two sprays of copper sulphate (0.5 %) was found most promising in reducing the disease intensity (46.94 %) and increasing yield (43.75 %). Among seven plant extracts tested, *Allium sativum* clove extract gave maximum inhibition of mycelial growth (96.70 %) at all concentrations. In field experiment, two sprays of *Allium sativum* clove extract (10 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (58.16 %) and increasing yield (49.47 %). Among seven fungicides tested, hexaconazole gave maximum inhibition of mycelial growth (98.81 %) at all concentrations. In field experiment, two sprays of hexaconazole (0.2 %) at 15 days interval from disease initiation, was found most promising in reducing the disease intensity (79.74 %) and increasing yield (88.51%). Under artificial inoculation condition, out of twenty one varieties only Switzerland and Angour Lata were observed to be resistant against Alternaria blight.

PHENOTYPIC AND MOLECULAR CHARACTERIZATION OF MUTANTS FROM DIFFERENT SPECIES OF ANNUAL CHRYSANTHEMUM

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The ornamental industry strives for novelty to generate new products (eg. plants with novel pigmentation and architecture) at competitive prices. Consumer preference is governed largely by plant appearances, flower colour and tolerance to insects and pests (**Tanaka et al., 2005**). A large number of new flower color/type and chlorophyll variegated mutant varieties have been developed worldwide and commercialized. Induced mutagenesis in chrysanthemum is the most successful story. Mutants are phenotypically different from parental variety only in flower color/shape and leaf variegation (**Datta, 1988**). New ornamental plant varieties are continuously being created by breeders in response to consumer demand for new products. These new cultivars in existing crops could be produced by the introduction, hybridization and through molecular techniques. Mutation is a method by which novelty can be created in already well established cultivar. For the past 40 years, the International Atomic Energy Agency has sponsored extensive research and development activities on mutation induction to enhance the genetic diversity in the germplasm of food and industrial crops which ultimately formed basis for release of over 2,700 new crop varieties in some 170 species. These mutants have created tremendous economic impact in agriculture throughout the world (<http://www-mvd.iaea.org>, 2012). Mutation assisted breeding (MAB) together with biotechnology can contribute greatly for genetic improvement of ornamental plants and in uplifting the socio-economic benefits in the developing countries (**Jain, 2006**). Several mutagens like radiations, ultraviolet light and a variety of chemicals have been utilized for this purpose. The induced mutagenesis in plants have been shown to create variations for large number of both by physical and chemical mutagens when seed and vegetative parts are used (**Gustafsson, 1960 and Broertjes, 1968 and 1972**). Molecular marker and DNA sequence analysis of extant and new floricultural germplasm collections should allow a more complete characterization and understanding of the genetic relationships between species and cultivars (**Dao et al., 2001**). Randomly amplified polymorphic DNA (RAPDs) is a PCR based marker system developed in 1990 (**Williams et al., 1990**) and amplify genomic regions using random decamer primers. With the single primer, arbitrary genomic fragments with high level of polymorphism were amplified. Also prior DNA sequence information is not essential in case of RAPD marker analysis. The RAPD markers have been used in characterization of Chrysanthemum cultivars and other closely related family members of Asteraceae (**Martin et al., 2002**). **Wolff and Rijn (1993)** showed that with the RAPD technique, reproducible pattern can be obtained in chrysanthemum and that with these patterns cultivars could be distinguished. It was, however, also demonstrated that cultivars from one family, differing for the flower colour, could not be distinguished with several DNA techniques (**Wolff et al., 1995**).

EFFECT OF LONG TERM APPLICATION OF FERTILIZERS AND MANURE ON NODULATION AND YIELD OF SOYBEAN IN A BLACK SOIL

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The study was conducted on the Research Farm of Department of Soil Science and Agricultural Chemistry, JNKVV, Jabalpur. The experiment was commenced in June 1972. The present study comprised of ten treatments i.e. 50% NPK, 100% NPK, 150% NPK, 100% NPK+HW, 100% NPK+Zn, 100%, 100%, 100% NPK+FYM, 100% NPK-S and control with four replications in simple randomized block design. Soybean Crop was raised with all the standard recommended agronomic practices other than those under treatments. The results on nodulation revealed that the maximum nodule number and dry weight of nodule was recorded when 100% NPK was supplemented with FYM whereas minimum was confined in control followed by N alone. The continuous application of fertilizer and manure resulted in significant response for grain and straw yield. The highest value of grain and straw was recorded in 100% NPK+FYM and lowest value in control.

Keywords: soybean, nodule, and yield.

ORGANIC FARMING: AN ECO FRIENDLY AND SUSTAINABLE AGRICULTURE

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Organic farming is widely preferred and adopted form of agriculture that relies on various techniques like vermicomposting, crop rotation, green manure, animal husbandry, bio fertilizers and biological pest control. Agriculture in recent time is becoming a high investment but a low yielding output due to abandoned use of synthetic chemicals which are causing harm to the ecosystem.

Indiscriminate and heavy use of chemical pesticides to have control over various insect, pests and diseases over the years has destroyed many naturally occurring effective biological control agents. People are becoming more conscious for their health and environment. Organic farming through sustainable agriculture not only meets the food and other requirements of present generation but also meets the requirements of future generations in an environment friendly way and maintains our environment. Organic agriculture is currently covering only a small area in developing countries but its extent is continuously growing as demand for organic products is rapidly increasing all round the world. High demand for Organic products is driven by belief that Organic Products are more healthful, tasty, and environmentally friendly than conventional products (CPs). Organic farming promotes both organic fertilizers and manure which also is a gateway for sustainable agriculture which is the need of the present era. These days the conscious farmers along with consumer had led for safe food production and consumption if we could guide it towards organic production it will be a boon for healthier life. When it comes to the establishment of sustainable farming systems organic agriculture has an unused role to play, no single approach will safely feed the planet. Rather, a merge of organic and other innovative farming systems is needed.

Keywords: conscious, consumer, environment, production, safe food, vermicompost, conventional products

PRODUCTION AND MANAGEMENT OF VERMICOMPOST IN RAJASTHAN

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Vermicompost is proving to be highly nutritive 'organic fertilizer' and a 'miracle growth promoter' rich in NKP (nitrogen 2-3%, potassium 1.85-2.25% and phosphorus 1.55-2.25%), micronutrients, beneficial soil microbes and also contain 'plant growth hormones & enzymes'. They can 'build up soil', 'restore soil fertility', 'sustain farm production' and also deliver 'safe food' for the civilization. Vermicomposting is a recycling process, where earthworms are allowed to eat organic waste to convert it into manure rich with exceptionally high nutritional content. Vermicomposting is practiced through 'Vermiculture' literally meaning 'to grow worms' or 'worm farming'. Earthworms (*Lumbricus rubellus*) are cultivated in agricultural farms to consume organic waste including all kinds of biodegradable wastes. Each earthworm can multiply to a tune of 247 in an year. It is possible to compost 1000 tonnes of organic waste within 3 to 4 months time, producing about 400 tonnes of vermicompost. It is known that 1000 worms can produce 5 kg. of compost every day. This can market @ Rs.4000 per tonnes whereas the total production cost involved will be only around 1000 rupees. Further, it was noticed that vermicompost preparation is complicated process, costly technology; labour consuming technology and transporting earthworms from one place to another were realized as the priority constraints by the respondents in adoption of vermiculture technology.

Keywords – Micronutrients, fertility, Earthworms, microbes, technology etc.

ROLE OF CARBON DIOXIDE (CO₂) AND OZONE (O₃) FOR STORED GRAIN PEST MANAGEMENT

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Insects not only attack field crops during the growing season, but also damage grains stored in granaries. More than 1200 species of 70 insect-pests have been identified which attacked stored grains and cereal products in store houses. According to FAO annually about 10% of all store grain i.e. 13 million tonnes of grain is lost world-wide in store due to insects. In India, 10- 40% of food grain is lost every year due to storage pest infestation amounting to Rs 50,000 crore. Presently, fumigation with chemical insecticides is the most effective and widely used method to control all stages and kinds of pests in grain bins, warehouses, and other mass grain-storage structures. The two most commonly used chemicals approved for fumigation are phosphine and methyl bromide. Methyl Bromide has been found to deplete the ozone, and its use is now restricted. Hence, Modified or controlled atmospheres (MA or CA) with higher or lower concentrations of atmospheric gases, mainly carbon dioxide (CO₂) and ozone (O₃) provides a cost-effective method to kill target pests and protect stored products and it has no residual effect. The treated products can be used immediately after opening. It overcomes the health hazard and it is safe as compared to chemical fumigations. It also eradicates insects with their development stages like egg, larvae, pupa and adult, with no resistance against pests. Mostly the use of CO₂ and O₃ are common in India under silo stored condition.

Keywords:- stored grains, fumigation, carbon dioxide (CO₂) and ozone (O₃)

AN EFFICIENT GENOMIC DNA EXTRACTION PROTOCOL THREATENED SPECIES COMMIPHORA WIGHTII (ARNOTT) BHANDARI

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Commiphora wightii (Arnott) Bhandari contains many secondary metabolites, polysaccharides and phenolic compounds. Due to higher level of secondary metabolites, DNA extraction is difficult. In the present work, an alternative protocol for genomic DNA

extraction from plant leaves was developed that is acquiescent to PCR-based molecular studies. This modified CTAB (3%) and PVP (Polyvinylpyrrolidone) 1.5% protocol include the use of 0.5M NaCl, 0.3% β -mercaptoethanol in the extraction as well as application of autoclaved sand for proper grinding of leaves and inclusion of RNase A treatment in the protocol to fasten the process. The extracted DNA using present optimized protocol was better in quality and quantity. It was also suitable for polymerase chain reaction with random decamer, inter simple sequence repeat and barcode primers. The developed protocol is rapid and cost efficient with high quality and sufficient quantity of DNA for downstream PCR-based genetic analysis.

Keywords: *Commiphora wightii*; molecular markers; PCR amplification; polyvinylpyrrolidone; β -mercaptoethanol; DNA extraction

ECO-FRIENDLY MANAGEMENT OF CITRUS CANKER (*XANTHOMONAS CAMPESTRIS* PV. CITRI)

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Citrus Canker (*X. campestris* pv. *citri*); a bacterial disease causes a significant yield loss of about 45-50% in citrus crop around the world. It was first introduced in Florida around the year 1910 on trifoliate citrus rootstocks. The primary symptoms are observed in leaf, stem and twigs with a brown scabby raised area producing a crater like appearance. Warm, humid, cloudy climate along with heavy rainfall and strong wind favors the disease incidence. The disease is mostly spread by heavy wind and high rainfall splashes. To avoid the introduction of disease quarantine and sanitary measures should be strictly followed. The choice of planting site should not favor the growth of pathogen and its introduction as well. The rootstocks should be selected from the disease free plants. The use of resistant varieties like Navelina, Vanencia and Folha Murcha (Sweet Orange) and Ponkan, Dancy and Tahiti Lime (Mandarin) can be done along with other canker tolerant varieties like "Tenali Selection" and "Balaji". Moreover, by the use of proper fertilization and irrigation plant vigor should always be maintained especially during disease prone climatic conditions. To reduce the incidence of disease on leaves and fruits up to minimum level, windbreaks alone or in combination with Copper spray should be done. The infected twigs should be identified before monsoon and then pruned and burnt. During dry season, pruning and defoliation can be done in combination with copper sprays to control the disease in an effective way as the environmental conditions for spread of bacterium is less favorable. A single spray of bacterial suspension of bacterial inhibitor i.e, *Bacillus subtilis* during the peak season (July) has resulted in the satisfactory decline in disease. Spraying of fungicide like Bordeaux mixture and lime-sulphur is often very effective to prevent the fruits against infection. It should be done during the three months of the development of fruits. Spray of Captan 75% WP @ 666.8g in 6-8 ltr of water has reduced the severity of the disease. Spray the mixture of Streptomycin Sulphate 9% and Tetracycline hydrochloride 1% SP @50 to 100 ppm solution repeatedly at an interval of 15 to 20 days after the appearance of flower is found effective in the control of the disease.

MANAGEMENT OF BAKANAE DISEASE OF RICE USING COMBINATIONS TRICHODERMA WITH CERTAIN FUNGICIDES

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Rice is an important cereal crop and growing all over the world. Rice grows in India is primarily divided into Basmati rice and Non-Basmati rice. India is the major producer and exporter of basmati rice to the world. India is one of the top producer and exporter of basmati rice. Production and productivity of basmati rice affected by different factors among these factors diseases are important one. Bakanae disease caused by *Fusarium moniliforme* is an emerging and very serious problem of basmati rice. It occurs in both upland and low land rice field. Bakanae disease produced typical symptoms is the abnormal elongation of seedlings, foot rot and seedling rot of rice. The pathogen can survive as seed and soil borne. Therefore seed treatment for the management of seed borne pathogen is most effective method of disease management. Seed treatment with bio-agent for the management of disease is an eco-farmers friendly method of disease management. Keeping this in view in present investigation Fungi *Trichoderma* was tested in management of bakanae disease of basmati rice as seed treatment. *Trichoderma* powder was applied for seed treatment with 6 g/kg seed alone and in combination with different fungicides 2 g/kg seed. This experiment was conducted in field condition. The observations were recorded on disease incidence after 30 days of seedling transplanting and yield (q/ ha). Three fungicides (Nativo, Saaf and bavisten) and two isolates *Trichoderma* (S1, and S7) were tested in field condition against *Fusarium moniliforme* the causal organism of bakanae disease of rice. Among three fungicides evaluated as seed treatment minimum disease incidence (0.0%) was observed in seed treatment with *Trichoderma* S1 followed by seed treatment with *Trichoderma* S1+saaf (0.1%). Maximum disease incidence was observed in case of control (0.75%) followed by seed treatment with *Trichoderma* (0.49 %). Maximum yield (40 q/ ha) was recorded in case of treatment of *Trichoderma* isolates S7 was found most effective for the control of bakanae disease of rice.

Keywords: Bakanae disease, *Fusarium moniliforme*, Bio-agent, *Trichoderma*, Nativo, Bavisten and Saaf.

A STUDY ON ETHNO-MEDICINAL PLANTS BY LOCAL INHABITANTS IN DEVPRAYAG TEHSIL, DISTRICT TEHRI GARHWAL, UTTARKHAND.

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Ethno-medicine is a study of how people of a particular culture and region make use of indigenous plants. A study was undertaken regarding knowledge of ethno- medicinal practices from native species, by the indigenous people of DevprayagTeshil, District TehriGarhwal, of high/low altitude region of Garhwal village's. A questionnaire survey was conducted in the local inhabitants having a greater knowledge for identification of medicinal plants and their natural habitat, parts used and method of preparation of medicine from the raw materials. A total of 50 number of species belonging to 34 different families were identified which are being used to make medicinal formulations beneficial in various ailments. Studies indicated development of different methods for collecting, processing, using and conserving of plants and/or their products by the indigenous people. Traditional knowledge regarding the uses and value of the indigenous medicinal plants can be documented for the future generations as well as for scientific knowledge.

Keywords: Ethno-medicine, indigenous knowledge, preparation of drug, medicinal uses.

EFFECT OF DIFFERENT FERTILIZERS ON THE GROWTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.) IN CHITWAN, NEPAL

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An experiment was conducted in the Horticulture Farm of Agriculture and Forestry University to demonstrate the effect of different fertilizers on the yield and yield parameters of okra (var. Arka Anamika). The experiment was laid out in Randomized Complete Block Design (RCBD) consisting of seven treatments and three replications. The various treatments used in the experiment were goat manure, sesame cake, mustard cake, synthetic fertilizer (NPK), poultry manure, vermicompost and untreated control. The required dose of nitrogen was fulfilled by the fertilizer itself whereas the insufficient amount of phosphorous and potassium was fulfilled by the addition of single super phosphate and muriate of potash respectively. The fertilizers were applied on the basis of recommendations given by the Nepal Agriculture Research Council (NARC). The effect of poultry manure on the number of open flowers and the number of fruits at 40 DAS was found superior. The effect of poultry manure on plant height, number of leaves, plant diameter was found superior at 50 DAS. Goat manure produced the superior result on the number of open flowers at 50 DAS. Poultry manure on the number of leaves and plant height produced a significant result at 60 DAS. Synthetic fertilizer responded well to the number of fruits at 60 DAS. Sesame cake produced the superior results at 70 DAS on the number of buds. Poultry manure responded well to all the parameters and produced the yield of 20 mt/ha with the BC ratio of 1.77. This experiment suggests the farmers to use the poultry manure to get the highest economic return. Vermicompost and mustard cake producing the superior and significant yield in this research are not recommended as they have a low BC ratio unless effective measures are encouraged to reduce the cost of these fertilizers.

Keywords: okra, fertilizers, yield, benefit-cost ratio

GLOBAL FOOD SECURITY AND CHALLENGES

SANGEETA

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Abstract: Food is our basic need, every human being on this planet need food to live, all the foods we grow to eat is provide various kinds of nutrients which are nessecery for healthy life. In this world many people are still do not have required amount of calorie in their daily diet, because of unavailability of food and equally some are throwing foods in garbage as waist in their daily life this figure is very critical. If we try to identify the reason behind this are unequal distribution of money and foods to all to survive their best life as human being, low agricultural production of crop to fulfill the needs of all, limited area of agriculture, techniques and education about how to grow best crops and vegetables in available land. Population is increasing rapidly across the world but the production is being shorter than the before because land are being used in residential purpose. The whole world is facing problem to feed rapidly increased population, many data shows that this crisis will increased day by day till 2050 it is expected to reach around 10billion. This term is used for the world as triple burden on the countries, and because of insufficient food intake problem of malnutrition, micronutrients deficiency and crisis of global hunger is rising. No country confronts these tremendous challenges alone nor should it. Now there is need to promote such a sustainable agriculture to solve the food security problem around the world.

Keywords: Global Hunger, Food Security, Malnutrition, Sustainable Agriculture.

ECO-FRIENDLY MANAGEMENT OF BROWN SPOT (BIPOLARISORYZAE) OF RICE**SANKALPA BHATTARAI¹, RASHMI ARYAL², JIWAN PAUDEL¹****¹Institute of Agricultural Science, BHU, Varanasi, (U.P), ²Mahendra Ratna Multiple Campus, IAAS, TU**

Brown spot of rice caused by *Bipolaris oryzae* Subr. And Jain (*Helminthosporium oryzae* Breda de Haan teleomorph (*Cochliobolus miyabeanus*) was a major cause of the Bengal famine of 1943 where the crop yield was dropped by 40% to 90% and death of 2 million people was recorded. The pathogen attacks the crop from seedling to milkstage. The fungus is reported to survive in soil and infected plant parts including stubbles, straw and grains for 2-3 years, which act as primary source of inoculum. Use of resistant varieties viz. NDR-359, CR-1, CR-2 and N-18 highly resistant, PR-103, IR-36, Prasad, Narendra-2, IR-597, Rasi, Jagannath, OC-1339 and Cross-116 resistant; IET-849, Pusa NR-381, Narendra-80, Narendra Dhan-97, Jalnidhi and Jallahari moderately resistant; Bala, BAM 10, IR-20, Jaya, Ratna, Tellahamsa and Kakatiya tolerant; is the best way to overcome disease. Field sanitation-removal of collateral hosts (*Digitaria angustifolia*, *Leersia hexandra*, *Echinochloa colonum*, *Pennisetum typhoides*, *Setaria italica* and *Cynodon dactylon*) and infected debris in the field, crop rotation with non host crops, adjustment of planting time, proper fertilization (Incidence of brown spot in rice was correlated with low available soil Si, Mn or K & Adequate N fertilization considerably reduces brown spot of rice), application of sulphur-coated urea or urea super granules at 87-110 kg N/ha and neem cake + urea, Good water management, use of soil amendments can help in controlling the disease. The 100% cow urine spray is able to minimize the brown spot infestation. Leaf extracts of *Juglans regia* reduced mycelial growth of *B. oryzae* by 64%, the extract of *Agave americana* at 0.1% and *A. Sativum* & *Pithecellobium dulce* at 10% provided >50% and 90% inhibition of spore germination and mycelial growth of *B. oryzae*, respectively. A significant reduction in mycelial growth (55-58%) and seed-borne infection of *B. oryzae* with a bioformulation of *T. harzianum* has also been recorded. Seed treatment with *T. viride*, *T. harzianum* and *Pseudomonas* species has yielded 70% or more reduction in brown spot. *Trichoderma viride* @ 6 g/kg seed treatment + Propiconazole @ 500 ml/ha for spray treatment against brown spot of rice is very effective. Seed treatment with tricyclazole (0.4%) followed by spraying with 0.25% mancozeb + 0.08% tricyclazole and seed treatment with thiram (2 g/kg) along with three sprays of Ridomyl MZ or Companion is highly effective against brown spot.

EFFECT OF WEED AND NUTRIENT MANAGEMENT ON PERFORMANCE OF BARLEY (HORDEUM VULGARE L.) AND ASSOCIATED WEEDS**SANTOSH KUMAR¹, VIVEK¹, N.S. RANA¹, R.K. NARESH¹, B.P. DHYANI²****¹Department of Agronomy, ²Department of Soil Science & Agricultural Chemistry
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Barley is the most important food grain crop among cereals and stands next only to rice in our country. It has significantly contributed in the success of the green revolution and has greatly helped to transform our country from a situation of ship to mouth to being self-sufficient. Barley is a good supplement for nutritional requirement of human body as it contains 8-10% protein and 69.6% carbohydrates, 1.3% fat, 3.9% crude fiber. The productivity of barley is low. The significantly higher number of yield attributes and yield was obtained with the application of 75% N-PK + 25% N through vermicompost followed by 100% NPK. While reduction in weed density and weed dry matter accumulation was highest with the application of 75% N-PK + 25% N through vermicompost and it was more economical due to higher gross returns, net returns and B:C ratio. Among the different weed control practices the highest cost of cultivation and gross return was observed in two hand weeding closely followed by Trisulfuron 15 g a.i ha⁻¹. Net return and B:C ratio and weed control efficiency was observed highest in Two hand weeding closely followed by Trisulfuron 15 g a.i ha⁻¹ and Carfentrazone ethyl 15 g a.i ha⁻¹. Among the weed management practices, weed control treatments gave significantly higher yield attributes and yield compared to control. Among the herbicides Trisulfuron 15 g a.i ha⁻¹ was found more effective over Carfentrazone ethyl 15 g a.i ha⁻¹. The mean contribution of *Phalaris minor* to the total weed population in two hand weeding was 22.73, 25 and 24.61 per cent at 30, 60 and 90 DAS respectively. Among non-grassy weeds *Chenopodium album* and *Melilotus* spp. were dominant weed species. The contribution of other weeds in the total weed population was 16.65, 17.29 and 12.43 per cent, respectively at 30, 60 and 90 days after sowing. It is concluded that the adoption of 75% NPK + 25% N through vermicompost being statistically at par with 100% NPK improved the growth, yield attributing characters and yield of barley crop significantly and is found much profitable. Among the weed control practices Trisulfuron 15 g a.i ha⁻¹ improved the different growth parameters yield attributes and yield of barley crop over the control. Nutrient uptake by crop, status of the soil also improved with the integration of organic and inorganic sources as of plant nutrient. Thus 75% N-PK + 25% N through vermicompost with Trisulfuron 15 g a.i ha⁻¹ may be recommended for better weed control and higher barley yield.

ECO-FRIENDLY MANAGEMENT OF COFFEE STEM BORER (*XYLOTRECHUS QUADRIPIES*)- A MAJOR CONSTRAINT IN NEPALESE COFFEE FARMING

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Coffee white stem borer, *Xylotrechus quadripes* is a serious and major pest of arabica and robusta coffee that causes serious yield loss in Nepal. It is well known for its habit of boring through the stems of coffee plants in plantations gradually lead to the death of the plant. It is a blackish brown coloured beetle measuring about 1-2 cm in length with three pairs of white stripes running obliquely across the wings. Alternate host plants of this beetle include rose sandal wood, teak etc. It has recently been considered as coffee cancer. Recently the effect of its infestation has been started from Gulmi, Palpa and Lalitpur, to the all parts of country. There are three well-known mechanisms of plant defense against insects. Antibiosis is the mechanism involving toxic substances in the cells of the host tissue that deter the insect from attacking those plants. Antixenosis is the mechanism involving surface texture of the plant (smooth bark, trichomes etc.) or even the cell contents of the plants that inhibit the development of insect (e.g. proteolytic enzyme inhibitors and hydrolytic enzymes) because of which the insect does not prefer the given plant as a host. Tolerance is the ability of the plant to withstand the insect attack and continue its life relatively unaffected. The borer completes its life cycle in 1 year and causes substantial economic loss every year. Integrated management, i.e. cultural, mechanical, sex pheromone and chemical methods, has been adopted to control the stem borer. Identifying, uprooting and destruction of borer infested plants before the start of the flight period based on the presence of the borer ridges on the main stem and thick primary branches using a jute sack or rough cloth during March and September to reduce the cracks and crevices in which the eggs are deposited is an important mechanical method of CWSB control. Then, paste a mixture of red soil and fresh cow dung on the stem. The plants that show borer ridges are uprooted and destroyed. As the borer breeds faster in drying stems, uprooted stems should be burnt immediately to kill the pest stages, otherwise the pest completes its development and emerging adults reinfest the plants. It is better to plant shade trees 1-2 years before the coffee plantation to maintain optimum shade and soil moisture in the coffee orchard. However, coffee farmers usually remove shade to increase crop yield, thereby increasing the borer incidence. Optimum shade management is a major constraint due to non-availability of skilled workers for lopping of shade trees. Use a coffee white stem borer pheromone trap, i.e. cross-vane pheromone trap, to catch female beetle during flight periods. Twenty-eight species of parasitoids, two species of general avian predators and two entomopathogenic fungi, *Beauveria bassiana* and *Aspergillus tamari* Kita, have been recorded as natural enemies of CWSB larvae. Insecticides and miscellaneous substances applied to the stem to kill eggs and young larvae as well as to repel egg-laying adults of CWSB are not effective. A coal tar distillate (10%) slightly reduced the borer infestation. Sodium arsenate in an emulsion of wood tar distillate caused 60% larval mortality, but it damaged the plants. At present, it is controlled by the application of Chlorpyrifos or Lindane that have comparatively short residual life. Application of lime solution (10%) on the main stem to control the pest has led to an eco-friendly alternative to chemical control.

ROLE OF BIOINFORMATICS IN AGRICULTURE

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Bioinformatics is an interdisciplinary area of the science composed of biology, mathematics and computer science. Bioinformatics is the application of information technology to manage biological data that helps in decoding plant genomes. During the last two decades enormous data has been generated in biological science, firstly, with the onset of sequencing the genomes of model organisms and, secondly, rapid application of high throughput experimental techniques in laboratory research. Biological research that earlier used to start in laboratories, fields and plant clinics is now starts at the computational level using computers (In-silico) for analysis of the data, experiment planning and hypothesis development. Bioinformatics develops algorithms and suitable data analysis tools to infer the information and make discoveries. Application of various bioinformatics tools in biological research enables storage, retrieval, analysis, annotation and visualization of results and promotes better understanding of biological system in fullness. This will help in plant health care based disease diagnosis to improve the quality of Plant. Application also various bioinformatics tools and databases enable analysis, storage, annotation, visualization and retrieval of outcomes to help enhanced understanding in living system research. Thus it will help to improve the plant quality based on health care disease diagnosis. In this chapter we describe the bioinformatics approaches (databases and tools) in plant science and implication of next generation sequencing technology (NGS) on crop genetics.

Keywords- Bioinformatics Omics Agriculture Sustainable development Sequencing technology

STUDIES ON THE BIO-EFFICACY OF CARBOSULFAN IN COTTON (*GOSSYPIUM ARBOREUM*)

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Experiment was conducted during Kharif 2014 and 2015 at research farm of Regional Agriculture Research Station, Khandwa (M.P.) with seven treatments namely, untreated control, carbosulfan 25 EC 250 g a.i., carbosulfan 25 EC 312 g a.i., carbosulfan 25

EC 375 g a.i, fipronil 5% SC, imidacloprid 17.8 % SL and thiamethoxam 25% WG./ha. These seven treatments were tested under randomized block design (RBD) with three replications against aphids and thrips, and also observed the phytotoxicity effect of different chemical treatments on cotton plants as well as record their impact on natural enemies of cotton pests like, Coccinellid beetles and Chrysoperla populations. Seeds of cotton CV. Bunny Bt (BG II) were sown in both experimental years. All the treatments were sprayed when target insect pests incidence was above Economic Threshold Level (ETL) and second application of spray was applied 15 days after first application. Phytotoxicity assessment in cotton was undertaken with by testing three different doses of carbosulfan 25% EC was applied on crop. Phytotoxicity observations were recorded at 1, 3, 5, 7, 10 and 15 days after application of the chemical. The level of phytotoxicity was estimated by visual assessment. The highest percent control of aphids recorded in treatments carbosulfan 25% EC @ 1500 ml/ha after second application. While similarly significantly lowest thrips incidence was recorded in carbosulfan 25 EC @ 1500 ml/ha after both application. Effect of carbosulfan 25 % EC against natural enemies revealed that there is no significant change observed in the population between the insecticidal treatments and the untreated control. Carbosulfan 25% EC @ 1500 ml/ha has recorded significantly highest yield of 16.80 g/ha (2014) and 18.71 g/ha (2015). It was at par with the treatments of carbosulfan 25% EC @ 1250 ml/ha. There was no phytotoxicity symptoms were observed on cotton plants after application of carbosulfan 25% EC @ 1250 ml/ha (x dose) and 2500 ml/ha (2x dose) at 1, 3, 5, 7, 10 and 15 days after application.

Keywords: Phytotoxicity, Natural Enemies, Aphid and Thrips

EFFECT OF VARIOUS SOIL APPLICATION DOSAGES OF RHIZOBIUM MELILOTI ON BIOMETRIC PARAMETERS OF FENUGREEK (*TRIGONELLA FOENUMGRAECUM* LINN.)

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Present investigations on effect of various soil application dosages (10, 20, 30, 40 and 50g) of Rhizobium meliloti on biometric parameters of fenugreek were carried out at department of Plant Pathology. The nine isolates of Rhizobium meliloti were isolated on CR-YEMA medium from root nodules and rhizosphere soil of fenugreek and all the isolates showed positive reaction for biochemical test viz., catalase test, potassium hydroxide and starch hydrolysis test and showed negative reaction for gram's staining. Among the various doses of Rhizobium meliloti, 50 g and 40 g gave highest seed germination (100%), and 50 g dose gave highest root nodules, shoot length, root length, plant fresh weight dry weight and Vigour index at ten and twenty one days after sowing, respectively followed by 40g and 30g

Keywords: Rhizobium meliloti, root nodules, Fenugreek, biochemical test, biometric parameters

IMPACT OF TREATED WASTEWATER AND FRESHWATER ON IRRIGATION UNIFORMITY IN TOMATO CROP UNDER DRIP IRRIGATION SYSTEM

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To study the water distribution uniformity remains one of the most used criteria for irrigation performance evaluation. In this paper, the effects of emitters' discharges spatial-temporal variations on water supply. The experiment was performed in tomato (*Solanum lycopersicum*) crop plot at Jain hills, Jalgaon district (Maharashtra). Emitter's discharges spatial variation measurements were made according to Keller and Karmeli method. These measurements were three replication of two water source (Treated wastewater and Freshwater) throughout irrigation period. Recorded results show that outlets flow rates were significant with 1% level of significance of their nominal value (4 l/h) for all tested emitters. In fact, emitters' discharges minor heterogeneity, recorded within, three replication of treated wastewater were 3.9 l/h, 3.94 l/h and 3.8 l/h but in freshwater uniformity were same for all replication. Because of such water supply spatial-temporal homogeneity obtained in both water source.

Keywords: Drip irrigation; Emitter discharge; Uniformity coefficient, Treated wastewater and Freshwater

STUDIES ON THE PHYSICO-CHEMICAL PARAMETERS OF TREATED WASTEWATER AND FRESHWATER ON TOMATO UNDER DRIP IRRIGATION SYSTEM

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This study was aimed to analyze of physico-chemical Parameters of Treated wastewater and Freshwater on Tomato under Drip Irrigation System at Jain hills, District Jalgaon, Maharashtra. Monthly changes in physicochemical parameters such as water pH, EC, TDS, Calcium, Magnesium, Chloride, Sulphate, Sodium, Potassium, Fluoride, COD, BOD, Carbonates, Bicarbonates, Boron, Ammonia, Copper, Zinc, Manganese, Iron, Lead and Cadmium were analyzed for a period of two trial from 01, 30, 60, 90 DAS in 2017 and 2018 in two water source (Treated wastewater and Freshwater). The results indicated that physico-chemical parameters of the both water source were within the permissible limits in two trials and can be used for irrigation.

Keywords: Drip Irrigation System, Treated Wastewater and Freshwater; Physico-chemical, parameter.

EFFECT OF PRE-TREATMENT BY ONION ON THE QUALITY OF DRIED OYSTER MUSHROOM (PLEUROTUS SAJOR-CAJU)

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In this study, Fruiting bodies of oyster mushroom were pretreated with onion extract and compare it with different pretreated methods. Mushrooms were subjected to blanching or dipping in Potassium metabisulphite (3g/l), or dipping in onion extract solution (10g/l or 20g/l) then oyster mushrooms were dried at 60°C using hot air tray drier. The experimental drying rate data were obtained to compare drying characteristics. Drying of raw mushrooms was taken as a control. For the product quality, rehydration capacity of the dried samples in water at 25°C as well as their color was determined. As expected, the color of onion pre-treated sample was improved as KMS treated sample. Rehydration capacity of onion pre-treated sample was enhanced as compare to control and blanched. Blanching reduced the attractiveness of dry mushrooms; sodium metabisulphite and onion extract improved it. It has been found that pretreatment and drying method affects the course and rate of drying. Samples subjected to hot-air drying were darker than those freeze-dried, which were clearly more attractive. The hot-air dried mushrooms on rehydration were inferior in quality to the freeze-dried samples. Flavor of the onion treated mushroom was not significantly different from that of the KMS treated mushroom.

Keywords: Drying, Oyster mushroom; Rehydration; Color; Pre-treatments; Sensory evaluation

IMPACT OF NHM MISSIONS IN INCREASING HORTICULTURE PRODUCTION

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National Horticulture Mission is a centrally sponsored scheme, the Karnataka state has implemented the developmental activities under the mission in the 30 districts, covering 16 important horticultural crops since from 2005-06 to till. The scheme aims at holistic development of horticulture sector duly ensuring forward and backward linkages, with the active participation of all the stake-holders including farmers and private entrepreneurs. Assistance for a number of components under NHM, particularly for the private sector involving infrastructure development such as nurseries, establishment of lab & clinics, post-harvest management and marketing is in the form of credit linked back ended subsidy. NHM helped in increasing the employment opportunities for the farmers through expansion of area under horticultural crops. The mission envisages production and productivity improvement of horticulture crops including fruits and vegetables through various interventions. Activities such as production of planting material, vegetable seed production, coverage of area with improved cultivars, rejuvenation of senile orchards, protected cultivation, creation of water resources, adoption of Integrated Pests Management (IPM), Integrated Nutrients Management (INM), organic farming, including insitu generation of organic inputs are taken up for development of fruits and vegetables. Capacity building of farmers and technicians are also provided for adopting improved technologies. Scheme also envisages creation of infrastructure for

Post Harvest Management (PHM), Good Agricultural Prices (GAP) and marketing for holistic growth of horticulture sector. The Mission also focuses on promoting processing of horticultural produce and value addition by providing incentives for setting up horticultural processing industries and food parks in potential areas and to encourage linkages between the markets for the horticultural produce and processing industry.

Keywords: National Horticulture Mission, post-harvest management, infrastructure and productivity

IDENTIFICATION OF HOMEBOX GENE UNDER SALINITY STRESS IN LENTIL (LENS CULINARIS)

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Plant profitability is antagonistically influenced naturally's fury as different biotic and abiotic stress. They causes misfortunes worth several million dollars every year because of decrease in yield efficiency and harvest disappointment. In truth they undermine the manageability of horticulture industry. Lentil (*Lens culinaris*) a significant cool season nourishment vegetable, experiences various biotic and abiotic stresses. Lentil contains resource of qualities/protein which help this yield to defeat abiotic stress and recognizable proof of pressure inducible qualities/protein are a significant zone of research. For its examination, preliminary of an abiotic tolerant quality i.e., Homeobox quality is utilized. Stress treatment at four salt focus, (0mM, 100mM, 150mM and 200mM) is given, germination will happen and cotyledons will be gathered and are utilized for genomic DNA separation by CTAB technique. At that point, Homeobox quality is recognized through PCR which will result in amplicon size of 750 bp. In this we infer that the quality presenting salt resistance give establishment of logical improvement of the harvest's profitability under pressure conditions and add to progress and adjustment of harvest yields.

GENETIC DIVERSITY AND RELATIONSHIP ANALYSIS AMONG PEA GENOTYPES (PISUM SATIVUM L.) BASED ON MORPHOLOGICAL TRAITS.

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The present investigation was carried out to identify the nature and magnitude of genetic divergence among fifty five genotypes of Pea for eleven morphological traits using Mahalanobis D^2 statistics. Based on cluster analysis, the genotypes were best fitted into six clusters. The maximum and minimum genotypes grouped in cluster III (14) and minimum were grouped in Cluster IV (4) respectively. The maximum intra-cluster distance was shown by cluster I (D^2 2.543) indicating maximum difference among the genotypes within and the minimum value was shown by cluster II (D^2 =1.827). Maximum value of inter-cluster distance (D^2 =6.471) was recorded between cluster I and cluster IV revealing that the genotypes of these clusters were highly diverse from others and can be used as divergent parents for hybridization and selection. Further, on the basis of variation in cluster means for different character the genotypes in cluster I had highest mean values for number of pods per plant, green pod yield per plant, shell weight per plant and seed yield per plant. Whereas, the genotypes of cluster IV showed maximum mean for days to 50% flowering, plant height, length of first fruiting node and number of seeds per pod. Thus, for getting high heterosis for recovering transgressive segregants, genotypes from cluster I and IV can be used as distant parents in any breeding programme for successful pea improvement.

Keywords: Pea, Genetic Diversity, Morphological Traits

PESTICIDES AND THEIR IMPACT ON ENVIRONMENT

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Pesticides are used to destroy the different type of pests. The use of pesticides in agriculture from early period. It is considered that pesticides are beneficial for crop, but they also left dangerous impact on Environment as well as human being. Excessive use of pesticides cause destruction of biodiversity, threaten for human being. It is estimated that almost 5.2 billion pound pesticide have been used world widely per year. According to WHO report 220,000 death reported by over use of pesticides in developing Countries. Because it is nonspecific, non-targeted due to this property these are harmful for human being and their residue having the property to develop male frog into female frog, declining crop production, food production. So their use in agriculture should be completely banned and try to searching out its alternative, such as ecofriendly approach. There is need of time for integrity of studies and awareness (Education) to different discipline as well as farmers.

Keywords – Pesticides, Environment, Human being, Crop.

AN INVESTIGATION OF BIOCHEMICAL PARAMETERS HYBRID RICE VARIETIES IN THE**SHILPA SINGH****Faizabad region of eastern Uttar Pradesh, India****Research Scholar, Department of Agriculture Biochemistry, N. D. U. A. T. , Kumarganj, Ayodhya, U.P.**

The experiment was carried out at the Department of Biochemistry of Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad as a part of PhD work. The seven varieties of hybrid rice namely- Dhani, US-312, 6201, 6302, 6444, JK-401, PHB-71 and 3 check varieties namely-Swarna, Sambhamah and Pusa Basmati were purchased from local market at Kumarganj, Faizabad from year 2012 to- 14. The results highlighted that, the variety Pusa Basmati found highly superior overall the varieties and noticed, highest reducing sugar (0.34%), protein (8.43%), tryptophan (0.21 /16g N), and methionine (2.16 g/16g N) content. The highest (1.80 %) total mineral content found in Sambhamah followed by (1.66 %) Pusa Basmati and found highly significant and superior over 6201 and lysine (2.13 g/16g N) followed by (1.92g/16g N) 6444 over US-312. The highest (74.71%) carbohydrate content was recorded in Swarna followed by (72.92%) Dhani and highly superior over 6302. Like wise the variety PHB-71 found highest (1.52%) total sugar content followed by (1.25%) Pusa Basmati and highly superior over 6302.

Keywords: Carbohydrate, Protein and Total Mineral, Tryptophan, Methionine and Lysine

PRECISION AGRICULTURE TECHNOLOGY FOR FARMERS PROFITABILITY**SHITAL YADAV¹ AND SONU GET²****¹Ph.D Scholar, Swami Keshwanand Rajasthan Agricultural University Bikaner, Rajasthan****²Ph.D Scholar, Rajasthan Ag. Research Institute, Durgapura (SKNAU Jobner), Rajasthan**

Precision agriculture is an information and technology-based farm management system to identify, analyses and manage spatial and temporal variability within fields for optimum productivity and profitability, sustainability and protection of the land resources by minimizing the production costs. It is an integrated agricultural management system incorporating global positioning system, geographical information system, remote sensing, yield monitor and variable rate technology. Smartphone and tablet applications are becoming increasingly popular in precision agriculture. Precision agriculture contributes in long term sustainable agriculture production and it substitutes information and knowledge for physical inputs. The farmers still use conventional farming system, suggest site specific nutrient management & variable rate technology use in maintaining profitability and reducing fertilizer application. The use of inputs based on the right quantity, at the right time and in the right place increase nutrient use efficiency & profitability by reducing fertilizer dose. There are three steps involve in PA: Assessing, managing variation and evaluation. Technology is advancing towards driverless machinery programmed by GPS to spread fertilizer or plow land. Other innovations include a solar powered machine that identifies weeds and precisely kills them with a dose of herbicide or lasers. Precision agriculture, as the name implies, means application of precise and correct amount of inputs like water, fertilizer, pesticides etc. at the correct time to the crop for increasing its productivity and maximizing its yields. Precision agriculture management practices can significantly reduce the amount of nutrient and other crop inputs used while boosting yields. Farmers thus obtain a return on their investment by saving on water, pesticide, and fertilizer costs.

Keywords – precision agricultural, geographical position system, remote sensing, sustainability

DISEASE CONTROLLING POTENTIAL OF *TRICHODERMA HARZIANUM* AND *TRICHODERMA VIRIDE* AGAINST PURPLE BLOTCH OF ONION**SHWETA SHUKLA AND ASHWAN KUMAR****Indira Gandhi Krishi Vishwavidyalaya Raipur , (Chhattisgarh) India**

Disease controlling potential of Trichoderma strains evaluated in vivo against purple blotch of onion .Ten Trichoderma strains were taken among which nine were Trichoderma harzianum and one Trichoderma viride. Trichoderma viride strain T18 was found to be more effective for promoting plant growth and controlling purple blotch disease under field conditions showing its competence not only in promoting growth but also controlling foliar incidence of purple blotch. Whereas, Trichoderma harzianum strain T3 and T5 were more effective in increasing bulb weight/plant.

Keyword:- Purple blotch, Trichoderma viride, Trichoderma harzianum, disease controlling potential, growth promotion

CULTURAL AND SCLEROTIAL VARIABILITY IN RHIZOCTONIA SOLANI KUHN CAUSING BANDED LEAF AND SHEATH BLIGHT IN FINGER MILLET

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Finger millet (*Eleusine coracana* L. Gaertn) is an important small millet crop grown by resource poor people in the semi arid regions of Asia and Africa. In India, the crop is grown in about 1.02 m ha with production of 1.39 m t and productivity 1363 kg ha⁻¹. Karnataka, Uttarakhand, Maharashtra, Tamil Nadu, Odisha, Andhra Pradesh and Jharkhand are major finger millet growing states in the country. The crop is climate resilient and contributed to food, feed, fodder and nutritional security at farm and regional level. The causal organism of banded leaf and sheath blight, *Rhizoctonia solani* Kuhn is an ubiquitous soil borne fungus and becoming a major constraint in sustainable production of finger millet. In the present study, cultural characters of *R. solani* were studied on eight solid media viz. Potato dextrose agar (PDA), oat meal agar (OMA), Richards agar (RA), corn meal agar (CMA), czapek'sdiox agar (CDA), finger millet leaf extract agar (FMLEA), finger millet seed extract agar (FMSEA) and FMLEA + 2% sucrose. Significant variation in radial growth and sclerotial characteristics of *R. solani* on different media was observed. Radial growth of the fungus ranging from 71.4 to 91.3 mm was maximum in PDA followed by CDA, OMA and CMA medium. Least growth was recorded in FMSEA and Richards agar medium. Colony colour varied from white to pale brown, slight to abundant growth pattern and fast to slow growth rate of *R. solani* on different media was recorded. Sclerotia initiation was observed on 2nd to 3rd day. Variation in number of sclerotia, weight of 10 sclerotia and size of sclerotia was 11.0 to 57.3, 132.0 to 1040.7 mg and 0.3 to 1.2 mm, respectively. Maximum numbers of sclerotia were formed in OMA, whereas weight and size of sclerotia were maximum in PDA. Varied range of sclerotial characters like topography (superficial or immersed), colour (light brown, brown and dark brown), arrangement in petriplates (peripheral, centre or scattered) and clump formation (more, medium or less) was recorded. The result revealed that culture media differentially influenced the growth, sclerotial and colony characters of *R. solani* isolated from finger millet.

SOIL CARBON SEQUESTRATION: PROSPECTS AND IMPLICATIONS

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A continuous increase in the atmospheric concentration of carbon dioxide (CO₂) and other greenhouse gases (GHGs, such as N₂O and CH₄) may alter the pattern of precipitation and mean temperature of the earth. Atmospheric enhancement of greenhouse gases can be checked by either reducing anthropogenic emissions, or sequestering C in plant biomass or the soil. The carbon sink limit of the agricultural and degraded soils is 50 to 66% of the carbon loss of 42 to 78 gigatons of carbon. Soil carbon sequestration can be characterized as the protected stockpiling of carbon in the soil that would some way or another be transmitted to or stay in the atmosphere and it remains securely put away and not released back to the atmosphere. Soil natural carbon sequestration rate relies upon the appropriation of prescribed advances, for example, precipitation, temperature, soil surface and structure, farming system, and soil management. The long term transformation of prairie and forestland to cropland or touching terrains has brought about misfortunes of soil carbon worldwide however there is a noteworthy potential for expanding soil carbon through reclamation of debased soils and appropriation of soil protection rehearses, like crop residue management, fallow management, integrated nutrient management etc. Land-use conversion and soil cultivation have been an important source of CO₂ to the atmosphere. It is evaluated that they are in charge of around 33% of GHG outflows. However, improved agricultural practices can help mitigate climate change by diminishing emissions from agriculture and different sources and by storing carbon in plant biomass and soils. There is need to recognize, create and advance social practices that decrease agricultural emissions and sequester carbon while helping to improve the livelihoods of farmers, especially in developing countries, through increased production and additional incomes from carbon credits.

Keywords: Carbon credits, carbon sequestration, crop residue, greenhouse gases, farming system

BIOPHARMING IN DEVELOPMENT OF PHARMACEUTICAL INDUSTRY

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Biopharming means "Making plants in to factories". The use of designer crops to produce pharmaceutical drugs and vaccines is an emerging technology that offers a low-cost, large scale alternative to current methods. Biopharming or plant molecular farming is the cultivation of crops for a pharmaceutical purpose, giving them the ability to produce desired therapeutic proteins that are then extracted, purified and used by the pharmaceutical industry to produce large molecules, protein based drugs. Biopharming aims to replace very expensive bioreactors (upstream process) by the pharmaceutical industry used for the producing therapeutic modules. These expensive modules can now be expressed in plants through the insertion of the genes that express the proteins. Biopharming

may also cheaper in the process of extracting (downstream process) the desired molecules. Thus, it is the new area of science that combines the use of biotechnology and agricultural plants in order to produce valuable products. These may include Plant Made Pharmaceuticals (PMPs), Plant Made Antibodies (plantbodies) and Plant Made Therapeutic Protein and Intermediate such as human vaccines and proteins, monoclonal antibodies, blood substitute–human hemoglobin, cancer therapeutic antibodies, interferons, edible vaccines for hepatitis-B, human growth hormone, proteins to treat diseases like HIV, CF, and Hypertension etc. The first genetically engineered plant-derived protein (PDP) was human serum albumin, initially produced in 1990 in transgenic tobacco and potato plants. The biggest challenge in plant molecular farming is a negative public perception towards GM crops, owing predominantly to safety concerns relevant to human health and to the environment. Thus far, no scientific has been published indicating that currently commercialized GE crops have a negative effect, but further scientific investigation is required for each individual case. Though biopharming is in very early stages, scientists in several nations have serious interest in this field, and some funding is beginning to emerge.

Keywords – biopharming, pharmaceuticals, designer crops, vaccines, therapeutics

INTEGRATED DISEASE MANAGEMENT OF GUMMOSIS OF CITRUS (*PHYTOPHTHORA PARASITICA*, *P. PALMIVORA*, *P. CITROPHTHORA*)

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The disease caused by *Phytophthora* spp. causes immense losses in all the citrus growing regions around the world among all the soil borne pathogens. The large scale destruction of citrus plant due to *Phytophthora* infection was recorded in Azore Island in the year 1836. Later, the epidemics of this disease were reported in several countries including France, Portugal, Italy and Brazil. Gummosis results into infection of the bark near the ground level by oozing of sap from small cracks in the bark giving the tree bleeding appearance. The gum being water soluble can easily be washed off during heavy rain. Major losses are seen in fruit yield and canopy volume of plant. Losses can also be observed in flood irrigated orchards and in plants which are closely spaced. Plants of age 20 to 25 years are comparatively less susceptible to losses. Since, it is soil borne disease, so it's necessary to select disease free planting material and resistant varieties to avoid the incidence. The seed treatment is done by exposing the seeds to hot water at 48.9°C for 4 to 10 minutes. To dodge the introduction of disease, strict quarantine and sanitary measures should be adopted. The contact of water with tree trunk can be avoided by adapting the ring method of irrigation injected with electrolytically generated chlorine that effectively kills the propagules of *Phytophthora*. Application of *Trichoderma harzianum* along with Bordeaux paste and Copper oxychloride has been found effective for recovery from the disease. Phytoextracts such as Garlic bulb extract, Neem extract and Tulsi extract can be also used as biopesticides for the recovery. The infected portion can be scrapped out with a sharp knife and the cut portion is disinfected with Mercuric chloride (0.1%) or Potassium permanganate (1%) by using swab of cotton. Above the ground level, the stem is painted up to 1m with Bordeaux which helps in controlling the disease. The disease is also effectively controlled by spraying or drenching with Ridomil MZ (72@2.75 gm/ltr) or Aliette (2.5g/ltr). Furthermore, pathogen recovery can be seen in the application of Al ethylphosphite but is not seen in soil or root if Metalaxyl is applied.

EFFECT OF BORON, UREA AND GA₃ ON THE VITAMIN C CONTENT OF BROCCOLI (*BRASSICA OLERACEA* VAR. ITALICA)

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Acclaimed widely as one of the most fastly popularized vegetable, Broccoli (*Brassica oleracea* var. italica), is undoubtedly one of the most nutritious vegetable too. It is also rated as one of the most remunerative cole crops. Vitamin C, also known as ascorbic acid, is necessary for the growth and development of the body as well as it plays a very significant role in the immune system of the body. It is an essential vitamin, as it cannot be produced by the body so must be supplemented from outside. Broccoli is a good source of Vitamin C. To assess the impact of foliar spray of boron, Urea and GA₃ on Vitamin C content in of broccoli cv. FIESTA under Ranchi condition, experiments were carried out at the Department of Horticulture, Birsa Agricultural University, Ranchi, Jharkhand during winter season of 2013-14 and 2014-15, The experiment was done in Randomized Block Design having sixteen different treatments with three replications. It was recorded that Boron, Urea and GA₃ all had affected the Vitamin C content of Broccoli. Treatment T₁₅: (Urea 0.5%)+GA₃(75ppm)+B as borax (2%) had resulted in highest Vitamin C Content i.e. 83.42 mg/100 g, which was recorded at par with T₅ i.e. GA₃@50ppm, T₉, B as borax@ 2.0% and T₁₄: (Urea 0.5%)+GA₃(50ppm)+B as borax (1.5%).. However T₃, Urea (1.5%) had recorded the lowest value.

Keywords: Broccoli, Foliar spray, Vitamin C.

DEVELOPMENT OF A VALUE ADDED AMLA PRODUCTS**SUMAN DEVI¹, ENA GUPTA²****1. Department of Food Science, C.S.A. University of Agriculture and Technology, Kanpur****2. Department of Food and Nutrition, University of Allahabad, Allahabad-211002, India.**

Emblica officinalis commonly known as Indian gooseberry or Amla, is perhaps the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda. Vitamin C, tannins and flavonoids present in amla have very powerful antioxidant activities. Due to rich Vitamin C, amla is successfully used in the treatment of Diabetes mellitus. It is one of the oldest Indian fruits and considered as “wonder fruit for health”. Amla pulp of fresh fruit contains 200–900 mg/100 g of vitamin C. Ascorbic acid retention was found to be decreased with increase in temperature. The fruit is highly perishable in nature and is available for short period from October to January. The excellent nutritive value and therapeutic value of amla fruit. Processed form of Amla fruit like murabbas, candy, dried chips, jelly, sauce, pickle, squash and syrup. Therefore, present study was undertaken to develop a value added Amla products. Amla bhujia was prepared from gram flour, amla pulp or amla powder with spices. Amla was incorporated at different form (powder and pulp). Amla Bhujia prepared was done using nine point hedonic scale. The Comparison of three samples B₁ (Gram flour with amla pulp), B₂ (Gram flour, amla powder, spices, oil with citric acid) and B₃ (Gram flour, amla powder, without citric acid). The result of study was revealed that according to sensory evaluation of amla bhujia were most overall acceptability for sample B₁ (gram flour with amla pulp) by judges using 9 point hedonic scale. Whereas Amla products beneficial to health and combat the nutrition.

Keywords: Amla; Medicinal uses, Diseases, Vitamin C, Sensory

VALUE ADDITION IN TROPICAL FRUIT CROPS**SUMAN YADAV¹, SONU GET², SHITAL YADAV³**

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Ber, Bael, Jackfruit, Jamun, Amla, Phalsa, Sapota Custard apple, Guava, Mango, Pineapple, Pomegranate, Tamarind and wood apple are the main tropical fruit crops. Joint effort of R&D institutions, farmers, government agencies and the trade has resulted in India as an emerging major producer of fruits in the world. Tropical fruit crops have potential for development of wastelands through planned strategies, need comparatively less water than food crops, provide higher employment opportunity and environment-friendly. Tropical fruits crops are nutritious, delicately flavoured and attractive natural foods of high therapeutic value so rich sources of vitamins, minerals and dietary fibers. Therefore value addition of such fruits by formulation of different value-added products are an important source of nutritional security. Value addition is the extra value created over and above the original value of something. Fruits have unlimited potential in the processed form and consumers all over world can get opportunity to enjoy the fruits in the form of their processed products. Some processed products of these fruit crops are juice, RTS, nectar, squash, cordial, jam, preserve, amchur, pickle, chutney, canned product, fruit powder, concentrate, jelly, cheese, toffee, vinegar, syrup, candy, wine, dried product, marmalade, cider, pickle etc. Due to the seasonal availability, efforts are made to process the fruits in large quantity to extend the shelf life and to make them available during rest of the year and in the areas where they are not available. Such as the RTS drinks conserved the natural color, flavor, aroma, and taste of fruit for 8-12 months and were within required parameters. Sales were continued for four years but profits were marginal due to small-scale production and marketing. Demand for processed fruit products, market share, and profits could be increased. Awareness on benefits of these products and market promotion is necessary.

Keywords – value addition, tropical fruits, processing, processed fruit product, RTS

STUDY ON EFFECT OF YIELD ON BANANA THROUGH PRECISION FARMING.***SUMIT BISWAS****Dept. of Fruit Science and Horticulture Technology, Shri Ram College of Agriculture, Thakurtola, Rajnandgaon (C.G**

The present investigation was carried out at All India Coordinated Research Project On Fruits (Banana), C.A., O.U.A.T., Bhubaneswar. The study consisted of five different treatment combination T1- Drip irrigation with 80% ER + Fertigation with 80% ER + Micronutrient foliar spray (Banana Shakti 2%) + Bunch spray of Sulphate of potash (2%) + Polyethylene mulching (100- micron thickness) T2- Drip irrigation with 80% ER + Fertigation with 80% ER + Micronutrient foliar spray (Banana Shakti 2%) + Bunch spray of Sulphate of potash (2%) T3- Drip irrigation with 80% ER + Fertigation with 80% ER + Micronutrient foliar spray (Banana Shakti 2%) T4- Drip irrigation with 80% ER + Fertigation with 80% ER + Bunch spray of Sulphate of potash (2%) T5- Soil application of region of specific RDF+ flood irrigation (Control). The result revealed that treatment with Drip irrigation with 80% ER + Fertigation with 80% ER + Micronutrient foliar spray (Banana Shakti 2%) + Bunch spray of Sulphate of potash (2%) + Polyethylene mulching (100- micron thickness) recorded maximum yield, viz. bunch weight (26.12 kg), hands per bunch (10.5), finger per bunch (173.34), finger weight (150.81 g), finger length (22.34 cm), finger girth (12.92 cm), pulp weight (108.61

g), pulp to peel ratio (2.57), acidity (0.44 %) yield (80.61 t/ha). Whereas peel weight (42.20 g) recorded significantly maximum in treatment T2 and TSS (20.02o B) maximum in T5 control which was found to be superior than other treatment taken during the investigation.

Keywords- Banana, Micro-nutrient, Drip, Fertigation.

SURVEY AND INCIDENCE OF ROOT KNOT DISEASE IN VARANASI

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Tomato (*Solanum lycopersicum* L.) is an important popular vegetable crop grown in the world. Being a relatively short duration crop with high yield and returns, its cultivation area is expanding regularly. Prevention of pests and diseases in tomato are extremely important. Tomato plants are susceptible to several fungi, bacteria, viruses and nematodes. Root-knot nematodes (*Meloidogyne* species) are microscopic and parasitic which can be found in the roots of infected plants. Under *Meloidogyne* genus, there are about 98 species and common species encountered by farmers are *M. incognita*, *M. javanica*, *M. hapla*, and *M. arenaria*. Root knot nematodes (*Meloidogyne* species) are known to attack tomato in many different parts of the world. They cause galls (infected swellings) on plant roots. Tomatoes are host to several species of root-knot nematodes (*Meloidogyne* species). Biological control of disease by using nematophagous fungi seems to be safe, eco-friendly and need based. These fungi comprise more than 700 species found in all major taxonomic groups including lower (oomycetes, chytridiomycetes, zygomycetes) and higher fungi (ascomycetes, basidiomycetes and deuteromycetes). The nematode trapping or predaceous fungi, endoparasitic fungi, and fungi that produce metabolites toxic droplets to kill nematodes. A preliminary survey was carried out to find the status of the root knot nematodes associated with the root zone of tomato in 30 locations in and around Varanasi district (Uttar Pradesh). Total 1068 root samples were collected and 575 root samples were detected to be infected with root-gall diseases in all fields surveyed in thirty locations. Therefore, overall incidence of the disease was 54%. Locations wise variations in the incidence of the disease were, found. On the basis of perineal pattern characteristics the two species of root-knot nematodes *Meloidogyne incognita* and *M. javanica*, were identified to infect tomato in different locations included in the surveyed fields. Both the species were either found singly or in mixed population. Maximum root-gall disease was found in village Gahura followed by Bhoranpur, Bahupur, Bandepur villages whereas minimum in Kaparphorvan village followed by Sajai and Siharva villages.

EFFECTS OF SODIUM FLUORIDE IN PLANT SEEDLINGS ON AMYLASE

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Numerous enzymes are involved in the breakdown of starch during germination. These include alpha-amylase, B-amylase, maltase, debranching enzymes, limit dextrinase, and starch phosphorylase. Although the end products of starch breakdown by phosphorylase are glucose-1-phosphate and limit dextrin, the final product from reactions catalyzed by other enzymes is result glucose. In the germinating seed, the sugar thus formed is used as a primary source of energy and as a starting material for synthesis of cellular components required for growth and development of the seedlings. Inhibition of amylase by fluoride, an important influence that this micro mineral element has on energy metabolism in germinating seeds. The markedly impaired germination observed in seedlings exposed to even low concentrations of sodium fluoride may be partly attributed to fluoride inhibition of amylase. The addition of CaCl₂ greatly alleviated the fluoride-induced inhibition of amylase implies that Ca²⁺ ions may be required for its activity. Recently, reported the possible role of calcium in the biosynthesis and secretion of α-amylase in rice. It is possible that, once absorbed into the tissue, fluoride may react with Ca²⁺ ions, causing enzyme inhibition. The presence of 5 mM CaCl₂ resulted in much higher enzyme activity than 10 mM CaCl₂. The reason for this is not known. It is possible that high Cl⁻ ion concentrations may be inhibitory. Seedlings exposed to fluoride contained more sugars than control tissues. Because amylase was inhibited by fluoride, it may be concluded that the sugar accumulation is not due to enhanced starch breakdown. Relatively, it may be due to impaired utilization of glucose produced during germination.

Keywords: amylase, fluoride, germinating seed, energy

IMPACT OF DIFFERENT PROTECTED CONDITIONS ON FLOWERING ATTRIBUTES AND PHYSIOLOGICAL TRAITS OF ORIENTAL LILY CV. WHITE CUP**SUNITAKUMARI*, SANTOSH KUMAR** AND C. P. SINGH******SRF* and Professor**, Department of Horticulture, G. B. Pant University of Agriculture and Technology, Pantnagar**

The present investigation was conducted at Model Floriculture Center of G. B. Pant University of Agriculture and Technology, Pantnagar during the year 2016-17 and 2017-18. The experiment was laid out in completely randomized design with two treatments and fifteen replications under polyhouse and shade net conditions. Most of the flowering attributes like number of buds per plant, duration to bud initiation and spike harvest, length and width of basal and upper bud, diameter of basal and upper flower and vase life were found superior under polyhouse conditions as compared to shade net house conditions. The physiological traits like total chlorophyll (mg /gm Fresh weight), nitrogen, phosphorus and potassium content in leaves were found maximum under polyhouse conditions as compared to shade net house conditions.

Keywords: Polyhouse, shade net house, flowering and physiological.

NON-THERMAL PRESERVATION TECHNIQUES FOR ENHANCING QUALITY AND SAFETY OF FOOD PRODUCTS**SUSHANT BHARDWAJ¹, SACHIN², V.K. SINGH³, M.K. GARG⁴ AND ARVIND⁵****^{1, 2, 3} Department of Processing and Food Engineering, CCS Haryana Agricultural University, Hisar, Haryana.****⁵ VIAET, SHUATS, Prayagraj, U.P**

Food is considered as the primary source of biologically active compounds which are essential for human well being. They are perishable that requires coordinated actions by growers, storage operators, processors, and retailers to maintain their quality. Mainly Foods are processed by applying the thermal treatments on them; this will reduce the nutrient content, loss of flavor and loss of texture. Recent advances in shelf life extension have been achieved by the non thermal technologies which do not affect the nutrient composition and flavor loss. These postharvest treatments aim to minimize quality loss, microbial spoilage and reduce the risk of pathogen contamination. Different non thermal technologies involve physical, chemical and gaseous treatments like hurdle approach for processing of fresh fruit and juice products using high hydrostatic pressure (HHP), pulsed electric fields (PEF), ultraviolet (UV) light, Cold Atmospheric plasma, E-beam processing, Ultrasonics and Membrane separation. Non thermal technologies can be applied to maintain fresh-like quality without compromising the sensory and nutritional aspects. Future research should focus on improving organoleptic quality and meeting safety standards of fresh produce at all steps of the supply chain.

Keywords: Non-Thermal technologies, High Hydrostatic Pressure, Pulsed electric field

MINERAL CONTENT ADVERSELY AFFECTED BY VARYING CONCENTRATION OF CR (VI) IN SORGHUM BICOLOR (L.).**SWEETY SIHAG*, AND U. N. JOSHI****Department of Chemistry and Biochemistry, CCS Haryana Agricultural University, Hisar (Haryana) India**

Sorghum (*Sorghum bicolor* L.) moench is the world's fifth most important cereal crop, behind rice, corn, wheat and barley and the third leading crop in the USA. It is cultivated for food, feed, fodder and the production of alcoholic beverage, but extensively grown for fodder in north India during summer and kharif season due to its greater adaptability, high fodder yield, better palatability, quality and digestibility. It gives higher fodder yield under adverse and poor management conditions. But it is affected by environmental factor such as heavy metals that reduce its productivity. The present investigation had been planned to find out toxic effect of chromium (VI) on sorghum which is an important fodder crop. Sodium, chromium and Zinc content were increased, whereas potassium and iron content decreased with increasing concentration of Cr (VI). A pot experiment was conducted to determine the effects of varying Cr (VI) levels [0.0–4.0 mg Cr (VI) kg⁻¹ soil in the form of potassium dichromate] on the quality parameters and mineral content of sorghum. The present investigation showed that the mineral content contains micronutrients (chromium, zinc and iron) and macronutrients (nitrogen, sodium and potassium) estimated at different growth stages, i.e. 35 DAS, 70 DAS and 90 DAS (Days after sowing) that were adversely affected with an increase in Cr (VI) levels from 0.0 to 4.0 mg Cr (VI) kg⁻¹ soil.

Keywords: Macronutrients, Micronutrients, Chromium toxicity, Sorghum bicolor

BIO-NANOTECHNOLOGY-A TOOL FOR SUSTAINABILITY AND BIOTIC AND ABIOTIC STRESS MANAGEMENT**TABISHJEHAN BEEN, ATUFA ASHRAF¹, SAMEENA MAQBOOL² AND SANNAMANZOOR****Division of Fruit Science, ¹Division of Plant Pathology, ²Division of Vegetable Science
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Plants being immobile are continuously exposed to different kinds of stresses i.e., biotic and abiotic stresses through various pathogenic attacks or through environmental vicissitudes. Therefore, identification of such plant material which can be resistant to these stresses is an area of prime concern. Nanobiotechnology alias nanobiology or bio-nanotechnology can be an effective way out to combat these stresses. Thrust, however, nowadays is mostly given on the biological/green synthesis of these nanoparticles employing plants/plant extracts. No other specialized technology can combine the activities of sustainable agriculture so productively with compatible sustainable practices. This technology when applied to sustainable agricultural processes, can lead to precise application of chemicals and improved plant growth. Due to high surface/volume ratio, the bioavailability and bioactivity of these nanoparticles is greatly increased; which makes them potent enough to be expended for augmenting plant growth, development and productivity, and biotic and abiotic stress tolerance. This, in turn, can be achieved through the use of nanofertilizers or encapsulated nutrients which can act as a suitable alternative to the efficient use of resources and can be a solution to decreasing soil fertility due to the enhanced use of chemical fertilizers and pesticides. Among the abiotic stresses, drought, salinity, alkalinity, submergence and mineral toxicity/deficiencies are considered as major factors that contribute to decreasing crop growth and productivity. Hence, the use of TiO₂, SiO₂ NP's (to increase seed germination), SiO₂ NP's (for drought tolerance), Si NP's (to improve stem growth, and maintain water potential in stressed plants) and ZnO NP's (to increase seed germination and germination rate) can be an effective way out. Furthermore, nanobiotechnology, with the aid of non-carrier based formulations and sensitive nano-biosensors, can be intended for the early detection of phytopathogens to increase crop throughput and biotic stress tolerance. Hence, this technology holds a bright future for sustainable agricultural development.

ROLL OF MANUAL SUGARCANE SCRAPER-CUM-CUTTER FOR ENHANCING JUICE AND JAGGERY QUALITY**TRISHLA SAHU* AND S.I. ANWAR****Department of Agricultural Processing and Food Engineering, SVCAET & RS, FAE, I.G.K.V., Raipur, (C.G.), India**

Jaggery (Gur) is one of the important products of sugarcane in India. For quality juice and jaggery making, sugarcane needs to be cleaned before crushing. A manual sugarcane scraper-cum-cutter designed and developed at ICAR-IISR, Lucknow was used for manual cleaning of sugarcane. To evaluate extent of cleaning was done in three modes i.e. light, medium and heavy cleaning and compared with uncleaned cane for comparison of results in terms of impurities removed. Maximum impurity removed in heavy cleaning (16.721 g) whereas the minimum by light cleaning (3.448 g) so that the heavy cleaning are found to be superior for improving juice quality and jaggery quality. It was found that colour values (L*, a*, b* values) of Compared juice and jaggery colour values of obtained from manually cleaned canes and uncleaned in which best quality of juice was found by manual cleaning.

Keywords- Sugarcane, sugarcane scraper-cum-cutter, jaggery and juice.**STUDY ON POPULATION DYNAMICS OF TUR POD BUG AND FLOWER THRIPS IN PIGEONPEA****UMASHANKAR, M.A. ALAM, SACHIN KUMR JAISWAL AND KRISNA**

The population dynamics of tur pod bug (*Clavigrella gibbosa*); Hemiptera: Coreidae and flower thrips (*Megalurothrips usitatus*); Thysanoptera: Thripidae) in pigeonpea under the agroclimatic condition Rewa district during kharif 2016-17. Studies conducted on the population dynamics of Pigeonpea pod bug in the agro climatic condition of Rewa region indicated appearance of tur pod bug infestation was recorded in the 4th week of October (i.e. 43rd SW 2016) with an average population of 0.34 bugs (N&A) per five plants and entire the month (October 2016). The higher population of the bug was observed in the month of November 2016, with a record of peak population of 5.8 bugs (N&A) per five plants in the 3rd week of November (47th SW). The pod bug population was found decreasing from 4th week of November (48th SW) and completely disappearance in the 2nd week of January 2017 (2nd SW). Studies conducted on the population dynamics of Thrips appeared in 3rd week of October 2016 (42nd SW) with an average population of 4.86 thrips per 10 flower. The higher population of flower thrips was observed during the 47th SW (i.e. 3rd week of November) with of peak population of 47.93 thrips per 10 flowers the population of thrips was started decline from the 4th week of November (48th SW) and complete disappearance in the 2nd week of January 2017.

Keywords – Population, Tur pod bug and Flower thrips

LAND RESOURCES LAND USE PLANNING AND MANAGEMENT IN NEPAL**UTTAM SAGAR SHRESTHA****Padmakanya Multiple Campus, Tribhuvan University, Kathmandu Nepal**

Land is the basic natural resources for the sustainable economic growth where all the human activities take place. The scientific land use planning and management is essential for the overall economic growth. Keeping this in view Nepal Government has laid down on the exercise of Land Use Planning and Management from the fifth five year plan(1970-1975) to the fifteenth five year plan (2019-2024). In this scenario, the present paper tries to review the land use change policies for best utilization and conservation of arable land. The research is based on text-mining method for information retrieve. It concludes that only the changing policy is not sufficient but issues related to abandonment of farm land, internal migration and development paradigm should be changed from the strategic level. The uncontrolled and haphazard encroachment in state land and cultivated land is increasing. This is really a challenge to the country where only 27 per cent land is under cultivation and agricultural sector contribute 32 per cent in national economy. Similarly, due to internal and external migration, the land abandonment process is increasing in the country. The situation will lead to scarcity of fertile land resources; severe threat to food scarcity. In order to manage such risks a national Land Use Policy, 2013 A.D (2069) was adopted to prioritize the protection of arable lands ensuring food security. So strong mechanism to control such land use changes are very crucial to manage food deficit in the country.

Keywords: land use, agricultural land, policies, food scarcity

CHARACTERIZATION AND IDENTIFICATION OF PROMOTER FROM RICE (*ORYZA SATIVA*)**ABHISHEK SINGH AND R.S. SENGAR****Deptt. of Agricultural Biotechnology, College of Agriculture, S. V. P. University of Agriculture and Technology, Meerut**

A large proportion of world's population depends on rice for food. Rice contributes to human nutrition up to 20% of the calories consumed worldwide. Asia, with 145 million ha yielding more than 650 million tonnes, is the main world rice producer accounting for 90% of the total. Europe contribution is limited to 3-4 million tonnes that result from a cultivated area of about 700,000 ha. Rice is grown in a wide range of environments characterized by different temperatures, climates and soil-water conditions. It can grow in areas well-suited for other crops. Abiotic stresses, such as drought, high salinity, high or low temperatures, flooding, high light, ozone, low nutrient availability, mineral deficiency, heavy metals, pollutants, wind and mechanical injury, all represent a serious threat to sustainable rice production. Among them, drought and high salinity are the two main causes of yield losses worldwide. Rice is fruit sensitive to various kinds of stresses that limited hangs on impact specifically during the seedling reproduction gametogenesis and flowering stage and exposure can lead to reduced survivability of seedling as well as increased spikelet sterility which successively reduces grain yield. The demand is increasing for food security because of population growth and environmental challenges triggered by climate changes. This scenario has led to more interest in developing crops with greater productivity and sustainability. Rice is an important model monocot and cereal crop in different part of worlds. A period of time the rice genome sequence has been published and annotated in 2005, relatively little is know about the transcriptional network that regulate rice gene. The process of genetic transformation, a major tool for crop improvement, utilizes promoters as one of its key elements. Those promoters are generally divided into three types: constitutive, tissue specific, and condition-dependent. Transcriptional control of a constitutive promoter often leads to reduced plant growth, due to a negative effect of accumulated molecules during cellular functions or energy consumption. To maximize the effect of a transgene on transgenic plants, it is better to use condition-dependent or tissue-specific promoters. However, until now, those types have not been as widely applied in crop biotechnology. These promoters can be utilized to fine-tune desirable agronomic traits and develop crops with tolerance to various stresses, enhanced nutritional value, and advanced productivity.

Keyword: Rice, Promoter, Stress, Transgene, Biotic, Abiotic

DOUBLING FARMERS INCOME PROGRAMME: AN APPROACH FOR SOCIO-ECONOMIC UPLIFTMENT FOR THE DIVERSIFIED FARMING COMMUNITY IN WEST KAMENG DISTRICT OF ARUNACHAL PRADESH**V.K. MISRA, N.D. SING, C.P. SINGH*, PEM THINLEY, T.S. MISHRA, N.K. MISHRA, SANGE CHOM THUNGON****K.V.K West Kameng, Dirang Arunachal Pradesh - 790 101, *F.E.T.C Colonelganj Gonda U.P.**

In India about 70% of the total population, depends on agriculture / allied sectors and lives in rural areas for their livelihood at subsistence or near subsistence level. These rural folk require not only a large supplement of nutritional food for their daily routine work but also needs new sources of gainful employment for their overall development. In view of the above facts a prestigious Doubling Farmers Income Programme has been started by the K.V.K West Kameng from the year 2017 to uplift the socioeconomic status of famers in the district. The seven villages from the various location of the district has surveyed for the said purpose by the KVK West Kameng where there were sufficient available resource to implement the programme beside some constraints. The name of villages is Sagar, Barchipam, Lachang, Khasso, Chug, Khalibhok and Yewang respectively. After the

survey a meeting has been conducted by the K.V.K with the district administration, line departments and other related departments to select the one village among these villages for the said purpose. After meeting it has decided by District Administration and all the other stakeholders that we have to work in Chug Village which comes under Dirang circle of West Kameng District Arunachal Pradesh. This district lying approximately between 91° 30' to 92°40' East longitudes and 26° 54' to 28° 01' North latitudes and covers about 7422 Sq.KM of geographical region accounting for 8.86% of the total area of the state. After the village selection the porogramme was immediately started by the K.V.K West Kameng through the involvement of farming community of the village including men and women both, as they plays an important and major role especially at household level for the upliftment of their family socioeconomic status. After the mass awareness as well as mass training programmes by the different experts of the K.V.K on related topics the seed of improved varieties of different crops like Pulses, Oil-Seeds, Vegetables and also fish fingerlings along with feed were distributed to farmers. They were also facilitated with different commodity which may be beneficial in integrated farming system, like poultry birds, Ducklings and goat also for rearing to improve their livelihood and nutritional status. The farmers were also trained about allied activities like mushroom farming and vermi-composting for income generation. After the tow years study (2017-2019) the data recorded revealed that the programme has a very good response in term of improved income and nutritional status of the farmers and their dependents besides the new source of employment opportunity through various suitable related sectors like nursery production of horticultural crops and seed rearing of different varieties of fish which provides not only the well acclimated culture material but also becomes a very good means of income generation.

Keywords: D.F.I, socio-economic upliftment, diversified, commodity, I.F.S, Ducklings, culture material etc.

GENETIC VARIABILITY, HERITABILITY AND GENETIC ADVANCE AS PER CENT MEAN IN TURMERIC (*CURCUMA LONGA L.*) GENOTYPES

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The investigation was undertaken on nineteen genotypes of turmeric (*Curcuma longa L.*) with a view to assess the genetic parameters in respect of yield and yield determining characters. The highest percentage of phenotypic and genotypic coefficient of variation was observed in number of tillers, leaf area, number of secondary rhizomes, length of mother rhizome, fresh weight of rhizome per plant, dry weight of rhizome per plant, yield per plot, estimated yield per ha, curcumin content, and oleoresin content. High heritability was observed for plant height (92), number of tillers (63), leaf length (89), leaf width (63), leaf area (99), number of secondary rhizomes (91), length of mother rhizome (88), fresh weight of rhizome per plant (97), dry weight of rhizome per plant (87), duration of the crop (95), dry recovery of rhizome (89), curcumin content (91), oleoresin content (92) indicating that these characters are important in crop improvement. Highest estimates of heritability observed for Leaf area (99) and Fresh weight of rhizome per plant (97), could be utilized for the improvement of fresh turmeric yield through clonal selection.

Keywords: Turmeric, Genetic variability, Heritability and Genetic advance as per cent mean.

PERFORMANCE OF PEA (*PISUM SATIVUM L.*) WITH RESIDUAL PHOSPHORUS IN COAL MINED HEAVY METAL POLLUTED SOIL OF JAINTIA HILLS

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Due to extensive coal mining, large areas of Jaintia Hills district of Meghalaya had turned into heavy metal polluted land, creating unfavourable condition for plant growth. Owing mostly to existing acidity related phosphorus (P) stress, average crop productivity in acid soil regions like Meghalaya is very low, that further dropped coupled with heavy metal pollution in these soils as phosphorus and heavy metals interact in soil resulting in the formation of insoluble metal phosphates which adversely affect the absorption, translocation and assimilation of P by plants. Therefore, a pot culture experiment was conducted taking maize as a phytoremediating crop superimposing eleven P levels viz., 0, 10, 20, 30, 40, 50, 60, 70, 80, 90, 100 mg P kg⁻¹ soil in heavy metal polluted soil collected from Jaintia hills district, Meghalaya to phytoremediate the polluted soil. As in acid soils, the residual effects of P fertilizer can persist for as long as 5-10 years (or more), depending on the initial P fertilizer rate applied, crop removal and soil buffering capacity, an another pot culture experiment was carried out during rabi 2017-18 at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Umiam utilizing the phytoremediated soil by maize (*Zea mays*) to assess the performance of pea (*Pisum sativum L.*) cv. Arkel with residual phosphorus under Completely Randomized Design (CRD) and replicated thrice. The residual P levels corresponding to the above imposed doses are 1.4, 2.13, 3.08, 4.41, 6.26, 8.71, 11.73, 15.48, 19.98, 25.63, 32.37 mg kg⁻¹ soil, respectively. The experimental results revealed that plant height, number of pods plant⁻¹ and number of seeds pod⁻¹ of pea is markedly increased with the increasing levels of residual P up to the highest level of residual P. The lowest plant height (25.50 cm), number of pods plant⁻¹ (3.03) and number of seeds pod⁻¹ (2.9) was observed under lowest residual P (1.4 mg P kg⁻¹) which significantly improved by 39, 76 and 56%, respectively in the highest residual P (32.37 mg P kg⁻¹). Similarly, the seed and

straw yield of pea significantly and markedly increased with the increasing level of residual P. The highest seed (16.8 g) and straw yield (44.24 g) was observed under highest residual P, which were 11 and 10 fold more in comparison to that received with lowest residual P. It may be concluded from the present investigation that the increasing residual soil available P maintained by higher P application rate under first pot culture experiment may be utilized and almost normal yield of pea cv. Arkel can be achieved with the highest residual P (32.37 mg P kg⁻¹ soil).

Key words: Heavy metal polluted soil, coal mining area, Jaintia hills, residual P, pea, growth and yield.

ESTIMATION OF TOTAL PHENOL CONTENT IN MALFORMED TISSUE OF MANGO (MANGIFERA INDICA L.) AS AN INDICATOR OF FUSARIUM MANGIFERAE INFECTION

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Mango holds a place of pre-eminence amongst the major tropical fruit crops and India is a major producer and chief exporter of mango in the world. Mango suffers from several diseases and disorders during its life cycle. Among the known diseases of mango, malformation is considered as the most destructive disease as it causes heavy economic losses of about 50-80 per cent on global basis. The malady appears in two forms viz., vegetative and floral. In vegetative malformation, the seedlings produce small shootlets bearing a cluster of small scaly leaves. Apical dominance is lost in affected seedlings. The multi-branching of shoot apex with scaly leaves is known as Bunchy Top or Witch's Broom (Bhatnagar and Beniwal, 1977). In floral malformation rachis is thick, shortened and highly branched with large number of flowers. The flowers are mostly male and rarely bisexual. In malformed panicles flowers are sterile and thus, fruit set is affected, leading to yield loss. Mango malformation disease occurs as the result of accumulation of ethylene under stress in plant parts following infection with *Fusarium mangiferae*. In response to fungal infection several defence related compounds like total phenols accumulate in malformed plant tissues. In the present study overall phenol content in leaves was estimated by the method described by Bray and Thorpe. In malformed tissue samples of five commercial mango varieties collected from different states recorded an increase in total phenol content. Total phenol content in healthy vegetative tissue of Amrapali was 51.00, 52.00, 53.50, 55.30 and 54.30 mg phenol/ 100 g of leaf tissues in Bihar, Jharkhand, Uttar Pradesh, Uttarakhand and Delhi, respectively and that in malformed vegetative tissue was 75.00, 81.00, 79.80, 76.38, 75.80 mg phenol/ 100 g of leaf tissues in Bihar, Jharkhand, Uttar Pradesh, Uttarakhand and Delhi, respectively

Keywords: Total Phenol Content, Mango, *Fusarium mangiferae*, Malformation

NEXT GENERATION SEQUENCING: A TOOL FOR MOLECULAR BREEDING

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Plant breeding deals with the estimation of genetic variation and mechanism of heredity. Earlier the genetic variation is captured by using molecular marker now with evolution of high throughput technique the next generation sequencing allow characterization and modification of genes and metabolic pathways as well as the use of genetic variation for studying the species diversity. DNA sequencing is the determination of nucleic acid sequences of DNA segment. This technique helps in identification of genes, regulatory elements and analysis of genome structure, this information improve our understanding of role of genes in development and evolution and facilitate the discovery of related genes, function across species, larger genetic regions, full chromosomes, or entire genomes of any organism For eg.- Potato genome sequencing was successfully constructed using a combination of illumina, 454 and Sanger reads. All NGS technology are massively parallel system relying on the immobilization of millions or upto billions DNA templates in a solid surface. It is used to describe number of different modern technologies including: pyrosequencing, illumina sequencing, SOLiD sequencing, Roche 454 sequencing, Ion torrent sequencing. This technology does not use hectic gel electrophoresis method instead it rely directly on in-situ based detection and extension. These technologies enable more quickly and cheap sequencing of DNA and RNA segments than the used method like Sanger and Maxem-Gilbert. The knowledge of DNA sequence of genes and other part of genome of organism has become indispensable for basic research studies biological process as well as applied field as diagnostic and forensic research.

Keywords: Sequencing, variation, Gene, DNA and RNA, NGS

MARKETING OF FISH IN UDAIPUR DISTRICT OF RAJASTHAN**VARUN MISHRA¹, NEERAJ PATHAK², ARCHIT SHUKLA³, BRAHMA NAND SHUKLA⁴**¹College of Fisheries, MPUAT, Udaipur, ²TNMFU, Tamilnadu, ^{3,4}CIFE, Mumbai

Rajasthan has enormous water resources for fish production. The southern region of the state especially, Udaipur division contributes significantly to the total fish production of the state. In the absence of regulated market of fisheries, producers are being exploited in this sector. Looking to vast scope of fisheries in the area, it was decided to find out production of fish and to explore the possibilities of market infrastructure facilities and possible strategies in marketing of fish products. The annual fish production in Udaipur district was estimated at about 1600.11 MT in the year 2017-18. The productivity in terms of kg/ha was maximum in the lake Udaisagar (1680.95) which is far greater than the average of national fish productivity. The productivity of Udaipur waters is well above the national average per hectare. There are three main kind of fishes produced in the area namely, Major carp, Minor carp and Catfish. Mrigal and Rohu was found to be costlier fishes as compared to other breeds. However, the producer price, whole sale price and retail price of Catla, Rohu and Mrigal for above 1 kg weight were having same price i.e. Rs.90.00, Rs.100.00 and Rs. 150.00 respectively. The marketing channel number two i.e. Producers----Wholesalers----Retailers---Consumers (30-32% marketing) was found to be the most effective channel (30-32% marketing). The margin of middleman was found highest for selling of tilapia and other fishes weighing more than 1.0 kg as compared to selling of any other fish of lesser weight. Fish arrival in Udaipur city during season is 12-15 quintals of fish per day, while in off season it is decreased up to 50 per cent and remains 5 to 7 quintals per day. It was observed that harvesting charges alone constitute 15-20 per cent of total expenditure in small scale fish production in Rajasthan. State shall not play any direct role in regulating the price as the market is not regulated and there is a lack of fish processing industries.

EFFECTS OF THE ADDITION OF SPIRULINA PLATENSIS POWDER ON THE NUTRITIONAL PROPERTIES OF EXTRUDED PRODUCTS BASED ON WHOLE WHEAT FLOUR**VATSALA SAHARAN^{1*} AND SUDESH JOOD²****Dept. of Nutrition and Dietetics, Shree Guru Gobind Singh Tricentenary University, Gurugram-122505****Dept. of Foods and Nutrition, College of Home Science, CCS Haryana Agricultural University, Hisar-125004**

Value added extruded products like noodles, macroni and spaghettis are not very much common among people specially in India, whereas, supplemented extruded products with different herbs or any other nutritional ingredient which give much more health benefits should be introduced into the market such as Spirulina platensis powder which consist of many nutrients and are also beneficial for human health. It has many nutrients like all essential amino acids, vitamins, minerals, antioxidants, in vitro protein digestibility, etc which are very helpful in today's world because junk food with refined flour and other food items in the market are not healthy and which are very common among youngsters. So, a study has been carried out to develop value added extruded products like noodles and macroni. Control and Spirulina platensis powder supplemented noodles and macroni were developed at 2, 4, 6 and 8% levels. Whereas, 8% level of Spirulina incorporated extruded products got minimum scores. So, on the basis of their organoleptic acceptability, Spirulina supplemented extruded products up to 6% level were further selected for nutrition composition. Among the supplemented products, 6% Spirulina powder incorporated extruded products exhibited higher amount of all the nutritional parameters i.e protein (15.60%) & (15.65%), crude fibre (3.29%) & (3.23%), ash (1.87%) & (1.90%), total dietary fibre (9.19%) & (9.23%), In vitro protein (65.47%) & (65.95%), total lysine (2.98 mg/100g) & (2.99 mg/100g) in noodles and macroni, respectively. However, total minerals were also found in high range in 6% supplemented extruded products as compared to control i.e Ca, P, Mg, Fe and Zn were found to be 82.10, 378.49, 139.40, 6.69 and 2.32 mg/100g and 82.21, 378.65, 139.98, 6.72 and 2.35 mg/100g in noodles and macroni, respectively.

Keywords: Spirulina platensis powder, Supplementation, Extruded products, Organoleptic acceptability, Nutrition composition**DESIGN ANALYSIS OF KAU POKKALI PADDY HARVESTER TOWARDS THE DEVELOPMENT OF ITSSCALE DOWN PROTOTYPE****VENKATA REDDY H.K, AND JAYAN P R****Kelappaji College of Agricultural Engineering and Technology, KAU, Tavanur-679573**

The traditional system of growing tall rice (*Oryza sativa* L.) varieties during the monsoon season and prawn culture(prawn filtration) during summer season, locally known as *pokkali*, is a sustainable system of production harmoniously blended with natural processes like sea water inundation in the low-lying coastal zones of Kerala. The Pokkali field is a unique eco system prevailing in the coastal tract of Kerala with rich bio diversity and amazing capacity to produce organic rice and shrimp alternatively. The lands of Pokkali rice cultivation in marshy and swampy fields with poor drainage systems and are subjected to the tidal action throughout the year. Also, these lands are connected to Arabian sea through backwaters and canals. Due to these naturally adverse conditions prevailing in these lands and the non-availability of labourers, the paddy cultivation goes on decreasing every year. Of the various farming operations in Pokkali rice cultivation, the harvesting is done by women labourers by

walking on the swampy and marshy inundated paddy fields at waist-deep water, which is laborious, tedious and cumbersome. Hence, there was a great demand for a suitable harvesting machine, especially for harvesting the paddy, which is under water at the time of harvest due to tidal effects. Though a number of paddy combine harvesters are commercially available, none cannot be used in such marshy water logged areas for harvesting paddy. Hence a power operated floating harvester, 'KAU Pokkali paddy harvester' with provisions for harvesting and conveying the ear heads of water submerged paddy stalks was developed and tested in a project at KCAET, Tavanur of the 8500 ha of Pokkali area, paddy cultivation is also prevalent in fragmented lands in some areas. The overall size of the harvester is 9.6m x 2.2m x 2.2m (L*W*H) with a total weight of about 3 tonnes. Due to the over size and weight, the maneuverability become a great problem for transportation and operation in small paddy lands. It necessitated designing a scale down proto type of the harvester to operate in all Pokkali areas with easy transportation and good maneuverability features. Moreover, its design analysis using Auto cad and solid works software and suggested suitable materials for various parts and generated drawings of its functional components. Also, the study of stability aspects of the harvester considering buoyancy, floatation and traction parameters will ensure a proper design for a scale down prototype of the KAU Pokkali paddy harvester. The overall size of the scale down harvester is 5m x 1.2m x 1.2m (L*W*H) with a total weight of about 1.7 tonnes.

Keywords: Pokkali, Harvester, Design.

EFFECT OF PRUNING SEVERITY AND SPRAYING OF CHEMICAL SUBSTANCES ON GROWTH AND FRUITING OF GUAVA TREES

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An experiment were carried out on 15 years old guava hybrid trees grown at the Horticulture Research Centre, SVPUA&T, Modipuram, Meerut during two successive seasons. Trees were subjected to the following pruning treatments; pinching, moderate or severe pruning and sprayed on after pruning with potassium nitrate (1, 1.5 and 3 %) or ethephon (200, 400 and 600 ppm) or dormex (0.5, 1.5 and 2%) compared with the control (sprayed with water only), to study their effect on inducing growth and yield of guava trees. Results showed a significant increase in average index number of bud burst and shoot length with severe pruning plus spraying potassium nitrate at 3 % concentration compared to the other treatments. Moderate pruning plus spraying ethephon at 600 ppm produced the highest number of new shoots in both the seasons. Dormex at 2% with moderate pruning gave the highest average index number of flower bud burst in the first season. Meanwhile, ethephon at 600 ppm with severe pruning produced the highest average index number of flower bud burst in the second season. A pronounced and significant increase in initial fruit set was found with moderate pruning and application of potassium nitrate at 3 %. Also, pruning treatments with spraying chemical substances improved tree yield.

Keywords: Pruning, pinching, bud burst.

EFFECT OF VOLATILE AND NON-VOLATILE COMPOUNDS OF TRICHODERMA SPP. AGAINST AGGREGATE SHEATH SPOT OF RICE IN MANIPUR

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Aggregate sheath spot of rice are caused by *Ceratorhiza oryzae-sativae* (Sawada) Mordue. Although Aggregate sheath spot is usually considered as a minor disease, it can be a very aggressive disease of rice under favorable condition. Among different fungal diseases of rice, aggregate sheath spot of rice has currently found in the valley districts of Manipur. The disease symptoms vary from sheath blight as characterized by oval lesions with green or gray centers surrounded by a distinct brown margin and several lesions can occur together. The pathogenicity test of the disease was confirmed at the Plant pathology Department. Initially morphological study showed the pathogen character as *Rhizoctonia spp.* and molecular studies confirmed the pathogen as *Ceratorhiza oryzae-sativae* with NCBI Accession number (MH255604). In this present study, six *Trichoderma* isolates were tested against *Ceratorhiza oryzae-sativae* through volatile and non-volatile compounds. In volatile compounds *T. harzianum* (KU904458) with 47.05% was most effective for control. Moreover, non-volatile compounds tested with two different concentrations of 7.5% and 15%, *T. asperellum* (KU933475) was showed most inhibition percentage in both concentrations with 60.59% and 65.68% respectively.

Keywords: Pathogenicity test, Accession number, Volatile and Non-Volatile compounds.

ASSESSMENT OF SEED PRIMING METHODS FOR SEEDLING CHARACTERS AND NODULATION IN BLACK GRAM (*VIGNA MUNGO* L.) SEEDS

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The experiment was conducted in Seed Testing Laboratory and Field Experimentation Centre of Department of Genetics and Plant Breeding, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad (U.P.) during kharif 2016, in order to standardize the best method of priming specific to Blackgram. Four methods of priming viz., hydropriming, osmopriming, halopriming, and organic priming with control (Unprimed) were evaluated by screening 12 hour duration and different concentrations viz., T₀-Unprimed (Control), hydropriming - T₁-Distilled water (hydration), osmopriming- T₂- Polyethylene Glycol (PEG₆₀₀₀) 20%, halopriming- T₃-Sodium Chloride (NaCl) 1%hydration, T₄-Calcium Chloride (CaCl₂) 1%hydration, organic priming- T₅- Tulsi leaf extract (5%) hydration, T₆- Curi leaf extract (5%)hydration. It was found that all the priming treatment showed significance difference with the control and the highest germination per cent, seedling length, seedling weight, vigour index, field emergence per cent, plant height and plant nodulation were observed for PEG₆₀₀₀ priming. Highest nodulation was observed in PEG and CaCl₂. Seed priming, its simplicity and no requirement for expensive equipment and chemical could be used as a simple method for overcoming related to a poor germination and seedling establishment and helps in sustaining agriculture and cost effective and economic, non toxic, eco friendly sources.

Keywords: Blackgram, methods of priming, seed quality parameters, nodulation.

CLIMATE SMART AGRICULTURE (CSA)

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Climate smart agricultural practices and technologies, in order to minimize the adverse effects of climate change and variability, but their adoption largely depends on economic benefits associated with the practices. Among the CSA practices and technologies including a majority of the farmers prefer to use of improved crop varieties, laser land leveling, zero tillage, conservation agriculture, site specific nutrient management, leaf colour chart, crop diversification, rain water harvesting, drip irrigation, crop insurance and contingent crop planning. Agriculture has to address simultaneously three intertwined challenges ensuring food security through increased productivity and income because of climate smart agriculture includes proven practical techniques but also innovative practices. It is about getting existing technologies off the shelf and into the hands of farmers and developing new technologies to meet demands of climate change. We suggest that a mix of actions that span spatial and temporal time scales is needed to be adaptive to a changing climate, address immediate problems and create enabling conditions for enduring change.

Keywords: CSA, Climate change, Best Management Practices, Security & Productivity

NUTRITIONAL QUALITIES OF FIELD PEA

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Field pea is most nutritious legume crops which is cultivated for its seed and mostly eaten as dry whole or split pulse (dhal). Field pea play important role in nourishment of humans because of a rich source of proteins, carbohydrates and vitamins for human nutrition. It is nutritionally very rich and contains 22.9% protein, 60.7% carbohydrates, 2.7% ash and 10.9% moisture with calorific value 343/100g, whereas the crude fiber and fat contents are only 1.4% each. Its seeds are also a good source of vitamins such as thiamine, riboflavin, and niacin. Field pea seeds are highly digestible and has high concentration of essential amino acids viz. lysine and tryptophan, which are generally low in grain cereals. Cereals and legumes eaten together create a mixture that has better protein balance. The high lysine of field pea seed proteins balances the lysine deficiency of cereal seed proteins. Field pea seeds has low sulphur containing amino acid. Some antinutritional factors are present in field pea viz. trypsin inhibitors, lectins (phytohaemagglutinins), indigestible oligosaccharides causing flatulence, gallic acid, and other phenolic acids and substances with phytoestrogenic effects. This crop is highly productive, grown for food and forage.

CROP RESIDUE MANAGEMENT FOR IMPROVING SOIL PRODUCTIVITY**VIJAYPAL^{1*}, VISHAL KUMAR² AND ABHISHEK SHORI²**¹Assistant professor Department of Agronomy Janta vedic college Baraut (Baghpat)- (UP) 250611²Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005,

Globally India ranks first in the production of pulses, jute and second in rice, wheat, sugarcane, cotton, and ground nut. Thus, because of the agricultural strength of the country, crop residues production in the country is also huge. However, due to the diversity in cropping practices and agro-climatic conditions across the India, distribution and availability of residues is highly spatio-temporal in nature. Crop residues, usually considered a problem, when managed correctly can improve soil organic matter dynamics and nutrient cycling, thereby creating a rather favorable environment for better crop growth and yield. The Crop residue management (CRM) in order to offer a permanent soil cover and a natural increase of organic matter content in surface horizon. The well-designed management and utilization of crop residues is essential for the improvement of soil quality and crop productivity under rice-based cropping systems. Viable option is to retain crop residue in the field; burning should be avoided. The strategies include chopping and spreading of straw during or after combining or the use of disc-type trash drills easily you can do under in situ or ex situ. Residues rich in lignin and polyphenol contents experience the lowest decay. A part from the higher quantity of rice and wheat residue, the residue of sorghum, maize, barley, chickpea, groundnut, rapeseed and mustard, sugarcane trash, potato, soybean, sunflower and some other minor cereals. Of the available residue for incorporation 53% are available in Kharif and 47% in Rabi season. The availability of crop residue in India would be 300, 343 and 496 million tonnes in 2000, 2010 and 2025, respectively. CRM is important components of low external input of sustainable agriculture without sacrificing productivity. CRM improves the physical, chemical and biological properties of soil as well as increased the crop productivity.

Keywords: Crop residue management, soil fertility, crop productivity and sustainable agriculture.**FOOD PROCESSING TECHNOLOGIES AND VALUE ADDITION FOR IMPROVED FOOD SAFETY AND SECURITY****VIKAS GILL^{1*} AND RITU²**¹Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004²Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004

Food processing adds value, enhances shelf life of the perishable agro food products, encourage crop diversification and ensures remunerative market price of the agricultural produce by making it more marketable. Processed products involves processed fruits and vegetables (Prominent processed fruits and vegetable items are fruit pulps and juices, dried fruits and vegetables, ready to serve beverages, fruit juice concentrates, canned/frozen fruits, jams, squashes, pickles, chutneys, mushroom products etc.), Biscuits, Bread, Fried Products, Popped and puffed cereals(popcorn, puffed sorghum, puffed ragi and puffed barley), Expanded Cereals, Beaten Rice, Extruded foods (vermicelli, noodles, corn puffs, texturised soyanuts), Fermented Products (Idli and samosa), Traditional Sweets (candies). Processing techniques that involve milling; separating; exposures to air, light, heat, or radiation; changes in acidity or osmolality; or other techniques during freezing, drying, canning, or vacuum packing can and often do alter the content of nutrients and other non essential bioactive food constituents. Hurdle technology, Nano technology, Smart packaging and food tracking, Non-thermal processing of foods: Novel and emerging technologies, particularly high pressure processing (HPP), pulsed electric field (PEF), cold plasma, UV irradiation and ultrasound have been examined as treatments for improving the shelf life of foods.

Keywords: Food processing, Food safety, Food security, Food technologies, Food value chain, Climate-smart technology**PRECISION AGRICULTURE FOR ENVIRONMENTAL SUSTAINABILITY****VIKAS KUMAR, NEHA, N. SAINI, M.S. JATANA, M. KAKRALIYA****CCS Haryana Agricultural University, Hisar**

Precision Agriculture can help in managing crop production inputs in an environmentally friendly way. By using site-specific knowledge, Precision Agriculture can target rates of fertilizer, seed and chemicals for soil and other conditions. Precision Agriculture will have an increasing role during this new millennium. It has been reported that world population is expected to be about 9.4 billion by 2050, and that increases in crop yields will have to be achieved primarily from land that is currently under production since most of the world's arable land is already being cultivated. Precision Agriculture substitutes information and knowledge for physical inputs. A literature review indicates precision agriculture can contribute in many ways to long-term sustainability of production agriculture, confirming the intuitive idea that precision agriculture should reduce environmental loading by applying fertilizers and pesticides only where they are needed, and when they are needed. Precision agriculture benefits to the environment come from more targeted use of inputs that reduce losses from excess applications and from reduction of losses due to nutrient imbalances, weed escapes, insect damage, etc. Other benefits include a reduction in pesticide resistance development. These increases in population growth and food and water demands will put increasing pressure for development of new more efficient technology and production practices that contribute to higher yields. Since intensive farming

can potentially impact soil and water quality, parallel increases in new practices and technology contributing to improved soil and water conservation practices will be needed to help sustain and maintain the needed yield increases from agricultural systems.

Keywords: Precision Agriculture, sustainability, environment.

QUANTIFICATION OF ROHU (LABEO ROHITA) FISH WASTES AND THE ASSESSMENT OF THEIR NUTRITIONAL QUALITY

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Rohu fish (*Labeo rohita*) when dressed generated a significant quantity of wastes. These wastes were segregated into fish head (FH), fins (FN), scales (SC), swim bladder (SB) and others (includes viscera) and were quantified. Based on total length (TL) and total weight (TW), fish (n=20), were grouped into smaller (20-25 cm, 100-250g), medium (25-30cm, 250-400g) and larger (30-35 cm, 400-550 g) size group. Total length, standard length (SL), head length (HL) and width (W) of small (20.93±0.67, 16.60±0.26, 5.07±0.15, 5.47±0.31), medium (29.27±0.31, 23.70±0.60, 5.60±0.10, 6.47±0.38) and large (33.60±0.85, 27.85±0.64, 6.70±0.71, 7.90±0.14) fish were noted. For small, medium and large rohu fish, the weight (g) of FH (31.33±4.16, 57.33±3.06, 96 ±14.14), FN (7.13±0.79, 13.74±0.95, 17.95±1.73), SC (4.38±0.36, 13.2±0.85, 20.60±2.37), SB (0.79±0.31, 1.78±0.04, 3.18±0.04) and others (11.36±5.10, 17.94±0.77, 29.58±5.12) were quantified respectively. Small rohu fish had 50.3% edible flesh and 49.45 % waste (FH: 28.14, FN: 6.40, SC: 3.94, SB: 0.71 and others 10.2%). Medium rohu fish had 65.48 % edible flesh and 34.51% waste (FH: 19.02, FN: 4.56, SC: 4.38, SB: 0.59 and others: 5.95). Large size rohu fish had 63.39 % edible flesh and 34.54% waste (FH: 19.82, FN: 3.70, SC: 4.25, SB: 0.65 and others: 6.10). Out of the total waste, FH, FN, SC, SB and others were (56.96, 12.96, 7.96, 7.96, 1.42, 20.65), (55.12, 13.24, 12.69, 1.71, 17.25) and (57.38, 10.73, 12.31, 1.91, 17.68) for small, medium and large fishes. For FH, FN, SC, SB, the percentage of moisture (39.89±0.89, 47.96±0.50, 52.18±0.82, 34.83±0.0), crude lipid (5.72±0.30, 7.86±0.10, 0.04±0.0, 3.01±0.0), total ash (11.63±0.32, 20.35±0.21, 14.83±0.05, 1.81±0.0) and total protein (42.76, 23.83, 32.96, 60.35) contents were calculated respectively.

CONSTRAINTS PERCEIVED BY THE FARMERS IN ADOPTION OF IMPROVED GINGER PRODUCTION TECHNOLOGY IN UDAIPUR DISTRICT OF RAJASTHAN

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Ginger is an important spice and medicinal crop. The present study was conducted in Udaipur district of Rajasthan. There are total eleven tehsils in Udaipur district, out of which two tehsils namely, Jhadol and Gogunda were selected on the basis of maximum area under ginger cultivation. Five villages from each identified tehsil were selected on the basis of maximum area under ginger cultivation. For selection of respondents, 100 ginger growers were randomly selected from identified villages (10 from each village) for data collection. It was found that majority of respondents (45.00%) fell in medium level of constraint group whereas, 28.00 per cent ginger growers were observed in the low level of constraint group and remaining 27.00 per cent respondents were possessed high level of constraint about adoption of improved ginger production technology. Study shows that major constraints for ginger growers were lack of knowledge about high yielding varieties, on-availability of improved high yielding varieties of the ginger crop, perishable commodities and resources poor farmers.

Keywords- Ginger, Constraints, Adoption, Production and Technology.

GOVERNMENT INITIATIVES TOWARDS THE MECHANIZATION IN INDIAN AGRICULTURE

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Indian agriculture farmers are categories according to the cultivation land holding area. Marginal and small farmers contribute 86% of total operational land holdings and 47% of total operated area. The total farm power availability in Indian agriculture was 2.24 kW/ha and mechanization level was 40% during 2016-17. However, the farm power distribution is quite uneven across the States, whereas the highest use of mechanical power is in the order of 3.5 kW/ha in Punjab and less than 1kW/ha in States like Bihar, Orissa and Jharkhand etc. Thus there is a strong need to bring out the mechanization level in all over the country. The govt. of India initiated the various programmes RKVY, NFSM, NGH, SMAM, etc. for the farmers and effort to reduce this uneven

distribution of mechanization level. Under the SMAM scheme near about 40 thousand of farmers and agricultural graduates are trained and promoted to stabilize custom hiring centre in whole country during the last five year. Custom hiring centres (CHC) are orient to serve the availability of farm machines to perform the agricultural operations timely and government also support entrepreneur and agricultural graduate to set-up the custom hiring centre by subsidy scheme. Custom hiring centre's has great impact in the major crop yields of respective states increases as 13%, 17% and 40% of Maharashtra, Bihar and Madhya Pradesh respectively with the reducing cost of production by increasing the annual use hour of the relevant machineries. CHCs objectives are indirectly correlated with increase in crop yield by using new technology and impactful methods of cultivation. FIRB system of wheat cultivation promoted by CHC increases 10% yield along with saving of 25% seed and 30% irrigation water in Rajasthan. Current scenario of agriculture tends to reduction in animate power source (Animal and Human) availability almost 20 to 35% over last three decades. This scenario requires to the mechanization for substitution of reduction. Hence; Govt. of India promote to increase mechanization by starting as 19883, 613 and 22338 number of CHCs, high tech hub and farm machinery bank at village level respectively in 2019-20. The estimated budget proposed for the scheme is USD 1.05 billion. It is expected to increase in farm power availability 2.45 kW/ha and mechanization level up to 50% by 2020. Consequently Indian agriculture needs energy intensive agriculture with high input use efficiency to achieve estimated target.

Keywords: Farm power availability, custom hiring, crop yield, mechanization level etc.

RESPONSE OF FOLIAR APPLICATION OF CHEMICALS ON YIELD AND YIELD ATTRIBUTING CHARACTERS OF RICE (*ORYZA SATIVA* L.) UNDER RAINFED CONDITION

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The investigation entitled "Response of foliar application of chemicals on yield and yield attributing characters of rice (*Oryza sativa* L.) grown under rainfed condition" was conducted during the kharif season in 2016 at Students' Instructional Farm of Narendra Deva University of Agriculture and Technology, Kumarganj, Faizabad-224229 (U.P.). The experiment was conducted in randomized block design with three replications and nine treatments on rice variety (Sahbhagi dhan) under rainfed condition. The treatments comprised of Control, KCl (0.5 and 1.0%), MgSO₄ (1.0 and 2.0%), Boric acid (0.3 and 0.6%) and Salicylic acid (0.25 and 0.5%). Chemicals were applied on the foliage of plant at 15 DAT and milky stage. Results of the experiments indicated that the Foliar spraying of 1% MgSO₄, 2% MgSO₄, 0.3% Boric acid and 0.5% Salicylic acid significantly increased no. of panicle bearing tillers. Highest number of grains per panicle was noted in case of 0.5% and 0.25% Salicylic acid followed 2% and 1% MgSO₄. All the treatments reduced the number of sterile grains per panicle and minimum sterile grains per panicle was recorded with 0.5% and 0.25% Salicylic acid followed by 0.6 and 0.3% Boric acid. However, maximum increase in grain yield was recorded with 1 % MgSO₄ and minimum with 0.5% KCl. While in highest 1000 grain weight was recorded with 0.5 % Salicylic acid and minimum with 1.0 % KCl. Results of the experiments indicated that yield and yield attributing characters like Number of panicle bearing tiller plant⁻¹, Number of grains panicle⁻¹, Number of fertile grains panicle⁻¹, Grain yield (qha⁻¹), Straw yield (qha⁻¹) and Test weight (g) were improved by different chemical concentrations. So, foliar spray of chemicals like KCl, MgSO₄, Boric acid and Salicylic acid can be used as a tool to improve yield and yield attributing characters of rice under rainfed condition.

APPLICATION OF DIFFERENT ORGANIC AND INORGANIC FERTILIZER DOSE ON GROWTH PARAMETER OF STRAWBERRY UNDER SOIL POT SYSTEM

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Strawberry is popular due to the softness. It is mainly grown in sub-tropical regions on hilly area and on elevation on the 3000 meter. In India Maharashtra gives the more production according to National Horticulture Board. The strawberry contains the Vit A, Vit B1, B2, Vit-C, Niacin and good source of antioxidant. There are many varieties of strawberry but in India mostly in hilly area Chandler and Winter Down is more cultivated. In research work we were taken the strawberry on pot system under controlled environment in poly house with nine treatments (T₁ control), T₂ (100% RDF recommended dose of fertilizer) + T₃ (75 % RDF + 25% vermicomposting), T₄ (50% RDF + 50% Vermicompost), T₅ (25% RDF + 75% Vermicompost), T₆ (100% Vermicompost), T₇ (100% Farm yard manure (FYM), T₈ (50% RDF + 50% FYM), T₉ (25% RDF + 75% FYM) respectively at research farm of Lovely Professional University Punjab India. As per the results, T₉ gives the best yield/plant (27.41g). It is due to the more biological activities in soils because of presence of FYM. The FYM increase the microorganism it play an important role in the synthesis of protein and more vegetative growth. And split dose application of inorganic fertilizer with organic manure increase the best availability of nutrient in soil. The strawberry plant need the high organic carbon for their growth, so the FYM fulfill the organic carbon availability for strawberry plant also increases yield. The T₃ shows the lowest result because of the 75 % RDF and due to the phosphorus content is more in the soil. And it is less suitable for the strawberry plants. The main problem in seedling was rotting of plants. But these organic fertilizers improve the soil health and enhancing the quality of fruits. And the respond in

the yield is less as compared to chemically synthesis fertilizer. It help to sustain the resources and helping in soil fertility and conserve the soils.

Keyword: Chandler, Fertilizer, Soil health,

ISOLATION AND IDENTIFICATION SOIL MYCOFLORA OF SUGARCANE FIELD IN LAKHIMPUR (KHERI) DISTRICT OF UTTAR PRADESH

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The present study deals with the seasonal variations in soil fungal population of traditional sugarcane field in central Uttar Pradesh. Soil fungi in sugarcane field need to improve knowledge of diversity of these micro fungi in sugarcane growing area; Paliya, Nighasan, Ramia Behar, Dhaurehra, Isanagar, Nakaha, Phoolbehar, Bijua, Bankeyganj, Lakhimpur, Behjam, Khumbhigola, Mohammadi, Pasgawan and Mitauli blocks in Lakhimpur Kheri district of Uttar Pradesh. The aim of this work was to isolate and identify the fungi from soil samples of these sugarcane fields. Fifteen samples of sand (surface of 20cm deep) were carried out during Jan- Dec 2014 in low to high tide. In all the 13 genera and 42 species were observed on these samples.

Keywords: Isolation, Soil, fungi, sugarcane, Field, Lakhimpur (Kheri).

TREATED SEWAGE EFFLUENT AS A SOURCE OF IRRIGATION IN AGRICULTURE

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The main problems facing agriculture are a declining supply of water and a decrease in the quality of the water. As the population continues to increase so does demand for food, but the amount of water available to produce that food does not increase. The main sources of irrigation in India are canal and tubewell water but these water resources are decreasing due to intensive cultivation and blind use of water to irrigate the agricultural land. Whenever good quality water is scarce, water of marginal quality will have to be considered for use in agriculture. In this case, use of sewage treated water to irrigate the field might be a good option to overcome the scarcity of water. Properly planned use of sewage treated effluent alleviates the surface water pollution and not only conserve the water resources but also supply various nutrients to the growing crops. However, sewage water may contains high TDS (total dissolved solids) and high amount of trace metals but composition of sewage water mainly depends on the source from where it is coming. In village and cities, domestic waste is the main which goes to the municipal solid waste treatment plant. Although, effluent comes after treatment of domestic wastes might contain nutrients up to some extent

DOUBLING THE FARMER'S INCOME THROUGH AGROFORESTRY SYSTEM SAME UNIT OF LAND

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Agroforestry models are the combination of cultivation trees plus agriculture crop and/or livestock unit on the same unit of land at same time. So that agroforestry models are helpful for the doubling of farmers' income is easily approach for the farmers. Agroforestry systems mostly reduced the risk of total failure of crop yield by the any kind of circumstances occurs by the nature. Agroforestry models gives the more benefits by the directly and indirectly benefits for the farmers. Directly benefits are the increases crop yield and indirectly benefits are like nitrogen fixation in the soil, soil conservation, increases soil fertility, water holding capacity increases, reduces the soil erosion, carbon sequestration, temperature maintain in summer as well as in winter supported the doubling of farmers income So that the farmers which are used mono-cropping farming can be increased our income through the agroforestry models. Agroforestry models are also reduced the cost of cultivation of farmers so that the farmers income increases in sustainable. Now a day so many agroforestry models was used which are helps to increase the income like fruit base agroforestry models and bund based agroforestry models are popularized in the recent time.

Keyword: - agroforestry; farmers; livestock; crop yield; doubling income of farmers

UTILIZATION OF FRUITS AND VEGETABLES WASTES AS A BIOFUEL

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The utilization of fruits and vegetables wastes to produce biofuel proves to be an alternative energy source for the limited non renewable energy and a dependable substitute for fruits and vegetables wastes. In India people are trying to produce bio fuels from various sources such as *Jatropha curcas*, *Pongamia pinnata*, *Azadirachta indica*, *Madhuca indica* etc. Biofuel are characterized as vegetable oil, Biodiesel, solid biofuels, bioethers, bioalcohols, biogas etc. They are broadly divided as first generation, second

generation, third generation and fourth generation biofuels. First generation biofuels comprise of biofuels derived from starch, sugar, vegetable oil or even animal fats processed by conventional methodologies. Biofuel produced from renewable biomass has received considerable attention in current years; it is one means to reduce fossil fuel use and emissions of greenhouse gases. Biofuel uses as a gasoline fuel additive as well as transportation fuel helps to alleviate global warming and environmental pollution. Second generation biofuel are obtained by processing a range of non-food crops and biowastes. Third generation biofuel includes those where algae serves as feedstock for biofuel production and these fuel are referred as oilgae. Bioethanol is obtained as product of fermentation of simple sugars in the biomass with help of microorganisms performing enzymatic digestion. Ethanol has been produced in industries by synthetic catalytic processing of petroleum products such as ethylene.

Keywords: Fruit and Vegetable wastes, biofuel, biomass, bioethanol Etc.s

EFFECT OF DIFFERENT NPK LEVELS ON GROWTH AND DEVELOPMENT OF SWEET ORANGE (*CITRUS SINESIS* OSBECK) PLANTS

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The present investigation entitled Effect of different levels of Nitrogen (N) Phosphorus (P_2O_5) and Potassium (K_2O) on growth and development of Sweet Orange (*Citrus sinensis* Osbeck) plants were carried out at Fruit Research Farm, Department of Horticulture, Allahabad School of Agriculture, Sam Higginbottom Institute of Agriculture, Technology and Sciences (Deemed-to- be-University) Allahabad (U.P.). The results revealed that the treatment T_2 (850 g / plant Nitrogen, 600 g / plant Phosphorus and 850 g / plant Potash) was found to be the best in terms of maximum plant height (83.57cm), maximum number of leaves (421.04), maximum number of branches (26.36), maximum stem diameter (3.04 cm), maximum spread of canopy (42.36 cm) and maximum length of inter-nodes (9.68cm) followed by treatment T_9 (800 g / plant Nitrogen, 400 g / plant Phosphorus and 500 g / plant Potash) and the minimum was recorded in T_4 (700g / plant Nitrogen, 400g / plant Phosphorus and 400g / plant Potash).

Keywords: Sweet Orange, Nitrogen, Phosphorus, Potassium and Growth

FT-IR AND GC-MS SPECTRAL ANALYSIS OF LEPIDIUM SATIVUM L. SEED

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Lepidium sativum is well known traditionally used medicinal plant and its seed are important for useful phytochemicals. The present study aimed to identifying the functional groups and fatty acids composition of *Lepidium sativum* L. seed using FTIR and GC-MS. The fatty acids composition of oil was palmitic acid (9.06%); Linoleic acid (12.69%); alpha-Linolenic acid (17.55%); Oleic acid (6.99%); Arachidonic acid (8.11%) and Behenic acid (1.77%) analysed by GC-MS and the compound detection employed by NIST library. The major groups i.e. amines, alcohols, carboxylic acids, aromatics, alkenes, amides etc were identified through FTIR spectroscopy and the characteristic peaks were detected. The findings of the study led to identification of chemical marker in *Lepidium sativum* L. Seed which may be used in phytomedicine to combat infections and diseases.

Keywords: GC-MS, FT-IR, *Lepidium sativum* L., chemical marker.

COMPARATIVE STUDIES OF AGRI-WASTE SUBSTRATES AND GROWING TEMPERATURES ON YIELD AND QUALITY OF PINK OYSTER MUSHROOM (*PLEUROTUS DJAMOR*)

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Pleurotus djamor commonly known as pink oyster mushroom is popular for its nutritional values and attractive pink blush. In last few decades oyster mushroom has captured interest of various researchers and growers through out the world as it can be easily grown on lignocellulosic agricultural wastes (wheat straw, rice straw, saw dust, stubbles, etc.) and therefore, provides a sustainable option to crop residue management and nutritional security alternative. The cultivation of mushroom is comparatively simple, low cost and environment friendly as compared to other food grain and horticultural crops. Pink oyster mushrooms can tolerate high temperatures very well and no other supplementation in terms of nutrients and crop protection is required for a profitable production. The yield efficiency of this mushroom was tested on different combinations of Agri-substrates inoculated at different time in the year. The effect of substrate quality and temperature was studied to find suitable substrate options available in India. The crop residues of wheat, rice, mustard, barley, pearl millet, chopped in small pieces were used in different proportions to prepare mushroom substrates for pink oyster mushroom cultivation. The observation showed that the best substrate proved for cultivation is rice/ paddy straw with bunch weight weighing from 300-450g/ bunch/ bag. The addition of mustard and barley straw

increased total yield and mushroom mineral contents. In all the substrate combinations, it was found that all are suitable for pink oyster cultivation and mushroom quality significantly differs as an effect of addition of other crop residues.

Keywords: Pink oyster mushroom, substrate, lignocellulosic, straw.

VARIETAL PERFORMANCE OF BANANA (*MUSA PARADISICA* L.) UNDER MIDDLE GUJARAT CONDITION

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An experiment entitled “Evaluation of different varieties of banana in tribal area of Chhotaudepur Region of Middle Gujarat” was conducted at the Agricultural Research Station, AAU, Jabugam which comes under Middle Gujarat Agro-Climate Zone-III during seasons of the year 2013-14, 2014-15 and 2015-16. The experiment consisted of eight treatment combinations comprised of four varieties (viz. V₁.Grand Naine, V₂.Robusta, V₃.Mahalaxmi and V₄.William) and two planting materials (viz. P₁.Tissue culture plants and P₂. Suckers), and conducted in RBD with factorial concept with four replications. The soil of the experimental field was sandy loam in texture. All the plants were planted at 1.80 m spacing with one plant per hole. On pooled basis, the variety William produced tallest plant of 202.4 cm and Robusta produced thicker plant among all. With regard to number of leaves per plant, the variety Mahalaxmi being at par with Robusta recorded more number of leaves per plants than rest of the varieties. Variety William recorded significantly longer bunch and being at par with Robusta and Mahalaxmi. With regard to number of fingers per plant, Grand naine recorded significantly the highest fingers per hand among all except Mahalaxmi. As per pooled analysis, variety William recorded the highest finger length and girth. Among the different varieties, William required significantly more number of days to attain day to flowering and maturity as compared to rest of the entries. Grand naine and Robusta took less number of days to attain flowering and maturity by about five weeks as compared to William. Among different varieties tested William registered the highest yield among all during individual years and in pooled analysis. It was however at par with Grand naine during 2014.

Keywords: Banana, Varieties, Yield attributes, Yield

INTEGRATED AND ORGANIC DAIRY FARMING FOR SUSTAINABLE LIVELIHOOD FOR FARMERS IN INDIA

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Livestock rearing in rural villages of India is an age-old practice and the farmers possess cattle, sheep and goats and poultry with agriculture. The by-products of each other act as complement to one another. Crop and dairy mixed farming is dominant form of milk production activities in India. It is an important livelihood options for the vulnerable sections namely landless, small and marginal farmer who forms major stakeholder in the smallholder dairy. The small marginal rural milk producers scattered all over the country, accounting for about 176.3 million tons during 2017-18 compared to 55.6 million tons in 1991-92. Dairy farming is one of the major enterprises for livelihood of rural farmers in India, for rural women, who are mainly involved in dairy. Not only the milk and milk products provide profit to the farmers, also, recycling farm waste paves way for production of bio- inputs and uses in field fetch more prices for organic agricultural produces. Production of organic feed grains helps to keep the animals healthy and production of organic livestock products. Hence to upscale the “Integrated Dairy Farming” along with connected activities like Fodder cultivation, bio-gas, panchagavya production, vermi-compost making, vegetable cultivation using drip, pot tray cultivation of vegetable seedlings and organic milk production.

ASSESSMENT OF SITE SPECIFIC NUTRIENT MANAGEMENT ON PRODUCTIVITY AND PROFITABILITY ON PADDY CROP IN SOUTH BIHAR

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KVK, Munger, BAU, Sabour

The On-farm trial was conducted during Kharif season 2015-16 and 2016-17 for "Assessment of site specific nutrient management practices on productivity and profitability of paddy crop" at farmers fields of Munger district. In India paddy crop is cultivated as major staple food crops in cereals. It is observed that paddy crop productivity and profitability has affected by abiotic i.e. temperature, rainfall, humidity and solar radiation etc and biotic factors like insect pest and disease and nutrient deficiency etc. In paddy crop has applied imbalance form chemical fertilizer dose, which is not obtained optimum yield. The On-farm trial was conducted in randomized block design with three technological options viz. Crop manager based nutrient recommendation

(115:47:50:25 kg NPKZn ha⁻¹), nutrient expert based nutrient recommendation (125:35:58:25 kg NPKZn ha⁻¹) and state nutrient recommendation (120:60:40:25 kg NPKZn ha⁻¹) and farmers practice (100:40:20:20 kg NPKZn ha⁻¹) under different locations. on the basis of the state crop recommendation, nutrient expert, crop manager and farmers practices KVK has planned On-farm trial for find out correct dose of fertilizer for crop optimum productivity and profitability. On the basis of results application of crop manager based recommendation (115:47:50:25 kg NPKZn ha⁻¹) was recorded significantly higher grain yield (69.8 and 71.2 qt/ha), straw and biological yield, growth and yield attributes of paddy over farmers practice during both the years nutrient expert recommendation and state recommendation in both seasons of trials. However, maximum gross returns (Rs.85280 and 52180 per ha), net return (Rs.52180 and 47697 per ha) and B:C ratio (2.58 and 2) was obtained with application of crop manager recommendation in paddy crop over farmers practice during both years in South Bihar.

HERBICIDE RESISTANCE & ITS MANAGEMENT THROUGH AGRONOMIC PRACTICES

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Herbicide resistance (HR) occurs due to the repeated use of one herbicide over the years. The history of herbicide resistance in weeds began in 1960's with the discovery and report of triazine resistance in Common groundsel (*Senecio vulgaris* L.) in Washington in the year 1970 (Yadav et al., 2006). Currently there are 365 resistant biotypes recorded, belonging to 200 weed species (115 dicots and 85 monocots) are spreaded over 4,50,000 fields of world (Heap, 2011). Most affected countries are USA, France, Australia & Canada. The first case of HR in India for the first time in *P. minor* was reported during 1992-93 (Malik & Singh, 1995). Continuous use of Isoproturon from 1980 as single herbicide for 10-15 years resulted in evolution of resistance (Malik & Singh, 1995; Walia et al., 1997). Resistance in weeds evolve due to alterations in the target site, enhanced metabolism and sequestration of herbicide away from its site. Management strategies like crop rotation, herbicide rotation, herbicide mixture, tillage and herbicide resistant crops etc. depend on detection, quantification & unraveling the mechanism of resistance leading to its successful management (Singh, 2006). Combined application of AEF 046360-8% EC & DIC 1468-14-22% EC (100+175 g/ha) was found effective against grassy as well as broad leaved weeds in wheat (Singh et al., 2009). Weed dry weight (g/m²) was also less in case of combined application in comparison with the herbicides used lonely. Crop rotation help in delaying the resistance to Isoproturon in *P. minor*. Malik and Singh in 1995 reported that isoproturon in Rice –Wheat cropping system was 67% whereas it was minimum i.e. 8% in case of rice-berseem-sunflower –wheat. Use of herbicide resistant crops is also a good option for HRM because in this case non-selective herbicide is used which kill all weeds in a single application. It require less spraying and lowers the operating cost. Any of the weed control methods, if employed in isolation in isolation, will not be successful to manage weeds and herbicide resistance as well. Therefore, looking into the situation case by case, we should follow integrated approach (improved agronomic practices, cultural, chemical and mechanical control methods, sanitation, herbicide rotation etc.) to achieve sustainable weed management, to delay or manage herbicide resistance.

ALTERNARIA ALTERNATA - A SPECIALIZED NECROTROPHIC PATHOGEN OF CROP PLANTS

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Alternaria species are mainly saprophytic fungi, but some like *A. alternata* have specialized itself in pathogenic capability over the years. This pathogen has evolved itself from saprophyte to a specialized necrotrophic pathogen. *A. alternata* infects almost 380 plant species where now it causes diseases of economic importance. In the last decade, reports on *Alternaria alternata* have generated great concern in scientific community both for diseases of economic importance it cause and for its ability to contaminate a huge number of natural and processed products. Melanin and host specific toxins (HSTs) are the two important factors involved in pathogenesis of *A. alternata*. Melanin also act as 'body armour', protecting against conditions like extreme temperatures, UV-radiation and compounds secreted by microbial antagonists, thus adding to longevity and survival. The role of toxin as a disease determinant is proved by the occurrence of the toxin in infected plants and the ability of the toxin alone to elicit at least part of the symptoms of the disease. The genes responsible for the production of HSTs are found on the conditionally dispensable (CD) chromosome. It have been isolated from six pathotypes of *A. alternata* and characterized. Detailed analysis of HST gene clusters has clarified their unique features, such as the presence of multiple sets on a single chromosome, high-density distribution of transposon-like sequences in the clusters and storage of the clusters in small CD chromosomes. Horizontal gene transfer has been proposed for the acquisition of genes for host-specific toxin biosynthesis. HSTs could be applied as selective agents in in-vitro selection at the cellular level for disease resistance. Host plants employ defensive reactions such as toxin detoxification and simultaneous phytoalexin elicitation, jasmonate along with salicylic acid and ethylene activating defence responses, high and rapid accumulation of Pathogenesis-related (PR) proteins and production of reactive oxygen species (ROS) to stop pathogen ingress. Genomic and transcriptomic comparisons are now taken in use to obtain genetic features of the pathogen to survive successfully in various stressful ecological habitats. In a scenario of rapid climate changes, the tolerance demonstrated by *A. alternata*, which is able to survive in prolonged stressing conditions of high and low temperature and dryness, increase the concern about this pathogen expecting higher levels of occurrence.

Keywords: Alternaria alternata, Host range, Phytopathogenesis, Toxin, Signaling pathway

STUDIES ON DISTRIBUTION AND MANAGEMENT OF *MACROPHOMINA PHASEOLINA*, *COLLETOTRICHUM DEMATIIUM* AND *CERCOSPORA KIKUCHII* ASSOCIATED WITH SOYBEAN SEEDS

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Soybean [*Glycine max* (L.) Merrill] is a major traded prime oil seed crop in the world. Seeds contain approximately proteins (37-41%), oil (18-21%), carbohydrates (30-40%) and ash (4-5%). In the present investigation seed health status of soybean from different agro climatic zone was determined and impact of *Colletotrichum dematium*, *Macrophomina phaseolina* and *Cercospora kikuchii* was recorded sowing seed quality. *Colletotrichum dematium* and *Macrophomina phaseolina* resulted in seed rot; seedling decay and seedling blight at early stage and provide a primary inoculum source for anthracnose, pod blight and charcoal root rot, respectively at later stage. Association of purple stained seed results in blotching and seed discolouration of soybean that results and lead to reduction in marketability of the produce. The 3 biopesticides *Trichoderma viride*, *Trichoderma harzianum* and *Pseudomonas fluorescens* obtained from 5 State Agricultural Universities, seed dressing with fungal biopesticides @ 10g / kg seed resulted in higher seed germination, seed emergence in field soil as compared to bacterial biopesticides, *Pseudomonas fluorescens* applied @ 10g/ kg seed. Seed dressing with Carboxin + Thiram @ 0.2% and Carboxin + Mancozeb @ 0.25% resulted in higher seed emergence as compared to untreated seed. Identification of new biopesticides of bacterial origin, other than *Pseudomonas fluorescens* is required. Compatible isolate of *Trichoderma viride*, *Trichoderma harzianum* and *Pseudomonas fluorescens* with chemical of new generation like Pyraclostrobin, Metiram, Thiophanate methyl, Tebuconazole and Propiconazole group are required. Use of certified seed category should continuously encourage among the farmers.

APPLICATION OF HIGH HYDROSTATIC PRESSURE TECHNOLOGY IN FOOD PROCESSING

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The main objective of any non-thermal technology is to maximize the freshness and flavor qualities of the foodstuffs while achieving the required level of food safety. High hydrostatic pressure (HHP) meets with these requirements and today it being incorporated in many companies as an alternative to conventional heat treatment procedures. Applications include the preservation of meat products, oysters, fruit jams, fruit juices, salad dressings, fresh calamari, rice cake, duck liver, jam, guacamole, and many ready-to-eat foods. In all these cases, microbial and enzyme inactivation is achieved without altering the product quality. In relation to the total percentage utilization of HHP equipment, vegetable products account for 28%, meat products for 26%, sea foods and fish for 15%, juices and beverages for 14%, and other products for 17%. HHP treatment has proven to be an effective technology to reduce the microbial load of foods for both pathogenic and spoilage microorganisms with minimal impact on the initial quality of the foods. To apply HHP to food preservation, various parameters such as time, pressure, temperature, and pH should be considered because these parameters determine the optimum pressure intervals for microbial inactivation. Likewise, a combined treatment of moderate temperature and HHP has proven to have great potential both for the inactivation of microorganisms and enzymes and for the development of new products due to the modification of proteins of animal or vegetable.

Keyword: High hydrostatic pressure, Non-thermal technology, Preservation and Applications

SALICYLIC ACID: ITS ROLE IN CROP PRODUCTION

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Salicylic acid (SA), a plant hormone plays an important role in induction of plant defense against a variety of biotic (caused by other living organism including fungi, bacteria, viruses, parasites, weeds, insects etc.) and abiotic stresses (is the negative impact of non-living factors on the living organisms in a specific environment like drought, salt stress, high-low temperature) through morphological, physiological and biochemical mechanisms. SA has also been implicated in several other (multiple) processes in plants like thermo-genesis, flowering, germination, fruit yield, bio-productivity etc. Application of SA increased number of leaves, number of tillers under stress condition. Thus, the foliar application of salicylic acid at critical stages of direct seeded rice during drought stress period to reduced yield loss. Foliar application of salicylic acid is more effective then seed priming of rice. But, seed priming with salicylic acid gave significant result on seed germination and heat tolerant capacity as compare to control. Some

researcher also found the heat tolerance capacity increased in mustard crop through application of salicylic acid. Chickpea (*Cicer arietinum* L.) is considered to be either sensitive or moderately tolerant to salinity with an expected global loss of 8-10% in yield per annum due to salt stress, gram responds positively to salicylic acid due to its prolific and deep rooting characteristics. Foliar spray of SA (40 ppm) twice at pre and post flowering stages of finger millet gave higher yield (3593 kg ha⁻¹). Plants produce proteins in response to biotic and abiotic stress and many of these proteins are induced by salicylic acid.

Keywords: Salicylic acid, drought stress, seed priming, rice, finger millet, yield.

SCREENING OF RESISTENCIA FOR SPOT BLOTCH IN HULLED AND HULLESS FORMS OF NEWLY DEVELOPED BARLEY (*HORDEUM VULGARE* L.)

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Fifteen genetically diverse varieties of hulled/hulless Barley (*Hordeum vulgare* L.) viz., NDB 1057, NDB1618, NDB 1445, RD 2768, RD 2909, RD 2899, HUB240, KB1319, BH 999, DWRB137, HUB114, RD 2794, Karan 16, BHS 352 and Dolma available at coordinating unit, AICRP on Wheat and Barley were crossed with three testers viz., NDB 943, NDB 1173, NDB 3 for building up the experimental material. Pair of 18 different barley varieties involved in four groups of hulled x hulled, hulled x hulless, hulless x hulled and hulless x hulless were crossed during Rabi 2016-17 at research farm of N.D.U.A.&T, Kumarganj, Ayodhya (U. P.). The twenty four hulled x hulled crosses, twelve hulled x hulless crosses, six hulless x hulled crosses and three hulless x hulless crosses and their parents were screened for spot blotch disease caused by *Bipolaris sorokiniana* under saline sodic soil. The whole experiment was conducted in saline sodic soil (pH =9.2, EC =2.21dSm⁻¹ and ESP 45%). Fifteen crosses and eleven parents in hulled x hulled, seven crosses and twelve parents in hulled x hulless, three hulless x hulled and one cross combination and two parents in hulless x hulless were moderately resistant, while eight F₁'s and two parents in hulled x hulled, three crosses and two parents in hulled x hulless, two cross and two parent hulless x hulled and one F₁ in hulless x hulless was moderately susceptible. One F₁ and one parents in hulled x hulled, two crosses and three parents in hulled x hulless, one cross and three parents in hulless x hulled and one cross and two parents in hulless x hulless were susceptible. It may be concluded that moderately resistant parents identified in this study could be used for breeding varieties, resistant to Spot Blotch of Barley.

EFFECT OF DIFFERENT LEVELS OF ZINC & IRON ON GROWTH & PRODUCTIVITY OF MAIZE (*ZEA MAYS* L.)

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An experiment was conducted to determine the effect of different levels of zinc and iron on growth and productivity of maize (*Zea mays* L.) during kharif season 2017 at agricultural farm of Dolphin (P.G.) Institute of Bio-Medical & Natural Sciences, Dehradun, Uttarakhand. For this experiment maize variety 'Kanchan' was taken with different treatment which is T1- control, T2- Zn 20kg + Fe 6 kg /ha, T3- Zn 20kg + Fe 10 kg /ha, T4- Zn 20kg + Fe 14 kg /ha, T5- Zn 25 kg + Fe 6 kg /ha, T6- Zn 25 kg + Fe 10 kg /ha, T7- Zn 25 kg + Fe 14 kg /ha, T8- Zn 30 kg + Fe 6 kg/ha. The experiment was laid out in Randomized Block Design with three replication of each treatment. All treatments studied at 25, 45, 65, 85 Day after sowing and the pooled data showed that treatment T6 was maximum at all growth parameters (plant height, number of leaves, plant dry weight, crop growth rate) and yield contributing characters (length of cob, number of grains, weight of cob, seed weight, grain yield, Stover yield) with significant difference.

Keyword: Maize, zinc, iron, growth, productivity

CONSERVATION OF AQUATIC MAMMALS IN INDIA

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Aquatic mammals occupy a wide range of marine and freshwater habitats around the world. They have been used by humans for millennia for food and to obtain other products. Aquatic mammals are probably one of the best sentinel organisms in aquatic and coastal environments because many species have long life spans and have extensive fat stores that can serve as depots for anthropogenic toxins. Marine mammals consist of cetaceans (whales, dolphins and porpoises), pinnipeds (seals, sea lions and walruses), sirenians (dugongs and manatees), Carnivora (sea otters, polar bears and pinnipeds), mustelids (sea otters and marine otters) and the polar bear – 130 or more species in total, including several that range into fresh water and some that exclusively occupy rivers and lakes. The Ganges river dolphin and Indus river dolphin are found in the waters of the Indian subcontinent is

also important freshwater mammals. European otter, Amazonian manatee and river dolphins are freshwater mammals which found in river water bodies. Aquatic mammals are impacted by many anthropogenic activities and mitigating these impacts requires knowledge about the geographic occurrence of threats. Aquatic mammals face a wide range of threats. Many of the struggles that aquatic mammals face are sadly due to human negligence and interference. This is causing concern in the effort to conserve these mega fauna, which are protected under Wildlife (Protection) Act, 1972. Conservation important practice due to the negative effects of human activity on aquatic mammals. Many nations have government agencies and NGO's dedicated conservation, which help to implement policies designed to protect. Scientific research has helped aid conservation's in making a large global impact towards protecting our earth and aquatic animals that inhabit it.

Keywords: Aquatic mammals, Threats, Human interactions, Conservation.

ON FARM TRIALS ON MANAGEMENT OF CHARCOAL ROT IN CHICKPEA AND LENTIL

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Charcoal rot in chickpea and lentil causes significant loss in Jehanabad district of Bihar. The above ground symptoms include yellowing and stunting of plants and premature ripening of pods. The roots are black (charcoal), discoloration of roots and lack of feeder roots. Therefore on farm trial on management of charcoal rot in chickpea and lentil was conducted at different farmer field of Jehanabad with the technical option 01 Farmer practices (without seed treatment), technical option 02 Seed treatment with Azoxystrobin (23%) @1 ml/kg seed and technical option 03 Seed treatment with Carbendazim (50 WP) @ 2g/kg seed. Results revealed that the higher yield of chickpea (16.90 q/ha) and 2.66 BC ratio with 0.50 per cent incidence of charcoal rot were recorded in plots of seed treated with Azoxystrobin followed by plots of seed treated with Carbendazim, the yield (16.80 q/ha) and 2.67 BC ratio with 0.5 per cent incidence of charcoal rot observed. Whereas plots without seed treatment the yield (16.00 q/ha) and 2.56 BC ratio with 1.00 per cent incidence of charcoal rot were recorded. Whereas the highest yield of Lentil was recorded 15.5 q/ha and 2.40 BC ratio with 3.30 per cent incidence of charcoal rot were recorded in plots of seed treated with Azoxystrobin followed by plots of seed treated with Carbendazim, the yield (15.3 q/ha) and 2.39 BC ratio with 0.4 per cent incidence of charcoal rot observed. Whereas plots without seed treatment the yield (15.00 q/ha) and 2.36 BC ratio with 1.20 per cent incidence of charcoal rot were recorded. Concluded that the seed treated plots produce marginally higher yield and reduce disease incidence. The seed treatment of chickpea with Azoxystrobin @1 ml/kg seed / Carbendazim @ 2g/kg seed is recommended to reduce charcoal rot in chickpea and lentil.

Keywords: charcoal rot, seed treatment, chickpea and lentil

TO STUDY THE PERFORMANCE OF DIFFERENT STRAWBERRY GENOTYPES FOR YIELD AND QUALITY CHARACTERS UNDER PUNJAB CONDITION

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A study was conducted to check the performance of 12 different strawberry genotypes under Punjab condition during 2017-18 on the basis of yield and quality characters. Strawberry cultivars, viz., Chandler, Winter dawn, Camarosa, FL-09-127, E1-13#32, Sweet Charlie, Hadar, E1-13#33, E1-13#31, Yamini, E-22 and Shani were planted on beds of 2 m × 1 m size at a spacing of 30 cm × 30 cm on the experiment farm of Baba Farid College, Bathinda during first week of November in a randomized block design with three replications. The results revealed that genotype Winter dawn recorded the highest number of flowers (19.6), followed by Camarosa (18.3) Chandler (17.67) and Shani (16.5). the maximum number of fruits per plant observed in Camarosa (15). The maximum fruit length was found in Camarosa (3.36 cm) but fruit breadth was found highest in E1-13#32 (3.28 cm). the highest TSS content observed in Shani (10.1 Brix) and total sugar content was highest in Camarosa (6.12 %). The highest vitamin C was observed in Sweet Charlie (74.8 mg/100g of pulp).

Keywords: Strawberry, genotypes, flowers, growth.

TAMARIND BEVERAGE: AN OVERVIEW

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Tamarind is a very valuable commodity in the world because of its nutritional components, including significant level of vitamin (B₁- Thiamin, B₃- Niacin, B₅- Pantothenic acid, B₆- Pyridoxine, and B₉ - Folates), C, E, calcium, iron, phosphorous, potassium, manganese, and dietary fiber. There are also a number of organic compounds that make tamarind a powerful antioxidant and anti-inflammatory agent. It is also known as Imli in India. India and Thailand is the major producer of

tamarind all over the world. This fruit is found in two types sweet and sour, the major part of sweet tamarind is harvested from Thailand and sour tamarind is founded in India. The fruit tamarind has very large area for its medicinal uses and broad application, because of its medicinal properties. It can be eaten fresh and can consume into different possessed products like: jam, beverage, candy etc. Tamarind fruit contains big amount of tartaric acid which make it sour fruits. The present review is reported that tamarind can be used as medicinal, health beneficiary food and it has potential for making many processed products.

Keywords: Imli, Tamarindus indica, unfermented beverage, Tamarind processing, Nutritional value of tamarind and Healthy beverage.

MANAGEMENT OF GREEN LEAF HOPPER (*NEPHOTETTIX VIRESCENS*) AND BROWN PLANT HOPPER (*NILAPARVATALUGENS*) THROUGH ECO-FRIENDLY APPROACHES"

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A field experiment was conducted to study the effect of various Eco-friendly insecticides viz., Camphor oil @ 1000 ml/ha, Cedarwood oil @ 1000 ml/ha, Cedarwood oil @ 1000 ml/ha, Lemongrass oil @ 1000 ml/ha, Neemazal @ 1000 ml/ha, Dinotefuran 20SG@ 200 ml/ha and Rynaxypyr 20SC@ 100 ml/ha against the population of Green Leaf Hopper (*Nephotettix virescens*) and Brown Plant Hopper (*Nilaparvata lugens*). The results revealed that all the plots treated with Eco-friendly insecticides had significant influence on the population of the insect pest. The lowest population of *N. lugens* and *N. virescens* was recorded in the plot treated with Rynaxypyr 100 ml/ha with a lowest mean population of 7.79% and 8.03% respectively as compared to 18.19% and 17.05% recorded in the control plot. The percent reduction of *N. lugens* and *N. virescens* population over control recorded was 57.17 and 52.90 respectively. The lowest mean population was also recorded in the plot treated with Dinotefuran 20SG@ 200 ml/ha with a mean population of 8.69% and 9.03% respectively. The plot treated with Cedarwood oil @ 1000 ml/ha recorded the highest mean population of *N. lugens* and *N. virescens* of 11.00% and 11.79% respectively. The highest grain yield of 5.9 ton/ha was recorded in the plot treat with Rynaxypyr 20SC@ 100 ml/ha which was at par with Dinotefuran 20SG@ 200 ml/ha with a yield of 5.68 tons/ha as compared to 3.27 tons/ha in control plot.

Keywords: *Nephotettix virescens*, *Nilaparvata lugens*, Rynaxypyr, Dinotefuran

AGROFORESTRY A BETTER TOOL FOR PROFITABLE PRODUCTION OF SPICES CROP

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Diversification of existing farming systems by developing suitable agroforestry models seems to be the need of the day to cope up with ever increasing demand for diversified products. There is a need for intensified conservation efforts as well as growing products and generating services in agro-ecosystems. Agroforestry plays a vital role in improving rural economy and vegetation by increasing per unit area production and generating rural employment for unskilled and semiskilled labourers. Moreover, grown trees generate more income which acts as saving bank for farmers. Some examples where the beneficial aspects of microclimatic changes are extensively used are shade trees to protect heat sensitive crops like coriander, fenugreek, ginger and ajwain from high temperatures, 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 demand of various spice crops is increasing in the national and international markets. The large deficit in the availability of quality material of these crops can be met only through their organized and scientific cultivation. Growing of spice crops in poplar will not only meet the demand of these crops but will also increase the area under forest. Maintenance of the traditional agroforestry systems, enhancing the size and diversity by selectively growing trees more useful for livelihood improvement; optimize food production, carbon sequestration, maintaining a continuous cycle of regeneration and participatory domestication of useful fruit tree species currently growing in wilderness to provide more options for livelihood improvement. Hence agroforestry system has been emerged as best way to overcome the constraints related to farming of many spices specially those which are susceptible to high temperature and water scarce condition.

Keywords: Agroforestry, spices, rural economy, livelihood improvement and food production.

ECO-FRIENDLY HORTICULTURAL PRACTICES IN TEMPERATE FRUIT PRODUCTION**ZAHWA JAN, G H RATHER, IKRAMANZOOR AND AMIT KUMAR****Division of Fruit Science, Faculty of Horticulture, SKUAST-Kashmir, Shalimar Campus, Srinagar (Jammu and Kashmir)**

Horticulture is the emerging thrust area of agriculture sector in post green revolution period for food, nutritional and environmental security. Horticulture deals with the cultivation and management of fruits, vegetables, ornamental flowers etc. and their post-harvest management practices. It is involved in the intensive use of resources, such as land, water, labour and inputs such as fertilizers and pesticides, irrigation and machines, however, degrade the ecological integrity and endanger the flora and fauna which cannot be sustained over generations. Future food, nutritional security would depend on improving the productivity of biophysical resources through the application of sustainable production methods, by improving tolerance of crops to adverse environmental conditions and by reducing crop and post-harvest losses caused by pest and diseases. Indigenous horticultural practices can play a key role in the design of sustainable and eco-friendly horticulture systems. On the other hand, rising population forced the upsurge in demand of food and nutritional security which can be possible through the scientific and modern interventions in this sector by enhancing the productivity of farm which is possible with the introduction of High yielding varieties, dwarfing rootstocks, organic farming and use of Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) for maximization of crop yields, enhanced productivity and sustainable development. This sector has potential for good employability with an eco-friendly option to cater the need of horticulture-based industries like High Density Plantations (HDP), Processing and Value Addition Units of horticultural produce. The rising concerns of global warming and climate change further aggravated the scope of eco-friendly horticultural practices for improvement of micro-climate and agro-ecosystem and transforming the lives and landscape of the masses in general.

SOIL AND WATER MANAGEMENT FOR CLIMATE SMART AGRICULTURE**ZIOM ADAM MICHAEL¹ AND RAM AVATAR MEENA²****^{1,2}Department of Soil Science and Agricultural Chemistry, Banaras Hindu University, Varanasi, Uttar Pradesh, India**

Climate smart agriculture is an integrated approach to managing landscapes-cropland, livestock, forests and fisheries-that address the interlinked challenges of food security and climate change. It is an agriculture that sustainably increases productivity, enhances resilience(adaption), reduces or removes GHG's(mitigation) where possible, and enhances achievement of national food security and developing goals. Soil and water management under changing climate for agriculture, food, environmental and energy and livelihood security is a prerequisite for sustainable agricultural production. With the degradation of our natural resources, soil and water have become a matter of serious concern for the farmers, researchers, academicians, scientists and policymakers as these in turn affect issues like upliftment of rural people, food, security, and livelihood. By providing farmers with access to water, irrigation has been a key factor in the intensification of agricultural production. The high level of pressure on water resources has had serious repercussions for water users and the environment. Competition over water use is growing in river basins where there are no measures in place for arbitrating conflicts. Biodiversity is declining more rapidly for species that depend on fresh water ecosystems than for species from other types of ecosystems. Consequently, aquifers are being depleted in countries with key agricultural production system including China, India, USA. Knowing the status and the potential of soil resources is fundamental for making decisions about sustainable soil management practices that can contribute to climate smart land use. Nuclear techniques are making significant contributions to climate smart agriculture by helping to combat soil erosion, improve soil fertility, crop yield. Healthy soils for a healthy life-soils provide global community with the space to increase the awareness and understanding of the importance of soil for food security and essential ecosystem functions. Managing soils is key to addressing climate change. Advanced water irrigation techniques have improved the lives of pastoral communities. Nuclear techniques that measure water and fertilizer use efficiency, enabling farmers to work out exactly how much water and nutrients to use and when. Isotopic techniques allow us to recongrhuth past climate and environmental conditions in order to better project the future climate patterns against agriculture.

Keywords: Agriculture, natural resources, management, irrigation, climate.**EVALUATION OF BIOEFFICACY OF EMAMECTIN BENZOATE AGAINST POD BORER AND NATURAL ENEMIES ON CHICK PEA (*CICER ARIETINUM* L.)****A. K. BHOWMICK, KAILASH CHAUKIKAR,* AND AMIT KUMAR SHARMA****Department of Entomology, JNKVV, Jabalpur – 482 004 (MP), India**

One of the most practical means of increasing chickpea production is to minimize losses caused by the biotic factors, which include insect-pests, diseases and weeds under field conditions. Gram pod borer, *Helicoverpa armigera* (H) causing 29% yield losses in chickpea at national level. A field experiment was carried out during 2012 at BSP farm, JNKVV, Jabalpur. The trial was carried out with eight treatments and replicated thrice following the Randomized Block Design (RBD). Plot size was kept 4m x 5m with row x plant spacing of 45 x 05 cm. Emamectin benzoate 05% WG @ 138 g/ha (6.9 g a.i/ha) was found to be the most

effective dose against Bengal gram pod borer (*Helicoverpa armigera*) and which was at par with the higher doses of Emamectin benzoate 05% WG @ 188 and 162 g/ha (9.4 & 8.1 g a.i/ha). Also the treatments of Emamectin benzoate 05% WG did not show any adverse effects on the populations natural enemies observed in the treated plot viz, Lady bird beetle and Chrysopa.

Keyword: *Helicoverpa armigera*, Emamectin benzoate, Natural enemies and chickpea.

DOUBLING OF FARMERS INCOME THROUGH DIFFERENT INTERVENTIONS

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The Government of India in its annual budget of 2016-17 set a policy target of doubling farmer's income by 2022 A.D. Agriculture sustains livelihood for more than half of the country's population. The majority of India's poor (70%) are found in rural areas where three-quarters of India's families depend on rural incomes. The government of India wants to double the farmer's income by 2022 A.D. through research and development and the improved welfare of its rural poor. It is an uphill task, but we can achieve it if we are able to raise agricultural productivity per unit of land, reduce rural poverty through a socially inclusive strategy that comprises both agriculture as well as non-farm employment; and ensure that agricultural growth respond to food security needs. NITI Ayog set seven-point strategies for doubling farmers income: Focus on Irrigation along with adequate resource building, Increase production through quality seeds, planting materials & organic farming, soil-test-based nutrient management, post-harvest crop losses: Large investment in warehousing & cold chain facilities & Value addition through food processing, Creation of a national agriculture market, removing distortions and e-platform across 585 markets, New crop insurance schemes: Pradhan Mantri Fasal Bima Yojna, and promotion of ancillary activities such dairy development, poultry, beekeeping, fisheries, agro-forestry & integrated farming system.

Keywords: Farmer, Agricultural income

CONSERVATION AND MANAGEMENT OF INDIGENOUS TECHNICAL KNOWLEDGE

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Indigenous Technical Knowledge (ITK) has immense potential for innovation, especially at the grassroots level. India is a country populated by a number of indigenous communities, most of which have their own set of unique traditional knowledge and technology base. Many of these knowledge and technologies are equals with the modern knowledge and technology system and have been provided the indigenous communities with comfort and self-sufficiency. These traditional knowledge and technologies have played a significant role in the overall socio-economic development of the communities. Sources of ITK are hidden in our village, communities and countryside. The main sources are farmers, community leaders, elder persons, folklore, song, poetry, ancient records, NGOs, extension agencies and published materials of different languages. These potential sources which possess indigenous knowledge (local farmers' knowledge) should be involved in the development activities. Thus, recognizing indigenous knowledge and harnessing it for allied agricultural development could form new paradigm for meaningful development where special emphasis could be placed on developing and disseminating local content, improving the relevance of the information to local development, as well as capturing and auditing all relevant local resources. Indigenous traditional knowledge system consists of an integrated body of knowledge system which tends to focus on different aspects of Agricultural Sciences. By linking the indigenous knowledge systems of the people with farmer, research and extension, the output of researches can be made more fertile and usable. ITK is a valuable asset to indigenous and local rural communities who depend on ITK for their livelihood as well as to manage and exploit their local ecosystem in sustainable manner. Identifying, documenting and incorporating ITK in agricultural extension organization are essential to achieve agricultural development. ITK system provides a frame of reference for strengthening agricultural extension and research programmes. The participatory technologies that are developed through ITK integration will provide diversified technological options. Indigenous Traditional Knowledge being low in cost will also benefit national economy besides sustainable agricultural development.

Keywords: ITK, Agricultural Development, Livelihood

LAND SUITABILITY EVALUATION FOR SOHAG-RED SEA ROAD SIDES, EASTERN DESERT, EGYPT**¹ALI R. A. MOURSY, ¹A. ABDEL GALIL, ¹M. S. IBRAHIM AND ²A. A. ABDELHADY****1. Soil and water Department, Faculty of Agriculture, Sohag University, Egypt****2. Soil Department, Faculty of Agriculture, Cairo University, Egypt**

The investigated area was a part of Sohag-Red sea road in Wadi Qena which considered a promising for horizontal agricultural expansion policy in Egypt. It lies between the 26°.75, 26°.65 latitudes (N) and 32°.7, 32°.9 longitudes (E) in an area about 204 km². The studied area was divided into six physiographic units viz., Wadifloor (WF), Low elevated sand sheet (LSS), High elevated sand sheet (HSS), Bajada (B), Piedmont (P) and Tableland (TL). Seventeen soil profiles were selected to be representative for the physiographic units of the studied area. Soil samples collected, prepared and analyzed for soil physical and chemical properties. Land suitability evaluation for different crops was applied using Agricultural Land Evaluation System (ALES) software which designed for arid and semi-arid regions. The obtained results showed that the studied area is moderate suitable (S2) for Sunflower and Olive crops, marginally suitable (S3) for Wheat, Barley, Maize, Peanut, Onion, Fig and Datepalm and not suitable (N) for Bean, Cotton, Potato, Tomato, Pepper and Alfalfa. The general dominant limiting parameters affecting land suitability are soil pH, EC, OM, CEC, CaCO₃, ESP and texture. Arc GIS 10.0 used for generating suitability maps for different crops in the investigated area. The obtained results and maps may be helpful for decision makers for best selection of cultivated crops to achieve efficient reclamation plans.

Keywords: Wadi Qena, GIS, ALES, Land suitability, mapping.

STUDY OF STATUS OF RABBIT MEAT IN RECENT YEARS AND ITS NUTRITIONAL QUALITIES AND BENEFICIAL EFFECT IN DAILY HUMAN DIET**ANKITA PAL, SAJID HUSSAIN, PRIYANKA SHARMA, ASHOK MALIK****Department of Livestock products Technology, College of Veterinary Sciences, Lala Lajpat Rai University of Veterinary and animal Sciences, Hisar-125004, India**

Study evaluated that increased consumer knowledge of the link between diet and health has raised the awareness demand for better and more healthy food alternatives. Here comes the role of rabbit meat as an alternative to the conventional meat food, currently rabbit meat products do not fully meet the consumer demand for convenience, thus hindering the further development of the rabbit meat industry. The main problems, including a lack of leading enterprises and brand products, insufficient investment and research, and the weakness of fundamental studies on traditional products. In Asia, the rabbit meat production from 2010 to 2016 accounted for almost 70% of the total world output. Due to its digestive physiology, the rabbit can therefore exploit cellulose-rich feed (forages) converting about 20% of its protein into edible meat and without competing with humans for food. Rabbit meat is healthy due to its specific nutritional characteristics such as high contents of polyunsaturated fatty acids, proteins, and essential amino acids. At the same time, moderately high energy values, low fat, and low cholesterol levels contribute to its desirable composition. Rabbit meat offers excellent nutritional properties being rich in protein (18.6–22.4g/100g edible fraction) of high biological value, poor in fat (1.8–8.8g/ 100g edible fraction), in cholesterol (47–61mg/ 100g edible fraction) and in sodium (37–47mg/100g edible fraction). Moreover, it is rich potassium (428–431mg/100g edible fraction), phosphorus (222–234mg/100g edible fraction), selenium (9.3–15.0µg/100g edible fraction), B vitamins and has a favorable, highly unsaturated fatty acid profile. As rabbit can effectively incorporate dietary fatty acids in muscle tissue lipids, it is possible to enrich meat with essential long-chain n-3 PUFA by supplementing diets with linseed oil rich in α-linolenic acid.

Keywords; Rabbit meat, nutritional value, dietary, biological value,

TEMPORAL TREND ANALYSIS OF MONTHLY, SEASONAL AND ANNUAL STREAMFLOW DATA (RAMGANGA RIVER) USING PARAMETRIC AND NON-PARAMETRIC TESTS**ANURAG MALIK* AND ANIL KUMAR****Department of Soil and Water Conservation Engineering, College of Technology,****G.B. Pant University of Agriculture & Technology, Pantnagar-263145, Uttarakhand, India.**

In this research, temporal trend in monthly, seasonal (winter, pre-monsoon, monsoon, and post-monsoon), and annual streamflow time data was detected using Kendall Rank Correlation (KRC), Mann-Kendall (MK) and Modified Mann-Kendall (MMK) tests; while magnitude (ha-m) of trend was determined using Theil-Sen's Slope (TSS) and Simple Linear Regression (SLR) tests at Naula and Kedar stations located in upper Ramganga river catchment, Uttarakhand State, India. The trend and auto-correlation coefficient (ACC) of three different time series were tested at 10%, 5% and 1% significance levels. The results of analysis revealed significant positive and negative trends were observed in monthly, seasonal and annual streamflow time series at 10%, 5% and 1% significance levels for Naula and Kedar stations. The magnitude of trend was also found falling in monthly, seasonal and annual

streamflow time series at both the stations. The temporal variability of streamflow trend helps the local stakeholders and water resource managers to understand the risk and vulnerability related to climate change and anthropogenic activities in the region.

Keywords: Trend analysis, Streamflow, Auto-correlation coefficient, Ramganga river, Uttarakhand

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Keywords: Trend analysis, Streamflow, Auto-correlation coefficient, Ramganga river, Uttarakhand

RESPONSE OF DIFFERENT LEVELS OF ZINC AND IRON ON GROWTH, YIELD AND YIELD ATTRIBUTING CHARACTERS OF WHEAT (TRITICUM AESTIVUM L.)

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The field experiment was conducted in Factorial Randomized Block Design and seed quality parameters were assessed by using Complete Randomized Design with three replications during 2011-12 & 2012-13 at Experimental Research Farm, Nawabganj, Kanpur and Seed Testing Laboratory of Department of Seed Science and Technology, respectively with wheat variety K-9162 (Gangotri). Four doses of zinc viz. 0.0, 5.0, 10 and 15 kg ha⁻¹ and iron viz. 0.0, 2.5, 5.0 and 7.5 kg ha⁻¹ were applied. The best performance was recorded in 10 kg Zn ha⁻¹ with respect to seed yield (38.90 q ha⁻¹), leaf area index at 90 DAS (3.94), days to 50 % heading (73.42), plant height (82.01 cm), number of tillers m⁻² (314.08), number of spikelet's spike⁻¹ (18.13), seed growth duration (35.25 days), days to maturity (116.46) and 1000 seed weight (47.06 g), As far as the iron levels as concerned the best values were recorded in 5.0 kg Fe ha⁻¹ with regards to days to 50 % heading (74.00), plant height (79.56 cm), number of spikelet's spike⁻¹ (17.79) and seed growth duration (35.71 days), The interaction combination i.e. 10 kg Zn x 5.0 kg Fe ha⁻¹ (Zn₂ x Fe₂) showed significantly better values for LAI at 30 DAS (1.85), plant height (83.50 cm), number of tillers m⁻² (320.67), seed yield (396.66 g m⁻²). Thus, it is concluded that application of 10 kg zinc and 5.0 kg iron ha⁻¹ either singly or in combination of both have been found most appropriate and economical for above.

Keywords: Zinc, Iron, Growth parameters, Yield, Wheat.

STUDY ON THE PRODUCTION, INCOME AND MARKETING OF MANDARIN ORANGE IN SALYAN DISTRICT

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The study on the production, income and marketing of mandarin orange was carried out in Salyan district at Sharada and Bagchaur municipality during January to April 2017. The main objective of the study was to access the information about production and market status of mandarin orange and its role in income generation. All together 100 respondents were selected, among them 15 respondents were from Khalanga, 20 respondents were from Peepalneta, 30 respondents were from Katmaula and the 35 respondents were from Dangigaun. In this study, 80 percent male and 20 percent female were involved in mandarin production. 67 percent of the respondents were literate and 33 percent were illiterate. 0.2-0.5 hectares of land holding was done by 44% of the respondents for mandarin production. 36% of the respondents used sprinkler irrigation. The status of mandarin production of 45% of the respondents was increasing. The annual income of 22% of the respondents was around Nrs.10, 000-50,000. The annual income of 92% of the respondents was increased after mandarin farming. Dang, Nepalgunj, Dhangadhi, Butwal and the local markets of Salyan were the main market for wholesaler, retailer and contractors.

Keywords: Production, Income, Mandarin, Market.

RESPONSE OF DIFFERENT LEVELS OF ZINC AND IRON ON GROWTH, YIELD AND YIELD ATTRIBUTING CHARACTERS OF WHEAT (*TRITICUM AESTIVUM* L.)

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The field experiment was conducted in Factorial Randomized Block Design and seed quality parameters were assessed by using Complete Randomized Design with three replications during 2011-12 & 2012-13 at Experimental Research Farm, Nawabganj and Seed Testing Laboratory of Department of Seed Science and Technology, respectively with wheat variety K-9162 (Gangotri). Four doses of zinc viz. 0.0, 5.0, 10 and 15 kg ha⁻¹ and iron viz. 0.0, 2.5, 5.0 and 7.5 kg ha⁻¹ were applied. Results showed that the application of zinc and iron affected significantly and doses of 10 & 15 kg Zn ha⁻¹ and 5.0 & 7.5 kg Fe ha⁻¹ showed significantly best and at par for most of the parameters. The best performance was recorded in 10 kg Zn ha⁻¹ with respect to seed yield (38.90 q ha⁻¹), leaf area index at 90 DAS (3.94), days to 50 % heading (73.42), plant height (82.01 cm), number of tillers m⁻² (314.08), number of spikelet's spike⁻¹ (18.13), seed growth duration (35.25 days), days to maturity (116.46) and 1000 seed weight (47.06 g). As far as the iron levels as concerned the best values were recorded in 5.0 kg Fe ha⁻¹ with regards to days to 50 % heading (74.00), plant height (79.56 cm), number of spikelet's spike⁻¹ (17.79) and seed growth duration (35.71 days). The interaction combination i.e. 10 kg Zn x 5.0 kg Fe ha⁻¹ (Zn₂ x Fe₂) showed significantly better values for LAI at 30 DAS (1.85), plant height (83.50 cm), number of tillers m⁻² (320.67), seed yield (396.66 g m⁻²). Thus it is concluded that application of 10 kg zinc and 5 kg iron ha⁻¹ either singly or in combination of both have been found most appropriate and economical for achieving the maximum seed yield and growth parameters of wheat variety K-9162 (Gangotri).

EFFICACY OF UREA-MOLASSES-MINERAL BLOCK (UMMB) SUPPLEMENTATION ON PRODUCTION AND REPRODUCTIVE PERFORMANCE IN BUFFALOES UNDER RURAL MANAGEMENT PRACTICES IN DISTRICT BALRAMPUR

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An On Farm Trial was conducted to study the efficacy of urea-molasses-mineral block (UMMB) supplementation on performance of buffaloes and feed economics under Tarai region of the district. Twenty lactating buffaloes in mid-lactation with similar age, body weight and breed were selected from dairy farm of the local farmer's and divided into two equal groups having ten animal in each group i.e. T₁ (control) and T₂ UMMB supplementation. The feeding of animals in control group (T₁) consisted of 10 kg. wheat straw, concentrate mixture @40 per cent of milk yield/day and 25 kg. green fodder (barseem) with grazing. In the treatment group (T₂) in addition to the above a regular supply of urea-molasses-mineral block (UMMB) as a lick was offered during the study period without interruption. The average milk yield were recorded 4.5±0.21 and 5.2±0.22 lit./day in T₁ and T₂, respectively. The significant increase in milk yield by 13.46 per cent in experimental group (T₂). Reduction in cost of milk production/ lit. was recorded 5.07 per cent in buffaloes supplemented with UMMB. The post-partum estrus period and service period reduced in experimental group (T₂) than the control (T₁). It can be concluded that feeding of urea-molasses-mineral block (UMMB) improved the feed efficiency, milk production, reproductive performance and health in buffaloes.

OPTIMIZATION OF HORMONAL REQUIREMENT FOR IN-VITRO RAPID SHOOT MULTIPLICATION IN SUGARCANE

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In sugarcane, slower multiplication rate using conventional methods takes more time in adoption for cultivation of newly released variety on large scale by farmers. Moreover, non availability of disease-free and true to type quality seed also affects sugarcane production. Now days, tissue culture techniques has been established as an effective and reliable tool for rapid production of quality planting materials. Thus, present study was designed to optimize hormonal requirements for rapid in-vitro shoot multiplication of two elite sugarcane varieties viz. Co 0118 and Co 05011. Explants were collected from field grown nine months mature plants and surface sterilized by different combinations of sterilants. The cultures were initiated by inoculating explants on MS media containing 0.5 mg/L of each BAP and Kn. The results obtained under study reported optimum surface sterilization when explants were treated with combination of 0.1% Mencozeb + Carbendazim for 10 min, 0.1% HgCl₂ for 5 min, 6% NaOCl for 10 min and 70% EtOH for 1 min. The explants inoculated on media supplemented with single hormone results in slower multiplication and growth. The optimum shoot multiplication and higher shoot length in variety Co 05011 was found to be in MS media containing each of BAP and Kn (1.0 mg/L), TDZ (0.5 mg/L) and GA₃ (0.25 mg/L), whereas MS media containing 1.0 mg/L each of BAP and Kn, 0.5 mg/L each of TDZ and GA₃ was found to be best for variety Co 0118. The higher survival % and shoot establishment was observed in MS media supplemented with 0.05% Cefotaxim.

Keywords: Sugarcane; Hormonal requirement; Multiplication; TDZ; Sterilization

ENERGY BALANCE AND MANAGEMENT IN RICE ECOLOGY: THE SOCIO-ECOLOGICAL AND ECONOMIC COST-BENEFIT ANALYSIS

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Energy management is the best solution for direct and immediate reduction of energy consumption. Chhattisgarh is known as the "rice bowl" of India. And the present study was conducted in patan block of durg district in Chhattisgarh with the sample size 105 small farmers cultivating rice crop. Information was obtained with the help of personal interview method during study period. Perception level of energy management in rice crop at community level increase the adoption level of improved technology management. Hence, this study was conducted to know the perception level of energy management, energy consumption, energy balance and its relationship with personal, socio-economical and agro-economic characteristics of rice grower. Energy balance is subtraction difference between input and output. The output was rice grain and inputs were human labour, animal power, machinery, irrigation chemical fertilizers (NPK), diesel fuel, plant protection chemicals, seed, and electricity. Total input and output energy equivalent (MJ). The coefficient of variation of this variable is 17.24 per cent which shows that this variable has got the very high level of consistency. Energy consumption in rice crop (Y_1) has been found to be the mean value of this variable is 21947.25 and the standard deviation is 3784.10 for the total distribution taken for the study. The coefficient of variation of this variable is 17.24 per cent which shows that this variable has got the very high level of consistency. Energy balance in rice crop (Y_2) has been found to be the mean value of this variable is 141819.29 and the standard deviation is 19017.38 for the total distribution taken for the study. The coefficient of variation of this variable is 13.41 per cent which shows that this variable has got the very high level of consistency. The finding of the study revealed that the overall level of perception of energy management was higher but adoption level was low. The coefficient of variation of this variable is 9.82 per cent which shows that the variable has got very high level of consistency. Economic cost-benefit ratio of rice crop (Y_4) has been found to be the minimum 1.67 and the maximum 4.13. The coefficient of variation of this variable is 13.51 per cent which shows that the variable has got very high level of consistency. The relationship of predicted variables viz perception level of energy management in rice crop at community level (Y_3), energy consumption in rice crop (Y_1), and energy balance in rice crop (Y_2), with exogenous variables has been found that some exogenous variables highly positive influencing to predicted variables for better sustainable production and have more capability for achieve better energy balance. Should be more awareness programs are organized to increase level of knowledge and adoption of energy management to sustain rice production in Chhattisgarh. The need of awareness to farmers toward the energy planning, auditing, energy use in balance, sustainable production and should be one policy on energy management link with institution.

Keywords: - Energy, consumption, rice crop, balance, management.

RUNOFF SEDIMENT MODELLING USING SOFT COMPUTING TECHNIQUE OF GHATSHILA, JHARKHAND

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The efficient management of the watershed is necessary for the development of watershed. Therefore, it is necessary to gain knowledge about sediment concentration in river to give a way to watershed management. The relationship between suspended sediment concentration (SSC) and river discharge (Q) is very complex which remains a challenge for SSC prediction in hyper-concentrated rivers. In this study, the wavelet-artificial neuralnetwork model (WANN) was built to predict SSC in the Ghatshila region of Jharkhand, within a Subernrekha river basin. In the WANN model, the observed daily time series for Q and SSC days (from 2004 to 2013) were computed in Matlab in which best input is selected using gamma test. The tool uses log-sigmoid as a transfer function and mean square error as a performance function in Matlab. This result compare with artificial neural network (ANN) results for sediment-runoff modelling. The coefficient of determination (R^2) and root-mean square error (RMSE) were adopted to evaluate the model's performance. For WANN model, the value for coefficient of determination and root mean square error is 0.9419 and 0.0777 respectively for training data while for testing data, the value is 0.8403 and 0.05907 respectively. For ANN model, the value for coefficient of determination and root mean square error is 0.9103 and 0.9539 respectively for training data while the value is 0.6406 and 0.91664 respectively for testing data. Therefore, the study shows that the performance of WANN model is better than ANN model. The study also depicts that more acquiring power of WANN for simulation of extreme flows with lowest percentage of error.

Keywords: Gamma Test, Wavelet ANN, Coefficient of determination, RMSE

IMMUNO-EFFICACY OF IMIDAZOLE ANTIFUNGAL DRUG IN CONTROLLING OOMYCETES INFECTION IN LABEO ROHITA FINGERLINGS

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The present study evaluated the effect of sub-lethal doses of antifungal drug miconazole nitrate (MCZ) on immunological responses including immune related gene expression and its role as a prophylactic drug against *S. parasitica* in *Labeo rohita* fingerlings. Fish were fed with sub lethal doses of MCZ i.e., T1- 6.30 mg MCZ kgBW⁻¹, T2- 12.61 mg MCZ kgBW⁻¹ and T3- 25.22 mg MCZ kgBW⁻¹ and sampling was done at different time intervals for 240 h. Immunological parameters viz. lysozyme activity, oxygen radical production and plasma anti-protease activity showed significant enhancement ($p < 0.05$) in fish fed with T2 and T3 doses. Significant reduction in plasma protein content was observed in all the dietary groups as compared to control. Expression of immune relevant genes like TLR-22 and β 2-M showed significantly higher expression at 6 h and 24 h of sampling in both liver and head-kidney. However, these genes showed a down-regulation after 120 h of sampling in both the tissues. Preventive efficacy study showed that single dose of MCZ provides protection against oomycetes up to fourth day of infection. Significantly higher mortality was observed in control diet fed fish as compared to fish fed with MCZ medicated diet. Thus, from the study, it can be concluded that the MCZ can act as a potent antifungal agent for preventing oomycetes infection as well as to enhance immune response.

Keywords: Miconazole nitrate, antifungal, immunological, immune- gene, prophylactic

MANAGEMENT OF WHITEFLY BEMISIA TABACI ON POTATO CULTIVARS

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Field studies were carried out to assess the incidence of whitefly on 8 promising potato cultivars (Kufri Chandramukhi, Kufri Surya, Kufri Chipsona- I, Kufri Lauvkar, Kufri Chipsona -III, Kufri Girdhari, Kufri Frisona and Kufri Himalyani) under protected condition with three sprays of insecticides (imidacloprid, thiamethoxam and spiromesifen) and unprotected condition during 2015-16 at Central Potato Research Institute Campus, Modipuram, Meerut (U.P.). The whitefly population was low and significantly varied in protected potato cultivars as compared to unprotected cultivars. The maximum incidence of whitefly (3.91/plant) was recorded in Kufri Frisona followed by K. Chandramukhi (3.86/plant) when crop was remaining unprotected. In protected potato cultivars, Kufri Surya, Kufri Lauvkar, Kufri Chip-III, Kufri Girdhari, Kufri Frisona and Kufri Chip-I. Potato cultivars – K. Chipsona-I, K. Chandramukhi and K. Surya were recorded the highest mean tuber yield (330.67q/ha) (318.18q/ha) and (310.22q/ha), respectively under protected condition, similarly these cultivars were recorded maximum yield even (Table-3) under unprotected condition. The maximum percent increase in tuber yield (33.09) was recorded in Kufri Chip-I followed by Kufri Lauvkar (27.64) and Kufri Chip-III (25.47) of protected cultivars as compared to unprotected potato cultivars. Thus, it is concluded from present study that processing potato cultivars should be well protected by three spray schedule of insecticides-imidacloprid, thiamethoxam and spiromesifen as and when there will be any buildup of whitefly on crop for effective management of whitefly, especially for seed crop.

OPTIMIZATION OF CALLUS INDUCTION PROTOCOL IN CARICA PAPAYA (CV. PUSA NANHA)

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The present study was conducted to optimize an efficient callus induction protocol in *Carica papaya* (cv. Pusa Nanha). Three different types of explant were collected from field grown papaya plants under study viz., leaf, petiole and lateral bud. The explants were surface sterilized by 5% labolene for 5 min, 0.1% bavistin for 10 minutes, 4% sodium hypochlorite for 3 minutes and 0.1% mercuric chloride for 3 min followed by 3 washings of autoclaved de-ionised water after every treatment. Explants were excised into 1-2cm diameter and inoculated on basal MS medium supplemented with various concentrations of NAA, Kinetin and TDZ. The cultures were kept in dark inside the culture room at $25 \pm 2^\circ\text{C}$ and humidity 55-65%. The results obtained under study showed that the media containing only NAA and Kinetin results in less percent of callus induction (10-20%) whereas earliest and highest callus induction percent (80-90%) was obtained in media supplemented with 3.0mg/l NAA, 0.5mg/l Kinetin and 1.5 μ M TDZ. Callus produced from leaf was maximum in growth, friable and white in colour while other explants produced callus dark in colour. The obtained callus was transferred to proliferation medium containing NAA (1.0mg/l, 2.0mg/l & 3.0mg/l) and the best callus proliferation was observed in 3.0mg/l NAA. The findings of present study suggest leaf as the best explant and TDZ as an effective growth regulator for callus production in papaya. This protocol for callus induction may also help in propagating papaya

plants via embryogenesis and organogenesis which may further be contributive in developing synthetic seeds and transformation studies.

Keywords: Papaya; Callus; NAA; Kinetin; TDZ

EFFECT OF CHLOROFLUOROCARBONS ON THE ENVIRONMENT

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Chlorofluorocarbons or CFCs (also well-known as Freon) are non-toxic, non-flammable and non-carcinogenic. They mainly contains fluorine atoms, carbon atoms and chlorine atoms. The 5 main CFCs include: CFC-11 (trichlorofluoromethane - CFCl_3), CFC-12 (dichloro-difluoromethane - CF_2Cl_2), CFC-113 (trichloro-trifluoroethane - $\text{C}_2\text{F}_3\text{Cl}_3$), CFC-114 (dichloro-tetrafluoroethane - $\text{C}_2\text{F}_4\text{Cl}_2$), and CFC-115 (chloropentafluoroethane - $\text{C}_2\text{F}_5\text{Cl}$). [1] The lifetime of CFCs in the atmosphere is about 20 to 100 years, and one chlorine atom may destroy more than 100,000 ozone molecules before it is transformed into a non-reactive species.[2] Although the emissions of CFCs around the developed world have largely controlled due to international conformity, the damage to the stratospheric ozone layers are still not stopped.

Keywords: Chlorofluorocarbons, Non Carcinogenic, Ozone Layer

EFFECT OF GA_3 ON REPRODUCTIVE GROWTH AND CORMEL PRODUCTION OF GLADIOLUS

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Gladiolus (family Iridaceae) is one of the most important bulbous flower crops due to its long attractive spike with variety of colours, prolonged vase life and its ability to withstand long distance transportation. Four different varieties of Gladiolus (V1- American Beauty, V2-Pacifica, and V3- Summer Pearl and V4-Single Jester) with uniform size of corms were taken for assessing the effect of four concentrations of GA_3 (25, 50, 75 and 100 ppm) on cormel production. The experiment was conducted in Factorial Randomized Block Design. Un-treated control was also maintained. The observations were recorded on various vegetative growths, cormel production and floral attributes. Spikes were harvested when basal florets showed colour. In this investigation GA_3 100 ppm was found most effective for enhancing reproductive growth Number of florets per spike (16.10) time taken for Colour breaking (89.53 days) were observed at 50 ppm. Maximum floret size (13.16cm) and earlier 50% flowering (84.81days) were recorded at 25 ppm GA_3 . Treatment with GA_3 showed delayed 50% heading in (101.66 days) at 100 ppm. The results revealed that var. Summer Pearl recorded earlier colour break (89.53 days), earlier 50% flowering (84.80 days) and maximum cormel production (16.43) maximum number of florets per spike (16.10) and maximum florets size (13.16 cm) were exhibited by var. American Beauty.

Key word:- Gladiolus, Gibberellic acid, Cormel, reproductive traits.

EFFECT OF DIFFERENT COMBINATION OF BIO-FERTILIZERS ON ROOT CHARACTER OF TRANSPLANTED AIR LAYERED PLANTS OF GUAVA (PSIDIUM GUAJAVA L.)

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The experiment was laid out from randomize block design (RBD) with three replication and the total six number of treatment with bio-fertilizer combinations (B_0 -Control, B_1 -Azotobacter + PSB + Potash Solubilizing Bacteria, B_2 - Azotobacter + PSB + Zinc Solubilizing Bacteria, B_3 - Azotobacter + Potash Solubilizing Bacteria + Zinc Solubilizing Bacteria, B_4 - PSB + Potash Solubilizing Bacteria + Zinc Solubilizing Bacteria, B_5 - Azotobacter + PSB + Potash Solubilizing Bacteria + Zinc Solubilizing Bacteria) were tested under the experiment at the experimental area on nursery, department of Horticulture, College of Agriculture Gwalior during 2016-17 and 2017-18. The observations were recorded on different aspects of root parameter like fresh and dry weight of primary and secondary roots. The result of experiment revealed that the maximum fresh weight of primary and secondary root found (1.414, 1.429 and 1.422 g) and (0.373, 0.403 and 0.388 g) in B_5 and minimum fresh weight of primary and secondary root (0.598, 0.623 and 0.611 g) and (0.197, 0.202 and 0.199 g) in B_0 during 2016-17 and 2017-18 and in pooled data. The maximum dry weight of primary and secondary root (0.278, 0.277 and 0.277 g) and (0.080, 0.085 and 0.083 g) recorded in B_5 and minimum dry weight recorded (0.139, 0.148 and 0.143 g) and (0.036, 0.040 and 0.038 g) respectively in B_0 during 2016-17 and 2017-18 and in pooled data. It was concluded that the B_5 is statically improved root characters.

Keyword – Guava, Bio-fertilizer, fresh and dry weight

EFFECT OF INORGANIC, ORGANIC AND BIO-FERTILIZERS ON GROWTH OF GUAVA (PSIDIUMGUAJAVA L.) VAR. GWALIOR-27 UNDER GWALIOR AGRO-CLIMATIC CONDITION OF M.P.

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The Guava, botanically known as *Psidiumguajava* belongs to the family of Myrtaceae. Guava was considered to be one of the most exquisite and nutritionally valuable remunerative crops. The origin of guava is from tropical America and it is also known as apple of tropics. The experiment was laid out from randomize block design (RBD) with three replication and the total fourteen number of treatment with RDF, organic compost and bio-fertilizer combinations were tested under the experiment at the experimental area, Gwalior M.P. during 2018-19. The observations were recorded on different aspects of growth parameter like plant height, diameter of stem, diameter of secondary branch, number of secondary branch, number of tertiary branch, plant spread (north to south) and plant spread (east to west) were found highly in T₉ (75% RDF + vermi compost 5kg + bio-fertilizer per tree) and it was at par to T₁₀ (75% RDF + Sheep manure 5kg + bio-fertilizer per tree) and T₈ (75% RDF + FYM 5kg + bio-fertilizer per tree) and T₉ followed by other treatments and minimum data recorded under T₀ (control).

Keyword – Guava, Bio-fertilizer and Growth

INTRIGATED NUTRIENT MANAGEMENT IN VEGETABLE CROPS

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Population growth and urbanization are creating increased demand of food over and there is growing concern over malnutrition especially in semi urban areas. To meet the full dietary needs of common man to eliminate malnutrition deficiency diseases and to relieve over stress there is greater need of enhanced vegetable production. Among the various factors of production of vegetable crops, soil health is crucial factor. Nitrogen is a mobile nutrient both in the soil and within the plant. Hence, emphasis should be given during the crop duration of each vegetable that the number of split application and time of each application should be manipulated to achieve maximum utilization and minimum loss of the applied fertilizer. Tomato and onion depend more on applied nitrogen whereas the brinjal okra, French bean absorb more of soil, nitrogen recovery of applied nitrogen fertilizer range from 13.9 % in chilli to 44% in brinjal. The potassic fertilizers intermediate in mobility in the soil and usually applied along with the basal dose at sowing /planting. Plants take most of their potash requirement in the early stage of their growth. Phosphorus is relatively immobile in the soil hence it should be banded to minimize fixation.

Key words:- Vegetable, population growth, deficiency, fertilizer, nutrient management.

DEVELOPMENT OF CHICKEN MEAT PATTIES BY USING POMEGRANATE FRUIT WASTE POWDER

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The study was conducted with an objective to evaluate the effect of pomegranate fruit waste powder on quality characteristics of chicken meat patties. The chicken meat patties were prepared with incorporation of 1% pomegranate whole fruit powder (T1) and 2.5% pomegranate peel powder (T2) and the nutritional and physio-chemical characteristics of product is studied that pomegranate whole fruit powder addition showed significantly higher moisture and higher fat content as compared to control as well as T2 chicken meat patties. The incorporation of (T1) and (T2) powder also decreased the cholesterol and free fatty acid content as compared to control sample. However, the emulsion stability and cooking yield of T2 chicken patties were statistically comparable with control sample but these were lower in T1 chicken patties. The addition of both sample in the products resulted lower thiobarbituric acid content as compared to control product. The pH values are less affected by T1 and T2 treatments. The shear press value was lower for T1 chicken meat patties and higher for the T2 chicken meat patties as compared to control. It is concluded that addition of pomegranate whole fruit powder at 1% and pomegranate peel powder 2.5% levels improved the nutritional and physio-chemical properties of chicken meat patties.

Key words: pomegranate peel powder and pomegranate whole fruit powder in chicken meat patties

COROLLARY STUDY ON ENTREPRENEURIAL BEHAVIOR OF BEE KEEPING FARMERS**R. S. GURJAR¹ AND S.K.BADODIYA²****1. Ph.D. Scholar and 2.Principal Scientist & Head****1. BRAUSS Mhow Indore (MP) 2. KVK Barwani RVSKVV, Gwalior**

Bee keeping entrepreneur is the most significant figure of economic activity and prime mover of development. The present study was conducted in surrounding area Morena city of Madhya Pradesh. From this list 200 bee keeping farmers were selected by random sampling method. The study revealed that majority 65.5 percent respondents had medium level of entrepreneurial behavior about bee keeping management practices. The entrepreneurial behavior was positively and significantly related with education, bee keeping experience, land holding, livestock possession, occupation, annual income, material possession, extension contact, economic motivation, market orientation, scientific orientation, attitude of bee keeping farmers towards bee keeping farming and knowledge of improved dairy management practices found to have positive and significant relationship with entrepreneurial behavior. Coefficient of determination R^2 was 0.978 which indicates that 97.00 percent variation in the entrepreneurial behavior of bee keeping farmers was explained by sixteen independent variables which were selected for study.

Key words- Entrepreneurial behavior, Bee keeping farmers, Bee keeping management practices, Planning ability, Coordinating ability and Self-confidence.

FACTOR AFFECTING THE PARTICIPATION OF RURAL WOMEN IN AGRICULTURAL ACTIVITIES**R. S. GURJAR¹ AND PRIYANKA GURJAR²****1. Ph.D. Scholar, Department of Agriculture Extension Education and 2. Ph.D. Scholar Department of Horticulture****1. BRAUSS Mhow Indore (M.P.), 2 RVSKVV, Gwalior, (M.P.)**

The present study was carried out in Morena, Morena and Jaura blocks of Morena district of Madhya Pradesh. A simple random sampling procedure was followed in order to obtain the appropriate sample of rural women. The total sample size was 144. The dependent variable was participation of rural women in agricultural activities. The independent variables were relating to socio-personal, socio-economic, communicational and psychological traits of rural women such as caste, education, marital status, farming experience, annual income, occupation, economic status, land holding, extension participation, extension contact, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities. The data were collected by personal interview technique with the help of structured interview schedule. The data were analyzed using statistical methods such as correlation and regression analysis. The traits like education, farming experience, economic status, extension participation, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities exhibited positive and strong correlation with level of participation and occupation of the rural women also positively related with level of participation. About 85.92 per cent variation in the extent of participation of rural women in agricultural activities was explained by all the 16 traits taken into consideration. Education, farming experience, economic status, extension participation, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities significantly influenced the extent of participation of rural women in agricultural activities.

Keywords: Farm women; Participation; Information

STUDY THE PHYSIOLOGICAL AND BIOCHEMICAL CHANGES UNDER THE DROUGHT IN CHICKPEA (CICER ARIETINUM L.)**R. T. SHENDE AND R. S. SENGAR****Department of Agricultural Biotechnology,****Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut india-250110**

Chickpea (*Cicer arietinum* L.) is an agronomically and economically significant plant for India. It is generally affected by terminal drought which causes retardation of flowering and decreases yield. The aim of this study was to determine significant factors which can be used to identify chickpea plant tolerance to drought stress. Drought is a major factor responsible for loss of productivity in agriculture and results in decline in food production by reducing uptake of water and nutrient. Plants under drought stress show different responses. Changes of, physiology and biochemical in face of drought stress in plants can be seen. With this objective we assessed physiological (fresh and dry weight, relative and real water content) and biochemical (enzymatic and non-enzymatic antioxidants, malondialdehyde, and total protein contents) parameters which were used to measure the impact of drought on chickpea. Among the biochemical changes induced by drought stress can be compatible dissolved in dry conditions of stress. Noted. chickpea genotypes under drought stress conditions. It is shown that the decrease in water potential, reducing the amount of leaf starch and total soluble sugars, hexose and sucrose increases the osmotic regulation of pea genotypes. But some of these differences correlate with changes in carbohydrate composition or the rate of gas exchange may osmotic potential weak

effect on stress levels, or stage of plant growth. In above finding all of these characters play essential roles in the drought tolerance of plants.

Keywords: Chickpea, drought, genotypes, rain-fed condition

PERFORMANCE OF LENTIL IN RESPONSE TO CLIMATE CHANGE UNDER RAINFED CONDITION OF VARANASI REGION

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In India, major pulses like chickpea, lentil, and pigeonpea account for 39, 10 and 21% of the total pulse production in the country (Anonymous 2009). Among all pulse crops, lentil is presumably the most ancient legume (Bahl et al. 1993). About 37% of the lentil area occurs in India, contributing to 32% of global production (Reddy et al. 2013). Its productivity trend is changing with the change in the climate. A review of last five-year weather data, from 2012 to 2017 was done; which include minimum and maximum temperature, rainfall, dry spell (10 days consecutive without rainfall), crop evapotranspiration and stress (number of days below permanent wilting point) to find out climatic facts responsible for low productivity of lentil. All factors are responsible for the low production of lentil because they are either directly or indirectly have their impact. Scrutiny of five years data reveals that rainfall is the major factor along with the temperature. Rainfall provides the require water to crop for their production metabolic activity; it also acts as a medium of nutrient mobility, which ultimately reflected in crop yield. The temperature had an influence on crop yield through crop evapotranspiration, as temperature increased the crop evapotranspiration also increased. Under sufficient moisture condition, crop evapotranspiration does not have to limit impact but under limited moisture condition, it had its negative effect on lentil yield.

Keywords: Lentil, rainfall, temperature, crop evapotranspiration, yields, etc.

EFFECT OF FYM, FERTILIZER AND MICROBIAL INOCULATION ON PRODUCTIVITY AND SOIL FERTILITY OF CHICKPEA IN VERTISOL

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A field experiment was conducted during 2016-17 at Sakroli village Distt. Vidisha (M.P.) to study the “Effect of FYM fertilizer and Microbial inoculation on productivity and soil fertility of chickpea in Verisol”. The treatments comprises as 50% RDF, 50% RDF + FYM 5 t ha⁻¹, 75% RDF, 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer, 100% RDF. The application of 75% RDF + FYM 5 t ha⁻¹ + Bio-fertilizer significantly increased the growth parameters viz. plant height, branches per plant, dry weight, number of root nodules per plant over control. Application of 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer recorded significantly higher value of pods per plant, seeds per pod, seed yield per plant and seed index and it was at par with 100% RDF. Highest and significant seed and straw yield was recorded with 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer (1924 kg ha⁻¹ and 2050 kg ha⁻¹) followed by 100% RDF (1875 kg ha⁻¹ and 1998 kg ha⁻¹) while maximum net return as well as B: C ratio were associate with 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer during both the year of investigation.

Keywords: FYM, inorganic fertilizer, Bio fertilizer, growth, yield, chickpea

IN-VITRO PROPAGATION OF PAPAYA (CARICA PAPAYA L.) VAR. RED LADY

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Papaya (*Carica papaya* L.) is a native of tropical and sub-tropical regions of the world and belongs to family caricaceae. It can be propagated both sexually (seeds) and asexually (grafting and root cutting) but the setback of propagation by seeds is the production of non-true-to type planting materials due to the segregation of off springs at the second filial generation, inherent heterozygosity, dioecious nature of the plant and the seed of open- pollinated flowers exhibit considerable variation in shape, size, flavor and susceptibility to disease. Similary, asexual methods are also tedious and impractical when carried out on a large scale. Therefore, to minimize these problems, micropropagation of papaya has become critical for the multiplication of specific sex type of papaya and contributive in the application of genetic transformation technologies. The papaya variety; red lady is generally grown in India with good productivity. Therefore, this study was conducted to develop an effecient protocol for in-vitro propagation of hermaphroditic papaya (red lady) from shoot buds. The shoot buds were collected from field grown papaya plants and inoculated on MS medium supplemented with varying concentration of auxin and cytokinins. Best initiated and proliferated shoots with highest mean number of shoots (16), highest shoot length (1.5cm) and mean number of leaves (18) were recorded on

MS medium with 1mg/l BAP and 0.5 mg/l NAA. On the other hand, the maximum number of roots (14.20) and root length (3.15 cm) were measured on MS media supplemented with 1.5 mg/l IBA. Lowest survival capacity (38%) of seedlings was recorded during acclimatization on mixture of garden soil, sand and cow dung at the rate of 2:1:1 respectively. Nevertheless, further investigations are also needed to maximize the survival rate of the seedlings for mass and commercial propagation of papaya.

Keywords: In-vitro; Hermaphrodite; Papaya; BAP; NAA; IBA; Shooting; Rooting; Hardening

EFFECT OF NITROGEN SCHEDULING ON YIELD, HARVEST INDEX AND NPK UPTAKE AT DIFFERENT STAGES UNDER TRANSPLANTED RICE

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A field experiment was conducted during kharif season of 2017 at Crop Research Centre of Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.). The soil of the experimental field was well drained, loam in texture, alkaline in reaction (pH 8.12), low in available nitrogen, medium in available phosphorus and available potassium with an electrical conductivity of 0.23 dSm⁻¹. Nine treatments comprising control (No N), 120 (RDN) N through urea at basal, maximum tillering and panicle initiation, respectively or 50:25:25 N, 50:50:00 N through urea at basal, maximum tillering and panicle initiation, respectively, 25:25:50 N through urea at basal, maximum tillering and panicle initiation, respectively, 75:12.5:12.5 N through urea at basal, maximum tillering and panicle initiation, respectively, 50% N, through urea at basal, and rest through LCC, 33% N through urea at basal, rest through LCC, 50% N through urea at basal, rest through SPAD, and 33% N through urea at basal, rest through SPAD, replicated thrice estimated in a randomized block design. The experimental results revealed that the highest grain yield (36.8 q ha⁻¹), maximum harvest index of (32.1%) and highest uptake of NPK were noticed in T₆ (50% N through urea as basal, rest through LCC).

Keywords: Harvest index, Leaf colour chart, NPK uptake,\

EFFECT OF SOWING DATE ON PRATYLENCHUS THORNEI AND ITS REPRODUCTION ON CHICKPEA.

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Ninety six varieties / lines of Chickpea were tested against *Pratylenchus thornei* and effect of sowing dates of chickpea was studied on reproduction of this nematode under screen house conditions. Inoculation was done @ 1000 nematodes per 500 kg pot on 7 to 10-day-old plants. Nematode population in soil plus root was estimated one month after inoculation of each 15 days interval of six date of sowing. On the basis of reproduction factor ($R_f = P_f/P_i$) varieties and lines were categorized as resistant ($R_f < 1$) or susceptible ($R_f \geq 1$). Of the 96 varieties/ lines, ICCV 2, JG 11, JG 12 and GBM 2 were rated as resistant where as varieties JG 62 and ICCV 05530 were rated as susceptible. No lesions or few lesions or browning was discernible on roots of inoculated plants. Final population and reproduction factor of *P. thornei* increased with the delay in sowing from 30th November to 5th January.

MICROCIDAL EFFECT OF AGNPS AGAINST ALTERNARIA PORRI UNDER IN VITRO.

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Purple blotch is one of the most important diseases in onion caused by *Alternaria porri*. It not only affects the bulb crop but also the seed crop and causing considerable yield losses up to 50 to 100 percent. However, many agrochemicals are being used to manage the *A. porri* but they having their own limitations. Hence we examined the effect of different concentrations of AgNPs against *A. porri*. Spherical shape AgNPs with a diameter of less than 100 nm in size were used as confirmed by EDX (Energy dispersive X-ray Spectrometry) and TEM. Eight treatments were used including a control viz. 0.0 ppm, 10ppm, 25ppm, 50ppm, 75ppm, 100ppm, 125ppm and 150ppm. In in vitro, AgNPs had potentially inhabited the growth of the *A. porri*. Maximum inhibition was observed at 150ppm (91.71%) followed by 125 ppm (91.24%) and 100ppm (87.56%). It was observed that the magnitude of the inhibition was greater along with the higher level of AgNPs.

Keywords: *Alternaria porri*, AgNPs, onion, Purple blotch, TEM and EDX.

MICROCIDAL EFFECT OF AGNPS AGAINST ALTERNARIA PORRI UNDER IN VITRO.**¹RATAN DAS, ²PRAHLAD DEB AND ³VEERE GOWDA R****^{1,2}Department of Horticulture and Postharvest Technology, Institute of Agriculture, Visva-Bharati, Sriniketan, WB, India****³Division of Vegetable Crops, Indian Institute of Horticultural Research, Hessaraghatta, Bengaluru, Karnataka, India**

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Keywords: *Alternaria porri*, AgNPs, onion, Purple blotch, TEM and EDX.

AGRIBUSINESS MANAGEMENT EDUCATION AND EMPLOYMENT OPPORTUNITIES: A REVIEW**RONAK P. GAJERA*AND B.L. RADADIYA******ASPEE Agribusiness Management Institute, Navsari Agricultural University, Navsari**

An agribusiness is a social institution. Agribusiness management education is a blend of economics, agriculture, business, and management principles. To develop a proficient and sustainable private sector-leads agribusiness sector, particularly in high-value areas of horticulture, livestock, and fisheries which support rural development, employment generation, and poverty eradication. There is a extravagance of opportunities available for competent agribusiness professionals in various agriculture-related organizations, build and sustain the relationship between the farming community and professional agencies involved in it. Agribusiness management field is recency origin and gaining rapid popularity among students as carrier choice and aims to design professional business leaders and entrepreneurs in agriculture and allied sectors. In Agribusiness management, students study how to make durable business decisions and minimize risk while working in the agricultural sector. Stream of this students can get jobs for various posts such as sales officer, procurement officer, warehousing managers, and logistics managers, etc. in national and Multinational Corporation. This investigates the potential open doors in agribusiness the board training which helps in business age and enterprise advancement.

Keywords – Agribusiness Education, agribusiness management, Employment opportunities and Entrepreneurship Development

ROLE OF WORKING AND NON-WORKING WOMENIN DECISION MAKING PROCESS**RUCHI****Department of Sociology, CCS Haryana Agricultural University, Hisar- 125004**

In Indian society working women have initiated willingly or unwillingly a process of de-segregation of the lives of men and women, which has started at the work place, but which, might also influence the whole social and gender order of society. There are many changes occurs in women status. These changes are occurred through the process by decision making. Changing roles of women, increasing women's education, and increasing participation of women in the labor force are important keys for family decision-making changes. The participation of women in decision-making is different in rural than urban. The women who are working are more independent to taking their decisions as compared to non-working women. Participation among the agricultural activities rural women's participation was relatively higher in various post harvest activities and livestock management activities than other agricultural activities. On the other side, their participation was almost nil in the case of aquaculture activities while participate in some selected non-agricultural activities like handicrafts making, tailoring, etc. The factors which effects the decision making process are mainly age, occupation, land holding, family type, family size, income, education, empowerment. There is some psychological factor like past experience motivation, cognitive biases, fear of loss, having son, etc. play an important role in decision making process of women.

Keywords: Decision making process, participation, economic activities

DEVELOPMENT OF CHICKEN MEAT KABABS BY USING ASHWAGANDHA ROOT POWDER AQUEOUS EXTRACT**SAJID HUSSAIN^{1*}, PRIYANKA SHARMA², ASHOK MALIK³, APOORVA ARGADE⁴, S.M. NAJAFI⁵****Department of Livestock products Technology, College of Veterinary Sciences****^{1,2,3,4}Lala Lajpat Rai University of Veterinary and animal Sciences, Hisar-125004, India****⁵Student in veterinary Medicine, School of Veterinary Medicine, Kazerun Branch, Islamic Azad University, Kazerun, Iran**

The study was conducted with an objective to evaluate the effect of Ashwagandha (*Withania somnifera*) root powder aqueous extract on quality characteristics of chicken meat kabab. The chicken meat kabab were prepared with incorporation of 2%, 4%, 6% and 8% Ashwagandha root powder aqueous extract and the nutritional and physico-chemical characteristics of product is studied and 4% Ashwagandha root powder aqueous extract was selected. Ashwagandha root powder aqueous extract addition showed significantly lesser moisture and lower fat content as compared to control chicken meat kabab. The incorporation of Ashwagandha root powder aqueous extract also decreased the cholesterol and free fatty acid content as compared to control sample. However, the emulsion stability and cooking yield were lesser in Ashwagandha (*Withania somnifera*) root powder aqueous extract chicken kababs. The addition of Ashwagandha root powder aqueous extract in the products resulted lower thiobarbituric acid content as compared to control product. The pH values are less affected in treated products compare to control. The shear press value was lower for Ashwagandha (*Withania somnifera*) root powder aqueous extract chicken meat kabab as compared to control. It is concluded that addition of Ashwagandha root powder aqueous extract at 4% levels improved the nutritional and physico-chemical properties of chicken meat kabab.

Keywords: Ashwagandha root powder, chicken meat kabab, quality.

DEVELOPMENT OF CHICKEN MEAT KABAB BY USING INDIAN GOOSEBERRY OR AMLA (PHYLLANTHUS EMBLICA) POWDER AQUEOUS EXTRACT**SAJID HUSSAIN*, ASHOK MALIK, PRIYANKA SHARMA, SANDEEP KUMAR, ANKITA****Department Of Livestock Products Technology, College Of Veterinary Sciences, Lala Lajpat Rai University Of Veterinary And Animal Sciences, Hisar-125004, India**

The study was conducted with an objective to evaluate the effect of Indian gooseberry also known as amla (*Phyllanthus emblica*) powder aqueous extract on quality characteristics of chicken meat Kabab. The chicken meat Kabab were prepared with incorporation of 2%, 4%, 6% and 8% Indian gooseberry powder aqueous extract and after sensory evaluation selected level of Indian gooseberry powder aqueous extract in chicken meat Kabab is 6% and the nutritional and physico-chemical characteristics of product is studied. Indian gooseberry powder aqueous extract addition showed significantly lesser moisture and lower fat content as compared to control chicken meat Kabab at selected level. However, the emulsion stability and cooking yield were also lower in Indian gooseberry aqueous extract chicken meat Kabab. The addition of amla powder aqueous extract in the products resulted lower thiobarbituric acid content as compared to control product due to its antioxidant property. The pH values are less affected in treated products compare to control. The shear press value and texture profile analysis was lower for Indian gooseberry powder aqueous extract chicken meat Kabab as compared to control. It is concluded that addition of Indian gooseberry powder aqueous extract at 6% levels improved the nutritional and physico-chemical properties of chicken meat Kabab.

Key words: Indian gooseberry or amla (*Phyllanthus emblica*), chicken meat Kabab, quality.

EFFECT OF DEWORMING ON MILK PRODUCTION AND GROWTH RATE IN DAIRY CATTLE**SANJEEV RANJAN, SANJEEV KUMAR AND JYOTI SINHA****Krishi Vigyan Kendra, Nalanda, Bihar**

In the present study, effect of deworming with fenbendazole on milk production and growth rate in dairy cattle was studied. The study was conducted on 125 dairy cattle and divided into two general categories: growth in milk production and body weight gain. The percentage increase in milk yield of untreated lactating cows and fenbendazole treated lactating cows at day 0 was 10 litres and 9 litres/day respectively. The percentage increase in milk yield in cows of control group was 4%, 5.5% and 6% at day 15, 25 and 35 respectively. Whereas the fenbendazole treated group it was 8.5%, 12% and 14% at day 15, 25 and 35 respectively. The percentage increase in body weight in untreated animals were 3.5%, 8% and 13% at day 15, 30 and 45 respectively, whereas it was 6%, 12% and 18% at and 15, 30 and 45 in fenbendazole treated animals respectively. From this study it was concluded that deworming increased the milk yield and growth rate in cows.

Key words: milk yield, growth rate, deworming, cattle

ENHANCEMENT OF PRODUCTIVITY AND PROFITABILITY OF SUGARCANE GROWING FARMERS THROUGH SUITABLE CROPPING SEQUENCES IN DISTRICT BALRAMPUR (U.P.)**SIYA RAM¹, BIKRMADITYA², A. K. PANDEY³ AND D.K. SRIVASTAVA⁴****1,3,4 Krishi Vigyan Kendra, Pachperwa, Balrampur (UP)****2 Assistant Professor, C.C.S.S.S (PG) Collage, Machara, Meerut (UP)****N.D.University of Agriculture & Technology, Kumarganj, Faizabad, 224 229 (U.P)****Corresponding Author¹: Subject Matter Specialist/ Associate Professor (Agronomy)**

Sugarcane (*Saccharum officinarum*.L) is one of the most important of cash crop of district Ballrampur. About 60000 ha area was sown by the sugarcane during 2015-16. Paddy-toria-sugarcane is most dominant cropping sequence of district. About 72% per year area of main sugarcane crop was left for ratooning. After harvesting of ratoon crop the farmers sown wheat which was so late. Due to uncertainty and unsurely of parchi for harvesting of sugarcane (ratoon) for the sowing of wheat, the farmers sale their ratoon crop of sugarcane on very less price. Due to late sowing of wheat and selling of sugarcane on very less price the productivity of wheat and profitability through sugarcane is very less. Keeping the above problem of sugarcane growing farmers of the district krishi vigyan Kendra Pachperwa Balrampur was decided to conduct On Farm Trial on “To asses more suitable cropping sequences after ratooning of sugarcane” during 2015-16. There was three treatments were kept, T1- Farmers practice sugarcane(ratoon)-wheat T2- sugarcane(ratoon)-Maize and T3- sugarcane(ratoon)-Urd on three farmers field of three villages. The plot size of each treatment was kept 0.13 ha. The result indicated that adoption of T3 was given more net profit (Rs. 151015/ha) and B:C ratio (2.98) followed by T2 which was more profitable over farmers practice (T1). Seeing the result of OFT about 30% farmers adopted sowing of Urd and Maize after ratooning of sugarcane in each village.

ESTIMATE CROP-EVAPOTRANSPIRATION AND ASSESS THE IMPACT OF RAINFALL, ON YIELD OF RAINFED RICE**SUDHANSHUVERMA*, DHARMINDER, ABHISHEKSHORI, VISHAL KUMAR, R. K. SINGH AND J.P. SINGH****Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi 221005, India**

This study has been conducted to estimate crop-evapotranspiration and assess the impact of rainfall, on rainfed rice yield in Varanasi district of Uttar-Pradesh. Historical climate data was sourced from department of Agronomy, and yield data of rice crop were taken from AICRP on Dryland Agriculture Varanasi Center, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, and were used as input to using CROPWAT model for the period of 2011 to 2017 years to estimate reference evapotranspiration (ET_0). Rice yield showed positive linear relationship with rainfall and crop evapo-transpiration for whole study period and the study. Rice is water loving crop so more rainfall more will be the yield as evident the years which record the highest rainfall, produce maximum yield. Deviation in yield was calculated from average yield. Percent yield reduction was also calculated from the highest yield of study period. The rain and crop waster use efficiency was also calculated. The lowest reduction in yield was 23.95% in 2013 and the highest yield reduction (61.37%) was recorded in 2017.

Keywords: Crop-evapotranspiration, CROPWAT, Rice, Yield**IDENTIFICATION OF NEW SPECIES OF ALTERNARIA IN SUGAR BEET CROP FROM INDIA****VARUCHA MISRA, MUKESH KUMAR, A. D. PATHAK AND A. K. MALL****Department of Crop Improvement, ICAR-Indian Institute of Sugarcane Research, Lucknow-226 002 (U.P.), India**

Diseases are an important aspect in any crop as it causes loss not only in production but yield is highly affected, resulting in heavy losses in farmer's earning. Sugar beet stands as a supplement cash crop for sugar production. Diseases in this crop cause destruction of 16-20% every year in world, however, in Indian conditions disease has been reported to cause a damage of 10-15%. In this respect, monitoring and identification of diseases symptoms is important. With this, the study was conducted to identify foliar leaf spot in sugar beet (*Beta vulgaris* Linn.). A novel fungal species have been identified in sugarbeet causing foliar leaves spot. At initial stages of examination, leaf spots are small, irregular to circular and spreading on leaves margins having a diameter of 20-50 mm. Appearance of first symptoms were observed in lower older leaves which later on spread to younger leaves. Spots are seen on both sides of leaves (dorsal or ventral). Microscopic examination revealed that there are two species of fungus infecting sugar beet leaves. On the basis of their morpho-taxnomic difference with reports of earlier fungus, two new taxon has been termed *Alternaria ashwinii* Mall, Misra, Kumar and Pathak sp. nov. and *Alternaria dilkushana* Mall, Misra, Kumar and Pathak sp. nov.. The first one have straight to flexous conidiophore with 1-4 spetate, brown in color and 10-80 μ m long and 2-3 μ m wide. Conidiogenous cells were sympodial, polytretic, solitary to catenate having 5-7 transversally septate, 0-1 oblique septate and 0-1 longitudinal septate. Conidia were of 43.2 - 45.6 μ m and 14.4 - 16.8 μ m in length and thickness respectively with beak length of 7.2 X 4.8 μ m. The second species have macronematous, monomenatous, straight to flexous conidiophores with brown in color and 10-90 μ m long and 3-4 μ m wide. Conidiogenous cells with sympodia, polytretic bearing thickened conidial scars.

Conidia were of 5.52 μm in length and 0.96 μm is the width of broadest part with 8-9 transverse septate and 0-1 longitudinal septate. Conidia beak was of 4.8 μm in length and thickness.

NOISE POLLUTION: DEFINITION, SOURCES AND EFFECTS OF NOISE POLLUTION

VIBHA SHARMA

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Noise is a prominent feature of the environment including that from sources such as transport, industry and neighborhood. Noise pollution is becoming more and more acute, and hence many researchers are studying the effect of noise pollution on people and its attenuation. Different sources have been identified that have potential for generation of noise pollution. Sources which are identified for the study are: noise level generated from vehicular traffic, noise from flour mill operation, construction machinery, and so on so forth. Based on the study and evaluation conducted for this research it is recommended here to implement three categories of innovative barriers and their designs, namely, (i) thatched shed; (ii) cubicles made of concrete, viz., normal concrete and concrete with coral shell powder (CSP); and (iii) fly ash brick; as they are cost effective, easy to install with locally available materials as well as beneficial to human beings in the long run. Research involved in field measurement of the noise levels generated by a traffic flow in an open stream as well as on a road provided with noise barrier. The noise that is generated from the existing system of operation is about 6% to 58% higher than the standards prescribed by the authorities. Such a severe noise pollution has to be reduced. Hence effective noise barrier was devised to attenuate the noise and the outputs are presented in the form of numerical results. From the numerical results and graphical representations, it is concluded that the reduction of noise level is about 5 to 8% in noise decibels through noise barriers. This will be significant when noise barriers are used especially in residential zones where a huge noise pollution is experienced due to vehicular traffic and construction machinery. In conclusion it can be stated that the noise barriers suggested are simple and they can be erected easily with locally available materials.

Keywords: noise pollution, human health.

POPULATION DECLINE AND CYTOGENETIC ANALYSIS OF KREZ FROG, CHRYSOPOASTER NOSIGNATA FROM JAMMU AND KASHMIR

WAHIED KHAWAR BALWAN AND NEELAM SABA

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Over the past few years, decline in population of Karez frog, *Chrysopaasternosignata* (Anura: Dicroglossidae) from Jammu and Kashmir state, India is quite alarming. The species inhabits the cold streams of Bhaderwah tehsil, district Doda (altitude 1500m-3000m) and has witnessed a great reduction in population size over the last three-four years. Anthropogenic activities, Climate change, habitat loss and toxicants are the possible causes for the reduction in population size. It is suggested that if the same factors are not strongly mended or conservation strategies not designed, we are soon going to find the species losing its 'Least Concerned' status also. Cytogenetic analysis of the Krez frog, *Chrysopoa sternosignata* from Jammu and Kashmir, was conducted for the first time. The frogs were collected from Bhaderwah town of Jammu & Kashmir. Chromosomal observations showed diploid number of 26 and the chromosomes were divided into two groups – first group of 5 pairs of larger chromosomes and 2nd group of 8 pairs of smaller chromosomes. Chromosome no. 2,3,4,9 and 10 were sub-metacentric and all other chromosomes were metacentric. No sex chromosomes were distinguishable. C-banding analysis showed presence of centromeric heterochromatin in all the chromosomes. Whereas NOR banding showed a pair of secondary constrictions on chromosome no. 10 on long arm, i.e. 10q. A slight difference was seen in the size of NORs on the chromosome of 10th homologous pair.

Keywords: Krez Frog, *Chrysopoaasternosignata*, C-Banding, NOR Banding, Climate change.

LINEAR REGRESSION MODEL AND ITS APPLICATIONS IN FORESTRY RESEARCH

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In this chapter along with a brief introduction, we have discussed basics of regression analysis. Properties of coefficient of regression have been listed. Applications of regression analysis in the field of forestry research have been discussed. SAS code for simple linear regression has also been provided in this chapter.

Keywords: Regression analysis, Linear, carbon sequestration and biomass

AGRO-NANOTECHNOLOGY: RECENT DEVELOPMENTS, CHALLENGES, AND PERSPECTIVES FOR SUSTAINABLE AGRICULTURE

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Nanotechnology is rapidly emerging in the field of agriculture. Nanobiosensors are the devices having at least one dimension less than 100nm. They can bind to the substance that is to be detected and send signals. They can be structured as nanotubes, nanowires, nanoparticles, nanocrystals and used as quick and effective delivery system because of their physiochemical properties. Nanoparticles have high surface area, high reactivity and tunable pore size. Nanomaterial tools have been developed for improving plant growth, food packaging, monitoring environmental conditions, improving food quality and safety, delivery of agrochemicals and nutrition, pesticides, nano-scale carriers, veterinary care, fisheries, aquaculture and detection of nutrient deficiencies. Combined application of nanosensors and Information Technology provide novel ways for different component detection with high accuracy. They have better bioavailability of molecules to the seeds and therefore manufactured for monitoring plant fractions, soil and water in the agroecosystem. Nanobiosensors allow on-site monitoring of environmental conditions for plant growth and protection. Nanosensors for plant pathogen and pesticide detection are also the applications of nanotechnology in the agriculture field. The advantage of using nano materials is their high solubility, high mobility, low toxicity and systematic activity due to small particle size. Therefore, Nanotechnology is a solution for ongoing problems in agriculture and useful tool for plant science research.

Keywords: Nanotechnology, Sustainable agriculture, Smart delivery, Nanobiosensors.

PRECISION AGRICULTURE, SOIL AND WATER CONSERVATION FOR SUSTAINABLE AGRICULTURAL SYSTEM

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Precision farming technology is a viable alternative to improve profitability and productivity. It is a site specific approach for managing the inputs on the field to maximise the returns. The farmers no more rely on application of same input across the entire field. It offers full automation and simplifies the collection as well as analysis of information. Yield monitoring, grid soil sampling and variable-rate fertilizer application, crop scouting, quantifying farm variation, soil water content, spatial variability of hydraulic conductivity and bulk density are some spheres where precision farming not only helps in quantifying these factors but helps in proper management also. Now-a-days, Soil and water erosion is of serious concern especially in arid and semi-arid areas. This is the main reason behind decrement in soil fertility, which is a contributing factor to soil productivity. Good soil health ensures sustainable agriculture as well as ecological balance. Hence, the conservation of the soil and water resources should be done intensively to protect and improve the physical, chemical as well as biological health of the soil profile. Sustainable agriculture is a balance between social, environmental and economic priorities. The balance is ensured with production of sufficient amount of food at affordable prices and also maintaining the quality of food. Enhancement of sustainable agriculture through soil and water conservation needs awareness as well as concern of community. Therefore, soil and water conservation plays a major role in sustainable agricultural production as it is necessary for wise resource development especially in protecting the environment and biodiversity.

Keywords: Sustainable agriculture, Precision farming, crop scouting, spatial variability.

IMPROVEMENT OF GROWTH AND YIELD OF ONION (*ALLIUM CEPA* L.) CV. AGRIFOUND LIGHT RED THROUGH DIFFERENT APPLICATION METHODS OF GIBBERELIC ACID AND *TRICHODERMA VIRIDE*

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Deptt. of Horticulture, College of Agriculture (Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya), Gwalior, MP

A field experiment was conducted at Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, (M.P.) during rabi 2014-15 and 2015-16 to study the effect of gibberellic acid and *Trichoderma viride* on growth and yield of onion (*Allium Cepa* L.) cv. Agrifound Light Red. Foliar application of GA₃ 100mg and soil treatment of *T. viride* (10kg/ha⁻¹) (T₁₁) was observed significantly maximum (68.67, 66.60 and 64.53 cm) plant height, (18.67, 17.82 and 16.97) number of leaves plant⁻¹, (62.83, 61.17 and 59.50 cm) length of leaf and (1.14, 1.12 and 1.10 cm) width of leaf at first year, second year and pooled, respectively, over to control (T₁ i.e., GA₃ 0mg + *T. viride* 0). Growth analytical parameters viz., (668.47, 656.97 and 612.72cm²) leaf area plant⁻¹, (4.46, 4.09 and 3.71) leaf area index, (1.77, 1.74 and 1.71) bulb / green top ratio and (1.49, 1.48 and 1.46) neck thickness of bulb at first year, second year and pooled, respectively, over to control (T₁ i.e., GA₃

0mg + T. viride 0). Significantly maximum (44.43, 43.31 and 42.18g) fresh weight of bulb plant⁻¹ and (28.13, 28.10 and 28.07g) dry weight of bulb for 100g fresh weight. (5.36, 5.33 and 5.31cm) diameter of bulb, (5.11, 5.90 and 6.01cm) length of bulb and (329.94, 323.57 and 326.76qha⁻¹) bulb yield were recorded in the treatment T₁₁ (GA₃ 100mg and soil treatment of T. viride (10kg ha⁻¹) at first year, second year and pooled, respectively. Significantly maximum (16.04, 15.73 and 15.89 kg plot⁻¹) and (329.94, 323.57 and 326.76 qha⁻¹) bulb yield were recorded in the treatment T₁₁ (GA₃ 100mg and soil treatment of T. viride (10kg ha⁻¹) and lowest (0.10, 0.07 and 0.09%) bolting percentage and this treatment also proved the best antagonistic activity against *Fusarium oxysporu* sp. Cepae basal rot with minimum disease incidence (5.22, 5.20 and 5.21%) over to control at first year, second year and pooled, respectively.

Keywords: Gibberellic acid, Growth & yield attributes, Onion, *Trichoderma viride*.

VEGETATIVE GROWTH, YIELD AND BASAL ROT DISEASE OF ONION (*ALLIUM CEPA* L.) AS INFLUENCED BY GIBBERELIC ACID AND *TRICHODERMA VIRIDE*

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Deptt. of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi VishwaVidyalaya, Gwalior, MP

A field experiment was conducted at Department of Horticulture, College of Agriculture, Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior, (M.P.) during Rabi 2014-15 and 2015-16 to study the effect of gibberellic acid and *Trichoderma viride* on growth, growth analytical parameters, yield and also incidence of basal rot disease (%) of onion (*Allium cepa* L.) cv. Agrifound Light Red. Foliar application of GA₃100 mg and soil treatment of T. Viride (10kg ha⁻¹) (T) was observed significantly maximum (68.67, 64.53 and 66.60 cm) plant height, (18.67, 16.97 and 17.82) number of leaves plant⁻¹, (62.83, 59.50 and 61.17 cm) length of leaf, (1.14, 1.10 and 1.12 cm) width of leaf and lowest (0.10, 0.07 and 0.09%) bolting percentage at first year, second year and pooled, respectively, over to control (T i.e., GA 0 mg + T.viride0). Growth analytical parameters viz., (668.47, 556.97 and 612.72 cm²) leaf area plant⁻¹, (4.46, 3.71 and 4.09) leaf area index, (1.77, 1.71 and 1.74) bulb /green top ratio, (44.43, 42.18 and 43.31g) fresh weight of bulb plant⁻¹ and (28.13, 28.07 and 28.10 g) dry weight of bulb per 100g fresh weight were recorded significantly maximum in the treatment T₁₁ (GA₃100 mg and soil treatment of T. Viride (10kg ha⁻¹) at 1st year, second year and pooled, respectively. Significantly maximum (16.04, 15.73 and 15.89 kg plot⁻¹) and (329.94, 323.57 and 326.76 q ha⁻¹) bulb yield were recorded in the treatment T₁₁ (GA₃ 100 mg and soil treatment of T. Viride (10kg ha⁻¹) and this treatment also proved the best antagonist ic activity against *Fusarium oxysporum* sp. cepae basal rot with minimum disease incidence (5.22, 5.20 and 5.21 %) over to control at 1st year, second year and pooled, respectively.

Keywords : Onion, Gibberellic acid, *Trichoderma Viride*, Leaf area and Leaf area index

RESPONSE OF SULPHUR, GIBBERELIC ACID AND NAA ON GROWTH, YIELD AND QUALITY OF KHARIF ONION (*ALLIUM CEPA* L.)

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The present investigation entitled “Response of Sulphur, Gibberellic acid and NAA on growth, yield and quality of Kharif Onion (*Allium cepa* L.)” was carried out during kharif 2016 – 17 and 2017 – 18 at the Experimental field RVSKVV, Krishi Vigyan Kendra, Rajgarh (M.P.). The experiment was consisted of 27 treatments combinations of three levels of sulphur i.e. 0, 20 and 40 kg ha⁻¹, three levels of Gibberellic acid viz., 0, 50 and 100PPM and three levels of NAA i.e. 0, 50 and 100 PPM. Experiments were laid out in Factorial Randomized Complete Block Design with three replications. Results was observed that the application of 40 kg S ha⁻¹ (S₂) was recorded significant maximum growth parameters (viz, plant height, number of leaves per plant, length of leaf, bulb/ green top ratio and neck diameter), yield and dry weight of bulb and minimum splitted bulb percentage. The bulb yield was increase in about 23.73% over treatment S₀ (0 kg S ha⁻¹). Significantly maximum marketable bulb percentage, moisture content percentage and TSS per cent were recorded in treatment (S₂). Foliar application of GA₃ 50PPM (G₁) recorded significant maximum growth parameters (viz., plant height, number of leaves per plant, length of leaf, bulb/ green top ratio and neck diameter), yield and its attributing characters such as fresh and dry weight of bulb, polar and equatorial diameter of bulb, bulb yield and minimum splitted bulb percentage. The treatment G₁ also recorded significantly minimum physiological weight loss, rotting per cent, incidence of black mould and sprouting per cent over the control G₀. Significantly maximum marketable bulb percentage, moisture content percentage and TSS per cent were recorded in treatment (G₁). Foliar application of NAA 100 PPM (N₂) observed significant maximum growth parameters (viz, plant height, number of leaves per plant, length of leaf, bulb/ green top ratio and neck diameter) and yield. Significantly maximum marketable bulb percentage, moisture content percentage and TSS percent were recorded in treatment (N₂) but shelf life per cent

was noted maximum in control treatment N_0 . Among interaction effect of sulphur, gibberellic acid and NAA, the maximum growth (i.e. plant height, number of leaves per plant, length of leaf, bulb/ green top ratio and neck diameter) and yield. The treatment combination $S_2G_1N_2$ was also recorded significantly minimum physiological weight loss, rotting percent, incidence of black mould and sprouting per cent over the control $S_0G_0N_0$ ($0 \text{ kg S ha}^{-1} + \text{GA}_3 \text{ 0PPM} + \text{NAA 0PPM}$). Significantly maximum marketable bulb percentage, moisture content percentage and TSS percent were recorded in treatment combination $S_2G_1N_2$ but shelf life per cent was noted maximum in control treatment $S_0G_0N_0$. It is revealed from the data obtained that a significantly maximum bulb yield of 290.18 q ha^{-1} was obtained in onion variety N - 53 under the treatment combination $S_2G_1N_2$ ($40 \text{ kg S ha}^{-1} + \text{GA}_3 \text{ 50 PPM} + \text{NAA100PPM}$).

Keywords: Onion, Sulphur, Gibberellic acid, NAA, Growth, yield and quality.

DIAGNOSIS AND RECOMMENDATION INTEGRATED SYSTEM (DRIS): NUTRIENT MANAGEMENT IN HORTICULTURAL PLANTS

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Diagnosis and Recommendation Integrated System (DRIS) was developed by Beaufils in 1973 for nutrient management. DRIS is more promising than the earlier approaches -Critical value approach (CVA) and the Sufficiency range approach (SRA). This method involves dual relation between a pair of nutrients (N/P, P/N, N/K, K/N...) instead of univariate approach like the use of sufficiency range or critical level in which the individual concentrations of the nutrients in leaf tissue are taken into consideration and no information about the nutritional balance emerges. DRIS as a comprehensive system, which identifies all the nutritional factors limiting the crop production and in doing so increases the chances of obtaining high yields by improving fertilizer recommendation. DRIS index values measures how far specific nutrients in the leaf or plant are from optimum range. Since India's independence, there has been significant improvement in horticultural production; but still there is need to further increase production and quality produce to meet domestic and international market. One of the most limiting factors to achieve these targets is lack of balanced nutrient management. DRIS norms already have been developed in perennial and annual crops like grapes, pepper, 'Valencia' orange, coconut, pomegranate, mango, apple, peach, kinnow fruit, cauliflower, Arabica coffee, rose, papaya, 'Nagpur' mandarin, banana, gerbera and Coorg mandarin, corn, soybean and wheat, sugarcane, potato, sunflower and rice etc. DRIS norm are developed through survey-based approach of the population. The DRIS norm once established, it is further used to develop DRIS chart and NII (Nutrient Imbalance Index).

IMPACT OF AGRICULTURAL PRICE POLICY ON MAJOR FOOD CROPS IN HARYANA

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The present study aimed to study the Impact of Agricultural Price Policy of major food crops in Haryana i.e. growth, trend, gap between FHP (Farm Harvest Prices) and MSP (Minimum Support Prices), impact of MSP on major food crops in Haryana. The annual data on prices and arrivals of major food crops were collected for the period from 2007-08 to 2017-18. The growth rate in prices and arrivals of major food crops were estimated by using CAGR (Compound Annual Growth Rate). The significance of CAGR was tested by using student 't' test. Linear trend form was used to estimate trends in prices and arrivals. To study the effectiveness of the price policy during the harvest periods, the deviations of FHP from MSP were worked out and divided into positive and negative deviations to examine whether market prices ruled higher or lower than the minimum support prices. The negative deviations reflected ineffectiveness of MSP policy for producers. These deviations were adjusted with MSP in order to examine the degree of their departure from the minimum support price. To study the impact of lagged Minimum Support Prices (MSPs) on the acreage allocation, production and productivity, linear Regression form of equations have been fitted. The results shown the considerable increase in growth rate and trends of food crops prices are positive and significant in food crops in the Haryana markets, whereas arrivals growth and trend found positive and significant in wheat, rice and gram. Bajra, Barley show negative significant growth and trends but in rapeseed mustard negative and non-significant due to decrease in area under these crops and also due to lack of procurement machinery. Gap between FHP and MSP resulted that in mostly cases FHP is higher than MSP because higher demand than supplies does not allow the market prices to fall below MSP. In recent years, market prices ruled higher than MSP. The impact of MSP on Area is higher but there is no impact of MSP on productivity of food crops.

Keywords: Growth rate, Trends, Procurement prices, Agricultural Price Policy, Farm Harvest Prices, Minimum Support Prices.

GENETIC ENHANCEMENT OF MAIZE (*ZEA MAYS* L.) FOR DROUGHT TOLERANCE AND QUALITY BY USING CONVENTIONAL AND MOLECULAR BREEDING APPROACHES

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The present era of agriculture is very challenging for developing high yielding strains with resistance nature of Abiotic and biotic stress. Earth temperature is slightly increases for a decade. There is need to develop drought and heat tolerance strains of major crop to fulfillment of food feed requirement of the world population. Maize (*Zea mays* L.) is one of the most important crops of world. In India, maize occupies an area of 8.67 million hectares with the production of 22.25 million tones and the average productivity is 2566 kg/ha-1 (Anonymous, 2013). It is cultivated in many states like Gujarat, Bihar, Andhra Pradesh, Karnataka, Madhya Pradesh, etc. Maize is more susceptible to drought than all other cereals (Hall et al., 1981) i.e. drought, affecting crop yield. It causes yield reduction by an average of 15% to 20%. Integrating molecular approaches in breeding for drought tolerance could increase significantly the potential for genetic gain under water limited conditions (Ribuat et al., 2009). The maize kernel is composed of pericarp (6%), endosperm (82%) and germ (12%). Maize endosperm protein is deficient in two essential amino acids, lysine and tryptophan. Several spontaneous and induced mutations that affect amino acid composition in maize have been discovered amongst which the *o2* gene (*opaque2*) has been used in association with endosperm and amino acid modifier genes for developing Quality Protein Maize (QPM) (Babu and Prasanna, 2014) which contains almost double the amount of endosperm lysine and tryptophan as compared to the normal/non-QPM maize. For quality improvement, microsatellite markers located within the *o2* gene provided opportunities for accelerating the pace of QPM conversion programs through marker-assisted selection (MAS). The importance of drought tolerance as a maize breeding objective. Drought affects the different developmental stages of crop growth. The characteristic of maize under drought stress is a delay in silking, resulting in an increase in the anthesis to silking interval (ASI), incomplete or nil fertilization and decrease or nil kernel development (Hall et al., 1981), by evaluating maize under moisture stress during flowering, it is possible to identify maize genotype capable of maintaining a shorter ASI and achieving the high grain yield. The present investigation will be under taken with a view to estimating heterosis and combining ability were investigated in maize populations obtained from half-diallel crossing among 12 inbred parental lines. General and specific combining ability effects were significantly different among parental lines. In the above contrast, inbred lines of maize will be screening for drought tolerance and quality. Observation will be recorded for 22 morphological characters namely viz. Days to 50 % tasseling, Days to 50 % silking, Days to 50 % maturity, Plant height (cm), Cob length (cm), Number of kernel rows per cob, Numbers of kernel per rows, 100 grain weight (g), Yield per plant (g), Number of cobs per plant, Ear height placement, Cob girth (cm), Shelling %, Canopy temperature (at vegetative and reproductive stages), Root length(cm), Shoot length(cm), Root-shoot ratio, Fresh weight(g), Dry weight(g), Turgid weight (g), Relative water content (%) and Saturation water deficit (%), 5 biochemical observation namely viz. Photosynthetic pigments, Membrane stability index, Estimation of Proline content, Estimation of sugar content (mg/g-1 fresh weight), Leaf Protein profiling by SDS PAGE and For molecular analysis, the two molecular markers SSR and ISSR will be used for screening of inbred lines. SSR for drought tolerance and ISSR for quality protein will be used. The nature and magnitude of gene action is an important factor in developing an effective breeding programme, which can be understood through combining ability analysis. Keeping all above points in view the present study was planned for drought tolerance and protein quality estimation and identification of better performing hybrid of maize inbred lines for Chambal region. This is first kind of study conducted for that region for maize improvement. This information will be very helpful to plant breeders for formulating hybrid breeding programmes.

Keywords: Maize, half-diallel analysis, combining ability, heterosis effect, Molecular Characterization

WEED PROBLEM AND ITS MANAGEMENT IN DIRECT SEEDED RICE: A CRITICAL REVIEW

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Rice (*Oryza sativa* L.) is the staple food of more than half of the world population grown on approximately 153 million ha. at global level. Asia contributes 90% of the total above area. Rice cultivation is facing some serious problems like low productivity due to heavy infestation of weeds, declining factor productivity due to water crisis, increasing labour cost, depleting soil health and global climate change. Direct seeded rice is gaining popularity in almost all rice growing countries but high intensity of weeds compete with rice crop and causes loss in yield, high production cost, reduce milling quality and market value of rice. Several research evidences at various places has shown that weeds such as *Echinochloa* spp., *Leptochloa* spp., *Cyanotis* spp., *Commelina* spp., *Digitaria* spp. and *Alternanthera* spp. Causes around 20-100% losses in direct seeded rice. Several weed management practises like stale seed bed combined with non-selective herbicide, adoption of zero tillage, brown manuring of *Sesbania*, crop rotation, growing competitive varieties, mechanical weeding and mulching has been employed but research evidences prove that integrated weed management approach based on critical period of crop weed completion, may be a sustainable tool to combat this weed problem in direct seeded rice field.

Keywords: Direct seeded rice, weed ecology, integrated weed management, weedy rice.

POWDERY MILDEW OF BIXA ORELLANA**V. K. YADAV****Department of Plant Pathology, JNKVV, College of Agriculture, Ganj Basoda (M.P.)**

Cultivation of medicinal plants has manifold in the decade owing to great concern in production of plant based drugs and their world trade. Sinduri (*Bixa orellana*) is a shrub or evergreen small tree having the medicinal importance. It is recommended for leprosy, eczema and elephantiasis. Leaves are used in jaundice and for snake bite. Fruit is astringent and purgative. The main product obtained from *B. orellana* is an organic dye present in the seed coat, commercially called 'annatto'. Due to its solubility in lipids, it is widely used in the food industry for giving red to orange-yellow colours to cheese, butter, oils, margarine, ice-cream, candy, bakery products and rice. But, there are various biotic constraints in the successful cultivation of *B. orellana*. One of them is that, the crop is menaced by a number of diseases and insects pests that adversely affects the physiology of the host. During survey work author have encountered a thin, sparsely mycelial growth of fungi on leaf surface of *B. orellana*. The infected samples were collected and examined under microscope. On the basis of morphology the fungus has been identified as *Oidium bixae* Veigas. It causes the powdery mildew disease. It is a polycyclic disease that impairs photosynthesis, stunt growth and increase the rate of senescence of host tissue. The disease in some situations, if left untreated, they may result in severe economic losses on crop. In absence of any previous work on powdery mildew of *B. orellana* at Chhattisgarh State, a taxonomic work has been carried out using characters of current taxonomic importance in defining the imperfect stages of *Erysiphaceae* in modern sense and samples were submitted to HCIO-No. - 47,232.

FOOD PROCESSING TECHNOLOGIES AND VALUE ADDITION FOR IMPROVED FOOD SAFETY AND SECURITY**VIKAS GILL^{1*}, DR. LILA BORA² AND RITU³**^{1,2}**Department of Vegetable Science, CCS Haryana Agricultural University, Hisar-125004**³**Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004**

Food processing adds value, enhances shelf life of the perishable agro food products, encourage crop diversification and ensures remunerative market price of the agricultural produce by making it more marketable. Processed products involves processed fruits and vegetables (Prominent processed fruits and vegetable items are fruit pulps and juices, dried fruits and vegetables, ready to serve beverages, fruit juice concentrates, canned/frozen fruits, jams, squashes, pickles, chutneys, mushroom products etc.), Biscuits, Bread, Fried Products, Popped and puffed cereals(popcorn, puffed sorghum, puffed ragi and puffed barley), Expanded Cereals, Beaten Rice, Extruded foods (vermicelli, noodles, corn puffs, texturised soyanuts), Fermented Products (Idli and samosa), Traditional Sweets (candies). Processing techniques that involve milling; separating; exposures to air, light, heat, or radiation; changes in acidity or osmolality; or other techniques during freezing, drying, canning, or vacuum packing can and often do alter the content of nutrients and other non essential bioactive food constituents. Hurdle technology, Nano technology, Smart packaging and food tracking, Non-thermal processing of foods: Novel and emerging technologies, particularly high pressure processing (HPP), pulsed electric field (PEF), cold plasma, UV irradiation and ultrasound have been examined as treatments for improving the shelf life of foods.

Keywords: Food processing, Food safety, Food security, Food technologies, Food value chain, Climate-smart technology

PRECISION AGRICULTURE- MORE PRODUCTION WITH LESS INPUT***VINITA, PARTE¹; ANJANA, KUJUR²**¹**College of Agriculture, Ganjbasoda, Vidisha, JNKVV, Jabalpur, MP**²**Rajmata Vijayaraje Scindia Krishi Vishwa vidyalaya, Gwalior, MP**

An agricultural production system is the outcome of a complex interaction of seed, water and agro-chemicals including fertilizers and pesticides. Therefore, careful management of all inputs is essential for the sustainability of such complex system. The focus on enhancing the productivity without considering the ecological impacts of the input resources has resulted into environmental degradation. Increasing environmental consciousness of the general public is necessitating us to modify agricultural management practices for sustainable conservation of natural resources such as water, air and soil quality, while staying economically profitable. The productivity can be increased without any adverse effect by maximizing the resource input efficiency. It is also certain that availability of labor for agricultural activity is going to be in short supply in future. The time has now arrived to bring information technology and agricultural science together for improved economic and environmentally sustainable crop production. This gives birth to Precision Agriculture or Precision Farming. Precision farming provides a new solution using a systems approach for today's agricultural issues such as the need to balance productivity with environmental concerns. It is based on the implementation of advanced information technologies. It includes describing and modeling variation in soils and plant species and

integrating agricultural practices to meet site-specific requirements. It aims at economic returns, as well as at reducing the energy input and the environmental impact of agriculture.

Keywords: Sustainability, Precision Agriculture, technologies, water, air and soil quality

ASSESSMENT OF IMPACT OF PROJECTED CLIMATE CHANGE ON GROWTH AND YIELD OF RICE CROP IN ODISHA USING DSSAT MODEL

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Potential impacts of climate change on rice production have been estimated in several studies. It has been reported that the variability in climate affects the crop production in both the ways by increasing or by decreasing, the magnitude may vary from place to place. Temperature and CO₂ are two important parameters related to climate change, which affects the crop yield of any region. In the present study an attempt has been made to access the impact of these two parameters on the productivity of a rulling rice variety Swarna in warm and humid region of Odisha. For this purpose CERES-Rice model 4.6 was used. The experimental results of rice cv. Swarna during kharif 2015 were used as baseline to assess the rice yield under different climate change scenarios. The projected CO₂ concentrations of IPCC were used in the model as 480,550 and 790 ppm against the years for baseline, 2030, 2050 and 2080 respectively. However, on the basis of studies carried out in the region, the model was run and rerun for temperature rise by 0-1⁰C. Validation of simulated values obtained from CERES-Rice model of cv. Swarna with observed data shows good agreement between them. The model shows higher accuracy in predicting grain yield, straw yield and days taken to growth stages as inferred by the d-stat values. In cv. Swarna by increasing the CO₂ concentration and seasonal temperature by 1-2⁰ C combining with increase in rainfall and solar radiation as per RCP scenarios causes increase in yield of kharif rice however, grain yield decreased with increase in temperature of more than 2⁰ C along with solar radiation more than 3.8 MJ/day. In 2030, there is an increase in yield but in 2050, there is almost no change in yield except for late transplanting date. However, in 2080 yield increases under early and late transplanting dates but declines in midseason transplanting. RCP 8.5 scenario results in declining yield in all transplanting dates in 2080.

Keywords: DSSAT, Crop simulation modelling, CERES-Rice modelling, RCP, Swarna variety

THERMAL REQUIREMENTS FOR PHENOPHASES AND YIELD OF RICE CULTIVARS UNDER DIFFERENT PLANTING DATES IN EAST AND SOUTH-EASTERN COASTAL PLAIN ZONE OF ODISHA

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Field experiment was carried out during Kharif season 2018-19 in Agrometeorological Research Field, Odisha University of Agriculture & Technology, Bhubaneswar, Odisha to investigate the influence of different planting dates on phenology and yield of different rice cultivars of East and South-eastern coastal plain zone of Odisha. The experiment was laid out in split plot design with four planting dates i.e. (20th July, 02nd August, 14th August & 01st September) which were sown (25th June, 12th July, 27th July & 16th August) before in main plot and four varieties of rice i.e. (Mandakini, Bina-11, Hasant & OR 2380-2) in subplots with three replication. Due to different planting dates and varieties the number of days required to attain different phenophases varied significantly. In case of different planting dates, first planting date took maximum number of days to attain different phenophases such as, for Tillering (35DAS), Panicle Initiation (74DAS), Heading (88DAS), 50% Flowering (97DAS), 100% Flowering (101DAS), Milking (103DAS), Dough stage (116DAS) and Physiological maturity (135DAS) followed by second planting date & least in fourth. Among different cultivars OR 2380-2 required maximum days to attain Tillering (31DAS), Panicle Initiation (90DAS), Heading (104DAS), 50% Flowering (113DAS), 100% Flowering (117DAS), Milking (121DAS), Dough stage (133DAS) and Physiological maturity (154DAS) followed by Hasant & lowest in Mandakini. In all the phenophases first planting date required more growing degree days (GDD) & photothermal unit (PTU) than second planting date. However, in case of heliothermal unit (HTU) the fourth planting date required more than third planting date & least in first planting date. At physiological maturity stage first planting date required more GDD & PTU (2496.8⁰C day & 31097⁰C day hours) than other planting dates and fourth planting date required more HTU (12354⁰C day hours) than other planting dates. Variety OR 2380-2 required maximum GDD, PTU & HTU (2592⁰C, 31183⁰C day hours & 13540⁰C day hours respectively) followed by Hasant (2353⁰C, 28551⁰C day hours & 11875⁰C day hours respectively) & least in Mandakini (2116⁰C, 25949⁰C day hours & 10203⁰C day hours respectively). Third planting date (14th August) produced maximum plant height (116.6 cm), maximum 1000 grain weight (23.67gm), maximum grain yield (3066kg/ha), maximum biological yield (5894kg/ha) than the other planting dates. Among the four different varieties Hasant produced maximum plant height (117.3 cm), maximum 1000 grain weight (24.75gm), maximum grain yield (3435kg/ha), maximum biological yield (6214kg/ha) and maximum Harvest index (55.45%) than the other

varieties. Third planting date (14th August) & with cultivar Hasant produced maximum grain yield (4711kg/ha) in East and South-Eastern Coastal Plain Zone of Odisha.

Keywords: Sowing dates, Rice varieties, Growing degree days, Photothermal unit, Heliothermal unit, Phenology, Yield

COMPARATIVE STUDY ON ROOTING OF APPLE CLONAL ROOTSTOCK HARDWOOD CUTTINGS

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The study conducted with an objective for utilization of upper part of the hardwood cutting of apple after performing grafting/stooling which otherwise goes as a waste. The experiment consists of two types of cuttings viz; cutting with apical bud and without apical bud with single treatment of IBA @ 2500 ppm **on the rooting capacity of MM-106, MM-111, M9-T339, M9-T337 and P-22 apple clonal rootstocks.** The maximum rooting percentage was recorded from the cuttings of MM-106 (46.87 %) with apical bud as compared with hardwood cuttings without apical bud. The rooting percentage was also high in rootstocks of M9-T337 and M9-T339 with apical bud whereas rootstocks Pajam-1 and P-22 are statistically at par with each other. From this study, it may be concluded that the cutting with apical bud and the IBA 2500 ppm was found to be the best treatment for inducing better root system in different clonal rootstocks of apple in terms of rooting percentage, number of primary roots and total root length. Further, rooted cuttings shall be used either for direct sale or for further grafting/budding.

DOUBLING THE FARMER INCOME THROUGH NEW TECHNOLOGY IN AGRICULTURE

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India, the fastest growing economy of the world still has more than 65 percent of population living in rural areas with heavy dependence in agriculture. Since last five decades, the strategy for development of Indian agriculture has been to increase the output irrespective of input levels. Although this strategy has been a phenomenon success known as Green revolution in achieving food security and bringing India in category of food bowls of the globe from begging bowl. But for farmers, last few years farming is becoming less profitable occupation due to high input cost and irregularity of climate. So, there is need of new revolution in Indian agriculture which is helpful for increasing the farmer's income. Now a day, innovations in agriculture has profitable for sustaining and increasing agriculture production. Farmers depend upon monsoon, markets and intermediaries who are part of Indian agriculture. Farmers can try off-season cultivation like poly house farming for mitigating the problem of irregular monsoon. In poly house, we control the overall climate according to crop requirement and produce the crops against the season. Off-season crop gives higher income comparison to seasonal crop. Digital marketing is the best alternative of sell and buy the produce and remove the intermediaries in marketing. Digital marketing is the place, where farmer know the rate of produce and sell them at profitable rate. e-Nam, kisan suvidha etc. are best example of digital mandi in India. Besides it value addition of agricultural products is another alternative of increasing farmer income. Potato growers can make valuable products from potato like- Chips, Papad and Bhujia etc. As similar to potato growers another farmer also applied value addition for their crops. Crop diversification and insurance of crop should be following by farmers.

INFLUENCE OF JEEVAMRITON THE PRODUCTIVITY OF WHEAT UNDER ZBNF IN EASTERN HIMALAYAN REGION

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Among the Indian farming community, agriculture techniques with its recent trending and post haste settling at a dynamic rate is ZBNF – Zero Budget Natural Farming. Under ZBNF, the cost of cultivation is presumed to be zero, as there is no use of fertilizers and pesticides, instead the inoculums made out of on farm available inputs and principles of intercropping are used to ensure the healthy growth of the crops. The present investigation was carried out to know the influence of one of the basic pillars of ZBNF – Jeevamriton the productivity of Wheat under ZBNF system during rabi 2016-17 at Model organic farm, CSKHPKV, Palampur, Himachal Pradesh. The experiment consisted of different treatment combinations of jeevamrit soil drenching at various intervals alone and also in combination with vermicompost. Among the various treatments, significantly higher grain yield that is 16.16, 8.99 and 3.36 per cent higher over the check (Vermicompost alone @ 10 t/ha) was recorded; for the treatment combination of vermicompost and soil drenching of jeevamrit at sowing, 30, 45 and 60 DAS; followed by vermicompost and soil drenching of jeevamrit at sowing, 30 and 45 DAS; and solo soil drenching of jeevamrit at sowing, 30, 45 and 60 DAS, respectively. Soil Microbial activity studies revealed significantly higher colony forming units (cfu) of bacteria, fungi and actinomycetes per gram of soil samples in treatment combination of vermicompost and jeevamrit at sowing, 30, 45 and 60 DAS. Significantly higher net returns and net returns per rupee invested were observed in solo soil drenching of jeevamrit at sowing, 30 and 45 DAS; followed by

solo drenching of jeevamritat sowing, 30, 45 and 60 DAS. Hence, from the present study, it is evident that combination of vermicompost during sowing and frequent application of jeevamritat the various interval had a positive impact on increasing the yield and yield attributing traits of wheat; along with sustained nutrient status and soil microbial activity.

Keywords: ZBNF, jeevamrit, Vermicompost, Yield, Microbial activity, and Net Return

SILICON BASED DEFENSE RESPONSE IN PLANTS: A PARADIGM SHIFTS IN RESEARCH APPROACH

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Silicon (Si) is the second most abundant mineral element in the earth's crust, and comprises up to 70% of soil mass. In soil, Silicon occurs as its oxides: Silica and Silicates. Concentration of silicon in plants on the basis of dry weight varies between 0.1-10 per cent. Silicon is not recognized as an essential element for general higher plants, it has beneficial effects on the growth and production of a wide range of plant species. Silicon is mostly absorbed by plant roots in the form of non-charged monosilicic acid [Si (OH)₄]. Si is known to effectively mitigate various biotic and abiotic stresses and enhance plant resistance against fungal and bacterial pathogens. The effects of Si on plant-pathogen interactions are analysed, mainly on physical, biochemical, and molecular aspects. In plants most cases, the formation of silica layers inhibits the penetration of fungal pathogen inside the cell. Si also induced biochemical/molecular resistance during plant-pathogen interactions were dominated as joint resistance, involving activating defense-related enzymes activates, such as polyphenoloxidase, glucanase, peroxidase, and phenylalanine ammonia-lyase (PAL); stimulating antimicrobial compound production such as phenols, flavonoids, phytoalexins and PR proteins in plants; regulating the complex network of signal pathways, such as salicylic acid (SA), jasmonic acid (JA), and ethylene and activating of the expression of defense-related genes. Si can act as a modulator influencing plant defense responses and interacting with key components of plant stress signalling systems leading to induced resistance. Priming of plant immune responses, alterations in phytohormone homeostasis, regulation of iron homeostasis, and networking by defensesignalling components are all most mechanisms involved in Si-triggered resistance responses.

DEVELOPMENT OF ECO-FRIENDLY MATERIAL FOR ENHANCEMENT OF RESIST PRINTING

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India is host to a wide variety of textile arts. Celebrated all over the world and applauded within the nation .In different regions boast of different textures, styles and techniques and each has a different method along with a unique output. Each has a distinct style which is easily recognizable when worn. Surface designing refers to superficial embellishment on the fabric or structural and applied on any substrate. The most predominating technique that enhance the consumer acceptance by beautifying the textile materials are dying, printing, embroidery, weaving and surface finishes. Resist materials are used in the decoration of fabrics to control the flow or placement of dye or paint. They help in the creation of imagery, intricate patterning and interesting dye effects. Their resist may be based, solvent based or with natural products. The study was undertaken to prepare a resist paste for printing of cotton fabric using sweet rice flour. A series of experiments were conducted to optimize different printing variables viz. concentration of sweet rice flour, dye concentration and immersion time. The variables were optimized through visual evaluation, physical properties testing and color fastness properties. Physical properties included light, washing, perspiration and crocking. Various products were also prepared with standardized recipes. Sweet rice flour with various concentrations i.e. 20gm, 25gm, 30gm, 40gm were taken separately for preparation of resisting paste for both natural dye and naphthol dye and cotton samples were resisted with these pastes. It was found that samples with 30gm were selected as best for both (natural and naphthol dye). Selected concentration of sweet rice flour were taken separately with different dye concentrations i.e. 2gm, 4gm, 6gm, 8gm, 10gm (both natural and naphthol dye) for preparation of dye solution and cotton samples were dyed with this solution. It was found that 6gm dye concentration was selected for the natural dyed sample and 4gm dye concentration was selected for naphthol dyed samples. Selected sweet rice flour concentration and dye concentration were dyed separately with different immersion time i.e. 10, 15, 20, 25, 30 minutes both for (natural and naphthol dye). It is concluded that best concentration of sweet rice flour and optimized dye concentration with different immersion time showed mostly significant difference among these variables. All the articles printed with optimized printing recipe were highly appreciated as these fulfill the eco-friendly standard of global markets.

CITRUS GRANULATION: X-RAY IMAGING AND RELATED QUALITY CHANGES**SWARAJYA LAXMI NAYAK^A, SHRUTI SETHI^A, R.N. SAHOO^B, A. K. DUBEY^C AND SWATI GOEL^B**^a**Division of Food Science and Postharvest Technology, ICAR-Indian Agricultural Research Institute, New Delhi-110 012**^b**Division of Agricultural Physics, ICAR-Indian Agricultural Research Institute, New Delhi-110 012 (India)**^c**Division of Fruits and Horticultural Technology, ICAR-Indian Agricultural Research Institute, New Delhi-110 012 (India)**

Granulation is a physiological disorder of citrus fruits manifested by shriveled juice sacs and internal dryness leading to gelling phenomenon. The extractable juice in granulated tissue is drastically reduced as a consequence of gelatinization and secondary epidermis formation/ thickened juice cell walls. Since, it cannot be detected externally; it leads to consumer dissatisfaction and poor returns to farmers. Processing industry faces huge economic loss due to reduction in the juice recovery from granulated fruits. Furthermore, nutritional value of the affected fruits also gets affected. Considering the widespread nature of the disorder across citrus species and seriousness of the problem, granulation studies were conducted in two citrus cultivars, namely, Itaborai and Marsh Seedless. X-ray imaging of the citrus fruits could effectively distinguish the healthy and granulated fruits non-destructively with an accuracy of 99%. A drastic reduction in juice yield (65 and 25 %), total soluble solids (26 and 21 %) and ascorbic acid content (50 and 29 %) was observed in both the cultivars, respectively. Granulation significantly impaired the sugar and acid balance as a consequence of which the fruits became organoleptically unacceptable. The imaging technique can be employed by the processors to sort the fruits online and save the economic losses faced by them.

IMPACT OF ACCELERATED AGEING ON VIGOUR CONTRIBUTING CHARACTERS OF SOYBEAN [GLYCINE MAX (L.) MERRILL]**AJAY PURI GOSWAMI****Department of Seed Science & Technology, G.B. Pant University of Agriculture & Technology, Pantnagar, Uttarakhand**

Soybean is known as poor storer due to rapid loss in viability which occurs under warm and humid conditions. Under these conditions soybean seeds become susceptible to storage fungi. To study about storage potential of different soybean varieties viz., PS 1347, PS 1042, PK 472 and PK 262 obtained from Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar were used in this study. All parameters taken under this investigation decrease as the period of accelerated ageing increases but at different level in different varieties. All characters were affected by accelerated ageing in all varieties of Soybean. Less adverse effect of accelerated ageing was found in variety PS 1042 followed by PS 1347 while maximum in PK 472 and PK 262. This shows variety PS 1042 can tolerate the ageing conditions with less impact on studied parameters, indicating good storage potential and variety PS 1347 considered as medium storer while PK 472 and PK 262 as poor storer.

SEASONAL INCIDENCE OF SUCKING INSECT PESTS IN BRINJAL AND THEIR NATURAL IN GIRD REGION OF MADHYA PRADESH, INDIA**BHARAT LAL¹, N.S. BHADUARIA², S.P.S. TOMAR³ AND DEVENDRA VISHVKARMA⁴**¹**Ph. D. Scholar, Dept. of Agric. Entomology, RVSKVV, Gwalior, Madhya Pradesh, India**²**Professor, Dept. of Agric. Entomology, RVSKVV, Gwalior, Madhya Pradesh, India**³**Assistant Professor, Dept. of Agric. Entomology, RVSKVV, Gwalior, Madhya Pradesh, India**⁴**Ph. D. Scholar, Dept. of Horticulture, RVSKVV, Gwalior, Madhya Pradesh, India****Bharat Lal, Ph. D., Scholar, Dept. of Agric. Entomology, RVSKVV, Gwalior, Madhya Pradesh, India**

A field experiment was conducted at Entomology Research Farm, RVSKVV, College of Agriculture, Gwalior (M.P.) to find out the seasonal incidence of sucking pests of Brinjal and their natural enemies and its correlation with weather parameters. The incidence of aphid, jassid and whitefly were started during 43rd SMW and attained their peak population during 8th, 1st and 1st SMW, respectively. While the activity of Coccinella spp. was started from 2nd SMW and reached its peak population during 8th SMW. Correlation studies revealed that the aphid population was correlated positively significantly with morning and evening relative humidity and rainfall ($r = 0.34$, $r = 0.72$ and $r = 0.41$, respectively). Significant positive correlation was observed between population buildup of jassid and whitefly with morning relative humidity ($r = 0.49$ and $r = 0.51$, respectively). The correlation studies between natural enemies and weather parameters revealed that the morning and evening relative humidity and rainfall were significantly positively correlated ($r = 0.49$, $r = 0.70$ and $r = 0.22$, respectively), with Coccinella spp. population while maximum and minimum temperature and evaporation were found to be negatively correlated ($r = -0.60$, $r = -0.33$ and $r = -0.43$, respectively). Population of Coccinella beetle was associated significantly positively with aphid population ($r = 0.88$).

Keywords: Brinjal, Aphid, Jassid, whitefly, Coccinellid beetle, Weather parameters.

INTRODUCTION OF KASHI ABHIMAN- A TOMATO VARIETY **BRAJ MOHAN AND YK SHARMA****SMS Horticulture, SMS Ag. Extension, K.V.K. DUVASU, Mathura, UP**

In India, the total vegetables production has crossed 169.1 million tonnes from an area of over 10.1 million hectare, with an average productivity 16.74 metric tonnes/ ha. Tomatoes are now the fourth most popular fresh market vegetable. It occupies 12 percent of total area under vegetable production. In Mathura cultivation of vegetable occupies around 20,000 hectare lands i.e. around 8% of the total arable land of Mathura. Tomato is important vegetable crop cultivated in Rabi season in Mathura and occupied around 1000 ha land. Despite best managerial practices and scientific technologies, the yield of tomato remained low due to regular use of varieties released by private sector like US-4 and Himsona etc. The farmers were not aware of the varieties which were more potential in term of yield and released by IIVR Varanasi/public sector. For enhancing the productivity. The KVK Mathura conducted demonstrations on farmer's field in the year 2017-18 on 5 locations to showcase the yield potential of Kashi Abhiman, a tomato hybrid variety developed by IIVR Varanasi. It starts fruiting after 70 days of transplanting and the fruit of this variety are deep red colour and mature uniformity. The average fruit weight was 70-85 gram and the variety gave an average yield of 583 q/ha., whereas, the prevailing varieties like Himsona and US-04 produced an average yield of 505 q/ha. The Yield was found 15.45% higher over these varieties which are prevailing in the district.

REVIEW ON ORTHODOX TEA PRODUCTION AND MARKETING IN NEPAL; LOCAL TO GLOBAL CONTEXT**BINOD JOSHI^{1*}, DHARMENDRA KALAUNI¹****¹Agriculture and Forestry University, Rampur chitwan**

Orthodox Tea is one of the high value agriculture commodity having enormous potential of export to international market. Nepal offers suitable climate, soil and topography for profitable production of the Orthodox tea having exceptional flavor, aroma and taste. In this context the study was carried out to review the production and marketing scenario of the Nepalese Orthodox tea. Additionally the study includes possible policy implications for the improvement of the existing production and marketing scenario in the country. The study showed that despite having ample opportunity of Nepalese Orthodox tea in domestic and international market, country has yet to maintain standard certification and trademark to flourish its trade compared to the neighbor country. About 90% of the total produced Orthodox tea was imported primarily to India through middleman. This has prevented tea farmers of Nepal from getting optimum premium as compared to other tea exporting countries like China and India. Thus there seems a strong and urgent need to regulate export of the Orthodox by making suitable, commonly accessible, efficient certification procedure along with the subsidies on such types of operation during export. It is recommended that government should establish sound bilateral and multilateral diplomatic relations with the foreign bodies/states for making easy market accessibility, duty free trade and similar other agreement.

Key-word: Orthodox Tea, Cultivation, Trade, Policy, High-value**ASSESSMENT OF FERMENTED BEVERAGES FROM PINEAPPLE (*ANANAS COMOSUS* (L.) MERR. CV. QUEEN) AND GINGER (*ZINGIBER OFFICINALEROSC.* CV. MEGHA) FOR NUTRACEUTICAL EFFECT****A. K. CHAURASIYA^{1*}, SUSMITA CHAKRABORTY², ANJU HAJONG³ AND TODIK JIMMY T SANGMA⁴****Department of Horticulture, North Eastern Hills University, Tura, Meghalaya- 794002 (India)**

Eleven treatments viz. T1(Pineapple (100%), T2(Ginger (100%), T3 (Pineapple + Ginger (90+10%), T4 (Pineapple + Ginger (80+20%), T5 (Pineapple + Ginger (70+30%)), T6 (Pineapple + Ginger (60+40%), T7 (Pineapple + Ginger (50+50%)), T8 (Pineapple + Ginger (40+60%)), T9 (Pineapple + Ginger (30+70%)), T10 (Pineapple + Ginger (20+80%)), T11 (Pineapple + Ginger (10+90%)) were studied at Department of Horticulture, North Eastern Hill University, Tura Campus, Meghalaya, India, during 2016- 2018 with a view to study the Physico-chemical characteristics of freshly fermented and aged fermented beverages. The physical and biochemical parameters of fresh fruits and fermented beverages were determined with TSS, Total sugar, Reducing sugar, Non- Reducing sugar, Titrable acidity, Ascorbic acid, Protein, β -carotene, Alcohol content, Carbohydrate and Starch. Significant difference were recorded for Total Sugar, Reducing Sugar, Non-Reducing Sugar, Titrable acidity, Ascorbic acid, Protein, β -carotene, Carbohydrate, starch, TSS and Alcohol percentage during fermentation. The Pineapple and Ginger wine was accepted by panelist, was determined as per the organoleptic test. The treatment T1 (3.34), T2 (3.33) and T5 (3.03) were considered the best quality.

Keywords: Alcohol, Yeast, Pineapple, Ginger, Fermentation.

PREPARATION AND STANDARDIZATION OF NOODLE RECIPES FROM CASSAVA (*MANIHOT ESCULENTA* L.) FOR LIVLIHOOD

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The present research work was carried out in the Laboratory of Department of Horticulture, North Eastern Hill University, Tura Campus, Meghalaya to standardize the different recipes for preparation of noodles. Cassava was procured from the local market of West Garo Hills. The methodology used for the physico-chemical analysis of fresh cassava and preparation of noodle recipe have been standardized. Organoleptic test and bio-chemical changes in processed products at ambient temperature regime was studied. The most acceptable recipe as well as the ultimate storage life of the selected products was finalized on the basis of sensory attributes. The Completely Randomized Block Design has been followed for statistical interpretations. The result showed that cassava contains high amount of carbohydrate (35.90%) and starch (26.50%). Cassava has TSS content of 10.33%, total sugars 2.935%, acidity 0.128%, protein 1.80%, ascorbic acid 31.48mg/100gm and 11.25 IU β - Carotene. As per the organoleptic test the treatments T2 and T3 were scored best with 3.901 and 3.591 respectively and benefit cost ratio of 1.64 % for T2 and 1.48 % for T3.

Key words: Beta carotene, cassava, organoleptic test, treatment, TSS

POLYPLOIDY BREEDING IN ORNAMENTAL CROPS

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Floriculture is an ancient farming activity in India having immense potential for generating gainful self-employment among small and marginal farmers. In the recent years it has emerged as a profitable agri-business in India. Government of India has identified floriculture as a sunrise industry and accorded it hundred per cent export oriented status. Novelty in commercial traits of flowers viz., colour, shape, size, length, etc. are always valued and preferred by consumers (Singh, 2014). Beside classical cross breeding and selection, more modern breeding techniques offer an extended potential to new genetic variation in ornamental plants. Polyploidy breeding holds immense prospects in developing desirable varieties in flower crops. With the help of polyploidy, changes in morphology and cytology of plant are observed. Allopolyploidy, arising from interspecific hybridization and polyploidy, can cause 'genomic shock' (McClintock, 1984), which may trigger a suite of genetic changes, including (retro) transposition, differential gene expression, chromosome rearrangements and epigenetic changes. These events and novel cis-trans interactions between progenitor genomes may generate variation, including transgressive phenotypes, and facilitate rapid divergence of both homoploid and allopolyploid hybrids. Mostly seen consequences of induced polyploidy are increase in size and shape of plants; leaves, branches, flower parts, fruits and seeds. Chemicals like colchicine, oryzalin, tri-Xuralin and amiprophosmethyl (APM) etc. are used in induction of polyploids. Although colchicine remained the most used for induction of polyploidy (Chopra, 2008). Polyploidy or whole-genome multiplication has played an important role in the evolution of flowering plants and effective method for doubling the chromosome number of a species (Tiwari, 2012). Genetic variations created can be further used in breeding programme. Out of the different measures adopted to fulfill the objectives of enhancing the beauty and shelf/vase life, polyploidy breeding is one of the most promising methods which can be adopted nowadays on a significant scale. This can be used in different floricultural crops as haploids have prolonged flowering period whereas; Tetraploids have luxuriant vegetative growth and enhanced flowering attributes. It is also to be noted that polyploids at many instances have better biotic and abiotic stress resistance.

IMPACT OF ACCELERATED AGEING ON THE SEED QUALITY PARAMETERS IN WHEAT (*TRITICUM AESTIVUM* L.) VARIETIES

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Accelerated aging is one of the most useful tests used for the evaluation of seed vigour and storability. The present investigation on "Impact of accelerated ageing on the seed quality parameters in wheat (*Triticum aestivum* L.) varieties" was conducted at Seed Testing Laboratory, Department of Seed Science and Technology, VCSG UHF, College of Forestry, Ranichauri, Tehri-Garhwal, Uttarakhand during 2015-16. For this purpose four varieties of wheat viz. VL-802, VL-829, VL-892 and UP-1109 were subjected to accelerated ageing at 45⁰ C and 100 % relative humidity for 15, 30 and 45 days along with control. The experiment was laid out in CRD with three replication of each treatment. Aged seed from different treatments of each variety were subjected to laboratory experiment for evaluating first count, standard germination, root length shoot length, fresh and dry root weight. Under the laboratory conditions, every treatment showed significantly difference for seed quality parameters after accelerated ageing. Variety VL-892 had more capable to maintain the seed quality attributes after 15, 30 and 45 days of accelerated ageing.

period as considered being good storer under ambient condition. Whereas, VL-829 and UP-1109 showed the medium storer and VL-802 poor storer variety on the basis of seed quality parameters.

Keyword: accelerated ageing, quality parameters, wheat varieties, storability test

PERFORMANCE EVALUATION OF EMITTERS OF DRIP IRRIGATION

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The laboratory and the field studies were conducted to investigate the performance of two different types (non-pressure compensating and pressure compensating types) emitters. The value of discharge exponent (0.5 and 0.125 for NPC and PC type emitter) was calculated by establishing discharge and pressure variations. The Cv value of NPC type emitters showed no definite change but for pressure compensating type emitters showed decreasing trend with increase in pressure. Field uniformity values were obtained 94.9 to 98.5 percent for NPC type emitters which are slightly higher than uniformity values for PC type emitter (90 to 95 percent). The approximately calculated uniformity values based on laboratory showed close conformity with values obtained by actual measurement in the field for NPC type emitters.

Keywords: Emitters, Cv value, Pressure and measurement.

EFFECT OF LAND USE ON SOIL ORGANIC CARBON DYNAMICS

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Soil organic carbon (SOC) is the most important component regulating soil fertility and crop productivity as well as global carbon cycle. On a global scale, the soil contains 1500 Pg (1 Pg = 10^{15} g) of organic carbon in the upper soil layer up to 1 m (Schlesinger, 1997; Amundson, 2001). The SOC and total soil carbon pool size of India has been estimated at 22.72 ± 0.93 petagram and 35.55 ± 1.87 peta gram respectively (Sreenivas et al., 2016). There is loss of 40- 90Pg carbon (C) from soil globally through cultivation and disturbance with current rates of C loss of about 1.6 ± 0.8 Pg C y^{-1} due to land use change in the tropics (Smith, 2007). Soil carbon pools are affected by land use which influences the global carbon cycle. The response of soil organic carbon (SOC) transformation to land use changes require size and mean residence time (MRT) of measurable SOC pools. When, soil carbon pool sizes and decay constants of active and slow carbon pools for different land use systems (forest, agriculture, orchards and grazing land) of major part of India are measured, soil organic carbon was significantly varied in different land use pattern and with soil management practices (Iqbal et al., 2014). In agroforestry system (1.438%) and the lowest organic carbon was found under fallow land (0.124% for 20-30 cm). Cropland and grassland organic carbon were found respectively 0.63% and 0.39% for top soil of south Kerala region (Gladiset et al., 2019). The inter-relationship of land use and soil management practices with SOC dynamics is moderately significant in recommending land management practices to mitigate the impact of the climate change at the local to regional level.

Keywords: Land use change, global warming, climate change

DEHYDRATION TECHNIQUE FOR QUALITY ENHANCEMENT OF HELICHRYSUM DRY FLOWERS

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Helichrysum, also known as 'strawflower' is an important component of dry flower industry, used in everlasting floral decorations, crafts, potpourris etc. To address the problem of petal reflexing and disc shattering in air dried helichrysum flowers, the present study is conducted by harvesting the flowers at six different stages of development and subjecting them to four dehydrating techniques viz. air drying (M_1), embedding drying in sand at room temperature (M_2), hot air oven drying at 60°C for 10 hours (M_3) and embedded drying in microwave oven at high power for 2.5 minutes (M_4). The results showed significant effect of harvesting stages and dehydrating methods on their quality and storability. Harvesting flowers at bud stage with 2-3 rows of ray florets open (S_1) or ray flowers open but disc not visible (S_2) are ideal for air drying as these flowers open fully with drying but petals still remain incurving and discs remain intact. Delayed harvest is not suitable for air drying. On the other hand, mechanical support provided by embedding in sand improved retention of shape of the flowers harvested at all the stages over air drying. Hot air oven drying at 60°C for 10 hours and embedded drying in microwave oven are the best methods for arresting the flowers at the particular stage they are harvested. However, for delayed harvest i.e. when flowers are mature with one to entire rows of disc

florets completely brown, microwave oven drying is the best method to stop further development and hold them identical to the freshly harvested flowers.

CHARACTERIZATION OF PHALAENOPSIS GENOTYPES UNDER TERAJ AGRO-ECOLOGICAL CONDITION OF WEST BENGAL

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Phalaenopsis, commonly known as 'moth orchid', is the most popular genus under the family Orchidaceae, which is valued as an indoor ornamental as well as cut flower. Among the potted flowering plants, phalaenopsis have the highest share in the international market. It can be a potential floriculture crop for cultivation in the Terai region of West Bengal, as it grows predominantly in sub-tropical weather condition. Hence, an initiative has been taken to create a gene pool and evaluate the genotypes as a pre-requisite for introducing the crop in this area. Based on morphological characters, 36 phalaenopsis accessions of the institute farm are characterised and grouped into 11 types based on the scores of different morphological characters as described in DUS testing guidelines. The genotypes showed marked variations in leaf shape, size, position of broadest part, shape of apex, symmetry of apex, leaf attitude, variegation and main colour of the upper side. The leaf length and width ranged from 9.5cm to 23.5cm and 3.8cm to 27.3cm, respectively. Quantitative traits like rachis length, number of flowers per spike, flower diameter varied significantly among the 11 types. Eleven characters on shape of different floral parts and twenty nine characters on colour of all the floral parts were considered for characterization and grouping of the accessions. The data has been summarised.

INTEGRATED NUTRIENT MANAGEMENT IN INDIAN MUSTARD (*BRASSICA JUNCEA*) IN BUDELKHAND REGION OF U.P., INDIA

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In India, during the past 3 decades, intensive agriculture involving exhaustive higher yielding varieties of cereals has led to heavy withdrawal of nutrients from the soil. Further more, use of chemical fertilizers by farmer has deteriorated soil health and decline soil organic carbon content. India is a largest producer of Indian mustard (*Brassica juncea*) next to groundnut. Indian mustard ranks in terms of area and production in the country, contributing about 23% of total oil seed production. The quality of mustard oil and its cake is greatly influenced by the use of imbalance and inadequate plant nutrients in nutrient deficit soil of Bundelkhand. The concept of integrated nutrient management has been found to be quite promising not only in maintaining higher productivity but also in providing greater stability in crop production. The present study as farm trial was conducted during two consecutive Rabi seasons of 2014-15 and 2015-16 at farmer's field of Jalaun District of Uttar Pradesh India. The soil was Kabar (highly deficient in nutrients), having pH 7.8, organic carbon 0.29%, available phosphorus 11.20 kg/ ha and available potash 308 kg/ ha. The cultivar Type -59 was tested under farmer's practices (80 kg DAP/ ha), 120 kg N + 60 kg P + 60 kg K and 120 kg N + 60 kg P + 60 kg K + 40 kg S/ ha. The results revealed that the Indian mustard was fertilized with N, P, K, S @ 120:60:60:40 kg / ha registered higher growth character viz; plant height No. of primary branches per plant and yield attributing character viz; No. of silique/ plant, seeds per silique and 1000 seed weight. and grain yield. The lowest growth and yield attributes and grain yield of Indian mustard was found under farmer's practices. The better combination of nutrient (NPKS) maintain better sources- sink relationship, under this situation, the dry matter of photosynthesis produced by source organs translocated towards sink organs (economic part) and produced higher seed yield of mustard. On the basis of above results it may be concluded that the Indian mustard fertilized with NPKS @ 120 : 60 : 60 : 40 kg ha⁻¹ was economically feasible and profitable under nutrient and moisture deficit soils of Bundelkhand.

IMPROVING WOMAN'S LIVELIHOOD AND FAMILY NUTRITION THROUGH KITCHEN GRADING IN FOOT HILLS OF HIMALAYAN RANGE OF BEHRAICH DISTRICTS IN U.P.

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Kitchen gardens mainly found in humid and sub humid parts of the world. Now a days Kitchen gardens are gaining more importance due to supply of organic food and availability of vegetables during the lean period. These gardens offer great potential for improving house hold food security and alleviating nutrient deficiencies. Kitchen gardening can enhance food and nutritional security in three ways; direct access to a diversity of nutritionally-rich food, increased purchasing power from saving of food bills and income from sale of garden products and to provide food during lean periods in foot hills of Himalayan region. This is also

more important in rural areas where people has limited income earning opportunities and poor access to markets. Kitchen gardens are also becoming and increasingly important showing of food and income for poor house hold in peri-urban and urban areas. Successful project on nutritionally gardening (Kitchen gardening) has been laid out at Krashi Vigyan Kendra Behraich. The choice for selection of site for a kitchen garden is limited due to shortage of land in home state. Usually a kitchen garden is establish in backyard of house and near water source in an open area. Receiving plenty of sun light a fairly consisting of 5 members, 200 sq. m. land is sufficient to provide vegetables and fruits throughout year. A rectangular garden is preferred to a square. plot for a long strip of land. Layout of garden and selection of crop suited to each season depend on agro-climatic condition depending on climatic and seasonal changes, modification are to be done in layout and crop allotment. In kitchen garden annual crops like brinjal, tomato, Bhindi, bitter guard may be planted in May-June, Potato, Tomato, Cabbage, Cauliflower, Knolkhol in September-October and Bottle guard, bitter guard, cucumber and tomato, roots crops like radish, carrot, spice crop like chillies, ginger, turmeric leafy crop like palak, methi, fruits crop like papaya, banana, guava, and mango and perennial crops chillies, beans may also be grown as per season of crop. Other agronomic practices like interculture, earthing, watering, propping, wrapping, and plant protection measured may also be done as and when required harvesting of most of the vegetables should be done at unripe and tendril stage. Unripe vegetable decreases cooking time, increases taste and palatability and improves nutrient content. Harvesting of most of the vegetables/ fruits should be done according to family requirement, Some of the vegetable/ spice like onion, garlic etc. required harvesting at fully ripen stage.

SOLID WASTE MANAGEMENT AND CLIMATE CHANGE IN INDIAN PERSPECTIVE

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Solid wastes are the wastes arising due to human settlement and are disposed off as garbage or trash. Solid waste management and climate change are big concerns for India these days. Due to rapid growth of urban population, as well as constraint in resources, India cannot cope with the volumes of solid waste generated that causes environment pollution, deteriorates public health, accelerates natural resources degradation, causes climate change and thus greatly impacts the quality of life of inhabitants of environment. Climate change traditionally refers to any change in climate over time due to natural variability or as a result of human activity. Solid waste contributes directly to green house gases emission through the generation of Methane from the anaerobic decay of waste in landfills and the emission of Nitrous oxide from our solid waste combustion facilities. Green house gases have high global warming potential that causes the planet to get hotter. Waste prevention and recycling are the ways that mitigate climate change. So there is need to cultivate community awareness and change the attitude of people towards the current levels of waste generation reduction and increase in material and energy recovery as this is fundamental to developing proper and sustainable waste management systems.

Keywords: Solid waste management, Urban population, Climate Change, Environment

INTEGRATED NUTRIENT MANAGEMENT: HOLISTIC APPROACH TOWARDS SUSTAINABILITY

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There are 115 million operational holdings in India of which about 80% belong to marginal and small farmers. Since the last five decades agricultural research has been focusing on the development of plant varieties which give higher yields with higher dose of fertilizers which are deteriorative for the soil health. Degradation of soil health as well as continuous increase of human population made us to think for an alternative way for proper nutrient management. Movement towards balanced nutrient management has already been approached in various places. Various long term fertilizer experiments being carried out in various agro-ecological regions have amply demonstrated that neither chemical fertilizers nor organic manures alone can sustain the crop production and soil fertility. However, conjoint use of fertilizers and manures would not only impart sustenance to the production but also improve physical, chemical and biological properties of soil on sustainable basis. Organics along with inorganic fertilizers provides balanced nutrition to crops which increases crop yield and quality. So, integrated nutrient management (INM) appears to be the most potential and promising strategy for realizing and sustaining crop productivity and soil health. The application of fertilizers in conjunction with organics in a balanced form is necessary for maintaining soil fertility and crop productivity under intensive cropping.

Key words: soil health, organic manures, INM

IN VITRO EVALUATION OF POTENT BI-CONTROL AGENT AGAINST SCLEROTINIA SCLEROTIORUM CAUSING SCLEROTINIA STEM ROT (WHITE MOLD) OF LENTILS

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Pluses constitute an important part of human food. Pulses are valued for their high protein content and protein quality and thus, supplement the cereal based diets. Lentil (*Lens culinaris* Medic.) is one of the oldest known protein-rich food legumes grown in India. Among all diseases Sclerotinia stem rot (white mold) of lentils caused by *Sclerotinia sclerotiorum* is a serious problem to lentil cultivation. Sclerotinia infection in pulses leads to stem and pod rot, crop lodging, and reduced seed fill. Yield losses due to this disease can be greater than 50 per cent if inoculum levels are high and the environment favors disease development. In India, use of chemicals continues to be major strategy to mitigate the menace of crop disease. However, because of the environmental concerns and other hazards associated with use of chemicals, use of biocontrol agents is gaining importance. But, the physiological and ecological factors limit the efficacy of biocontrol agents. In the present investigation the efficacy of potent bio-control agent evaluated against *Sclerotinia sclerotiorum* in vitro. Effect of potent bio-control agent on percent inhibition of pathogen was recorded. It was observed that maximum percent inhibition recorded in *Pseudomonas fluorescens* (95.55%) followed by *Trichoderma* spp. isolates TS007 (75.55 %), *Bacillus subtilis* (71.11%). This indicates above bio control agent have potential to management the important role in biologically based strategy for management of *Sclerotinia* stem rot (white mold) of lentils and enhance the plant growth and yield.

Keywords. Sclerotinia, Lentil and Bio-control agent.

IMPACT ON AGRICULTURAL LAND BY DEGRADATION OF SOIL

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Soil degradation is a global process, but affects arid and semi-arid zones in the India. Soil degradation is increasing worldwide, especially in the countries within the tropics. Depletion of nutrients and soil organic matter and erosion are the principal forms of soil degradation. Among the land used for agriculture and forestry, soil is an important component. The intensive and increasing pressure on land leads to its degradation and pollution, which may result in a partial or complete loss of its productive capacity. Soil degradation can be either a result of natural hazards or due to unsuitable land use and inappropriate land management practices. The main causes of degradation due to direct/indirect human intervention are deforestation and removal of natural vegetation, overgrazing, converting forests to farms, cultivating steep slopes and degrading marginal lands, other agriculture related activities and over exploitation of the vegetation for domestic purpose. Major threats to the conservation of soil resources are soil erosion both by water and air, salinization/alkalinity, acidity, organic carbon losses, nutrient imbalance, pollution/contamination by toxic substances, and soil sealing and capping. Urgent measures are required to arrest the degradation process and to restore productivity of degraded soils so that more food could be produced to provide livelihood and environmental security to the increasing Indian population. This requires the systematic knowledge on the soils, characterization of basic resources like soil, water, climate and biodiversity problems and potentials for optimizing land use.

OFF-SEASON VEGETABLE CULTIVATION ADAPTING LOW COST BAG

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The significant change in climate on a global scale impacts vegetable cultivation and agriculture as a whole consequently affects the world food supply. The present vegetable production of India is 175 MT (NHB, 2017-18) which is much less than the requirement if balanced diet is provided to every individual and it is to be raised to 250 MT by 2024-25 (Sing, 1998). The recent trends in agricultural science and technology shows different ways to achieve this target and the most potential approach is perfection and promotion of off-season vegetable production which encourages protected cultivation, vegetable forcing for domestic consumption, raising off-season nurseries, vegetable seed production for off-season cultivation etc. (Sing et al., 1999). Use of low cost bags for growing seedlings provides good opportunities for virus free vigorous and off-season planting materials, if grown under protected conditions and this economize seed cost of some crops particularly hybrid seeds, thus increases the interest in containerized growing. Containers are now being made from plastic, paper, steel, peat, wood, glass or clay those are very much affordable for the farmers. A study in Kicukiro District revealed that the tomato cultivars sown in low cost plastic bags

improved the germination rate of ANNA F1 and Nouvel F1 cultivars to 93% compared to 63% obtained in statistics of raised bed nursery from 2006 to 2009 in the same region. The farmers who purchased seedlings in poly bags from October 2009 to January 2010 also said that they realized a loss of only 3% between transport and transplantation which is reasonable due to the distance between the two sites and the transport facility they use (Ndayambaje, 2009). Poly bag nurseries are potential to increase the number of persons engaged in vegetable farming as well as developing home gardens. Containers were not known for vegetables but their use should change mindset of people fearing the cost of some high quality cultivars, knowledge, their dependable strength and skills which remain hidden to high number of farmers (G&N Consultants Ltd, 2008). According to Thakur (1994) "Off-season vegetable production and marketing is the most profitable farm business giving very high production and income to farmers per unit area of land".

Keywords: Off-season vegetable, low cost bag, recent trends, hybrid seeds, high production and income.

IMPACT OF CLIMATE CHANGE ON ENVIRONMENT AND FUTURE FOOD SECURITY

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Increase in global average temperature and changes in rainfall pattern and intensity since the last century is the most severe problem the world is facing today. Emission of green house gases (GHGs) over the past years has been increased due to anthropogenic activity and industrial development. Uncontrolled use of fossil fuels, rapid deforestation, burning and biomass decaying cause increase in atmospheric CO₂ concentration, which currently is around 388 ppm and predicted to increase to approximately 470-570 ppm until year 2050 (IPCC, 2007). Current and predicted pattern of global climate change are a major concern in several fields of socio- economic activities, such as agriculture, forestry, etc., and is the global threat for food security for coming future. The different climatic factors such as carbon dioxide (CO₂), temperature, solar radiation, precipitation etc., help understand impacts of climate change and take serious adaptation/mitigation against climate change. In addition to changing climate, increased variability in weather may occur with consequent frequent extreme events such as heat waves, droughts, wind storms and floods having negative impacts on agriculture. Decreased surface water supplies and more dependence on ground water source will lead to a threat for coming future in terms of water availability. The Agricultural Research Institute (ARI) found that increases in temperature (by most about 2°C) had reduced potential grain yields in most places. Reductions in yields as a result of climate factors are predicted to be more pronounced for rain fed crops (as opposed to irrigated crops) specifically under areas with low water availability or drought-prone areas. Higher temperature actually decreases yield by speeding up a plant's senescence. Radiation also has an important role in photosynthesis and crop productivity. It has been noticed recently that the interception of solar radiation on the earth surface has been disturbed due to blockage by gases and particulate matter (aerosols) emitted by human activities and this decrease is predicted to reduce agricultural productivity at serious rate. To tackle problems associated to climate change we have to focus on practicing activities of mitigation and potential adaptation measures. Minimizing GHGs emission and substituting energy, carbon sink, and using modern technologies etc. are the best possible method to get a solution. It is also crucial to introduce plant varieties with improved tolerance to climatic extremes.

Keywords: GHGs; climatic extremes; food security; mitigation

CLINICAL EFFICACY OF VINCRISTINE SULPHATE AND THEIR SCAFFOLDS ON TRANSMISSIBLE VENEREAL TUMOR IN CANINE

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The present study was conducted on twelve dogs of either sex affected with canine transmissible venereal tumour (CTVT). The animals were divided into two groups viz. A and B. The animals were administered with different drug viz. Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks and scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks. The physical appearance in relation to onoclytic effect, histopathological changes, ultrastructural (SEM) changes, biochemical (glucose, BUN, creatinine, AST and ALT) and haematological (Hb, PCV, TLC, DLC and platelets) studies were made at 0 week, first, second, third and fourth week by using standard protocol. On the basis of parameter observed in this study, it is concluded that extent of apoptosis in CTVT cell at first and second week interval was more in the animals treated with scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks as compare to vincristine sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks as indicated by histopathological (H&E staining) examination and ultrastructural studies. Ultrastructurally, healthy cells had round to

oval nuclei with large eccentric nucleolus and dispersed chromatin. Dilation of perinuclear space, clumped nuclear chromatin along the nuclear envelope and invaginated nuclear membrane was common in degenerating neoplastic cells. The cytoplasm of degenerating cell contained relatively swollen mitochondria with a few irregular cristae, abundant rough endoplasmic reticulum, fewer ribosomes, Golgi apparatus, occasional lipid droplets and numerous tubular and vesicular profiles. Vincristine sulphate is safe drug used in the in the present study as there was no adverse biochemical and hematological changes during entire period of study, however, the variable changes observes during these period were purely temporarily and were within normal physiological limits. The early and best regression of the CTVT was observed in the animals treated with scaffolds of Vincristine Sulphate @ 0.025 mg/kg intravenously once in a week for four consecutive weeks.

MASS MULTIPLICATION OF ENTOMOPATHOGENIC NEMATODES (EPNS) ON SPODOPTERA LITURA

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Investigations were conducted under laboratory at room temperature ($25 \pm 1^\circ\text{C}$), Department of Nematology, CCS HAU, Hisar during 2016-17. The virulence of five strains of *Steinernema abbaasi* and two *Heterorhabditis indica* were evaluated against *Spodoptera litura* in four doses (5, 10, 20 and 40 IJs/insect larvae) under in vitro conditions. The isolated strains of entomopathogenic nematodes (*S. abbaasi* and *H. indica*) were used for its multiplications, EPNs infected dead larvae of *S. litura* were removed from the well and kept on white trap for the emergence EPN from the body of insect and IJs were collected at three days interval, till the emergence was stopped in about in 21 days. Result revealed that highest yield of *S. abbaasi* isolate HAR-EPN-Sa-3 which was 39,080 IJs/cadaver, followed by HAR-EPN-Sa-2 (36,180), HAR-EPN-Sa-5 (27,540) and HAR-EPN-Sa-4 (25,990). HAR-EPN-Sa-1, recorded the least multiplication of all the isolates i.e. 23,330 IJs/cadaver, emerged from the body of the *S. litura* when inoculum level of 40 IJs per insect larva was used. There was no multiplication upto 3rd day. In case of *H. indica*, highest yield of HAR-EPN-Hi-2 which was 47,085 followed by HAR-EPN-Hi-1 42,440 IJs/cadaver, at the inoculum level of 40 IJs per insect larva was used. There were no multiplications upto 3rd and 6th days. Mass production of IJs of tested EPNs from *S. litura* larva showed highest yield of EPNs (*H. indica*+*S. abbaasi*) which was 58,550 followed by *S. abbaasi* 17,385 and *H. indica* 14,665 IJs/cadaver. It could be concluded that, multiplication rate of IJs increased with increase in exposure time and combination of EPNs.

Keywords: EPNs, mass multiplication, *Steinernema abbaasi*, *Heterorhabditis indica*, *Spodoptera litura*

PRECISION AGRICULTURE: THE FUTURE OF FOOD

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Global agriculture is facing formidable challenges that are expected to increase over the next few decades. To cope with future challenges, radical changes to the food system and investment in research are vital for finding new solutions to novel problems. The major concerns in agricultural growth and development in the present can be identified as the rapid decline in total productivity, multi-nutrient deficiencies, stagnant farm incomes, lack of eco-regional approach, declining and fragmented land holdings, agricultural trade liberalizations, diminishing and degrading natural resources and global climatic variation. Therefore, to increase productivity in the future the adoption of newly emerged technology can be considered as a viable solution. Precision farming is a newly introduced concept in Indian agriculture, which includes information centered technologies for enhancing precision in order to assess farm variability and strategize input application to increase farm profit simultaneously reducing environmental risks. The basic ideology of precision farming system emphasizes the on-site application of the production inputs as per need according to the spatial and temporal variability of the field for most economic crop production. Attractive site-specific decisions can be implemented as a part of satellite farming, such as soil characterization, non-destructive monitoring of crop stresses, crop nitrogen monitoring, degree of weed infestation and determining crop biomass using precision tools like Remote sensing, GPS, GIS etc. Though it is widely adopted for commercial crops in developed countries, in most of the developing countries, it is still in a nascent stage. There is a good scope for implementation of precision technologies in the developing country but for this, it needs a sustainable program and strategic support from the public and private sector is essential. Farmers should be encouraged by fostering their knowledge, technology, networking, and information access in order to prepare them as modern agricultural actors.

Keywords: variability, site specific, satellite farming, remote sensing, GPS, GIS

EFFECT OF SYNTHETIC AUXIN AND UREA ON FRUIT DROP AND YIELD OF ASSAM LEMON**BIDYARANI DEVI SENJAM* AND S. R. SINGH****Department of Fruit Science, College of Horticulture and Forestry, Central Agricultural University, Pasighat, AP**

Effect of foliar application of synthetic auxin (2,4-D, NAA) and urea on fruit drop and yield of Assam Lemon was investigated during the Winter and Summer seasons of the year 2017. The experiment was carried out at the Fruit Research Farm, Department of Fruit Science, College of Horticulture and Forestry, Pasighat, Arunachal Pradesh with 9 treatments and 5 replications, laid out in Randomized Block Design (RBD). The treatments applied were: T₁ (NAA @ 10 ppm + 1% urea), T₂ (2,4-D @ 10 ppm + 1% urea), T₃ (NAA @ 20 ppm + 1% urea), T₄ (2,4-D @ 20 ppm + 1% urea), T₅ (NAA @ 10 ppm + 2,4-D @ 10 ppm + 1% urea), T₆ (NAA @ 20 ppm + 2,4-D @ 20 ppm + 1% urea), T₇ (NAA @ 10 ppm + 2,4-D @ 10 ppm), T₈ (NAA @ 20 ppm + 2,4-D @ 20 ppm) and T₉ (Control). Among the different treatments, T₆ (NAA @ 20 ppm + 2,4-D @ 20 ppm + 1% urea) was found to be most effective with maximum number of fruits/plant at harvesting stage (67.6), yield/plant (8.29 kg), fruit length (8.84 cm), fruit diameter (5.36 cm), fruit fresh weight (118.68 g/fruit), pulp content (81.58 g/fruit), juice content (40.47 ml/fruit) with minimum fruit drop (13.91 %) as compared to control (18.40 fruits/plant at harvesting stage, 4.14 kg/plant yield, 7.54 cm fruit length, 4.63 cm fruit diameter, 96.10 g/fruit fresh weight, 60.62 g/fruit pulp content, 27.65 ml/fruit juice content and 33.15% fruit drop.). Hence, foliar application of NAA @ 20 ppm + 2,4-D @ 20 ppm + 1% urea twice (after fruit setting and fully developed stage) can be recommended to the Assam Lemon growers for reducing fruit drop and increasing the yield and productivity in the North Eastern Region of India.

Keywords: NAA, 2,4-D, Assam Lemon, fruit drop, yield.

COMPARATIVE EFFICACY OF DIFFERENT INSECTICIDES FOR MANAGEMENT OF FRUIT BORER (EARIAS VITTELLA FAB.) AND JASSID (AMRASCA BIGUTTULLA BIGUTTULLA ISHIDA) ON OKRA, ABELMOSCHUS ESCULENTUS (L). MOENCH.

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Investigation was conducted during pre-kharif, kharif and post-kharif seasons of 2015 and 2016 in the Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal, India. Imidacloprid 17.8 SL @ 25 a.i./ha provided excellent control with highest average yield of 12.06 q/ha. Acephate 75 SP @ 500 a.i./ha found second best effective insecticides producing the average yield of 11.79 q/ha closely followed by agniastra @ 25ml/liter (11.72 q/ha). The microbial insecticides i.e. spinosad @ 80g a.i./ha and emamectin benzoate @ 25g a.i./ha provided less control than other group of insecticides where average yield was recorded 11.03 and 10.60 q/ha. Considering all aspect of studies agniastra @ 25ml/L might be selected for better efficacy which also fit well under organic system of production.

Keywords: efficacy, insecticides, management, fruit borer and jassid, okra

PRECISION FARMING IN VEGETABLE CROP PRODUCTION

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Precision agriculture is a popular new concept in production technology. During green revolution a considerable rise in production as well as productivity of agricultural crops was observed, but blindfolded use of agro-chemicals like fertilizers and pesticides has created many concerns like water pollution, degradation of soil health etc. Now a day Eco-friendly agricultural systems are required which can bring sustainability in crop production by keeping the various environmental concerns to minimum. Precision technology aims at improving scenario of crop production by an efficient use of agricultural inputs. Some subcomponent of precision farming techniques with a smaller data volume are also employed in olericulture under controlled conditions. In Indian olericulture scenario there is a huge potential for employing precision technique that generate intermittent data, and the same can be used to increase returns. Precision technology is a management strategy that employs, detailed site specific information to precisely manage vegetable production inputs. Technology and management practice such as Global Positioning System, Geographic Information System, variable rate control, yield mapping and post-harvest processing can be readily adopted to vegetable crop production by employing these techniques exact or accurate results of yield of vegetables can be obtained by doing the right thing, at the right place, at the right time. Precision farming is thus a proven technique in improving crop yield under open condition.

Keyword - Precision technology, Geographic Information System, yield mapping

EVALUATION OF DIFFERENT WHEAT GERMPLASMS AGAINST RICE WEEVIL *SITOPHILUS ORYZAE* (L.)

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Thirty wheat germplasms were collected and evaluated to know their reaction to the rice weevil, *S. oryzae* under laboratory condition during summer (July-August) of 2016 and winter season (December-January) of 2016-2017. Freshly harvested grains were collected from AICW&BIP center, UBKV, Pundibari, Cooch Behar. Thirty wheat germplasms were tested against the *Sitophilus oryzae* and NW-6056, DPW-62150 and BRBW-3759 was found highly susceptible to *S. oryzae* on the basis of percentage of grain damage, percent weight loss and population build up. The germplasms DBW-39 was less noted to be susceptible. The results revealed that Percentage of grain damage, percentage of weight loss and population build up caused by *Sitophilus oryzae* was more in summer season as compared to the winter season. From the present studies reveals that percentage of grain damage and percentage of weight loss keeps on increasing slightly from the first day of observation (i.e., 7 days after exposure of grain to *Sitophilus oryzae*). The subsequent evaluation after 56 days of observation shows that, the percent of wheat grain damage and percent of weight loss due to *Sitophilus oryzae* was found to be highest on the 56th days with a grain damaged percentage 29.17 % and 17.36% and weight loss percent 25.07% and 15.54% during the summer and winter seasons.

Keywords: Wheat, *Sitophilus oryzae* (L.), weight loss, grains damaged, adult population

BRIDGEABLE BREACHES IN LEGUMES PRODUCTION FROM BIONOMICAL POINT OF VIEW

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Legumes are an important part of the main sequences of crops followed throughout the country, with specific variations in the regions in terms of preferences and adaptation to the situation of agricultural production. Legumes are correctly known as mini-nitrogen factories. The integration of legumes in the rotation of crops also helps in breaking cycle of pests, thus contributing to improving the overall productivity of the system. Although they inherit these beneficial effects, legumes are adopted mainly as rainfed crops with minimal support for the conditions of use of external inputs that result in low productivity and production below demand to demand at the national level. Besides poor yield realization, ever increasing population, abrupt climatic changes, disease and pest complex, socio and economic situations of pulse cultivators, poor storage facilities etc. add to the deficit legumes availability in the country. In summary, to reduce the bridgeable gaps of legumes, we need site specific approaches to each crop and region that should be adopted within the general framework of the system approach, including the possible horizontal expansion of in legumes acquiring new niches and policy support for the legumes value chain.

CONTRACT FARMING AND SUSTAINABLE AGRICULTURE DEVELOPMENT

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Farming is an age-old means of livelihood for millions of Indians. However, there have been few systems/models in which farmers are assured of market for their produce, sometimes they get remunerative price, too. Farmers have on occasions to sell their produce at throw away prices for want of buyers. On the other hand the agriculture -based food industry, this requires timely and adequate inputs of good quality agricultural produce. This underlying paradox of the Indian agricultural scenario has given birth to the concept of contract farming, which ensures a proper linkage between the 'farm and market.' A contract is an agreement made between two or more parties enforceable by law. Contract farming is that it facilitates backward and forward market linkages that are the cornerstone of market-led, commercial agriculture. Well-managed contract farming is considered as an effective approach to help solve many of the market linkage and access problems for small farmers. This review paper discusses briefly its growth and status including the performance of different models of contract farming based on empirical studies. There are indications that the rural economy has flourished under contract farming system despite certain problems being faced by the farmers like delayed payment, delay in procurement and low supply of agricultural inputs to them. In India contract farming also has considerable potential in doubling the farmer's income where small and marginal farmers can no longer be competitive without access to modern technologies and support of different agencies involved in farming.

Keywords: Contract farming, agriculture, income, sustainable development.

WATER POLLUTION: A CASE STUDY OF SAHARSA DISTRICT RURAL AREA IRON EFFECT OF WATER)**DEEPAK KUMAR SINGH AND AMARJEET KUMAR****Assistant Professor & Head, Department of Geography, Banwari Shankar College, Simraha, Saharsa, B.N.M.U. Madhepura, Bihar, Research Scholar, Geography, JP University, Chapra, Bihar**

The standard of living in Saharsa district is very low. Here all people depend ground water for drinking water. Ground water is polluted due to seepage from sewers, pits, septic tanks, Irrigation of fertiliser in rich fields. Finally it can be concluded that a large number of people are migrants, most of them belong to the lower – Socio-economic groups and the villages of the district. Most of the places at Saharsa district where Iron minerals are highest. These areas have lack of drinking water. Government should pay attention to the pitiable condition of Saharsa. The research area is Saharsa District in Bihar, India. For highlight to polluted water supported diseases are increases. Over all 2352 water sample tested by PHED Saharsa under Bihar Govt. India. It Clearfield to all sample who is collected from rural area household. All Tested sample in 95% is up Iron in 0.5p PM, 20% is up in 1p PM some 2P PPM. The research work is deeply going on study in village and Panchayats. (PPM – PARTICLE PER MILLION)

Keywords:- Water pollution, Health, Social, Save Water, Environment, Scarcity Drinking Water.**EFFECT OF NITROGEN AND PHOSPHORUS LEVEL ON K & S CONTENT AND THEIR UPTAKE AT DIFFERENT GROWTH STAGES OF POPCORN (ZEA MAYS VAR. EVERTA) IN SOUTH SAURASHTRA REGION OF GUJARAT, INDIA****SHALINI KUMARI^{*1} SNEHA², SANTOSH KUMAR³, RAMJEET YADAV⁴ AND SHASHANK TYAGI⁵****^{*1}Department of Soil Science & Agricultural Chemistry, Junagadh Agricultural University, Junagadh-362001(Gujarat)****^{2,3,4}Department of Soil Science & Agricultural Chemistry, Bihar Agricultural University, Sabour, Bhagalpur (Bihar)****⁵Department of Agronomy, Bihar Agricultural University, Sabour, Bhagalpur (Bihar)**

Among all maize corn Popcorn is one of the major ones, which is popular as a snack food in many parts of World. Popcorn is also known as popping corn. Popcorn Size of kernels is small but the endosperm is hard. It's kernels are composed of hard starch, when heated, swell and burst. Popcorn balls are were hugely popular around the turn of the 20th century. A field experiment was conducted in 2013-14 to investigate effect of different levels of potassium and sulphur on content and uptake of nutrients (N, P, K and S) in different plant parts, at different growth stages of popcorn (Zea mays var. everta) at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during rabi season. The experiment consisted of four levels of nitrogen (0, 90, 120, 150 Kg N ha⁻¹) and four levels of phosphorus (0, 45, 60, 75 Kg P₂O₅ ha⁻¹) making sixteen treatment combinations tested in factorial randomized block design with three replications. The results indicate that application of 150 Kg N ha⁻¹ and 75 Kg P₂O₅ ha⁻¹ remain significantly unaffected on concentration of potassium and sulphur in leaves, stem and root part of plant at 30 DAS and 60 DAS of popcorn. The concentration of potassium in leaves, stem, root part and grain of the plant did not significantly influenced due to various level of Nitrogen and phosphorus application at harvest. The interaction effect of nitrogen and phosphorus was found to be non-significant in respect of potassium and sulphur content at 30DAS, 60 DAS and at harvest.

Keywords: popcorn, Nitrogen, Phosphorous, content, uptake**DOUBLING OF FARMERS INCOME THROUGH CROP DIVERSIFICATION****SUNITA*, HEENA, SWAMY H.M.****Department of Agricultural Economics, CCS Haryana Agricultural University, Hisar-125004, India**

Farming in India is characterized by small and fragmented land holdings which rely on monsoon rains. Operating small holdings is often unviable and under this situation farming is not a profitable business. The goal of doubling farmers' income by 2022-23 can play crucial role in promoting farmers welfare, reducing agrarian distress. For doubling of the farmer's income, strategies might be massive investments in agricultural research and development, conservation agriculture technology, implementation of farmers friendly policies, judicious use of available resources and inputs, along with improved market and transportation facility, MSP reform, supported by adequate and timely availability of bank credits. According to the reports published from Niti Aayog, doubling real income of farmers till 2022-23 over the base year of 2015-16, requires annual growth of 10.41% in farmers' income. Therefore, strong measures are actually needed to harness all possible sources of growth in farmers' income within as well as outside agriculture sector. Farmers should think of taking up the agriculture alternatively, say the diversification of crops and integrated farming system, which may turn more remunerative, better input use efficient, and less risk involved. Crop diversification and growing of large number of crops are practised in dryland areas to reduce the risk factor of crop failures due to recurring droughts. Major advantages of crop diversification include increased income of small farm holdings; less risk for price fluctuation, climatic variability; balancing food demand and increasing the production of quality fodder for livestock animals.

Most importantly, during the last half century, India's food production multiplied 3.7-fold but the strategies could not recognize the need to raise the farmers' income and there was no direct relation to promote farmers' welfare.

Key words: Crop Diversification, Niti Ayog, Doubling income, Annual growth

VARIABILITY IN SEED DORMANCY AMONG THE RICE (*ORYZA SATIVA*. L) GENOTYPES IN THE MANIPUR VALLEY CONDITION

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In Manipur, rice is the staple crop which is cultivated over 1.9 lakh ha under rainfed condition in the kharif season. Due to climate change the occurrence of unpredictable pre-rabi rainfall around the time of harvest can reduce the yield to considerable level and also the quality of the seed because of pre harvest sprouting. Therefore, variety which has dormancy for a longer period of time becomes desirable to such situation. Dormancy is a form of developmental arrest and is an adaptive trait that promotes the survival of several plant species. In flowering plants dormancy occurs in seed and vegetative propagules (Lang 1996). In the study, 30 indigenous rice genotypes collected from NE states and maintained at GPB, COA, CAU Imphal, were evaluated. The experimental material consisted of freshly harvested seed from kharif 2017. The seed of 35 rice genotypes were grown in the 2017 kharif season at GPB departmental farm COA, CAU Irosemba. At maturity, plots were harvested at 18-22% moisture content, and the panicles were threshed manually to avoid any injury to the seed. The seeds were first sundried till seeds attained a moisture content of 10-11%. The seeds were then divided into groups of 3000 seeds each and were stored in store at ambient temperature. The seeds were taken at the intervals of 15 days for 4 months. The seeds were allowed to germinate using the paper towel method as per the method described by ISTA (1985). The germination percentage was counted 5th and 14th days. The viability of the seeds was also tested using tetrazolium test. **The dormancy duration was computed as the period from the harvest till the germination reached to 80% in each entry.** This limit was chosen as non- dormant seeds normally give more than 80% germination in the routine tests carried out in our laboratory. **The post-harvest observations were recorded every 15 days interval, starting 5 DAH up to 97 DAH on germination percentage. The seed viability was recorded immediately after harvest. For the germination test, 100 seeds were put for germination between paper towels and the whole set was replicated 4 times. Germination percentage was counted on 5th and 14th day after planting.** In the study, all the genotypes were found to be viable in tetrazolium test. However, variation was observed in the germination percentage. The germination percentage was low in the freshly harvested seed and it slowly increased as the storage period increased. It was found that Tathai (collected from Manipur) showed high germination (95%) even in fresh seeds (5 days after harvest), while genotypes KBA Naga showed lowest germination soon after harvest (8%). Thus these genotypes may be considered having least dormancy period among the evaluated genotypes. KBA Naga and Krishnahansa on the other hand showed least germination (79%) in the seeds stored up to 111 days after harvesting. Thus genotypes may be considered having long dormancy period among the evaluated genotypes. The present investigation KBA Naga and Krishnahansa appear to be promising in regard to longer dormancy period. Possibility of using these parents as donors for developing dormant varieties is a prospective breeding objective.

ECO-INDIGENOUS KNOWLEDGE AND CLIMATE SMART AGRICULTURE

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There is now a growing recognition that indigenous Technical knowledge could somehow respond to the greatest threat of climate change. ITK is cumulative body of knowledge and practices maintained and developed by people with expanded histories of interaction with the natural environment. ITK or traditional ecological knowledge is unique to a particular culture or society. Eco-indigenous agricultural knowledge is designed to preserve biodiversity, natural resources which in turn promote food security. Climate smart agriculture refers to the development that meets the needs of the present generation without compromising the ability of future generations to meet their sustainable development. It should be pro-poor, pro-nature, pro-livelihoods and pro-women. Climate Smart Agriculture means production of food, feed & fiber, Protection of environment & health, conservation of land & resources, development of rural communities, maintenance of agricultural heritage. A practical climate smart agriculture should take into consideration the long and short term effects of current actions common concerns, Inter and intra -generational equity, gender equity justice and moderate production and consumption habits. Efficient communication knowledge and its transfer between and within generations. Therefore most effective policy for promoting climate-smart agriculture or sustainable agriculture is global shift to eco-indigenous agriculture. Scientists believe that agriculture has the potential to change from being one of the largest green house gas emitters to a net carbon sink. This indicates that there are number of eco-indigenous farming practices which are easy and less expensive to implement and can reduce the contribution of Green House Gases. The international panel on climate change (IPCC) has proposed carbon capture and storage (CCS) as an effective method for removing carbon gases from the atmosphere. However, recent research findings show that ecological agriculture sequesters carbon from the

atmosphere more cheaply and more effectively than CCS. The eco-indigenous knowledge is an essential factor for solutions to the problems of preserving biodiversity, promoting sustainable development and mitigating climate change effects.

IMPACT OF DIFFERENT PROTECTED CONDITIONS ON FLOWERING ATTRIBUTES AND PHYSIOLOGICAL TRAITS OF ORIENTAL LILY CV. WHITE CUP

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The present investigation was conducted at Model Floriculture Center of G. B. Pant University of Agriculture and Technology, Pantnagar during the year 2016-17 and 2017-18. The experiment was laid out in completely randomized design with two treatments and fifteen replications under polyhouse and shade net conditions. Most of the flowering attributes like number of buds per plant, duration to bud initiation and spike harvest, length and width of basal and upper bud, diameter of basal and upper flower and vase life were found superior under polyhouse conditions as compared to shade net house conditions. The physiological traits like total chlorophyll (mg /gm Fresh weight), nitrogen, phosphorus and potassium content in leaves were found maximum under polyhouse conditions as compared to shade net house conditions.

Keywords: Polyhouse, shade net house, flowering and physiological.

DETERMINATION OF CHLOROPHYLL CONTENT AND STOMATAL DENSITY IN DIFFERENT ROOTSTOCK SCION COMBINATION OF PEAR

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A field study was conducted to determine the chlorophyll content and stomatal density in different rootstock scion combination of pear at Experimental Farm, Division of Fruit Science, Sher-e-Kashmir University of Agricultural Sciences and Technology of Kashmir, Shalimar, Srinagar (J & K) during 2017. Treatments consisted of four levels of scion cultivars (Carmen, Abate Fetel, William Bartlett and Chinese Sandy Pear) and five levels of rootstocks (Quince C, BA-29, Quince, Kainth and Pear Sucker) constituting twenty treatment combinations. It was found that highest chlorophyll content (3.71 mg/g) was observed in Chinese Sandy Pear/Quince. Maximum stomatal length (27.11 μm) was recorded in Abate Fetel/Kainth, Maximum stomatal width (9.96 μm). Maximum stomatal density (20.63 $\text{no}/\mu\text{m}^2$) was recorded in Carmen/Quince. The highest survival percent (86.67 %) were recorded in Abate Fetel/Quince, Chinese Sandy Pear/BA 29 and William Bartlett/Quince C. Maximum saleable plants were achieved in William Bartlett/Quince (86.33 %). On the basis of foregoing summary, the results may be concluded as follow: determination of chlorophyll content and stomatal characters on different rootstock-scion combinations in pear in the present study. Among the different rootstock-scion combinations Quince performed better with respect to all the studied parameters followed by Quince C.

BEST NUTRIENT MANAGEMENT STRATEGIES FOR BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA* PLENK.) YIELD AND NUTRITION IN SUB-TROPICS

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Broccoli (*Brassica oleracea* var. *italica* Plenck.) is highly remunerative vegetable crop grown in India in recent times because of its food value and feasibility for cultivation. Broccoli curd constitute about one fourth of the total aboveground biomass is the best and cheapest sources of vitamin C, β -carotene and micronutrients for human nutrition. We studied the different nutrient management strategies with organic and inorganic sources of nutrients and their possible combinations on the macro- and micro-nutrients, quality contents and yield of Broccoli (Everest F₁ hybrid) in an Inceptisol of West Bengal. Among the fifteen treatments used, integration of FYM with inorganic nutrients achieved the highest yield (360.9 q ha⁻¹) followed by the integration of MOC with inorganic (331.4 q ha⁻¹) > only inorganic (324.5 q ha⁻¹) and the lowest was obtained in control. On an average, curd constituted ~ 28.8% of the total biomass of broccoli. There was little variation in curd contribution of broccoli under different treatments compared. Curd and leaf macro-(N, P & K) and micro-(Fe, Mn, Zn & B) nutrients contents were higher with integrated nutrient management. On an average, N concentration were higher in curd than that in leaf but P and K showed the reverse trend. Among the micronutrients, Fe, Zn and Cu concentration was higher with curd but reverse was true for Mn and B. Contents of both vitamin C (115.5 mg/100g), β -carotene (9445.8 IU) and antioxidant (90-92%) were also higher with integrated nutrients than either inorganic or organic sole.

MARKER ASSISTED BREEDING IN FRUIT CROPS**ANKIT DONGARIYAL*, D.C. DIMRI, MANPREET SINGH PREET, RAJAT SHARMA****Department of Horticulture, GBPUA&T Pantnagar, U.S.Nagar, Uttarakhand (India)**

In recent few years significant technological advancement has been observed (concepts, approaches and applications) in fruit improvement which has revolutionized the fruit production (Janick, 2012). In the last two decades, the availability of many genomic resources like genome sequences, high-throughput analysis of gene expression, sufficient numbers of molecular markers, express sequence tags (ESTs) and high-density genetic maps has paved the way to the genetic engineering and molecular breeding of fruit plants for crop improvement. Genomics provides a valuable tool for improving the efficiency of breeding by allowing progeny possessing a trait of interest to be selected at the seed or seedling stage through various processes. Marker assisted breeding provide an invaluable tool for improving perennial crops through disease resistance, fruit quality, and rootstocks. Genomics assisted breeding can increase the efficiency of incorporating desirable traits present in wild germplasm into domesticated, or elite, cultivars through Marker assisted selection (Ribaut et al., 2010). Marker-assisted selection (MAS) is gaining considerable importance as it would improve the efficiency of plant breeding through precise transfer of genomic regions of interest (foreground selection) and accelerate the recovery of the recurrent parent genome (background selection). MAS have been widely used for simple inherited traits than for polygenic traits, although there are few success stories in improving quantitative traits through MAS. Markers have significant role in identifying rare recombinants with minimum linkage drag and recovering recurrent parent genotypes in back cross breeding programme (Sonah et al., 2011). Molecular marker technology can be used to trace trade secrets by rapid identification of female parent inbred line contaminants. These lines might be used directly as parents of hybrids or as parents for further breeding. Nowadays diversity studies using molecular markers are common practice. Molecular markers technology can benefit breeding objectives by increasing the efficiency and reliability of selection and by providing essential insights into how genes and QTL are identified. In the future, MAS pyramiding could also facilitate the combination of QTLs for biotic and abiotic stress tolerances in fruit crops.

BIOSYNTHESIS OF SILVER NANOPARTICLES USING PLANT EXTRACT**SUSHILA, NISHA ARYA AND SARITA DEVI****Deptt. of Textile and Apparel Designing, I.C. College of Home Science, CCSHAU, Hisar, Haryana**

Nanotechnology is emerging as a rapidly growing field with its application in science and technology for the purpose of manufacturing new materials at the nanoscale level. Recently, biosynthetic methods employing either biological microorganisms such as bacteria and fungus or plants extract, have emerged as a simple and viable alternative to more complex chemical synthetic procedures to obtain nanomaterials. Different types of nanomaterials like copper, zinc, titanium, magnesium, gold, alginate and silver have come up but silver nanoparticles have proved to be most effective as it has good antimicrobial efficacy against bacteria, viruses and other eukaryotic microorganisms. Plant extract contains various secondary metabolites, it acts as the reducing and stabilizing agent for the bio-reduction reaction to synthesize the novel metallic nanoparticles. The present study focuses on the synthesis of silver nanoparticles with particular emphasis on biosynthesis using plant extract and most commonly proposed mechanisms regarding the antibacterial properties of nanoparticles.

Keywords: nanotechnology, nanoparticles, plant extract, antimicrobial**SOIL AND WATER MANAGEMENT STRATEGIES FOR SUSTAINABLE HILL AGRICULTURE****SHAKSHI MANKOTIA*****Dr. YS Parmar University of Horticulture and Forestry Solan (Nauni)**

The rising population and reduction in the amount of land and some other resources have created tremendous pressure on current agricultural producers to meet the increasing food demands. To cope with this challenge, certain key inputs, such as fertilizers and other chemicals, are overused, which are worsening the surroundings. This intensive agricultural production without adherence to ecological sustainability has led to declining soil health, land degradation and severe environmental problems. The concept of agricultural sustainability and various soil and water management strategies that have been designed to optimize crop yield under sustainable environmental conditions, including integrated nutrient management (INM), integrated soil fertility management (ISFM), integrated soil-crop system management (ISSM), water harvesting and watershed management. Soil management strategies aim to improve crop productivity and reduce deterioration of land by optimizing various characteristics of soil such as its biological, physical, chemical and hydrological properties, through balanced nutrient management (Esilaba et al., 2005). Soil and water management strategies also comprise of innovative approaches, like incorporating fertilizer at depths below the ground surface, adding urease inhibitors, or applying coated urea, which may enhance the uptake of nutrients. These modifications may inspire growers to give more attention to long-term policies, which are also environment friendly, instead of only considering the yield associated returns (Zhang et al., 2012). The results obtained from the experiment conducted by Avasthe et al. (2013) have shown that drip irrigation is of immense value in hilly area fruit production and must be promoted for both water conservation and

higher income. Combination of FYM and inorganic fertilizers increased the yield by 35% on average in maize-millet and by 16% on average in rice-wheat cropping systems (Sherchan et al., 1999). So, integrated use of chemical fertilizers and organic source of nutrients enhances productivity and quality of crops and sustain the fertility status of soil.

Keywords: Sustainability, Strategies, Water harvesting, INM, ISFM, ISSM.

MITIGATING THE DETRIMENTAL EFFECT OF FLOWERING STAGE DROUGHT BY EXOGENOUS APPLICATION OF POTASSIUM NITRATE AND GLYCINE BETAINE IN RICE (*ORYZA SATIVA* L.)

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This investigation was carried out in the rainout shelter at Student Instructional Farm (SIF), Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.) during Kharif (wet season) 2015 and 2016 to find out response of glycine betaine and potassium nitrate in improving growth and yield of rice under drought at flowering stage. Experiments were laid out in randomized block design with 3 replications, one variety i.e. Swarna Sub 1 and nine foliar treatments. Rice plants were exposed to drought at 60 DAT for 15 days by holding irrigation during drought treatment. During drought treatment soil moisture tension of the field was ranged from 60-80 kPa. Foliar application of different concentrations of glycine betaine (100 & 200 ppm) applied at 60 DAT and different concentrations of KNO₃ (2 & 3%) applied at 30 DAT & at 60 DAT as well as their combination was given. Data regarding various growth and yield parameters of rice were recorded using standard procedures. The data so collected were analyzed statistically by using the Fisher's analysis of variance technique and LSD at 5% probability was used to compare the differences among treatment. Drought at flowering stage hampered the growth and yield of rice but exogenous application of glycine betaine and potassium nitrate will helps to ameliorate the detrimental effect of drought. All the foliar treatment improved the growth and yield of rice under drought stress. Thus, from this investigation it was concluded that potassium nitrate and glycine betaine when applied exogenously could help to mitigate the harmful effect of drought stress however maximum improvement in growth and yield was observed when glycine betaine and potassium nitrate were applied in combination and therefore it may be recommended that foliar spray of combination of glycine betaine and potassium nitrate i.e. foliar spray of KNO₃ @ 2% at 30 DAT & glycine betaine @ 200 ppm at 60 DAT to be used for mitigating flowering stage drought in rice.

ECO-PHYSIOLOGICAL STUDY OF CYTOKININ AND GIBBERELIC ACID ON WHEAT VARIETY K 0607 (*TRITICUM AESTIVUM* L.)

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The experimental research study entitled Eco-physiological study of cytokinin and gibberellic acid on wheat (*Triticum aestivum* L.) Variety K0607 was conducted during Rabi season 2015-16 in micro plots at Department of crop physiology Chandra Shekhar Azad university of Agriculture and Technology, Kanpur, aimed with the physiological as well as biochemical effect of two plant growth regulators having different concentration viz., Gibberellic acid (GA₃) 20ppm, Gibberellic acid (GA₃) 30ppm, Gibberellic acid (GA₃) 40ppm, Gibberellic acid (GA₃) 50ppm, Cytokinin (kinetin) 2.5ppm, Cytokinin (kinetin) 5ppm, Cytokinin (kinetin) 7.5ppm, Cytokinin (kinetin) 10ppm, on growth, yield and quality of wheat (*Triticum aestivum* L.). The study was carried out in micro plots, Randomized block Design (RBD) adopted for the experiment. All the two growth hormones involved higher, lower and one control. All treatments were replicated three times. Result can be concluded that the spraying of cytokinin 5 ppm enhanced the yield of wheat variety K0607 under timely sowing condition. Both the growth regulators cytokinin 5ppm and Gibberellic acid 50 ppm enhanced all the growth and physiological characters of wheat and all the yield attributes resulted in higher biological yield Harvest Index and finally economic yield of wheat variety K0607.

SEASONAL INCIDENCE OF JASSID, AMRASCA BIGUTTULA BIGUTTULA (ISHIDA) IN OKRA *ABELMOSCHUS ESCULENTUS* (L.)

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Okra which is commonly known as Bhindi or lady's finger, belongs to family Malvaceae, is a popular vegetable crop due to its high nutritional and medicinal values. In India, okra is cultivated throughout the country and year for its immature tender fruits. The jassids cause damage right from an early seedling stage to the fruit setting stage. The field experiment was conducted with a view to study the seasonal incidence of jassid at Students' Instructional Farm, NDUAT, Ayodhya during Kharif, 2015 in RBD with eight treatments including untreated control in three replications, sowing pusa sawani variety in third week of July. Jassid population started since the vegetative stage and continued till harvesting stage of the crop and was noticed for the first time during

32nd SW and continued up to 41st SW till the harvest of the crop. The minimum (0.20 jassid/leaf) and maximum (12.70 jassids/leaf) jassid population were recorded during 32nd SW and 37th SW, respectively. Jassid population showed non-significant positive correlation with minimum temperature (0.291), maximum temperature (0.371), relative humidity (0.071) and non-significant negative correlation with rainfall (-0.282).

AN INSIGHT INTO ANTI-ARTHRITIC PROPERTY OF MADHUCA INDICA FOR RHEUMATOID ARTHRITIS USING MOLECULAR MODELLING APPROACH

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Rheumatoid arthritis (RA) is a chronic systemic inflammatory ailment which involves activation of CD4 T cell and chiefly affects synovial joints alongwith other tissues and organs. Chitinase-3-like protein 1 (CHI3L1) and Chitotriosidase-1 (CHIT1) correlated with disease severity in a range of diseases, like rheumatoid arthritis, osteoarthritis, autoimmune and chronic inflammatory disorders. Therefore, they were selected as key drug target proteins for RA. In the present study, several herbal compounds reported for Madhuca Indica leaf and bark were identified as potential CHI3L1 and CHIT1 inhibitors in treating RA using an in silico approach. The bioactive compounds were screened based on anti-inflammatory and anti-arthritis activity with the help of PASS Server. The selected ligands were computationally generated with the help of ChemSketch and their inhibitory effect was studied through the molecular docking approach using AutoDock Vina 1.5.6. Finally, ADMET analysis of the ligands was then done with the help of SwissADME so as to ascertain the best ligand against the RA proteins. The ligand β - amyryn acetate and α - amyryn acetate were identified as promising herbal compounds which showed a strong binding affinity towards CHI3L1 and CHIT1 respectively with least docking score compared to their PDB reported ligands. Thus, the study showed that both β - amyryn acetate and α - amyryn acetate followed ADMET analysis by accepting Lipinski's Rule of 5 which can be further investigated using in vitro and in vivo studies to verify its therapeutic potential in treating RA.

Keywords: Rheumatoid Arthritis, Chitinase-3-like protein 1, CHI3L1, Chitotriosidase-1, CHIT1, Molecular Modelling, β - amyryn acetate, α - amyryn acetate, Pass Server, Chem Sketch, Auto Dock Vina 1.5.6., ADMET, Swiss ADME, Lipinski's Rule of 5

IMPACT OF CLIMATE CHANGE ON INSECT PESTS

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Climate refers to the phenomenon that is causing earth to warmer which means that our climate and our weather systems are changing. Climate change had led to the increase in global average temperature, rainfall intensity, cyclonic activities on the sea surface and also the increasing frequency of flood and drought. On agriculture, the climate change cause reduction in yield in warmer region due to the heat stress, land degradation, more livestock death and increased insect out breaks by altering the time of time of emergence , prolonged overwintering and altering geographical distribution climate change affect the insect population. Alteration in food quality of chick pea due to elevated CO₂ significantly affect the growth parameter of *Helicoverpa armigera* in the form of increased food consumption, gain in larval weight and more fecal matter production. Climate change have diverse effect on natural enemies of pest species increased temperature will result increased mortality decreased effectiveness due to nutrient imbalance in host. Change in secondary metabolites in plant due to elevated CO₂ affect herbivore semiochemicals which affect natural enemies to locate their host.

Keywords: Climate Change, Insect Pests, Temperature, Mortality.

BIO-NANOTECHNOLOGY - A TOOL FOR SUSTAINABILITY AND BIOTIC AND ABIOTIC STRESS MANAGEMENT

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Plants being immobile are continuously exposed to different kinds of stresses i.e., biotic and abiotic stresses through various pathogenic attacks or through environmental vicissitudes. Therefore, identification of such plant material which can be resistant to these stresses is an area of prime concern. Nanobiotechnology alias nanobiology or bio-nanotechnology can be an effective way out to combat these stresses. Thrust, however, nowadays is mostly given on the biological/green synthesis of these nanoparticles employing plants/plant extracts. No other specialized technology can combine the activities of sustainable agriculture so productively with compatible sustainable practices. This technology when applied to sustainable agricultural processes, can lead to precise application of chemicals and improved plant growth. Due to high surface/volume ratio, the bioavailability and bioactivity of these nanoparticles is greatly increased; which makes them potent enough to be expended for augmenting plant growth, development and productivity, and biotic and abiotic stress tolerance. This, in turn, can be achieved through the use of

nanofertilizers or encapsulated nutrients which can act as a suitable alternative to the efficient use of resources and can be a solution to decreasing soil fertility due to the enhanced use of chemical fertilizers and pesticides. Among the abiotic stresses, drought, salinity, alkalinity, submergence and mineral toxicity/deficiencies are considered as major factors that contribute to decreasing crop growth and productivity. Hence, the use of TiO_2 , SiO_2 NP's (to increase seed germination), SiO_2 NP's (for drought tolerance), Si NP's (to improve stem growth, and maintain water potential in stressed plants) and ZnO NP's (to increase seed germination and germination rate) can be an effective way out. Furthermore, nanobiotechnology, with the aid of non-carrier based formulations and sensitive nano-biosensors, can be intended for the early detection of phytopathogens to increase crop throughput and biotic stress tolerance. Hence, this technology holds a bright future for sustainable agricultural development.

USE OF ICT IN CAREER PREFERENCES OF GIRL STUDENTS IN STATE AGRICULTURE UNIVERSITY IN UTTAR PRADESH.

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Agriculture education is play important role in can adopting technologically advance farming tactics for different climatic condition and consequently increases productivity of producer as well as up lifts their standard of living. Agricultural universities in India help to farmers to make farming easy viable and profitable. The under representation of females in information and communication technology (ICT) field of study and career continues to attract considerable attention. The results show that 90% of women studied are self-motivation in their choice of the ICT career with very little external incentivizing or encouragement supporting their choice, besides the high compensation and prestige associate with skilled ICT work. Most familiarly with communication technologies was found Mobile phone ranked at first with mean score of 3.45, maximum numbers of respondent were using communication technology 2-4 hours in day, searching detail related to subject ranked at first with mean score 1.79 and maximum of the respondent 63% were found in the satisfied category.

USE OF MODIFIED ATMOSPHERES FOR THE CONTROL OF STORAGE INSECTPESTS

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The explosion of human population is creating an unprecedented demand for greater production of food grains. The post-harvest losses due to infestation by insect pests have required the use of diverse procedures for their control. In the recent past, the preservation of agricultural products during the storage has relied heavily upon the insecticides to control the storage pests. These management methods have different side effects on the environment, human health and the consumers today expect the food products that are pesticide free. Hence, there is a need of eco friendly methods to manage the storage pests. Modified or controlled atmospheres offer as safe and environmentally benign alternative to the use of conventional residue-producing chemical fumigants for controlling insect pests that attack stored grain. The modified atmosphere storage method involves alternation of the concentrations of the normal atmospheric gases such as nitrogen, oxygen and carbon dioxide, to an atmosphere lethal to stored product pests. This modified atmosphere storage has many advantages compare to conventional methods of storage. These includes elimination of insects from stored commodities without polluting the atmosphere, no harmful residues remain after the treatment of the commodity with nitrogen, oxygen and carbon dioxide, absence of effects on germination, many other parameters important in the quality of different commodities and decreased hazard of leakage into workspace of toxic material. These advantages, together with cost competitiveness against many existing practices, ensure that modified atmospheres will be used on a routine basis as a method of insect control in stored products in the future.

ADVA NCES IN THE VALUE ADDITION TO FOODS - RECENT TRENDS

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Value addition to foods may be done by several ways. It could be done by the use of preservative, food ingredients capable of eliciting functionalities and by fortification using micronutrients. There are novel and emerging food processing technologies that are possible to preserve the ingredients in the food intact. The shelf life enhancement of the processed food can be done by adapting newer packaging technologies. Food processing industries in many of the countries across the world generates huge quantity of by-products that can be put into use by value addition. These by-products have less use and create considerable environmental pollution. The by-products of the fruits, vegetables, etc. may be used for value addition adapting commercially viable approaches. Fermented foods are value added foods that could be developed using novel starters. It is also important to note the regulatory aspects of foods whenever the foods are preserved by value addition. There is a rapidly growing body of literature

covering the role of emerging food processing technologies for value addition and their significant effects on storage and preservation. It is true that consumers are increasingly aware of diet and life-style related health problems that demands safe food ingredients and additives. Food processing industries pose disposal of by-products, at the same time it should be borne in mind that they are also promising sources of useful bio-actives and compounds.

Keywords: Additives, Ingredients, Advanced technologies, Packaging, Fermentation, By-products utilisation, Food concerns.

ECO-FRIENDLY HORTICULTURAL PRACTICES IN TEMPERATE FRUIT PRODUCTION

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Horticulture is the emerging thrust area of agriculture sector in post green revolution period for food, nutritional and environmental security. Horticulture deals with the cultivation and management of fruits, vegetables, ornamental flowers etc. and their post-harvest management practices. It is involved in the intensive use of resources, such as land, water, labour and inputs such as fertilizers and pesticides, irrigation and machines, however, degrade the ecological integrity and endanger the flora and fauna which cannot be sustained over generations. Future food, nutritional security would depend on improving the productivity of biophysical resources through the application of sustainable production methods, by improving tolerance of crops to adverse environmental conditions and by reducing crop and post-harvest losses caused by pest and diseases. Indigenous horticultural practices can play a key role in the design of sustainable and eco-friendly horticulture systems. On the other hand, rising population forced the upsurge in demand of food and nutritional security which can be possible through the scientific and modern interventions in this sector by enhancing the productivity of farm which is possible with the introduction of High yielding varieties, dwarfing rootstocks, organic farming and use of Integrated Nutrient Management (INM) and Integrated Pest Management (IPM) for maximization of crop yields, enhanced productivity and sustainable development. This sector has potential for good employability with an eco-friendly option to cater the need of horticulture-based industries like High Density Plantations (HDP), Processing and Value Addition Units of horticultural produce. The rising concerns of global warming and climate change further aggravated the scope of eco-friendly horticultural practices for improvement of micro-climate and agro-ecosystem and transforming the lives and landscape of the masses in general.

ECO-FRIENDLY BIO-BLEACH PROCESS FOR PRODUCTION PULP FROM AGRICULTURAL CROPS

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Various parts of agricultural crops are used for the production of pulp using Kraft pulping process followed by chemical bleach sequence that produces more than 300 highly colored chlorinated organic compounds including small quantity of highly toxic dioxins. Pulp and paper industry is one of the most important enemy of clean environment where multistage use of chlorine based bleach technology is most dangerous to the environment. It has been referred as "Chlorine Bomb". Chlorine free bleach processes are very expensive, and therefore, the paper technologists are seriously investigating reduced chlorine bleach sequences. During the pulping process xylan is re-precipitated between the cellulose and lignin fibers that blocks the channels which require greater amount of chlorine to remove residual lignin. Pre-treatment of pulps with cellulase free xylanases facilitates the entry of chlorine between cellulose fibers by removing re-precipitated xylan. It allows the removal of lignin complex with reduced amount of chlorine which leads to lesser release of toxic dioxins. This biobleach process helps in saving the environment. We have succeeded in producing cellulase free extracellular xylanases from *Streptomyces thermoviolaceus*, *Saccharomonospora viridis*, *Phanerochaete chrysosporium* and *Aspergillus fumigatus* that are able to reduce 25 to 33% of chlorine consumption during the widely used CEDED bleach sequence without adversely affecting quality of paper including the brightness. Pretreatment of Birchwood Kraft pulp with extracellular cellulase free xylanases preparations from *Streptomyces thermoviolaceus* was highly effective at 65°C and one cycle of 3-h treatment allowed 30-35% savings in chlorine in CEDED bleach sequence. Comparison of commercial preparations of Pulpzyme and Cartazyme with our preparations showed that our enzyme preparations preserved better quality of paper fibers. High activity cellulase free extracellular xylanases were produced from a mutant of *Aspergillus fumigatus* on cheap substrate, wheat bran under solid state fermentation conditions. The enzyme preparation was active at 60°C at pH 7.0 that allowed 33% savings in chlorine in CEDED bleach sequence without adversely affecting paper qualities. Enzyme preparations from *P. chrysosporium* under solid state fermentation conditions yielded cellulase free xylanases that were active at 65°C at pH 7.0 and allowed 40% savings in chlorine in CEDED bleach sequence where paper qualities including strength of paper fibers were better preserved. Though, enzyme preparations from *Saccharomonospora viridis* were also cellulase free and highly active at 70°C but its activity was not as high as that of *S. thermoviolaceus*, *P. chrysosporium* and *A. fumigatus*. Release of reducing sugars and chromophoric materials and reduction in Kappa number were used as parameters of bio-bleach effect of enzyme preparations. Brightness (ISO), tear index, tensile index and burst index were taken as standard parameters of quality of paper. It is suggested that cellulase free xylanases active at high temperature and alkaline pH values have great commercial potential in pulp and paper industry to save the environment.

APPLICATION OF VERMICOMPOST FOR SUSTAINABLE CROP PRODUCTION AND SOIL HEALTH**¹AJAY BABU, ²SHANI KUMAR SINGH, ³PRATIMA SINGH AND ⁴VIMAL KUMAR****¹Dept. of Soil Science and Agricultural Chemistry, IAS, BHU, Varanasi, U.P., ²Dept. of Extension Education, IAS, BHU, Varanasi, U.P., ³Dept. of Genetics and Plant Breeding, IAS, BHU, Varanasi, U.P., ⁴Dept. of Agriculture, Government of Uttar Pradesh, Krishi Bhavan, Mirzapur, U.P., India**

Role of vermicompost in nourishing agricultural crops has attracted the attention of researchers throughout the globe in past few decades. Vermicompost is the method of using earthworms to transform organic waste into nutrient rich compost. The earthworms casting is nutritive organic manure rich in humus to enhance NPK and micronutrients to beneficial microbes, antibiotics, enzymes, growth hormones etc. There are many reports in literature showing beneficial effects of imbedding vermicompost in soil. Soil earthworms play a vital role in agriculture, it decomposes dead organic litter by consuming them and release as castings. The earthworms accelerate decomposition of plant litter and organic matter and improve soil fertility by releasing mineral elements in the forms that are easily uptake by plants. Application of vermicompost as organic manure in soil built-up organic carbon, improve nutrient status, enhance cation exchange capacity, microbial activities, microbial biomass carbon and enzymatic activities. The earthworms' castings also have pest repellent attributes. Beside that vermicompost also improves soil structure, soil aggregation and improve water retention capacity.

Keywords: Vermicompost, Earthworms, Plant growth, Soil Microbes and Soil health.**ETHNO BOTANICAL STUDY OF FEW GENUS OF DISTRICT PULWAMA (JAMMU AND KASHMIR)****AANISIA ZAHOOR, SUCHIT A. JOHN****Department of Biological Sciences, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad, UP**

The conventional knowledge system has gained major importance throughout the world in perspective with conservation, suitable development and search for new exploitation patterns of plant resources. An attempt has been made in the present study to enumerate the traditional importance of certain locally available medicinal plants of district Pulwama, Jammu and Kashmir, India. Ethno botanical data was collected by small interviews and discussions with tribal people (Gujjars, Bakirwals) and traditional practitioners. The result revealed that people of the region have always used these medicinal plants for curing various human ailments and are still dependent on them for food, fodder, and other cultural purposes. Due to various anthropogenic factors many medicinal plants are on the verge of extinction. In order to have knowledge about the plants in terms of their medicinal value the efforts like present study should be encouraged and promoted in order to conserve such natural treasure.

Key words: Pulwama, ethnomedicin, tribal, traditional knowledge.**PHENOLOGY AND GROWTH PARAMETERS OF SOYBEAN (*GLYCINE MAX* L. MERRILL) AS INFLUENCED BY VARIABLE PHOTOPERIODS IN NORTHERN INDIA****ANIL K. DOGRA^{1*}, NIDHI JARNGAL¹ AND ASHUTOSH SRIVASTAVA²****¹Deptt. of Botany, Govt. Degree College, Hiranagar (J&K), ²Rani Lakshmi Bai Central Agricultural University, Jhansi, UP**

The optimum time for soybean (*Glycine max* L. Merrill) planting in the Northern India is first fortnight of June. Planting at other times has consistently resulted in seed yield losses which have been blamed on premature flowering induced by short photoperiods. The present study was conducted to outline the progress of growth stages of soybean at different planting dates and to determine the role of photoperiod in growth restriction at late planting dates. In field study, sixteen genotypes were planted at first fortnight of June (normal) and July (late) planting dates in 2012 at Punjab Agricultural University, Ludhiana, India on a sandy loam soil. Field results demonstrated that more photo- assimilates partitioning occur during growth stages R1 and R5, but may be reduced with delay in planting. Plants grown under the first fortnight of June stimulated photoperiod had greater assimilation of photosynthate from source to sink within the plant as compared to the July simulation. Leaf area, leaf area index (LAI), crop growth rate (CGR), total biomass, and seed yields were significantly improved with increasing under normal planting date as compared to the late planted because of photoperiodically effect. Photoperiod apparently strongly affects the number of developing sinks and, as a consequence, the total sink-strength of the plant grown under late conditions declined.

Keywords: Soybean, Phenology, Photoperiod.**INTEGRATED WEED MANAGEMENT IN RICE-WHEAT CROPPING SYSTEM****ANUBHA SINGH AND ANURAG UPADHYAY****Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi- 221005**

Rice-Wheat system is the widely accepted cropping system and covers about 11 million hectare area in India. This system provide about 40 per cent of carbohydrate requirement of Indian people. With the start of green revolution rice and wheat crop production

increases due to use of high yielding varieties, chemical fertilizer and plant protectant chemicals. The yield of Rice wheat system is now decreasing or stagnating due to deteriorated soil health, weed infestation, pest and diseases, nutrient imbalance, irrigation facility and lower input use efficiency. Weed possess is a severe problem for declining factor productivity of this system. Some important weeds of rice-wheat system are *Echinochloa* spp., *Digitaria sanguinalis*, *Phalaris minor*, *Chenopodium album* and *Rumex* spp. which decreases the yield of the system to a noticeable extent. Use of only chemical method of weed control leads to development of weed resistance, weed shift and soil nutrient imbalance which ultimately results in lower yield. Integrated weed management (IWM) may be a potential option to address the above problems with managing the weed density below the threshold level. **Integrated Weed Management** (IWM) is an approach to managing weeds using multiple control tactics. The purpose of IWM is to include many methods in a growing season to allow producers the best chance to control troublesome weeds. Combination of different methods like physical, cultural, mechanical, chemical and biological may manage the weed efficiently without damaging the soil environment. Some agronomic interventions like selection of varieties, time of sowing, seed rate, tillage and crop establishment, residue retention, mulching and nutrient management with other methods are potential combination for efficient and economic weed management in Rice-Wheat system.

Keywords: Weeds, IWM, Rice-Wheat system

EFFECT OF GROWTH PROMOTER ON THE PERFORMANCE OF FEED CONVERSION EFFICIENCY, body WEIGHT AND MORTALITY OF BROILER CHICKS

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The research was conducted at poultry research form of Udai Pratap Autonomous College, Varanasi (U.P.) was carried out on one week aged 98 chicks in December 2012. The broiler chicks were divided into four group having 23, 25, 25 and, 25 chicks in I, II, III, and IV group respectively. The dose of growth promoter provided to chicks with drinking water was 1.5 ml, 2.5 ml, and 3.5 ml/liter fresh water, in I, II, and III group respectively, IV group was control group of experiment. The highest feed conversion ratio was found in first group (1.78) while it was equal in II and III group (1.57). The lowest feed conversion ratio was also found in II and III experimental group. These two experimental groups show the better growth rate and consumed less amount of feed. The data indicates that the initial body weight of experimental chicks during 1 st week of age ranged between 169 gm to 180 gm. The highest body weight has been recorded in II group while it was lowest in III group and significant effect on body weight. The result indicated that the only first group having 3.92 percent mortality. Other experiment groups were having zero percent mortality during this study. It means the growth promoter having the better effect on the performance of the broiler chicks.

Keywords: Growth promoter, feed conservation efficiency, body weight and mortality of broiler chicken

IMPACT OF AGRICULTURAL TECHNOLOGY MANAGEMENT AGENCY ON SOCIO-ECONOMIC UPLIFTMENT OF TRIBAL FARMERS IN MADHYA PRADESH

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The study was carried out in the Mandla and Dindori districts of Madhya Pradesh state. This study was conducted in randomly selected 300 villages of four purposively selected blocks i.e. Mandla and Nainpur located in Mandla district similarly Dindori and Mehandwani located in Dindori district. The aim of this study to know the impact of ATMA on socio-economic upliftment on the tribal respondents. A total of 300 respondents including 150 Mandla and 150 Dindori farmers were selected randomly. The data collection was done by the use of interview schedule through personal interview. Data were analyzed with help of suitable statistical tools. The findings concluded that the number of livestock, mechanical power, pucca type of house, home related items, possession of other assets and annual income were found slightly higher among both the districts respondents.

Keywords: ATMA, socio-economic upliftment, tribal farmers, Madhya Pradesh.

SCREENING OF DIVERSE WHEAT GENOTYPES FOR DROUGHT TOLERANCE IN BUNDELKHAND REGION

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Drought is one of the most limiting factors for stable crop production world-wide but especially for developing countries where ever increasing population has already putted an enormous demand on stable food supplies. In India, wheat is the second major staple crop, after rice, has been reported 50-90% yield reduction under rainfed conditions. Bundelkhand region (India) is well known for their drought prone climatic region and has currently experienced recurring droughts. A field experiment was conducted at Research farm, RLBCAU, India during rabi season 2017-18. Plan materials were consisted 100 diverse set of wheat genotypes along with checks. Stay green trait was recorded based on visual scores (1-4 scale) for the leaves from anthesis to physiological maturity after every 7 days of intervals. The entries

were grouped as stay green SG (>75 % foliar green tissue), moderately stay green MSG (50-75 % foliar green tissue), moderately non-stay green MNSG (25-50 % foliar green tissue) and non-stay green NSG (< 25 % foliar green tissue). At physiological maturity, based on visual score, approximately 3.0 % genotypes were showing SG, 6.0 % MSG, 8.0 % MNSG and 83.0 % as NSG. This showed that the leaves of drought susceptible plant senesced earlier than those of tolerance ones (stay green) and hence, retained current photosynthesis for grain filling till physiological maturity. Since, stay green plant remains active for longer grain filling period under stressed conditions and contribute towards grain weight. Thus, stay green habit might be of great importance in developing drought tolerant cultivars in future.

Keywords: Abiotic stress, Drought, Stay green, Wheat

SMART AGRICULTURE: INVESTIGATING THE BUSINESS OF A PRODUCTIVE, RESILIENT AND LOW EMISSION FUTURE

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Over the last decade, international concerns about climate change have stimulated broad investment in the pursuit of agriculture that is more climate-smart. These concerns are particularly pressing in India, where most farmers remain severely impoverished and dependent on rain-fed production systems. This volume collates some of the latest research from agricultural scientists working to speed up the development and adoption of more climate-smart farming systems in India. Ongoing efforts to better characterise climate risks, develop and disseminate climate-smart varieties and farm management practices, and integrates the technologies into well-functioning value chains. The additional research efforts needed to improve the understanding and response to climate risk. The expert authors also make suggestions for strengthening the responsiveness of agricultural research and extension systems to future climate changes.

Keywords: climate change, smart agriculture, Rainfed, and farm management

REVIEW ON ADVANCES IN DRY FLOWER TECHNOLOGY

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Fresh flowers though quite attractive, are highly expensive and short lived as well as available only during a particular season and the beauty and charm of fresh flowers can be retained only for a few days even by using some preservatives. Therefore, to overcome this problem different techniques were tried among them dehydration of flower may play significant role. Dried flowers are an integral part of floriculture with a capacity of earning high returns from low value and easily available plants. They are near to natural, preserved and processed, having beauty as well as an everlasting value. Dried flowers are essential export items both in Indian and International markets and they contribute to nearly 77.1 % of Indian floriculture exports annually which are exported to mainly USA, Japan, Australia, Russia and Europe. The demand for dry flowers is increasing at a rate of 8-10 % annually thus offering a lot of opportunities for the Indian entrepreneurs to enter in the global floricultural trade. A number of flowers respond well to drying techniques such as orchids, zinnia, allium, sweet william, carnation, stock, freesia, narcissus, chrysanthemum, pansy, daffodils, marigold, rose, lilies, foliage like ferns, aspidistra, eucalyptus, ivy, laurel, magnolia and mahonia etc. There are numbers of drying methods such as air drying, sun drying, press drying, embedded drying, microwave drying, freeze drying and molecular sieve drying preservation techniques. Among the drying methods evaluated, microwave oven drying at 50 °C after embedding in silica gel was best for flowers and pods and press drying was best for drying leaves. The dry flower industry as a whole can contribute immensely to area development which in turn leads to be overall development of the nation.

Keywords- Dehydration, Preservative, Embedding, Silica, Zinnia, Allium, Mahonia, Daffodils, Fern, Aspidistra, Eucalyptus, Laurel, Magnolia.

CARBON CAPTURE AND STORAGE: A TOOL TO ADDRESS CLIMATE CHANGE

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Since the industrial revolution there has been drastic increase in the concentration of atmospheric carbon dioxide and other greenhouse gases (GHGs) which is the major reasons to the global warming and associated climatic change. The global atmospheric CO₂ concentration has increased from 280ppm in 1750 to 410.79ppm in 2018 which has been primarily attributed to fossil fuel use and land use change (NOAA, 2018). According to the projection by the Global Carbon Project (2018), India (7%) currently rank fourth in CO₂ emission in the world behind China (27%), US (15%), EU 28 member states (10%). Potential adverse impacts of climate change include sea surface temperature rise, reduction of sea ice extent, sea-level rise, flood, droughts, ocean acidification etc. One of the approaches to reduce CO₂ concentration in the atmosphere is carbon capture and storage/

sequestration, the process of removing carbon from the atmosphere and depositing it in a reservoir i.e. plants and soil (terrestrial sequestration), underground rocks (geological sequestration) and ocean (ocean sequestration). The Carbon dioxide is naturally captured from the atmosphere through physical, chemical and biological processes. Some anthropogenic carbon capture and storage techniques exploit these natural processes to capture and store carbon dioxide from atmosphere. Carbon capture and storage, which refers to large-scale, permanent artificial capture and sequestration of industrially produced CO₂ using subsurface saline aquifers, reservoirs, ocean water, aging oil fields, or other carbon sink. Technically and economically feasible strategies are needed to mitigate the consequences of increased atmospheric carbon dioxide. CO₂ capture and storage is technologically feasible and could play a significant role in reducing greenhouse gas emissions over the course of this century. To arrest the phase of global climate change it is very important to sequester mountainous amount of carbon from atmosphere. Though various techniques are available to do this job CO₂ can be efficiently, both ecologically and economically, stored for long term in forest ecosystems. In order to develop this kind of critical thinking cutting edge research is needed to estimate current carbon fluxes so as to develop strategies to fix CO₂. Various forestry practices such as afforestation, reforestation, sustainable forest management and agroforestry etc. should be emphasized. More studies are required to analyse and reduce the costs and to evaluate the suitability of potential geological storage sites. Also pilot scale experiments on mineral carbonation are needed. Apart from developing science and technology, policy framework and extension plays a crucial role at both regional and international level to combat the challenge of global climate change

EFFECT OF FLY ASH, FYM AND VERMICOMPOST ON SOIL PHYSICO-CHEMICAL PROPERTIES

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Intensive cultivation and the use of high yielding crop varieties with high nutrient demand have declined the soil fertility. Application of only chemical fertilizers may not sustain the fertility, hence application of organic source of nutrient need to be increased. So present investigation entitled “Effect of fly ash, FYM and vermicompost on soil physico-chemical properties” was carried out as a pot culture study at the Agricultural Research Farm, Rajiv Gandhi South Campus, Banaras Hindu University, Mirzapur during the year 2017-18. Graded doses of fly ash, FYM and vermicompost was given in pots and wheat crop grown. Results revealed that maximum bulk density (1.42 Mg m⁻³), pH (6.98) was recorded with the 100 % RDF (recommended dose of fertilizer). Highest electric conductivity (0.327 dS m⁻¹), organic carbon, available nitrogen, available phosphorus and available sulphur were recorded under the 100% RDF + 7.5 t ha⁻¹. Furthermore the highest potassium content was recorded under the 100% RDF + 20t ha⁻¹.

Keywords: Fly ash, FYM, vermicompost, soil properties, nutrient

ALTERNATIVE SOURCES OF P AND K FERTILIZERS IN RELATION TO SOIL HEALTH AND CROP PRODUCTION.

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India makes self sufficient country in food grains with the regular rise in agricultural production. During green revolution era continuous blinding, injudicious and haphazard application of chemical fertilizers, insecticides, pesticides and herbicides are increased up to huge levels has enhanced production and productivity of crops. In spite of all these, now crop productivity has become constant. It is a serious matter of concern for all farmers, scientific communities, state and central government. Soil quality is an important criterion which helps in maintaining inherent capacity of soil on sustainability dimension. The food grain production in India has increased from 52.0 Mt in 1951-52 to 264 Mt in 2013-14. The consumption of chemical fertilizer nutrients (N+P₂O₅+K₂O) in India has registered a spectacular increase from 1951-52 to the present consumption. Nevertheless there is deficit of these nutrients to meet the crop demand which has to come from sources other than chemical fertilizers. Phosphorus is the 11th most abundant element in the earth's crust, while K makes up 2.5% of earth's crust, making it the 7th most abundant element. At the same time P is also the least mobile element among the major plant nutrients and unavailable under most of the soil conditions. The use efficiency of the fertilizers P under best management practices seldom exceeds 20%, while the use efficiency of K is about 70%. For manufacturing of P- fertilizers, India imports large amounts of high-grade rock phosphate (RP) containing >30% P₂O₅ and sulphur (S) from other countries. The situation in case of K is even worse. India has insufficient K-bearing minerals for fertilizer manufacturing. Thus, all K-fertilizers are imported in the form of either murate of potash (KCl) or sulphate of potash (K₂SO₄). The cost of these raw materials has increased many folds in recent times all over the world, so much so the cost of finished products of P and K-fertilizers in India. These, impose heavy burden on Govt. exchequer. Therefore, research priorities have been directed toward finding alternative sources of P and K fertilizers for crop production. The aim of such investigations primarily revolved around the use of indigenous minerals such as low-grade rock phosphate (RP) and waste mica as the sources of P and K, respectively, which are of poor quality and are not suitable as raw materials for conventional P-and K-fertilizer production. With about 260 Mt reserves of RP in India, interest in the use of this indigenous material as alternative P fertilizer has

increased greatly. Although RP can effectively replace water-soluble P in acidic soils, its efficiency in neutral to alkaline and calcareous soils is extremely poor. Likewise, India is fortunate to have the world's largest deposit of muscovite mica distributed over a total area of about 400 km² in Munger District of Bihar and Koderma and Giridih Districts of Jharkhand. Waste mica is generated in large quantities (about 75% of raw mica) during the cleaning of raw micas after their mining. This material is not used in agriculture and dumped near mica mines. It belongs to muscovite mica (white mica), which has the theoretical composition of $[(OH)_4 K_2 (Si_6 Al_2) Al_4 O_{20}]$ and contained about 8-10% total K. The low-grade RP and waste mica can be used in agriculture as a source of P and K for plant growth, if modified by chemical and biological means. One option for improving these resources is through composting technology or microbial means using crop residues and/or organic wastes, where the availability of P and K from RP and waste mica are expected to increase in the final product because of release P and K into available forms. Therefore, dissolution of P and K- bearing minerals like RP and waste mica by phosphate and potassium solubilizing bacteria holds a good proposition for releasing P and K in soil, which then could be utilized by plants as source of P and K. With the merging concern on large quantity of the agricultural waste being produced, the concept of waste management becomes one of the key focuses of sustainable agricultural development. Thus, the appropriate management of agricultural wastes assumes a great significance. One of the alternative options of utilization of these large quantities of nutrient rich agricultural wastes is by converting them into value added product like compost and recycle them back to the field which have drawn the attention of scientists to reduce environmental pollution and increase efficiency of carbon and nutrient rich inputs for higher productivity. A new technology has been developed to prepare RP and waste mica enriched compost using biodegradable organic materials like crop residues, farm wastes, animal feed wastes and tree leaves. The raw materials required for preparation of 1000 kg enriched compost are: 1000 kg biomass (crop residues/biodegradable wastes), 200 kg low-grade RP, 200 kg waste mica and 100 kg fresh cattle dung. The RP and waste mica enriched compost contains 1.4-1.5% total N, 5.0-6.0% total P₂O₅ and 2.5-3.0% K₂O, respectively. Therefore, addition of 1 tonne of enriched compost will substitute about 14-15 kg of N, 50-60 kg of P₂O₅ and 25-30 kg of K₂O respectively. Enriched compost had higher total P, citrate soluble P, organic P, acid and alkaline phosphatase activities than normal compost. Similarly, enriched compost had higher total K as well as exchangeable and non-exchangeable K than ordinary compost. Therefore, research priorities have been directed toward finding alternate sources for crop production. The aim of this article is to review the potential use of low-grade P and K- minerals by different methods and their effect on sustainable crop production and soil health. Enriched compost could be an alternative and cost effective option to prepare a value added product using agricultural wastes and low-grade minerals like RP and waste mica in place of costly chemical fertilizer for crop production and maintaining soil fertility. Low-grade indigenous RP could be utilized as a source of P to crops with the interventions of organic acid loaded nanoclay polymer composites and inoculation with phosphate solubilizing microorganism and reduce the dependence on commercial fertilizers like DAP. Bio-intervention of waste mica could be an alternative and viable technology to solubilize insoluble K into plant available pool and used efficiently as a source of K-fertilizer for sustaining crop production and maintaining soil K.

Keywords: crop productivity, rock phosphate, muscovite mica, crop residues, Enriched compost.

FALL ARMYWORM *SPODOPTERA FRUGIPERDA* (J.E. SMITH):- PREDICTABLE EMERGING POTENTIAL THREAT TO MAIZE CROP IN MADHYA PRADESH, INDIA

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Fall Armyworm is a new emerging pest in India from last year which infests over 80 crops. Fall armyworm pest native is United States to Argentina. It is first time reported at West and Central Africa in 2016. In India, First time, the infestation was seen in south India (Karnatka) state of India, Now, it toward to central Madhya Pradesh. This pest majorly feeds on Maize crops and then alternate hosting on grasses and Amaranthus etc. In India, FAW completes their life cycle within 30-60 days in summer and winter respectively, and 2-3 generations life in year. FAW disperse with the wind direction and also in maize growing area. The eggs were dome sapped and laying in either cluster or single covered white threads to prevent unfavorable condition. The total egg laid approximately about 1500-2000 per female. The egg stage is 2-3 days and 5-6 days during the summer and winter month in egg laying period. The larvae have 6 instars during this period which length 1.5cm to 30mm. In the initial period, larvae head seen black colour and after it convert light orange colour with inverted Y marking and rational two black dots on the dorsal surface with brownish body bears white sub-dorsal and lateral lines which is the most identification characteristics. The pupation period takes place in soil in the depth 2-8 cm in loose cocoon which constricted by either soil particles or plant debris. The pupa is seen redish brown colour and it is measures about 10-15mm it remains in soil 8-25 days. Generally, the adult lives 10-15 days. The forewings of females are less distinctly marked, ranging from a uniform grayish brown to a fine mottling of gray and brown. The hind wing is iridescent silver-white with a narrow dark border in both sexes. In symptoms, the larvae feeds on leaf by scratching of tissues in the one side with feeds move upper portion to down ward and making hole. It makes hole in line pattern on leaf. It likes early whorl stage mid whorl stage. The pest can manage by integrated pest management and make save environment with farmer benefited cultivation.

Keywords:- FAW, Fall army worm, *Spodoptera frugiperda*, Maize crop, Potential threat

STANDARDIZATION OF STORAGE CONTAINER AND TEMPERATURE FOR SEEDGERMINATION OF ALBIZIALEBBECK

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Albizia lebeck is a multi-purpose, fast-growing, medium-sized deciduous tree with a spreading crown. It is a valuable timber species which is used for furniture, flooring, veneer, paneling, carving, posts, and a variety of agricultural implements. Its leaves are used as fodder, mulch and green manure. Due to insect attacks, its seeds get damaged during storage in ordinary conditions. Hence, the present study was carried out to study the effect of storage containers and temperature on seed germination in laboratory and nursery condition at different intervals. The different treatment were comprised of storage container and temperature viz., B1T1- Poly bag - Room temperature (15-40°C), B1T2 - Poly bag-BOD(25°C), B1-T3 - Poly bag- Refrigerator (5°C), B2-T1 - Paper bag-Room temperature(15-40°C), B2T2 - Paper bag- BOD(25°C), B2T3 - Paper bag-Refrigerator, B3T1 - Cloth bag-Room temperature (15-40°C), B3T2 - Cloth bag- BOD (25°C) and Cloth bag- Refrigerator (5°C). Seed germination tests were conducted at various intervals viz., 15 days after seed collection and thereafter at 60 days interval up to 600 days. Results revealed that 72 % of seed germination was recorded in fresh seeds and thereafter seeds germination decreased in all the storage treatments. However, after 600 days of storage period, the maximum seed germination percent (40.0±2.54) was recorded in B1T3 (Poly bag-Refrigerator) followed by B2T3 - Paper bag-Refrigerator. The present study conclude that the seeds of *Albizia lebeck* can be stored for longer period in polybag or paper bag at 5°C.

Keywords: Germination, Storage container and Temperature, *Albizia lebeck*

WEED MANAGEMENT THROUGH AGROFORESTRY SYSTEMS

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Weed plants are a constitutive component of agro ecosystem and can cause serious economic damage (up to 98%). Their control often requires the commitment of substantial resources in the way of labor, capital or pesticide. It contributes more than 37 percent of the total crop production losses due to agricultural pests. Agroforestry, a sustainable land use system which combines trees, shrubs, crops and pasture on the same land management unit resulted in a lower infestation of both parasitic and non-parasitic weeds. In sequential agroforestry system like shifting cultivation and improved fallow system, organic material from the tree had been integrated into the soil resulting in an improvement of soil quality. Enhancement of soil fertility increases the vigor of crop growth and enables the crop to better compete with weeds. In simultaneous agroforestry system (Alley cropping, Home garden, etc.), shading by tree and moderation of microclimate could be an important factor in suppressing weeds. As shading from tree restricts the light availability to under grown weeds thus decreases seed germination and growth of weeds. In Alley cropping, the pruned material from the tree (especially *Leucaena leucocephala*, *Erythrina* spp.) which is used as manure; leads to inhibition the growth, development, and abundance of weeds and simultaneously addition of organic matter for enhancing soil fertility. Although, agroforestry does not always suppresses the weeds. In semi-arid areas, agroforestry systems can also provide better conditions for the growth of the weeds. Furthermore, agroforestry systems didn't suppress weeds in its initial year of establishment. A long term well established agroforestry system is mostly prerequisite for the suppression of the weeds.

Keywords: Weeds, Agroforestry, Alley cropping, Soil fertility, shifting cultivation

ECOLOGY AND CONSERVATION OF THREATENED BIRDS IN AND AROUND NAGZIRA WILDLIFE SANCTUARY, MAHARASHTRA

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Birds, the warm-blooded bipeds with amazing adaptations evolved millions of years ago from reptiles. These colorful, delicate-looking, highly evolved animals are the only creatures with feathered wings that make them capable of true and perfect flight. This ecologically valuable group of vertebrates is the subject of the present study which deals with ecology and conservation status of threatened birds in and around Nagzira wildlife sanctuary, Maharashtra state. Nagzira wildlife sanctuary is located in Gondia district. It lies between 20° 45' to 21° 2' North Latitude and 80° 5' to 80° 15' East Longitude. It is popular in the eastern Vidarbha region of Maharashtra for diversity of vegetation ranging from dry mixed forest to rain forest. This southern tropical dry forest is enriched with varied wildlife, and is an important conservation unit in central India. Birds visit this beautiful lake every winter. The most important habitat in the park is the Bodalkasa Lake, home to many bird species. Flocks of migratory A total of 312 bird species from 57 different families under 14 orders have been recorded. Among these 252 were local residents, 53 winter visitors,

05 passage migrants and 02 breeding migrants. Out of total 312 avian species recorded, 12 are listed under different threatened categories (Birdlife International 2013). Ecology and conservation of these threatened species is discussed in the present study.

FLAX (*LINUM USITATISSIMUM* L.) SEED: A POTENTIAL BIOACTIVE COMPOUNDS AND ITS HEALTH BENEFITS

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Growing awareness about the role of diet and quest for human wellness has fuelled interest in 'Functional foods' and 'Functional attributes' of many traditional foods are being reinvented. Flax continues to surge forward in its recognition as a functional food and has recently gained attention in the area of cardiovascular disease primarily because it is the richest known source of alpha-linolenic acid, the phytoestrogen, lignans, as well as being a good source of soluble fiber. Flaxseed is one of the oldest crops, having been cultivated since the beginning of civilization. Flaxseed, or linseed (*Linum usitatissimum* L.), comes from the flax plant, which is an annual herb. The ancient Egyptians used flaxseed as both food and medicine. The Latin name of flaxseed (*Linum usitatissimum* L.) means "very useful", and it has two basic varieties: brown and yellow or golden (also known as golden linseeds). On a very small scale (about 20%), the seed is directly consumed for edible purposes and about 80% of the oil goes to the industries for the manufacture of paints, varnish, oil cloth, linoleum, pad link etc. The oilcake is good feed for milch cattle. The stem yields fibre of good quality having high strength and durability. The fibre is lustrous and blends very well with wool, silk, cotton etc. Strong twines, canvas, suitings, shirtings and various indispensable products for defense purposes are manufactured from it. The woody matter and short fibers may be used as raw pulp for making paper of good quality. The rough and strong linseed fibre can be effectively used for low cost roofing tiles based on unsaturated polyesters. Linseed (*Linum usitatissimum* L.) is a minor oilseed crop in India but it is such a valuable crop that every part of the plant has a specific economic importance. In the last two decades, flaxseed has been the focus of increased interest in the field of diet and disease research due to the potential health benefits associated with some of its biologically active components. Cultivar development of flax is currently focused on enhancing the oil content and nutritional value to meet the demand of nutraceutical market supply, as an alternate source of fish oil, a rich source of ω -3 fatty acid, α -linolenic acid (ALA), short chain polyunsaturated fatty acids (PUFA), soluble and insoluble fibers, phytoestrogenic lignans (secoisolariciresinoldiglycoside-SDG), proteins and an array of antioxidants. The protein content in seeds of flax varies from 20-30%. Proteins of flaxseeds are limited by lysine, but are characterized by a high coefficient of digestibility (89.6%) and biological value (77.4%). The content of dietary fiber reaches 28% by weight of whole seed, with the ratio of soluble and insoluble fractions from 20:80 until 40:60. The seeds and oil of the linseed plant contain health promoting substances, which are rich in alpha-linolenic acid (ALA), an essential fatty acid that appears to be beneficial for heart disease. ALA belongs to a group of substances called omega-3 fatty acids. Good health requires the right ratio of omega-3 fatty acids to omega-6 fatty acid in the diet and the ideal ratio is around 1:2 (omega-3: omega-6). The ratio of omega-3: omega-6 present in linseed oil is about 4:1, so linseed oil is a good source of omega-3. The linseed lowers cholesterol, blood pressure and prevents arthritis and cancer particularly hormone sensitive cancers such as breast and prostate. It reduces threat of blood clots and helps in better regulation of blood sugar levels. It also has quality of lowering down the cholesterol level in mammals. Lignan, present in oil has anti-carcinogenic effect. Lignans have diverse range of biological activities and flax seeds contain a lignin derivative, secoisolariciresinoldiglucoside which get metabolized into the mammalian lignans. The flax lignans influence the early risk markers of mammary and colonic carcinogenesis in animal models. This review highlights the potential of 'flax seed' as a 'nutraceutical' and its role as a protective and therapeutic medicinal food.

Keywords: Flax seed, α -linolenic acid, Lignan, fibers, Health benefits.

INFLUENCES ON PROTEIN HYDROLYSATES ON NUTRIENT USE EFFICIENCY IN POTATO CROP AND QUALITY OF TUBERS

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The term protein hydrolysates of biostimulant is defined as a substance of organic material that is neither a plant nutrient nor a pesticide, but has a positive impact on plant health. Protein hydrolysates have been shown to influence several metabolic processes, such as photosynthesis, respiration, nucleic acid synthesis and ion uptake. In the middle Indo-Gangatic plain a field experiment was conducted at the Institute Agricultural Research Farm, Banaras Hindu University, Varanasi, India. The field experiment of potato crop was laid out in a split-plot design with three irrigation schedules (I_1 , 3 irrigation, I_2 , 4 irrigation & I_3 , 5 irrigation) in main-plots and sub-plot spray three types of protein hydrolysates of amino acid based biostimulants (A_0 , control, A_1 , animal based, A_2 , plant based & A_3 , mixed amino acids) at three plant growth stage spray of amino acid with three replications. The trial of potato crop seeds was planted rabi season (2014-15 and 2015-16) and the recommended dose of fertilizers for the crop was 150:100:120 NPK kg ha⁻¹. The nutrient use efficiency of nitrogen (N), phosphorus (P) and potassium (K) fertilizers by

potato crop at different growth stages (30, 60 & 90 days was estimated). The uptake efficiency of N, P and K by crop was enhanced significantly with the use of amino acid biostimulants of different sources. The maximum uptake efficiency of nutrient by crop in respect to control was registered by applying A₂ amino acid biostimulants. The uptake efficiency of N, 120.12 kg ha⁻¹ and 163.23 kg ha⁻¹ in first and second year, respectively was observed maximum at 60 days after sowing (DAS). The maximum phosphorus uptake efficiency by crop in respect to control was observed 70.57 kg ha⁻¹ at 60 DAS in the first year and 107.50 kg ha⁻¹ at 30 DAS in the second year, respectively and the maximum uptake of potassium by crop was observed 292.84 kg ha⁻¹ at 60 DAS in the first year and 365.31 kg ha⁻¹ at 30 DAS second year. The overall order of increasing impacts on N-uptake by crop was due to application of A₂>A₃>A₁. The range of percent enhancement of N, P, and K nutrient uptake efficiency by crop were 61.3-127.3, 70.7-189.2 and 41.3-110.5, respectively due to application of A₂ amino acids biostimulants followed by A₁ and A₃. The tuber quality (TSS, starch and protein content) of potato was significantly improved by the application of all the amino acids based biostimulants. The range of percent enhancement of protein content in potato tuber due to application of A₁, A₂ and A₃ in respect to control was 6.9-16.0, 13.4-33.9 and 9.1-21.9, respectively.

Keyword: Protein Hydrolysates, Nutrient Use Efficiency, Potato Tuber Quality.

PRECISION AGRICULTURE- MORE PRODUCTION WITH LESS INPUT

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An agricultural production system is the outcome of a complex interaction of seed, water and agro-chemicals including fertilizers and pesticides. Therefore, careful management of all inputs is essential for the sustainability of such complex system. The focus on enhancing the productivity without considering the ecological impacts of the input resources has resulted into environmental degradation. Increasing environmental consciousness of the general public is necessitating us to modify agricultural management practices for sustainable conservation of natural resources such as water, air and soil quality, while staying economically profitable. The productivity can be increased without any adverse effect by maximizing the resource input efficiency. It is also certain that availability of labor for agricultural activity is going to be in short supply in future. The time has now arrived to bring information technology and agricultural science together for improved economic and environmentally sustainable crop production. This gives birth to Precision Agriculture or Precision Farming. Precision farming provides a new solution using a systems approach for today's agricultural issues such as the need to balance productivity with environmental concerns. It is based on the implementation of advanced information technologies. It includes describing and modeling variation in soils and plant species and integrating agricultural practices to meet site-specific requirements. It aims at economic returns, as well as at reducing the energy input and the environmental impact of agriculture.

Key words: Sustainability, Precision Agriculture, technologies, water, air and soil quality

DESIGN AND EVALUATION OF A SOLAR CUM ELECTRIC KNAPSACK SPRAYER FOR CROPPING SYSTEM OF CHHATTISGARH

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The proposed equipment solar cum electric powered knapsack sprayer of 16litres capacity was developed at mungeli district of Chhattisgarh using locally available materials and its performance evaluated. Laboratory and field tests were conducted to determine flow rate, application rate and distribution rate. Basic hydraulic principles were considered for determining flow rate, while application rate was determined by effective use of walking speed on field the results showed that the sprayer has a flow rate of 2.5 to 3litres/min by using different nozzles, application rate of 1240 l/ha to 1485 l/ha. The result from the laboratory test indicated that the efficiency of spray decreased with decrease in voltage of battery and application rate is influenced by walking speed. The sprayer is capable of spraying 1240 l/ha to 1485 l/ha in 8.26 hours at a walking speed of 0.65 m/s. if solar panel is not connected then the device cannot be operated continuously for more than 2.6 hours due to decrease in voltage. Battery can also be charged by solar panel. The 10W solar panel can produces 0.833 Amp. The charging time of the battery using solar panel has been measured by continuously charging battery and it is found that 11 hours for two days of every day 8 hours.

Keywords: Solar energy, battery, alternating current, D.C., rectifier, sprayer, nozzle

NITROGEN MANAGEMENT IN GRAIN AMARANTH THROUGH ORGANIC SOURCE**A.N. CHAUDHARY, VINOD B. MOR, M.S. PATEL AND N.N. PRAJAPTI****Centre for Crop Improvement, S.D. Agricultural University, Sardarkhrushinagar**

An experiment entitled “Evaluation of organic source for nitrogen management in grain amaranths” was conducted at the Centre for Crop Improvement, S.D. Agricultural University, Sardarkhrushinagar which comes under North Gujarat Agro-Climate Zone-I during seasons of the year 2014-15. The experiment consisted of six treatments comprised of six organic sources (viz. T₁. RDF, T₂. FYM 8 ton / ha, T₃. Vermi-compost 2 ton / ha, T₄. Castor Cake 1 ton / ha, T₅. FYM 4 ton / ha+ VC 1 ton / ha and T₆. FYM 4 ton / ha+ CC 0.5 ton / ha) and conducted in RBD with four replications. The soil of the experimental field was loamy sand in texture. Spacing between rows was maintained 45 cm x 10 cm with 1 kg/ha seed rate. The Results revealed that, the yield was influenced due to fertilizer management, among the different fertilizer management treatment -1 RDF gave higher grain yield (1555 kg/ha), followed by treatment -5 FYM 4 ton / ha+ VC 1 ton / ha (1018 kg/ ha). The highest Straw yield was recorded by treatment -1. RDF (5670 kg / ha), followed by treatment- 2 FYM 8 ton / ha (4840 kg/ ha). It is concluded that for higher organic grain amaranths production apply FYM 8 ton / ha.

Keywords: Grain amaranths, Organic, Nitrogen**CROP PRODUCTION PRACTICES AND CONSTRAINTS IN RATOON CANE MANAGEMENT****PRABIN DAWADEE*, SAUHARD DUBEY****Department of Agronomy, Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002**

The characteristic features of ratoon crop is such that when shoot portion is harvested the remaining root system being intact will result in fresh tillers from secondary shoots and another crop can be harvested during the following year. In India, more than 50% of the cane area is always under ratoon. Although scientific studies state that ratoon crops leads to increased net returns through reduced cost of cultivation. Sugar cane ratoon crop need selection of suitable varieties with good ratoon ability. The key ratoon management strategies are off-barring, stubble shaving, gap filling through bud chip settlings, polybag seedling and quartering of clumps, detashing during fifth month, propping and trash mulching. The advantages of ratoon cultivation turned out to be reduced cost of cultivation especially in multiple rations, early maturing by a month, stabilization of cane area in a sugar mill, better quality cane, early crushing of cane, conservation of soil quality and structure due to minimal tillage, and less water requirement due to reduced crop duration. The major constraints expressed were high labor for trash disposal, untimely off barring, laborious gap filling, poor ratoon yield and non-suitability of soil for multi ratooning. Apparently, the ratoon crop deserves much higher attention and care in the present scenario to boost the productivity of sugarcane.

Keyword: Sugar cane, ratoon crop, reduced crop duration, productivity**OBSTACLES IN THE PATH OF FEMALE DAIRY FARMERS IN GAINING FINANCIAL STABILITY AND DOUBLING THEIR INCOME****PRACHI .K. WASNIK¹, SANDEEP KUMAR², A.A. BROADWAY³, ANU KUMARI⁴, JOHN DAVID⁵ AND BINOD KUMAR BHARTI⁶**^{1,2,3,4,5}**Dairy Technology, Warner College of Dairy Technology, SHUATS, Prayagraj, Uttar Pradesh, India -211007.**⁶**Asst. Prof. cum Jr Scientist, Dairy Chemistry, Sanjay Gandhi Institute of Dairy Technology, BASU Patna, Bihar.**

Dairy, being considered as the biggest employment generating and poverty alleviating sector, has the potential to act as the major instrument in bringing about socio-economic transformation of poor rural people. Dairy has an important role to empower female farmers and double their income. Still the use of women force in the dairy industry is minimal and dairy is limited up to men alone as a dominating factor in this area. Women have the potential to actively participate in dairy field and fulfill their roles perfectly in financial, social, political and other such progressive areas with distinct recognition. There are many obstacles in this path. Despite being the producers of milk, women either tend to or are forced to rely on their male counterparts due to many circumstances. They are often prevented from maximizing the benefits of dairy farming mainly due to lack of exposure to markets and services. Empowering women is still a mission unaccomplished because of the obstacles either un-attained or under attained as they still struggle for occupying their distinct position which they deserve. But it is possible to be accomplished through dairy sector with dairy co-operatives. Human rights should be equally enjoyed by women to make remarkable contributions in the financial, political, social and cultural areas of the dairy sector. This can double female dairy farmers' income and ultimately benefit the society and whole country as strengthening women ultimately means strengthening the entire nation.

Keywords: Dairy, development, empowerment, farmer, income, milk, women.

CONSEQUENCES HEALTH HAZARDS OF PLASTIC DEBRIS ON MARINE ECOSYSTEM: A REVIEW**PRACHI DIXIT****Department of Biotechnology, School of Sciences, ITM University, Gwalior, M.P.**

The threat to aquatic environment is caused by aquatic debris of plastic. Due to plastic debris, there has been reduce in aquatic fauna inhabitants, either they tangled through their body or they were ingested by fishes and turtles faulting debris to be kill. According to a report of Dainik Bhaskar news paper, 2018 harvesting of 32 million tones of plastic every year in the world. Out of these 1.2 million tones of plastic debris goes into the sea. From 1950 to 2018, 8.3 billion tons of plastic was produced. More of it has been in the sea if the current situation of plastic production remains, 12 billion tons of plastic garbage will be in the atmosphere by 2050. This will be equal to the weight of 10 million blue whales. While there are just 20,000 blue whales in the world right now. Another report of Dainik Bhaskar, 2018 says that annually 10 lakhs of marine animals are being killed by plastic. Whale fish were found dead on the coast of Indonesia. It got more than 1000 plastic pieces from its stomach. There were 115 cups, 25 plastic bags, 4 plastic bottles and plastic pieces. The list of affected species signifies that oceanic garbage is affecting a considerable figure of species. It affects at least 267 species global, as well as 86% of all sea turtle species, 44% of all seabird species and 43% of all marine mammal species. The amassing of such trash can reduce the gas exchange between the overlying waters and the stoma waters of the sediments, and the ensuing hypoxia or anoxia in the benthos can obstruct with the ordinary environment implementation and modify the framework of existence on the aquatic ground. There is still comparatively diminutive information on the impact of plastic pollution on the aquatic environment. Seeing as the use of plastic continuous to enhances, so the quantity of plastic is polluting the aquatic environment and harm marine animals.

Keywords: Marine ecosystem, Plastic debris, Blue whales, Aquatic mammals and plastic pollution.

ROLE OF MOBILE APPS TO DISSEMINATE VEGETABLE INFORMATION**PRADEEP KUMAR BOLA*AND ANUPAMA*****Horticulture officer, Jilasevasadan, Khambaliya, Distt. Devbhoomi, Dwarka, 361310 (Gujarat)****Department of Horticulture, Agriculture University, Jodhpur, 342304 (Rajasthan)**

Vegetables make a major portion of human diet. Though the vegetable requirement is 300 g/day/person but we are able to meet about 1/9th of the requirement only. Vegetable is one of the most important sector in India for food and nutritional security, poverty alleviation and sustainable development. Vegetables are very perishable in nature so timely and reliable sources of information inputs are urgently requires by Indian farmer for taking decisions. In present time mobile apps have become the most popular Information communication technology (ICT) tool for horticulture sector. Mobile app helps in transferring of general know –how on vegetable farming techniques and trends, information on crops and varieties and how to grow them etc. Mobile apps play an important role in provide advisory services to farmers to meet the immediate needs to solve the field problems and also play role in disseminating advanced information about weather forecasting, high yielding seeds, fertilizers etc., new technology related to management of soil, water, seed, fertilizers, post-harvest handling technologies and training in new techniques so that farmers can make better and timely decision concerning their agricultural practices related to vegetable cultivation. Disseminating and spreading cultivation related information to farmers is made easier with the help of mobile apps which helps farmers make better management decisions and save their time and money. Mobile apps in the arena of vegetable can be the best option to increase countries vegetable production and fulfil the countries demand. There is need for provision of incentives to promote access to and use of mobile apps.

Keywords: Mobile apps, vegetables, timely, farmers, development.

RECENT TRENDS AND FUTURE PROSPECTS FOR LIVESTOCK PRODUCTION**PRAMOD PRABHAKAR AND PRAMOD****Department of Animal Husbandry, MBAC, Agwanpur, Saharsa (BAU, Sabour, Bhagalpur)**

The livestock sector is increasingly organized in long market chains that employ at least 1.3 billion people globally and directly support the livelihoods of 600 million poor smallholder farmers in the developing world. The livestock sector globally is highly dynamic. In developing countries, it is evolving in response to rapidly increasing demand for livestock products. In developed countries, demand for livestock products is stagnating, while many production systems are increasing their efficiency and environmental sustainability. The Trends in the livestock sector, world food economy is increasingly driven by the shift in diet and food consumption patterns towards livestock products. In the last few decades, in the developing countries of Asia - where the bulk of the world population increase has taken place - consumption of meat has been growing at over 4 percent per annum, and that of milk and dairy products between 2 to 3 percent per annum. Aggregate agricultural output is being affected by these trends, not only through the increase in livestock production per se, but also through the linkage of livestock production to the crop sector that supplies feedstuffs, mainly cereals and oilseeds, as well as the fisheries sector. Globally, livestock production is the largest user of agricultural land. The continued growth of developing countries' share in world livestock output is being associated with the

gradual shift of their production from grazing and “backyard” systems to stall-fed systems using concentrated feed stuffs. In the future, many countries will see a continuing trend in which livestock breeding focuses on other attributes in addition to production and productivity, such as product quality, increasing animal welfare, disease resistance and reducing environmental impact. The tools of molecular genetics are likely to have considerable impact in the future. Human population in 2050 is estimated to be 9.15 billion, with a range of 7.96–10.46 billion. Most of the increase is projected to take place in developing countries. Complete genome maps for poultry and cattle now exist, and these open up the way to possible advances in evolutionary biology, animal breeding and animal models for human diseases. Genomic selection should be able to at least double the rate of genetic gain in the dairy industry, as it enables selection decisions to be based on genomic breeding values, which can ultimately be calculated from genetic marker information alone, rather than from pedigree and phenotypic information. Genomic selection is not without its challenges, but it is likely to revolutionize animal breeding.

Keywords: Livestock, Future, Scenario, Development, Sustainability.

EFFECT OF GROWING SEASONS AND DE-TOPPING LEVELS ON PERFORMANCE OF OKRA VARIETIES (*ABELMOSCHUS ESCULENTUS* L.) UNDER TERAJ REGION OF WEST BENGAL

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An experimental research work was carried out to study the effect of different growing seasons and de-topping levels on performance of okra varieties at Uttar Banga Krishi Viswavidyalaya, Pundibari during 2016 and 2017. The experiment was laid out in Factorial Randomized Block Design with three replications. It consists of three factors viz., two seasons (Pre-*kharif* and rainy), four de-topping levels (3 leaf stage, 6 leaf stage, 9 leaf stage and without de-topping) and four varieties (Arka Anamika, Basanti, Mahyco Bhindi No. 10 and US 7109) of okra. Experimental result revealed that different growing season; de-topping levels and varieties of okra significantly affect all growth and yield attributes. While interaction effect was non-significant for all parameters except plant height, number of branches and number of fruits per plant. Among the different treatment combinations, maximum number of fruits per plant (37.10), highest fruit yield (486.99 g/plant and 23.79 t/ha) as well as highest benefit cost ratio (3.62) were recorded in US 7109 variety de-topped at 6 leaf stage of the plant during pre-*kharif* season (S₁D₂V₄). Hence, it may be suggested that growing of okra variety US 7109 de-topped at 6 leaf stage in pre-*kharif* season for cultivation under West Bengal conditions.

Keywords: De-topping, okra, season, varieties, yield

ROLE OF GIBBERELIC ACID UNDER NaCl STRESS ON TOMATO (*LYCOPERSICON ESCULENTUM* L.)

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The effect of phytohormones under saline stress is critical in modulating physiological responses that will eventually lead to adaptation to an unfavorable environment. Nevertheless, the functional level of plant hormones, and their relative tissue concentration, may have a different impact on plant growth and stress tolerance at increasing salinity of the root zone. Tomato has important role in food and commercial utilization in the whole world, which is second to potato in global vegetable production. Susceptibility towards salinity stress has limited the productivity of Tomato. Salt stress alters a wide array of plant metabolic mechanisms. Different strategies of the application of phytohormones are required to overcome the adverse effects of salt stress. Growth and biochemical attributes i.e. shoot length, leaf area, fresh weight, dry weight, number of fruits; chlorophyll concentration, lycopene ascorbic acid and proline were affected by salinity stress under NaCl treatment. But application of GA₃ in combination was to be proved beneficial in alleviating the adverse effects of salt stress on these growth and biochemical parameters. However, GA₃ applied with salt proved more effective in comparison to control. The results of the experiment revealed that combined application of GA₃ and salt may ameliorate most of the attributes and was proved to be a physiological remedy to increase the tolerance against the ill effects of salt stress.

Keywords: Tomato, Proline, NaCl, GA₃ (gibberellic acid), Lycopene, Salinity stress.

STUDIES ON BIOCHEMICAL MECHANISM OF RESISTANCE FOR THE MANAGEMENT OF ALTERNARIA BLOTCH OF APPLE CAUSED BY *ALTERNARIA ALTERNATA* F. SP. *MALI*

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Alternaria blotch caused by *Alternaria alternata* f. sp. *mali* is one of the economically important disease of apple particularly in Himachal Pradesh. *Alternaria alternata* f.sp. *mali* infection on host physiology revealed that reducing and non reducing content were more in uninoculated plants in all the test cultivars with time lapse. Total phenolics content, polyphenol oxidase, peroxidase, PAL activity and ROS were more in inoculated plant during all the sampling hours in all the three test cultivars. Screening of cultivars revealed that only one cultivar Top Red Delicious showed highly susceptible reaction and Starking Delicious showed susceptible reaction. Six cultivars viz., Manchurian Crab, Tydeman's Early Worcester, Hardeman, Stark Spur Golden, Gold Spur and Scarlet Gala were found to be moderately susceptible at RHR&TS Mashobra while, two cultivars viz., Royal Delicious and Vance Delicious showed susceptible reaction at Nauni. Among SAR chemicals tested, BABA @2000 ppm found to be the most effective in all the cultivars, with minimum disease severity ranging from 5.24-7.15 per cent and maximum disease control ranging from 69.71-75.85 per cent. In case of SAR chemical treatments, there was an increase in reducing sugar and non reducing sugar over the untreated control in all three cvs. of apple with maximum in salicylic acid and minimum in calcium carbonate treated leaves, respectively. Total phenol content in apple leaves after treatment with SAR inducers was found to be maximum in salicylic acid treated leaves and minimum in calcium carbonate. Polyphenol oxidase, Peroxidase and PAL activity was found to be highest in salicylic acid treated leaves in all the three cultivars. Production of Reactive oxygen species was found to be highest in salicylic acid treated leaves in all the three cvs. Thus, using SAR chemicals to induce resistance to apple against *Alternaria* blotch caused by *Alternaria alternata* f. sp. *mali*, may provide a practical supplement to an environmentally friendly disease management when it is combined with appropriate integrated disease management practices.

INFLUENCE OF SSNM, METHODS OF SOWING AND VARIED DATES OF SOWING ON *BT* COTTON IN *VERTISOLS* IN TBP COMMAND

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A field experiment was conducted at Agronomy Farm, College of Agriculture, University of Agricultural Sciences, Raichur, Karnataka with the objective to know the uptake pattern of NPK with respect to methods of establishment and varied dates of sowing in *Bt* cotton in the TBP irrigation command. Significantly higher uptake of N, P and K was observed in transplanting method (191, 49.6 and 201 kg/ha respectively) compared to dibbling method of sowing (181, 46.8 and 190 kg/ha respectively). Among the varied dates of sowing, significantly higher N, P, and K uptake was observed with crop sown on 1st fortnight of June (238, 51.8 and 211 kg/ha, respectively) and significantly lower N, P and K uptake was observed in crop sown on 1st fortnight of August (123, 43.6 and 171 kg/ha, respectively). As a result of this, significantly higher seed cotton yield was observed with transplanting method in the early days of June month. From these results, we can conclude that early transplanting in the month of June leads *Bt* cotton to uptake higher amount of NPK that results ultimately to higher seed cotton yield especially in irrigation command area.

Keywords: *Bt* Cotton, Nutrient uptake, SSNM, Crop Establishment Methods and Sowing Windows.

PRECOCIOUS PRODUCTION OF DRAGON FRUIT USING PLANT GROWTH REGULATORS

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The dragon fruit is one of the promising and nutrient rich fruit suitable for cultivation in the varied agroclimatic conditions because of its xerophytic nature and wider adaptability. The dragon fruit is popularly known as pitaya fruit and among various species in the *Hylocereus* genus *H. undatus* and *H. polyrhizus* are growing commercially in many regions of the world. A manipulation of cacti growth behavior is possible using several plant growth regulators (PGRs) such as auxins, gibberellins, cytokinins, ethylene, abscisic acid and other brassinosteroids. The production cycle of fruits is limited in the year due to its long day nature and non-availability of quality planting material at right time. The critical study of photoperiodic regulation along with specific PGRs for inducing off-season flowering is needed. An application of PGRs during propagation for induction of rooting in the stem cuttings, and also to facilitate the rapid production of uniform healthy planting material using various combinations of PGRs in the tissue culture. Therefore, considering the agronomic characteristics of the pitaya fruit can be made it round year availability using specific plant growth regulators at accurate concentrations in single or in combination. The all-time production of dragon fruits

will be feasible through use of precise PGRs at correct phenophases of plant instead of long-term traditional and transgenic breeding.

TRICHODERMA AS A BIO-CONTROL AGENT

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The development and use of Bio control agents based biopesticides gained significance due to the recognition of deleterious effects on environment generates by excessive or improper application of synthetic chemicals. In India, biopesticides production is currently dominated by antagonistic fungi *Trichoderma spp.*, which alone occupies 60% of the market share. *Trichoderma* is a genus of asexually reproducing fungi that are often the most frequently isolated soil fungi. Nearly all temperate and tropical soils contain 10^4 - 10^3 culturable propagules/gm. These fungi also colonise woody and herbaceous plant materials in which the sexual teleomorph (Genus-*Hypocrea*) has most often been found. Recent discoveries show that they are opportunistic avirulent plant symbionts, as well as parasite of other fungi. These root micro-organisms cause substantial changes to plant proteome and metabolism. It colonizes roots which frequently enhances root growth and development, crop productivity, resistance to abiotic stress and uptake and use of nutrients. It competes for key exudates that stimulate the germination of propagules of plant – pathogens. It competes with soil micro-organisms for nutrients and space. They inhibit or degrade pectinases and other enzymes that are essential for plant pathogenic fungi. Research on topic has generated a large body of knowledge, including isolation and cloning of range of genes that includes proteins of which some have antimicrobial activity including the genes that encode fungitoxic cell-wall degrading enzymes can be used to produce transgenic plant that are resistant to disease and discovery of enzymes that are useful in bio-priming of chitin. *Trichoderma* can induce resistance in plants both at local and systemic level, however, the induction of resistance in plants has been poorly studied as compared to responses that are induced by Rhizobacteria and the triggering molecule in *Trichoderma spp.* which leads to induce systemic resistance are unknown. Recent trends of both conventional and organic growers indicate an interest in using Bio control agents or their products, suggesting it has demand and market potential of *Trichoderma spp.* as Biological control will increase in future.

ACORUS CALAMUS: NEED FOR ITS CONSERVATION

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The wetland monocot herbaceous perennial *Acorus calamus* commonly known as sweet flag which belongs to Acoraceae family. The aromatic, bitter rhizomes are used in the traditional medicines to treat numerous health problems such as indigestion, flatulence and diarrhea, it is widely distributed from temperate to tropical regions and in India, it is found in Assam, Kerala, Tamil Nadu and Karnataka. It was first grown in wild and now we rarely find it. Because of its heavy exploitation and reduced population, it has been grouped under least concern species in IUCN red data book so it calls for its conservation. The sweet flag can be produced using both seeds and rhizomes but it rarely produces seeds so rhizomes can be used as a planting and storage material for the conservation purpose. *Acorus* produces spreading rhizomes with a bud at each node it is continually growing with each node being protected by a small membranous structure which protects the bud from exposure to the external environment and losing. Experiments are being conducted to conserve the plant using micro-propagation methods, but long term storage via in vitro methods may affect its native behaviour. So experiments need to be conducted to find out the best ways of multiplication and conservation of sweet flag using rhizomes.

ANTIBIOSIS EFFECT OF DIFFERENT MAIZE GERMPLASM ON THE BIOLOGY OF PINK STEM BORER *SESAMIA INFERENS* (WALKER)

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The adverse effect of the host plant on the biology (survival, development and reproduction) of the insects and their progeny is due to the biochemical and biophysical factors present in it is known as antibiosis. Present investigation was aimed to find out the antibiosis effect of different maize germplasm on the biological attributes of pink stem borer, *Sesamia inferens*. Observations were recorded on the leaf injury rating at different intervals and biological attributes viz., larval weight and survival at different intervals, pupal weight, percent pupation, larval and pupal period, adult emergence, adult female fecundity, egg hatching (%) and growth index. Leaf injury rating at 25 DAI (Days after Artificial Infestation) evidently showed that V-341 and WP-8 were moderately resistant germplasm whereas rest of all the germplasm were susceptible. Among all the germplasm, WP-21, HKI-193-1 and E-63 showed antibiosis effect in terms of reduced larval and pupal weight, low larval survival, prolonged larval and pupal duration, less per cent pupation and adult emergence, reduced fecundity and egg hatching and lower growth index of *S. inferens*. Thus, these

germplasm were found least susceptible. Maize germplasm DC-2, HKI-193-2 and E-62 favoured the growth and development of *S. inferens* in terms of all biological parameters. Hence these germplasm were found highly susceptible. Screening parameters viz., larval and pupal weight, larval survival, leaf injury rating, per cent pupation, larval and pupal period, adult emergence, fecundity, egg hatching and growth index can be comprehensively used to get a cue regarding the germplasm susceptibility level against *S. inferens*.

Keywords: Antibiosis, leaf injury rating, Maize germplasm, *Sesamia inferens*, susceptibility

DOUBLING FARMERS INCOME THROUGH ENHANCED PRODUCTIVITY AND IMPROVED SOIL HEALTH UNDER HORTI- AGRI SYSTEM

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India is blessed with vast natural resources viz. land, water, vegetation and climate. But, the increasing population of India has exposed all these resources to their indiscriminate exploitation. It results in shortage of resources, their pollution and posed a threat for them. It also questioned about how will we feed and nourish our increasing population, under such circumstances? The answer may be by increasing land under cultivation but it is possible up to some extent only, because we know that we can't expand the earth. The second option will be to utilize the available land in a judicious manner i.e. utilization of waste land which was not previously under cultivation and to utilize each centimeter of land by different forms of intercropping, high density plantings and of course through various system of plantings viz. horti- agri systems (fruit plants + field crops), horti- silvi systems (fruit plants + forest trees), horti- pastoral systems (fruit plants + pasture / animals), horti- agri- silvi systems (fruit plants + field crops + forest trees) etc. Out of different system horti- agri system has its own importance due to the fact that at the present world scenario, malnutrition is a big problem. This system is able to maintain sustainability with respect to production. The sustainability is maintained by maintenance of soil health through different positive interaction among different components. This is an integrated approach consisting of agriculture and horticulture which would ensure multiple production patterns and can maximize the production of food, fodder and fuel. this system may be an option for increasing farmers income for their livelihood security.

PLANT VIRUSES AS PHARMACEUTICAL TOOL AND NANO PARTICLE

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Plants can be used as bioreactors for modern pharmaceutical products. Plant-made pharmaceuticals are being readily employed for a variety of purposes in medicine today. Several pharmaceutical products have begun to hit the marketplace. For example microbicides for HIV treatment, vaccines for pandemic influenza, therapeutic agent for Gaucher's disease. Plant made vaccines possess several benefits like lack of need of safety considerations, no contamination by human pathogens, are easy to upscale, cheap, and lack refrigeration requirements as well as a sophisticated medical infrastructure. Plant viruses have potential to be used as expression vectors for pharmaceutical production. Plant viruses can produce large amounts of heterologous proteins within a very short time frame without being transgenic plant. Hence, it also lack the controversial public perception associated with the production of transgenic plants. Nanoparticles are microscopic particles between 1 and 100 nanometres (nm) in size with a surrounding interfacial layer. The properties of many conventional materials change when formed from nanoparticles. This is typically because nanoparticles have a greater surface area per weight than larger particles which causes them to be more reactive to some other molecules. Nanoparticles have gained much attention for its biomedical applications. Plant viruses can be used as nanoparticles, to not only deliver drugs, but also sources of material for electronics and optics, as examples. The highly ordered symmetry of icosahedral viruses provides a multivalent scaffold for epitope display. Conversely, empty virus-like particles based on icosahedral plant viruses offer a molecular entrapment platform for carrying drugs, imaging agents and other materials. While nanoparticles based on plant viruses do not cause adverse reactions, and yet can be highly immunogenic. Other advantages are: safety for human, degradability, known structures to atomic level, possibility of attaching ligand with vigorous control on structure, availability for genetic and chemical manipulations and very flexible methods to prepare them. Variety of plant viruses have been modified by chemical and genetic modification of their inner cavities and their outer-surfaces. These modifications provide suitable sites for attachment of markers and drug molecules for vascular imaging and tumor targeting. These characteristics make plant virus nanoparticles prospective vehicles for use in developing countries where patients have low access to modern medical treatment and thus poor prognosis for survival. Interestingly, several plant viruses have been shown to accumulate at solid tumors and elicit a highly localized immune response within the surrounding microenvironment

Keywords: nanoparticle, plant virus, immune response

EXITING KNOWLEDGE OF RESPONDENT DEVELOP UTILITY ARTICLE AND DISCARDED TEXTILE CLOTHING MATERIAL IN KANPUR**PRATIMA SACHAN*, PRATIMA TIWARI** AND DEESHA PATEL *******Dept. of Extension and Communication Management, C.S. Azad University of Agriculture and Technology, Kanpur, UP**

Textile recycling is the method of reusing or reprocessing used clothing, Fibrous material and clothing scraps from the manufacturing process. Researchers have stressed the importance of identifying ways to reduce the post-consumer textile and apparel waste being sent to landfills. Consumer education is a key to reducing waste. "There is a general lack of knowledge of how and where clothing is disposed of". This study was carried out in Kanpur city. The total hundred numbers of respondents were selected from the different houses and areas. A descriptive research design was adopted for the present study. Textile in municipal solid waste are generally found mainly in the form of discarded clothing, although other sources include furnishing from furniture, carpets, tires, foot mat and nondurable goods such as bed sheet and towels. Interview schedule developed to collect the data regarding their needs, and for knowing the recycle practices are existing in the household. The tools used for this purpose was the interview schedule. After designing the articles as per the respondent's needs and preferences. Findings regarding transformation into products of utility shows that maximum respondent (16 percent) made durri and table mats and only 6 percent respondents prepared cushions. Results also highlights that 39 percent of the respondents sold reused/recycled textiles, and only 28 percent of the respondents were donating their textiles for reuse. During the investigation it was found that 53 percent of the respondents were buying textiles according to their needs.

Keyword: Knowledge, Utility, Article, Discarded**STUDY OF PHOTOTOXIC AND CHEMITOTOXIC RESPONSE OF *CHRYSOCORIS STOLLI* WOLF (HETEROPTERA- PENTATOMIDAE -SCUTELLERANE)****PRAVESH KUMAR SEHGAL*, SATPAL SINGH*****Department of Zoology/Entomology Government Degree College, Thatyur , Tehri Garhwal Uttarakhand Pin 248091****Department of Plant Pathology, SVPUA&T, Meerut (U.P.) 250110**

Chrysocoris stoll Wolf (Heteroptera- Pentatomidae-Scutellerinae) is a phytosuccivorous bug, which infests *Cassia occidentalis*, *Croton sparisiflorum*, *Pennisetum typhoides*, (Bajra) and *Litchi chinensis* at Saharanpur in good number and by its desapping habit causes considerable loss to these plants of economic value. The first food plant of this bug is *Cassia occidentalis*, (Kasaundi) (Leguminasae) (This plant is grown throughout India and it is useful in ringworm, elephantiasis and scorpion sting. The leaves are tasty, aphrodisiac, lexiceric, cure cough, Asthma, Kafka and vita. It is also used for stoma chic cure, Fridosha, fevers, sore throat and biliousness (Ayurveda) Phototoxic responses: During present investigations, following experiments were conducted to find out the response of *Chrysocoris stoll* towards various shades and intensity of light. All these experiments were conducted in laboratory as well as in the field during night. Two types of experiments were conducted for this purpose. Chemitotoxic response: A said earlier that *Chrysocoris stoll* is a polyphagous sap sucking bug which attacks the plants of different families. The plant sap of these families possesses carbohydrate like sucrose, glucose and cellulose, different amino acids and crude proteins. Besides these, it also possess many inorganic minerals like Ca, P, K, Mg, Cu, Fe and I, etc and few fatty acids such as stearic acid, oleic acid and linoleum acid etc. This prompted to work out the preference of this bug towards some chemicals and for this some simple experiment was carried out district Saharanpur.

Keywords: Phototoxic responses: Chemitoxic response of *Chrysocoris stoll* Wolf.**STUDY ON SESAMUM AND MUNGBEAN INTERCROPPING SYSTEMS IN WESTERN RAJASTHAN****PRAVIN KUMAR¹ S. M.KUMAWAT^{2*}, S. P. SINGH³ AND P. S. SHEKHAWAT⁴****¹Dept. of Agronomy, College of Agriculture, SKRAU, Bikaner-334006, India, ^{2,4} Swami Keshwanand Rajasthan Agricultural University, Bikaner-334 006, ³Agro, Agricultural Research Station, S. K. R. A. U., Bikaner-334 006, India**

An experiment was conducted at the Instructional Farm, College of Agriculture, Swami Keshwanand Rajasthan Agricultural University, Bikaner during *Kharif* 2018. The experiment site is located at 28.01°N latitude and 73.22°E longitude at an altitude of 234.7 m above mean sea level. According to "Agro-ecological conditions of India, this region has categorized as Arid ecosystem (Hot Arid Eco-region). Soils are sandy and sandy loamy, desert soils with low water holding capacity, hot arid climate and potential evapotranspiration (PET) ranges between 1500-2000 mm annually. Bikaner falls in Agro-climatic zone Ic (Hyper Arid Partially Irrigated Western Plain Zone) of Rajasthan. During *kharif* season of 2018, total rainfall recorded was 124.1 mm. The soil of experiment site was poor in fertility status having O C (0.08%), with available NPK of 121, 17.2, 209 kg/ha, respectively and alkaline in reaction (pH8.2). The experiment was laid out in a factorial randomized block design comprising twelve treatments of sesamum and mung bean intercropping system and replicated thrice following random table (1). Both crops viz, sesamum (var. RT-351) and mung bean (var. IPM-02-03) were raised following recommended dose of fertilizer (RDF) for sesamum and other packages of practice similar in zone Ic. Randomly selected and tagged five plants were carefully uprooted from sample rows of

each plot for estimation of growth characters, and yield attributes and yield was calculated from net plot harvest. Results of the study indicated that plant stands of seamum and mungbean were noted in sole crop plots and decreased significantly in intercropping treatments. Plant height increased in sesamum and mung bean sole crops at 60 DAS and harvest, while decreased non significantly with intercropping with different row ratios of sesamum + mung bean treatments. Whereas, dry matter accumulation vary significantly in sole and inter cropping treatments of sesamum + mungbea with the minimum value in sole crop as against the maximum dry matter noted in 3: 3 and 4:4 row ratio at 60DAS and harvest. The seed /grain yields were recorded the highest in sole sesamum (1313 kg/ha) and mungbean (779kg/ha) and decreased gradually under different ratios with the lowest sesamum yield of 597 kg/ha in 1:3 ratio and mungbean yield of 107 kg/ha, in 3:1 ratio. The highest seamum equality yield (SEY) was computed in 5:3 row ratios of sesamum+ mungbean, followed by 3:3 ratio sowing. Similar trend was observed in aggressivity with minimum values of 0.17 and 0.41 under sesamum +mungbean intercropping ratios of 5:3 and 3:3, respectively. Further, the Land equivalent ratio (1.08) and ATER value (1045) were found higher in seamum+ mungbean intercropping 5:3 ratios also.

Keywords: Intercropping, Sesamum, Mungbean, Plant height, Dry matter accumulation, LER, ATER, Aggressivity, Seed/ Grain yields

CONSUMER BEHAVIOR IN E – SHOPPING

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Online shopping has very important position in the 21st century as most of the people are busy loaded with working schedule. In such a situation online shopping became the effortless and most suitable mode for their shopping. Internet has changed the status of consumer's store, and has rapidly developed into a global perspective. An online shop arouses the physical similarity of buying products as well as services from internet shop and this process of shopping is called business-to-consumer e- shopping. The present paper is based on the survey on the e-shopping users. This paper examines the behavior and perception of online customer in Hisar.

Keywords: internet users, online consumer, e-shopping

SCLEROTINIA SCLEROTIUM (STEM ROT) OF RAPESEED MUSTARD AND ITS MANAGEMENT

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Sclerotinia sclerotiorum is the causal fungus of *Sclerotinia* stem rots in Indian mustard. *Sclerotinia* stem rot incidence is increasing gradually year after year and emerging as a serious threat to mustard crop. Significant affect of this disease on qualitative and quantitative characters depending on crop stage infection at farmer fields. As there is 27.67% to 66.37% loss in test weight in infected seed samples, hence it has direct affect on crop yield. The loss in oil content also increased from 10.79% to 34.70% which ultimately affect the quality of oil content and oil yield. *Sclerotinia sclerotiorum* is a soil borne pathogen having worldwide distribution. Common hosts of white mold are herbaceous, succulent plants, particularly flowers and vegetables. It can also affect woody ornamentals. White mold can affect their hosts at any stage of growth, including seedlings, mature plants and harvested products. Large numbers of sclerotia are formed in soil on dead organic matter, on roots, on inside the pith of stem in rapeseed mustard crop. The first symptom of *Sclerotinia* stem rot was noticed as water soaked patches on leaves and stem of plant at flowering stage. The disease is mainly on aboveground parts producing a cottony white mold, the small white bodies appear in mold and gradually change from white to black as hardened sclerotia develop. Many control practices are adopted. As carboxamide formulations are registered for use. The foliar spray application of carbendazim 250g/l in field. Foliar application of phytoextracts of *Allium sativum* has been reported in checking this disease. *Trichoderma* sp. has also been used as bioagent to control this disease.

Keywords: Indian mustard, *Sclerotinia* rot, *Sclerotinia sclerotiorum*, white mold, control

INTEGRATED PEST MANAGEMENT-ROLE OF BIOLOGICAL CONTROL AGENTS

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Biological control, bio control, or biological pest control is an important method for suppression or control of the population of undesirable insects by the introduction, encouragement, or artificial increase of their natural enemies to economically non-important levels. It is an important component of integrated pest management (IPM) programs. The use of these controlling agents is being preferred as compared to those of chemical methods because of their safety, target specificity, and long term action. Insect have a very significant role in limiting the crop production. Most of the farmers use chemical insecticides for insect control, which have very unfavorable impacts on environmental as well as human health. India accounts for large amount in insecticides usage than

other pesticides such as fungicides and herbicides. Conventional insecticides acquire inherent toxicities that put the environment, human health at risk. These fatalistic effects of conventional insecticides on human health led to a rebirth of farmer interest in botanical insecticides because of their minimal ecological side effects as well target specificity. To decode the problem of non-specific insecticide risk as well as to deal with the human exposure there is needed a modern concept of pest management based upon an understanding of agro-ecosystem ecology, and amalgamation of various control tactics into pest management systems. In several IPM tactics there is biological pests control is a useful technique that discourage the development of populations of harmful organisms involving the manipulation of beneficial organisms or natural enemies. It also explains how biological control interacts with other IPM tactics.

Keywords: IPM, Pesticides, Biological Control, Management

STUDIES ON EPIDEMIOLOGY AND MANAGEMENT OF MUNGBEAN YELLOW MOSAIC VIRUS DISEASE OF MUNGBEAN (*VIGNA RADIATA* L. WILCZEK)

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Mungbean Yellow Mosaic Virus (MYMV) is one of the most prevalent and destructive pathogen in Mungbean (*Vigna radiata* L. Wilczek) which belongs to family Gemini viridae, belongs to genus Begomovirus. It was observed that vector, whitefly (*Bemisia tabaci*) is responsible for its transmission. A field experiment was conducting at Plant Pathology Research Farm, CCS Haryana Agricultural University, Hisar, Haryana with aim to find out the successful management of MYMV. We are using the different different biorational approaches such as use of Neem oil @ 5 ml/kg of seed, faba bean seed extract @ 10% and salicylic acid @ 150 mg/l for seed priming which are laid out in RBD having six treatments with three replications and there effect seen on yield. Another field experiment is laid out in RBD with 4 replication for checking the role of temperature and humidity (%) accompanied by rainfall (mm). The effect of the these parameters are observed on: (1) Disease severity at 7 days interval, (2) Whitefly population at 7 days interval.

USE OF VERMICOMPOST FOR IMPROVING THE SOIL HEALTH

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Current soil management strategies are mainly dependent on inorganic chemical based fertilizers, which cause a serious threat to soil health and environment. Vermicompost is the excreta of earthworm, which are capable of improving soil health and nutrient status. Vermicomposting is a simple biotechnological process of composting, in which certain species of earthworms are used to enhance the waste material passing through the earthworm-gut and produce a better product to nutrient rich vermicompost. Vermicomposting differs from composting which is a mesophilic process that utilizes microorganisms and earthworms that are active at 10°C to 32°C. The key role of vermicompost in improving physical properties such as aggregate formation, bulk density, porosity and hydraulic conductivity is well known. Earthworms secrete gelatinous substances that coat and stabilize soil aggregates, they improve soil aeration by burrowing activities and soil turn over. Vermicompost contains an average of 1.5% - 2.2% N, 1.8% - 2.2% P and 1.0% - 1.5% K. The organic carbon is ranging from 9.15 to 17.98 and contains micronutrients like Sodium (Na), Calcium (Ca), Zinc (Zn), Sulphur (S), Magnesium (Mg) and Iron (Fe). The excreta of earthworm (worm manure) are rich in microbial population, enzyme activities plant growth regulators, and fortified with pest repellence attributes as well.

Keywords: Vermicompost, soil health, earthworm, soil properties, nutrients.

SOIL LOSS ESTIMATION USING EMPIRICAL EQUATION METHODS

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Soil erosion may be simply defined as the detachment and transportation of soil (Tideman, 1996). Many empirical models, such as Universal Soil Loss Equation (USLE), Revised Universal Soil Loss Equation (RUSLE), Water Erosion Prediction Project (WEPP), Soil Erosion Model for Mediterranean Regions (SEMMED), Areal Non-point Source Watershed Environment Response Simulation (ANSWERS), Limburg Soil Erosion Model (LISEM), European Soil Erosion Model (EUROSEM), Soil and Water Assessment Tool (SWAT), Simulator for Water Resources in Rural Basins (SWRRB), Agricultural Non-point Source pollution model (AGNPS), etc. Estimate soil erosion and to establish soil erosion management plans, many computer models have been developed and used. Remote Sensing (RS) and Geographic Information System (GIS) being a well known tool available for dealing with the major water resources problems, it is used in the present study of Assam, using RS and GIS technique several models have been developed to estimate soil erosion. The universal soil loss equation (USLE) is an empirical procedure developed from statistical analysis of

erosion data from a large number of plot studies under different conditions. The USLE for estimating average annual soil erosion. Five essential parameters such as Runoff-rainfall erosivity factor (R), soil erodibility Factor (K), slope length and steepness (LS), cropping management factor (C), and support practice factor (P) have been used to estimate soil loss amount in the study area. Tombus *et al.*, (2012) assessed soil erosion of Corum Province of Turkey based on USLE Method. They estimated the soil loss of the working area as 28.85 ton/ha/year

Keywords: Soil loss, erosion risk, USLE, GIS, remote sensing

HAIRY ROOT INDUCTION IN *OCIMUM TENUIFLORUM* USING DIFFERENT STRAINS OF *AGROBACTERIUM RHIZOGENES*

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The work has been carried out with a view to establish the protocol for *Agrobacterium rhizogenes* mediated hairy root induction *Ocimum tenuiflorum* L, an important medicinal plant, using two different strains of *Agrobacterium rhizogenes* MTCC 2364 and MTCC 532. Aseptic explants for transformation were obtained by inoculating shoot tips of *O.tenuiflorum* on MS media supplemented with BAP- 2.0 mg/l, AdSO₄ - 50mg/l and Citric acid- 1.0 mg/l. Both strains were evaluated for their transformation efficiency in shoot tips, nodes and leaves of *O.tenuiflorum*. MTCC 2364 was maintained at 28°C for 48 hours in YEP medium and MTCC 532 strain was grown in YEN medium at 25°C for 24 hours, Acclimatization of bacterial culture in MS medium for 4 hours was found effective for transformation. The explants were treated for different co-culture periods. The percentage of hairy root induction varied with infection period. The strain MTCC 532 exhibited the highest transformation frequency 81.11% in shoot tips, 78.14 % in nodes and 79.44 % in leaves. The highest number of hairy roots, 10.25 in shoot tips, 8.95 in nodes and 6.27 was found at 120 minutes of co-culture period after 24 days. In case of MTCC2364 strain highest transformation efficiency of 74.44 % in shoot tips and 62.33 % in leaves was achieved at 120 minutes of co-culture period with the highest number of hairy roots, 8.70 in shoot tips and 5.87 in leaves after 24 days. MTCC 532 was found to be most effective for transformation frequency as well as number of hairy roots/ explant. Molecular characterisation of hairy roots was done through PCR using *Aux1* gene specific primer. Presence of *Aux1* gene was confirmed in the transformed roots of MTCC 532 at 540 bp. Amplification of *Aux1* gene at 540 bp was not found in transformants of MTCC 2364.

ROLE OF MILK SOCIETIES FOR MILK PRODUCERS

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A Study was Conducted During 2017-18 & 2018-19 On The Role Of Milk Societies To Milk Producers in The Meerut District. For The Studies 32 milk Producers Were Selected From 8 Villages Covering Four Blocks of Meerut District. During Study it was found That With ought Societies members of Milk Producer are Sallying milk to milk man in Local Level on Low Prices at the average rate of Rs 36/Litre. Resulting net Profit was decreasing and Members of Milk Societies were sallying on High Prices at the Average rate of Rs 42/Litre. Milk members of the Societies are gating 16.60% higher prices in Comparison Non-members of the Societies and societies members are gating the payments regularly in comparison to non-Members of the Societies. Study revealed that Milk Societies Members are Gating Higher And Regular payment hence non societies members gating low and irregular of the milk. On the above basis it proves that milk societies are playing significance role to development of milk Producers.

INFLUENCE OF PLANTING METHOD, MULCHING AND NAA APPLICATION ON MAJOR DISEASES AND YIELD OF BELL PEPPER (*CAPSICUM ANNUM* L.) VAR. SOLAN BHARPUR

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An experiment comparing raised and flat beds, different mulches and NAA application under irrigated conditions was conducted on bell pepper (*Capsicum annuum* L.) var. Solan Bharpur during *Kharif*, 2017 at the Vegetable Research Farm, Department of Vegetable Science, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The experiment was laid out in a randomized block design factorial with three replications and twelve treatment combinations involving a spacing of 60x45cm. Studies were conducted on disease severity of *Phytophthora* leaf blight, incidence of collar rot and incidence of fruit rot (*Phytophthora nicotianae* var. *nicotianae*) and yield of bell pepper. Results showed that severity of leaf blight (1.08%) and incidence of fruit rot (2.30%) was found minimum in T₃ and maximum in T₁₂ (7.20 % and 12.02%, respectively), whereas incidence of collar rot was lower in T₁ (2.99%) and higher in T₁₂ (12.02%). Maximum fruit yield (397.00 quintals/ha) was obtained with T₃. In all the three diseases, higher severity and incidence was found in T₁₂.

Keywords: Bell pepper, *Capsicum annuum* L., *Phytophthora nicotianae* var. *nicotianae*, Yield.

A COMPARATIVE STUDY ON PSYCHOLOGICAL WELL-BEING OF SENIOR CITIZENS ACROSS GENDER**PRIYANKA BENIWAL¹ AND CHANDRAKALA SINGH²****Department of Human Development and Family Studies COHS, Chaudhary Charan Singh Haryana Agricultural University, Hisar, Haryana**

Seasons of life are the offerings of the dynamic creation of God. Each developing phase has its unique characteristic features, developmental tasks, qualities and realization points in the platform of positive psychology. Old age is the final developmental stage which is adorned by folds of wisdom, generatively and ripened meaning of life for successful aged. Since the dawn of civilization, human beings have recognized a progression through the life course, from infancy through old age. The increase in the number of elderly individuals has led to discussions about health care facilities and social support system in India. Aging is usually associated with physical decline and frailty as well as psychological modifications. The present study was conducted with the aim to find the level of psychological well-being of senior citizens across gender. The study was conducted in Sirsa district of Haryana state, purposively selected due to easy accessibility. Various areas of Sirsa city were considered to draw the sample. The study was conducted on 200 senior citizens equally comprising both males and females of age group 65-70 years. Psychological well-being of senior citizens was assessed by using Psychological well-being scale by Sisodia and Choudhary (2005). The study elucidates that majority of the senior citizens had moderate level of psychological well-being. On comparing the mean scores of male and female respondents significant differences were observed in life satisfaction, mental health, interpersonal relations and overall psychological well-being. It can be concluded from the results that male senior citizens had better psychological well-being as compared to their female counterparts.

Keywords: Psychological well-being, social support, aging, developmental tasks.

POST-HARVEST HANDLING PRACTICES AND TREATMENT ON QUALITY AND SHELF LIFE OF TOMATO (*LYCOPERSICON ESCULENTUM*) FRUITS**PRIYANKA DEVKOTA^{1*}, REETA KHADKA^{1*}, AADESH SUBEDI^{1*}****Agriculture and Forestry University, Chitwan, Nepal**

Tomato production is one of the major source of income in developing countries. In global scenario the postharvest losses of this high value crop is upto 30 to 40% that exceeds to much higher level in developing countries. Due to lack of information on appropriate post-harvest treatments, packaging, temperature etc., the fruits not only lose their quality but also encounter a substantial quantity of post-harvest loss. From this study, it was revealed that the postharvest quality and shelf life of the fruit in part will depend on some postharvest handling practices and treatments carried out after harvest. Handling practices like harvesting, precooling, cleaning and disinfecting, sorting and grading, packaging, storing, and transportation played an important role in maintaining quality and extending shelf life. Use of appropriate postharvest treatments like refrigeration, heat treatment, modified atmosphere packaging (MAP), Gibberellic acid and calcium chloride (CaCl₂) application was also vital. Appropriate post-harvest handling can maintain the quality and shelf-life of tomato while failure to address these practices causes great loss.

Keywords: Post-harvest handling, Post-harvest technique, shelf-life, Modified Atmosphere Packaging, Gibberellic acid and calcium chloride

EFFECT OF INORGANIC, ORGANIC AND BIO-FERTILIZERS ON GROWTH OF GUAVA (*PSIDIUM GUAJAVA* L.) VAR. GWALIOR-27 UNDER GWALIOR AGRO-CLIMATIC CONDITION OF M.P.**PRIYANKA GURJAR¹ AND R.S. GURJAR²****1. Department of Horticulture, College of Agriculture, Gwalior, 2. BRAUSS, Mhow, Indore (M.P.)**

The Guava, botanically known as *Psidium guajava* belongs to the family of Myrtaceae. Guava was considered to be one of the most exquisite and nutritionally valuable remunerative crops. The origin of guava is from tropical America and it is also known as apple of tropics. The experiment was laid out from randomized block design (RBD) with three replication and the total fourteen number of treatment with RDF, organic compost and bio-fertilizer combinations were tested under the experiment at the experimental area, Gwalior M.P. during 2018-19. The observations were recorded on different aspects of growth parameter like plant height, diameter of stem, diameter of secondary branch, number of secondary branch, number of tertiary branch, plant spread (north to south) and plant spread (east to west) were found highly in T₉ (75% RDF + vermi compost 5kg + bio-fertilizer per tree) and it was at par to T₁₀ (75% RDF + Sheep manure 5kg + bio-fertilizer per tree) and T₈ (75% RDF + FYM 5kg + bio-fertilizer per tree) and T₉ followed by other treatments and minimum data recorded under T₀ (control).

Keyword: Guava, Bio-fertilizer and Growth

COMPUTER UTILIZATION BEHAVIOUR OF K.V.K SCIENTISTS

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In the era of globalization and economic liberalization, capacity building of farmers is an important factor to orient the production system. It is no doubt a big challenge to meet the global requirement in the context of food security and environmental sustainability. The information revolution has started revolutionizing technology transfer system through various wordiers made in this regard, still wide disantpies exist within and across the country in general and the state in particular. The study was under taken with objectives (1) To study the diversity of software packages used for work. (2) To study the computer supported task performance and finally to study the intensity of computer use covering 25 Krishi Vigyan Kendra functioning under the administrative control of Orissa University of Agriculture and Technology where 80 no. of sample subject matter specialist were purposively chosen and the data was collected through well structured, pre-tested mailed questionnaire. As revealed from the study, it is observed that computer Microsoft words is used most frequently, followed by Microsoft Power Point and Internet Browsing. In the context of computer supported task performance, it is in the order of storing data relating to agriculture and allied field of the KVK operational area followed by drafting and finalizing scientific and popular articles and acquiring up to date information relating to their professional field. The result revealing the intensity of computer use reveals that 44.28% use it for more than 2 hrs, in working day followed by 38%, for 1-2 hrs and 10% for less than 30 minutes, 5.72% for 30 minutes to 1 hrs and only 1.43% of respondent skip using computer. The study paved the way for creating conducive environment for computerization of extension system with strong organizational support by motivating and encouraging scientist to improve upon their computer utilization behaviours.

WATER SAVING TECHNIQUES FOR ENHANCING GROWTH AND PRODUCTIVITY IN OILSEED CROPS-A REVIEW

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Water, the need of life, is likely to pose the greatest challenge on account of an increased demand with population rise and economic development, and shrinking supplies due to over-exploitation and pollution. Although water is an abundant and renewable natural resource covering two thirds of the planet, a very small proportion of this is effectively available for human and agricultural use. Oilseed crops are the second most important elements of Indian agriculture after cereals. India has the fifth largest oilseed economy in the world after USA, China, Brazil and Argentina. Since water is scare water saving techniques have been developed to reduce water use and also provide considerable yield. Drip irrigation is one of the most important irrigation methods. Application of irrigation water and fertilizer through drip which provides precise and site specific water and nutrient application near root zone of plant reduces or eliminates runoff, deep percolation, evaporation and minimizes the weed growth. Water use efficiency and yield of crops can be improved by following drip irrigation, application of straw mulch, use of anti-transpirants etc. Yield of oilseed crops are greatly influenced by fertilizer and irrigation practices. Potential seed yield from oilseeds can be achieved by adopting optimum irrigation schedules and various water saving practices. So, optimum scheduling of irrigation, application of mulch, drip irrigation, use of anti-transpirants and bed planting leads to increased yield and water use efficiency (WUE) of various oilseed crops.

Keywords: Oilseed crops, water use efficiency, water productivity

PHARMACOLOGICAL PROPERTIES OF *ILICIIUMVERUM*: A REVIEW

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Illiciumverum is being a source of spices and pharmaceutical treatment of many harmful diseases has been widely used in most of the Asian countries. Ministry of Health of the People's Republic of China (2002), considered it as “both food and medicine” due to its low or non-toxicity towards human’s health. In the present study, the review focus mainly on food and medical applications of *I. verum*. The fruits are commonly used as an ingredient of the traditional “five-spice” powder of Chinese cooking, and the essential oil of *I. verum* can be used as a flavoring. The extraction from *I. verum* has carminative, stomachic, stimulant, and diuretic properties, and is used as a pharmaceutical supplement. Shikimic acid extracted from *I. verum* is one of the main ingredients in the antiviral drug Tamiflu used to fight avian influenza. It has also been reported to possess antimicrobial and antioxidative properties

as well as significant anticancer potential. This review presents a detailed compilation of the literature on phytochemicals and pharmacological properties of *Illicium verum*.

Keywords: *Illiciumverum*, Antibacterial, Antifungal, Antioxidant, Anticancer Shikimic acid, Tami flu.

HABITAT MANIPULATION: AN ECOFRIENDLY TACTIC

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The intensive use of pesticides has impaired the integrity of ecosystems and presents severe risks for human health. Now more than ever, in a context where crop pests and pathogens are spreading from changing climate, there is greater recognition of the need to reduce the use of synthetic pesticides and to develop robust non-chemical tools. One of the approaches to deal with these emerging problems is to modify the established techniques to make crop environment less favorable for pest. Habitat manipulation is based on thorough understanding of pest ecology as it relates to the crop being produced. Idea behind is to find weak links in the insect seasonal cycle and exploit them. Various strategies for manipulating habitat are to reduce or disrupt pest habitat in and around crop, disrupting continuity of pest requisites, diverting pest population away from the crop and reducing yield loss from the insect injury. These can be achieved through sanitation, destruction or modification of alternate hosts, tillage, irrigation, water management, crop rotation, location planting time and trap crop etc. Insect problem continue due to uninterrupted supply of requisites provided at appropriate times and places relative to the seasonal cycle of these species. This supply can sometimes be interrupted to reduce infestations of pests. Manipulating their presence in time and space would reduce insects. Modifying host tolerance and harvest schedules reduce the impact of insect injury and can also be used to improve biological control of crop pests (Smith and Chaney. 2007). Habitat manipulation is not a stand-alone strategy, therefore, must be integrated with other methods for successful pest management. The effects of habitat manipulation on food web structures is to be thoroughly examined and knowledge is obtained to increase understanding of these systems. For this, there is a demand for researchers contributing to enhance the skills of advisors and farmers to experiment with habitat manipulation and observe the results over time.

QUALITY SEED PRODUCTION AND INNOVATIVE APPROACHES FOR ORNAMENTALS

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The varied agro-climatic conditions existing in India and the availability of relatively inexpensive human labour, technical expertise, and other materials provide a vast scope for the production of a wide range of flower seeds of both tropical and temperate origin. Ornamentals and flowers are part of Indian culture ever since the existence of humanity by providing not only esthetic value but also important for economic value as sale of flower, production of quality seeds, essential oils and making edible products etc. India is the largest producer of flowers, approximately on one lac thirty thousand hectare area and also largest consumer. So, to meet such high requirement quality seed is much more important to produce the quality product. Quality seed remains always the integral part and it alone gives 15 to 20 percent of the crop success. Commercial flower seed production is an international business involving highly specialized growers. Commercial seed production has undergone unrestricted revolutionary growth in terms of number of crops and their varieties as well as production technologies. This phenomenal development is the result of technological advancements in the production of flower seeds and developments in the areas of production, packaging, handling, transportation and marketing of flowers and ornamental plants all over the world. So, the utilization of improved agricultural practices and advanced seeds enhancements techniques are required. Seed enhancement practices, improved germination and seed vigour to obtain disease free product of commercial value should be encouraged for profitable value and flower seed production could be effective alternative to the farmers who involved in floriculture and could prove to be useful for financial upliftment.

Keywords: floriculture, enhancement, germination.

EFFECT OF UV TREATMENT ON LIQUID FOOD PRODUCTS

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Due to high nutritional quality, juice blend is the preferred choice of beverages. However, current methods that are used in the processing of juice products, such as thermal pasteurization which is most preferred method for processing food due to its ability to inactivate microorganisms and food spoilage enzymes, therefore extending the shelf life of juices. However, due to high heat exposure, thermal treatment can negatively affect the food product quality, causing several chemical and physical changes which lowers the bioavailability of some bioactive compounds such as ascorbic acid. Non thermal processing, UV treatment is an alternative method that has been used to extend shelf life and enhance safety of fresh juice while preserving nutritional qualities. However, the efficiency of UV treatment in liquid foods is dependent on its constituents like pigments, organic solutes and

suspended particles which limit the transmission of UV light through the liquid food. The absorbance of UV light in fruit juices is reported to be significantly more compared to water. Also Vitamin C is light sensitive, which degrades in presence of UV light. UV light has also shown positive results as evident from the reduction in number of pathogenic microorganisms. UV light with a peak emission at 254 nm exhibits germicidal effect against microorganisms such as bacteria, viruses, yeasts and moulds. Furthermore, contrary to heat treatments, the use of UV has been reported to cause minimal damage to the physicochemical and nutritional quality of juice. With the current developments in food process engineering, it is now possible to use UV light for minimal processing of liquid products for reducing the microbial population without significantly affecting the nutritional quality of the product. However, there is still a need of efficient systems to apply UV technology for its commercial applications with validation of protocols for food applications.

Keywords: UV Treatment, Thermal Pasteurization, Bioactive Compounds

REVIEW OF BIOCHAR APPLICATIONS IN THE SOIL

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Biochar is a stable solid, rich in carbon, and can endure in soil for thousands of years. Like most charcoal, biochar is made from biomass by pyrolysis method. Biochar has the potential to mitigate the climate change by Carbon sequestration. Biochar can increase soil fertility. It also helps to improve the acidic soil by minimising the pH, increase agricultural productivity, and provide protection against some foliar and soil-borne diseases. Biochar is produced in an environmentally friendly manner by recycling plant waste into fertilizer. Nitrogen is a significant factor in crop growth, and the use of biochar as a source of soil nitrogen has been a subject of much study. The direct application of biochar as nitrogenous fertilizer is inefficacious because biochar contains more carbon than nitrogen. Instead, the porosity and large surface area of biochar is effective at retaining nitrogen compounds and inhibiting its leaching by runoff. Biochar can improve almost any soil. Areas with low rainfall or nutrient-poor soils will most likely see the largest impact from addition of biochar.

Keywords: Pyrolysis, Carbon sequestration, crop growth, climate change, leaching, recycling

INTRODUCTION OF FARM FORESTRY

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Farm forestry incorporate commercial tree growing into farming systems. It has many forms like timber-belt, alley and widespread tree planting farm forestry provide the alternative source of income. It improves the production of agricultural crop with shelterbelt for stock and crops and can also provide substantial environment benefits such as salinity control. With the help of farm forestry to remove the obstacles which have to overcome before a farmer can enter the local wood market. Farm forestry depends upon the cost of labour and material; dominate the price of raising plantation; rate of return depends on growth rate and yield etc; financial capability of farmer to rotation of crop; irrigation and fertilizer supply on time; willing to invest of inputs in tree farming. Farm forestry is the management of trees for a specific purpose within a farming context. Typically these are timber plantations on private land. However, it can be applied to a range of enterprises utilizing different parts of the tree and managed in a variety of ways.

Keywords: timber belt, production, salinity control, rate of return, farm forestry

BIOLOGICAL CONTROL OF POST-HARVEST DISEASES OF FRUITS AND VEGETABLES BY MICROBIAL ANTAGONISTS

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Fresh fruits and vegetables encounter diseases between harvest and consumption, resulting in significant food waste and economic losses. According to the Food and Agriculture Organization [1] about 45% of harvested fruits, vegetables, roots and tubers are lost. Most of this loss occurs during storage due to microbial infestation (bacteria, fungi, etc.). Traditionally, chemical fungicides and food preservatives are used to control postharvest decay. However, exposure to these chemicals is, in many cases, hazardous to humans, animals and the environment [2]. Due to the toxicological risk of residual chemicals in food products, their application in the postharvest period has been limited to a few registered chemicals and is completely prohibited in some European countries [3]. Several postharvest diseases can now be controlled by microbial antagonists. Although, the mechanism by which microbial antagonists suppress the postharvest diseases is still not clear. However, competition for nutrients and space is the most widely accepted mechanism of their action. Production of antibiotics, direct parasitism and induced resistance in the harvested commodity are the other modes of action by which biocontrol agents suppress the activity of postharvest pathogens in fruits and vegetables [4]. Microbial antagonists are applied either before or after harvest, but postharvest applications are more effective than preharvest applications [5]. Different microbial antagonists like *Cryptococcus laurentii* Kufferath & Skinner, *Bacillus subtilis* (Ehrenberg)

Cohn, *Pseudomonas syringae* and *Trichoderma harzianum* Rifai are being used. To improve the efficacy of microbial antagonists, mixture of two or more compatible antagonists (6), antagonists with low dose chemicals (7), heat treatments with antagonists (8) are being used. Biocontrol products like Aspire, Bio Save, Shemer etc., have also been developed and registered for post-harvest application in fruits and vegetables.

ROLE OF INTEGRATED FARMING SYSTEM IN DOUBLING FARMERS' INCOME

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Integrated farming system is farming system which consists of at least two separate but logically interdependent farm enterprises. Integration in IFS occurs when output of one enterprise is used as an input in another enterprise. The Indian agriculture is dominated by small and marginal farmers having low investment capacity. The role and factors associated with integrated farming system have been studied as a potential option to improve farmers' income and ensure their sustainable livelihood. The contribution of different combinations of enterprises such as poultry, fishery, sheep and goat and horticulture; with crop and dairy as base enterprises have been analyzed for their impact on farmers' total income. In India's present scenario, Integrated Farming System (IFS) plays an imperial role for maximizing profit and production to meet nutritional requirement with food security with less investment. IFS is gaining more attention due to deteriorating resource base, low rate of farm resource recycling, narrowed biodiversity, employment generation, climate change and sustainability issues. IFS can be one of the strategies for doubling the farmers' income as the farmer can get income from different enterprises round the year. The constraints faced by farmers in adoption of IFS include shortage of labor, Lack of availability of critical inputs like seeds etc. at proper time, low investment capacity due to small size of land holdings and lack of awareness about benefits of integrated Farming System.

Keywords: Integrated farming system, doubling farmers' income etc.

ROLE OF AGROFORESTRY IN ACHIEVING FOOD AND NUTRITIONAL SECURITY

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Agroforestry – the integration of trees with annual crop cultivation, livestock production and other farm activities – is a series of land management approaches practiced by more than 1.2 billion people worldwide. Agroforestry systems provide a variety of products and services that are important locally, nationally and globally, but their role is not always acknowledged adequately in development policies and practices, possibly reflecting the difficult-to-measure, diverse pathways by which they affect peoples' lives. Relatively low-input agroforestry options are often favored by women who are unable to afford high-cost technologies due to severe cash and credit constraints. Reaching food and nutritional security requires a range of interconnected approaches from increasing the crop yield and soil fertility, biofortification of staple foods to cultivating wide range of plants which provide edible fruits, vegetables, nuts and diversify the diets of the people. However, farming communities around the world use more exotic crop varieties and lesser indigenous varieties which are often richer in nutrients, fiber and protein sources than the conventional staple crops. These indigenous varieties have been harvested from forests by local communities as NTFPs. However, the use of these food sources is threatened due to rising deforestation and fragmentation of forests. Agroforestry is a provider of crucial benefits such as; food and nutritional security, enhanced agricultural productivity, mitigation of climate change impacts and resilience of environmental functions. Hence, global focus on the use of agroforestry as a tool to achieve those objectives should be increased and refined due to its ample positive social and environmental benefits. However, multifaceted analysis is needed to scrutinize in a context where basic local needs are prioritized to identify optimal management practices by giving equal opportunities to both social and environmental benefits.

Keywords: Agroforestry, food security, benefits, productivity.

BREEDING STRATEGY IN UTTAR PRADESH

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Livestock diversity of state is reflected in term of various breeds of cattle, buffalo, sheep and goat. Uttar Pradesh is the leading State in livestock sector with the wealth of about 9.5% of country's cattle, 22.6% of buffalo, 1.7% of sheep, 10.5% of goats, 12.1% of pigs, 20% horses and ponies, 30% of mules, 19.2 % donkeys, 1.7% camel and 2.4% poultry. The state ranks first in buffalo , second in indigenous cattle, pigs, horses, and donkeys population; third in total cattle and goat population; fourth in rabbit population; sixth in crossbred and camel population; tenth in sheep population and twelfth in poultry population. UP is the home tract of Ponwar, Kherigarh, Mewati, Kenkatha and Gangatiri cattle however Haryana (western Uttar Pradesh), Sahiwal (middle part of UP) and Tharparkar (Bundelkhand) are also reared by the farmers. The home tract buffalo breeds are Bhadawari buffalo (high milk fat) and

Tarai buffalo but Murrah and its grades are more prevalent in the buffalo wealth of state. Jamnapari and Barbari are two famous goat breed whereas Jaunpuri and Tarai lesser known goat breed are found in state. Sheep diversity in state is reflected in term of Muzaffarnagari, Jalauni, Nali breeds. Other species like Bikaneri camel, Kathiawari horses along with exotic breeds and their crosses (HF, Jersey cattle, Italian donkeys, Angora rabbit, Yorkshire and Landrace pig, Rambouillet and Marino sheep etc.) are also reared. Over and above to these indigenous animal genetic resources, there may be still more livestock population in the state, which need to characterized and recognized as a breed. The germplasm of such well-defined breeds constitute a valuable genetic resource which needs to be conserved on priority basis. Animal performance recording and registration system at farmer's herds should be developed and linked with PT programmes. In-situ and Ex-Situ conservation programmes should be integrated with breed improvement and development programmes.

STUDY ABOUT INTEGRATED NUTRIENT MANAGMENT

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The increasing food demands of a growing human population and the need for an environmentally friendly strategy for sustainable agricultural development require significant attention when addressing the issue of enhancing crop productivity. Here we discuss the role of integrated nutrient management (INM) in resolving these concerns, which has been proposed as a promising strategy for addressing such challenges. INM has multifaceted potential for the improvement of plant performance and resource efficiency while also enabling the protection of the environment and resource quality. This review examines the concepts, objectives, procedures and principles of INM. A comprehensive literature search revealed that INM enhances crop yields by 8-150% compared with conventional practices, increases water-use efficiency, and the economic returns to farmers, while improving grain quality and soil health and sustainability. Model simulation and fate assessment further reveal that reactive nitrogen (N) losses and GHG (greenhouse gas) emissions are reduced substantially under advanced INM practices. Lower inputs of chemical fertilizer and therefore lower human and environmental costs (such as intensity of land use, N use, reactive N losses and GHG emissions) were achieved under advanced INM practices without compromising crop yields. Various approaches and perspectives for further development of INM in the near future are also proposed and discussed. Strong and convincing evidence indicates that INM practice could be an innovative and environmentally friendly strategy for sustainable agriculture world wide.

EFFECT OF CR11 CULTURE MEDIA ON MULTIPLICATION OF MESENCHYMAL STEM CELLS IN CAPRINE

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Mesenchymal stem cells (MSCs) have the capacity to differentiate into cells of connective tissue lineages, including bone, fat, cartilage and muscle. Mesenchymal stem cells (MSCs) are considered to be a potential source for cell and gene therapy. Major challenges to the therapeutic use of MSC include the effective harvesting and in vitro expansion of cells to sufficient numbers and of sufficient purity. Many culture media are used to culture and propagation of MSCs. There is no any reference of the culturing of MSCs in CR11 media. Therefore the present study was conducted to test the CR11 media on isolation and proliferation of MSC in caprine. The goat of six month to two years old of either sex were anesthetized by the intramuscular injection of xylazine @ 0.3 mg/kg body weight followed, 10 minutes later by, ketamine @30mg/kg Body weight, in the thigh muscles. The bone marrow aspirate were collected with the help of an 18 G bone marrow biopsy needle from the lateral aspect of iliac crest into a hypodermic needle containing heparin. The marrow sample were diluted with equal amount of Dulbecco's phosphate buffered saline (DPBS) and layered onto 10 ml of Ficol- Hypaque. The samples were subjected to centrifuge at 2000 rpm for 30 minutes and the nucleated cells were collected from the interface. The cells were washed with two volumes of DPBS and were collected by centrifugation. The supernatant was discarded and the cells were resuspended with culture media, counted and plated at 2×10^5 cells/ cm^2 in T-25 flasks. MSC (P8) were cultured in the CR11 media containing 10% FBS for 95 hours in T 25 flasks. It was observed that after 95 hours of culture, an average total number of 1.03×10^6 cells were recovered in CR11+ 10% FBS. The average doubling time of cell was 26.397 hours. The results indicated that the multiplication of cells were better in CR11 as compared to well established another culture media like DMEM with low glucose and DMEM with high glucose.

EFFECT OF SPERMINE-NONOATE ON MOTILITY, VIABILITY, MEMBRANE INTEGRITY AND LIPID PEROXIDATION OF MURRAH BUFFALO (*BUBALUS BUBALIS*) SPERMATOZOA**R. A. SIDDIQUE¹, SHABANA², K. P. SINGH³ AND S. K. ATREJA⁴****¹Veterinary Biochemistry, COVAS, Sardar Vallabhbhai Patel University of Agri & Tech, Meerut, U.P., ²Shobhit University, Meerut, U.P., ³Deoria, Govt of Uttar Pradesh, ⁴Animal Biochemistry Division, NDRI, Karnal-Haryana**

NO acts as double edged sword serving as a key signaling molecule in both physiological and pathological processes; lower concentration of NO at physiological level plays a beneficial role in protecting various sperm functions such as motility and viability and capacitation whereas higher level of NO causes decrease in sperm motility, viability and even at much higher levels of nitric oxide more than 1000 mM in mouse spermatozoa are toxic. In our study freshly ejaculated Murrah buffalo semen samples were collected and cryopreserved with L-Arginine (1 mM), spermine-NONOate (10 mM) and no additive. Post-thaw sperm motility, viability, membrane integrity and lipid peroxidation were assessed. Cryopreserved samples without any additive showed significantly ($P<0.05$) lower motility (32.3371.45%) as compared to the cryopreserved samples treated with L-Arginine (38.3371.66%) and spermine-NONOate (43.3371.45%). Among cryopreserved samples, the semen extended in presence of spermine-NONOate showed significantly ($P<0.05$) higher MTT reduction rate than the L-Arginine treated group followed by untreated group. Lipid peroxidation was significantly ($P<0.05$) increased after freeze-thawing in untreated samples and decreased significantly ($P<0.05$) in spermine-NONOate (3.1170.08 nmoles/108 cells) and L-Arginine (3.5070.08 nmoles/108 cells) treated samples. L-Arginine and spermine-NONOate improved post-thaw spermatozoa motility and viability through the generation of nitric oxide which might play an important protective role against lipid peroxidation during freezing and thawing of the buffalo spermatozoa required for artificial insemination. In conclusion this study indicates that the L-Arginine and the spermine-NONOate play an important role in protecting the post-thaw spermatozoa motility, viability, membrane integrity and lipid peroxidation in the cryopreserved Murrah buffalo spermatozoa extended and cryopreserved either with L-Arginine (1mM) or spermine-NONOate (10 mM).

INTEGRATED DISEASE MANAGEMENT OF PIGEONPEA WILT**R. POORVASANDHYA, KOTA CHAKRAPANI, B. SINHA, PH. SOBITA DEVI****Department of Plant Pathology, College of Agriculture, CAU, Imphal**

Red gram (*Cajanus cajan* L.) a major pulse crop of tropical and sub-tropical countries. In India total area coverage and production of pigeonpea has been about 4.5 Mha and 4.2 MT respectively. Maharashtra contributed >27 per cent of area and 25 per cent of total production (2017-18). Pigeonpea suffers mainly from wilt disease caused by *Fusarium oxysporum* f. sp. *udum*. It is an important soil borne pathogenic fungi causing wilt disease in pigeonpea and imparts 30-100% yield loss. The seedling stage is more prone to wilt infection, but the visible symptoms mostly appear at different growth stages of host plants based on the severity of infection. Soil borne diseases are usually less severe on organic than on inorganic farms. A number of studies have shown that under drought conditions, crops in organic agriculture systems produce significantly and sustainably higher yields (often 7-90%) than comparable conventional agricultural crops. One of the best possible ways to reduce yield losses due to *Fusarium* wilt is to grow resistant varieties. Therefore, enhancement of resistance is a major challenge, which needs to be addressed on priority basis. Recent survey showed that effective disease control requires application of integrated disease management. Further, more than one strategy may be needed for tackling the pathogen. Integrated Disease Management (IDM) approach was carried out to combat pigeonpea wilt a combination of best fungicides, bio agents, organic amendments and different cropping systems.

Keywords: *Fusarium*, Wilt, Integrated Disease Management, Resistance.**INTEGRATED NUTRIENT MANAGEMENT IN VEGETABLE CROPS****PRIYANKA GURJAR¹ AND R. S. GURJAR²****¹Department of Horticulture, College of Agriculture, Gwalior ²BRAUSS Mhow Indore (M.P.)**

Population growth and urbanization are creating increased demand of food over and there is growing concern over malnutrition especially in semi urban areas. To meet the full dietary needs of common man to eliminate malnutrition deficiency diseases and to relieve overstress there is greater need of enhanced vegetable production. Among the various factors of production of vegetable crops, soil health is crucial factor. Nitrogen is a mobile nutrient both in the soil and within the plant. Hence, emphasis should be given during the crop duration of each vegetable that the number of split application and time of each application should be manipulated to achieve maximum utilization and minimum loss of the applied fertilizer. Tomato and onion depend more on applied nitrogen whereas the brinjal okra, French bean absorb more of soil, nitrogen recovery of applied nitrogen fertilizer range from 13.9 % in chilli to 44% in brinjal. The potassic fertilizers intermediate in mobility in the soil and usually applied along with the basal dose at sowing /planting. Plants take most of their potash requirement in the early stage of their growth. Phosphorus is relatively immobile in the soil hence it should be banded to minimize fixation.

Keywords: Vegetable, population growth, deficiency, fertilizer, nutrient management.

COROLLARY STUDY ON ENTREPRENEURIAL BEHAVIOR OF BEE KEEPING FARMERS

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Bee keeping entrepreneur is the most significant figure of economic activity and prime mover of development. The present study was conducted in surrounding area Morena city of Madhya Pradesh. From this list 200 bee keeping farmers were selected by random sampling method. The study revealed that majority 65.5 percent respondents had medium level of entrepreneurial behavior about bee keeping management practices. The entrepreneurial behavior was positively and significantly related with education, bee keeping experience, land holding, livestock possession, occupation, annual income, material possession, extension contact, economic motivation, market orientation, scientific orientation, attitude of bee keeping farmers towards bee keeping farming and knowledge of improved dairy management practices found to have positive and significant relationship with entrepreneurial behavior. Coefficient of determination R^2 was 0.978 which indicates that 97.00 percent variation in the entrepreneurial behavior of bee keeping farmers was explained by sixteen independent variables which were selected for study.

Keywords- Entrepreneurial behavior, Bee keeping farmers, Bee keeping management practices, Planning ability, Coordinating ability and Self-confidence.

EFFECT OF AZOLLA FERN FEEDING ON MILK PRODUCTION IN FIELD CONDITION

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A field trial was carried out in Jhunjhunu district of Rajasthan to access the effect of azolla fern feeding on milk production in field condition. Thirty lactating cross bred cows of almost same stage of lactation and from III to IV parity were selected for two consecutive years in a selected village. They were divided into three groups, having 10 in each group. First group was supplemented by 0.5 kg azolla fern / day (T_1), second group was supplemented by 1.0 kg azolla fern (T_2) for 60 days and third group served as control (Animal owners practice) [T_3]. Results of the trial revealed that the average milk production was 10.7, 11.6 and 10.2 liter / day for treatment T_1 , T_2 and T_3 , respectively. Treatment T_1 increases milk production 0.5 liter (4.9 %) per day and treatment T_2 increase 1.4 liter (13.7%) per day in comparison to control group (T_3). Treatment T_1 had significant effect on milk production in comparison to control group. Treatment T_2 had also significant effect on milk production over treatment T_1 and T_3 . The average fat content was 3.4, 3.7 and 3.3 percent in cross bred cow for treatment T_1 , T_2 and T_3 , respectively. Treatment T_1 had no significant effect on fat content over control group but the treatment T_2 had significant effect on fat content over treatment T_1 and T_3 . The net profit from sale of extra milk and more fat content was Rs. 09 and 39 with B: C ratio 1.8 and 3.9 for treatment T_1 , and T_2 respectively. It can be concluded that incorporation of azolla fern in milch cow feed gave better performance in increasing the milk production as well as increasing the fat content of milk.

TAMARIND – A POTENTIAL SPICE FOR VALUE ADDITION

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Tamarind is one of the most important and common trees of India. India is the chief producer and consumer of tamarind in the world. Post harvest loss of fresh tamarind is the most pressing problem of the processing industries in the country. Hence, value addition and product diversification are the main aspects for solving these problems. Due to perishable nature of the fruits, they require immediate processing to avoid post harvest losses. About 90 per cent of tamarind fruits are used as fresh and are hardly used for processing. Two products like tamarind sweetened sauce and tamarind chutney was developed. The sweetened sauce had 45.50°Bx, 31.00 %, 17.30%, 2.85, 0.29% and 0.25mg/100g of TSS, total sugar, reducing sugar, pH, acidity and vitamin C. The chutney had 35, 21.30, 10.80, 3.02, 0.30 and 0.26mg/100g of TSS, total sugar, reducing sugar, pH, acidity and vitamin C. The TSS, reducing sugar and pH of the products increased during the storage period while the total sugar, acidity, and vitamin C decreased. The organoleptic score of the chutney was more than the sweetened sauce and these characteristics showed a reduction during storage. There was a gradual increase in the bacterial and fungal population during the 120 days of storage.

EFFICACY OF ORGANIC MANURE AND SYSTEM OF RICE INTENSIFICATION (SRI) METHOD FOR GROWTH AND YIELD OF RICE UNDER CITRUS BASED AGROFORESTRY SYSTEM

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To find out the best organic manure for using of System of Rice Intensification (SRI) method is an important tool to obtain high growth and yield of rice under citrus based agroforestry system in Kharif season. Planting in college of Forestry SHUATS Allahabad UP India, an experiment was carried out in *kharif* seasons of 2017 in RBD design with three replications nine treatments. The results revealed that SRI recorded significantly higher values for all growth parameters, plant height cm, No of tillers hill⁻¹, leaf area index, flag leaf length cm, and Dry weight gm, was significantly Length of panicle (cm), Number of panicle per hill-land Test weight, was significantly. After harvesting time The result recorded the higher Grain yield (3.71 t/ha⁻¹), Straw yield (4.40 t/ha⁻¹) and Benefit cost ratio (B.C. ratio). 1:5.4 was in the treatment T₅ 75% RDN through FYM+ 25% RDN through PM. significantly. Rice under Citrus based agroforestry system, respectively.

Keywords: Rice, Organic manure SRI Method, citrus

EFFECT OF PHOSPHORUS, ZINC FERTILIZATION AND CUTTING MANAGEMENT ON GROWTH AND FODDER YIELD OF COWPEA

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A field experiment was carried out during *kharif* 2016 and 2017 on sandy loam soil at Agricultural Research Station, SKRAU, Bikaner to evaluate "Effect of phosphorus and zinc fertilization and cutting management on growth and fodder yield of cowpea. Bikaner is spread in large area and agricultural and livestock production are the main source of livelihood, therefore growing green fodder with high quality and productivity is the good scope for the area. The treatment comprised of three fertilizer dose (Control, 20 kg phosphorus + 5 kg zinc and 40 kg phosphorus + 10 kg zinc) as basal and five cutting management practices namely C₁= harvest for green fodder at 50% flowering, C₂= grain harvesting, C₃= green pod + green fodder harvesting, C₄= C₁+ re-growth green pod+ green fodder harvesting and C₅= C₁+ re-growth grain harvest. Total fifteen treatment combinations was laid out in factorial RBD and replicated thrice. The experimental field soil was sandy loam in texture with medium in fertility status having organic carbon 0.18% and available NPK content of 115, 24.6, 266 kg/ha, respectively with alkaline in reaction (PH 8.22) and EC 0.04 ds/m. The crop was grown adopting packages of practice for the agro-climatic zone-1c. Besides, phosphorus and zinc fertilizer and cutting management were done as per treatments. Two years pooled data shows that higher growth attributes namely number of branches per plant, L:S ratio, days to 50% flowering were recorded with fertilizing cowpea @ 20 kg phosphorus + 5 kg zinc which were higher by 26.10, 2.31 and 2.08 % over control, respectively. The maximum dry matter and dry fodder yield were recorded in 40 kg phosphorus + 10 kg zinc fertilized plot, being at par to lower dose but significantly higher to the tune of 9.95 and 9.88 % over control, respectively. The economical value computation (Rs ha⁻¹) was also found significantly higher with 20 kg phosphorus + 5 kg zinc fertilization treatment. Further, the highest DFY (49.34 q/ha) was recorded when cowpea crop harvested at 50% flowering followed re-growth + next harvesting for green pod + green fodder treatment (C₄) proved statically superior over rest treatments.

DEVELOPMENT OF AND PERFORMANCE EVALUATION OF AJWAIN SEED EXTRACTOR

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Spices seed extractor was developed to extract the seeds from ajwain flowers during 2016-19. The overall dimensions of developed spices seed extractor are 1665 × 580 × 40 mm which is operated by 2 hp single-phase electric motor. The developed spices seed extractor consist of feeding hopper, extraction unit, sieve/cleaning unit, main frame and power transmission system. Machine and operational parameters were optimized for ajwain seed extraction and cleaning. The performance of the developed extractor was studied on the basis of extraction efficiency, seed damage, cleaning efficiency, seed loss, germination and specific energy consumption. The optimized machine and operational parameters for ajwain seed extraction were found to be stud bolted type drum having rotational speed of 700 rpm and feed rate of 170 kg/h for maximum seed extraction efficiency and minimum seed loss. The optimized parameters for ajwain seed cleaning were found to be sieve unit slope of 12 degrees, stroke length of 3 mm and frequency of 550 strokes/min.

Keywords: Spices seed extractor, ajwain, extraction efficiency, seed damage, cleaning, efficiency, seed loss

FACTOR AFFECTING THE PARTICIPATION OF RURAL WOMEN IN AGRICULTURAL ACTIVITIES**R.S. GURJAR¹ AND PRIYANKA GURJAR²****1Department of Agriculture Extension Education and 2. Ph.D. Scholar Department of Horticulture****1BRAUSS Mhow Indore (M.P.), 2 RVSKVV, Gwalior, (M.P.)**

The present study was carried out in Morena, Morena and Joura blocks of Morena district of Madhya Pradesh. A simple random sampling procedure was followed in order to obtain the appropriate sample of rural women. The total sample size was 144. The dependent variable was participation of rural women in agricultural activities. The independent variables were relating to socio-personal, socio-economic, communicational and psychological traits of rural women such as caste, education, marital status, farming experience, annual income, occupation, economic status, land holding, extension participation, extension contact, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities. The data were collected by personal interview technique with the help of structured interview schedule. The data were analyzed using statistical methods such as correlation and regression analysis. The traits like education, farming experience, economic status, extension participation, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities exhibited positive and strong correlation with level of participation and occupation of the rural women also positively related with level of participation. About 85.92 per cent variation in the extent of participation of rural women in agricultural activities was explained by all the 16 traits taken into consideration. Education, farming experience, economic status, extension participation, source of information, mass media exposure, level of aspiration, scientific orientation, attitude towards agriculture and knowledge about agricultural activities significantly influenced the extent of participation of rural women in agricultural activities.

Keywords: Farm women; Participation; Information**EFFECT OF FYM, FERTILIZER AND MICROBIAL INOCULATION ON PRODUCTIVITY AND SOIL FERTILITY OF CHICKPEA IN VERTISOL****R.S. GURJAR¹ AND PRIYANKA GURJAR²****1BRAUSS Mhow Indore (M.P.) 2Department of Horticulture, College of Agriculture, Gwalior**

A field experiment was conducted during 2016-17 at Sakroli village Distt. Vidisha (M.P.) to study the "Effect of FYM fertilizer and Microbial inoculation on productivity and soil fertility of chickpea in Vertisol". The treatments comprises as 50% RDF, 50% RDF + FYM 5 t ha⁻¹, 75% RDF, 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer, 100% RDF. The application of 75% RDF + FYM 5 t ha⁻¹ + Bio-fertilizer significantly increased the growth parameters viz. plant height, branches per plant, dry weight, number of root nodules per plant over control. Application of 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer recorded significantly higher value of pods per plant, seeds per pod, seed yield per plant and seed index and it was at par with 100% RDF. Highest and significant seed and straw yield was recorded with 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer (1924 kg ha⁻¹ and 2050 kg ha⁻¹) followed by 100% RDF (1875 kg ha⁻¹ and 1998 kg ha⁻¹) while maximum net return as well as B: C ratio were associate with 75% RDF + FYM 5 t ha⁻¹ + bio-fertilizer during both the year of investigation.

Keywords: FYM, inorganic fertilizer, Bio fertilizer, growth, yield, chickpea**DEVELOPMENT AND EVALUATION OF BIOACTIVE COMPONENTS IN GUAVA TEA****R. VIJAYALAKSHMI *, AKILA. B., ARUNKUMAR, R. AND HEMALATHA, G.*****Dept. of Human Development and Family Studies, Community Science College and Research Institute, Tamil Nadu Agricultural University, Madurai**

Herbal teas and medicinal plant formulations are produces from green and dried herbs, flowers, fruits, leaves, seeds, barks and roots of medicinal plants and sold in a loose form or packed in bags. Guava leaves are rich sources tannins, polyphenolic compounds, flavonoids, ellagic acid, triterpenoids, guajaverin and quercetin. Matured guava leaves blanched in hot water and blended with supporting herbs such as coriander leaf and dry ginger along with activating herbs such as cinnamon/ orange peel/ lemongrass. The herbal tea blends were packed to conduct the shelf life studies under ambient temperature. The flavouring compounds present in the herbal tea blends were analyzed by GC-MS. The compounds n-Hexadecanoic acid, Caryophyllene, 1,6,10-Dodecatrien-3-ol, 3,7,11-trimethyl, (E) and 9,12,15-Octadecatienoic acid was predominantly found in the samples. The highest extraction efficiency was obtained from 3.61 g of tea blends infused at a temperature of 94.22°C for a time 225.95 seconds to attain maximum antioxidant activity of 85.19 mg AAE/ml. The initial moisture content of herbal tea blends were 5.22 % which had increased to the range of 5.33 % to 5.35 % after 180 days of storage period. The initial acidity and pH of herbal infusions were 0.54-0.56 and 5.33-5.53. A decreasing trend in total phenol content of herbal infusions was observed during storage. The maximum total phenol content was noted in T₁ (113.5 mg GAE/ml) which had decreased to 105.54 mg GAE/ml at the end of storage period. The total flavonoid content was found to be decreased at the end of 180 days of storage period. Among

developed herbal infusions the initial total flavonoid was in the range of 4.604 to 5.127 mg QE/ml which was declined to 3.92 to 4.51 mg QE/ml. During 180 days of storage period there was reduction in total antioxidant activity from 91.64 mg AAE/ml to 85.72 mg AAE/ml in cinnamon flavoured tea. When compared with commercial tea infusion the total antioxidant activity was maximum in the guava leaf herbal infusions.

PLANT DEFENCE RESPONSE AGAINST PATHOGENS

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Plants represent a rich source of nutrients for many organisms including bacteria, fungi, protists, insects, and vertebrates. Although lacking an immune system comparable to animals, plants have developed a stunning array of structural, chemical, and protein-based defenses designed to detect invading organisms and stop them before they are able to cause extensive damage. Plants have an innate immunity system to defend themselves against pathogens. With the primary immune system, plants recognize microbe-associated molecular patterns (MAMPs) of potential pathogens through pattern recognition receptors (PRRs) that mediate a basal defense response. Necrotrophs with a broad host range secrete toxins that act on metabolic targets common to many plants. In contrast, the pathogenic ability of necrotrophs that release host-specific toxins is conditioned by the gene that encodes the ability to produce the toxin and by a gene in susceptible cultivars of the host that encodes sensitivity to that toxin. Hostspecific necrotrophs usually form a pathogenic race or pathotype structure where some races can attack some cultivars within a species but not others. If the gene that conditions sensitivity to a particular host-specific toxin is absent from a cultivar, that cultivar will be resistant to the disease caused by that pathogen

Keywords: Host, Pathogen, Defence, Necrotroph

MECHANISM OF PLANT PATHOGEN INTERACTION DURING DISEASE DEVELOPMENT

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Phytopathogen infection leads to changes in secondary metabolism based on the induction of defence programmes as well as to changes in primary metabolism which affect growth and development of the plant. Plant resistance to pathogens requires the activation of complex [metabolic pathways](#) in the infected cells, aimed at recognizing pathogen presence and hindering its propagation within [plant tissues](#). The production of reactive oxygen species (ROS) is a key event in HR. Several enzymatic systems have been proposed to be responsible for the [oxidative burst](#) characterizing HR. In spite of this both compatible and incompatible responses induce alterations in [plant metabolism](#), only in the latter the plant is able to efficiently block pathogen penetration without suffering excessive damage. In an incompatible interaction (host resistant), early concomitant accumulation of phenylalanine ammonia-lyase and chalcone synthase mRNAs, localized mainly but not entirely in tissue adjacent to the site of infection, was observed prior to the onset of phytoalexin accumulation and expression of localized, hypersensitive resistance. In contrast, in a compatible interaction (host susceptible) there was no early accumulation of these transcripts; instead, there was a delayed widespread response associated with phytoalexin accumulation during attempted lesion limitation.

Keywords: Pathogen, plant defence, interaction, hypersensitive response

AGRI-BUSINESS IS A NOTABLE SECTION OF PASTORAL REGION FOR AGRICULTURALIST

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India is the country of village's because more than seventy percent people lives in village and dependent on agriculture for serving their life. Thus an endeavor to eradicate poverty and the social upliftment of the nation cannot be visualized/ confirmed without reinforcement the Indian agriculture. Agriculture also produces raw material to sustenance various agro based businesses and subsidiary businesses including dairy, textile, food and pharmaceuticals. Agriculture activities are to be made more competitive with the input of modern technologies and value additions. It is in this situation that agriculture has to be assumed as an agribusiness activity. Agri-business has become well recognized word globally. Agri-business can be fragmented into three economically code pendent sectors, that is, the input sector, the farm sector and the product sector. in which input sector offers deliveries of inputs which include seed, fertilizer, chemicals, machinery, fuel and feed, etc to agriculturalists for production of crops and raising livestock, farm sector produces crops and animal or livestock products. And the product sector processes and allocates the crops and livestock products to the final clients. Hence agri-business is avital sector of economy wherein production and distribution of inputs to farmers, and production, marketing, processing & distribution of farm products to final clients take place.

Keyword: Agri-business, farmers, inputs, sectors, villages, product

ULTRASOUND ASSISTED EXTRACTION OF DYE FROM WALNUT HULL**RAHUL SINGH, P K OMRE**¹*Dept. of Post-Harvest Process and Food Engineering, GBPUAT, Pantnagar, UK*

The study was carried out to extract the dye from walnut hull using ultrasound assisted extraction. Box-Behnken Experimental design of Response Surface Methodology (RSM) was used in this research for designing experiments and selecting parameters. Power (60,80 and 100 %), sonication time (10, 20 and 30 minutes), solid solvent volume (1:20,1:30 and 1:40 ml) and particle size (150,300 and 450 µm) were selected as the independent variable, whereas sonication frequency (20Hz) sample weight (15g) were kept constant. This research work was basically done to study the optimized parameters on the basis of dye yield, which was the dependent parameter. The data from all the experiments were analyzed using Design Expert 9.0.6.2 and the response functions were developed using multiple regression analysis and second order model was fitted for each response. It was found that power, particle size and solid solvent volume had highly noteworthy consequence on dye yield.

Keywords: walnut hull, ultrasound, extraction, dye**NEW AGE AGRICULTURAL TOOLS THAT UTILIZES ICT SYSTEM****RAHUL SINGH CHOWHAN^{*1}, PURVA DAYYA², DASHRATH SINGH CHUNDAWAT³, ANUPAMA⁴**¹ DEE, AU, Jodhpur ²Phd Scholar, MPUAT Udaipur, ³ AU Jodhpur ⁴Phd Scholar, Horticulture, AU Jodhpur

ICT introduces the employment of computer technology in agriculture. ICT and agriculture conjointly coined a brand new term known as E-agriculture. E-agriculture is increasing its approach in existence of farmers. We are able to see farmer's exploitation of smart phones and apps, they make use of Whatsapp and Facebook for contacting agriculture mortal to raise suggestions. ICT will increase our operating potency in field by exploiting technological gadgets like GPS armed Tractors, Geo-fencing fortification, remote sensing for pests management, automatic milking machine and many other similar tech-friendly gadgets on the field. The coming farming is extremely captivated with info technology and that extends its national and international boundaries. ICT in agriculture provides wide selection of answer for numerous issues in agriculture with help of many expert systems and decision support systems. ICT uses mobiles devices, services, networks and their application to unravel our issues in agriculture exploitation call network, soil data system and skilled systems. These forms of systems are autonomous and work on basis of model base and databases by process queries of farmers and providing acceptable solutions. There are traditional ICT technologies like radio, TV and satellite communication that are still enjoying an important role for info dissemination. E-agriculture continuous to evolve as applications of ICT comes into markets. In agriculture price chain, E-agriculture system plays an important role as different kinds of ICT have completely different strengths and weaknesses once apply to specific intervention. ICT plays a very important role in farmer's life however there are several barriers in wide reach of ICT to villages that principally contains lack of information, low education level, impoverishment and alternative influencing factors. Several rural farmers don't have access to ICT tools either due to lack of convenience of facility or lack of information. That's why system of E-agriculture encompasses trainings, workshop, tech-melas, e-choupal etc for rural farmers.

Keywords: ICT, E-choupal, Geo- fencing, GPS, Remote Sensing**APPROACHES TO REDUCING POST HARVEST LOSSES IN HORTICULTURAL CROPS****RAJ BALA CHOUDHARY AND VIRENDRA KUMAR****Sri Karan Narendra Agriculture University, Jobner- 303329, Rajasthan (India)**

That weight of wholesome edible product that is normally consumed by human and that has been harvested by human action with intention of using it for feeding but which for any reasons fails to be consumed by human. Post-harvest losses (PHL) in horticultural crops are estimated to range from 20-40 per cent in India and these losses can assume considerable economic and social importance. All fresh horticultural produce are high in water content and are subjected to desiccation (wilting & shrivelling) and to mechanical injury. That's why these perishable commodities need very careful handling at every stage so that deterioration of produce is restricted as much as possible during the period between harvest and consumption. Post harvest management of fresh produce includes a series of operations viz; washing, pre-cooling, pre-sorting, grading, waxing, hot water treatment, VHT, chemical treatment, irradiation, packaging, labelling and storage carried out after harvesting in course of rendering the produce available to consumer. Post harvest process differ among crops, and some crops do not require all stages listed to maintain quality of produce. Proper post harvest management has its role in making the produce better available for processing, export, marketing while restoring quality parameters. A grower who can meet these challenges, will be able to expand his or her marketing opportunities and be better able to compete in the marketplace.

Key words: Horticultural Crops, Perishable, PHL, Quality etc.

EFFECT OF ALOE VERA (*ALOE BARBADENSIS*) SUPPLEMENTATION ON PRODUCTION INDICES AND MORTALITY OF BROILER CHICKEN***RAJ KUMAR, ¹P.K. SINGH AND ²DEEPAK SINGH*****Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut-250110****¹Department of Animal Husbandry and Dairying, R.B.S. College, Bichpuri, Agra-283105, India**

The present study investigated the effect of dietary supplementation of three physical forms of aloe vera viz. powder, gel and juice on the energy efficiency (EE), protein efficiency (PE), performance index (PI), production number (PN) and mortality pattern of broiler chicken. Two hundred and forty day old unsexed broiler chicks (Cobb 400) were distributed in four groups with four replicates, each consisting of fifteen chicks on a completely randomized design. The treatments included the control (T1- basal diet as per BIS 2007) and three groups with basal diet mixed with aloe vera powder @ 0.5% in feed (T2), gel @ 2% in feed (T3) and fresh aloe vera juice @ 2% in drinking water (T4), respectively. The results revealed that PE and EE were significantly ($p < 0.05$) different during last week among T2 and T3 groups as compared to control group. Values of PI and PN showed non-significant results among treatment groups. Mortality recorded was within standard limits which showed that there was no detrimental effect of aloe vera supplementation on health and performance of broilers. The cost of production calculated at the end of experiment revealed that net profit on drawn weight (/kg) was 3.96 (powder form), 7.39 (gel form) and 8.77 (juice form) as compared to control group (basal diet only). Thus, aloe vera can act as an efficient, effective and economical herbal feed additive in broiler industry. Aloe vera (*Aloe barbadensis*) an important and traditional medicinal plant belonging to the family Liliaceae. It is indigenous to Africa and Mediterranean countries. Extracts of Aloe vera is a proven skin healer. Aloe vera help to soothe skin injuries affected by burning, skin irritations, cuts and insect bites, and its bactericidal properties relieve itching and skin swellings

ARSENIC HOT SPOT IN GROUND WATER UNDER WATER MANAGEMENT IN INDIA**RAJ KUMAR,* DURGESH KUMAR,* SANDEEP KUMAR**, GIRISH GOYAL******Department of Soil conservation and Water Management*, Department of Agronomy*, C.S.A. University of Agriculture and Technology Kanpur, UP**

Water is taking centre stage due to the increasing social & environmental needs, industrialization, pollutions and over extraction of ground water. The climate change impact is likely to exacerbate the situation. Burgeoning competition for water among domestic, agriculture industry and environmental needs calls for cooperation amongst the stake holders for sustainable development of this precious natural resource. Arsenic is a naturally occurring trace element found in rocks, soils and the water in contact with them. Arsenic has been recognized as a toxic element and is considered a human health hazard. The occurrence of Arsenic in ground water was first reported in 1980 in West Bengal in India. In West Bengal, 79 blocks in 8 districts have Arsenic beyond the permissible limit of 0.05 mg/l. The most affected areas are on the eastern side of Bhagirathi River in the districts of Malda, Murshidabad, Nadia, North 24 Parganas and South 24 Parganas and western side of the districts of Howrah, Hugli and Bardhaman. The occurrence of Arsenic in ground water is mainly in the aquifers up to 100 m depth. The deeper aquifers are free from Arsenic contamination. Apart from West Bengal, Arsenic contamination in ground water has been found in the states of Assam, Bihar, Chattisgarh, Haryana, Jharkhand, Karnataka, Punjab, Uttar Pradesh, West Bengal. The occurrence of Arsenic in the states of Bihar, West Bengal and Uttar Pradesh is in alluvial formations but in the state of Chhattisgarh, it is in the volcanic rocks exclusively confined to N-S trending Dongargarh Kotri ancient rift zone. It has also been reported in Golaghat, Jorhat, Lakhimpur, Nagaon, Nalbari, Sibsagar, Sonitpur district of Assam. The Arsenic hot spots (Hot spots are locations where the arsenic concentration in ground water sample is more than the permissible limit of BIS, 0.01 mg/ L) in India. The data on arsenic concentration in water samples mostly collected from the groundwater observation wells/ hand pumps. Arsenic contaminated areas have been shown as points based on analytical results of Central Ground Water Board. Arsenic has been reported in the range 0.01 to 0.05 mg/ litre and more than 0.05 mg/ Liter respectively.

Keywords: Central Ground Water Board (CGWB), biodiversity conservation and management**SUITABLE HORTICULTURAL CROPS FOR POLYHOUSE FARMING AND THEIR SEASONAL ROTATIONS FOR PROFITABLE FARMING****RAJ KUMAR JAKHAR****Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh**

Horticulture-based farming systems are highly diverse numbering more than 300 species, depending upon the climate, season, size of landholdings and market etc. Being high value crops with higher nutritional contents, besides with a higher demand in urban and peri-urban areas, horticultural crops provide a paradise for the progressive grower on one end and marginal farmer. Among flower crops, Rose, gerbera, liliun, tulip, anthurium, carnations, orchids, chrysanthemum and their nursery. Polyhouse flower crops like rose, gerbera, liliun, tulip, anthurium, carnations, orchids, chrysanthemum and their nursery are mostly annual or perennial crops and hence seasonal crop rotations are not required. Most of these cut flowers required round the year as per market

demand can be cut. Floriculture crops are highly remunerative as the quality, colour and shelf-life as well as freshness is very important and can give annual returns of 8-10 times more than the open field conditions. They are also more important from export perspective, so critically important in the country. Floriculture industry is led by produce from polyhouse growers mainly in Europe and developed nations. Thus, floriculture can ensure more income which in turn promotes better livelihood and nutritional security of farming families undertaking horticulture-based farming.

RAJASTHAN- NAME OF THE UNIQUE TASTE

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Rajasthani cuisine was influenced by both the war-like lifestyles of its inhabitants and the availability of ingredients in this arid region. Food that could last for several days and could be eaten without heating was preferred. Scarcity of water and fresh green vegetables have all had their effect on the cooking. It is also known for its snacks like Bikaneri Bhujia, Mirchi Bada and Pyaa Kachori. Other famous dishes include *Bajre ki roti* (millet bread) and *Lashun ki chutney* (hot garlic paste), *Mawa Kachori* from jodhpur, Alwar ka mawa, *Malpauas* from pushkar and Rassgollas from Bikaner, "paniya" and "gheriya" from Mewar. Originating for the Marwar region of the state is the concept Marwari Bhojnalaya, or vegetarian restaurants, today found in many part of India, which offer vegetarian food of the Marwari people

Keyword: Arid region life Style, Rajasthani cuisine etc.

CONSERVATION OF INDIGENOUS RICE VARIETIES FOR UTILIZATION IN ORGANIC AGRICULTURE

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North-east India as well as Assam is traditionally a rice growing area. At present, rice occupies about two-third of the total cropped area in the state. Due to the diversity in the soil and climatic conditions several indigenous rice varieties are found in this region which can be utilized in a sustainable manner. The local/ indigenous varieties have been grown in the state since time immemorial and by now most of them are getting lost due to the advent of hybrids and high yielding varieties. Conservation of such varieties is essential as they can be grown with minimum possible input and have a considerable demand in local and international market due to their nutraceutical benefits. Moreover, these local varieties are very suitable for the organic farming as they require little or no inputs. A study was done in three diverse villages of North-east India to identify potential varieties which can be grown in the organic plots and hence provide high incomes to the farmers. Many local varieties are cultivated in these villages with no fertilizer input and out of these, varieties Malbhog, Neuli, Mabok and Lesim were found to be producing yields which are at par with the popular high yielding varieties of the region. Since organic agriculture has surfaced again in the scenario, we can utilize these local varieties in organic farming conditions which will benefit the farmers as well as the consumers. These local/indigenous varieties also have many desirable medicinal properties as well that can meet the consumer preference and market demand among the local and international markets if produced commercially.

LIGHT MANAGEMENT STRATEGIES FOR COMMERCIAL HORTICULTURE

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Light is radiant energy, usually referring to [electromagnetic radiation](#). It plays a major role in the growth and development of plants in various physiological and morphological aspects. The part of light which plants can sense is called as Photosynthetically Active Radiation (PAR). Sensing the light by plants is possible by photoreceptor proteins *i.e.*, Phytochrome and Cryptochrome which absorb red and blue wavelengths of visible spectrum respectively that operate many functions of plants. Meanwhile, there are many problems regarding the light availability in both fields and under protected cultivation due to various reasons. To overcome these problems there are some new approaches for light quality and intensity manipulation viz. are strategies like reflective ground films, photoselective nets, and artificial light (LED light) sources etc. for obtaining higher productivity as well as desired crop specific qualities. Thus, artificial light management strategies can be used for improving quality and yield of various horticultural crops (Folta and Childers, 2008). Various workers have been using these technology in different horticultural crops such as peach (Layne and Rushing, 1999), strawberry (Takeda *et al.*, 2010) and Peas (Wu *et al.*, 2007) etc. and they were found significant results regarding the fruit quality, flowering and vegetative growth respectively. To meet the increasing quality food requirements from limited land resources, keeping the problems of climate change, increasing population in mind there is an urgent need to focus on the smarter technologies like managing light environment both on farm and under protected cultivation for round the year quality fruit production on commercial scale. The light management strategies way resolved synergistically with PGR and other cultural operations.

PRODUCTION PERFORMANCE OF PEARL VARIETY OF GUINEA FOWL IN UTTARAKHAND**RAJAT VERMA, BRIJESH SINGH, PANKAJ PATEL, ARUN KUMAR, RASHMI SAINI, VIJAY AMRIT RAJ PANWAR AND SURYA PRATAP SINGH CHAUHAN****Department of Livestock Production Management, C. V. A. Sc., GBPUAT, Pantnagar-263145, Uttarakhand**

Guinea fowl (*Numida meleagris*) is one of the most important poultry enterprises in low income and poor resourced communities. The Pearl variety is the most common. Growth is often measured as live weight gain per unit time. Live weight could be a useful measure of growth as it is highly predictive of the amount of desirable edible products such as muscles. Live weight is one of the important factors directly related to the profitability of guinea farming, as because the efficiency of reproduction and market price of birds (as meat purpose) are determined by the body weight. Present study was aim to assess the growth performance of pearl variety of guinea fowl. On the basis of these parameter i.e. feed intake, body weight gain and feed conversion ratio. We found that during starter period (1-4 week), grower period (5-8week) and finisher period (9-12 week) the feed intake is 407.35 gm, 1268.61 gm and 1802.23 gm, Body weight gain is 210.52 gm, 391.30 gm and 432.29 gm, FCR is 1.93, 3.24 and 4.16, respectively and overall (1-12 week) feed intake 3478.19 gm, body weight gain 1034.12gm and FCR 3.36. On the basis of this result the pearl variety of guinea fowl has higher body weight gain in finisher period.

EFFECT OF GENOTYPES ON UN-GERMINATED SEEDS IN STORAGE IN RICE**¹RAJBIR SINGH AND ²KARUNA VISHUNAVAT****¹Depeartment of Plant Pathology, Gochar Mahavidyalaya, Rampur Maniharan, Saharanpur-247451 (UP), India****²Department of Plant Pathology, G.B. Pant University of Agriculture and Technology, Pantnagar -263145 (Uttarakhand)**

This study was undertaken to know the effect of different genotypes (CMS 58025 A, CMS 58025 B, IR-66, KMR-3 and Pant Dhan 11) on per cent un-germinated seeds in rice at different storage period (January to May). It has been observed that in irrespective of all the genotypes the minimum percentage of un-germinated seeds was in genotype KMR-3, while the maximum percentage of un-germinated seeds has been recorded in CMS 58025 A and CMS 58025 B at all the storage period.

RICE RESIDUE MANAGEMENT: OPTION FOR ENHANCING SOIL HEALTH AND SUSTAINABLE CROP PRODUCTION IN NORTHERN STATES OF INDIA**RAJBIR SINGH KHEDWAL^{1*}, JAYESH SINGH² AND ANU KALIA³****¹Department of Agronomy, Punjab Agricultural University, Ludhiana-141004, Punjab, India****²Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana-141004, Punjab, India****³Department of Soil Science, Punjab Agricultural University, Ludhiana-141004, Punjab, India**

Rice residue is an important natural resource; but its availability in huge amount poses a major problem in its successful management. Management options for residue are burning, incorporation, surface retention and mulching, biochar, baling and removing the straw and utilizing as an energy source. Despite some advantages like killing of deleterious pests and clearing the piles before wheat planting, burning results in huge loss of organic matter and precious nutrients, deterioration in the quality of air, and increased emission of greenhouse gases. The loss of soil organic matter (SOM) is one of the recognized threats to sustainability. Residue management practices affect soil physico-chemical properties viz. soil moisture, temperature, aggregate formation, bulk density, hydraulic conductivity, pH, EC, OC, N, P, K and micronutrients. Crop residues are highly siliceous, and have the potential of transforming electrochemical properties of acidic soils that reduces P fixation; improving base retention and increasing the soil pH. Residue incorporation results in more microbial activity than residue removal or burning. Thus, if residues are managed properly, then it increases soil properties, weed suppression, less use of water and may allow use of normal zero-till machine for timely sowing of wheat into combined harvested rice fields and avoid *in situ* burning of rice straw. It also contributes towards the sustainable wheat production and can help in tackling the increasing release of carbon in the air due to burning in northern states of India.

Keywords: Conservation tillage, microbes, rice residue, soil health, wheat

EFFICACY OF THIAMETHOXAM 30% FS AS SEED TREATMENT AGAINST TERMITES IN BENGAL GRAM**RAJENDRA SINGH¹, S. K. SACHAN¹, JAYESH SACHAN¹, DEEPAK KUMAR¹, NIRVESH SINGH² AND RISHIPAL¹, JOGINDER SINGH³ AND ANANT KUMAR⁴****¹Department of Entomology, SVP University of Agriculture and Technology, Meerut, UP, ²Department of Entomology, CSAUAT, Kanpur, UP, ³Department of Horticulture, J. V. College, Baraut, Baghpat, UP, ⁴KVK, Ghaziabad, SVP University of Agriculture and Technology, Meerut, UP**

A field experiment on “Efficacy of Thiamethoxam 30% FS as seed treatment against Termites in Bengal gram” was carried out at CRC Cherodi Farm, SVPUA&T, Meerut (UP), for two consecutive years of 2010-11 and 2011-12. The experiment was laid out in

a Randomized block design with seven treatments with three replications. Gram was var. Vallbhakalar was used during both the experimental years. The crop was grown as per agronomic practice recommended by the university.

Thiamethoxam 30% FS @ 0.60 & 0.75 g.a.i /kg of seed (product wise 2.0 & 2.5 ml /kg of seeds) as seed treatment were found significantly superior over untreated check and market standard treatments against termites. Also these treatments recorded significantly higher yield as compared to all other treatments tested. All the tested doses of thiamethoxam 30% FS did not cause any phytotoxicity symptom on Bengal gram crop even when tested at higher dose of 1.5 g.a.i./kg seed (5.0 ml/kg seed). All the tested doses of thiamethoxam 30% FS as seed treatment were found safe to Bengal gram and beneficial insects (natural enemies)

PROSPECTS, CONSTRAINTS AND POSSIBILITY OF DATE PALM IN THAR DESERT OF RAJASTHAN

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Date palm (*Phoenix dactylifera*) also known as *khajoor* is an important fruit tree of semi arid and arid regions. It grows well under poor and light texture desert soils due to its hardy plant characteristics and deep root system. It is one of the most important fruit trees for saline water and extreme temperature condition viz. low and high temperature. It needed dry hot climate for growth and development of fruits. The major date growing areas in India are Kutch region (Gujarat), western Rajasthan and certain parts of Punjab, Haryana as well as Tamil Nadu to some extent. In Rajasthan it is cultivated in the district Bikaner, Jaisalmer, Sriganganagar, Hanumangarh, Barmer, Jodhpur and Nagaur etc in some areas. In Rajasthan, the areas of date palm are increasing day by day due to subsidy provided by Government of Rajasthan on tissue culture plant in desert districts of state. At present 833.5 hectares area are covered under date palm plantation in the Rajasthan. Halawy, Barhee, Khadrawy, Khuneizi and Khalas are eaten as fresh and Medjool are used for preparing *Chuhara*. The major constraints in expansion of date palm area in our country is quality planting materials, high irrigation requirements, rainfall during maturity time, unavailability of quality pollen grains, damage by birds etc. Date palm crop has industrial significance and many processed products like Chuhara, pind, jam, beverages, wine, etc. Seed is also used for animal, fish and poultry feed, besides oil extraction.

EXTRACELLULAR ENZYMATIC ACTIVITIES OF ENDOPHYTIC BACTERIA ISOLATED FROM GREEN GRAM

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The term “endophytes” includes a family of microorganisms that grow intra-and/or intercellularly in the tissues of higher plants without any symptoms on the plants in which they reside. Endophytic bacteria have been found in virtually every plant studied, where they colonize the internal tissues of their host plant and can form a range of different relationships including symbiotic, mutualistic, commensalistic and trophobiotic. Most endophytes appear to originate from the rhizosphere or phyllosphere. Endophytic bacteria can promote plant growth and yield and can act as biocontrol agents. Endophytes can also be beneficial to their host by producing a range of natural products that could be harnessed for potential use in medicine, agriculture or industry. In this work ten different bacterial strains were isolated from seven different varieties of green gram. Isolated endophytic bacteria were screened qualitatively and quantitatively for production of extracellular enzymes such as amylase, protease, cellulase and lipase. Out of the ten bacteria screened KHDEB5 showed highest production of amylase as well as cellulase enzyme i.e. 0.32U/ml and 0.021U/ml respectively, productivity of protease and lipase was highest in KHDEB4 (15U/ml and 0.83 U/ml respectively). The strong enzymatic activities of the endophytic extracts shows a high potential for developing the potential biotechnological applications of endophytes for improving phytoremediation and the sustainable production of nonfood crops for biomass and biofuel production.

Keywords: Endophytic bacteria, extracellular enzymes, green gram

REVIEW OF MEDICINAL AND AROMATIC PLANTS

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India is rich in medicinal and aromatic plants covering an extensive area with different environmental conditions. The geographical position of India, its geomorphology, the presence of flora of past geological eras and the coexistence and interplay of biotic and non-biotic factors have defined it as a region of high plant diversity and endemism, a fact that also impacts the category of medicinal and aromatic plants (MAPs). Man found that a plant which is astringent in taste will arrest diarrhoea, a plant which is acid to taste will control vomiting and a plant which is aromatic will control nausea. In the olden days indigenous medicine had attained a very high standard, and we have stalwarts in Ayurveda, Siddha, Unani, Allopathy and Homeopathy. After some decades there is a shift within many developing countries from subsistence to commercial usage. In India, MAP's play an

important role in the country's agricultural profile due to quantitative and qualitative advantages. MAPs cultivation can help small-scale farmers to strengthen their livelihoods and as a result, greater access to a wider range of assets can be achieved, and a capacity to build these into successful and sustainable activities. Various parts of these annuals, biennials and perennial plants have been used as medicines, perfumes, and food. A total of 118 ecosystems are found in Nepal and 10,091 species of plants has been documented which include 5884 species of flowering plants. About 700 of the total plant species reported constitutes medicinal properties, of which 238 plants species have been chemically tested for their medicinal importance.

Keywords: MAP's, Sustainability, flora, agriculture, uses, benefits, biodiversity

STUDY OF GENETIC PARAMETERS IN SESAME GENOTYPES

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Sesame is the sixth most important oilseed crop in the world after soybean, rapeseed, cottonseed, sunflower and groundnut. India is the world leader in the area and production of sesame. In India, It is grown in marginal and sub-marginal lands to an altitude of 1200 meters, about 500 mm rainfall and with temperature requirement about 25-27° C. It is grown as rain fed crop mainly in the states of Gujarat, West Bengal, Uttar Pradesh, Rajasthan, Madhya Pradesh, Andhra Pradesh, Maharashtra, Tamilnadu, Odisha and Karnataka, which account for more than 96% of the total area and production. In the present experiment various genetic parameters like variability, heritability and genetic advance was studied. Ten sesame genotypes in three replications were evaluated at research farm of Agriculture College, Ganjbasoda during *kharif* 2017. Observations were recorded for nine characters viz. plant height, days to 50% flowering, number of primary branches, days to maturity, length of capsule, number of capsules /plant, number of seeds/ capsule, 1000- grain weight and seed yield/plant. Analysis of variance showed significant differences among all the genotypes for all the characters under study. High broad sense heritability was observed for all the characters studied. Moderate genetic advance was reported for plant height, number of capsules per plant and number of seeds per plant.

SPENT MUSHROOM SUBSTRATE OF LENTINULA EDODES: A POTENTIAL SUBSTRATE FOR LIGNOCELLULOLYTIC ENZYMES

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Lentinula edodes also known as the edible shiitake mushroom is the most widely cultivated mushroom because of the exotic taste and medicinal quality. *L. edodes* degrades individual components of lignocellulose, i.e. lignin, cellulose and hemicellulose, by secreting an array of oxidative and hydrolytic enzymes. In this experiment a lignocellulosic wastes known as “spent mushroom substrate” after cultivation of *L. edodes* on different substrates were processed for study of lignocellulolytic enzymes. Spent Mushroom Substrate (SMS) was appraised for its potential as a lignocellulosic waste source for extraction of various lignin and cellulose degrading enzymes. Saw dust of *Mangifera indica*, *Toona ciliata*, *Bombax ceiba* and *Populus alba* plants were mixed with wheat bran, calcium sulphate and used for cultivation of *L. edodes*. Activity of Lignocellulolytic enzymes (Oxidative & Hydrolytic) produced by *L. edodes* before and after cold treatment was studied. The increased in activity of enzymes was recorded after cold treatment. Among oxidative enzymes i.e. laccase, LiP (lignin peroxidase) and MnP (Manganese peroxidase), the maximum specific activity of manganese peroxidase was observed in samples taken before and after cold treatments. The highest MnP activity was recorded in SMS of *Toona ciliata* i.e. 6.86 U/mg of protein (after cold treatment) and 6.81 U/mg of protein (before cold treatment). Maximum laccase activity was recorded in SMS of *Bombax ceiba* i.e. 2.57 U/mg of protein (after cold treatment) and 0.13 U/mg of protein (before cold treatment). No, LiP activity was recorded in SMS's of *L. edodes*. In case of hydrolytic enzymes (cellulase and xylanase), maximum activity of xylanase was recorded compared to cellulase. Among all substrates, SMS of *Mangifera indica* has shown maximum xylanase activity, 0.52 U/mg of protein (before cold treatment) and 0.58 U/mg of protein (after cold treatment). According to these results; the spent mushroom substrate of *L. edodes* can be a cheapest expedient substrate for maximum lignocellulolytic enzymes recovery. These enzymes can be used for many biotechnological and industrial processes.

CLIMATE CHANGE AND RESILIENCE IN FRUIT CROPS

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India is the second largest producer of fruit plants after China. Mango, banana, citrus, guava, grape, pineapple, and apple are the major fruit plants grown in India. Change of climate which is ascribed directly or indirectly to human action that changes the composition of global atmosphere and which is in addition to natural climate changeability observed over comparable time period. The Earth's climate has been shifting rapidly and these are thought to be mostly man-made. Global mean temperatures increased by 0.74°C during last 100 years and best estimates predict that the global annual mean temperatures will increase in the

range of 1.8–4°C by the year 2100 that escalates variability and enhance frequency of extreme weather events such as heat waves, cold waves, droughts and floods. Now it can be established as in overall climate change will have a negative effect on Indian agriculture, through varying by season and region. If the tree might itself be left standing, there are risks of production losses. The knowledge gaps in terms of tropical fruit trees and climate change need to be urgently addressed for building climate resilient agriculture systems that also mitigate climate change. Climate modelling and GIS can help match fruit trees to probable future climate scenarios and open up avenues for production in new areas. Being a recurrent crop that can stay productive for decades and in the process sequester carbon, commercial fruit tree orchards, field gene banks and fruit trees in home gardens, can be options for using both agricultural and degraded lands for carbon sequestration. Since the trees continue to provide mitigation services, even while suffering production losses, they also fulfil the additionally criterion of carbon financing. Thus, climate change is likely to affect growth and development of many fruit crops in the tropics and sub-tropics. To mitigate the damage caused, information on specific climatic conditions and interactions needs to be generated.

Keyword: climate, global, change, tree, mitigate, sequestration

SOIL CONSERVATION THROUGH SUSTAINABLE AGRICULTURE AND HORTICULTURE

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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. A sequel to the deforestation is typically large scale erosion, loss of soil nutrients and sometimes total desertification. Techniques for improved soil conservation include crop rotation, cover crops, conservation tillage and planted windbreaks and affect both erosion and fertility. When plants, especially trees, die, they decay and become part of the soil. Farmers have practiced soil conservation for millennia. Political and economic action is further required to solve the erosion problem. A simple governance hurdle concerns how we name and value the land and what we call it and this can be changed by cultural adaptation and Sustainable agriculture is farming in sustainable ways based on an understanding of ecosystem services, the study of relationships between organisms and their environment. It has been defined as "an integrated system of plant and animal production practices having a site-specific application that will last over the long term", for example to: Satisfy human food and fiber needs, Enhance environmental quality and the natural resource base upon which the agricultural economy depends, Make the most efficient use of non-renewable resources and on-farm resources and integrate, where appropriate, natural biological cycles and controls, Sustain the economic viability of farm operations, Enhance the quality of life for farmers and society as a whole.

Keywords: Soil, agriculture, horticulture, resources, productivity.

BENEFICIAL ROLE OF SILICON ON INSECT, PEST AND DISEASE RESISTANCE IN RICE (*ORYZA SATIVA*.L).

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The use of plant resistance inducers is considered an environmentally friendly strategy to efficiently decrease insect pest populations. In addition to acting as a mechanical barrier, Si can reduce pest damage by enhancing the induced chemical defences of plants following insect attack. Silicon acts as an abiotic elicitor of systemic stress signals, mediated by phytohormone pathways, leading to the efficient synthesis of defensive compounds. . The common phytohormones salicylic acid (SA), jasmonic acid (JA) and ethylene play primary roles in orchestrating plant defence responses . JA is suggested to regulate defences against both cell-content-feeding and tissue-chewing insects . Defence against phloem-feeding insects is regulated by both SA and JA signals . Interestingly, evidence for the strong interaction between Si and JA against insects is accumulating , this being considered a possible mechanism by which Si enhances resistance to insect pests. Moreover, Si-induced resistance could also be expressed by priming the host plant to defend itself against insect pests attack. Chewing insects are more susceptible to Si physical barriers than are phloem feeders, as the latter may be able to avoid the phytoliths but we cannot dismiss the possibility that plant tissue injury resulting from the feeding itself may trigger the battery of Si-induced plant responses. Further studies are therefore required to explore: Si-mediated resistance to insect pests in non-Si-accumulating plant species, both mechanical and biochemical mechanisms of insect pest resistance and the correlation between constitutive and induced resistance in which Si plays a role. Silicon, with all its remarkable protective plant defence effects, could be an eco-friendly alternative to conventional pesticides in IPM in agriculture.

A PHARMACOGNOSTIC STUDY OF *VITEX NEGUNDO* LINN. *ANDRICINUS COMMUNIS* LINN. LEAF COLLECTED FROM ECO-FRIENDLY AND NON ECO-ECOFRIENDLY ZONE OF HARIDWAR DISTRICT.**RAM KHILARI BAIRWA¹, BHUMIKAVARSHNEY², KARAN SINGH³, RUCHI SINGH^{4*}****Department of Medicinal Plants' Sciences, School of Biological Sciences and Sustainability, Dev Sanskriti Vishwavidyalaya, Haridwar, Uttarakhand**

Since ancient times, medicinal plants and simpler herbal remedies have been used in all parts of the world for the treatment and alleviation of various ailments. The selected medicinal plants' species has been of interest to researchers because it is a medicinal plant employed in the Indian traditional system of medicine. These plants are rich in therapeutically valuable phyto constituents and used in different healing system of medicine. The present investigation deals with the comparative pharmacognostic study of *Vitex negundo* Linn. and *Ricinus communis* Linn. leaf. A detailed morphological and qualitative study was also carried out. Physiochemical parameters like determination of total ash content, acid insoluble ash, alcohol soluble extractive and water soluble extractive were observed. The observed values of the physiochemical test of total ash content and acid insoluble ash of *Vitex negundo* Linn. and *Ricinus communis* Linn. collected from eco-friendly zone were 7.0 & 0.5% and 17.05 & 1.0% respectively and the values of both the parameters of the plant collected from non-eco-friendly zone were 6.5 & 0.5% and 18.5 & 1.0% respectively. The present study on pharmacognostical investigation of *Vitex negundo* Linn. And *Ricinus communis* Linn. leaves might be useful to supplement information with regard to its identification parameters, which are assumed significant in the way of acceptability of herbal drugs, in the present scenario, which lacks regulatory laws to control the quality of herbal drugs.

Keywords: *Vitex negundo* Linn., *Ricinus communis* Linn., Leaves, Pharmacognostic, Physiochemical.**RESPONSE OF IRRIGATION SCHEDULING ON TOMATO (*LYCOPERSICON ESCULENTUM*) UNDER MICRO IRRIGATION SYSTEM****¹RAM KUMAR*,²RICHA KHANNA, ²PADAM SINGH AND ³JOGINDER SINGH****¹School of Agricultural Sciences and Engineering, IFTM University, Moradabad (UP) -244102****²Department of Agril. Engg. College of Forestry, Ranichauri Tehri Garhwal Uttarakhand-249199****³Department of Horticulture, J. V. College, Baraut, Baghpat (U.P.)**

The study was conducted to assess the effect of drip irrigation scheduling on growth and fruit quality of tomato and to determine the benefit-cost (B-C) ratio of tomato under different treatments. Five treatments viz., T1, T2, T3, T4 and T5 using drip irrigation method without using fertilizer and chemicals were tested to improve irrigation scheduling in tomato this study, it has been analyzed that maximum reduction has been obtained under the treatment T3 (3 hr water applied in time interval of three day) whereas minimum achieved under treatment T5 (control) 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 and lowest was obtained under T5 treatment. Highest water use efficiency (WUE) and benefit-cost ratio (BCR) also achieved under the T3 respectively. It was concluded that modern irrigation system should be used as a benchmark for planning and management of available water resource by reducing water losses in large extent.

Keywords: Drip irrigation method, Scheduling, Water use efficiency, Yield**FERMENTED CEREAL PRODUCTS AND THEIR APPLICATION IN PREVENTION OF VARIOUS DISEASE****RAMA MAURYA¹ AND ²SANDEEP K. MAURIYA****¹College of Community and Applied Science, Maharana Pratap University of Agriculture and Technology Udaipur Rajasthan, ²Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP)**

Fermented cereal food products play an important socio-economic role in developing countries as well as making a major contribution to the protein, energy, B vitamin requirements of major populations in the country. Lactic acid bacteria for curd formation and yeasts for sour dough are the common group of microorganisms associated with traditionally fermented foods. Many different types of traditional fermented foods and beverages are produced at household level in India. These are fermented milk products including, curd, butter milk yoghurt, kefir, fermented soya milk, cereal-based fermented food are fermented rice, idli, dosa, dhokla, nan, and a variety of muffins, cakes etc, and, non-alcoholic beverage, fermented fruits, and vegetables. However, there are some differences in the preparation of traditional foods and beverages from region to region. Cereals based fermented products including prebiotics, probiotics, which improve the gut microflora and rich source of energy, protein, fibers, antioxidants and B vitamins which have direct impact on improving human health. Whole grain cereals contain micronutrients which are essentially needed that are vitamin E, folate, zinc, calcium, iron, phenolic acids, magnesium, copper, lignin and lignans. Wheat, buckwheat, oat, barley, flaxseed, psyllium, brown rice and soy products are notified as the most common cereal based functional food in India. Whole grains cereal rich source of complex carbohydrates and fibers, so it reduce blood glucose, protect from cardiovascular disease, reduces lipid profile level and protect from some cancers specially colon cancer.

Keywords: Socio-economic, fermented, microorganisms and colon cancer.

ALOE VERA: IMPORTANCE AND ITS BENEFITS**RAMA MAURYA¹ AND ²SANDEEP K. MAURIYA****¹College of Community and Applied Science' Maharana Partap University of Agriculture and Technology Udaipur Rajasthan, ²Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (UP**

I was studied about the more information of herbal plant *i.e* Aloe Vera. It is a specific plant, it show various types of activities in medical era. Aloe vera is for wound healing, treating burns, minimizing frost bite damage, protection against skin damage from x-rays, lung cancer, intestinal problems, increasing high density lipoprotein (HDL), reducing low density lipoprotein (LDL), and reducing blood sugar in diabetics. There are more than 200 bioactive chemicals and phytochemicals are present. Aloe vera gel is extracted from its leathery leaves and appropriate processing techniques are needed for stabilization as well as preparation of the end products. The regulatory bodies also need to look into the safety and toxicological aspects of aloe vera products for food applications. It is presumptive to mention that nutraceutical claims of aloe products made by the manufacturers are numerous. I was studied about the more information of herbal plant *i.e* Aloe Vera. It is a specific plant, it show various types of activities in medical era .so it play an important role in pharmaceutical field. Aloe Vera and its preparation have been widely used as a medicine since ancient times. Various researches have been conducted to prove the efficacy of aloe Vera in various health problems. The active ingredient hidden in its succulent leaves have the power to soothe human life and health in a myriad ways. *Aloe vera* as the wonder plant is multiple from being an antiseptic, ant-inflammatory agent, helps in relieving like cancer and diabetes, and being a cosmetic field.

Keywords: Aloe vera, processing, photochemical and ant-inflammatory.

EFFECT OF VARIOUS IPM MODULES ON THE INCIDENCE OF GRAM POD BORER, *HELICOVERPA ARMIGERA* (HÜBNER) IN CHICKPEA, *CICER ARIETINUM* (L.) AGRO – ECOSYSTEM***RAMAWATAR BAJIA, R. P. MAURYA, S. K. NAGAR, N. K. MEENA AND BAZILLA GAYAS****School of Agriculture, Suresh Gyan Vihar University, Jaipur, India**

The present investigations were carried out to find out the effect of various integrated pest management (IPM) modules on the incidence of *Helicoverpa armigera* and population build up of natural enemies in chickpea agro-ecosystem. Results from eight IPM modules revealed (in both the years *i.e*. 2014 and 2015 of experimentation) that M₂ with 1.67 and 1.41 larvae/ Meter Row Length followed by M₆ with 1.84 and 1.80 larvae/ MRL followed by M₅ with 1.87 and 1.93 larvae/ MRL in both the years, were found effective in reducing the population of *H. armigera* in chickpea. Regarding per cent reduction in *H. armigera* over control (PROC), the study revealed that M₂ was most effective and significantly superior over the rest of modules with highest PROC observed in M₂ (55.8% after 1st spray and 60.9% after 2nd spray), followed by M₆ and M₅. On the basis of the above results, it can be concluded that the module, M₂ was the best module as it contained lowest larval population, lowest per cent reduction over control and highest parasitism was observed in M₈ (untreated control) were recorded.

Keywords: *Cicer arietinum*, *H. arimigera*, IPM modules

SEASONAL VARIATION OF REPRODUCTIVE ORGANS IN SNAKEHEAD FISH *CHANNA PUNCTATUS* (BLOCH, 1793)**RAMESH P L¹ AND M RAMACHANDRA MOHAN²****Dept. of Zoology, The National College, Basavanagudi, Bengaluru, Dept. of Zoology, Bangalore University, Bengaluru.**

The freshwater *Channa punctatus* is popularly known as snakehead fish and is famous nutritious food fish. It is specific annual breeding fish. The reproductive cycles or organs of *C. Punctatus* has of five phases viz., preparatory phase, early maturing phase, prespawning phase, spawning phase and spent phase. Seasonal study and observation of these fishes reveals that the period and duration of different phases in reproductive cycle. The size of the gonads is maximum or become larger in size during spawning phase while it is minimum or less in preparatory phase. The ovaries of *C. Punctatus* under cross section and external visibility shows increases their sizes and shapes from preparatory phase to spawning phase and during spent phase their sizes gradually decreases. During different phases of reproductive cycle ovaries exhibits changes in their colour and appearance. During preparatory phase ovaries exhibits whit is hand they turn pink is that the time of early maturing and prespawning phase is due to vascularization of ovaries. They became transparent and turn yellowish due to thinning of tunica albuginea and underlying yellowish eggs. During spawning period smooth contour of ovaries are become granular nature. When fishes are treated with CdCl₂ of various ppm concentrations the gonads shows variation in their size, colour and shape. It is due to the effect of cadmium chloride in gonadal tissues and their development.

Keywords: *Channa punctatus*, gonads, spawning, CdCl₂

MANAGEMENT OF ROOT KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* INFECTING TOMATO USING NEMATOPHAGOUS FUNGUS, *TALAROMYCES PINOPHILUS***RAMI KASSAM, JYOTI YADAV AND UMA RAO*****Division of Nematology, ICAR-Indian Agricultural Research Institute, New Delhi-110012, India**

Suppression of plant parasitic nematodes with nematode predators, parasites or antagonists is an attractive and eco-friendly approach than the toxic chemical pesticides. In the present study, rhizosphere soil of different crops collected from different Indian states was used for isolating nematophagous fungi following baiting method and identified based on morphological and molecular (ITS1 and ITS4) approaches. Several fungi could be isolated and one of them was identified as *Talaromyces pinophilus*. In vitro evaluation of this fungus confirmed its ability to parasitize juveniles of *M. incognita*. Its further evaluation in a green house study against *M. incognita* infecting tomato plants was carried out by adding 2×10^6 CFU before, simultaneously and after the nematode infection (one week gap). The results show that all the treatments reduced the number of galls (171, 200.3 and 319 respectively) compared to Carbofuran (3G at 3 g per kg of soil) and only nematode treatment (532.3 and 640 respectively). Additionally application of the fungus also enhanced plant height (47.77 cm) compared to carbofuran and control treatment (36.7 and 41.1 cm respectively). The discovery of this fungal species in reducing nematode infection effectively under pot conditions shows its potential to manage *M. incognita* as an alternative to chemical control under field conditions after a thorough and expanded study of their biology and ecology.

Keywords: *Talaromyces pinophilus*, *Meloidogyne incognita*, nematophagous fungi, tomato plant.

FRUIT NUTRIENTS CONTENT UNDER FOLIAR NUTRITION OF POMEGRANATE WITH ZINC**RAMYA, S.H AND SUBBARAYAPPA, C.T****University of Agricultural Sciences, GKV, Bengaluru-65**

Field experiments were carried out in Marganahalli village of Chikkaballapur district which located at the Eastern dry zone of Karnataka (India), during two seasons of 2015-16 and 2016-17 to explore the effects of foliar spray of different sources of zinc on growth, yield, quality and nutrients content in pomegranate fruit var. Bhagwa grown in drip irrigated sandy loam. Experimentation was done by using zinc sulphate, Zn-EDTA and zinc metalosate as zinc sources in randomised block design with twenty treatments and three replications. The obtained results indicated that the foliar application of zinc as zinc metalosate, Zn-EDTA and ZnSO_4 along with recommended dose of NPK significantly increased the macronutrient content of fruits except phosphorus content and their values varied from 1.63 to 2.64, 0.16 to 0.31 and 1.07 to 2.07 %, respectively. Among the treatments foliar application of zinc @ 0.150% as zinc metalosate (T_{13}) significantly increased the nitrogen (2.64 %) and potassium (2.07 %) content of fruits but it was on par with treatment T_{18} which consists of zinc @ 0.150 per cent as Zn-EDTA. But the treatments did not showed significant effect on fruit phosphorus content. With increasing levels of zinc through different zinc sources, there was a reduction in fruit phosphorus content. Recommended dose of NPK along with farm yard manure (T_3 : 0.31 %) significantly increased fruit phosphorus content compared to other treatments and the lowest phosphorus content in fruit was recorded in treatment T_{13} (0.16 %) which received 0.150 per cent zinc as zinc metalosate. With respect to micronutrients content in the pomegranate fruit, non-significant difference was observed among the treatments except zinc content in the fruit. Significantly higher zinc content of 37.29 mg kg^{-1} was recorded in the pomegranate fruit in T_{13} treatment.

Keywords: Foliar spray, zinc sources, pomegranate and fruit nutrient content

INTEGRATED FARMING SYSTEMS: AN INNOVATIVE APPROACH TO DOUBLE FARMER'S INCOME**RAMYA KRISHNA KOKA^{*1}, B SRISAI SIDDHARTHA NAIK² AND KIRAN PILLI^{*3}****1,3Department of Agricultural Chemistry and Soil Science, BCKV, Mohanpur, 2Dept. of Agronomy, MPUAT, Udaipur**

Majority of the Indian farming communities follow traditional norms of agriculture which support their livelihood. In India, farming is characterized by small, marginal, and fragmented land holdings (about 86 per cent) and is highly depended on monsoon showers. Operating small holdings is often unviable and in this situation, farming is not a profitable business or enterprise. The major challenges and issues in agriculture are flood, drought and hail storm; in addition, high cost and meager availability of quality seeds, fertilizers, irrigation, lack of marketing facility, low storage, and processing facilities etc. exacerbate the problems faced by small and marginal farmers. Therefore, there is an urgent need for transformation in agricultural production combined with integrated farming system (IFS) approaches that involves crop cultivation, dairy, poultry, fishery, mushroom cultivation, agro-forestry, piggery, beekeeping, vegetable and fruit production, use of renewable energy source (i.e. Solar energy, Biogas) etc. For doubling of the farmer's income, few strategies need to be adopted considering the basic requirements of the farmers. These strategies may include massive investments in agricultural research and development, adoption of Good Agricultural Practices (GAP), conservation agriculture technology, implementation of farmers friendly policies, judicious use of available resources and inputs, along with improved market and transportation facility, minimum support price (MSP) reform, supported by adequate and timely availability of bank credits. It has been estimated that a rise in MSP will raise farmer's income by 13-26 per cent. Smart

farming and credit supporting smart farming are other possible strategies in doubling farmer's income. Economic and socio-ecological access to sustainable production is of prime importance in the current context, and farming systems approach strives to achieve just that.

BIOLOGICAL CONTROL OF FUSARIUM WILT OF CHILLI (*CAPSICUM ANNUUM* L.) BY PHENOTYPIC VOLATILE AND NON VOLATILE INHIBITORY COMPOUNDS OF RHIZOSPHERIC ANTAGONISTIC ORGANISMS

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Rhizospheric antagonists can act as potential biocontrol agents, showing antagonistic activity against phytopathogen by production of volatile and non-volatile metabolites. In vitro assessments revealed their antibiosis and mycoparasitic ability to affect growth pathogen *Fusarium oxysporum* due to production of toxic volatile and non-volatile metabolites. A total of 20 rhizosphere microbes were isolated from healthy rhizosphere soil samples of chilli collected from major chilli growing areas of Andhra Pradesh. Out of which (eight fungal antagonists, ten bacterial antagonists and two fluorescent *Pseudomonads*) were found to exhibit antagonism against chilli wilt pathogen. On further in vitro evaluation, nine isolates including four fungi, four bacteria and one *pseudomonas* sp. were found to be most efficient against chilli wilt pathogen. Among them four promising antagonists were tested RFA 2 showed the highest mycelial inhibition of the pathogen (24.35% and 74.5%) followed by RFA 4(17.29% and 60.47%) and RFA 1 (5.17% and 31.76%), whereas RFA 3 showed less inhibitory effect (2.35% and 22%) by production of volatile and non volatile inhibitory compounds respectively after seven days of inoculation. Thoserhizospheric bacterial antagonists (RBA1, RBA 2, RBA 3 and RBA 4) and rhizospheric fluorescent *pseudomonads* (RFP1) which were found to be extremely efficient against *Fusarium* wilt pathogen of chilli in dual culture were further phenotypically identified based on the production of Siderophores, HCN and ammonia. Among them fluorescent *pseudomonads* RFP 1 was positive to siderophore, HCN and ammonia production.

Keywords: HCN, biocontrol, Ammonia, phenotypic identification, siderophores

ASSESSMENT OF DIFFERENT LEVELS OF WATER APPLICATION FOR WHEAT IRRIGATION

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An experiment was conducted at farmer's field in Jehanabad district of Bihar during Rabi season 2014-15 and 2015-16 for assessment of different levels (depth) of water application for wheat irrigation and to find out its effect on water saving, time saving, yield and economics. The experiment was laid out in Randomized Block Design with 10 and 6 replications (no. of farmers) in two respective years along with three technological options: Farmer's practice-Irrigation on eye experience basis till water stagnation in the field for more than 12 hours, TO1- Applying measured quantity of water for 5 cm irrigation and TO2- Applying measured quantity of water for 6 cm irrigation in wheat. In order to apply measured quantity of water, stream flow rate of irrigation pump was determined using a container of known volume (litre) and time taken (second) in filling it. Accordingly, pump was allowed to run for time required for application of 5 cm and 6 cm depth of irrigation water in TO1 and TO2, respectively. Three irrigations were applied in each treatment by making 5 m wide border strips in wheat field. Result revealed that in year 2014-15, applying 6 cm irrigation in wheat (TO2) yielded 16.3 % more with B: C ratio 2.07 along with saving of 16.9 % irrigation water and 16.7 % saving of irrigation time whereas in case of TO1, 7.69 % increased yield with saving of 30.5% irrigation water, 30.6 % time with B: C ratio of 1.92 was observed as compared to B:C ratio of 1.84 in farmers practice. In 2015-16, again TO2 yielded 15.31 % more wheat with B:C ratio as 1.92 and saving of 16.94 % irrigation water along with 16.7 % time saving than farmer's practice plot and TO1 gave 4.12 % increased yield along with a saving of 30.55 % irrigation water, 30.63 % time with B: C ratio 1.87 as compared to B:C ratio of 1.84 in farmers practice plots. Findings of the study indicated that TO2 (applying measured quantity of water for 6 cm irrigation) in wheat performed best in terms of yield and B: C ratio followed by TO1 as compared to farmer's practice.

Keywords: Depth of irrigation, Technological options, Water saving, Wheat

PERFORMANCE OF DIFFERENT SOURCES OF SULPHUR ON GROWTH & YIELD OF MUSTARD IN MIDDLE GANGETIC PLAINS OF BIHAR

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A field experiment was established at Saran district of Bihar to evaluate the effect of Different sources of sulphur (*i.e.*, Phosphogypsum: T₁, Bentonite: T₂ & Control: T₃) on Yield and economics of mustard. The experiment comprised three treatments and seven replication performed under Randomised Block Design during *rabi* season (2018-19). Results revealed that application of bentonite and phosphogypsum improved the seed yields of mustard by 35.7 & 15.6%, respectively over control. Similarly, number of seeds/silique & stover yields were recorded the highest in bentonite application which was followed by phosphogypsum and control. With the application of bentonite the highest restoration of available sulphur in soil followed by phosphogypsum whereas, availability of sulphur was lowered by 1.6 times as compared to initial value of soil. A satisfactory seed yields in treatment T₂ reflected to the highest net return (Rs. 42994.0/ha) & cost benefit ratio (1:3.4). In conclusion the bentonite sulphur source was performed better for mustard cultivation in middle gangetic plains of Bihar.

Keywords: Mustard, Bentonite, Phosphogypsum, Yield, Economics

FUMIGANT ACTIVITY OF ORANGE JASMINE, *MURRAYA PANICULATA* (L) JACK. ESSENTIAL OIL AGAINST ALMOND MOTH, *CADRA CAUTELLA*

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Plant secondary natural insecticides are chemicals extracted from plants called botanical insecticides and used as potential alternative to synthetic or chemical pesticides which is an excellent component of integrated pest management. Identifying and evaluating plant secondary natural insecticides is the important feature for developing novel botanical insecticides. Leaves of Orange Jasmine, *M. paniculata* (L) Jack were selected for current study. The essential oil of *M. paniculata* was obtained by hydro distillation extraction method. The fumigant activity was investigated at different concentrations viz., 16, 20, 28, 36 and 60 µl/lit of air using gas-tight flat bottom flasks (250ml) against different stages viz., eggs (2-3 days old), larvae (5-7 days old), and adult (2-3 days old). The mortality was recorded after 24, 48 and 72hrs of exposure time. For eggs, mortality was evaluated based on hatchability after treatment. Studies revealed that *M. paniculata* essential oils exhibited good fumigant activity. After 24, 48 and 72 hrs of treatment at 60µl/lit dose the mortality for larvae were 23, 63 and 70%, and for adults were 33, 87, 100%, respectively. Similarly, the mortality for eggs was 52 and 55.67%, respectively, after 24 and 48 hrs of treatment at 60 µl/lit dose. Gas chromatography-mass spectrometry (GC-MS) analysis of essential oil revealed 32 volatile components. The major components were germacrene-D (23.9%), alpha-zingiberene (23.3%), beta-caryophyllene (17.2%), trans-nerolidol (13.2%), humulene (4.28%), delta-elemene (4.06%) and γ -Murolene (3.42%).

ASSESSMENT OF AMYLOLYTIC FUNGAL STRAINS FOR GLUCOAMYLASE PRODUCTION UNDER SUBMERGED FERMENTATION

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First generation ethanol from starchy crops particularly maize is an established technology that being a renewable and bio-based resource has advantages over gasoline. The second generation ethanol from lingo-cellulosics is still at lab to pilot scale and is yet to see commercialization. This has increased the demand of starchy feed-stocks for energy. India is the second largest producer of wheat in the world and as per the estimates provided by Food Corporation of India (FCI) huge quantities of wheat grains spoils every year as a consequence of unfavourable climatic conditions and lack of adequate storage warehouses. Furthermore, the fungal infested grains are unfit for human and animal consumption but they still contain high starch content which is an adequate substrate for conversion into fermentable sugars with the help of alpha- and gluco-amylases produced by microorganisms. Profiling microorganisms with potential for glucoamylase production in low cost culture media has been widely recognized due to their broad applicability. In the present investigation, glucoamylase production from the standard cultures (*Aspergillus niger* MTCC 2208 and *Aspergillus terreus* MTCC 11778) was performed in minimal starch medium (100 ml) under submerged fermentation conditions (Temp. 28°C, pH - 5, inoculum size - 10⁸ cfu/ml) after incubating at different intervals of time (24, 48, 72, 96, 120, 144 and 168 hrs). The fermentation medium was harvested by centrifugation at 10,000 rpm for 20 min at 4°C to obtain the crude extract, which served as extracellular crude enzyme source and assayed in terms of saccharifying activity. In submerged fermentation, maximum saccharifying activity was manifested by *Aspergillus niger* (10.4 IU/ml/min) followed by *Aspergillus terreus* (5.79 IU/ml/min) at 4 and 5 days of incubation period, respectively. Under Separate Hydrolysis and Fermentation (SHF)

conditions, commercial amylases and indigenous amylases saccharified wheat hydrolysate resulted in 6.2 % v/v and 4.9% v/v ethanol fermented by *Saccharomyces cerevisiae* at 72 h of incubation, respectively. The estimated cost of bioethanol production from damaged wheat grains using indigenous and commercial amylases at 5 litre scale were found to be Rs. 51.60 and Rs. 37.63, respectively.

Keywords: Saccharifying, Fermentation, glucoamylase, *Aspergillus niger*, *Aspergillus terreus*

IMPORTANCE OF THERMO-TOLERANCE IN SILK WORM

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The phenotypic output of silkworm crop like cocoon weight, shell weight, and cocoon shell ratio which are linked to genotype expression were highly influenced by differences in the environmental constituents. Amongst all the adverse environmental fluctuations thermal conditions play a vital role in the yield of cocoon. Recent advances in biotechnology would greatly facilitate breeding of thermo-tolerant bivoltine silkworm breed. Collective efforts of the researchers during the past decade resulted in the evolution of heat-tolerant silkworm strains. Of all the breeds developed lately, the only silkworm breed that showed a better performance during the past few decades in this field was NB4D2. Furthermore one of the researchers study demonstrated heat shock response in five bivoltine breeds (NB4D2, NP2, KSO1, CSR2, and CSR4) varied during different developmental stages. Of the five instars young silkworms, the first, second, and third instars, were relatively sensitive to any given heat shock temperature while older silkworms tolerated high temperatures for relatively longer periods of time. In another researchers work, multivoltine race, strains C. Nichi and Pure Mysore showed better survival rates than the bivoltine race, strain NB4D2 exposed to 41°C and above. It has been noticed in many researchers study that tolerance levels were maximum in later instars i.e., fourth and fifth instars when compared to early larval instars, adult moths or the eggs. A temperature of 39°C and an exposure time of 1 or 2 h was tolerated equally whereas temperatures above 43°C proved to be lethal for all stages. The individual or collective role of HSPs in relation to biological, commercial, physiological, and immunological features among different silkworm races (including non-mulberry silkworms) is important for understanding the factors that govern thermo-tolerance and acclimation in insects. Knowledge of HSPs and their use as molecular markers would facilitate conventional breeders to select better parents, with a reduction in laborious crosses for development of suitable silkworm strains, important for tropical countries under silkworm race improvement programs.

EVALUATION OF VARIOUS PLANT PROTECTANTS FOR THEIR EFFICACY AS DRY SEED DRESSERS AGAINST INFECTION OF BOTTLE GOURD ISOLATE *FUSARIUM PROLIFERATUM*

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Bottle gourd is a cucurbitaceous vegetable whose generic name, i.e., *Lagenaria* is derived from the Latin word 'lagena' which means 'bottle'. The crop makes up a staple in Indian cuisine and occupies an area of 157.08 thousand ha with a production of 2572.01 thousand million ton in India according to 2016-2017 estimates. The isolation studies on seed and fruit mycoflora of bottle gourd revealed the association of fourteen fungal species belonging to eight genera, viz., *Fusarium proliferatum*, *Fusarium incarnation-equiseti* species complex, *Penicillium polonicum*, *Clonostachys rosea* f. sp. *catenulata*, *Meyerozyma guilliermondii*, *Rhizopus oryzae*, *Aspergillus tubingensis*, *Aspergillus* sp. (I), *Aspergillus flavus*, *Aspergillus* sp. (II), *Fusarium* sp., *Talaromyces pinophilus*, *Aspergillus* sp. (III) and *Colletotrichum lagenarium*. Out of fourteen fungal isolates, *Fusarium proliferatum* was found to reduce seed germination and seedling vigour as observed under *in vitro* tests on bottle gourd seeds. Seven plant protectants (two non-systemic fungicides, three systemic fungicides and two bioagents) were evaluated *in vitro* at three different concentrations, each, for their efficacy as dry seed dressers against *Fusarium proliferatum*. The observations on germination tests revealed that seed dressing with Propiconazole 25% EC led to the reduction in per cent frequency of seedling infection followed by Copper oxychloride 50% WP. Amongst the bioagents, *Trichoderma harzianum* 1% WP was found to be better against seedling infection caused by *Fusarium proliferatum*. The fungicide Carbendazim 50% WP was found to be effective in increasing the speed of germination followed by *Trichoderma harzianum* 1% WP. The results revealed that fungicides performed better over bioagents in reducing per cent frequency of infection while seed germination (%) was found to be the highest in seeds treated with bioagent *Trichoderma harzianum* 1% WP.

Keywords: Bioagent, bottle gourd, fungicide, *Fusarium proliferatum*, plant protectants

ABOVE GROUND BIOMASS STUDY IN BAGHELKHAND MOUNTAIN REGION OF CENTRAL INDIA

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The main objective of this study was to define the most accuracy for aboveground biomass estimation. In this study the estimation of above ground biomass (AGB) using non-destructive allometric equations method in tropical dry

deciduous forest in 0.1 ha sample plots, allocated in Baghelkhand region of Vindhya mountain in twenty sites. The volume of tree was calculated using site specific local or regional volume equation. The biomass of each species was estimated taking tree volume and species specific gravity. The relationship between basal area and above ground biomass showed positive correlation for all sites and forest types. In study site many tree species was founded in which majorly *Acacia catechu*, *Accacianilotica*, *Buteamonosperma*, *Ziziphusspecies*, *Madhuca indica* and *Diospyrsmelonoxylon* etc. Field measurements for different density classes, basal area and biomass across the all different study sites. This study concludes that tropical deciduous forests of the studied area in Madhya Pradesh are having strong potential for carbon sequestration. Estimation of above ground tree biomass in the present study provides data for tropical dry deciduous forest covering a large part of state.

Keywords: Allometric Equation, Basal Area, Biomass, Deciduous Forest, Non-Destructive, Specific Gravity.

PRECISION FARMING TECHNIQUE FOR WATER RESOURCE MANAGEMENT

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Water is a key factor in increasing agricultural production. About 90 percent of India's water resources are used for agriculture out of this only 50 percent is actually used by plants and the remaining water resources are wasted either as deep percolation or as evaporation (FAO, 2010). Therefore, efficient use of water which is delivered for irrigation purposes has given primary attention for improving water delivery efficiency. This requires appropriate method of measuring and evaluating how effectively water extracted from a water source is used to produce crop yield. Agricultural water use efficiency involves improvements in technologies and management of agricultural water, while improving crop yield. Recognizing the fast decline of irrigation water potential and increasing demand for water from different sectors, a number of demand management strategies and programmes have been introduced to save water and increase the existing water use efficiency in Indian agriculture. One of the approach is Precision farming . It is an approach where inputs, including water and fertilisers, are applied in precise amounts to maximise yields by reducing water use, residues in soil and water, and chemical sprays, and substantially increased average yields compared to traditional cultivation techniques. Hence it is a comprehensive system designed to optimize production by using a key elements of information, technology, and management, so as to increase production efficiency, improve product quality, improve the efficiency of crop chemical use, conserve energy and protect environment. Thus, precision farming is an appealing concept and its principles quite naturally lead to the expectation that farming inputs can be used more effectively, with subsequent improvements in profits and environmentally less burdensome production. Especially in the case of small farmers in developing countries, precision farming holds the promise of substantial yield improvement with minimal external input use. The goal of Precision Farming (PF) is the management of crop and soil variability to increase profitability and reduce environmental impact. Within the concept of PF the main activities are data collection and processing and variable rate applications of inputs. The tools available consist of a wide range of techniques and technologies from information technology, sensor and application technologies, farm management and economics. Precision irrigation is panacea in irrigation related problems. It is the sub component of the precision farming techniques, which are exclusively associated with the irrigation.

Keywords: Precision farming, water use efficiency and profitability

PROSPECTS AND CHALLENGES FOR INDIAN FARMERS IN CULTIVATION OF FRUITS CROP AND THEIR PROCESSING

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India is known to be a fruit basket of the world. After China, India has been considered as the second largest producer of fruits with a share of eight per cent in world fruit production. India produces 65 per cent and 11 per cent of world's mango and banana, respectively, ranking first in the production of both the crops. It has the highest productivity in grape in the world. The requirement of these fruits at present estimated at 11.1 lakh tones while the production is estimated around 5.56 lakh tones due to low productivity of these crops in the arid regions and the productivity range between 6.68 tonnes per ha 9.8 tonnes per ha due to cultivation of these crops in marginal lands. Due to skilled manpower deficiency, poor cold storage facilities, inefficient post-harvest management and minimal technological interventions. India is the second largest producer contributes only 1% of the global market of the fruit processing industry. In India, the wastage of fresh fruit, produce has been estimated to be of a very high order, i.e. around 30-35% of the total production during harvest, storage, grading, transport, packaging and distribution because of the challenges involved in the industry. With the creation of adequate specialized cold storage facilities, logistics infrastructure, skilled manpower and modern technological interventions, post-harvest losses can be minimized resulting in higher returns to the major stakeholders of the entire fruit supply chain i.e. farmers and the consumers. The paper provides a short review on the status of the Indian fruit processing industry, fruit processing technologies, supply chain of fruit processing industry, improper post-harvest management and inefficient cold storage facilities. The paper also shelters the global & the Indian scenario of fruit

processing industry, government schemes & policies related to the industry. The authors have also emphasized on the challenges of the Indian fruit processing industry. In this paper SWOT analysis and PEST analysis has also been conducted and key potential areas i.e. economy, agricultural yield, development, productivity enhancement, employment generation for the future generation have been identified in order to achieve a greater role in the industry.

Keywords: Fruit Processing Industry, Post-harvest management, Cold Storage facilities, SWOT Analysis, PEST analysis.

HYBRIDIZATION FOR ENHANCING GENETIC DIVERSITY IN LITCHI

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Worldwide litchi is considered as one of the most environmentally sensitive plant adapted to warm subtropics and elevated tropics with cool dry winters and warm wet and humid summers. Litchi production in India is beset with a series of bottlenecks such as narrow genetic base and lack of natural biodiversity, limited period of availability of fruits with high post harvest losses and low productivity. Litchi has been in cultivation 2000 years ago. Over the period of time, a large number of ecotypes in various countries including India have been identified; however a cultivar possessing all desired characters is still lacking. Litchi trees are very good yielders but production potential in this crop is greatly influenced by abiotic stress, particularly that of climatic aberrations which affect fruit yield and quality. The narrow genetic base in litchi restricts the selection of desirable clones from the available populations. Widening the genetic base has been one of the objectives in litchi crop improvement programs. For addressing this, hybridization programme was initiated in litchi involving major cultivars using fresh and one year old pollen grain. The best parental combination and effective pollination period (EPP) was noted. Results showed that different cultivars showed different response with respect to fruit set in different crossing combinations. Among cultivars, China was observed to be the best female parent followed by Shahi which ensures good hybrid fruit set. The effective pollination period (EPP) giving maximum success of seed set in litchi was reported in Shahi, China and Bedana at 6-7 AM, 6-8 AM and 8-9 AM, respectively. The methodology employing fresh and one year old stored pollen (4 °C) was found to be highly effective for hybridization programme in litchi. The final fruit retention in crosses involving fresh and old pollens varies from 0.24 to 0.81% and 0.23 to 0.52% respectively. Result also revealed that limited number of initial fruit set resulted in high retention of fruits in Bedana (1.64 % and 1.69%) and Shahi (19.29 % and 15.30%) with current season and one year old pollen of 'Swarna Roopa'.

Keywords: Litchi, Hybridization, Effective pollination period, old pollens, fruit set, fruit retention

GENETIC DIVERSITY ANALYSIS FOR SELECTING BETTER VARIETY OF TURMERIC (CURCUMA LONGA)

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Curcuma longa (turmeric) is a small rhizomatous perennial herb of Zingiberaceae (Ginger family) originated in India and now is cultivated in tropical and subtropical parts of the world. While originated in South East Asia, India has the predominant position as the largest producer of turmeric in the world. Besides India, it is also grown in China, Taiwan, Indonesia, Sri Lanka and other tropical countries. The highest diversity is concentrated in India and Thailand. In India, *Curcuma longa* has been in use as a culinary ingredient since 3000 BC. the genetic variation in the turmeric germplasm is essential to increase the efficiency of selection in breeding programs, as well as to direct conservation strategies in germplasm collections. The genetic diversity of turmeric germplasm were studied using RAPD markers. The polymorphic information content and resolving power are in the range 0.00 to 1.00 and 0.00 to 1.1 respectively were found to be most informative with higher resolving power. Genetic similarity found through jaccard's coefficient in range 0.30 to 0.76. The results also demonstrate the efficiency and reliability of RAPD markers in for genetic diversity and relationships among the turmeric germplasm.

STANDARDIZATION AND EVALUATION OF PLANT PROTEIN FORTIFIED MANGO BEVERAGES

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The present investigation "Standardization and Evaluation of Plant Protein Fortified Mango Beverages" was conducted in the Centre of Food Science and Technology, CCS Haryana Agricultural University, Hisar. The objective of the study was to isolate/prepare and characterize protein isolate/milk from soyabean, peanut and rice bran and to develop protein fortified mango RTS and squash. The RTS and squash were prepared from ripe fruit of mango cv. Safeda. Various proportions of soya peanut isolates and rice bran concentrate, milk were added to the beverages to fortify it. The control and protein fortified beverages were

bottled in 200 ml capacity sterilized glass bottles and stored for 90 days at room temperature ($30 \pm 2^\circ\text{C}$) for analyzing its quality and sensory attributes at 30 days intervals. It was observed that acceptable quality of RTS and can be prepared with 20 % pulp, 1 % SPI, 16 % TSS, 0.28 % acidity, 0.5 % carrageenan, 0.1 % maltodextrin, 0.1% mango essence and 0.5 g/l sodium benzoate. Similarly, protein fortified mango squash can be prepared with 40 % pulp, 2 % PPI, 50 % TSS, 1.20 % acidity, 0.1 % carrageenan, 0.1 % maltodextrin, 0.1% mango essence and 1g/l sodium benzoate. The sugar replacement with fructose showed improvement in overall acceptability. The 100 % replacement of sucrose with fructose improved the mouth feel, taste and aroma of the beverages and reduced the non-enzymatic browning during storage.

Keywords: Carrageenan, fortification, fructose, mango, peanut milk, protein isolate, rice bran, RTS, shelf life, soya bean, soya milk, squash, viscosity

MICROBIAL BIOTECHNOLOGY: A TOOL FOR SUSTNABLE ENVIRONMENT

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In modern cities majority of the sewage water is treated in sewage treatment plants (STP) but even after treatment it is mainly disposed of in natural water recourses. However tertiary treated sewage water (TT Water) can be used for number of alternate purposes such as irrigation, construction, service stations, recreational purposes like replenishment of lakes etc. However there are problems associated with the use of treated water for these purposes such as

- Improper treatment and irregular monitoring of the efficiency of STP'S
- Presence of excess nutrients such as phosphates and nitrates which lead to eutrophication
- Growth of sulphate reducing bacteria (SRB) which lead to foul smell

By working in collaboration with Department of Environment Chandigarh all these problems were addressed. For one year STP's of Chandigarh were monitored regularly and it was concluded that it is not the type of technology it is management of the STP's which determines the quality of treated water, with given recommendations quality of treated water was improved. To explore the possibility of using TT water for the management of Sukhna Lake Chandigarh quality of TT water was compared with water of Sukhna Lake. It was found to be fit in all aspects except excess of nutrients. An inherent technology was standardized using denitrifying and phosphate solubilizing bacteria; which completely removed these nutrients from TT water. Chandigarh administration has taken a note of the work and exploring the use of sewage water with this process for saving the Sukhna lake Chandigarh. TT water is being used for irrigation in Chandigarh but the foul smell in it is the major problem. a process was standardized reduce the growth of SRB's by aeration and addition of acceptable chemicals which led to the complete removal of smell form TT water. Municipal Corporation has taken up the process and is going to apply it for solving the problem of foul smell. Therefore microbial process can be used to convert waste water into asset and solving various problems related to society at large.

AN ECONOMIC ANALYSIS OF PADDY CULTIVATION IN FLUORIDE AFFECTED REGIONS IN TAMIL NADU

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Groundwater is a prime source of water for agricultural and industrial uses in several regions around the globe. Scarcity of water prevails all over the world, so ground water remains the sole choice to supplement the ever-increasing demand for water. Continuous decline of groundwater due to over abstraction of water leads to decline in groundwater quality as well as contamination in groundwater such as fluoride, arsenic and chloride. Fluoride is 13th element in the earth crust and critical ions that influence ground water quality. Fluoride contamination in groundwater is affected all over the countries. India is one among the countries and nearly 65 million peoples were affected by dental fluorosis as well as in Tamil Nadu, 23 districts were affected out of 33 districts. The effect of fluoride contaminated groundwater on agriculture crop. Paddy is major crop cultivated by the farmers in the study area. The paper aims to estimate the cost and returns of paddy crop in fluoride contaminated area and to identify the constraint expressed by the farmers in fluoride affected locale. A multi-stage sampling method involving a combination of purposive and random sampling procedures was employed in drawing up the samples for collecting primary data. The results showed that cost of cultivation of paddy was high in fluoride affected locale compared to non affected locale and yield was high in non affected locale. In the response priority index method decline in groundwater was given utmost priority by the farmers.

Keywords: Groundwater, scarcity, fluoride contamination and paddy.

CLIMATE SMART AGRICULTURE TO OVERCOME CLIMATE CHANGE**NAVINKUMAR¹, B. DHANANJAYA² AND DILIP S.³****¹Department of Agricultural Extension Education UAS, Raichur, ²KVK, Brahnavar, Udupi., ³Dept. of Extension Education, CCS Haryana Agricultural University, Hisar**

In the present scenario of climate change and the need for the shift towards climate smart agriculture, more and adequate efforts are required to develop climate smart villages and that the role of extension is to bring about the empowerment of farmers to mitigate and adapt to climate change. Food security depends on how we treat our planet so let's make agriculture more productive and sustainable for future generation. FAO estimates that agricultural production should increase by 60 percent by 2050 to satisfy the expected demand for food and feed. Agriculture must, therefore, transform itself if it must feed a growing global population and provide the basis for economic growth and poverty reduction. Climate change will make this task more difficult due to its adverse impacts on Agriculture is "climate smart" when it contributes to increasing food security, adaptation and mitigation in a sustainable way. This new concept now dominates current discussion in agricultural development because of its capacity to unite the agendas of the agriculture, development and climate change communities under one brand.

Keywords: Climate, Agriculture, Mitigation.**FOOD SECURITY WITH SUSTAINABLE AGRICULTURE****¹NAWAZ AHMAD TEELI, ²MOHIT HUSAIN, ³RAYEES AHMAD AND ⁴ARSHEED AHMAD MIR****^{1,3,4}Research Scholar, Faculty of Forestry, SKUAST-Kashmir-190 025****²Senior Research Fellow, Dept. of Silviculture & Agroforestry, College of Forestry, NAU-Navsari, Gujarat-396 450**

Sustainable agriculture is an integrated system of plant and animal production practices having a site specific application that will last over long term. Conservation agriculture is more sustainable and environmentally friendly management system for cultivating crops. Ensuring food security in the face of climate change is one of the major challenges that confront humankind in the 21st century. It is now widely recognized that the remaining genetic diversity found in wild species related to domesticated crops is an important reservoir of genes that are required to develop new varieties suited to meet dual challenge of climate change while feeding a rising population. The water and land requirements of current agriculture are significantly less than global reserves but local shortages are common and have serious impact on food security. However trade has limited impact on low-income populations who remain dependent upon sustainable agriculture and local resources potential, adverse environmental impacts of increased agricultural production include unsustainable depletion of water and soil resources, major changes in the global nitrogen and phosphorus cycles, human health problems related to excessive nutrient and pesticide use and loss of habitats that contribute to agricultural productivity. Sustainable options for decreasing food demand for increasing production include reduction of food losses on both the producer and consumer ends, elimination of unsustainable practices such as prolonged groundwater overdraft, closing of yield gaps with collateral expansion of fertilizer application, increases in crop yield and pest resistance through advances in biotechnology and moderate expansion of rain fed and irrigated crop land. Food security exist when all people at all times have physical, social and economic access to sufficient, safe and nutritious food. Food security is based on four pillars-availability, access, utilization and stability. There are very strong linkages between food and nutrition security, responsible environmental stewardship and greater fairness in food management. They intersect in agriculture and food systems at global, national and local level.

Keywords: Agriculture, Food security, Climate change, Stability and Yield.**EVALUATION OF DIFFERENT LOCALLY AVAILABLE MEDICINAL PLANTS AT MEERUT DISTRICT OF UTTAR PRADESH FOR THEIR CHEMICAL COMPOSITION****NAZIM ALI^{1*}, DEBASHIS ROY², D. S. SAHU¹, AHMAD FAHIM³, AJIT KUMAR², DEEPAK SINGH¹ AND RAJ KUMAR¹⁸****Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut- 250 110, U.P.**

Medicinal plants are widely used in various industries like pharmaceuticals, cosmetic, agriculture and food. India is considered as goldmine of herbal medicines and popularly called as 'medicinal garden of the world'. As an estimate, approximately 25,000 effective herbal preparations are used in traditional medicine by more than 1.5 million traditional medicinal practitioners for preventive, promotional and curative applications in India. Among those herbal plants, giloy/guduchi (*Tinospora cordifolia*), ashwagandha (*Withania somnifera*), lemon grass (*Cymbopogon citratus*), kalmegh (*Andrographis paniculata*), tulsi (*Ocimum tenuiflorum*), shatavari (*Asparagus recemosus*), aloe vera (*Aloe vera*), ajooba (*Bryophyllum pinnatum*) and roselle (*Hibiscus sabdariffa*) are important to be mentioned. Though having significant use in medicine and others, these herbs are not much studied scientifically for their biological assessment. All medicinal and herbal plants were collected from the Horticulture Research Centre (HRC) of the university. Then they were dried, grinded and analyzed for dry matter (DM), organic matter (OM), crude protein (CP), ether extract (EE), crude fibre (CF) and total ash (TA). The highest moisture content was found in Aloe vera. This may be

due to a good amount of gel present in this plant. Tulsi (*Ocimum tenuiflorum*) was found to contain highest dry matter (49.70%). Aloe vera contained the highest amount of total ash (15.16%) which depicts high mineral content of this plant. Roselle (*Hibiscus sabdariffa*) contained the least ash content (3.04%). Kalmegh (*Andrographis paniculata*) was found to have the highest protein (18.32%) and shatavari (*Asparagus recemosus*) was the lowest (2.56). The fat content was the highest (12.04%) in kalmegh (*Andrographis paniculata*). More fibre content (55.32%) in giloy (*Tinospora cordifolia*) makes it unsuitable for animal feed supplementation though it contains a good amount of protein and minerals. From this study, it may be concluded that medicinal plants contain important nutrients and minerals that are useful for human as well as animal health.

Keywords: Medicinal plant, Tulsi, Kalmegh, Shatavari, Chemical composition

MACRO AND MICRO-MINERAL PROFILE OF DIFFERENT DRY AND GREEN FODDER SAMPLES IN MEERUT DISTRICT OF UTTAR PRADESH

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A study was conducted to find out the macro and micro-minerals status in of different dry and green fodder farm condition in Meerut district of Uttar pradesh. Total five types of crop residues and fodder samples were collected. For estimation of copper (Cu), zinc (Zn) and manganese (Mn), 2.0 g of each samples was digested with the help of tri-acid mixture (nitric acid: sulphuric acid: perchloric acid in ratio of 3:1:1). It was observed that the highest Ca concentration was present in sorghum fodder followed by maize fodder while lowest was found in wheat straw samples. The phosphorus concentration varied from 0.14 to 0.43 % Sorghum fodder was found the richest. Copper concentration varied a lot among sample as the range varied from 3.92 to 19.46 ppm. The richest Cu source was found to be maize fodder. Zinc concentration varied from 14 to 56.30 ppm and manganese varied from 12.70 to 44.09 ppm. Based on observations, it was inferred that calcium content was found sufficient except in wheat straw and sugarcane top. This may be due to presence of oxalate which binds with calcium. Phosphorus content was also low in wheat straw, sugarcane top and bajra fodder. Cu and Zn content was also found in wheat straw, sugarcane top and bajra fodder. Mn was found deficient in almost all the samples. It may be concluded from the above experimentation that most of the greens and crop residue samples at this region are deficient in micro minerals like copper, zinc and manganese. Phosphorus was also found deficient. Thus animals are required to be supplemented with mineral mixture fortified with phosphorus, copper, zinc and manganese to maintain high productivity.

Keywords: Dry fodder, green fodder, Macro-micro minerals

SCREENING OF BRINJAL GENOTYPES AGAINST MAJOR INSECT PEST COMPLEX OF JHARKHAND SUB ZONE-V

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Brinjal (*Solanum melongena* L.) is considered as one of the important vegetable crop due to its nutritive value consisting of minerals like iron, Phosphorus and calcium and also vitamins like A, B and C. The crop is subjected to attack by number of insect pest right from nursery stage till crop harvest. Among these the major ones are shoot and fruit borer (*Leucinodes orbonalis* Guenee). This pest is one of the most injurious to brinjal crop. It attacks tender shoots dry up while the flowers and developing fruits fall prematurely and the damaged fruits become unfit for human consumption. Keeping these in view an experiment was conducted on "Screening of brinjal genotypes against major insect pest complex of Jharkhand Sub Zone-V". The objective of this experiment was to find out a suitable resistant/ tolerant variety of brinjal for scientific and commercial cultivation in Sub Zone-V of Jharkhand. An experiment was conducted with three replications and 20 treatments under randomized block design in 2016-17. Plot size was 5.00 x 1.50 sq.m and spacing was 50x50 cm. Thus 30 plants were planted in a plot. FYM was applied 25 ton ha⁻¹ with 100:50:50 kg NPK ha⁻¹. Seedling was raised on 27.10.2016 and transplanting was done on 25.11.2016. All the approved agronomical practices were followed for raising a good crop for screening of 20 varieties of brinjal against brinjal shoot and fruit borer. Analysed data revealed that the local check variety viz., LC-3 was found highly susceptible. Whereas, Swarna Pratibha (C) and Lal gulab (Pvt. check) were found resistant along with four other genotypes viz; CB-25, Swarna shree, Pant Samrat and PB-4. Three genotypes found moderately resistant, five found tolerant and five found susceptible.

Keywords: Brinjal, brinjal shoot and fruit borer, vegetable, screening, resistant.

ERADICATING MALNUTRITION THROUGH VALUE ADDITION OF FRUITS AND VEGETABLES**NEELAM KUMARI****SMS- Home Science, KVK, PipraKothi, Dr. RPCAU, PUSA, Samastipur, Bihar, India -848125**

Now a day, a lot of attention is being given on health and nutrition of persons. Today, consumers demand food products, which are nutritious and convenient to use. Lot of focus has been given to the food products having some additional health benefits, rather than the conventional products. Value addition to foods may be done by several ways. It could be done by the use of preservative, food ingredients capable of eliciting functionalities and by fortification using micronutrients. There are novel and emerging food processing technologies that are possible to preserve the ingredients in the food intact. The shelf life enhancement of the processed food can be done by adapting newer packaging technologies. Guava has been used traditionally as a medicinal plant throughout the world for a number of ailments. Being perishable crop if it could also be processed in to powder during gluts for retaining its goodness by extraction of pulp and preparation of guava powder and used in baked products. Sweet potato is widely used in India for food consumption after boiling, baking or frying. Processing of sweet potato tuber increases their availability and reduces post harvest wastage. The processed products of sweet potato include: Sweet potato flour, Sweet potato granules and canned sweet potatoes. Ginger is used in various food preparations to impart its characteristic flavor and is probably the only spice being used in production of beverages like ginger beer, ginger ale and ginger wine. The different processed products from ginger include- Paste, Candy, Pickle, Chocolates, Beverages, Powder, Juice, Ice cream and Oleoresin.

Keywords: Value addition, Malnutrition, Food processing, Guava, Ginger and Sweet potato

ASSESSMENT OF DIFFERENT FUNGICIDES AGAINST RUST (*UROMYCES FABAE* DE BARY) DISEASE OF FIELD PEA (*PISUM SATIVUM* L.)**NEELAM SONI¹, NIKITA DEWANGAN¹ AND MUKESH KUMAR²****¹Dept. of Plant Pathology, JNKVV, Jabalpur (M.P.), ²ICAR-Indian Institute of Sugarcane Research Lucknow (U.P.)**

Rust disease caused by *Uromyces fabae*, is one of the major disease of field pea and economic constraints to pea production worldwide. The present study was conducted during Rabi season of year 2017-18 at the experimental field of JNKVV, Jabalpur (M.P.) for assessment of different fungicides in controlling rust disease of field pea. Seven treatments including control with three replications were taken up by using randomized block design (RBD). Treatments of foliar spray of propiconazole (Tilt 25 % EC) @ 0.1 % (T1), tebuconazole (Folicure 25.9 % EC) @ 0.17 % (T2), difenoconazole (Score 25 % EC) @ 0.06 % (T3), hexaconazole (Contaf plus 5 % SC) @ 0.2 % (T4), azoxystrobin (Amistar 23 % SC) @ 0.1 % (T5), carbendazim + mancozeb (Saaf 75 % WP) @ 0.2 % (T6) and control (Spray of plain water)- T7, were applied at the first initiation of disease symptoms and second at 15 days after the first spray. The data were recorded at 10 and 20 days after the spray. All the tested fungicides were found to be significantly superior over control in reducing the disease incidence of pea rust. Analysis of the data showed that the per cent disease intensity (PDI) was significantly low (11.40 and 14.96 %) in Propiconazole 25 % (EC), followed by Difenoconazole 25 % (EC) with 14.66 and 16.09 per cent, respectively. The highest seed yield was recorded in Propiconazole 25 % (EC) sprayed plot 19.61 q/ha, followed by Difenoconazole 25 % (EC) with 19.40 q/ha, respectively as compared to control which recorded maximum per cent disease intensity (28.74 and 39.85 %) and lowest seed yield 13.75 q/ha. Thus, considering the above data any one of these fungicides spray as soon as appearance of the disease symptoms and second at 15 days after the first spray can be suggested for the good control of pea rust.

Keywords; Efficacy, Fungicides, *Uromyces fabae*, Pea, Rabi, Per cent, Yield.

EFFECT OF ABIOTIC FACTORS ON THE INSECT POPULATION BUILD UP ON CABBAGE, *BRASSICAE OLERACEA* IN KANPUR REGION, UTTAR PRADESH**NEELAM YADAV*, NEERJA AGRAWAL* AND RENU YADAV*******Deptt. of Entomology, Chandra Shekhar Azad Univ. of Agri. and Tech. Kanpur, Uttar Pradesh, India****** Deptt. of Zoology, C.C.S.P.G. College Heonra, Etawah, India**

A weekly survey of pests present on cabbage crop was undertaken from November 2018 to March 2019 at Insectary, department of Entomology CSAUAT, Kanpur. Data show that, several insect pests were found to attack cabbage crops which were identified under four families and two orders. These are Cabbage aphid (*Brevicoryne brassicae* L., Aphididae; Homoptera), Diamond back moth (*Plutella xylostella* L., Plutellidae, Lepidoptera), Head borer (*Hellula undalis*, Crambidae, Lepidoptera), Painted bug (*Bagrada cruciferum*, Pentatomidae, Hemiptera). The most common cabbage pests are *Brevicoryne brassicae* (25.52%) followed by *Hellula undalis* (16.8%) and *Plutella xylostella* was (1.16%) while *Bagrada cruciferum* was recorded (0.45%). Effects of weather factors on population dynamics of the most common cabbage pests were found to decrease if temperature decreased as well as relative humidity. This study aimed to identify all the cabbage crop pests presents that are likely to cause problems in the future, the effect of different ecological factors as temperature and humidity on the occurrence of the different pests and their

natural organism that attack pests are studied. Data calculated on correlation coefficient to estimate the relationship between the numbers of cabbage pests associated with weather parameters.

Keywords: Cabbage pests, abiotic factors, temperature, humidity, Correlation

ECO-FRIENDLY APPROACHES FOR SUSTAINABLE DEVELOPMENT IN AGRICULTURE

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Agriculture is the most important enterprise in the world. Agriculture is the process of producing food, feed, fiber and other desired products by the cultivation of plants and the raising of domesticated animals. In a true sense, it is a productive unit where human get the free gifts of nature namely, land, light, air, temperature, rain water, humidity etc. are integrated into a single primary unit indispensable for human beings. The effect of prolonged and over usage of chemicals in crops production has resulted in human health hazards and pollution of environment and ground water. At present, the issue is whether to continue with the chemical inputs-based intensive technologies or to go back to the traditional environment friendly farming practices like organic farming for sustainable production, income and socio-economic development of the farming community. In this context that biological pesticides are being considered as environmentally safe, selective, biodegradable, economical and renewable alternative for use in organic farming system. Green Pesticides or ecological pesticides which are believe to be environmentally friendly and thus cause less harm to the eco system and animal health. In agrology, pesticides are evaluated for minimal average environmental effects. Biocides include germicidal, antibiotic, antibacterial, antiviral, antifungal, antitrozoals and antiparasites. Pesticides typically came in the form of sprays and dusts. Many ecological pesticides are biological pesticides. Environmental friendly agricultural technologies for food safety appropriate technologies, which do not assault the nature, would have key roles to play in ensuring food security, in improving human health and in rehabilitating and conserving the environment to safeguard the well being of the posterity. Instead of striving for more “green revolutions” with emphasis on miracle seeds, hard-hitting, synthetic and engineered pesticides and increased use of fertilizers, the future must look to natural ways and processes for augmenting agricultural productivity. In fact, all development efforts and activities should be within well defined ecological rules rather than within narrow economic gains. Sustainable agricultural systems must be ecologically sound for long-term food sufficiency, equitable in providing social justice, and ethical in respecting path future generations and other species.

MODULATION OF GROWTH AND BIOCHEMICAL PARAMETERS IN FENUGREEK (*TRIGONELLA FOENUM-GRACUM* L.) EXPOSED TO SALINITY STRESS

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Understanding and eventually shortening crop susceptibility to abiotic stresses such as salt, heavy metal, heat etc., could permit for elevated yields throughout stress environment in the cultivated areas of the world including arid and semi arid areas of the planet. Such research support sustainable yields and profitable crops. To moderate these effects, current biotechnological approaches are useful which 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 with this objective current investigation was carried out on fenugreek (*Trigonella foenum-graecum* L.), a valuable medicinal plant to find out the physiological and biochemical basis of salinity tolerance. Different concentration of NaCl viz.0 (as control), 50, 100, 150 and 200 mM were used to induce salinity. Results showed significant differences in evaluated indices. Results revealed a significant correlation between physio-biochemical indices under salinity stress. Salinity triggers antioxidative activity and rate of lipid peroxidation increased. Thus, results suggest that antioxidative enzymes play a significant role in detoxification and redox homeostasis during salt stress in fenugreek plant.

Keywords: Antioxidative mechanism, Growth parameters, Salt tolerance, *Trigonella foenum-graecum* L, vigour index.

ANAEMIA IN CHRONIC RENAL FAILURE PATIENTS UNDERGOING HAEMODIALYSIS: A CROSS SECTIONAL STUDY

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Chronic renal failure disease is frequently associated with anaemia and the level of anaemia correlates with the stage of chronic kidney disease (CKD). A cross-sectional study was conducted in 44 chronic kidney disease patients in the department of

medicine, M.L.B. Medical College, Jhansi during the period January to June, 2018. The study was evaluating the profile of anaemia and to find the association between the severity of anaemia and CKD-5 patients time period of taking on haemodialysis. Haemoglobin, blood urea, serum albumin, serum creatinine levels were examined using standard techniques. There was a significant difference in the haemoglobin of CKD patients taking 30 days regular interval 3 times values ($P < 0.05$). All 44 patients (100%) were anaemic there was no significant correlation between the severity of anaemia and serum creatinine levels ($P > 0.82$) the most frequent anaemia in chronic kidney disease patients was a malnourished type of a moderate degree anaemic (7 -10mg/dl). A significant correlation was not found between the severity of anaemia and serum creatinine levels 30 day interval of CKD of patients on haemodialysis.

Keywords: haemodialysis, anaemia, serum creatinine, haemoglobin, malnutrition.

AMLA (*EMBLICA OFFICINALIS*): A WONDERFUL BERRY WITH ITS THERAPEUTIC EFFECTS

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Emblica officinalis Gaertn. or *Phyllanthus emblica* Linn, commonly known as Indian gooseberry or Amla, is perhaps the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda. Several parts of the plant are used to treat a variety of diseases, but the most important is the fruit. Many ailments are treated by the fruit which is used either alone or in combination with other plants. These include common cold and fever; as a diuretic, laxative, liver tonic, refrigerant, stomachic, restorative, alterative, antipyretic, anti-inflammatory, hair tonic; to prevent peptic ulcer and dyspepsia, and as a digestive. *E. officinalis* possesses antipyretic, analgesic, antitussive, antiatherogenic, adaptogenic, cardioprotective, gastroprotective, antianemic, antihypercholesterolemic, wound healing, antidiarrheal, antiatherosclerotic, hepatoprotective, nephroprotective, and neuroprotective properties as demonstrated in numerous preclinical studies. Furthermore, experimental studies have reported that *E. officinalis* and some of its phytochemicals also exhibit anticarcinogenic properties. *E. officinalis* is also reported to possess radiomodulatory, chemomodulatory, chemopreventive, free radical scavenging, antioxidant, anti-inflammatory, antimutagenic and immune-modulatory activities. These properties are efficacious in the treatment and prevention of cancer. This review summarizes the results related to these properties and also emphasizes the aspects that warrant future research establishing its activity and utility as a cancer preventive and therapeutic drug in humans.

Keywords: Amla, *Emblica officinalis*, *Phyllanthus emblica*, therapeutic applications

NANOPESTICIDES: STATE OF KNOWLEDGE AND ENVIRONMENTAL FATE

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Nanotechnology is any engineered materials, structures, systems and process which exist or operate at a scale of 100 nm or less ($1\text{ nm}=10^{-9}\text{m}$). With the development of improved systems for monitoring environmental conditions and delivering pesticides appropriately, nanotechnology can further improve our understanding of the biology of different crops and thus potentially enhance yields. Nanopesticides are plant protection products where nanotechnology is employed to enhance the efficacy or reduce the environmental footprint of a pesticide active ingredient. There are different types of nano formulations that can be used for agrochemicals like nano emulsions, nano dispersion, nano suspensions and other. Many nanoformulations combine several surfactants, polymers, and metal nanoparticles in the nanometer size range. The aims of nanoformulations are generally common to other pesticide formulations, these being to increase the apparent solubility of poorly soluble active ingredients, to release the active ingredient in a slow/targeted manner and to protect against premature degradation. Nanoformulations are expected to (a) have significant impacts on the fate of active ingredients and (b) introduce new ingredients for which the environmental fate is still poorly understood. The incorporation of nanometals and nanometal oxides into organic pesticide formulations also influence the dynamic of pesticide residues as well as the toxicity. Current exposure modeling procedures are probably satisfactory for assessing the fate of most nanoformulations. Pesticide fate models employed in current environmental risk assessment methodologies to assess drainage exposure to Surface water (MACRO) and Leaching to groundwater (PEARL, PELMO, MACRO and PRZM). The present analysis provides a useful framework to identify priorities for future research in order to achieve more robust risk assessments of nanopesticides.

Keywords: nanopesticides, active ingredient, environmental fate, exposure modelling

PLASTIC MULCHING A BOON FOR PRODUCING BETTER QUALITY YIELD OF HORTICULTURAL CROPS

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In agriculture since time immemorial, farmers have been using natural mulches such as leaf, straw, dead leaves and compost for centuries, during the last 60 years the advent of synthetic materials has altered the methods and benefits of mulching. Mulch are

technical term means 'covering of soil'. In this manner it plays a positive role in water conservation, elimination of weed growth, moderation of soil temperature and hence to create condition more conducive for good plant growth resulting in higher yields of quality produce. Plastic mulches are available in different colours (Black, White, Silver etc.,) and thickness (25-200 microns). Usually film thickness of 30-50 microns can be used for one to two seasons (4-12 months) for annual crops. While, thickness of film 100-200 microns can be used for about 2-3 years in widely spaced fruit crops. Plastic mulches retention the moisture in the top layer of soil upto 30 cm as well as maintenance of the temperature compare to higher fluctuations in the un-mulched areas. It is evident that the growth and yield parameters of the crops covered with plastic mulch have significant difference over the organic mulches though; few organic types of mulch are on par with the plastics mulch in some of the horticulture crops. 100 micron (400 gauge) thickness of black LDPE film used for mulching, is more beneficial in terms of water use efficiency and suppression of weeds especially the monocot weeds like nut grass (*Cyperus rotundus*) and also *Cynodon dactylon* thereby avoiding the competition for water and nutrients with the main crops resulting in higher yields of better quality produce with minimize duration for flowering, maturity and harvesting of crops as compare to un-mulched plots. While, 50 microns (200 gauge) black LDPE film will suppress only dicot and some of the monocot weeds as the nut grass damages and destroys the film by piercing through the mulch film. In crossandra one of flower crops the establishment of the saplings will be to the tune of 95 per cent as compared to only 45-60 percent in unmulched plots because of the weed competition. The bi-coloured mulch film with silver grey on the top and black at the bottom used as a mulch material in strawberry cultivation apart from increasing the yield and quality of the fruits, duration of fruit bearing can also be increased. Hence, the plastics mulch has a major role in agriculture in general and horticulture in particular for enhancement of yields of the better quality produce. Plasticulture is crucial to Indian agriculture in view of the changing technological scenario for boosting crop yields and productivity. Introduction of linear low density polyethylene (LLDPE) as a mulch film has brought a revolution in agricultural water management. It is actually a boon to dryland farmers. This is one of the fastest growing plasticulture applications in the world. The cost of LLDPE film is also lesser than one third of LDPE mulch film. Moreover for mulch activity lower thickness (15 to 20 microns) is highly suitable. However due to ever increasing cost of raw materials the films are costlier now. Hence Low cost machines may be developed for spreading and rolling down the film in the field. PFDC's may be geared up for large scale demonstration in farmer's field to give a wide publicity

INTEGRATED NUTRIENT MANAGEMENT ON GROWTH AND YIELD OF WHEAT (*TRITICUM AESTIVUM* L.)

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The present investigation entitled "Integrated nutrient management approach on wheat (*Triticum aestivum* L.)" was carried out with the objective to evaluate the effective nutrient management for maximizing productivity of wheat. Wheat is one of the major staple crops in the country in terms of both production and consumption. Integrated Nutrient Management (INM) effects on various growth and yield attributes of wheat crop and its nutrient uptake rate by influencing the nutrient status in soil system. The crop was given N, P, K, S, Zn, B and Mn nutrient as per treatments through urea, single super phosphate, murate of potash, zinc sulphate, Borax and ammonium, manganese, respectively. In addition to these nutrients, farmyard manure and *Azotobacter* in respective treatments were also given with recommended dose of NPK. Five irrigations were given at different critical stages of the crop. Weed control was adopted for all the treatments and there were need of any plant production measures. The observations on growth parameters (plant height, number tillers/m row length, leaf area index, yield attributes (viz. effective tillers/m row length, characteristic of ear head, 1000-grain weight) and grain as well as straw yields were recorded. Nutrient (NPK) content and their uptake in grain and straw were also analyzed under all the treatments. The economic analysis (cost of cultivation, gross and net monetary returns and profitability of the treatments) on per hectare basis was circulated. After harvest of the crop soil samples from each plot were taken and analyzed to know the changes in chemical properties of the post-harvest soil. Finally, the data were statistically analyzed.

Keywords: Integrated nutrient management, FYM, balanced fertilizer.

CURRENT STATUS AND CHALLENGES OF MICROALGAE AS AN ECO-FRIENDLY BIOFUEL FEEDSTOCK: A REVIEW

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In present world, progressively rising population, depleting energy reserve and overwhelming global warming is of great concern. To look these issues, world is in search of renewable and environmental friendly source of energy. Currently, microalgae have been receiving considerable attention as a promising biofuel feedstock's in comparison to other sources. Several unique characteristics of microalgae includes high productivity, no competition for arable land, fresh water and high CO₂ sequestration efficiency make it most sustainable environmental friendly alternative of fossil fuels. Despite of all advantages, there are hurdles in commercialization of algal based technology. This review presents the various perspectives of microalgae for sustainable source of

energy. We have introduced briefly the algae cultivation strategies, algal conversion technologies and also discussed the hurdles and strategies for commercialization of algal based technology.

Keywords: microalgae, biofuel, environmental friendly, renewable

EVALUATION OF AQUACROP MODEL FOR WHEAT CROP UNDER DIFFERENT IRRIGATION CONDITIONS IN TARAI REGION OF UTTARAKHAND

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By 2030, the world economy is projected to double and the world population to increase by one third (Gurria, 2009). To feed these people, crop production should be increased by 33%. The agricultural sector needs particular attention, as it accounts for about 70% of water use worldwide. Wheat is not only the most widely cultivated crop but also the most consumed food crop all over the world. A field study was conducted during *rabi* 2013-14 at agricultural farm of G.B. Pant University for improving water management in wheat using Aquacrop model in *Tarai* region of Uttarakhand. Aquacrop, model has been calibrated for winter wheat using grain and biomass yield for the three treatments of sowing dates viz., 3rd December, 18th December and 3rd January data of 2013-14 crop season. The calibrated Aquacrop model was then applied to validate wheat yield and biomass for three consecutive years viz., 2010-11, 2011-12, and 2012-13. The simulation results of Aquacrop model for all the above mentioned years were in accordance with the observed grain yield and biomass of wheat. The model subsequently used to simulate yield under three irrigation scenarios viz., 40 mm, 50 mm and 60 mm each having 4 levels. Present study shown that in this region 3 irrigations of 60 mm each at CRI, Panicle initiation and Milking stages are required, (excluding rain water contribution) for optimum yield except in the drought years. The simplicity of Aquacrop in its required minimum input data, which are readily available or can easily be collected, makes it user-friendly.

Keywords: Aquacrop, Calibration, Validation, Wheat, Irrigation Scenario, Simulation

GENETIC DIVERSITY ANALYSIS AMONG DIFFERENT BMR LINES OF SORGHUM (*SORGHUM BICOLOUR* L. MOENCH) FOR FORAGE YIELD AND QUALITY ATTRIBUTING TRAITS

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The present study was conducted for morphological and biochemical characterization on 25 sorghum genotypes (*Sorghum bicolor* L. Moench) for 31 fodder yield and seven quality attributing traits using Mahalanobis' D² analysis. The main quality attributing traits in forage sorghum are crude protein, IVDMD (in vitro dry matter digestibility), NDF (Neutral Detergent Fiber), ADF (Acid Detergent Fiber), Lignin, DDM (Digestible dry matter) and Protein yield; out of these crude protein and IVDMD are most important. Crude protein (CP) content is often considered as a good quality determinant and commonly used for measure of feed quality, whereas, IVDMD is a measure of plant quality index. In present investigation variability studies revealed that crude protein and IVDMD varied from 8.2 to 9.4 % and 59.4 to 68.2 %, respectively. Based on clustering pattern, the genotypes were grouped in six clusters with cluster I having the highest genotypes and cluster V with the lowest number. The highest intra-cluster distances were observed in cluster I (5.06) and lowest in cluster VI (3.57), while, Cluster VI showed maximum inter-cluster distance (11.38) and minimum in cluster IV (5.35). The genotypes of cluster I, IV, V and VI were identified as diverse as well as having higher mean values for most of the yield component traits. Thus, hybridization involving genotypes of clusters VI and IV and clusters I and V are expected to release maximum amount of variability and advocated in order to achieve high yielding segregants.

Keywords: Sorghum, CP, IVDMD, Mahalanobis' D² analysis, Variability.

EFFECT OF GUAVA WEDGE GRAFTING ON DIFFERENT DIAMETERS OF ROOTSTOCK UNDER DIFFERENT GROWING CONDITIONS

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The graft success of seedlings depends on seedling diameter and skill of grafter. Rootstocks at younger age are bound to reduce the cost of graft in nursery. 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 diameter for successful wedge grafting with polycap of guava rootstock cv. L-49 under different growing conditions (Greenhouse, shade-net and open condition) with different diameter of rootstock (6-6.5, 10-10.5 and 14-14.7 mm). The results revealed that under greenhouse + 10 mm diameter of rootstock takes minimum days (23.8) for successful grafting and maximum

scion length (18.7cm) were recorded on 95 days after grafting followed by 6 mm diameter under shade-net. At 10 mm diameter, early contact of cambium layer of stock and scion results in easy callus formation and initiation of subsequent growth. 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 greenhouse on 10 mm diameter of seedling followed by 6 mm diameter of seedling.

Keywords: Guava, Rootstock, Propagation, Greenhouse, Shade-net, Diameter

EFFECTS OF THE ADDITION OF SPIRULINA PLATENSIS POWDER ON THE NUTRITIONAL PROPERTIES OF EXTRUDED PRODUCTS BASED ON WHOLE WHEAT FLOUR

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Value added extruded products like noodles, macroni and spaghettis are not very much common among people specially in India, whereas, supplemented extruded products with different herbs or any other nutritional ingredient which give much more health benefits should be introduced into the market such as *Spirulina platensis* powder which consist of many nutrients and are also beneficial for human health. It has many nutrients like all essential amino acids, vitamins, minerals, antioxidants, *in vitro* protein digestibility, etc which are very helpful in today's world because junk food with refined flour and other food items in the market are not healthy and which are very common among youngsters. So, a study has been carried out to develop value added extruded products like noodles and macroni. Control and *Spirulina platensis* powder supplemented noodles and macroni were developed at 2, 4, 6 and 8% levels. Whereas, 8% level of *Spirulina* incorporated extruded products got minimum scores. So, on the basis of their organoleptic acceptability, *Spirulina* supplemented extruded products up to 6% level were further selected for nutrition composition. Among the supplemented products, 6% *Spirulina* powder incorporated extruded products exhibited higher amount of all the nutritional parameters i.e protein (15.60%) & (15.65%), crude fibre (3.29%) & (3.23%), ash (1.87%) & (1.90%), total dietary fibre (9.19%) & (9.23%), *In vitro* protein (65.47%) & (65.95%), total lysine (2.98 mg/100g) & (2.99 mg/100g) in noodles and macroni, respectively. However, total minerals were also found in high range in 6% supplemented extruded products as compared to control i.e Ca, P, Mg, Fe and Zn were found to be 82.10, 378.49, 139.40, 6.69 and 2.32 mg/100g and 82.21, 378.65, 139.98, 6.72 and 2.35 mg/100g in noodles and macroni, respectively.

Keywords: *Spirulina platensis* powder, Supplementation, Extruded products, Organoleptic acceptability, Nutrition composition

CORRELATION COEFFICIENT ANALYSIS OF DIFFERENT SEED QUALITY PARAMETERS IN MAIZE HYBRIDS

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Rabi season and *kharif* season produced seeds of four maize hybrids viz HQPM 1, HQPM 5, HM 8 and HM 9 were subjected to various viability and vigour tests during 2016-17 in laboratories of the department of Seed Science & Technology, CCS Haryana Agricultural University, Hisar. Correlation coefficient analysis was employed to find out the association among various seed viability and vigour parameters for both the season (*rabi* and *kharif*). From this analysis, it was observed that the standard germination showed positive and significant association with seed vigour index-I (0.978*), tetrazolium test (0.965*), while it was negatively and significantly correlated to electrical conductivity (-0.998**). On the other hand electrical conductivity which is a measure of electrolyte leakage from seed showed significant and negative association with standard germination (-0.998**), seed vigour index-I (-0.979*) and tetrazolium test (-0.966*). In *kharif* season the standard germination showed positive and significant association with seed vigour index-I (0.954*), vigour index-II (0.966*), seed density (0.981*) and tetrazolium test (0.973*), while electrical conductivity showed negative and significant association with seedling length (-0.965*), seed vigour index-I (-0.965*), seed vigour index-II (-0.964*), seed density (-0.961*), seedling dry weight (-0.967*) and tetrazolium test (-0.972*). Tetrazolium test which is considered as indicator of seed viability showed the positive and significant association with standard germination (0.965*, 0.973*) and vigour index-I (0.998**, 0.967*) in *rabi* and *kharif* season respectively. So from the above study it can be concluded that a good quality and vigorous seed will always have lower electrical conductivity and perform better in all other seed quality parameters.

Keywords: Maize, season, correlation, quality, electrical conductivity

ENVIRONMENTAL AND SUSTAINABLE FRIENDLY ENERGY RESOURCES: RENEWABLE ENERGY, GREEN ENERGY, BIOFUELS AND WASTE PRODUCT ENERGY**NIDHI SHARMA, SAVITA RANI, SUNITA RANI AND JAGDISH PARSHAD****Department of Microbiology, CCS Haryana Agricultural University, Hisar-125004**

Sustainability is the only key to solve the rising issues of the environment. Sustainable development should meet the needs of the present without compromising the ability of future generations to meet their own needs. The terms "sustainable energy" and "renewable energy" are often used interchangeably while referring to sources of energy, however particular renewable energy projects sometimes raise significant sustainability concerns, as they generally contribute to world energy security, reducing dependence on fossil fuel resources, and providing opportunities for mitigating greenhouse gases. Various Cost-benefit analysis work by a disparate array of specialists and agencies have been conducted to determine the cheapest and quickest paths to decarbonizing the energy supply of the world. Renewable energy resources may be used directly (solar ovens, geothermal heating, and water- and windmills) or used to create other more convenient forms of energy generation through wind turbines or photovoltaic cells, or production of fuels such as ethanol from biomass, the energy in biomass is accumulated over a period of months, as in straw, or through many years as in wood. Green energy is energy that can be extracted, generated, and/or consumed. A biofuel is a [fuel](#) that is produced through biological processes, by using agriculture, [anaerobic digestion](#), commercial, domestic, industrial wastes. [Bioethanol](#) is an alcohol made by fermentation, biodiesel is produced from oils or fats. As of 2011, mandates for blending biofuels exist in 31 countries at the national level and in 29 states or provinces. Biogas is [methane](#) produced by the process of [anaerobic digestion](#) of organic material by [anaerobes](#). Green diesel is produced through [hydro cracking](#) biological oil feedstocks, such as vegetable oils and animal fats. Waste to energy is a solution for tomorrow's energy. The most common method for waste to energy generation is **incineration**, decomposition.

Keywords: Sustainability, Renewable energy, Biomass, Biofuel**POPULATION DYNAMICS AND BIO-EFFICACY OF SOME NEWER INSECTICIDES AGAINST APHID, *APHIS GOSSYPHII* (GLOVER) AND JASSID, *AMRASCA BIGUTTULABIGUTTULA* (ISHIDA) INFESTING BT COTTON****NIHAL R^{1*} AND SUVASH CH. BALA²**¹**Department of Agricultural Entomology, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal**²**AINP on Agricultural Acarology, Directorate of Research, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, Nadia, West Bengal**

An Experiment was conducted at District seed farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia to understand the population dynamics of cotton aphid and cotton jassid evaluate some newer insecticide against cotton aphid and cotton jassid in Bt-cotton for consecutive two years during *Rabi* season 2016-17 and 2017-18. According to two years mean data, aphid population first appeared in the field during 3rd standard meteorological week (SMW) and after the population progressively increased and reached its peak (139.00 aphids per leaf) in 9th meteorological week whereas jassid *Amrasca biguttulabiguttula* infestation was first noticed in the field at early vegetative stage of crop i.e. 3rd meteorological week and remained more or less active throughout the growing season of cotton and reached its peak population (53.10 per 10 leaves) in 8th meteorological week after that the population showed fluctuating downward and reached the lowest level (8.06/10 leaves) at 20th standard meteorological week. The results from the bio-efficacy data revealed that The treatment imidacloprid 17 % SL @ 150 ml/ha and Diafenthiuron + Acetamiprid @ 600g/ha were significantly superior in controlling cotton aphid, recorded 95.00% and 93.97% mortality respectively at 3 days after spraying. The treatment Diafenthiuron + Acetamiprid @ 500g/ha and @ 600g/ha were significantly superior in controlling cotton jassid, recorded 91.46% and 92.73% mortality respectively at 3 days after spraying.

Keywords: Cotton, Aphid, Jassid, Population Dynamics, Bio-efficacy.**CONSTRAINTS ANALYSIS IN POULTRY PRODUCTION IN MPUAT SERVICE AREA AND AJMER DISTRICT OF RAJASTHAN****NIKITA****Department of Agricultural Economics, CoA, SKRAU, Bikaner**

A study was undertaken during December 2016 to May 2017 to analyze the constraints faced in poultry production by producers in MPUAT service area and Ajmer district of Rajasthan. For the study there were total four poultry farms selected randomly and purposively from the four different blocks of study areas. The data were collected by personal interview with the help of pre-tested interview schedule containing a list of constraints and the farmers were asked to rank them. Constraints faced by poultry growers in egg and chicken production in both the areas were identified and ranked by using their frequency of occurring. In this technique the poultry farmers have been asked to rank the factors that are limiting the poultry production. The order of the merit given by the respondents was changed into ranks. The data so collected were tabulated and analyzed statistically. Major constraints faced by poultry producers in poultry production in the study areas were high cost of feed, day old chicks, medicine and veterinary charges

etc in MPUAT service area and in case of Ajmer district high disease incidence, high fluctuations in selling prices, high rate of mortality, high cost of variable inputs, high cost of establishment, non-availability of government policies and subsidies and non-availability of resources were found to be major problems in poultry production.

Keywords: poultry, constraints, production, rank

MORPHOLOGICAL PERFORMANCE OF BANANA (*MUSA SPP.*) CULTIVARS UNDER SUB-HIMALAYAN TERAI REGION OF WEST BENGAL

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A field experiment was carried out at Instructional Farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal during 2018-19 with an aim to evaluate the morphological performance of some banana cultivars namely Malbhog, Chini Malbhog, Kanchekala, Bichekala (seeded banana), Madhubas, Grand Naine, Red banana, Manua, Thorchara and Amrit Sagar were assessed. Evaluation was made with the help of IPGRI banana descriptors to know the performance in the locality of Sub-Himalayan terai region of West Bengal. Maximum morphological variation was observed for plant characteristics. Highest plant height and number of leaves recorded in Bichekala (seeded banana), maximum number of suckers and pseudo stem girth were observed in Kanchekala. As per the result of present study permitted to better understand the performance of banana cv. Bichekala (seeded banana) is better for the cultivation.

Keywords: Banana, Morphological Descriptors, *Musa* spp., Suckers

MOLECULAR PHYLOGENETIC ANALYSIS OF *CATLA CATLA* (HAMILTON, 1822) COLLECTED FROM DIFFERENT WATER BODIES OF WESTERN UTTAR PRADESH, INDIA

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The present study was conducted on Molecular Phylogenetic Analysis of *Catla catla* collected from different sites of Western Uttar Pradesh. DNA isolation was done and gel electrophoresis was carried out. The genomic DNA was amplified and sequenced. Different regions of taxonomic importance like 16 S rRNA and Cytochrome Oxidase subunit was amplified using available primers. The DNA sequences were edited and contig sequences were generated through DNA Baser version 4.20.0 and Bio-Edit and were submitted to National Centre for Biotechnology Information (NCBI) through BankIt submission tool. The sequences were compared by using computational technique, BLAST (Basic Local Alignment Search Tools) with the other related species sequences available at the Gen Bank of NCBI (National Centre for Biotechnology Information). The Phylogenetic analyses of all the sequences were performed using software MEGA 7.0. Available data was retrieved from the NCBI database and were utilized for the construction of distance matrix and Phylogenetic analysis through maximum parsimony method and NJ tree construction. Sequence of *Catla catla* was taken and used as out group for generating the trees. The molecular data based on 16 S rRNA and COI gene sequences was close to topotype population. The cryptic samples and other fish were identified and characterized based on three gene studies viz. 16S, COI, showed maximum similitude to gene sequences of gene sequence available on NCBI *Catla catla* and hence considered as the same. The tree is drawn to scale, with branch lengths in the same units as those of the evolutionary distances used to infer the Phylogenetic tree.

Keywords: Molecular Phylogenetic Analysis, DNA extraction, *Catla catla*, 16 S rRNA, COI gene.

DECADAL CHANGES IN LAND USE/LAND COVER USING TEMPORAL REMOTE SENSING DATA AND GIS-A CASE STUDY IN BASALTIC TERRAIN OF CENTRAL INDIA

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The surface of the earth is undergoing rapid land-use/land-cover (LULC) changes due to population growth, various anthropogenic activities and natural phenomena. The main aim of this study was to gain a quantitative understanding of land use and land cover decadal changes in Miniwada Panchayat using remote sensing data and GIS techniques. Supervised classification-maximum likelihood algorithm was applied in ArcGIS to detect land use /land cover changes using multispectral satellite data obtained from Landsat TM and Landsat 8 for the years 2005 and 2015, respectively. The study area was classified into five major LU/LC classes viz. waterbodies, Forest, agricultural land, fallow land and others. Change detection analysis was performed to compare the quantities of land cover class conversions between time intervals. Ground truth observations were also performed to check the accuracy of the classification. The results revealed both increase and decrease of the different LULC classes from 2005 through to 2015. The results indicate that during the decade, the agricultural land showed 3.61 % decline, others include settlement and

government areas showed 15.28 % increase in the past 10 years. A significant shift from some classes to others was also observed. Land use and land cover changes have wide range of consequences at all spatial and temporal scales. The study reveals that the LULC pattern and its spatial distribution are the major rudiments for the foundation of a successful land-use strategy required for the appropriate development of any area.

Keywords: Land use, Land cover, Landsat data, Remote Sensing, GIS, Supervised Classification

GENOME EDITING AND ITS APPLICATION IN IMPROVEMENT OF HORTICULTURAL CROPS

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Quality of the harvested horticultural crops is very important for its consumption, storage, process and also for nutritional security. Moreover, the market price also depends on the quality of the horticultural crops. Quality is a major issue in horticultural crops like vegetables, fruits, flowers and spices and quality improvement is one of the major objective in breeding programmes. Improvement of quality through traditional breeding practices is a difficult task due to non-availability of desirable germplasm in large quantity. Mutation breeding was largely used for quality improvement of crops but it has its own limitations. Therefore, use of advanced biotechnological tools is necessary for quality improvement in horticultural crops. The best example of quality improvement by CRISPR/Cas9 technique is the amylopectin containing starch in potato that is completely devoid of amylose (Andersson *et al.*, 2016). The high amylopectin starch potatoes have great demand for many technical applications and in processing industry. Complete absence of amylose further confirms the multi-allelic mutagenesis of granule bound starch synthase (GBSS) gene in genome edited potatoes. Enhancing the shelf life of fruits, vegetables and flowers is an integral part of breeding for quality improvement. Ethylene hormone plays a key role in wilting of flowers and fruit ripening which determines the shelf life (Reid and Wu, 1992). The Knockout of specific genes involved in ethylene biosynthesis using CRISPR/Cas9 is an effective technique to enhance the shelf life of horticultural crops (Xiong *et al.*, 2015). In some crops like tomato, pumpkin, bottle gourd, pointed gourd, ash gourd and watermelon, seedless or less seeded fruits are preferred for consumption or for processing. Genome editing has been proved to be an effective method to develop seedless or parthenocarpic fruits in tomato by knockout of Slagamous-like 6 gene (Klap *et al.*, 2017) and SlIAA9 gene (Ueta *et al.*, 2017).

Key words: Genome editing, CRISPR/Cas9 (Clustered regularly Interspaced Short Palindromic Repeats) Horticultural crops and Quality improvement.

GENETIC CONTROL AND ALLELIC RELATIONSHIPS OF FLOWERING TIME GENES IN CHICKPEA

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Chickpea (*Cicer arietinum* L.) is a cool season annual legume crop. Terminal drought & heat stress are major constraints to chickpea production. Therefore, time of flowering plays a critical role in adaptation of chickpea cultivars to different environments. The wide variability for time to flowering in chickpea germplasm has been documented. In 1999, in Israel chickpea breeders assessed the potential range of chickpea germplasm as a source for early flowering and studied the inheritance of time to flowering trait between an early-flowering breeding line (ICC 5810) with weak photoperiodic response and a late-flowering high-yielding (Hadas) cultivar with a strong photoperiod response & observed 3(late):1(early) ratio in F₂. This segregation is consistent with action of a major photoperiod response gene (*Ppd*) affecting time to flowering. In 2000, genetics of flowering time was studied in between ICCV 2 X JG 62 cross. The F₂ population was advanced through the single-seed-descent method to develop recombinant inbred lines (RILs). The time of flowering for the two sets of RILs showed bimodal distributions with nearly equal peaks. This suggests that a single gene controls the difference for the time of flowering. Therefore the allele carried by JG 62 was designated as *Efl-1* and that by ICCV 2 as *efl-1*. Genetics of flowering time was studied in late×early, early×late and early×early crosses under field to obtain additional information on the number of genes involved and their allelic relationships. Results have shown that duplicate dominant genes with cumulative but unequal effect govern flowering time in chickpea. A genotype with a dominant allele in homozygous or heterozygous condition at one of the loci and homozygous recessive allele at the other (*Efl1,efl2*) control earliness (26–40 days) and a genotype with homozygous recessive alleles at both loci (*efl1,efl2*) is responsible for super-earliness (<25 days). Another study was conducted to establish allelic relationships of the early flowering genes of ICC 16641, ICC 16644 and ICCV 96029 with three known early flowering genes, *efl-1* (ICCV 2), *ppd* or *efl-2* (ICC 5810), and *efl-3* (BGD 132). The results indicated that the *efl-1* gene identified from ICCV 2 was also present in ICCV 96029, which has ICCV 2 as one of the parents in its pedigree. ICC 16641 and ICC 16644 had a common early flowering gene which was not allelic to other reported early flowering genes. The new early flowering gene was designated as *efl-4*.

Keywords: Chickpea, Time of flowering, Genetics of flowering, Allelic relationships.

EFFECT OF BIO-MANURES ON GREEN FORAGE YIELD OF OAT IN IRRIGATED CONDITIONS

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A field experiment was carried out during winter season of 2008-09 and 2009-10 to study the effect of nutrient management by using value added bio-manures in Oat crop in sandy loam soil at Fodder Farms of Indian Veterinary Research Institute, Bareilly, U.P., India. Result indicated that application of vermi bio-manure @ 10t/ha(T₂) produced maximum oat green fodder yield 390.5 q/ha over the control (T₁) 270.8q/ha, followed by vermi ; NADEP 50 : 50 (T₇) yield 374.6q/ha, followed by FYM : NADEP 50 : 50 yield 365.7q/ha (T₆) , followed by Vermi : FYM : 50 :50 (T₅) produced yield 348.6q/ha green fodder yield of Oat. Application of FYM 10t/ha produced green fodder yield 311.7q/ha and lowest by application of bio-fertilizers (T₈) produced 300.6 q/ha green forage yield of oat. The dry matter yield was also in the similar trend. This trials was conducted under collaborative Research project-Recycling of animal and farm waste and application of their value added products in sustainable crop production and animal husbandry. The results indicate that application of vermi-compost @ 10t/ha is suitable for recommendation of manures under organic fodder production. The trial was conducted in sandy loam soils in irrigated conditions of Bareilly district of western Uttar Pradesh. The author is PI of the sub project under which trial was conducted.

Keywords: Manures, forage, bio fertilizers, yield, irrigation, soils

THE REGULATORY MECHANISMS OF ABIOTIC STRESS TOLERANCE IN PLANTS

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Plant productivity is severely affected by abiotic stress like salinity, drought and temperature. Due to these stresses, physiological and biochemical responses in plants vary and cellular aqueous and ionic equilibriums are disrupted. There are hundreds of genes and their products respond to these stresses at transcriptional and translational level and understanding the functions of these stress-inducible genes helps to unravel the possible mechanisms of stress tolerance. The perceptive about the post-translational modifications of proteins, degradation of proteins and also non-coding micro-RNA interactions will allow us the modulation of the target proteins. There are several crop plant have been improved with traits that confer tolerance to these stresses using traditional and modern breeding methods. Mechanisms that operate signal perception, transduction and downstream regulatory factors are now being examined and an understanding of cellular pathways involved in abiotic stress responses provide valuable information on such responses. A DNA cassette containing an *Arabidopsis* C repeat/dehydration-responsive element binding factor 1 (*CBF1*) cDNA and a *nos* terminator, driven by 35S promoter, was transformed into the tomato genome. These transgenic tomato plants were more resistant to water deficit stress than the wild-type plants. Three DREB homologue genes viz., GmDREBa, GmDREBb and GmDREBc were isolated from soybean. Each of the deduced proteins contains an AP2 domain of 64 amino acids. The transcriptions of GmDREBa and GmDREBb were induced by salt, drought and cold stresses in leaves of soybean seedlings and these three genes function specifically in response to abiotic stresses in soybean.

Keywords: Abiotic stress, Arabidopsis, cDNA, DREB, Soybean, Tomato

PIGEONPEA PRODUCTION IN INDIA: A DECOMPOSITION ANALYSIS

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The time series secondary data on area, production and yield of pulses from 1950-51 to 2016-17 were broadly partitioned into seven decades in order to demonstrate the trend of pulse production in more convincing and simple manner in the present study. The partition of the data in decade's terms could clearly show the pigeonpea production status and growth pattern in the country. The farmer could achieve these increasing mainly introduction to resistant varieties against different diseases and insects-pests, better management and matching with improved production and protection technologies. It has also been observed that the growth of area, production and yield for pulses registered positive during overall period. Decomposition analysis was performed and the percentage contribution of area, yield and their interaction on pulses production for each decades and the overall period was also estimated. The yield effect has a greater say in pulses for overall period. Response to change in production because of effect in area is evident during fifties, sixties and ninties. In seventies and eighties, the change in production is due the reduction in yield effect. The intearaction of area and yield is not much except in the ninties.

PREDICTING THE AREA AND PRODUCTION OF SUGARCANE IN TAMIL NADU USING NEURAL NETWORKS**P. DINESH KUMAR, TUFLEUDDIN BISWAS AND DEBASIS MAZUMDAR****Department of Agricultural Statistics, Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, India**

Sugarcane is a major cash crop in India, grown in almost 5 million hectares of area with a production of 339 million tonnes. In India, Tamil Nadu is a significant state in the production of sugarcane. The past year data shows that there was a huge fluctuation in the area and production of Tamil Nadu. So, predicting the area and production with traditional modelling techniques fails because the assumptions are never attained in those situations. To overcome that, soft computing techniques like Artificial neural networks used. In this study, multilayer perceptron neural network (MLP-NN) with back propagation was used to predict the area and production of sugarcane in Tamil Nadu. MLP-NN (2,2) model predicts the area with minimum MAE (18.139) and RMSE (23.058) value with higher accuracy (99%). For production, MLP-NN (2,1) model estimates with minimum MAE (24.875) and RMSE (31.199) value with higher accuracy (99%). So, MLP-NN (2,2) and MLP-NN (2,1) are the best ANN models to predict area and production of sugarcane in Tamil Nadu respectively. Additionally, ANN models perform better in predicting the nonlinear stochastic data.

Keywords: Sugarcane, Multilayer perceptron, Neural network, Back propagation, nonlinear, Neuron.

ATTRIBUTION OF SOIL AGGREGATING ELEMENTS AND ORGANIC CARBON FRACTIONS IN SOIL AGGREGATION UNDER DIFFERENT LAND USES IN ACID SOILS OF MEGHALAYA, INDIA**P. HELENA*, CHANU, P.K. BORA AND SANJAY SWAMI****School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Umiam (Barapani) Meghalaya, India*****Present address: Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, UP.**

The land use is an important factor affecting soil organic carbon (SOC) accumulation and storage in soils. The study was conducted at two different areas, Bhoirymbong and Umsning of Ri-Bhoi District, Meghalaya in eight (8) different land use systems viz. *Jhum*, Upland Rice, Terrace Rice, Rice mono-culture, Rice-Potato, Pineapple, Mixed forest and Broom grass. The soil organic carbon (SOC), particulate organic carbon (POC), soil microbial biomass carbon (SMBC) and hot water extractable carbon (HWEC) were measured in soil of different land uses. Aggregates were fractionated using a wet-sieving procedure to obtain the distribution of water-stable aggregates. Mean Weight Diameter (MWD) is found highest in Upland Rice (2 mm) and Terrace Rice (1.72 mm) at 0-10 cm and 10-20 cm depth, respectively in the study areas. Furthermore, higher MWD in surface soil was obtained from Upland rice which indicated that as the Upland rice cultivation is traditionally a mono-culture activity without much soil manipulation the aggregation might not have broken in the cultivation process. Carbon fractions influence the aggregate formation and its different size fractions. SMBC, SOC, POC and HWEC show significant ($p \leq 0.05$) and strong positive correlation with MWD at both depths of the study sites. At 0-10 cm depth, highest positive correlation with MWD was shown in SMBC (Bhoirymbong) and SOC (Umsning). And, at 10-20 cm depth, highest positive correlation with MWD was shown in SMBC in the study areas. So, from the findings of this study clearly shown that the proper selection of land use according to the state of soil aggregating elements for better soil sustainability.

Keywords: Soil aggregation; Microbial Biomass Carbon; Soil Organic Carbon; Particulate Organic Carbon; Hot Water Extractable Carbon

CHIRONJI: IMPORTANT NEGLECTED MINOR FRUIT TREE AND ITS BY-PRODUCT**P. K. NISHAD^{1*}, S. PATEL², R. K. NAIK² AND N. K. MISHRA²****¹ICAR-Central Institute of Agricultural Engineering, Bhopal, ²Indira Gandhi Krishi Vishwavidyalaya, Raipur, MP**

The edible chironji fruit consists of three portions: the inner small kernel or meat (20-25%), the middle hard shell (68-75%), and an outer green shell cover or hull (5-7%). The nutritional importance of chironji fruit is related to its kernel. Other parts of fruit such as shells and hulls were used as livestock feed and burned as fuel. Chironji shell or hull is considered a by-product of the chironji industry that is usually underutilized or considered waste. It is removed from the chironji seed after the seeds are sun dried. Some studies have been reported in order to give a nobler destination to this material. In this review, a characterization of chironji fruit and potential applications of its by-product as a food ingredient are discussed.

Keywords: Chironji seeds, chironji by-products, chironji shell, chironji hull

INTEGRATED MANAGEMENT OF *ALTERNARIA* LEAF BLIGHT AND NECROSIS OF SUNFLOWER**P. N. MANE¹, MANJUSHA S. GAIKWAD^{2*}, AND S. B. SAKHARE³**¹Oilseed Research Unit, Dr. PDKV., Akola, India, ²College of Agriculture Gadchiroli, Dr. PDKV., Akola, India, ³Oilseed Research Unit, Dr. PDKV., Akola, India

Field experiment was conducted at Oilseeds Research Unit, Dr. Panjabrao Deshmukh Krishi Vidyapeeth, Akola during *kharif* 2013 -14 and 2015-16, to study integrated management of *Alternaria* leaf blight and necrosis of Sunflower. Seed priming with *Trichoderma viride* @10g/kg seed, Carbendazim 50 WP @ 2g/kg seed + Thiamethoxam 600 FS @ 4g/kg seed, *Trichoderma viride* @10g/kg seed + Thiamethoxam 600 FS @ 4g/kg seed with foliar spray of Propiconazole 25 EC @ 1ml/l + Thiamethoxam 25 WG @ 1.6g/l, 25 EC @ 1ml/l + Azadirachtin 1500 ppm @ 1.5 ml/l, *Pseudomonas fluorescence* @ 5 g/l + Azadirachtin 1500 ppm @ 1.5 ml/l were evaluated. Hydro priming has been used to infuse fungicides into seeds. Seed priming with Carbendazim 50 WP @ 2g/kg seed + Thiamethoxam 600 FS @ 4g/kg seed followed by spray of Propiconazole 25 EC @ 1ml/l + Azadirachtin 1500 ppm @ 1.5 ml/l at onset of disease and 15 days later (T4) was found economical (1 : 7.52 ICBR) and effective for the integrated management of *Alternaria* leaf blight and necrosis of Sunflower.

EKBOM SYNDROME: BUGS OF THE MIND**P. P. PRADHAN, R. N. BORKAKATI****Department of Entomology, Assam Agricultural University, Jorhat, Assam, India-785013**

Ekbom Syndrome synonymous with delusional parasitosis, is a turmoil wherein people erroneously trust that they are pervaded with parasites, insects, or bugs, while as a general rule no such invasion is available. People experiencing this disorder frequently guarantee to feel tactile sensations and to imagine the bugs, albeit nobody else can see them. Morgellons malady is a dubious condition portrayed by a fixed conviction that fibers that are imbedded or expelling from the skin; this condition is likely in the range of DP. Ekbom Syndrome is a capricious condition; it is unmanageable and can't be redressed by contention or proof. Ekbom Syndrome sufferers display a scope of unsurprising practices in their endeavors to take out their pervasions, including looking for distinguishing pieces of proof and treatment from physicians and entomologists. Regularly they additionally experience comorbid psychological conditions. Since this is a delusional affliction, effective treatment commonly requires antipsychotics, requiring intercession by therapeutic experts.

Keywords: Delusion, infestation, Imperceptible bug, Formication**EFFECT OF SEED PRIMING ON THE PERFORMANCES OF WHEAT (*TRITICUM AESTIVUM* L.) VARIETIES****P. S. PATRA, RAJESH SAHA AND A. SARKAR****Uttar Banga Krishi Viswavidyalaya, Pundibari, Cooch Behar, West Bengal-736165**

Wheat (*Triticum aestivum* L.) is the second most important cereal crop after rice grown and drought is one the major abiotic hassles which affects wheat production and reduces yield. Keeping the above facts in mind a field experiment was conducted during rabi season of 2017 at the instruction farm of Uttar Banga Krishi Viswavidyalaya, Cooch Behar, west Bengal to study the effect of seed priming on the performances of wheat varieties. The experiment was conducted in factorial randomized block design with three levels of seed priming (hydro-priming, GA₃ priming and control) and five varieties (C-306, PBW-343, HD-2967, K-1006 and DBW 39). All treatments were replicated three times. At first, the wheat seed is disinfected with 0.1% solution of HgCl₂ for 5 minutes. Thereafter, seeds were pre-soaked for a period of 24 hours at 25 ± 1 °C either with hydro-priming (pre-soaking with distilled water) or with phyto-hormonal treatment (pre-soaking with GA₃ solution made of 50 ppm). Wheat were sown on 19.12.2017 and harvested on 07.04.2018. Results of the experiment showed that seed priming with GA₃ improved germination (89.5 %, 92 %, 87.33%, 86% and 87.25 % respectively in C-306, PBW-343, HD-2967, K-106 & DBW-39) thereby minimized seed rate and optimized plant population followed by hydro-priming. Seed priming with GA₃ also helped in attaining more number of spikes/sq.m, grains/spike, longest spike, test weight which ultimately facilitated higher grain yield (3.12, 3.32, 3.01, 2.95 & 2.97 t/ha respectively in C-306, PBW-343, HD-2967, K-106 & DBW-39).

EFFECT OF DIFFERENT ORGANIC SOURCE ON GROWTH, YIELD ATTRIBUTES AND YIELD OF SORGHUM VARIETIES UNDER SOUTH GUJARAT**P. K. DUBEY, A. R. KASWALA, AND K. G. PATEL****Department of Agricultural Chemistry and Soil Science, ASPEE College of Horticulture and Forestry, Navsari, Agricultural University, Navsari- 396 450 (Gujarat), INDIA**

A field experiment was conducted in the certified Organic farm, Department of Soil science & Agricultural Chemistry, Navsari Agricultural University, Navsari, Gujarat in the year 2015-2018 to study the effect of different organic sources on growth, yield

attributes and yield of sorghum varieties under south Gujarat soil conditions. The experiment was conducted in *rabi* season as well as laid out in Factorial Randomized Block design (FRBD) with three replications and it comprised of three treatments with different levels. The treatments were, i) Varieties (V_1 : GJ 38 & V_2 : GJ 42), ii) Solid organic nutrients (M_1 : 100% RDN through NADEP compost & M_2 : 50% RDN through NADEP compost) and iii) Liquid organic nutrients (L_0 : Control, L_1 : Seaweed 4%, three spray & L_2 : Enriched banana pseudostem sap 1%, three spray). The growth parameters like plant height and earhead length were found significantly higher with the variety V_1 i.e., GJ-38. Whereas, the application of solid and liquid organic nutrients were not affected the growth parameters individually in all the years of experiment and in the pooled analysis. The yield attributing parameters, earhead diameter and grain as well as straw yield was found statistically superior with the variety V_2 (GJ-42). The variety V_2 (GJ-42), the application of 100 % RDN through NADEP (M_1) and L_1 (at par with L_2) individually recorded the higher grain and straw yield. Therefore, it is concluded that the sorghum (variety: GJ-42) organically cultivated by applying 50 % RDN (40 kg N/ha) through NADEP compost with 1% spray of Enriched banana pseudostem Sap or Seaweed 4%, three times (20, 40 and 60 DAS) attained the higher growth and yield.

Key words: Growth, NADEP, Variety, Yield

EFFECT OF GRAVITY BASED DRIP FERTIGATION ON GROWTH, YIELD AND QUALITY OF OKRA

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A field study was conducted on sandy soil during kharif seasons of 2012 and 2013 to investigate the effect of gravity based drip fertigation on growth, yield and quality of okra. The experiment consisted of 11 treatments which comprised three levels of gravity based drip irrigation system (Flood Irrigation, Drip Irrigation and Drip Fertigation) with three fertigation levels (50%, 75% and 100%) at 3, 5 and 7 days intervals. The experiment was laid out in a randomized block design with three replications. The results of the study revealed that highest length, weight and yield of fruits were recorded through drip fertigation with 75% RDF at 5 days intervals and also the higher Field Water Use Efficiency in these treatments was due to optimum consumption of water throughout the season and higher Fertilizer Use Efficiency was recorded from the fertigation method due to high efficient use of fertilizers by the plant which resulted in higher fruit yield of okra and we also check the performance evaluation of gravity based drip irrigation system on the experimental field on the basis of data recorded were determination of uniformity coefficient, distribution uniformity, distribution characteristic, and emission uniformity. From economical point (B:C ratio) of view, the choice of the preference of different treatments was observed as flood, drip and drip fertigation. The maximum income from produce and net income were obtained in 75% RDF through fertigation in equal splits at 5 days interval and benefit cost ratio was obtained in 75% RDF through fertigation in equal splits at 7 days interval. Gravity based Flood and Drip irrigated average crop recorded 26.90 and 22.72 percent lower yield than drip fertigation through 75% RDF at 5 days intervals and the higher yield percentage in drip fertigation due to more favorable effect on vegetative growth of okra during 2012 and 2013 respectively.

EFFECT OF POST EMERGENCE HERBICIDES ON WHEAT

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A field experiment was carried out at college of Agriculture, Malegaon camp using Randomize block design with three replications during *Rabi* 2016-17 to evaluate the effect of post emergence herbicides on wheat. The study comprises of different six weed management methods as treatments. The predominance weed of the experiment field during the season in wheat were *Cyperus rotundus*, *Parthenium hystoriphorus*, *Tridax procumbens*, *Amaranthus viridis*, *Alternanthera echinata* and *Euphorbia hirta*. The data showed that all weed control treatments brought out significant effect on weed population and dry weight of weeds. Treatment T_3 (Metsulfuron-methyl 20% WP) recorded significantly lowest weed count ($1.13/m^2$), weed dry weight ($0.09 m^2$) and higher weed control efficiency (99.06%) and it was followed by treatment T_5 (HW at 20 and 40 DAS). All weed control treatments significantly enhanced the grain and straw yield of wheat over weedy check. Significantly higher grain yield ($39.13 q ha^{-1}$) was obtained from treatment T_5 (HW at 20 and 40 DAS). Significantly higher straw yield ($71.71 q ha^{-1}$) and Harvest index (58.19) was obtained from treatment T_3 (Metsulfuron-methyl 20% WP) over rest of the treatments.

FARM WASTE DISPOSAL: AN OVERVIEW**P.P. GHORPADE¹, D.C. MOLYA², K.R. HARINI²****¹NAHEP-CAAST Project, ²Department of Livestock Production & management, College of Veterinary Science & Animal Husbandry, NAU, Navsari, Gujarat- 396450, India**

When animals are free ranging tend to distribute their waste over a large area and the natural processes disseminate the waste i.e., “Dilution to the pollution”. If animals are confined waste concentrate in one spot and its disposal become part of the management protocol at the farm. Organic waste includes manures, animal beddings, yard wastes such as leaves and grass clippings including kitchen scraps. Organic wastes are broken down by the microorganisms in a heat-generating environment, reduce the volume and harmful organisms are destroyed resulting in potentially useful marketable products. Inadequate waste management at the animal farm leads to pollution and health problems along with undesirable working condition and bad odors. Organic recycling practices like composting, vermi-composting and biogas production are the scientific approach to waste management. Composting requires the right mix of ingredients to optimize C: N ratio, moisture content, porosity; temperature, and odor must required to be monitored. Biogas technology converts waste into methane which is used as an energy source. Vermicomposting is a waste disposal method produces compost which is 3 to 4 times rich in NPK level and also requires less time as compared to normal composting. Bio-methanization & bio-hydrogen are limited to the laboratory. MFCs are moderately efficient and recyclable. The dairy farm waste water is good for the production of biodiesel as well as possesses high waste water nutrient removal efficiency. Odor mitigation should be included in the protocol of waste management. Management must be aimed to maintain carbon: nitrogen (C: N) ratio. Targeted microbial and nutrient manipulation may be utilized for designer manure/ compost production. Bio-dynamic fertilizer will also become popular in the coming future.

PLANT PROTEOMICS IN THE ERA OF ‘OMICS’: A REVIEW**PABITRA JOSHI****Department of Genetics and Plant Breeding, Agriculture and Forestry University, Rampur, Chitwan, Nepal**

The fundamental basis of human and animal nutrition is plant. They exhibit unique physiological processes notably in response to their biotic and abiotic environment. As proteins are the final products of genes, they potentially account better than transcripts for activity variations. Proteomics is defined as the systematic analysis of the proteome, the protein complement of genome. Sample preparation is the most critical step in any proteomics study for accurate results for protein analysis. For separation of complex protein or peptide samples: (1) denaturing polyacrylamide gel electrophoresis (PAGE) also referred to as sodium dodecyl sulfate polyacrylamide (SDS-PAGE); (2) two-dimensional (2-D) gel electrophoresis; and (3) liquid chromatography (LC) are generally used. Protein quantitation and identification is done using mass spectrometry. Post translational modification (PTM) help to regulate protein function and can alter protein localization. Protein-protein interactions play key roles for mediating functions such as sensing the environment, mediating signal transduction, adjusting the activity of metabolic and signaling enzymes, converting energy into physical motion, and maintaining cellular organization. Although having some limitations in proteomics study, future advances in techniques and instrumentation will ultimately deliver the ability to analyze, characterize and quantify the entire protein constituent of a cell.

Keywords: Transcripts, Proteomics, Genome, PAGE, SDS-PAGE, LC, Mass spectrometer, PTM.**A REVIEW ON INTEGRATED NUTRIENT MANAGEMENT IN IMPROVING FRUITS QUALITY****PADEKAR.V.D, KADAM .A.S, AND JADHAV.A.R****Department of Horticulture, College of Agriculture, Latur**

Extensive and continuous chemical fertilizers leads to deterioration of soil productivity and several detrimental effect on environment. The accumulation of metals in plant tissue affecting the nutritional value and edibility. On other hand productivity of horticultural produce removes large amount of essential nutrient from the soil Due to Lack of appropriate management deteriorate the nutrient reserve in the soil. Moreover, indiscriminate use of nutrients other than those applied. Thus there is need to lay emphasis on management of natural resources like organic manures, Biofertilizers etc. Only organic manures and Biofertilizers not substitute but supplement to chemical fertilizers for increasing yield and also, to maintain a balance in agro ecosystem. The judicious use of organic input with inorganic is one of the important components of sustainable agriculture to be better and sustainable yield. It is a system that help to restore and sustain crop productivity and also assists in checking the emerging micronutrient deficiencies. Further, it brings economy and efficiency in the use of fertilizers.

A REVIEW ON ROLE OF BIOFERTILIZERS IN IMPROVING FRUITS QUALITY**PADEKAR, V. D., KADAM, A. S. AND SOLANKE. A. A.****Department of horticulture, College of Agriculture, Latur**

Biofertilizers are solubilizes insoluble soil phosphate and produce plant growth substances in the soil. They are environment friendly and playing a significant role in crop production. Nitrogen fixing bacteria and phosphate solublize bacteria are the main biofertilizers for fruits production. Biofertilizers are beneficial microorganism that can release nutrient from raw material and plant residue in the soil. They are recommended as an alternative or supplement for mineral nutrition. They improve yield by up to 30% because of nitrogen and phosphorous they add to the soil. Application of bio-fertilizers containing beneficial microorganism instead of chemical are known to improve plant growth through the supply of plant nutrients and may help to sustain environmental health and soil productivity. It is now well established that vigorous plants are better able to withstand biotic and abiotic stress. Due to the higher cost and hazardous effect of chemical fertilizers, application of biofertilizers has gained momentum in the recent years to enhance plant growth and yield. Various biofertilizers have been successfully applied in different fruit crops.

PARAMUTATION FOR EPIGENETIC CROP IMPROVEMENT**PALLAVI BHATT, SALIL K. TEWARI, RANJANA TAMTA****Department of Genetics and Plant Breeding, G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India-263145**

Plant breeding relies on the pre-existing genetic diversity present within a species to develop allelic combinations that may provide desired traits. Paramutation describes a process that results in heritable epigenetic changes of gene regulation and trans-homologue interactions resulting in the discovery of epialleles .i.e. alleles with identical DNA sequences but differing in DNA methylation and chromatin structure. These epialleles may provide for the epigenetic diversity resulting in additional sources of variation within a species that could be captured or created for crop improvement. Paramutation phenomenon encompasses the ability of the silenced allele (paramutagenic) to silence the other allele (paramutable) present in trans. The newly silenced (paramutated) allele remains stable in the next generations even in the absence of paramutagenic allele and acquires paramutagenic ability itself. The inheritance behaviour of these epialleles permits a fast diffusion of a particular phenotype in a population. Several classic evidences of paramutation have been found in plants like maize (pericarp color, p1), tomato (sulfurea), snapdragon(nivea) and transgenic crops (tobacco and petunia). Potential roles of paramutation through transgenerational transfer of epigenetic information have been proposed among which generating epiRIL (a homozygous line almost identical at the genetic level but segregates at the DNA methylation level) population has revealed role of differentially methylated regions (DMRs) between accessions in influencing quantitative traits. Paramutation phenomenon leading to epigenetic variation and the stability of newly formed epigenetic variants over generations utilizes the potential of epigenetic variation to improve crops. The development and application of methods for widespread epigenome profiling and engineering may generate new avenues for using the full potential of paramutation in crop improvement.

E- NAM: - A SUSTAINABLE AGRICULTURE MARKETING AND EXTENSION PLATFORM FOR DOUBLING FARMER'S INCOME**PANKAJ KUMAR*, ABHISHEK KUMAR, LALIT KR. VERMA AND PUKHRAJ SINGH****Deptt. of Agricultural Economics, J.V. College, Baraut (Baghpat)-250611**

Prosperity of Indian agriculture is possible through two ways: one by emphasizing production constraints which leads to greater agricultural productivity and the other by making agricultural produce accessible to the market where it can be sold off giving remunerative prices to farmers. The country has made significant progress in Agriculture production but agriculture marketing and extension is challenging task which needs to be addressed immediately. e- NAM or National marketing market is an online marketing and trading platform for purchase and sale of Agriculture commodities by buyers, traders, exporters and ultimately benefiting the farming community. The e-NAM was launched on 14 April 2016 with an objective to centralize, streamline and strengthen agriculture marketing and extension sectors in India. It is a common online trading platform to all the stakeholders, the registered in e-NAM gets fair price or high price for their produce on the other hand, the buyers or traders get quality agriculture produce in bulk at a time therefore this process eliminates the brokers, agents or middleman. It is considered to be transformative steps which can revolutionize the agri marketing and extension sectors. Thus linking all the progressive farmers across all the states and involving all the stakeholders can result in doubling the farmer's income and improving the livelihood of farming community.

Keywords:-e-NAM Agri Marketing, farmer's

PROCESSING OF MIXED FRUITS RTS BEVERAGES DURING STORAGE**PANKAJ KUMAR, VIVAK KUMAR, JAIVIR SINGH, PUJA, DEEPALI MUDGAL, SUNIL****Department of Agricultural Engineering, Sardar Vallabhbhai Patel University of Agriculture and Technology, Modipuram, Meerut (U.P.)**

Fruits have been a part of human diet and food supplement over the years. They are good sources of essential elements which are very important for our body to make body function properly, such as water, vitamins (A, B1, B2, C, D and E), minerals (Ca, Mg, Zn, Fe, K etc.) and organic compounds. Fruits can be preserved as beverages such as fruit juice (orange, apple, grape juice etc) or alcoholic beverage such as wine, brandy or vinegar. Fruit juices are valuable for the nutritional point to view. They are rich in vitamins minerals. In developed countries fruit juices commonly from part of the breakfast and are production in very large countries. The mixed fruits based RTS beverage of sample at room temperature and refrigerator storage condition were acceptable. However, the RTS samples stored at refrigeration condition was found superior over other storage condition followed by room temperature conditions. The formulated mixed juice samples were stored at room temperature and the change of TSS, acidity, pH and Vitamin-C content was observed during the storage period. Ready-to-serve (RTS) beverages made up of fruit pulp have greater amount of water that is useful for body balancing by preventing dehydration. Fruit RTS beverages contain high percentage of sugar and provide a few vitamins and minerals. The consumption of fruit-based beverages in the form of fruit blends and smoothies is increasing due to public awareness on the presence of various functional ingredients beneficial to health.

Keywords: Mixed fruits, RTS, Storage, Human health.

MORPHOLOGICAL EVALUATION OF RICE GENOTYPES FOR DROUGHT TOLERANCE**PANKAJ KUMAR, RIMA KUMARI AND V.K. SHARMA****Department of Agricultural Biotechnology and Molecular Biology, Dr. Rajendra Prasad Central Agricultural University, Pusa (Samastipur)-848125, Bihar**

A set of 31 rice genotypes were screened for drought tolerance during *in vitro* seed germination and seedling growth stage. The genotypes were tested against five levels of drought stress imposed by 0, 5, 10, 15 and 20% polyethylene glycol (PEG) 6000. The experiment was laid out in a complete randomized design with three replications. The results revealed that germination gradually decreased with increasing water stress among the 31 rice genotypes. Seedling growth also decreased among the 31 rice genotypes with the increase in water stress level. Thus, through morphological evaluation, identified drought tolerant genotypes can be used as parental donor in rice breeding programme to develop drought tolerant rice varieties.

A COMPARATIVE STUDY OF MICROBIAL POPULATION IN INDIAN MAJOR CARP FISHES COLLECTED FROM AQUACULTURE PONDS AND OXBOW LAKES IN BETTIAH, BIHAR**PANKAJ KUMAR****Krishi Vigyan Kendra, Saran, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar, 848125**

A comparative study on bacterial load in Intestine, skin and gills of Indian Major Carp fishes (*Catla catla*, *Labeo rohita*, *Cirrhinus mrigala*) collected from different culture fish ponds and Oxbow lakes of Bettiah were examined. The result obtained indicated the species *Staphylococcus sp.* accounts for the highest bacterial occurrence (40.2%) and *Pseudomonas sp.* had the lowest (9.6%). In all the samples from Oxbow lakes and culture ponds the highest range of bacterial count (3.90×10^5 cfu/g to 5.10×10^5 cfu/g) was found in the intestine of the Indian Major Carp Fishes and the lowest (2.55×10^5 cfu/g to 3.85×10^5 cfu/g) was recorded in the skin of fishes. Among the samples from two different locations the no. of bacterial count were recorded significantly higher in the samples collected from Oxbow lakes. The results of this study revealed a higher degree of bacteriological contamination in these samples of fish from oxbow lakes. Hence, the fishes caught from the oxbow lakes should be processed properly before consumption otherwise it may pose a serious threat and hazard to the consumer.

ROLE OF POULTRY IN INDIAN ECONOMY**PANKAJ PATEL, SHIVE KUMAR, RAJAT VERMA, ARUN KUMAR, RASHMI SAINI****Department of Livestock Production Management, C.V.A.Sc., GBPUAT, Pantnagar-263145, Uttarakhand**

The poultry sector in India has undergone a paradigm shift in structure and operation from a mere backyard activity into a major commercial agriculture based industry over a period of four decades. Development of high yielding layer and broiler varieties together with standardized package of practices on nutrition, housing, management and disease control have contributed to spectacular growth rates in egg and broiler production in India. Poultry contributes nearly 1 percent to total GDP. It furnishes employment to around 4 million people in India. The egg production in the country is 88 billion numbers and broiler production is

projected at 4.5 million tons with 6% and 7% annual growth rate respectively. Currently the annual per capita availability is 3.35 Kg of poultry meat and 69 eggs. The growth in the broiler segment is expected to remain strong due to consumer preference for chicken meat, increasing income levels, and changing food habits. Farmers in India have moved from rearing non-descript birds to hybrids which ensure faster growth, good liveability, better feed conversion and high profits. Contract farming in poultry has been successful in India. The nature of contracting has been instrumental in sharing growers' risk through buyback guarantee and also provision of coping with production failure. Provision of quality inputs such as chicks, feed and medicine has helped the poultry farmers raise quality chickens. Since, poultry meat being the cheapest source of animal protein with no social taboo, broiler farming has good potential to provide employment opportunities to rural unemployed youth.

PEST MANAGEMENT IN DIFFERENT FARMING SYSTEMS

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The side-effects of the modern agricultural chemicals and machines raise serious interrogations about the overall benefits of the new technology in Conventional farming system. Agricultural chemicals, including hormones and antibiotics leave residue in food that may cause cancer or genetic damage. This farming system has more popular in farmers, although highest debt for input requirements. This situation has been leading to a new thought of looking at other natural farming systems like organic farming and zero budget natural farming. The alternative technologies return to traditional, eco-friendly practices; organic farming is one among them. The three main tactics dealing with pest problems in organic agriculture are the use of botanical pesticides, biological control agents and cultural (management) techniques. Organic farming is holistic food production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. Another alternative, to overcome the rising problems of synthetic insecticide is Zero Budget Natural Farming (ZBNF). The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming with Nature and without chemicals. Subhash Palekar, the discoverer of ZBNF, gave many theories, principles and methods of ZBNF. The principal methods of ZBNF include crop rotation, green manures and compost, biological pest control. For the management of pests, biopesticide are supernumerary to minimize harsh effects of synthetic insecticides. Three new biopesticides viz., Brahmastra, Agniastra and Neemastra, extract from different natural occurring plants with cow urine and cow dung are effective against major pest of economic crops. These organic and zero budget natural farming systems not only reduce the dependence on the insecticides for pest management but also help in sustainability in production with minimizing the cost of raising crop.

Keywords: Agniastra, Brahmastra, Conventional Farming, Neemastra, Organic Farming, Zero Budget Natural Farming

DEVELOPMENT OF TECHNIQUES AND STANDARDIZATION FOR MANUFACTURING ALOE VERA BURFI

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Burfi is the most popular traditional *khoa* based sweet and preferred by people scattered all over the world where traditions and celebrations are much valued. Different varieties of *burfi* like nut *burfi*, chocolate *burfi*, coconut *burfi*, saffron *burfi*, rava *burfi* etc. are very much liked and demanded. People are also concerned about the health issues and tend to move towards herbal food products and those products containing aloe vera are readily preferred. Considering this, systematic attempt has been made in the present investigation for preparation of aloe vera *burfi*. Two variables viz. aloe vera gel and sugar were kept at different levels. Response surface methodology (RSM) was employed to optimize the concentrations of variables, for preparation of aloe vera *burfi*. On the basis of response like moisture content %, acidity %, hardness, browning index and average branch length, preparation variables were optimized by using RSM in realistic vicinity to locate the true optimal value of multiple compositional variables. Using RSM optimum variables for *burfi* production were predicted as 10% aloe vera gel and 30% sugar among all combinations.

Keywords: *Aloe vera*, Burfi, RSM, Texture

INTEGRAL EFFECT OF NUTRIENT MANAGEMENT AND PLANTING METHODS ON THE YIELD OF MAIZE (ZEA MAYS L)**¹PARAS KAMBOJ, ²VIKAS AND ²KIRAN KHOKHAR****¹Department of Agronomy, ²Department of Soil Science, CCS Haryana Agricultural University, Hisar - 125004**

Maize is an important cereal crop belongs to family Gramineae. Maize is also known as the “Queen of Cereals” because of its highest genetic yield potential. It was originated from Central America and Mexico (Chhidda Singh *et al*). The experiment was conducted at the research farm of Lovely Professional University, Phagwara, Punjab. The main objective of the experiment was to know the best planting method with the best combination of different organic and inorganic sources of the nutrient. The experiment was conducted under split plot design, planting methods were taken in main plots and nutrient combinations in the sub-plots so that more effect of the nutrient combination should be understood. Treatments were - 0% RDN at Flat Bed Method (control), 100% RDN at Flat Bed Method, 50 % RDN + FYM at Flat Bed Method (50% of recommended dose of nitrogen from Urea and rest 50% from FYM (Farm Yard Manure)), 50 % RDN + Biofertilizer at Flat Bed Method, 50 % RDN + Vermicompost at Flat Bed Method, 50 % RDN + VermiCompost + FYM + Biofertilizer at Flat Bed Method, 0% RDN at Ridge and Furrow Planting Method, 100% RDN at Ridge and Furrow Planting Method, 50 % RDN + FYM at Ridge and Furrow Planting Method, 50 % RDN + Biofertilizer at Ridge and Furrow Planting Method, 50 % RDN + Vermicompost at Ridge and Furrow Planting Method, 50 % RDN + VermiCompost + FYM + Biofertilizer at Ridge and Furrow Planting Method. Recommended dose for the crop is 150 Kg N, 75 Kg P, 50 Kg K per ha. The experimental results show maximum number of green leaves at 75 days (T12 - 50 % RDN + VermiCompost + FYM + Biofertilizer at Ridge and Furrow Planting Method). The more green leaves are able to trap more sunlight and able to produce more photosynthates as compare to other treatments. Thus this treatment attains maximum grain yield of 6650 kg/ha which is 52.27 % higher than the control.

Keywords: Split plot design, Vermicompost, Biofertilizer, Flat Bed, Ridge and Furrows

STUDIES THE GENETIC DIVERGENCE OF PHENOTYPIC AND GENOTYPIC TRAITS IN WHEAT (TRITICUM AESTIVUM L.) GENOTYPES**PARGAT SINGH^{*1}, V. K. MISHRA¹, BRAJESH SINHA¹, UMAKANT BANJARE¹, SHWETA SINGH²****¹Department of Genetics and Plant Breeding, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi****² Department of Botany, Institute of Science, Banaras Hindu University, Varanasi-221005**

Wheat is world's most widely cultivated food crop which belongs to the family Graminae (Poaceae) and the genus *Triticum*. It is the most important cereal crop in the world that ranks second in total production as a cereal crop. 242 germplasm lines of wheat (MNP-1) was used to study genetic divergence. All the 242 genotypes grouped into 8 cluster following Ward's method. Cluster I and IV constitute of 65 genotypes forming the largest cluster. The highest mean values for different traits were observed to fall in different clusters. Cluster I, II, III, IV and VI exhibited highest mean values for most of the traits. Highest mean value for AUDPC (998.8) and days to maturity (408) were observed in cluster VII and VIII respectively. AUPDC and days to maturity traits lies in near cluster indicate that these traits are more closely to each other. Maximum mean value for Ppd-D1 marker and plant height found in cluster VII and VI respectively. The pattern of group constellation provided the existence of significant amount of variability that helps in finding of significant traits for crop improvement.

Keywords: wheat, genetic divergence, Ppd-D1, AUDPC.

ISOLATION, CHARACTERIZATION AND EVALUATION AND THE BIOCONTROL EFFICACY OF BACTERIOPHAGES OF RALSTONIA SOLANACEARUM**PARINDA BARUA^{*}, PALASH DEB NATH****Department of Plant Pathology, Assam Agricultural University, Jorhat- 785013, Assam, India**

Ralstonia solanacearum is a soil-borne gram negative bacterium which causes the bacterial wilt disease of a wide range of economically important crops all over the world. Due to its unusually wide host range and ability to cause disease within a very short time, *R. solanacearum* has been ranked as the 2nd most destructive plant pathogenic bacterium. Bacteriophages are the viruses that parasitize bacteria. The use of phages for bacterial disease management is a fast expanding approach in the field of agriculture. In the present study, seven bacteriophages infecting *R. solanacearum* were isolated from wilt infected Bhut Jolokia (*Capsicum chinense* Jacq) of Jorhat district of Assam. Three rounds of purification were carried out to achieve phages with same genetic code. For morphological characterization of the isolated phages, the plaque morphology was studied after 48 hours of plating. The plaque size for the isolated phages ranged from small and clear centre with halo of 0.5±0.20 mm in sample RSP1 to very big and clear centre with a big halo of 5.21±0.29 mm in sample RSP7. The plaque forming units (pfu) were calculated for each of the phage samples which ranged from 7.2x10⁵ pfu/ml in sample RSP4 and 2.8x 10⁹ pfu/ml in sample RSP7. The chloroform sensitivity test of the isolated phages revealed that except for phage RSP1, rest all the phages were non sensitive towards chloroform. *In vivo*

treatments of isolated phage RSP7 with *R. solanacearum* isolate F3C2 revealed that the bacterial wilt control was typically best when the phage was applied at the time of inoculation of *R. solanacearum* then and less effective if applied before or after inoculation. The finding of the present study recommends the use of lytic phages as biocontrol agents for the management of bacterial wilt disease.

Keywords: Bacteriophages, biocontrol, *Ralstonia solanacearum*, bacterial wilt, Bhut jolokia (*Capsicum chinense* Jacq).

RENEWABLE CUM FREE ENERGY SOURCES, KEY SOLUTION TO FOOD SECURITY AND SUSTAINABILITY

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The development of food processing technologies adapted to the conditions and demands of farmers in developing countries has received less attention than the area of household cooking. However, diverse concepts have been developed and tested, which indicate that huge potential exists to improve the postharvest treatment of produce by using renewable energies. Most of these concepts are still niche specific and, generally speaking, innovative efforts are needed in order to develop more robust and better-adapted solutions that can be widely disseminated. Designs of solar dryers have not been only a emerging technology but posses great potential to address a lot of issues related to Food Security and also Food sustainability. Models have been adapted to suit specific climatic conditions, the type of product and expected quality. However, poor quality manufacturing and performance is still common. Generally every dryer is unique, and maintenance and repair require greater than ordinary technical skills. Another interesting field of innovation is the application of hybrid systems that use a secondary energy source, such as biomass and biogas, as backup for gloomy days and at night.

Keywords: Post harvest, Food Security, Food Sustainability, Solar Dryers, Biomass

CHLOROPHYLL MUTATION IN CHICKPEA (*CICER ARIETINUM L.*) CULTIVARS

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Grain legumes occupy a unique position in world agriculture by virtue of their high protein content and capacity to fix atmospheric nitrogen. For developing countries like India, pulses constitute the 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 proteins from pulses are also nutritionally valuable because of higher lysine content than the cereal proteins. Seeds of three varieties of chickpea having good agronomic base and belonging to diverse group viz. Desi (BGM-524) Kabuli (BG-1053) and green seeded (KSB-220) were treated with different doses of Gamma Rays, ethyl Methane sulphonate (EMS) and their combination (EMS + Gamma Rays). The total experimental seeds were taken 4800, treated with different doses. Selection was done at both inter family and interfamilial levels. BG-1053 variety of *kabuli* chickpea was found different chlorophyll mutation under different treatments. Showed that the highest (1.80%) frequency of chlorophyll mutations were found under (20 kR + 0.10% EMS) treatment followed by 60 kR + 0.30% EMS with 1.60 per cent frequency, while the lowest frequency (0.80%) was observed under the treatment of 30 kR gamma-rays. The spectrum and frequency of induced chlorophyll viable mutation are presented, the maximum plant types in the treatment of 50 kR, 40 kR + 0.20% EMS and 60 kR + 0.30% EMS with (0.60%) and lowest value found in treatment of 30 kR + 0.10% EMS, 0.25% EMS, 0.30% EMS, 50 kR + 0.25% EMS with 0.20 per cent. The maximum morphological mutation in leaf type were found in 20 kR and 60 kR (0.80%) and lowest (0.20%) in 50kR, 0.20% EMS and 20 kR + 0.15 EMS. For pod type morphological character was found a maximum value in 20 kR gamma-rays with and lowest (0.10%) in 50 kR + 0.10% EMS, 30 kR + 0.15% EMS, 60 kR 0.30% EMS with (0.20%). The highest value of seed types were found in 0.10 EMS and 40 kR + 0.20% EMS with (0.60%) while the lowest (0.20%) was observed under various treatment. The frequency of total mutation rate (chlorophyll + viable) under various treatments are presented in Table 4.8. The table under reference indicates that the mutation rate in most of treatment are deviated between (0.26-0.38%) except for the treatments 30 kR (1.4%) having 7 mutated plants followed by the 40 kR doses of gamma-rays (1.8%). The total mutation rate in pooled treatment of gamma-rays (kR) was observed low, except 20 kR gamma-rays compression to both treatments of EMS and combined (kR + EMS%) with different concentration. On the basis of above results, it is clear that the 20 kR gamma-rays treatment had more mutation percentage of mutant plants (3.8%).

ENHANCING METACOGNITIVE SKILLFULNESS OF ADOLESCENTS**PARUL KALIA****Punjab Agricultural University, Ludhiana (Punjab)**

Metacognition refers to one's "thinking about thinking" and is often defined by its accompanying skills such as monitoring and evaluation. Often researchers use metacognition as an overarching umbrella term but cognitive and educational theorists argue as to whether metacognition is a single construct or made up of distinct, differentiable factors. Metacognition has also been acknowledged as an abstract thinking ability known to enhance learning outcomes. The present research has made an attempt to assess the metacognitive skills among the students of the constituent colleges of PAU Ludhiana. The sample included 200 college students, in age range of 17-19 years. Metacognitive Awareness Inventory developed by Schraw and Dennison (1994) was used to measure the metacognitive skillfulness of the selected subjects and subsequently an attempt was made to prepare guidelines for parents and teachers to create a metacognitive environment since early years through daily interventions to strengthen their learning outcomes.

FLOWER AND SEED PRODUCTION OF AFRICAN MARIGOLD CV. 'PUSA NARANGI GAINDA' AS INFLUENCED BY PLANT GROWTH REGULATORS AND ITS APPLICATION TIME**PARVEEN KUMAR, ARVINDER SINGH*, NOMITA LAISHRAM, SHEETAL DOGRA, M. IQBAL JEELANI****Sher-e-Kashmir University of Agricultural Sciences & Technology of Jammu, Jammu and Kashmir - 180009 –INDIA**

The effect of different plant growth regulators and their application time were investigated on quality flower and seed production of African marigold cv. 'Pusa Narangi Gaiinda'. The experiment was laid out in a Factorial Randomized Block Design with 18 treatment combinations comprising of nine growth regulator treatments and two application times (Application at 25 DAT and 50 DAT). (Control, GA₃ @ 150 ppm and 250 ppm, Salicylic acid @ 150 ppm and 200 ppm, Benzyl adenine @ 75 ppm and 100 ppm, CCC @ 1000 ppm and 1500 ppm). Foliar application of 250 ppm GA₃ proved significantly superior over other treatments and control in recording maximum plant height (65.44 cm), plants spread (57.70 cm), shoot fresh weight (282.33g) and root fresh weight (47.63 g). Earlier flower bud initiation (50.40 days), maximum number of flowers per plant (45.45), maximum flower diameter (8.22cm), maximum flower weight (9.01g), highest flower yield per plant (409.73g), higher seed yield/plant (22.76g), germination percentage (90%), vigour index (1016.50) and lowest electrical conductivity of seed leachate (0.639 *mumhos/cm/g*) were also recorded with foliar application of 250 ppm GA₃. However, maximum number of laterals (12.30) and flowering duration (45.83days) on the other hand were recorded with the application of 100 ppm Benzyl adenine. It is also observed that application at 25 days after transplanting recorded superior values for all the flower and seed parameters under study. None of the plant growth regulator treatments and their application time could significantly affect the shoot dry weight, root dry weight and 1000 seed weight. Results suggest that 250 ppm GA₃ enhanced growth, and improved seed yield and quality parameters of marigold.

EFFECT OF INTEGRATED NUTRIENT MANAGEMENT (INM) ON GROWTH OF BROCCOLI (BRASSICA OLERACEA L. VAR. ITALICA) CV. PUSA KTS-1**PAVITRA DEV* AND MANENDER SINGH*****Department of Horticulture, C.C.S. University Campus, Meerut 250004****Department of Horticulture, College of agriculture, CCS HAU, Hisar, Haryana**

Broccoli (*Brassica oleracea* L. var. *Italica*) is an important cole crop vegetable, belong to family Cruciferae. A field experiment was carried out to find out the impact of integrated nutrient management on growth and yield of broccoli (*Brassica oleracea* L. var. *Italica*) cv. Pusa KTS-1. The experiment was conducted at Horticultural Research farm, Department of Horticulture, Ch. Charan Singh University campus, Meerut (U.P) India, during the year 2017-18. The treatments involved in the study were twelve in numbers i.e. T₁ (Control), T₂ (RDF 150:100:100 N.P.K), T₃ (FYM @ 30 t/ha), T₄ (VC @ 10 t/ha), T₅ (80% NPK + 6 t/ha FYM), T₆ (80% NPK + 2 t/ha VC), T₇ (60% NPK + 12 t/ha FYM), T₈ (60% NPK + 4 t/ha VC), T₉ (40% NPK + 18 t/ha FYM), T₁₀ (40% NPK + 6 t/ha VC), T₁₁ (20% NPK + 24 t/ha FYM), T₁₂ (20% NPK + 8 t/ha VC). The experiment was laid out in Randomized Block Design. The soil of the experimental field was well-drained, sandy loam having good moisture and heat absorbing capacity. Results revealed that combined application of RDF 80% + Vermicompost @ 2 t/ha (T₆) gave the better effect on vegetative parameters of broccoli viz., plant height (31.61 cm), number of leaves per plant (16), leaf length (48 cm) and leaf width (21.66 cm) as compared to other treatments.

EFFECT OF PLANT GROWTH REGULATORS ON GROWTH AND YIELD PERFORMANCE OF ONION (*ALLIUM CEPA* L.) CV. PUSA RED**PAVITRA DEV AND AKSHAY KUMAR****Department of Horticulture, C.C.S. University Campus, Meerut 250004**

Onion is one of the most important bulbs and species vegetable crops. Onion (*Allium cepa* L.; $2n = 16$) belongs to the family Alliaceae. Onion has an excellent medicinal value and used for salad as raw and an important ingredient of Indian “Tadka”. Every plant has the potential of yielding its maximum but maximum production may be achieved if plant growth regulators are being properly used. Plant growth regulators may be considered as a new generation of agrochemicals after fertilizers, pesticides and herbicides. Keeping this view in the mind, a field experiment was carried out to determine the effect of plant growth regulators on growth and yield performance of onion (*Allium cepa* L.) cv. Pusa Red. The experiment was conducted at Horticultural Research farm, Department of Horticulture, Ch. Charan Singh University campus, Meerut (U.P) India, during the year 2017-18. The treatments involved in the study were nine in numbers i.e. T₁ (GA₃ @ 100 ppm), T₂ (GA₃ @ 150 ppm), T₃ (IAA @ 100 ppm), T₄ (IAA @ 150 ppm), T₅ (NAA @ 100 ppm), T₆ (NAA @ 150 ppm), T₇ (MH @ 150 ppm), T₈ (MH @ 300 ppm), T₉ (Control). The experiment was laid out in Randomized Block Design. The soil of the experimental field was well-drained, sandy loam having good moisture and heat absorbing capacity. Investigation results clearly indicate that the application of GA₃ @ 150 ppm (T₂) gave a better effect on vegetative and yield parameter viz., plant height (53.13 cm), number of leaves per plant (4.66), leaf length (51.13 cm), fresh weight (46.76 gm), yield (303.74 q/ha) as compared to other treatments.

EVALUATION OF DIFFERENT MULBERRY (*MORUS* SPP.) GENOTYPES FOR GROWTH PARAMETERS UNDER TEMPERATE CLIMATE OF KASHMIR**PAWAN SAINI^{1,2} AND S. S. CHAUHAN¹**¹**Central Sericultural Research & Training Institute, Central Silk Board, Galander, Pampore, Jammu & Kashmir**²**Department of Plant Breeding and Genetics, Punjab Agricultural University, Ludhiana – 141004, Punjab, India**

Mulberry, a heterozygous, outbreeding, perennial tree plant has been classified based upon various parameters and grouped into different species. The extent of magnitude of genetic diversity presents in the mulberry germplasm; helps genetic improvement through breeding. To utilize the germplasm, evaluation and characterization are the prime pre-breeding steps for the assessment of genetic diversity and their further utilization in breeding programmes in an effective and planned way to evolve superior mulberry varieties. In order to capture the full potential genotypes, 47 mulberry genotypes (16 exotics and 31 indigenous) belonging to four different species i.e. *indica*, *alba*, *multicaulis* and *bombycis* of dwarf plantation at a spacing of 90 x 180 cm were evaluated for 12 agro-morphological traits (petiole length, petiole weight, leaf length, leaf width, number of leaf, total number of shoots, length of longest shoot, total shoot length, leaf weight, shoot weight, total shoot weight and leaf yield) of the different mulberry genotypes. Based upon evaluation index computed through Seri-Stat ver. 3.0 software developed by CSGRC, Hosur depending upon multiple economic traits high and top performing and most promising genotypes using Z-score were identified. Out of 12 traits studied, PPR-1 a newly developed mulberry strains found to be most top, high performing and most promising genotypes among all the genotypes followed by the standard variety Gosheorami stands 2nd, S-54 ranks 3rd, Brentul Kashmir ranks 4th and English Black ranks 5th. The present study indicates that temperate mulberry genotypes are proved to be superior over the tropical genotypes with respect to growth and attributing parameters and could be utilize for genetic improvement of mulberry through conventional as well as molecular breeding approaches.

Keywords: Genetic diversity, Growth parameters, Mulberry, Pre-breeding, Temperate genotypes**EFFECT OF FOLIAR SPRAYS OF BORON ON NUTRIENT UPTAKE, YIELD AND QUALITY OF FRENCH BEAN IN ENTISOL****PAYAL A. MAHADULE, KRISNPAL SINGH AND A.D. JAGDHANI****College of Agriculture, Pune, Mahatma Phule Krishi Vidyapeeth, Rahuri 413 722**

The pot culture experiment was conducted to study the effect of foliar application of boron through boric acid @ 0.2, 0.4, 0.6 and 0.8 per cent and soil application of borax @ 2.5 kg ha⁻¹ and 5.0 kg ha⁻¹ on growth, yield, nutrient uptake and quality of French bean (Cv. Phule Suyash) in Entisol at Division of Soil Science and Agricultural Chemistry, College of Agriculture, Pune, during Rabi 2017-2018. The experimental soil was deficient in boron (0.35 mg kg⁻¹). There were eight treatments replicated thrice in completely randomized design. The foliar application of boron with 0.6 per cent boric acid increased the number of pods per plant, number of grains pod⁻¹, straw yield and 100 grain weight and yield of french bean. The concentration of boron in index leaf of french bean was increased with increase in levels of boron applied through boric acid and borax over GRD and control treatment. The total uptake of N, P, K and B was significantly increased due to 0.6 per cent boron applied through boric acid. Thus, foliar application of boron @ 0.6 per cent through boric acid with GRDF at flower initiation and pod development stage was

found to be increased in growth and yield, nutrient uptake and quality of french bean. However, the soil application of borax @ 2.5 and 5.0 kg ha⁻¹ at the time of sowing of french bean improved the boron level in soil.

Keywords: French bean, Boron, foliar spray

IDENTIFICATION OF THE OPTIMUM DATES OF SOWING FOR MITIGATE THE CLIMATE CHANGE UNDER AEROBIC RICE CULTIVATION DURING NAVARAI SEASON IN KARAİKAL REGION.

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A field experiment was conducted at Department of Agronomy, Pandit Jawaharlal Nehru College of Agriculture and Research Institute, Karaikal, Puducherry to “identification of the optimum dates of sowing for mitigate the climate change during *Navarai* season under aerobic rice cultivation”. The seeds were sown at different sowing dates (February 6th, February 13th and February 20th) and treatments were evaluated in factorial RBD, with three replication. Among dates of sowing 6th February sown crop was record higher growth attributes viz., plant height (130.3 cm), number of tillers hill⁻¹ (10.2), leaf area index (7.8), dry matter production (DMP) (10027.2 kg ha⁻¹) and grain yield (2591 kg ha⁻¹). Correlation regression studies revealed that the direct weather parameters such as maximum and minimum temperature, morning and evening relative humidity were contributed significantly to the rice grain yield and DMP. Similarly, the derived weather parameters viz., total Relative Humidity Disparity (RHD) and total Heat Use Efficiency (HUE) were also significant contributed significantly to the rice grain yield and DMP. The result proved that the sowing window February 6th to be more effective for achieving higher productivity of aerobic rice during *Navarai* season at Karaikal, the tail end of Cauvery Delta Zone.

Keywords: Aerobic rice, weather parameter, dry matter production, grain yield and dates of sowing.

DOUBLING THE FARMER'S INCOME THROUGH INNOVATIVE APPROACHES

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The government agenda for doubling farmer's income by 2022 is a daunting task since around 70% of the farmers have annual per capita income less than Rs. 15,000. Only 10% of them earn more than Rs. 30,000. Only 7% of the marginal farmers fall in the high-income class (> Rs. 30,000). To achieve doubling farmer's income might require novel strategies through government development initiatives, technology generation and dissemination besides policies and reforms in agriculture sector. Development / refinement of new fertilizer products with high efficiency such as controlled release fertilizers from different indigenous minerals and by-products, Customized / fortified fertilizers etc. Adopting fertilizer prescription system for drip irrigation and fertigation. Crop life cycle nutrient management i.e. meeting nutrient requirement of crop at different growth stages through fertigation and foliar application. Implementation of soil testing protocols for organic farming under selected crops, which have commercial demand in organic food market. Resource conservation technologies well supported by precision farming like laser land leveling, direct seeding of rice, etc. saves water and energy costs by more than 25%. These technologies will help farmers to minimize the adverse impact of climate change induced weather aberrations especially temperature variations that are likely to be more severely felt in North Western Region of the country. Enhancement of water productivity through soil, crop and irrigation management. Evaluation of location specific rainwater harvesting techniques and its impact on hydrology crop performance and livelihood of farming community. Use of cost effective polymers, soil conditioners, zeolites to improve the soil aggregation and increase water holding capacity of soil. On the go sensor development using optical/ NIR/ microwave/ hyper spectral remote sensing techniques for soil moisture, nutrient, salinity, organic carbon and tilth estimation. Hyper-spectral narrow-wavebands and formulate vegetation indices best suited for early detection of crop nutrient stress under varying water supply situations and scaling up the information for satellite remote sensing image analysis for large area estimation.

CLIMATE CHANGE MITIGATION AND ADAPTATION OF FARMERS IN NORTH EAST HILL REGION: AN EMPHERICAL STUDY

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Climate change is a physical process and it is driven by and understood by social process. However, climate information is sometimes used for planning and decision making. Climate change is a phenomenon where people have to rely on scientific models. Adaptation is a construct used in climate change. IPCC has estimated that by 2030, as much as 42% of world population will live in countries with insufficient freshwater for their agricultural land. This study states that the rate of adaptation and mitigation to the climate change in North East Hill Region of India by using a Social network analysis . Social network linkages of

farmers and how the decision making is done among farmers is studied. NER comprises of seven sister states of Arunachal Pradesh, Assam, Manipur, Meghalaya, Mizoram, Nagaland, Tripura plus the brother state of Sikkim. The objectives are : 1. To identify the social network linkages of farmers in climate change adaptation. 2. To study about the decision making patterns of farmers in adaptation and mitigation to climate change. 3. To study the constraints and the impacts of climate change on farmer. The rate of adaptation and mitigation after studying the objectives, it was concluded that 83.3% of farmers are flexible for the adaptation and mitigation strategies(MoDoNER) Ministry of Development of North eastern region at national level, it supports the three North Eastern states in their efforts to enhance the climate resilience of rural communities.

Keywords: Climate change, Adaptation, Mitigation, Social network analysis.

IMPACT OF CLIMATE CHANGE IN FRUIT PRODUCTION

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Climate change refers to any change in climate over time, whether due to natural variability or as a result of human activity (Anon, 2007). Climate change is caused by factors that include oceanic processes, [biotic](#) processes, variations in [solar radiation](#) received by Earth, [plate tectonics](#) and [volcanic eruptions](#), and human-induced alterations of the natural world. Global warming and climate change is now perceived to be the greatest threat to agriculture production and food security in the 21st century. Fruit production is a mid- to long-term investment. Therefore, varieties used and cropping areas cannot be changed once the crop has been established as this would result in massive economic losses for farmers. Fruit trees have, however, the advantage of being more resilient to variations in weather conditions, except for some critical periods such as flowering or fruit filling. In citrus fruits temperatures above 37°C may cause serious damage to tender fruitlets, and between 44-45°C can slow down fruit growth and cause excessive fruit abscission. Maximum and minimum temperature and Increased CO₂ levels are expected to favor growth and increase crop yields and therefore, will be helpful in counteracting the adverse effects of temperature rise in future. Innovative methods are thus required to develop simulation models for important horticultural crops. As a matter of fact no systematic studies have been carried out till now in India. Therefore, detailed investigation on impact of climate on fruit growing is necessary.

Key words: Climate change, Global warming, Fruits, Economic losses, Mitigation.

EFFECTIVE MICROORGANISM TECHNOLOGY IN FRUIT CROPS

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A primary problem of organic farming is the low yields procured, as compared to that of conventional farming systems. The original concept of using EM (Effective Micro-organism) in crop production, primarily in organic systems to overcome the inherent problems such as low productivity. EM was first applied to enhance productivity of organic or nature farming systems. Effective micro-organisms (EM) technology is a liquid mix of microbes developed in Japan which promotes vigorous plant growth. EM is a brown colour liquid concentrate containing a consortium of beneficial microbes and acts as soil conditioner as well as a microbial inoculant. The principle of EM is the conversion of a degraded ecosystem full of harmful microbes to that is productive and useful microorganism. EM leads to the improvement of soil nutritional status, physical, chemical and microbiological properties, helping crops to grow healthy and strong. Research on papaya in Brazil, apples in Japan increase yields of traditional organic system

Keywords: Organic farming, Effective Micro-organism, Beneficial microbes, Nature farming

COLONY COLLAPSE DISORDER- AN ABNORMAL SIGN TO HONEY BEE COLONY

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Honeybees play a prominent role in food production due to the fact that they visit and pollinate plants. They can visit 50-100 plants on each foraging trip to collect nectar. In the past few years, there was a tremendous decline in bee populations. One prominent reason is Colony Collapse Disorder (CCD). It was reported as a major cause for a decline in bee population and a subsequent fall in agricultural productivity in worldwide and also in India. Many biological and physical factors such as diseases, insecticides, monoculture, heavy doses of chemical fertilizers, mobile signals, environmental stresses or a combination of all these are attributed as a reason for bee collapse. However, clear-cut facts on bee collapse are yet to be emerged and available information strongly suggest the involvement of more factors. Bee collapse remains an under explored area. Solutions to honey bee decline must also embrace the idea that existing institutions and epistemic cultures may be handicapped by the novelty and complex openness that define the ecological relationships between humans and pollinators. There is a need to invest in diverse kinds of research and to expect that future ecological surprises are inevitable.

Keywords: Honey bees, colony collapse disorder and bee collapse.

IMPORTANCE AND DIVERSE USES OF MANURE PLANT *DHAINCHA* (*SESBANIA ACULEATA*)**POOJA BHATT¹ AND ANITA RANI²****Department of Clothing and Textiles, College of Home Science, G. B. Pant University of Agriculture and Technology Pantnagar, U. S. Nagar, Uttarakhand**

The plant fibres like cotton, bast fibres like flax and hemp, leaf fibres like sisal and husk fibres like coconut have been indispensably used in textile sector. The leguminous plant *Sesbania aculeata* belongs to Fabaceae family and grows in diverse climatic conditions. The plant is native to countries like India, Bangladesh, Pakistan, China, Sri Lanka, Africa, Southern United States and Philippines. The plant provides variety of utility purposes including green manure, wood and fodder. The fibres of the plant are obtained from stem and can be used as cordage, fish nets and sackcloth similar to hemp fibres. The fibre is also a promising source of paper manufacturing. The foliage obtained from the plant is used as fodder for livestock. Traditional applications of *dhaincha* includes use as astringent, anthelmintic and anti-tumor agents in the medical field. The beans obtained from the plant have the ability to treat ringworms and other skin infections. The leaves yield pinitol, which acts as anti-diabetic agent along with being used for fodder, paper and biomass. The plant is also a rich source of natural gum which is used as thickening agent. The most appealing quality of plant is that it improves nitrogen content of soil, thus used as green manure. *Dhaincha* is a crop usually grown for its nutritional value and cultivated in monsoon season. It is a crop with variety of uses and need to be used extensively to attain maximum benefits.

Keywords: Dhaincha, Sesbania, Textile fibres, Leguminous plant**SELF-HELP GROUP: A KEYSTONE IN INDIA FOR SOCIO-ECONOMIC TRANSFORMATION AMONG RURAL AREAS****POOJA MISHRA, ANTIMA MISHRA,* DEEPIKA BARANWAL ** AND V.K. MISRA*******Gramoday Prkalp, Deendayal Research Institute Gonda (U.P.), *College of Home Science N.D.U.A & T Kumarganj, Ayodhya (U.P.), **Deptt. of Home Science, Arya Mahila PG College (BHU), Varanasi, *** K.V.K West Kameng Dirang Arunachal Pradesh**

In India, while the government has introducing so many schemes from a top down approach to deal with the problem of rural poverty, and to improve the prosperity of our country, these schemes have not achieving much attention at the grassroots level. The primary cause of this reason has been the lack of engagement of the rural communities at the household level where the rural populace feels a sense of responsibility to assist in their own alleviation from poverty. The self-help group bridges this divide by targeting households in poverty stricken rural areas. Villagers, mainly women, are organized into groups where they are taught entrepreneurial skills to enable them to forge a better livelihood. These skills, couple with the assistance rendered by the banks, have allowed them access to greater credit and, therefore, the ability to achieve higher social development. Self-Help Group is a small voluntary association of poor people preferably from the same socio-economic background, generally has members not exceeding 20. It can be alone women group, all-men group or even a mixed group who work for the capacity building of themselves. However, it has been the experience that women's groups perform better in all the important SHG activities in comparison to others. The goals of Self help groups (SHGs) are to become an effective agent of social and economical transformation. They serve as a platform to establish the banking with the poor which is reliable, accountable and a profitable business. It also enables livelihood opportunities for village womens / rural poor's through micro-credit with the existing banks in the area and provides a community platforms from which women become active in village affairs, stand for local election or take action to address social or community issues.

Keywords: Rural poverty, prosperity, entrepreneurial skills, Self-Help Group, micro-credit etc.**STUDY OF GENETIC VARIABILITY OF *ALTERNARIA* SPP. ISOLATED FROM DIFFERENT AGRICULTURAL CROPS****POOJA SINGH, SUSHMA NEMA*, KEERTI TANTWAI, SAJJAN K. POONIYA AND LALIT PRASAD SINGH RAJPUT****Biotechnology Centre, Jawaharlal Nehru Krishi Vishwavidyalaya, Jabalpur 482004**

Alternaria belongs to the family Pleosporaceae of the order Pleosporales in the subdivision of Ascomycotina. This fungus is characterized by its ability to produce a number of enzymes able to injury many types of crops. In the present investigation, the symptoms of *Alternaria* blight on different agricultural crops such as cabbage, cauliflower, coriander, fenugreek, brinjal, onion, faba bean, dahlia, dracaena, hollyhock, carrot, marigold, tomato and wheat were studied with objectives of (i) To identify *Alternaria* species on the basis of morphological characteristics. (ii) To characterize *Alternaria* species based on Internal Transcribed Spacer (ITS) region. *Alternaria* produced distinctive "bull's eye" patterned leaf spots in almost all the infected plants.

Out of total fourteen infected plant sample, nineteen *Alternaria* isolates were obtained. The observations were recorded from the seven day old culture for colony characteristics on PDA. Based on morphology 10 isolates of *Alternaria alternata*, two isolates *Alternaria tenuissima* and *Alternaria longipes* and one *Alternaria porri*, *Alternaria brassicae*, *Alternaria brassicicola* and *Alternaria* sp. were identified. *Alternaria* species grow rapidly and produced flat, downy to woolly grayish green to black colonies. All the isolates exhibited characteristics dark-coloured multicelled conidia with longitudinal and transverse septa (phaeodictyospores) and a beak or tapering apical cells. DNA Isolation of all isolates of *Alternaria* was carried out using CTAB method. Isolated DNA was subjected to amplification with ITS1 and ITS4 primers in a thermal cycler. The amplified products ranged from 580-600bp. These amplified products were sequenced and identify the species of different isolates BLASTn in NCBI online. All the sequences were published in NCBI public domain. The resulting sequences of all isolates were compared to other sequences in the GenBank as 99-100% identical. Genetic variability was conducted by phylogenetic analysis.

IMPROVED FARM TOOLS FOR FARM WOMEN TO INCREASE PRODUCTIVITY AND REDUCE DRUDGERY-AN ASSESSMENT

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The farm women performing all the agricultural tasks with the traditional tools and methods, they are not women friendly appropriate tools or either not available or are insufficient in number or unawareness. Unsafe, hazardous, unhealthy and long hours of work with traditional and awkward postures accelerate health related problems, especially among farm women. Most of the works performed by farm women are tedious as well as time consuming. As most of these operations like weeding, harvesting, digging, seed separation from pods, winnowing, threshing, seed shelling, cleaning and preparation etc. are done manually or by traditional tools, which are slow and cause considerable fatigue and drudgery. Many of these operations are traditionally done in varying body postures, some of which if done for long duration are not only inconvenient but also cause serious health hazards. All these factors result in drudgery by causing physical and mental fatigue, monetary hardships, exploitation, pain, economic stress etc. Majority of the respondents perceived farm activities as either moderately difficult. The present study was done to improved farm tools for farm women to increase productivity and reduce drudgery in Udham Singh Nagar district of Uttarakhand. Data was gathered from 200 farm women through a well structured questionnaire, focused group discussion and personal interview method. Finding revealed that farmwomen used traditional tools and implements since a long time but most of the women farmers felt immense drudgery in their use. It was also found that most of the farm women were unaware of improved farm tools and implement which reduce drudgery. The present study also revealed that most of the respondents used traditional tools and implements since a long time and subsequently 77.50 % of respondents were also faced difficulties and problem in using traditional tools and implements. Maximum 86.66 present of rural farm women engaged in cutting and load carrying activities. They are however subsequently exposed to prone drudgery activities. This result implies that the respondents were least aware about improved or women friendly drudgery reducing tools.

COMPARATIVE STUDY OF TWO WEED PLANTS FOR HEAVY METAL ACCUMULATION EFFICACY

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The current study was conducted to study comparative evaluation on two weeds *R. communis* and *C. procera* on heavy metal contaminated tannery soil. TCS was found moderately contaminated with Cr along with other heavy metals such as Mn, Cu, Pb. Accumulation of metals in whole plant was observed in order: Mn > Cr > Cu > Pb which was higher in *R. communis* than *C. procera* growing naturally in TCS. Assessment of TF_(dyn) as well as BCF_(dyn) factor proved that translocation of Cr from root to shoot was low (<1) whereas its accumulation in both plants were higher (>1) than other associated metals. Dynamic factors used for evaluation of heavy metals toxicity in TCS and selected plant species (*R. communis* and *C. procera*) further confirms and justify primary factor results. As these plants are not grazed by grazing animals, ecological metal transfer risks from these plants are quite low. High commercial importance such as biofuel production with medicinal values further enhances its probability to be/can be used for phytostabilisation of moderately Cr contaminated sites. In addition, present study provides better assessment of metal toxicity in soil and plant and dynamic factors can be implemented for any metal contaminated sites.

Keywords: Phytostabilization , weed, dynamic factor, heavy metals.

THE PHYSIOLOGICAL BASIS OF DROUGHT TOLERANCE IN CROP PLANTS: A SCENARIO-DEPENDENT PROBABILISTIC APPROACH

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Some crops and varieties require less water than others once they are established. The vegetables, grains and herbs that specifically mention the terms “drought-resistant” or “drought-tolerant” in the variety description. Drought is an environmental restraint for plants which would become more severe in coming years if effective measures won't be taken. It is a condition of reduced or very low availability of water to plants for a prolonged period of time hence disturbing plant growth, development, water relations, and efficiency of many terrestrial plants. Plants acclimatize themselves to different sophisticated biochemical, physiological, morphological changes to overcome drought conditions. Crops are prone to high susceptibility towards decrease in grain yield, reduced transpiration, and changed hormonal balance regulated through mechanisms of activation of anti-oxidant defense system, stomatal pore regulation, and osmoregulation in plant tissues. With advances in drought tolerance and plant genetic engineering, many drought tolerant traits can be acquired.

Keyword: Crop, Tolerance, Defence, Drought

ENHANCING NITROGEN USE EFFICIENCY THROUGH DIFFERENT AMENDMENTS AND THEIR EFFECTS ON PRODUCTIVITY OF RICE

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Food security is a major global issue because of the growing population and decreasing land area. Due to the limited capacity for arable land expansion, it requires sustaining yield improvement in existing land to meet the increasing food demand. Rice is one of the staple food crops for approximately half of the global population. Therefore, rice production must be increased significantly to satisfy the requirements of the growing world population. Nitrogen (N) is the most critical externally added input for any crop production system. Efficiency of applied nitrogenous fertilizers is very low due to its various losses i.e. volatilization, leaching, surface runoff and denitrification from soil-plant system. Therefore, response to applied nitrogen and its use efficiency have to be monitored properly for obtaining the maximum potential and sustainable yield. The proper understanding of advanced soil and plant management practices which helps in enhancement of nitrogen recovery efficiency ultimately adds towards the goal of achieving long term sustainable production system. Nitrogen use efficiency (NUE) is a critically important concept in the evaluation of crop production systems. The detrimental impact of the overuse of N fertilizers on the environment can be minimized if it is accompanied by sustainable agricultural practices which includes the use of different soil amendments such as Farm yard manure, compost, green manure, poultry manure and slow release inorganic fertilizers etc. Addition of organic sources such as rice straw, compost and poultry manure has potential to improve soil biological quality and increase productivity of the paddy fields (Das and Adhya 2014). Therefore, in order to make the soil well supplied with all the plant nutrients in the readily available form and to maintain good soil health, it is necessary to use organic manures in conjunction with inorganic fertilizers to obtain optimum yields and improving N-use efficiency.

Keywords: Amendments, N-use efficiency, Sustainability, Rice

RESPONSE OF DIFFERENT LEVELS OF N P K AND FYM ON SOIL HEALTH AND YIELD OF OKRA (*ABELMOSCHUS ESCULENTUS* L.) VAR. ARKA ANAMIKA

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A field experiment was conducted during *Kharif* (rainy) season of 2016 on Response of different levels of N P K and FYM on Soil Health and Yield of Okra (*Abelmoschus esculentus* L.) Var. Arka Anamika” on central research farm department of Soil Science and Agricultural Chemistry, SHUATS, Allahabad. The soil of experimental area falls in order Inceptisol and soil texture was sandy loam. There were nine treatments combination replicated thrice in 3x3 factorial Randomized Block Design. The best application of T8 - (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹) has effect on physical and chemical property of soil and yield of okra. The observed in post harvest soil resulted were significantly increased maximum values of water holding capacity (63.42%), % pore space (62.17%), organic carbon (0.74 %), nitrogen (304.90 kg ha⁻¹), phosphorus (33.58 kg ha⁻¹) and potassium (186.03 kg ha⁻¹) was with treatment T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹). The combination of T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹) showed slight decrease in pH (7.12), bulk density (1.30 Mg m⁻³), and particle density (2.51 Mg m⁻³), the same treatment EC (dS m⁻¹) was slightly increase 0.35 in post

harvest soil. The maximum cost benefit ratio (C:B) 1:3.44, maximum gross return 224250.00, maximum net profit 159100 ha⁻¹, and highest yield 149.50 q ha⁻¹ with T8 – (100% RDF @ N100 P60 K50 kg ha⁻¹ + 100% FYM @ 25 t ha⁻¹).

Keywords: Soil nutrients, yield attributes, FYM, NPK and Okra.

IDENTIFICATION OF SOURCES OF RESISTANCE IN SESAME AGAINST LEAF WEBBER/CAPSULE BORER (*A.CATALAUNALIS*)

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Sesame is described as the “Queen of oilseeds” because it contains high oil (38- 54%), protein (18-25%), calcium, phosphorous, oxalic acid and excellent qualities of seed oil and meal. The presence of some antioxidants (sesamin, sesamol and sesamol) makes the oil to be one of the most stable vegetable oils in the world. The growing domestic demand for edible oil, coupled with the emergence of sesame as a potential export crop, provides good opportunity for farmers to take up the cultivation of this crop and be assured of good market value. However, the gap between the potential achievable yield and the average yield of sesame is wide. One of the major constraints in the production of sesame is the colossal damage caused by various insect pests. Among the insect pests leaf webber/capsule borer is a major menace for enhancing the production and productivity of sesame. It is therefore, extremely important to devise means to reduce the extent of damage due to this insect pest without adversely affecting the agro-ecosystem. Among the ecofriendly management measures the use of resistant/tolerant varieties is one of the effective alternative and will not have adverse effect on the ecosystem. Therefore for managing this insect pest using resistant/tolerant variety is a right choice. Hence two hundred entries including two checks (SI-250 resistance check and TC-25 susceptible check) representing varied genetic diversity were tested against leaf roller and capsule borer (*A.catalaunalis* Dup.). The experiment was conducted at experimental field of project co-ordinating unit sesame and niger, College of Agriculture, JNKVV, Jabalpur during *kharif* season of the year 2012. Among the screened entries none of the entry was found free from infestation by leaf webber/capsule borer. The average plant, flower and capsule damage was varying from 3.8 to 44.3%, 12 to 53.6 and 4.4 to 27.0% respectively. At vegetative stage of plant growth the entries NAL/28/27/31/4 (3.8%) , SP-3267 (6.9%), SI-0018-B (7.4%), NIC-9627-I (7.4%), IS-722-I (7.4%), G-3 (8.3%), RJS-738-1-84 (9.1%) were recorded lowest damage while at flowering stage the entries viz., IS-178-C (12.0%) and S-0062-A (12.5%) while at capsule stage the entries IS-451 (4.2%), and RJS-56-A (4.4%), NIC-16095-A (4.8%) were recorded lowest damage. Based on the overall damages at different stages of plant growths the entries viz., IS-178-C, SP-3267, EC-334966 and IC-199443 were found promising against *Antigastra*. These promising lines can be used in transferring the resistance in to commercially viable varieties. Even partially resistant cultivars may also provide adequate control even with minimum usage of insecticides. It will help to prolong the useful commercial life of existing insecticides by discouraging the development of insecticide resistance strains of the insect.

Keywords: Germplasm, resistance, leaf webber/capsule borer, sesame

NURSERY MANAGEMENT IN BORO RICE SEEDLING THROUGH DIFFERENT DATES OF SOWING

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The present study was carried out during 2015-16 in Kishanganj, Katihar and Purnea districts of Bihar. In order to identify the appropriate date of seed sowing in *boro* rice, variety IR 64 was sown in the farmers' field at 15 locations in five blocks of three districts on four different dates at 10 day interval starting from 30.10.2015. To assess the seedling vigour, observations on seedling height, number of leaves per seedling and seedling colour were recorded at 30, 45 and 60 days after seeding. Results revealed that early sowing of nursery at the end of October resulted in higher seedling height and more number of leaves per seedling but, it also resulted in more seedling discoloration and more incidence of disease occurrence as the seedling remained in the bed for a longer period. Delayed sowing by the end of November resulted in shorter seedlings with lesser leaves per seedling and more leaf yellowing. Seed sowing on 10th November and 20th November produced seedlings with optimum vigour without much leaf yellowing after 60 DAS. Therefore, these two are the optimum dates of seed sowing in *boro* rice for transplanting 60 days old seedling in the month of January-February for rice-potato-rice and rice- mustard-rice cropping system.

Keywords: Boro rice, Nursery, Seedling Colour, seedling vigour, seedling height, IR 64

POSTHARVEST LOSSES IN AGRICULTURAL PRODUCTS

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Harvest is a major event for any food that is derived from plants. As a plant part is severed from the plant it loses its source of supply of nutrients and its repository for metabolic waste products. Until the detached plant part undergoes conventional food processing, it continues to live, respire, transpire, and senesce, ultimately leading to death. Postharvest deterioration continues until the item is either processed or consumed. Handling techniques have been developed to slow the physiological processes to provide a product that is satisfactory to the consumer.

Keywords: fruit, vegetable, postharvest deterioration, loss prevention, processing.

AQUAPORIN AND ITS ROLE IN DROUGHT MANAGEMENT

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Aquaporins are membrane channel proteins that are ubiquitously present in all kingdoms of life. Since the discovery of the lipid bilayer in the 1920s, the flow of water across cells and subcellular compartments was assumed to be carried out by simple diffusion across biological membranes. The molecular identity of the first water channel protein, aquaporin 1 (AQP1) was established by Agre and coworkers in 1992 based upon its ability to dramatically increase the water permeability of *Xenopus* oocytes expressing the CHIP28 gene. Presently, 35 aquaporin encoding genes in *Arabidopsis thaliana* (thereafter Arabidopsis), 31 in maize, 33 in rice, 47 in tomato and 66 in soybean were discovered. They are categorized according to their intracellular locations and sequence similarities: the plasma membrane intrinsic proteins (PIPs), tonoplast intrinsic proteins (TIPs), NOD26-like intrinsic proteins (NIPs) and small, basic intrinsic proteins (SIPs). Regulation of plant aquaporin activity occurs at different levels viz. post transcriptional, post translational, pH, heteromerization, ROS, diurnal and circadian regulation. The change in the response and expression of plant aquaporins is due to different environmental stimuli. Both PIPs and TIPs are more responsive to drought, salt and cold stress that disturb cell osmotic balance. They regulate root hydraulic conductivity (*L_{pr}*) and transpiration rates. TIPs along with NIPs are involved in biotic stress responses and are involved in regulating nutrient homeostasis between host and its pathogen. NIPs and TIPs are also found during pathogen interaction. Plants are able to escape or tolerate drought by regulating their aquaporin activities through different ways such as decreasing water loss via transpiration (regulation of stomata), maintaining inner water status of cell, CO₂ homeostasis and by cytosolic osmoregulation. During the year 2017, around 59% of India has received substantially less rainfall as compared to previous years. Drought affects economy, agriculture and society. Aquaporin has been found to effectively regulate plant water relation so that it can be used by plant breeder for developing drought tolerant varieties in future.

GENOME-WIDE ASSOCIATION STUDIES AMONG RICE (*ORYZA SATIVA* L.) GENOTYPES FOR GRAIN METABOLITES

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Asia is considered as 'rice bowl' of the world, producing and consuming more than 90% of the world's rice. Most of the agronomically important traits in rice are governed by multiple genes and hence are quantitative in nature resulting in wide morphological & biochemical variation among genotypes. Genome-wide association studies (GWAS) offer a powerful strategy for identification and characterization of genes associated with complex traits. Rice is an ideal candidate system for the application of GWAS because it is self-fertilizing and has a high-quality reference genome sequence with many phenotyping resources. The present investigation was undertaken with the objective to identify potential SNPs associated with some important yield related phenotypic and secondary metabolite traits in rice. GWAS was carried out on 9 agronomic traits and 18 targeted metabolite traits. The wide variation was displayed by nine phenotypic traits in 96 rice genotypes studied. All the genotypes were also genotyped with 6000 SNP markers followed by data filtering by removing SNPs with missing genotype calls >10% and minor allele frequency < 0.05. After filtering, 2660 SNPs were retained for association analysis. PCA was performed with all 2660 SNPs using GAPIT R package and a total of 4 major groups and 8 sub groups were detected in 96 accessions. The genotypic, phenotypic data/ metabolite data and population structure data were imported into Tassel v5 for performing the general linear model (GLM) association analysis to identify QTL loci. GWAS analysis for morphological traits identified 118 SNP (p-value < 0.005) significantly associated with different trait and spread across all 12 chromosomes coding for the trait. GWAS analysis for targeted metabolites identified a total of 135 SNPs (p-value < 0.005) significantly associated with the trait. For, 3, 5-diglucoside trait, 18 major candidate SNPs were identified with stringent p-value < 0.001, representing higher chances of association with the trait. The most significant SNP (10677003) was found on chromosome no.10 based on lowest p-value (0.0000063649) accounting for 20.1% variation for the trait. For targeted cyaniding 3-O-glucoside trait, 11 candidate SNPs were identified. The most significant SNP (7109684) was found on chromosome no.7 based on lowest p-value (0.0001719), accounting for 15% variation for the trait. GWAS analysis for ferulic acid identified 19 SNPs significantly associated with stringent p-value < 0.001. The most significant SNP (10562661) was found on chromosome no.10 based on lowest p-value (0.0001448), accounting for 24.8% variation for the trait. For the caffeic acid trait, 10 candidate SNPs were identified with p-value < 0.005. The most significant SNP (31636) based

on lowest p-value (0.00155) was found on chromosome no.1, accounting for 14.2% variation for the trait. GWAS analysis for coumaric acid identified 2 SNPs significantly associated ($p < 0.005$). For vanillic acid, 30 candidate SNP were identified with p-value < 0.005 , with SNPs (509593), found on chromosome no.1 accounting for 15.9% variation. The study detected multiple novel loci and candidate genes related to rice morphological and targeted secondary metabolite traits, which very well demonstrated that genome-wide association studies are powerful strategies for uncovering the genetic variation of complex traits and identifying candidate genes in rice.

IMPACT OF CLIMATE CHANGE ON AGRICULTURE: STUDY AND NEED OF FUTURE

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Climate change, which is largely a result of green house emission, agriculture factor burning fossil fuels, is already affecting the Earth's temperature, precipitation, and hydrological cycles. This change is apparent from the mid to late 20th century onwards and attributes largely to the increased levels of atmospheric carbon dioxide produced by the use of fossil fuels. Continued changes in the frequency and intensity of precipitation, heat waves, and other extreme events are likely, all which will impact agricultural production. Furthermore, compounded climate factors can decrease plant productivity, resulting in price increases for many important agricultural crops. Pathogens and disease may also be affected by a changing climate. This may be through impacts of warming or drought on the resistance of crops to specific diseases and through the increased pathogenicity of organisms by mutation induced by environmental stress. Over the next 10-20 years, disease affecting oilseed rape could increase in severity within its existing range as well as spread to more northern regions where at present it is not observed. Changes in climate variability may also be significant, affecting the predictability and amplitude of outbreaks. The net effect of climate change on world agriculture is likely to be negative. Although some regions and crops will benefit, most will not. Adaptation strategies are short and long-term changes to human activities that respond to the effects of changes in climate. World agriculture faces a serious decline within this century due to global warming. Overall, agricultural productivity for the entire world is projected to decline between 3 and 16 % by 2080. Developing countries, many of which have average temperatures that are already near or above crop tolerance levels, are predicted to suffer an average 10 to 25% decline in agricultural productivity by the 2080s. In agriculture, adaptation will require cost-effective investments in water infrastructure, emergency preparation for and response to extreme weather events, development of resilient crop varieties that tolerate temperature and precipitation stresses, and new or improved land use and management practices.

Key words: Climate change, Tolerance, agriculture, Adaptation

FUMIGANT TOXICITY AND REPELLENT ACTIVITY OF *MURRAYAKOENIGII*, *CALLISTEMON CITRINUS*, *CITRUS LIMETTA*, *CURCUMA LONGA* AND *PINUS ROXBURGHII* OILS AGAINST STORED GRAIN PEST *RHYZOPERTHA DOMINICA* (FABRICIUS)

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Grain storage is an integral component of post-harvest management practices. In India approximately 10.0 per cent of food grain is lost during storage half of which is accounted for insect pests which may go up to 40% losses in case of some insects. *Rhyzoperthadominica* (F.) (lesser grain borer, Coleoptera: Bostrichidae) is major pest of stored grain in India, it may cause up to 40% of grain loss as compared to other stored grain pests. Although there have been certain insect management practices like use of synthetic pesticides but due to increasing concern of pesticide residue in grains has encouraged researchers to look for some other alternatives. In one such attempt fumigant toxicity and repellent activity of some essential oils derived from *Murrayakoenigii*, *Callistemon citrinus*, *Citrus limetta*, *Curcuma longa* and *Pinus roxburghii* were tested against *R. dominica*. Insect was allowed to breed and feed for one month and then the number of adults emerged were counted. It was found that there was almost 100% inhibition against this pest in all the essential oils when used in 0.1% concentration. Different combinations were also prepared from these essential oils and then also it was observed that not less than 99.05 % inhibition was observed. High repellency was observed falling under class 4 and 5 when insect was tested against all the essential oils used in study. Thus, the results observed indicates that these essential oils may revolutionize post-harvest management technology of grain storage by providing quality food and environmental friendly approach.

A STUDY ON THE EFFECT OF SALINITY CONDITIONS ON SOME PHYSIOLOGICAL PARAMETERS OF CHILLI PEPPER (*CAPSICUM ANNUM*)

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Stress is a condition where physiology of plant get affected as well as plant affected at molecular level also. Crop yield are exaggerated by different types of stress like flood, drought and salinity. In salinity, accretion of salts started near the root cells which make harder to extract water from soil. In the condition of stress plant produce some reactive oxygen species for defence mechanism against salinity or other stress conditions. As stress affect plants and not all plant species are able to grow in saline conditions, plant species that can optimally grow in salt stress generally termed as halophytes. *Capsicum annum* is considered as second most consumable vegetable in world belongs to the family solanaceae. Assessment of viability of seeds, percentage of germination and estimation of fresh weight, dry weight and moisture percent were measured at different salt concentrations ranges from 0-20 gm L⁻¹ NaCl. This study showed that different concentrations of NaCl had significant effect on all physiological parameters like germination percentage, germination time and viability of seeds. As the concentration of NaCl increased, it induced delay in germination of seeds and also recorded fall in germination percentage. In pot experiment, with increasing NaCl concentration, induced a significant decrease on plant height, root length, fresh and dry weight of plant. Root length, plant height as well as the amount of chlorophyll was reduced in a concentration dependent manner. Results of this study demonstrate that NaCl affects major of the physiological process in pepper which directly affect the crop yield. There is a pattern in this study that with increasing salinity level there are depletion in all studied parameters recorded. During the condition of stress plant illustrate numerous responses at physiological, cellular and molecular level. This study put forward the potent candidature of *C. annum* towards salt tolerant which further could be beneficial where concentration of salts remains higher like near the coastal areas.

Keywords: *Capsicum annum*, salinity, germination, NaCl.

EFFECT OF TILLAGE AND CROPPING SYSTEM ON PHOSPHORUS FRACTIONS IN SOIL AGGREGATES

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Soil being an essential resource to biosphere and human beings, is also amongst the most complex and least understood systems. While its role in affecting crop productivity is widely studied, our understanding over biochemical controls on elemental dynamics in soil still needs improvement. Phosphorus is an essential element classified as macro nutrient required by plant for growth and development. It is least mobile element in plants and soil contrary to other macronutrients. In soil it is an important limiting nutrient to agricultural production and, due it's scarcity was considered as one of global environmental challenges of the 21th century. The amount of P fertilizer needed depends not only on the crop P requirement, but also on the amount of extractable soil P and the P fixing capacity of the soil. For phosphorus requirement plants depend on inorganic form of phosphorus. It has now been established that Al-P, Fe-P, R-P and Ca-P are the major soil inorganic fractions and their relative proportion depends upon various factor. Management practices may help to improve use efficiencies of the said nutrient so that the fertilizer P can be better managed in agricultural system Continuous ploughing and other tillage operation stimulate organic matter losses by increasing aeration, changing temperature and moisture conditions and thus favouring microbial decomposition. Conservation tillage systems, with proper residue management, are expected to maintain or increase SOM. Cropping system affects phosphorus dynamics by rapid decomposition of the P in the soil coarse fraction with an increase of inorganic P in the fine fractions. Keeping these points in view, investigation was carried out with objectives to study the 'Effect of Tillage and Cropping System on, the aggregates associated with phosphorus and distribution of phosphorus fractions in soil aggregates, a field experiment was conducted in Factorial Randomized Block Design with 9 treatments, each replicated thrice at two depths i.e 0-15&15-30 cm. Three treatments in main plot for Tillage practices were: ZT-Zero tillage, PB-Permanent Bed and CT-Conventional tillage and three treatments in sub plot for cropping system were - (Rice-Wheat, Maize-Wheat and Maize-Maize). Result from these objectives obtained that soil aggregates significantly influences the phosphorus concentration within the size fraction. Macro-aggregate (>2.0 mm) contributed higher phosphorus concentration than microaggregate. Within the aggregate size fractions, large macro-aggregate attributed to highest phosphorus concentration followed by small macro-aggregates and microaggregates and least at silt + clay fraction irrespective of tillage and cropping system over 0-30 cm soil depth and in case of phosphorus fraction found that in Zero tillage soluble and exchangeable Phosphorus was maximum in comparison to other tillage practices. Same trend were observed in all other fractions. Thus it may be concluded that Exclusion of tillage practices improves the each fraction of soil phosphorus. Larger aggregates contributed higher phosphorus density than smaller aggregates. Zero tillage in rice-wheat cropping system enhances total phosphorus in soil. Maize-wheat cropping system improves aggregate associated phosphorus. This infers that zero tillage with crop

diversification with C₃-C₄ system will holistically improves the phosphorus reserve and protects it from fixation, hence improves phosphorus use efficiency.

Keywords: Phosphorus fraction, residual, cropping system, soluble, tillage, soil aggregate

CHERRY CV. BIGARREAU NOIR GROSSA (MISRI) PRODUCTION AS INFLUENCED BY DIFFERENT INTERCROPS

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Effect of intercrops viz., maize, pea, strawberry, cabbage, red clover, french bean, oats and clean cultivation (control) on Cherry cv Bigarreau noir grossa (Misri) production as influenced by different intercrops, was studied during the years 2008 and 2009 under Kashmir conditions. Cherry trees bearing the age of 9 years were grafted on Colt rootstock and were spaced at the distance of 4x4 m². Plot size was 16 m². The results obtained revealed significant improvement in cherry trees intercropped with leguminous crops like pea, red clover and french bean than clean cultivation and heavy feeder crops (requiring high level of soil nutrients) like strawberry, cabbage, oats and maize. Highest per cent fruit set (13 %), fruit maturity (75 DAFB up to date of harvesting), fruit yield (17.75 kg/tree) fruit weight (4.08g), fruit Anthocyanin (4.47 mg/g of fruit) and fruit physico-chemical characteristics like fruit TSS (19.98 %), Fruit Acidity (0.72%) and Total Sugars (11.20 %) were recorded maximum in cherry trees with leguminous type of crops i.e. pea and red clover respectively. The impact of intercrops on relative economic yield of Cherry (system equivalent yield) revealed that the Cherry trees intercropped with pea had better benefit: cost ratio (1.32) followed by cabbage (1.28) and french bean (1.10) than clean cultivation (0.91).

Keywords: Intercropping, Sweet cherry, Quality parameters, Fruit yield, Relative economic yield.

STEM CELLS GENERATED CLINICAL VALIDATION OF HEPATIC REGENERATION AND CD44 GENE EXPRESSION IN CANINE

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The present study was conducted to determine the therapeutic efficacy of hepatocytic stem cells for hepatic regeneration in dogs. Twenty four canine patients suffering with hepatic dysfunction were divided into four groups i.e., A, B, C and D. The animals were subjected to different treatment groups as group A (Control), group B (Inj. pepsid@ 1ml/10 kg b.wt. IM alternatively for 15 days IM), group C (hepatocytic stem cells @ 5×10⁷ cells intraperitoneally only once) and group D (hepatocytic stem cells @ 5×10⁷ cells + Inj. pepsid@ 1ml/10 kg b.wt. IM alternatively for 15 days IM). The efficacy of treatment was assessed by observing various haematological (Hb, TEC, TLC, DLC, ESR, PCV, BT and CT), biochemical (serum total protein, serum albumin, serum glucose, serum cholesterol, serum urea nitrogen, serum creatinine serum AST, serum ALT and serum GGT) and CD44 gene expression. Therapeutic efficacy of different combinations viz. pepsid and hepatocytic stem cells have better effect on liver regeneration. However, the combination of hepatocytic stem cells and pepsid (group D) exhibit greater healing efficacy followed by the combination of hepatocytic stem cells (group C). Hence, this combination can be used safely by veterinarians for the treating various hepatic affections in canine patients.

LONG TERM BALANCE FERTILIZER APPLICATION EFFECT ON SOIL HEALTH AND YIELD OF RICE (ORYZA SATIVA L)

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Rice and wheat have been grown in sequence on the same land over 26 mha of South and East Asia to meet the food demand of increasing population. The study of soil fertility and crop productivity under long-term cropping has long been the subject of immense importance. The present study “Long Term Balance Fertilizer Application Effect On Soil Health And Yield Of Rice (*oryza sativa* L.)” was conducted at A2 block of N. E. Borlaug Crop Research Centre of G.B. Pant University of Agriculture and Technology, Pantnagar (Uttarakhand) during *kharif* 2017. These treatments were a part of long-term fertility experiment since 1984. The value of soil pH and EC were higher compared to the initial value in the fertility treatments. Soil organic matter after

harvesting of rice also increased due to continuous application of NPK+FYMr and NPK+Zn+FYMr. The highest value of available nitrogen was recorded with $N_{120}P_{40}K_{40}+Zn+FYMr$ which was statistically at par with $N_{120}P_{40}K_{40}+FYMr$ but significantly higher than all other treatments. The grain yield over 33 years of experimentation revealed that highest production (6.10 t ha^{-1}) was obtained with the application of $N_{120}P_{40}K_{40}+Zn+FYMr$ which was statistically at par with $N_{120}P_{40}K_{40}+FYMr$ and $N_{120}P_{40}K_{40}+Zn$. This could be due to the additional supply of N, P, K and Zn with FYM applied @ 5 t ha^{-1} since last many years that led to better fertility status resulting the good supply of nutrients. The experiment thus suggests the importance of balanced nutrition in proper growth and development of rice.

STUDIES ON THE IMPACT OF INTERCROPPING ON SWEET CHERRY QUALITY FRUIT PRODUCTION

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A field experiment was conducted to evaluate the studies on the impact of intercropping on sweet cherry quality fruit production, to different intercrops. Those intercrops were legumes such as pea (nutrient providing) red clover, french bean and, heavy feeder (requiring higher level of soil nutrients) crop types of maize, oats, cabbage and strawberry compared to a clean cultivation control. Growth of young 'Misri' (Bigarreau Noir Gross) on Colt rootstock cherry trees during 2008 and 2009 was significantly affected by the vegetative intercrops. Cherry trees intercropped with leguminous crops, such as pea, red clover and french bean, had greater tree growth as measured by shoot extension, tree girth, height and spread than those under clean cultivation and heavy feeder crops like oats and maize. Yield, leaf nutrient status (N, P, K, Ca, Mg) and relative economic yield (system equivalent yield) of cherry trees intercropped with pea, red clover and French bean were greater than clean cultivation. However, lowest yield and yield related characters like (Fruit no. Fruit weight and Fruit volume), leaf nutrient status and economics in terms of Benefit:Cost ratio were lower in cherry trees with maize, oats and strawberry.

Key words: Cherry, Intercrops, Relative economic yield, Leaf nutrient status.

EFFECT OF FOLIAR FEEDING OF UREA AND GROWTH REGULATOR ON FRUIT DROP, YIELD AND QUALITY OF MANGO CV. AMRAPALLI

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Present investigation entitled "Effect of foliar feeding of Urea and growth regulator on fruit drop, yield and quality of mango cv. Amrapalli" was conducted at Main Experiment Station, Department of Horticulture, Narendra Deva University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad (U.P.) during 2016 to 2017 with a view to find out the effect of Urea and NAA alone or in combinations on fruit drop, yield and quality of mango fruit cv. Amrapalli. Three doses of NAA viz., 10, 15, 20 ppm and one dose of Urea (2%) and one control (untreated) were arranged in Randomized Block Design with three replications. The maximum number of fruits/shoot, fruit retention, fruit yield and minimum fruit drop were recorded with the application of T_8 (Urea @ 2% + NAA @ 20 PPM) followed by T_7 (Urea @ 2% + NAA @ 15 PPM). All the physico-chemical characters were influenced by foliar sprays of Urea @ 2% and NAA @ 10, 15 and 20, PPM alone or in combinations. The fruit length, breadth, volume, pulp weight pulp per cent and pulp stone ratio were recorded maximum with the foliar application of T_8 (Urea @ 2% + NAA @ 20 PPM) followed by T_5 (Urea @ 2% + NAA @ 20 PPM). Chemical characters viz., T.S.S., acidity, ascorbic acid, total sugars and vitamin 'A' content were influenced with the foliar application of all the treatments. The maximum T.S.S, ascorbic acid, total sugars, vitamin 'A' and minimum acidity content were observed with the foliar application of T_8 (Urea @ 2% + NAA @ 20 PPM) followed by T_5 (Urea @ 2% + NAA @ 20 PPM).

LIVELIHOOD STRATEGY VARIATION IN RUDRAPRAYAG DISTRICT OF GARHWAL HIMALAYA: IMPLICATIONS FOR POVERTY REDUCTION

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This paper has emphasis on, to understand the variation of livelihood strategies within and between the blocks to understand the quality of life in the villages of district Rudraprayag. The study also identifies the factors that are interlinked with the socio-economic attributes of the people which involved in various income generating activities. This analysis is essential to understand the mechanism of livelihood strategy changes within and between the blocks of district Rudraprayag. The people's are mainly dependent on tourism, agriculture, animal husbandry and vegetable cultivation for their livelihood. The major livelihood source of

people was tourism. A random sampling method were used to select the villages. Structured and semi-structured questionnaire and interview method were used to understand the importance of resources for livelihood generation and other livelihood options. The data gathered from each selected village was compiled and analyzed by using SPSS 16. A higher proportion of household (57.6%) of Agstumuni block depends on agricultural activities while the majority of people of Jakholi and Ukhimath block depend on remittances (65.1) and agriculture (55.8) respectively. Analysis of the socio-economic characteristics of rural households also reveals that age, labour endowment, education, and community characteristics in terms of access to basic infrastructure are some of the barriers that poor households in rural areas face to enter into high-return livelihood strategies.

INTEGRATED FOLIAR DISEASE MANAGEMENT OF POTATO UNDER MANIPUR CONDITIONS

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Potato (*Solanum tuberosum*) is the most important food crop of the world. Potato is a temperate crop grown under subtropical conditions in India. Potato production in India 48,605,000.0 tonnes. Major foliar diseases of potato are powdery mildew (*Erysiphe cichoracearum*), Early blight (*Alternaria solani*), Late blight (*Phytophthora infestans*), Wilt (*Fusarium spp*), Potato leaf roll virus, Potato virus Y and X etc., Major foliar disease of potato in Manipur is Early blight, Wilt of potato (*Fusarium spp.*). Integrated disease management early blight disease can be done by different methods like cultural method (Field selection, Crop rotation, growing season, irrigation, fertilizer application), Biological method (use of *Trichoderma spp.*) and chemical Method (Mancozeb 3-4 gm/kg seed) and for Potato Wilt Disease Control by different methods like Cultural Method (Field selection, crop rotation) and use of Biological Fungicide like Mycostop.

Keywords: Integrated disease management, foliar diseases

TOPOGRAPHICAL AND ANATOMICAL STUDIES TO INSIGHT THE EFFECT OF *BOTRYTIS CINEREA* ON THE LEAVES OF SUSCEPTIBLE AND RESISTANT CHICKPEA GENOTYPES BY SCANNING ELECTRON MICROSCOPY AND FLOURESCENCE MICROSCOPY

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Botrytis cinerea Pers. Fr, the causal agent of grey mould disease, is the second most studied phytopathogenic fungus with necrotrophic lifestyle. It causes serious losses in more than 1000 plants species including important crop worldwide. In chickpea, the fungus causes Botrytis grey mould (BGM) disease and attacks all the aerial parts of the plant. Scanning electron microscopy (SEM) was used to see the process of invasion of *Botrytis cinerea* in leaves of susceptible and resistant chickpea genotypes. Seedlings of both the genotypes were inoculated with (1×10^4 spore mL⁻¹) inoculum of fungus. The observations were taken after 3, 5 and 7 days of inoculation. In case of water inoculated samples, it was observed that there were differences in number of stomata in resistant (*C. pinnatifidum*) and susceptible (PBG5) genotypes, which were validated by stomatal index studies done by using fluorescence microscope. After invasion of the fungus, degradation of cell wall occurred followed by intercellular and intracellular development of the fungus in susceptible genotype. Although fungal growth was observed in resistant genotype, but disintegration of host tissues did not occur leading to absence of disease symptoms. After 7 days of inoculation, tissues of the seedlings lost their integrity and identity and seemed as rotten mass covering with dense mycelium in susceptible genotype, PBG 5. Moreover, anatomical studies were also done in both the genotypes by cross sectioning of leaf and stem samples in the potato pith and observing the sections under the fluorescence microscope at various days post inoculations. The observations revealed disintegration of epidermis, mesophyll and colonization of vascular system in PBG 5 at 5 and 7dpi. In case of *C. pinnatifidum*, thickening of outer epidermis was observed after infection with *B. cinerea*.

Keywords: *Botrytis cinerea*, invasion, scanning electron microscopy, Fluorescence microscopy

ECOFRIENDLY DYEING OF WOOL FABRIC WITH NATURAL KACHNAR (*BAUHINIA VARIEGATA*) DYE

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The goal of any technique is to make our lives better. In the present time, commercially viable alternatives for preparing and finishing wool substrates based on the use of enzymes have emerged. The present study has been planned to assess the effect of different enzymatic treatments on dyeing efficiency of wool. Standardization of enzyme treatments for four enzymes i.e. Protease, Lipase, Transglutaminase and Laccase was performed on the basis of dye absorption and wash fastness for different concentration and treatments. The scoured fabrics were pretreated with the enzymes and dyed with selected natural dye. Scanning Electron Microscopic (SEM) and Fourier Transform Infrared Spectroscopy (FTIR) were used for analysis of dyed and enzyme treated fabric. The color coordinates, strength and fastness, various mechanical, performance and functional properties of the enzyme treated dyed fabric were

tested with comparative analysis between alkali and enzyme scoured fabrics treated with enzymes and dyed with natural dye. Results indicated that percent dye absorption and wash fastness of Kachnar (*Bauhinia variegata*) dye was higher for all the enzymes as compared to *marigold* dye. Out of the four enzymes Protease and Lipase were selected based on dye absorption. The parameter optimized for enzyme treatment of neutral scoured fabric were 0.25 and 0.5 percent enzyme concentration, with constant M:L Ratio(1:20), pH(7-8), temperature (55°C) and time (60 minutes), respectively. Thus, can be concluded that enzyme treatments enhanced the dyeing efficiency of the wool fabric with better color fastening properties. The mechanical and performance properties of wool fabric were also improved with enzyme pretreatment and kachnar dye showing very good to excellent protection from UV radiation and bacterial attack. Hence the enzymes are suitable replacement materials for wool fabric in textile wet processing because to their positive response towards environment and no harmful effect on fabric properties.

Keywords: enzymes, wool, natural dyes, fabric

ECONOMIC GROWTH ENHANCE WITH ADOPTION OF CULTIVATION TECHNOLOGY OF PADDY STRAW MUSHROOM (*VOLVARIELLA VOLVACEA*)

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Paddy straw mushroom (*Volvariella volvacea*) is a world famous edible mushroom variety that has high demand due to its deliciousness and nutritive value. Although there is a big demand in Korba district of Chhattisgarh in India, there was no adoption for cultivation of Paddy straw mushroom since it needs high temperature (33-35°C) and 85-90 % relative humidity in the growing environment. There were no efficient use of Paddy straw. Hence, an innovative approach to farmers Paddy straw Mushroom Cultivation Technology was transfer successfully under Front Line Demonstration conducted at different village of Korba district during the year 2018-19. To develop an bed method of outdoor cultivation that would maintain above environment requirements. Paddy straw wastes were used separately as main composting materials. The yields of outdoor cultivation method of paddy straw were 1093.75gm/5kg substrate with spawn run in 15 days and pinhead formation in 12 days respectively. Average number of Fruiting body is 39 in single bed. It has been observed that the outdoor method can be successfully adopted by farmers to cultivate paddy straw mushroom profitably in Korba district.

Key words: Outdoor cultivation; Paddy straw mushroom

EFFECT OF ESSENTIAL MACRO AND MICRO-NUTRIENT CHEMICAL COMBINATIONS FOR BEST EXPLOITATION OF GROWTH TRAITS IN POTATO UNDER TERAI REGION OF WEST BENGAL

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Potato is one of the most important food crops after rice and wheat. The climatic condition of terrain agro ecological region favours the cultivation of potato along with this good yield. But due to deficiency of macro nutrient and micronutrient in the soil of terai region the growth of the potato crop hampers, which ultimately result in poor yield. The mentioned problem keep in mind the present experiment conducted through enrichment of soil by external use off macro and micronutrients. The experiment focused only the growth parameters of the potato. In case of sole application the calcium (Ca) play important role in case of plant height at 50DAP (23.08 cm) and 70 DAP (29.06 cm), no of leaves at 50DAP (60.50) and 70 DAP (78.05), fresh weight (242.50 g) and dry weight (42.33 g). In case of combined application calcium (Ca), magnesium (Mg), sulphur (S), zinc (Zn) and boron (B) combined shows highest plant height at 50 DAP (28.66 cm) and 70 DAP (32.15 cm), number of leaves at 50DAP (80.72) and 70 Dap (90.67), fresh weight (277.17 g) and dry weight (45.83 g). Thus the results revealed that the soil is deficient in most of the macro and micro nutrients particularly those are unavailable in acidic soil of the terai zone. Therefore its application solely or in combination with others always showed some beneficial effects.

Keywords: Potato, calcium (Ca), magnesium (Mg), sulphur (S), zinc (Zn) and boron (B)

SOIL MOISTURE AND NEST SITE PREFERENCE IN BUMBLE BEE

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The majority of native and naturalized bees are solitary ground nesting bees in Bengaluru Karnataka, India. The natural habitat that the wild bees require for nesting is steadily decreasing with the increase in urbanization and commercial agriculture. The ground nesting bees asses soil conditions before initiating a nest. Most bee species only live as adults for four to six weeks and are typically known to prefer soils, much of their lives are spent as immatures in underground nests. The study is designed to examine

the biotic and abiotic factors in affecting the distribution of *Bombus spp.* Therefore, soil characteristics likely play an important role in nesting rates in prairie ecosystems. The nesting requirements for bees varies considerably among different species, with well-drained soil being the only factor generally influencing nest site selection in ground nesting bees (Linsely 1958), but individual species data tends to focus on the biology and behaviour of the bee and also soil characteristics like the soil texture, percent organic matter, temperature, soil moisture, bare ground, food and habitat, bulk density, soil types and pH of the soil at the nest site were identified. Depending on the depth, the soil was found to be either silt loam or silt. Moreover, management techniques that affect important soil habitat characteristics such as the above mentioned factors could have a large effect on bee community structure. One of the most important factors in the choice of a nest site is the elevation of drainage of the soil. Many solitary bee species nest in dense aggregations. So the effect on nest aggregations of Bumble bee factors like moisture and temperature play an important role as the food and habitat are relatively abundant throughout these selected areas. Rate of development from the overwintering stage to the adult depends primarily on soil moisture and soil temperature, but the main factors that restrict the distribution of the Bumble bee, causing colonies to aggregate in open and dry areas are an interaction of moisture during the daylight hours because the soil should have the correct moisture levels for successful nesting. In addition, water potential of the larval food provision mass has to be low as it does not mould. So in this study soil moisture is considered as an important factor that was observed.

Keywords: *Bombus spp.*, soil moisture, Nesting sites, Nesting behavior

MANAGEMENT OF LEAF SPOT DISEASE OF *OCIMUM GRATISSIMUM* CAUSED BY *ALTERNARIA ALTERNATA*

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A field experiment was conducted during *Kharif* season of 2016-17 entitled “Management of leaf spot disease of *Ocimum gratissimum* caused by *Alternaria alternata*” at Main Experimental Station, Department of Medicinal and Aromatic Plants, N. D. University of Agriculture and Technology, Kumarganj, Faizabad. The experiment was conducted with 24 germplasm in Randomized Block Design replicated thrice with seven treatments including three chemicals, three plant extracts along with control. The oil content per cent, number of leaves per plant, leaf weight per plant (Kg), leaf yield (q/ha) and disease severity per cent were recorded in 90 days old plants. Results revealed that germplasm NOB-7 showed maximum oil content per cent (2.14%). While the maximum leaves yield recorded in NOB-1 (14.81 q/ha) and disease severity (15%). Under chemical management of leaf spot disease of *Ocimum gratissimum* Propiconazole 25EC @0.1% was found most effective with lowest PDI (18.79%) and maximum PDC (71.52%) as compared to Tebuconazole 250EC @ 0.1% with PDI (23.25%) and PDC (65.99%), Blitox 50WP @0.1% with PDI (32.40%) and PDC (50.99%). Whereas, among plant extracts NSKE @ 5% was most effective having PDI (41.11%) and PDC (37.7%) as compared to Garlic @ 5% with PDI (45.57%) and PDC (30.94%) and Ginger @5% with PDI (52.99%) and PDC (19.69%). Thus, it can be concluded from the present experimentation that Propiconazole 25 EC @ 0.1% is the best treatment to overcome the Leaf spot disease of *Ocimum gratissimum* as a chemical fungicide and among the plant extracts NSKE @ 5% followed by Garlic (bulb, cloves) and Ginger at the same concentration revealed lesser disease control as compared to chemical fungicides. The medicinal plants now days also used as crude drug for ayurvedic preparations. *Ocimum gratissimum* leaves affected by the presence of pathogenic fungi (*Alternaria alternata*) controlled by using the botanicals instead of chemical fungicides despite more effective just to keep the medicinal value of the plant.

SUSTAINABLE AGRICULTURAL DEVELOPMENT AND ORGANIC FARMING IN INDIA

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Agricultural Sector, world over, has experienced a phenomenal growth since the mid-twentieth century. The growth, driven by Green Revolution technology, has made a significant dent on aggregate supply of food grains, ensuring food security to the growing population. The next stage of growth however, faces a serious challenge in terms of sustainability. India can safely be characterized as an agricultural country despite the recent spurt in manufacturing and services and the declining share of agriculture in the national income, since majority of its workforce (65%) are still engaged in agriculture and allied activities. In the present paper the need for sustainable agriculture has been emphasized. Policies for sustainable agriculture and organic farming and possible actions in India are discussed. Agricultural Sector, world over, has experienced a phenomenal growth since the mid-twentieth century. The growth, driven by Green Revolution technology, has made a significant dent on aggregate supply of food grains, ensuring food security to the growing population. The next stage of growth however, faces a serious challenge in terms of sustainability. Whereas the main problem faced by the developing countries in the south pertains to sustainability of resource use, the main challenge facing the developed economies in the north is overuse of inputs. These problems have led to increasing awareness and a felt need for moving away from the input intensive agriculture perused during the Green revolution phase, to sustainable in different parts of the world.

PROGRESSIVE OLIVE FARMING: ONE MORE FEATHER TO RAJASTHAN'S TURBAN**RAVINA PAWAR****Dr. YS Parmar University of Horticulture & Forestry, Nauni-173 230, Solan (Himachal Pradesh)**

"Agriculture in Rajasthan is a gamble with rain." To give a U-turn to this proverb olive cultivation has been promoted under public-private partnership (PPP) in the state as per technical feasibility and economic viability of the olive cultivation in Rajasthan. By seeing the ample possibilities subsidies are provided on plant saplings, fertilizer and drip-irrigation systems by Rajasthan Olive Cultivation Ltd (ROCL). Seven varieties of olive viz., Arbequina, Barnea, Coratina, Picholine, Picual, Koroneiki, Frantoio were imported from Israel and planted at eight farms in Jaipur, Jhunjhunu, Bikaner, Sri Ganganagar, Nagaur, Jalore, Alwar and a centre of excellence was set up at Jaipur's Bassi area. The progressive farming of olive in Rajasthan has inaugurated a new initiative with launching of world's maiden processed olive leaf tea unit, set up at Bassi (Jaipur) to achieve the target of doubling the farmer's income of the farmers of the state by 2022. It has been a great innovation and Rajasthan is the first to set up a tea unit. Now days, people find themselves in a tough spot where the ever increasing stress that comes with fast-paced lifestyle, can make a shift to healthy habits and olive tea is definitely going to help them. It reduces risk of cancer, keeps heart healthy, anti-viral properties, reduces blood pressure, amplifies immunity, rejuvenates skin, aids in diabetes, anti-inflammatory agent and being rich in antioxidants, vitamin-C and free of caffeine, it has a potential to become an alternative to the daily drinks that people consume at large such as green tea, coffee, black tea and more. After few years of harnessing olive saplings brought from Israel, Rajasthan is all set to launch its own olive oil brand, which will be the country's first indigenously produced brand. The state will be launching its olive oil under the brand "Raj Olive Oil." Being the state's "first plantation crop" demand for olive farming is gradually increasing against the lower returns of traditional crops like bajra and wheat. Thus, olive farming emerges as a new burning lamplight at the agriculture portal of Rajasthan.

MOLECULAR EVALUATION OF RICE VARIETIES FOR SALINITY TOLERANCE USING SALT STRESS RESPONSIVE CANDIDATE GENES**RIMA KUMARI*, PANKAJ KUMAR, V.K. SHARMA AND HARSH KUMAR****Department of Agricultural Biotechnology and Molecular Biology, Dr. RPCA University, Pusa (Samastipur) Bihar**

A panel of eighteen rice varieties including two tolerant (Pokkali and CSR-36) and two susceptible (IR-29 and IR-64) checks rice varieties were screened with the help of six salt stress responsive candidate genes for the purpose of their molecular profiling in relation to their salinity tolerance. The six primer pairs (*OsHKT1*;5, *SNAC1*, *CDMK*, *CCC*, *SHMT1* and *SHMT2*) specific to the candidate genes containing microsatellite generated polymorphisms in the form of variation in the length of amplified products that was inferred on the basis of differential positions occupied by amplicons during their resolution through agarose gel electrophoresis. The six salt stress responsive candidate genes that contained microsatellite repeat motifs, recorded relatively greater number of alleles. Hierarchical classification and spatial distribution patterns based on amplification profiles dependent similarity indices unambiguously discriminated these 18 varieties in accordance with their salt tolerance. Principal coordinate analysis completely supported the results obtained from hierarchical classification of the varieties. Therefore, identified salt tolerant varieties in present investigation can be used as parental donor in rice breeding programme to develop salt tolerant rice varieties.

Keywords: Rice, Candidate genes, Salt stress**DEVELOPMENT OF HERBAL KULFI USING TULSI, GINGER AND CLOVE****REKHA RANI¹, KHUSHAL SOLANKI², BHOPAL SINGH³ AND SHUVAM SINGH⁴****^{1,2,4} Dairy Technology Department, Warner College of Dairy Technology (WCDDT), SHUATS, Uttar Pradesh-211007, India. ³ Dairy Technology, DayalBag Educational Institute (DEI), Agra, Uttar Pradesh**

Initial trials were conducted to adjudge the most acceptable levels using tulsi paste (2.5%, 5.0% and 7.5%), ginger juice (2.0%, 3.0% and 4.0%) and clove extract (2.0%, 3.0% and 4.0%). The final optimized product contains 2.5% tulsi paste, 2.0% ginger juice and 4.0% clove extract were highly acceptable and be used to develop a product without adversely affect the sensory attributes of Kulfi. The Kulfi prepared without addition of tulsi, ginger and clove was treated as control. The fat (12.0%), protein (3.53%), total solids (42.80%), ash (1.0233%), carbohydrate (23.04%), acidity (0.28% L.A.), specific gravity (1.2884), melt down time (6.33ml), anti-oxidant (10.01% anti-oxidant activity) and total phenolic (56.96mg GAE/100gm) content respectively in optimized Kulfi. The products possess good level of anti-oxidant, total phenolic content. The standard plate count was found 3.85 Cfu/gm. The yeast and mold and also coliform count were absent in the product as per FSSAI standard. The herbal Kulfi conforms to the FSSAI (2017) requirements. The addition of tulsi paste (2.5%), ginger juice (2.0%) and clove extract (4.0%) in Kulfi was effective in enhancing the quality of Kulfi as well as contains anti-oxidants and phenolic compounds. The calorific value of herbal

Kulfi was 222.26 kcal. The price for manufacturing 25gm of herbal Kulfi stick using tulsi paste, ginger juice and clove extract was found to be Rs.5.72.

Keywords: Tulsi, ginger, clove, Kulfi, sensory, cost

WOMEN'S IN AGRO-BIODIVERSITY CONSERVATION

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Biodiversity, combination of two vital words "bio and diversity" pertaining to the variation of life. Agro-biodiversity encompasses all relevance to food, agriculture & the sustainability of agro-ecosystems. Agro-biodiversity is the source of genetic material that is vital to future generations. The convention on Biological Diversity in its preamble recognizes —the vital role that women play in the conservation & sustainable use of biological diversity and affirms the need for full participation of women at all levels of policy making & implementation for biological diversity conservation. Women play an important role in conserving agrobiodiversity, due to their important role in household activities, and the influence they have on their children, by teaching them about the importance of nature and conserving biodiversity. Across the globe, women predominate as wild plant gatherers, home gardeners & plant domesticators, herbalists & seed custodians. Women provide close to 80% of the total wild vegetable food collected in 135 different subsistence based societies. Women often have specialized knowledge about the neglected species. The challenge for the next generation is the safeguarding of agro-biodiversity by paying greater attention to diverse & integrated agricultural systems especially those managed by women that provide food and livelihood security. The maintenance of plant and animal diversity will protect the ability of men and women farmers to respond to changing conditions, to alleviate risk and to maintain and enhance crop and livestock production, productivity and sustainable agriculture.

Keywords: Agro-biodiversity, Conservation, Women, Development

RESPONSE OF INTEGRATED NUTRIENT MANAGEMENT FOR SUSTAINABLE SUGAR BEET PRODUCTION

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Present investigation was carried out to standardize integrated nutrient management for sugar beet production. Results showed that integrated use of 75% recommended fertilizers along with organic manures and inorganic fertilizers produced root yield at par with the previous recommendation (80:100:80 NPK +150 q/ha FYM) and improved soil organic carbon. Besides yield, integrated use of fertilizer, manures increased TSS and total phenols content and decreased pyruvic acid as compared to inorganic fertilizer application alone. Combined application of fertilizers, organic manures and inorganic fertilizers maintained initial soil available NPK status. We conclude that the combined application of inorganic fertilizer (60:75:60 kg NPK) along with organic manures and inorganic fertilizers produced yield at par with previous recommendation, improved root quality and maintained soil fertility. Adoption of this practice saved 25% inorganic fertilizers and protect environment from pollution.

EFFECT OF AZOLLA AS FEED SUPPLEMENT ON MILK PRODUCTION IN GRADED MURRAH BUFFALOES

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Productivity of dairy animals mainly depends on efficient feeding management. Balanced feeding results in better utilization of nutrients and optimum milk production. Farmers feed their buffaloes with roughages and concentrate (mustered cake + wheat bran) without any consideration regarding quality and quantity of feed in Datia District of Madhya Pradesh. Traditional supplements based on mustered cake and wheat bran are expensive and increase the feed cost. Feed cost is the biggest cost in livestock business, which can be reduced by using alternative feed ingredients that have high value, relatively cheap prices, easy to obtain and safe for consumption, and ones of its is Azolla pinnata. Azolla, on a dry weight basis, is constituted of 25-35% protein content, 10-15% mineral content and 7-10%, a combination of amino acids, bio-active substances and biopolymers. An on Farm Trial was conducted in Krishi Vigyan Kendra Datia in Kharif 2018 to study the Effect of azolla as feed supplement on quality and quantity of milk production in buffaloes. For cultivation of azolla, 8"x 5" size of Azolla cultivation pits was prepared at the farmer's field. Twenty four graded murrah buffalo was selected randomly for the study and divided in two groups i.e. control group (T1) and treatment group (T2). In each group there were twelve buffalo. In control group (T1) buffalo was fed with wheat straw and green fodder with concentrat (mustered cake + wheat bran). In the treatment group (T2) 2.5 kg fresh azolla/animal/day was supplemented over conventional ration. The average daily milk production was increased by 8.52 % i.e. 8.14 liter in control group (T1) to 9.09 liter in treatment group (T2). Average Gross return, average Net return and B:C ratio was also increased from

Rs. 333.05, Rs 149.87 and 1.82 per animal per day in control group (T1) to Rs. 363.44, 175.26 and 1.93 per animal per day in treatment group (T2) respectively.

Key words: *Azolla pinnata*, Milk production.

MANAGEMENT OF FRUIT PESTS BY PHEROMONE NANOGELS

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Environment-friendly management of fruit flies involving pheromones is useful in reducing the undesirable pest populations responsible for decreasing the yield and the crop quality. A nanogel has been prepared from a pheromone, methyl eugenol (ME) using a low-molecular mass gelator. This was very stable at open ambient conditions and slowed down the evaporation of pheromone significantly. This enabled its easy handling and transportation without refrigeration, and reduction in the frequency of pheromone recharging in the orchard. Notably the involvement of the nano-gelled pheromone brought about an effective management of *Bactrocera dorsalis*, a prevalent harmful pest for a number of fruits including guava. Thus a simple, practical and low cost green chemical approach is developed that has a significant potential for crop protection, long lasting residual activity, excellent efficacy and favorable safety profiles. This makes the present invention well-suited for pest management in a variety of crops.

Keyword: Management, Fruit Pests, Pheromone, Nanogels

SCREENING OF BARNYARD MILLET (*ECHINOCHLOA FRUMENTACEA* (ROXB.) LINK) GENOTYPES FOR SEED QUALITY PARAMETERS UNDER LABORATORY CONDITION

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The present investigation was carried out under laboratory condition in the Department of Seed Science and Technology, College of Forestry, Veer Chandra Singh Garhwal Uttarakhand University of Horticulture and Forestry, Ranichauri, District- Tehri Garhwal, Uttarakhand with 35 diverse genotypes including three checks (VL-172©, VL-207© and PRJ-1©) of barnyard millet (*Echinochloa frumentacea* (Roxb.) Link). In the studies different observations were recorded on standard germination (%), root length (cm), shoot length (cm), seedling length (cm), seedling fresh weight (g), seedling dry weight (g), vigour Index-I, vigour Index-II, relative growth index (RGI), mean daily germination and rate of germination. Among the genotypes, the mean value of PRJ-1 showed highest standard germination percentage (88.67 %), root length (3.99 cm), shoot length (6.98 cm), seedling length (10.97 cm), seedling fresh weight (0.136 g), seedling dry weight (0.077 g), vigour index-I (972.64) and vigour index-II (6.85) whereas genotype IEC-546 and IEC-566 showed highest rate of germination (0.62). The relative growth index was found highest in genotype IEC-636 (62.33). The genotypes IEC-411, TNAU-149, VL-239, TNAU-155, VL-172 and VL-207 were at par with the genotype PRJ-1 for standard germination percentage. The results of present study are helpful to select better germplasm on the basis of seed quality parameters for improved germination percentage in the hilly regions. The genotype PRJ-1 and IEC-546 can be further utilized in hybridization and crop improvement programme.

Keywords: Barnyard millet, *Echinochloa frumentacea*, genotypes, growth index, germination, seed quality

EFFECT OF RHIZOBIUM INOCULATION, PHOSPHORUS AND MOLYBDENUM IN YIELD, YIELD ATTRIBUTES AND NODULATION OF COWPEA UNDER MULCHED AND UN-MULCHED FIELD CONDITION IN CHITWAN DISTRICT

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Cowpea is an important source of nutrition being popular in Nepal. In order to study its effect on nodulation, yield and yield attributes, a research was conducted in the sandy loam soil of the horticulture farm of Agriculture and Forestry University in 2018. The experiment was laid out in factorial 2×5 RCBD which consists of mulched and un-mulched condition as 1st factor and rhizobium inoculation(R) at 1gm/ 16.66 gm seed, phosphorus(P) at recommended dose of 120kg/hac, use of R plus P(RP), RP plus Molybdenum(RPMo) at 2 gm per kg seed and control with no such application as 2nd factor. So altogether there are ten treatments with three replications. Regarding 1st factor, mulched treatment was found significantly superior than un-mulched treatment in case of all yield attributes like canopy, stem diameter and plant height. Yield and no of nodules per plant was found 312.61 gm and 121.63 respectively in mulched treatment which was highly significant (P<0.001) than un-mulched. In case of 2nd factor, plant

height at 60 days after sowing was found significantly superior in all applications than control. Yield and no of nodules per plant was found 312.53 gm ($P<0.01$) and 129.33 ($P<0.05$) respectively in RPMo treatment which was statistically significant and at par with P, RP and R treatment respectively and lowest in control. The rise in number of nodules due to the different treatment applications had the high positive correlation ($P<0.01$) with yield and yield attributes. There was no any significant interaction between the two factors. Use of mulching and RPMo treatment was found the most suitable combination for cowpea in sandy loam soil.

Keywords: *Rhizobium*; Molybdenum; Cowpea; mulched; un-mulched; Phosphorus

IMPACT OF AGRICULTURAL PRICE POLICY ON MAJOR FOOD CROPS IN HARYANA

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The present study aimed to study the Impact of Agricultural Price Policy of major food crops in Haryana i.e. growth, trend, gap between FHP (Farm Harvest Prices) and MSP (Minimum Support Prices), impact of MSP on major food crops in Haryana. The annual data on prices and arrivals of major food crops were collected for the period from 2007-08 to 2017-18. The growth rate in prices and arrivals of major food crops were estimated by using CAGR (Compound Annual Growth Rate). The significance of CAGR was tested by using student 't' test. Linear trend form was used to estimate trends in prices and arrivals. To study the effectiveness of the price policy during the harvest periods, the deviations of FHP from MSP were worked out and divided into positive and negative deviations to examine whether market prices ruled higher or lower than the minimum support prices. The negative deviations reflected ineffectiveness of MSP policy for producers. These deviations were adjusted with MSP in order to examine the degree of their departure from the minimum support price. To study the impact of lagged Minimum Support Prices (MSPs) on the acreage allocation, production and productivity, linear Regression form of equations have been fitted. The results shown the considerable increase in growth rate and trends of food crops prices are positive and significant in food crops in the Haryana markets, whereas arrivals growth and trend found positive and significant in wheat, rice and gram. Bajra, Barley show negative significant growth and trends but in rapeseed mustard negative and non-significant due to decrease in area under these crops and also due to lack of procurement machinery. Gap between FHP and MSP resulted that in mostly cases FHP is higher than MSP because higher demand than supplies does not allow the market prices to fall below MSP. In recent years, market prices ruled higher than MSP. The impact of MSP on Area is higher but there is no impact of MSP on productivity of food crops.

Keywords: Growth rate, Trends, Procurement prices, Agricultural Price Policy, Farm Harvest Prices, Minimum Support Prices

STUDIES ON GENETIC DIVERGENCE IN FORAGE SORGHUM (*SORGHUM BICOLOR* L. MOENCH)

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Thirty genotypes of sorghum were undertaken to examine the genetic divergence. They were tested in randomized block design with three replications during Kharif 2017. D² analysis was carried out using ten characters i.e., days to 50% flowering, plant height, leaf length, leaf breadth, leaf area, stem girth, number of leaves per plant, leaf stem ratio, total soluble solids and green fodder yield having significant difference between genotypes and independency for observations. The thirty genotypes were grouped in six clusters. The number of genotypes in each cluster ranged from 1 to 14. Cluster II was the largest with 14 genotypes followed by cluster I (7), Cluster V (4), Cluster VI (3) and Cluster III and IV (1 each) genotype. The average intra and inter cluster D² values and average intra and inter cluster distance values are presented in. Maximum inter cluster D² value (1019.496) was observed between cluster IV and VI while the minimum average inter cluster D² value (169.065) was showed between cluster IV and V. The maximum intra cluster distance was found in cluster IV (163.164) followed by cluster VI (132.690), cluster II (118.170), cluster I (87.423), cluster III (84.924) and cluster V (54.781). The maximum inter cluster D² value indicated that genotypes of cluster IV and VI are not so closely related whereas the genotypes of cluster IV and V are closely related. It is apparent therefore, the genotypes of various clusters do not differ so significantly with regards to their relative genetic distance as indicated from the low variation of D² values. The cluster mean calculated for ten characters under study have been given. Days to 50% flowering had highest mean for cluster number I (87.111) and lowest mean for cluster number IV (80.593). Plant height exhibited highest mean for cluster number III (321.007) and lowest mean for cluster number V (192.632). Leaf length noted highest mean for cluster number II (69.963) and lowest mean for cluster number VI (66.474). Leaf breadth revealed highest mean for cluster number II (6.528) and lowest mean for cluster III (5.476). Leaf area recorded highest mean for cluster number II (327.463) and lowest mean for cluster number VI (240.623). Stem girth reported highest mean for cluster number II (16.880) and lowest mean for cluster number VI (15.533). Number of leaves per plant had highest mean for cluster number III (11.444) and lowest mean for cluster number I (9.711). Leaf stem ratio revealed highest mean for cluster number VI (0.485) and lowest mean for cluster number II (0.181). Total soluble solids exhibited highest mean for cluster number I (9.533) and lowest mean for cluster number III (8.102). Green fodder yield observed highest mean for cluster number II (601.441) and lowest mean for cluster number

I (545.367). Contributions of various traits under study towards the expression of genetic divergence are presented. It is clear from the table that plant height showed maximum contribution to divergence (40.46) followed by green fodder yield (29.00), leaf stem ratio (24.37) and number of leaves per plant (20.00) and lower contribution was made by leaf length (0.080) towards the divergence.

YIELD STABILITY AND ADAPTABILITY ANALYSIS OF TARTARY BUCKWHEAT ACROSS MOUNTAINOUS ENVIRONMENTS IN NEPAL

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Buckwheat is a traditional, climate-resilient and highly nutritious crop of the high mountains of Nepal, yet, with declining cultivation trend despite its tremendous potential. The farmers have no choice other than relying on landraces of tartary buckwheat as none has been released so far. Yield data of seven promising tartary buckwheat genotypes evaluated using a randomized complete block design with three replicates across four mountainous locations of Nepal viz., Lamjung, Dolakha, Humla and Jumla, were subjected to combined analysis of variance and after detecting GEI the data was graphically analyzed to interpret adaptability and stability using the GGE Biplot software. Combined analysis of variance revealed highly significant differences for environment (5.96%), genotype (62.78%) and genotype x environment (17.59%) for the grain yield. The first two principal components, PC1 and PC2 accounted for 90.5% of the total GGE variation with PC1 and PC2 explaining 61.5% and 29%, respectively. Based on the Biplot analysis of four environments, two mega-environments were suggested. The first mega-environment contained Lamjung and Dolakha with genotype NGRC03727 being the winner while the second mega-environment contained Humla and Jumla with C04684 being the winner. NGRC03836 was the most stable followed by C02087. NGRC03727 and C04557 were closest to the ideal genotype in terms of stability and yield performance, as compared to other test genotypes. Dolakha was the most desirable test environment as compared to rest of the environment while Lamjung had the greatest discriminating ability in genotype evaluation. The analyses facilitated site-specific recommendations as well as general recommendation of the high-yielding and stable buckwheat genotypes to the farming community, and supported the varietal release and registration of the superior genotypes, viz., NGRC03727, C04684 and C04557, in the national agricultural system.

Keywords: Adaptability, buckwheat, GGE Biplot, Nepal, stability, tartary, yield.

MANAGEMENT OF PURPLE BLOTCH IN ONION

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Purple blotch caused by *Alternaria porri* (Ellis) Cifferi is one of the major disease in onion growing areas of Himachal Pradesh. Survey studies conducted in the present investigation revealed that disease occurred in moderate to severe form in different onion growing localities of Solan and Sirmour districts of Himachal Pradesh. Symptoms of the disease were observed on foliar parts of onion. Characteristic target board like symptoms could be easily seen on affected leaves. The test pathogen was isolated in pure culture on PDA and based on cultural and morphological characters it was identified as *Alternaria porri* (Ellis) Cifferi. Pathogenicity tests revealed initial symptoms as small sunken whitish fleck which later on, became oblong with peculiar zonations giving target board like appearance to the lesion. The microscopic examination revealed peculiar obclavate to obpyriform conidia with long beak. *In vitro* evaluation of botanicals and some new molecules of fungicides along with conventional fungicides was conducted to work out the relative efficacies at different concentrations against mycelial growth of *Alternaria porri* causing purple blotch in onion. *In vitro* evaluation studies reflected Cabrio Top (metiram + pyraclostrobin) and Folicur (tebuconazole) as most efficacious fungicides in inhibiting the mycelial growth of *Alternaria porri* while amongst botanicals garlic and NSKE provided significantly high inhibitory response.

Keywords: Purpleblotch, Pathogenicity, Botanicals and Fungicides

NEEM – A BOTANICAL INSECTICIDE WITH DIVERSE MODE OF ACTION

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Neem (*Azadirachta indica* A. Juss), a versatile tree of meliaceae family. Charaka (600 BC), the father of the Indian system of medicine (Ayurveda) described the flowers, fruits, leaves, bark and roots of the *neem* as “Panch amrit”. Azadirachtin, a complex tetranortriterpenoid limonoid from the neem seeds, is the main component responsible for both antifeedant and toxic effects in

insects. Other limonoid and sulphur-containing compound with repellent, antiseptic, contraceptive, antipyretic and antiparasitic properties are found elsewhere in the tree, e.g. leaves, flowers, bark, roots. Feeding behavior depend upon both neural input from the insects chemical senses (taste receptor on tarsi, mouthparts and oral cavity) and central nervous integration of this 'sensory code'. It stimulates specific 'deterrent' cells in chemoreceptors and also blocks the firing of 'sugar' receptor cells, which normally stimulate feeding. Azadirachtin can be shown to cause profound effects on the reproductive process of both male and female insects. For example, in *L. migratoria* azadirachtin inhibits both oogenesis and ovarian ecdysteroid synthesis so preventing oviposition. It also affects the physiology of insect, indirectly via the endocrine system in which neurosecretory system of the brain causes a blockage of the release of morphogenetic peptide hormones and directly on cells and tissues. Azadirachtin is taken up into cells and causes inhibition of both cell division and protein synthesis. Such effects are seen in flaccid paralysis of muscles, midgut cells necrosis and loss of nidi (regenerative cells) of the gut and lack of midgut enzyme production.

Keywords: Neem, insecticide, azadirachtin

COMPUTER APPLICATION IN LANDSCAPING– A REVIEW

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Floriculture has extended its roots deep towards success. Landscape gardening itself is an art requiring skill, manpower and labour. If only the skill could be used without manpower and labour then it looks to be a time saving task for the landscape designers. The concept of Computer aided designing for landscape gardening is comparatively new. The popular machinery required is known as hardware and an instruction to make the machinery operate is termed as software or programmes. The hardware includes input devices, a central processing unit, data storage devices and output devices. Input devices; include a typewriter, keyboard, light pen, track ball, joy stick, mouse and a scanner. Output devices include monitors, printers and plotters. Most common software programme are Word processing (Store letters, reports, memos and other written documents) Graphic visualization (used in green industries mostly by landscape designers and landscape architecture: CAD- Computer aid design, LANDCADD, Video imaging, Greenhouse environmental control) Numerical calculation (It is the capacity of software to accomplish mathematical functions) CAD substitute to the T-square and pencil. Various software packages in the LANDCADD inventory include site planning and landscape design, Irrigation design, plan specifier, quadrangle and construction details. Video imaging computerized techniques that superimposes a landscape concept over a photographic image of the undeveloped landscape. The computerized environmental control cannot act like a human command but can sense and monitor temperature, light, humidity, CO₂ and velocity and direction of wind, soluble salt levels, pH and other growth-related factors. In the coming future computers will surely overcome the limitations persisting in ones mind and prove it to be a useful tools for designing.

Keywords: Landscape, Hardware, Software, CAD, LANDCADD, Video imaging.

ASSESSMENT OF GENETIC DIVERSITY IN GREENGRAM (*VIGNA RADIATA* (L.) Wilczek) THROUGH MORPHOLOGICAL AND MOLECULAR MARKERS

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The present investigation with fifty mung bean varieties/genotypes was included in present study. The trial was laid out in Randomly Complete Block Design and replicated thrice each during *kharif* session 2016 at the CRC at S. V. P. U. Ag& Tech, Meerut (250110) Uttar Pradesh, India. Analysis of variance revealed substantial amount of variability for all the characters. Heritability in broad sense ranged from 34.78-95.59% characters with highest heritability mentioned here viz. number of branches per plant (95.59), biological yield per plant (95.59) founded. Higher magnitude of phenotypic correlations than the corresponding genotypic ones indicating the inherent association the various traits number of branches per plant showed positive and highly significant genotypic correlation with number of pods per plant (0.654**) followed by, biological yield per plant (0.407**). Number of branches per plant showed positive and highly significant genotypic correlation with number of pods per plant (0.758**) and biological yield per plant (0.446**). Path coefficient analyses for 10th character have maximum positive direct effect at phenotypic level it was observed for biological yield per plant (1.0085), number of branches per plant (0.0546) and days to 50% flowering (0.0452). Partitioning indirect effects was done at the phenotypic level it exhibited that biological yield per plant had the maximum indirect positive effect (0.4106). Maximum inter cluster D² value (4.964) was recorded between cluster VII and III. Whereas the minimum average intercluster D² value (2.257) was recorded between clusters V and I. The highest intra cluster divergence was found (2.481) for cluster III and minimum (1.562) for cluster VI. Molecular characterization with 24 SSR and ISSR primer, out of 114 and 235 bands generated by SSR and ISSR primers respectively were polymorphic, thus the primers showed 100 % polymorphism. The primer SSR (UBC-820) and ISSR (VR 212) produced highest number of bands i.e. 28 and 33 respectively. The polymorphic Information content (PIC) for SSR and ISSR varied from 0.0004 to 0.0922 and 0.36 to 0.9856 with an average 0.69 and 0.743, while resolving power (RP) was in the ranged from 0.04 to 1.12 and 0.24 to 1.32 with an average 0.82

and 0.886 respectively. Significant genetic variation was found among all mung bean cultivars with the GS value ranging from 0.1 to 1 and 0.14 to 1 for SSR and ISSR respectively. The (UPGMA) based on the clustering grouped 50 genotypes into two major groups i.e. I and II groups for SSR and ISSR marker.

INTERGRATED NUTRIENT MANAGEMENT: A WAY FORWARD FOR SUSTAINABLE VEGETABLE PRODUCTION

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India is a leading vegetable producing country in the world and it ranks second in term of vegetable production after China. Vegetables are rich source of nutrient, fiber and minerals. India occupies approximately 175.08 million tonne of production with 10.29 million hectare area. In spite of the large production, the productivity of vegetable is much below the potential and per capita requirement of India. The major problem in lower productivity of vegetables is soil health deterioration, weed problem, water scarcity, disease and insect-pest occurrence and multi nutrient deficiency. Among the above said problem, the imbalance in macro and micronutrient due to inappropriate use of chemical fertilizer propose a major threat to the productivity and quality of vegetables and also leads to disturbed soil physical, chemical and biological properties. Only organic mode of fertilization cannot be advised for the sufficient production of vegetables to fulfill the demand of growing population. Integrated nutrient management (INM) emerges as a viable option to answer the problem of nutrient management without disturbing the soil health, which ultimately results in sufficient production on sustainable basis. Integrated nutrient management is judicious and efficient use of chemical fertilizer in conjunction with organic and their application in judicious manner definitely enhance vegetable crop yield, soil health and resource use efficiency, now INM is gaining importance as an effective farm technology worldwide to enhance factor productivity, resource use and conservation. Integration of different organic, inorganic and bio fertilizer in right amount and at right time help to reduce the cost, losses of nutrient due to better availability, improve micronutrient in soil and increase the growth of soil flora and fauna which ultimately results in better nutrient uptake and higher production with good quality.

Keywords: Vegetable, INM, sustainability, soil health

MANAGEMENT OF PURPLE BLOTCH IN ONION

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Keywords: Purpleblotch, Pathogenicity, Botanicals and Fungicides

GROWTH, YIELD ATTRIBUTES, YIELD AND QUALITY OF WHEAT (*TRITICUM AESTIVUM* L.) AS INFLUENCED BY USE OF WATER HAVING VARIABLE SALINITY AND SODICITY

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The response of wheat (*Triticum aestivum* L.) to different salinity and sodicity levels of irrigation water was investigated in a pot experiment at Net House, Junagadh agricultural university, Junagadh during *rabi*-2017. The experimental soil was clayey texture, slightly alkaline in reaction (pH_{2.5} 8.08), without having any problem of salinity (EC_{2.5} 0.48 dS m⁻¹). The experiment comprising of four levels of saline irrigation water (C) with electrical conductivity values of 2.0, 4.0, 6.0 and 8.0 dS m⁻¹ and four levels of sodic irrigation water (S) with SAR values of 5.0, 10.0, 15.0 and 20.0 were in 16 different treatment combinations in completely randomized design (Factorial) replicated three times used for irrigating

wheat. The interaction effect of salinity and sodicity ($C \times S$) levels of irrigation water used in the study on growth, yield attributing characters, yield and quality parameters was not significantly different. However, there was decrement in the growth, yield and quality of the wheat crop with increase in salinity and sodicity in irrigation water. The highest growth, yield and quality was obtained with ($C_1 \times S_1$) and the lowest growth, yield and quality was obtained with ($C_4 \times S_4$). Thus, the results obtained provide a promising option for the use of saline and sodic irrigation water can be used for irrigation of wheat crop without undue yield reduction since the buffering capacity of the soil exerted in the first year of the crop growth reduced the harmful effects of salinity and sodicity which is present in the irrigation water.

Key words: Wheat, salinity levels, sodicity levels, growth, yield attributes, yield, quality.

EFFECT OF SEED PRIMING ON YIELD AND QUALITY ENHANCEMENT OF RAPESEED-MUSTARD

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Seed priming is an effective technology to enhance rapid and uniform emergence and to achieve high vigour leading to better stand establishment and yield. Strategies for improving the growth and development of Rapeseed-mustard have been investigated for many years. Rapid germination and emergence are essential for successful crop establishment for which seed priming could play an important role. Crop production and quality of the produce gets affected by drought, initial establishment and low availability of macro and micro nutrients. Although soil and foliar replications are the most prevalent methods, seed treatment through seed priming has been found to improve crop establishment for increasing seed yield and seed quality. The field experiment was conducted at AB, Block Farm Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, W.B. during winter (Rabi) Season 2017-2018. Six varieties viz Anushka, Sanchita, TBM-143, TBM-204, Kranti, Pusa Bold and three seed priming chemicals viz KH_2PO_4 , KNO_3 , PEG6000 along with hydro priming and control (dry seed) revealed that PEG6000 produce maximum seed yield among the treatments ($1613.12 \text{ kg ha}^{-1}$) and Pusa Bold produced maximum seed yield ($1687.2 \text{ kg ha}^{-1}$) among the varieties. In quality enhancement TBM-143 has the maximum vigour index (2288.1) among the varieties and among the treatments KNO_3 has the maximum vigour index (1862).

Key words: Rapeseed-mustard, Seed Priming.

STUDIES ON BIOTIC AND ABIOTIC STRESSES RESPONSES IN CROP PLANT

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The Agriculture productivity is extreme affected by weather phenomena, and the plant breeders have to continuously improve the germplasm that has to be tolerant to various biotic and abiotic stresses. Molecular biologist trying hard to understand the changes in plant due to these stresses further providing the necessary knowledge to plant breeders. Crop responses against the stress are complex and involve a number of physiological, molecular and cellular changes. Recent evidence demos that a combination of biotic and abiotic stress can have a positive response on plant performance by reducing the susceptibility to biotic stress. This interaction between abiotic and biotic stress is orchestrated by different signalling pathways like hormone signalling, that may induce and antagonize one another, in particular. Specificity in multiple stress responses is further controlled by the range of molecular mechanisms that act together in a complex regulatory network. Identifying master regulators that connect both biotic and abiotic stress response pathways is fundamental in providing opportunities for developing broad-spectrum biotic and abiotic stress tolerance in crop plants.

Keywords: Abiotic stresses, biotic stresses, molecular mechanism.

KNOWLEDGE AND ADOPTION OF AGRICULTURAL TECHNOLOGY INFORMATION CENTRE (ATIC) SERVICES BY FARMERS

ROHIT KUMAR

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The ATIC is a “single window” support system linking the various units of a research institution with intermediary users and end users (farmers) in decision making and problem solving exercise. The rationale behind establishment of ATIC are: To provide diagnostic services for soil and water testing, plant and livestock health. To supply research products such as seeds and other planting materials, poultry strains, livestock breeds, fish seed, processed products etc, emerging from the institution for testing and adaptation by various clientele. A research is conducted in eight different villages. From each village, 15 farmers are selected randomly and make a total sample size of 120 for study. There are two types of variables i.e. Independent variables and Dependent variables. Independent variables are Age, Education, Family size, Occupation, Land holding, Annual Income, Cropping system, Innovativeness, Motivation, Socio-economic status and Information sources. Dependent variables are Knowledge level, Extent of Utilization, Constraints. The data collected is tabulated and analyzed by applying appropriate statistical tools like

percentage, frequency, mean score, rank order, etc., keeping in view the objectives of the study and to draw the meaningful inferences.

BIODIVERSITY CONSERVATION AND SUSTAINABLE ECO-TOURISM

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Biodiversity Conservation emerges more important due to the globalize process of the world economy and also for survival of the world as a balance habitat. Biodiversity of an ecosystem is a vital issue of an economy. Soil, water, climatic condition, forest cover and biodiversity are crucial in determining the renewable resource flow of an economy. Sustainable development stresses on economic development alone with the object of conservation of environment. India is one of the twelve mega diversity country in the world. The country possesses about 8 percent of global biodiversity occupying the 10th position in terms of plant species, out of the 25 hot spots of biodiversity in the world. North- Eastern region is one of the hottest hot spots ranking 6th position among the 25 biodiversity hot spots. Ecotourism stresses on significance of conservation and welfare activities along with recreation. Many tourists assume that merely travelling to natural areas is eco-tourism. But the true meaning of ecotourism is uniting conservation, communities and sustainable travel. Ecotourism is a form of tourism involving visiting fragile, pristine and relatively undisturbed natural areas, intended as a low impact and often small scale alternative to standard commercial tourism. Its purpose may be to generate funds for conservation of environment, to provide environmental education to the traveler to enable economic empowerment of the local dependent communities and to foster respect for various cultures. As the name suggests ecotourism is conscientious travel to natural areas which conserves the environment and improves the well-being of the local people. This therefore means that ecotourism is primarily about bringing together environmental conservation, communities and sustainable travel. It also helps in increasing employment and entrepreneurship at a local level. Income and expenditure of local people increase because of ecotourism. Participation in ecotourism, the education level, an increase in productive human capital and an increase in income enhance people's livelihoods. Ecotourism is also regarded as a sub-component of sustainable tourism which is also one of the fastest growing segments of the tourism industry.

Keywords: Biodiversity, conservation, natural resources, development, ecotourism.

INFLUENCE OF SOIL APPLICATION OF ZINC SULPHATE AND FERROUS SULPHATE ON GUAVA (PSIDIUM GUAJAVA L.) CV. HISAR SAFEDA UNDER HIGH DENSITY PLANTING

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The present research was accomplished on Psidium guajava L. cv. Hisar Safeda to investigate the effect of zinc and iron on yield attributing parameters under high density planting. Forty eight uniform plants were selected randomly for the purpose of recording data and treated with ZnSO₄ (zero, 30, 60 and 90 g/plant) and FeSO₄, (zero, 10, 20 and 30 g/plant) during mid of February and August in 2016-17. Number of fruits, fruit size (during both seasons), fruit weight and volume (during winter season) had maximum values with application of 90 g zinc sulphate per plant which was closely followed by 60 g zinc sulphate for fruit number and size. While, maximum fruit weight and volume in rainy season noted with application of 60 g zinc sulphate which was at par with 90 g zinc sulphate. Maximum number of fruits and fruit breadth in rainy season, fruit weight and volume in winter season and fruit length in both seasons were obtained with 20 g ferrous sulphate which was at par with 30 g ferrous sulphate except for fruit length in winter season. Whereas maximum number of fruits and fruit breadth in winter season, fruit weight and volume in rainy season were obtained with the application of 30 g ferrous sulphate which was closely followed by 20 g ferrous sulphate.

CONSTRAINTS BEING PERCEIVED DURING UTILIZATION OF INFORMATION AND COMMUNICATION TECHNOLOGIES (ICTS) BY KVKs SCIENTISTS IN MADHYA PRADESH AND CHHATTISGARH

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KVKs is an innovative institution providing for effective linkage among researchers, farmers and extension workers, practical approach to training through "Learning by doing" and flexible syllabi based on a survey and needs of farmers and location specific requirements. Information and Communication Technologies (ICTs) provides information about any event-taking place anywhere in the world, at any time, available to any person anywhere in the world at any time. ICTs can be used to increase effectiveness and efficiency of extension system. So, in this era of information revolution, the KVKs Scientists should be encouraged to use

ICTs for different extension activities and field works. But constraints are elements, factors, or subsystems that restricts an individual or an entity, from achieving its potential (or higher level of output) with reference to its goal. So, it has become imperative to identify and prioritize the factors or reasons that hinder utilization of ICTs. Hence an attempt was made through a research study was undertaken for 304 scientists working in different KVKs in Madhya Pradesh and Chhattisgarh, to find out the problems and constraints being faced by KVKs Scientists during utilization of ICTs as perceived by them. The findings of the study indicate that among economic constraints 'less financial support from the government, among technical constraints Slow and poor server connectivity and among operational constraints Lack of ICTs- oriented training were perceived as serious constraints in the utilization pattern of ICTs by KVKs scientists.

Keywords: Constraints, Information and Communication Technologies (ICTs), Krishi Vigyan Kendras (KVKs), Learning by doing.

INFLUENCE OF FOLIAR SPRAY OF MICRONUTRIENTS ON SEED YIELD AND QUALITY IN CHILLIES (*CAPSICUM ANNUUM* L.)

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A field experiment was conducted at Vegetable Experimental Farm, Division of Vegetable Science, SKUAST-K, Shalimar to study Influence of foliar spray of micronutrients to enhance seed yield and quality in chillies (*Capsicum annum* L.) for three consecutive years 2016, 2017, 2018 kharief.. N, P, and K were applied as per recommended package of practice (120:80:60 kg/ha). Experiment was laid out in RBD with three replication and spacing of 60 x 50 cm was maintained. The experiment was based on eight different treatments. T1: control, T2: Spraying FeSo₄@0.2%, T3: Spraying Calcium Nitrate@0.2%, T4: Spraying Boron@0.2%, T5: Mixture of All, T6: T5 without FeSo₄, T7: T5 without Calcium Nitrate, T8: T5 without Boron. Data was recorded on Plant height (cm), number of fruits/plant, dry fruit weight, fruit length (cm), fruit width (cm), 100 seed weight, Seed yield/plant (g) and seed yield (q/ha). The results showed significant differences among various treatments. Maximum plant height (63.33) was observed in T5. Maximum no of fruit per plants (52.45) were also observed in T5. Highest dry fruit weight (7.93g/100g) was observed in T5. Maximum 100 seed weight (0.83) was observed in T5. highest seed yield per plant (19.55 g) and seed yield q/ha (6.51 q/ha) was observed in T5. Economics of various treatments was also worked out and B:C ratio was calculated. It was found that T5: Mixture of All micronutrients remunerative in terms of B: C Ratio giving a B: C ratio of 6.51. Thus treatment T5 appears to be a viable tool to increase seed yield in chilli under temperate conditions.

Keywords: Chilli, seed, temperate conditions. Dry fruit weight

ANALYSIS OF GENETIC DIVERSITY OF INDIAN MELON (*CUCUMIS MELO* L.) LAND RACES AND ITS COMPARISON WITH GLOBAL REFERENCE MELON POPULATIONS USING SSR MARKERS

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The investigation entitled, "Analysis of genetic diversity of Indian melon (*Cucumis melo* L.) land races and its comparison with global reference melon populations" was conducted at Department of Vegetable Science and School of Agricultural Biotechnology, Punjab Agricultural University Ludhiana. Eighty-eight melon accessions collected from Uttarakhand and Uttar Pradesh states of India representing four agroecological regions (six sub-regions) and eight reference accessions from USA were characterized and evaluated for nineteen morphological traits of plant and fruit, biochemical traits. Significant differences were noted among all the accessions for all the characters observed. D2 analysis grouped the accessions into ten clusters. The reference accessions obtained from USA and land races collected from different agro-ecological zones of India were found to be scattered in different clusters. No parallelism was found between genetic and geographic diversity. DNA polymorphism was utilized to cluster the genotypes into different clusters based on similarity as well as dissimilarity coefficients. On basis of SSR analysis, dendrogram clustered 96 accessions into three major groups. There was a significant correlation between botanical groups and the clustering pattern. Accessions belonging to cantalupensis cluster together in cluster I, accessions of reticulatus group cluster together in cluster II and momordica group cluster together in cluster III. However, some accessions of cantalupensis and reticulatus were intermixed in cluster I and II. Reference accessions cluster together forming a genetically unique assemblage in subgroup IIA and shared similarity coefficient of 0.65 with sub-group IIB. This suggested that reference accessions shared genetic affinities with Indian melon accessions that could not have been predicted based on their geographic origin.

Keywords: genetic advance, heritability, melon, SSR

INFLUENCE OF MICRONUTRIENT APPLICATION ON YIELD, QUALITY AND STORAGE LIFE OF BOLTING GARLIC (*ALLIUM SATIVUM* L.) LONG DAY TEMPERATE CLIMATE OF INDIAN HIMALAYAS

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There is no formal recommendation for micronutrient dosage to garlic fields in Kashmir valley, which grows mostly the bolting type garlic. The technologically less aware and resource poor farmers of the region are mostly oblivious to micronutrient fertilizers and their importance for the crop. However, significantly positive effects of micronutrients like zinc and boron on garlic yield productivity and storage life are well documented. Hence, a first of its kind study on the effect of zinc and boron on bolting garlic production and post harvest life and quality on garlic selection under the influence of long day temperate agro-ecological climate of Kashmir valley was conducted to determine their dosage for garlic fields of the region. The foliar application of 0.25% borax 30 and 45 days after transplanting resulted in highest marketable yield and dry matter content (Kg/ha) compared to control. Whereas, 0.5% micronutrient mixture comprising 2.5% Fe, 0.5 % B, 3.0% Zn, 1.0% Cu and 1.0% Mn applied 30 and 45 days after transplanting gave highest total soluble solids (%) and least storage losses (% weight loss). However, the economics of cultivation permit the application of 0.25% borax 30 and 45 days after transplanting for remunerative gains.

Keywords: Bolting garlic, temperate long days, zinc, boron, marketable bulb yield, pyruvic acid, total soluble solids, storage life

SOIL NUTRIENT DYNAMICS: A 20-YEAR ASSESSMENT FROM *ACACIA MANGIUM* STAND

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Silvicultural operations like thinning and pruning influences soil properties. With the rapid increase in a plantation area in tropics, this study can give insights for sustainable management. The organic matter input from pruning and thinning helps to maintain or increase the soil nutrients. This has been demonstrated by several studies. Nonetheless, there is limited knowledge about the long-term effect of soil chemical properties changes when plantations subjected to thinning in tropical ecosystems, especially India. This study addresses the above gap and simultaneously quantifying the changes in the soil property under an exotic species, *Acacia mangium*. The present study was undertaken to investigate the effect of thinning in an *Acacia mangium* stand that was subjected to variable levels of thinning such as heavy thinning (retaining 533 trees ha⁻¹), moderate thinning (retaining 800 trees ha⁻¹), light thinning (retaining 1066 trees ha⁻¹) and control (retaining 1600 trees ha⁻¹). Triplicate soil samples collected from 18 soil profile pits at different soil depths (five depths viz. 0-20, 20-40, 40-60, 60-80 and 80-100 cm) were used for estimating the pH, Bulk Density, Soil Carbon, total N, available P, exchangeable K and organic carbon, including samples from treeless control plot. All the thinning regimes registered significantly higher total nitrogen and soil carbon stock compared to contiguous treeless control plot. However, after long-term, the effects of thinning had no influence on soil bulk density, pH, available phosphorus and exchangeable potassium. Additionally, the study revealed the *Acacia mangium* does not cause any impairment to the soil due to allelopathic nature. The results of the study can also provide some lead in understanding the impact of exotic species like *Acacia mangium* on soil properties. This can facilitate in management strategy to achieve both ecological and economic benefit.

Keywords: thinning; long term effect; soil nutrient dynamics; productivity; soil carbon content

INNOVATIVE APPROACHES IN POST HARVEST MANAGEMENT AND VALUE ADDITION IN LITCHI

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Litchi fruit are prized on the world market for their flavour, semi-translucent white aril and attractive red skin. Litchi is now grown commercially in many countries and production in India, Australia, China, Israel, South Africa and Thailand has expanded markedly in recent years. Increased production has made significant contributions to economic development in these countries, especially those in South-East Asia. India accounts for 20 percent of world's quality litchi production. But major limitation like pericarp browning and post harvest decay leading huge post harvest losses. These qualitative and quantitative losses not only reduce the availability of fruits but also the economic return to growers. On the other hand, the demand for quality and healthy litchi fruits is one of the fastest growing segments of the market and food industry. Therefore, the development of innovative approaches to post harvest management and value addition in litchi are of great necessity to reduce losses and to meet consumer demands for good quality litchi fruits along with diversified products. Post harvest application of various treatments like cooling and heating the fruit, use of various packages and packaging materials and the application of fungicides and other chemicals have been found to reduce the pericarp browning but not for desirable period of export and distant market. Sulfur dioxide fumigation effectively reduces pericarp browning, but approval from Europe, Australia and Japan for this chemical is likely to be withdrawn due to concerns over sulfur residues in fumigated fruit. Thus, sulfur-free postharvest treatments that maintain fruit skin colour are increasingly important. The ICAR-NRCL has developed and standardized post harvest techniques to minimize these losses. Post

harvest application of various treatments like early harvesting, sorting and grading, sequential dip treatments with chemicals, pre-cooling, use of various packages and packaging materials and storing at low temperature have been found to reduce the pericarp browning and extending the shelf life of litchi fruit. Besides above, Litchi fruit is negligibly exploited at post harvest level for processing particularly in India. These situations normally encourage to develop various litchi products. As litchi fruits having excellent flavour and nutritive value can be exploited in processing and value addition which will make it more remunerative, availability throughout the year and minimize the post harvest wastage. In this area ICAR-NRC on Litchi had developed some promising technologies to produce litchi nut, dehydrated litchi pulp, various beverages products and litchi wine. These innovative approaches will certainly lead to the better return to the growers, traders and processors.

Keywords: Litchi, post harvest, Processing, value addition

STUDIES ON INTEGRATED NUTRIENT MANAGEMENT WITH BIOFERTILIZER ON GROWTH AND YIELD OF BETELVINE UNDER GANGETIC ALLUVIAL ZONE OF WEST BENGAL

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The present experiment was carried out in two consecutive years of 2012-13 and 2013-14 at experimental site of AICRP on MAP and Betelvine, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal. The design of the experiment was RBD with 9 treatments comprising of different combinations of organic (*Azotobacter*, *Phosphobacter* and mustard oil cake) and inorganic (urea and SSP) sources of nutrients. Maximum vine elongation, basal girth, leaf size, leaf yield and other yield attributing characters was found significantly better in the treatment with *Azotobacter* @ 10 Kg + 140 kg N (MOC) + *Phosphobacter* @ 5 Kg + 50 Kg P+100 Kg K ha⁻¹year⁻¹. Though the treatment was statistically at par with *Azotobacter* @ 5 Kg + 170 Kg N (MOC) + *Phosphobacter* @ 5 Kg + 50 Kg P + 100 Kg K ha⁻¹year⁻¹ in respect of dry matter production. It was concluded from the study that the treatment with *Azotobacter* @ 10 kg + 140 kg N (MOC) + *Phosphobacter* @ 5 Kg + 50 Kg P+100 Kg K ha⁻¹year⁻¹ can be used as an approach in integrated nutrient management practice in betelvine cultivation under this region of West Bengal.

Keywords: *Azotobacter*; Betelvine; Biofertilizer; *Phosphobacter*

EFFECTS OF DIFFERENT FERTILIZERS ON GROWTH, YIELD AND ROOT KNOT NEMATODE MELOIDOGYNE SPP. IN OKRA ABELMOSCHUS ESCULENTUS UNDER FIELD CONDITION IN SUMMER SEASON IN CHITWAN, NEPAL

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An experiment was carried out at Agriculture and Forestry University, horticulture farm to determine the effects of different fertilizers on root knot nematode and yield on Okra (var. ArkaAnamika) at summer season in inner terai region of Chitwan, Nepal. The treatment was carried out in completely randomized block design (RCBD) with 7 treatments replicated 3 times. The treatment includes: goat manure, sesame seed cake, mustard seed cake, poultry manure, furacron, vermicompost plus untreated control including only chemical fertilizer (NPK). All treatments were added to provide the sufficient amount of Nitrogen required for the crop as recommended by Nepal Agriculture Research Council. Required amount of required Phosphorous and potassium was supplied by adding Single Super Phosphate and Muriate of potash respectively. The germination percentage was found significantly superior in Furacron (93.33%) and followed by goat manure (92.67%), vermicompost (86.67%), sesame seed cake (82.67%), mustard oilcake (81.67%), control i.e. NPK (76.67%) and poultry manure (61%). Similarly, In terms of number of galls, furacron (3.43) was found the most effective followed by goat manure (5.60), Poultry Manure (6.63), Mustard Seed Cake (8.47), Sesame seed cake (9.07), vermicompost (16.60) and control (21.96). In terms of yield, poultry manure (20mt/ha) was found superior followed by vermicompost (17.38mt/ha), goat manure (16.72 mt/ha), sesame seed cake (16.62mt/ha), furacron (14.61 mt/ha), mustard oilcake (12.97 mt/ha) and control (10.51mt/ha). The highest net profit was found in case of Poultry manure while the lowest incremental cost benefit ratio was obtained in Furacron and followed by Goat Manure, Poultry manure, Vermicompost, Sesame seed cake and Mustard seed cake. The highest yield and nematode control was obtained in Poultry manure which is at par with Furacron treatment. This experiment suggests the use of Furacron or poultry manure will provide more economic return and also decreases the root knot nematode in okra.

Keywords: manures, galls, nematode, okra, Furacron

EFFECT OF IRRIGATION LEVELS AND STRAW MULCH ON CROP ESTABLISHMENT, WEEDS AND FODDER YIELD OF BAJRA NAPIER HYBRID UNDER HOT DRY REGION OF INDIA

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Results showed that Green fodder yield (GFY) and dry matter yield (DMY) increased gradually with increasing irrigations from 0.8 IW/CPE to 1.2 IW/CPE. Though, the maximum GFY and DMY were recorded under 1.2 IW/CPE ratio (1016.3 q/ha & 113.8 q/ha), being at par to irrigation at 1.0 IW/CPE ratio which were significantly superior over 0.8 irrigation at IW/CPE ratio. Application of straw mulch improved GFY and DMY in comparison to no mulch treatment in BN hybrid. The highest GFY (991.1 q/ha) was recorded under straw mulch @ 10t/ha which proved at par to 7.5 and 5.0 t/ha was significantly higher by 12.28% over no mulch treatment. Further, growth characters viz, plant height and L:S ratio increased significantly with increasing irrigation frequency from 0.8 to 1.2 IW/CPE. The maximum plant height and L:S ratio were noted with irrigation at 1.2 IW/CPE ratio being at par in L:S ratio at 1.0 IW/CPE and which was significantly superior over both irrigation treatments 0.8 and 1.0 IW/CPE ratio. Weed population and weed dry weight increased significantly with increasing irrigation level from 0.8 to 1.2 IW/CPE while weed control efficiency showed reverse trend. The highest WCE was noted at 0.8 IW/CPE (50.1%) and the minimum value (47.0%) recorded at 1.2 IW/CPE ratios. Further, data reveal that application of straw mulch improved growth characters viz, plant height, L:S ratio, significantly by increasing dose of straw mulch compared to without mulch. However, weeds count, weed dry weight/m² were recorded the highest value in without mulch control treatment (74.1 and 10.8). Application of varying dose of straw mulch (5, 7.5 & 10 t/ha) when compared with no mulch (control) significantly reduced weed population by 29.3, 62.8 & 77.0 per cent and weed dry weight by 31.0, 74.1 and 86.0 per cent, respectively. The varying irrigation levels and straw mulch treatments not influenced significantly the population count recorded per hectare of BN hybrid during establishment stage and study duration also.

Keywords: Bajra Napier hybrid, growth characters, green fodder yield, dry matter yield, irrigation levels, straw mulch, weeds

PROCESSING AND VALUE ADDED PRODUCTS OF PLANTATION CROPS IN KONKAN REGION

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India is one of the largest producers of the plantation crops in the world because India is blessed with a rich and diverse agro climatic profile. Plantation crops are those crops which can be consumed only after processing. Accordingly the processed products of plantation crops has a great export demand with high foreign exchange capacity. Plantation crops also have health benefits e.g. cashew fruit have medicinal properties which are used for curing scurvy and diarrhea, and it is effective in preventing cholera. In coconut the lauric acid, a medium chain fatty acid component in virgin coconut oil showed potential use as anti-obesity treatment. Value added products refers to increasing the economic value of a commodity through particular production processes. Plantation crops like cashew is cultivated primarily aiming cashew nut production. The large amounts of cashew apples are considered as agricultural waste and the by-product of cashew nut production. Cashew apple (*Anacardium occidentale* L.) has multi-purpose; it can be processed to obtain human food. It is useful as raw material for many industrial applications. However, high perishability, astringency and short shelf life prevent the effective utilization of cashew apples. Konkan region is major producer of plantation crops like coconut, cashew nut, arecanut etc. and high amount of by-products are generated by these crops. These by-products can be efficiently used to produce good quality food products which helps in employment generation and strengthening rural economy.

OFF-SEASON VEGETABLE CULTIVATION UNDER PROTECTED STRUCTURES: A PROMISING TECHNOLOGY FOR DOUBLING FARMERS INCOME

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The demand for fresh vegetable prevails round the year but supply is restricted to cultivation season. The performance of the different vegetable crops is highly influenced by changes in climatic vagaries like fluctuation in temperature, light, humidity, wind velocity etc. that adversely affect the growth, physiological process, flowering, fruit setting and finally yield and economic return. The unpleasant climate drastically reduced the total production or even result in total crop failure. To increase the availability of the fresh vegetables beyond normal season, promotion of off-season cultivation is the need of the hour. Summer crop of winter season vegetables under open field condition is not possible as scorching sun and higher day and night temperature adversely affects the vegetative growth, prompted flower and fruit drop. Again cultivation of summer crop during winter months in open field suffers from low temperature, cold waves and freezing injury. By adopting proper protection technologies and providing favourable environment, the crops can be raised during off season. With the introduction of shade net which partially control the

temperature and light and creates a favourable environment for crop growth that enables raise the crop under intense summer months with desirable yield and quality. Again poly house maintained higher temperature and light intensity compared to outside during winter months which favours the growth and yield of summer season vegetables. The full paper discussed the different aspects of off-season vegetable cultivation to make the production system economically viable and remunerative.

Keywords: Off-season vegetable cultivation, agro shade net, poly house, temperature and light.

ESTIMATION OF GROWTH RATE, INSTABILITY, DECOMPOSITION OF OUTPUT COMPONENTS AND STATUS OF REQUIREMENT AND DEFICIT OF PULSES IN ARUNACHAL PRADESH

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The present study investigates the districtwise trends, growth and instability, decomposition of growth component and status of requirement and deficit of pulses of area, production and productivity of Arunachal Pradesh. The study is based on secondary data of pulses production, area and yield for the period of 2005-06 to 2014-15 using the compounded annual growth rate, Cuddy Della Vally Index, Decomposition analysis and value of pulses requirement @ 18.25 kg per head per annum (as per FAO recommendation). Analysis of annual compound growth rate indicates that, out of 16 district of Arunachal Pradesh, 9 district was found to have positive growth rate in area and the highest significant growth was observed in Dibang Valley (4.94%) followed by Tirap (4.1%) and Anjaw District (2.2%). In case of production, the highest growth rate was also observed in Dibang Valley (6.28%) followed by Anjaw (5.6%) and West Kameng (4%) while East Siang (5.72%) has the highest growth rate followed by Anjaw (3.33%) and West Kameng (2.1%) in yield. It was also found from the analysis of instability that among the entire district of the state, the lowest order of instability in the area, production and productivity of pulses was observed in East Kameng (3.9%). The decomposition analysis of growth reveals that out of 16 district of the state, the area effect of 12 districts was found to be the major contributor towards change in total production of pulses. Again the analysis of districtwise requirement and deficit of pulses as per the population suggest that out of 16 districts, only the Dibang Valley was found to have surplus production in pulses (72.52%) while the district Kurungkumey has the highest percentages of deficit (94.40%) followed by Changlang (92.06%) and Lohit (90.53 %).

Keywords: Arunachal Pradesh, L. Cardamom

A STUDY OF FISH MARKETING AND SUPPLY CHAIN ANALYSIS IN BHARATPUR METROPOLITAN CITY, CHITWAN, NEPAL

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This research survey was conducted to assess the fish market situation, investigate the supply chain, to know the constraints of marketing, marketing margins, producer's share, consumer purchasing behavior and status of fish farming in Chitwan district during Sep-Dec 2018. In a household survey, 50 fish traders (producers, wholesalers and retailers) along with 50 consumers were interviewed with pre-tested semi-structured questionnaire for collection of primary data within the Bharatpur Metropolitan city: Prime Minister Agriculture Modernization Project (PMAMP) Fish zone implementation sites (Shankarchok, Parbatipur, Jagatpur, Gunjanagar, Shardanagar and Bhuwanwasti). Data obtained from semi-structured questionnaire was subjected to descriptive analysis. Literate respondents involved in fish trading were (90%). The fish trading was dominated by male (82%). The age category that involved in fish trading was above 35 years of age. The market demand of fish in Chitwan was produced within district itself providing (74.27%) of total demand, remaining (25.72%) of the fish demand was imported from various parts of India: West Bengal, Rajasthan, Bihar. The market share was dominated by carp species (Bighead, Silver, Common and Grass) contributing (38.09%) of the total market share. The Rohu had highest market margin (Rs 72/kg) as compared to other species of fish sold in the market. Indian fish products were packed in thermo cool box and minutely crushed ice cubes and were transported by trucks. Nepalese fish products were packed in plastic crates and transported by pickup van. Indian average fish size was (1.98Kg) whereas Nepalese average fish size was (1.08 Kg). Producer supplied (51.32%) of the fish product to the wholesaler, (21.01%) to the retailer and remaining (27.67%) of the produce directly to the consumers. Wholesaler supplied (74.45%) quantity of fish to the retailers and remaining (25.55%) directly to the consumer. Retailers were dominated by Indian vendors. The consumers were particularly influenced by price, quality, size and freshness of fish. They were aware and conscious about the use of formalin and chemical poisoning of fish commodities.

Keywords: Supply chain, post-harvest, marketing, consumer's preferences, constraints

RECENT ADVANCES IN CLIMATE RESILIENT RICE WITH SPECIAL EMPHASIS ON SUBMERGENCE TOLERANCE**S. BALAKRISHNA*AND SHANTANU DAS****Department of Genetics and Plant Breeding, Nani agricultural institute, Sam Higginbottom university of agricultural, Technology & Sciences, paryagraj**

Rice plants are much damaged by several days of submergence and become serious problem for rice farmers mainly in the South & Southeast Asian countries. In India submergence is a serious problem particularly in low land area of Eastern India where average productivity is only 0.5-0.8 t ha⁻¹. Considering all the factors submergence is considered as the third most important constraint for higher productivity in Eastern India. Rice handles submergence stress by internal aeration and growth control. A quiescence strategy based on Submergence-1A (Sub1A) or an escape strategy based on SNORKEL1 (sk1) and SNORKEL2 (sk2) is used for the growth control. Aerenchyma formation, CHO, elongation, hormone and alcoholic fermentation etc are important physiological components of submergence tolerance. Apart from genetic basis, submergence tolerance is a quantitative traits and the major QTL related to submergence tolerance is Sub1 contributing 70% of the phenotypic variation in tolerance. Through marker assisted backcrossing, an effective approach for incorporation of gene several submergence tolerant cultivars have been developed and released in different counties. The issue of climate change compels breeders to combine multiple abiotic tolerance traits into a single genotype for adaptation to submergence and stagnant flooding, submergence and anaerobic germination, submergence and drought, submergence and salinity or a combination of these stresses which co-exist in one cropping season. With knowledge of the genetic mechanisms and newer sources of tolerance, rice scientists can explore radical approaches to design the next generation of rice varieties that are climate-change-resilient and acceptable to the farmers.

ECO-FRIENDLY MANAGEMENT OF ROOT ROT DISEASE OF MOTHBEAN (*RHIZOCTONIA SOLANI*) THROUGH BIO-AGENTS**S. L. GODARA*, SURESH KUMAR¹ AND NARENDRA SINGH²*****Director Research, S. K. Rajasthan Agricultural University, Bikaner -334006, Rajasthan.****¹Asstt. Prof., ARS Navgaon, S. K. N. Agricultural University, Jobner, Jaipur, Rajasthan.****²Assoc. Prof. AINP on Arid Legumes, A.R.S., S. K. Rajasthan Agricultural University, Bikaner -334006, Raj., India**

Management of soil-borne pathogens is a significant challenge in modern agriculture. There has been a large upsurge in interest in biological disease control recently, reflecting increasing environmental concern over indiscriminate use of pesticides. The present experiment was conducted during Kharif seasons of 2014 to 2016 to find out effective management of root rot disease (*Rhizoctonia solani*) of mothbean (cv. RMO-225) with six different combination of bio- agents viz, *Trichoderma harzianum* seed treatment, *T. harzianum* seed treatment + soil application of *T. harzianum*, *T. harzianum* + *Pseudomonas fluorescens* seed treatment, *T. harzianum* + *P. fluorescens* seed treatment + soil application of *T. harzianum* + *P. fluorescens*, *P. fluorescens* seed treatment and *P. fluorescens* seed treatment + soil application of *P. fluorescens*. All the treatments were found effective in controlling the root rot disease. Seed treatment followed by soil application of the bio-control agents significantly reduced plant mortality caused by the root pathogens and increased grain yield compared to untreated control. The minimum root rot disease incidence 21.78% was recorded in the treatment combination *T. harzianum* + *P. fluorescens* seed treatment (4+4 gm/kg seed) + soil application of *T. harzianum* + *P. fluorescens* (1.25 +1.25 kg in 50kg FYM for each/ha) followed by *T. harzianum* seed treatment 8 gm/kg seed + soil application of *T. harzianum* 2.5 kg in 100 kg FYM/ha (25.56 %). The highest grain yield 10.56 q/ha was recorded in the same seed treatment with combination *T. harzianum* + *P. fluorescens* seed treatment (4+4 gm/kg seed) + soil application of *T. harzianum* + *P. fluorescens* (1.25 +1.25 kg in 50 kg FYM for each/ha) followed by *T. harzianum* seed treatment 8 gm/kg seed + soil application of *T. harzianum* 2.5 kg in 100 kg FYM/ha (9.42 q/ha). These treatments can provide an effective, economical and eco friendly management of root rot of mothbean.

Keywords: Mothbean, root rot, *Rhizoctonia solani*, bio-agents, seed treatment, soil application, management**STATISTICAL MODELLING AND FORECASTING OF AREA UNDER BLACK GRAM IN ODISHA USING ARIMA MODEL****SUBRAT KUMAR MAHAPATRA¹, JAYASHANKAR PRADHAN¹, ABHIRAM DASH² AND ANUPAMA BALIARSINGH¹****¹College of Agriculture, Odisha University of Agriculture & Technology, OUAT, Bhubaneswar, Odisha****²College of Agriculture, Chiplima, Sambalpur, Odisha**

A study was conducted on statistical modelling and forecasting of time-series data of area under black gram in Odisha. Box-Jenkins Autoregressive integrated moving average (ARIMA) time-series methodology was considered for modelling and forecasting of area under black gram. The different ARIMA models are judged on the basis of Autocorrelation Function (ACF) and Partial autocorrelation Function (PACF) at various lags. The data from 1971-72 to 2006-07 are used for model building and

from 2007-08 to 2015-16 used for successful cross-validation of the selected model on the basis of the absolute percentage error. The ARIMA models are fitted to the original time series data as well as the first difference data to check the stationarity. The possible ARIMA models are identified on the basis of significant coefficient of autoregressive and moving average components. The best fitted models are selected on the basis of low value of Root Mean Square Error (RMSE) and Mean Absolute Percentage Error (MAPE). ARIMA(1,1,0) AND ARIMA(1,1,1) are the selected model for modelling as well as forecasting purpose. ARIMA (1,1,0) model perform better than the other model. ARIMA (1,1,0) is the best fitted model for area under black gram having absolute percentage error ranges from 0.60% to 8.35% in cross-validation of the model. The best fitted ARIMA model has been used to forecast the area under black gram for the year 2016-17 to 2018-19. The model also showed the forecasting of area under black gram for the year 2018-19 to be about 548.01 thousand hectares with lower and upper limit 314.56 and 781.45 thousand tonnes respectively.

Keywords: Modelling, Forecasting, ARIMA model, ACF, PACF, MAPE, RMSE, Area, Black gram

STUDIES ON NON TIMBER FOREST PRODUCTS OF TIRAP DISTRICT OF ARUNACHAL PRADESH, INDIA

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The land of rising sun and land of dawn lit mountain Arunachal Pradesh lies in between the latitude 26° 28' and 29°30' and longitude of 92°31' to 97°30' with the total population of 13,83,727 from a total geographical area 83,743 sq. km is inhabited by 26 major tribes along with 110 sub-tribes, each having its own culture, customs, languages, belief and practices. Many of the NTFPs are being threatened due to deforestation and degradation of land by increasing population pressure. There is a need to explore more areas and communities to identify potential NTFPs. Therefore, a thorough survey was done to study the NTFPs for its documentation among the various tribes at Tirap district of Arunachal Pradesh which lies between the latitude 26° 38' to 27° 47' N, longitudes 96°16' to 95°40' E and altitude 150-1000 m above MSL, where main tribes are Nocte, Wangsu and Konyak. On an average the climate of the district is hot and humid at lower altitude and cold at upper altitude with average annual rain fall of 2520.00 mm and 139.54 rainy days. More than 90 per cent local people of the district depend on NTFPs directly or indirectly for their livelihood. Multistage sampling method was adopted to select the villages and an extensive field survey was undertaken with the help of local people and collected the NTFPs from the nearby jungle. The required information was taken by conducting informal interviews with old knowledgeable local people. From the survey, total 56 NTFPs were recorded, out of which Tree species were-11 nos., Shrubs-14 nos., Herbs-24 nos., bamboo-4 nos. and Cane-3 nos. The utility pattern of these 56 NTFPs were Medicine – 15 sp., Vegetable- 19 sp., Fodder- 6 sp., Edible fruits- 14 sp., Salad/pickle – 9 sp., Spices- 5 sp., Thatching materials- 3 sp., Mushrooms- 3sp., Fish poisoning-2 sp. and packing materials-2 sp. Most of the NTFPs have multifunctional utility among the local inhabitants. The data recorded clearly indicates that it is the need of hours to maximize the awareness for the use of NTFPs for long term sustainability of the region.

INM ON LEAF YIELD OF CORIANDER VARIETY SUPER MIDORI

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An experiment entitled “ Integrated nutrient management of Coriander variety Super Midori” of Tokita seed was conducted in the Department of Vegetable Science, College of Agriculture, OUAT, Bhubaneswar during Rabi 2013 - 2014 to assess the effect of nitrogen (50, 60 and 70 kg/ha), potash (50 and 60 kg/ha) in combination with FYM (20 t/ha), phosphorous (40 kg/ha) on growth, growth attributing characters of coriander leaves under two sets of experiment i.e. line sowing and broadcasting. It was observed that numbers of leaves were higher in line sowing as compared to broadcasting. Highest number of leaves of 37.45/plant was recorded in N3K3 under line sowing. Due to interaction effect & nutrition there was not much variation in leaf area as observed during the experiment. The increase in leaf area is a positive indication of response of growth factors in many of the nutritional investigation and also of directly indicated the increase in photosynthetic activity of a plant producing more of photosynthates and more metabolic activity. The highest leaf area of 4.53 sq.cm was recorded in N3K2 in line sowing & 4.50 m² in broadcasting. It was observed that the highest yield per plot (3.48 kg) was observed in N3K2 in line sowing as compared to lowest yield of 2.71 kg/plot in N1. Whereas the yield per hectare was significantly influenced which was 15.90 (t/ha) in N3K2 in line sowing & 15.72 (t/ha) in broadcast in N3K2. Application of higher doses of nitrogen and potash has increased the leaf yield both in line sowing & broadcasting and the interaction effect was more pronounced.

GLOBAL FOOD SECURITY AND CHALLENGES**SANGEETA****Home Science (food & nutrition), Ramabai Govt. women P.G. College, Akbarpur –Ambedkarnagar (U.P.)**

Food is our basic need, every human being on this planet need food to live, all the foods we grow to eat is provide various kinds of nutrients which are nessecery for healthy life. In this world many people are still do not have required amount of calorie in their daily diet, because of unavailability of food and equally some are throwing foods in garbage as waist in their daily life this figure is very critical. If we try to identify the reason behind this are unequal distribution of money and foods to all to survive their best life as human being, low agricultural production of crop to fulfill the needs of all, limited area of agriculture, techniques and education about how to grow best crops and vegetables in available land. Population is increasing rapidly across the world but the production is being shorter than the before because land are being used in residential purpose. The whole world is facing problem to feed rapidly increased population, many data shows that this crisis will increased day by day till 2050 it is expected to reach around 10billion. This term is used for the world as triple burden on the countries, and because of insufficient food intake problem of malnutrition, micronutrients deficiency and crisis of global hunger is rising. No country confronts these tremendous challenges alone nor should it. Now there is need to promote such a sustainable agriculture to solve the food security problem around the world.

Keywords: Global Hunger, Food Security, Malnutrition, Sustainable Agriculture.

A STUDY ON ETHNO-MEDICINAL PLANTS BY LOCAL INHABITANTS IN DEVPRAYAG TEHSIL, DISTRICT TEHRIGARHWAL, UTTARKHAND**SANDEEP CHETTRI*, P. C. SUBBA****Department of Medicinal and Aromatic Plants (HAPPRC), H. N. B Garhwal University, Srinagar, Uttarkhand**

Ethno-medicine is a study of how people of a particular culture and region make use of indigenous plants. A study was undertaken regarding knowledge of ethno- medicinal practices from native species, by the indigenous people of DevpryagTeshil, District TehriGarhwal, of high/low altitude region of Garhwal village's. A questionnaire survey was conducted in the local inhabitants having a greater knowledge for identification of medicinal plants and their natural habitat, parts used and method of preparation of medicine from the raw materials. A total of 50 number of species belonging to 34 different families were identified which are being used to make medicinal formulations beneficial in various ailments. Studies indicated development of different methods for collecting, processing, using and conserving of plants and/or their products by the indigenous people. Traditional knowledge regarding the uses and value of the indigenous medicinal plants can be documented for the future generations as well as for scientific knowledge.

Keywords: Ethno-medicine, indigenous knowledge, preparation of drug, medicinal uses.

EFFECT OF POLYMER COATED UREA AND NEEM COATED UREA ON CHEMICAL PROPERTIES OF INCEPTISOL OF VARANASI FOR RICE (*ORYZA SATIVA* L.)**SACHIN SHARMA, JANARDAN YADAV, AYUSH BAHUGUNA****Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.), India**

Rice (*Oryza sativa* L.) is the most important cereal crop of world both in respect to area and production. India ranks first in area and second in production after China in the world. The scope for increasing the production by cultivating more land, particularly in developing countries like India is limited and hence, the other alternative lies in increasing the production per unit area. To exploit the yield potential of a variety, the inputs which can bring about a massive increase in production are fertilizers and irrigation. Viewing above facts an investigation entitled Effect of Polymer Coated Urea and Neem Coated Urea on Chemical properties of Inceptisol of Varanasi for Rice (*Oryza sativa* L.) was conducted at the Department of Soil Science and Agricultural Chemistry, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi (U.P.) during the *kharif* season of 2017. Effect on chemical properties of inceptisols, treatment involving split application of polymer coated urea and neem coated urea (50% + 50%) showed a significant increase in nitrogen, phosphorous and non significant change in potassium, organic carbon and Ec, pH is observed. Treatment T₁₂(50% of RDN through PCU + 50% by NCU 3 Split) was applied showed a significant increase in available nitrogen in soil from 225.70 to 264.94 kg ha⁻¹. The maximum phosphorous was observed in treatment T₁₂(50% of RDN through PCU + 50% by NCU 3 Split) which was significantly higher than single basal of PCU at same rate of application and higher over the other treatment upto 21 kg ha⁻¹. The Ec, pH and Organic carbon are respectively 0.23 dsm⁻¹, 8.1, 0.57% after harvesting was observed in in the treatment T₁₂(50% of RDN through PCU + 50% by NCU 3 Split).

Keywords: Polymer coated urea, neem coated urea, rice

UPLIFTMENT OF FARMER'S INCOME THROUGH CONCEPT OF PRECISION FARMING**SANGAM ADHIKARI¹, BASANTA PANDEY¹, SAMBIDDHA THAPA¹, SUSHANT RAMAN NEPAL¹, SUDEEP PATHAK²****¹Department of Agriculture and forestry, Tula's Institute, Dehradun, ²BFIT Group of Institutions, Dehradun**

The conceptual use of modern techniques and parameters on the agriculture field leads to the betterment on the product outcome. Very sadly, most of the precision farming techniques are just closed inside the agricultural textbook which are easily practicable but are not practiced on the field of agriculture. Undertaking the parameter of agriculture extension on precision farming for income generation, we have the benefits of economic status upliftment of the root level farmers along with the awareness development on the common scientific agricultural practices. Taking on account of such scientific approaches on the agriculture field like Soil testing, fertilizer analysis, seed selection, Field preparation, intercultural operations, harvest and post harvesting techniques; we certainly can observe the betterment on the yield of the crop. If we approach towards the root level farmers we can find the very few farmers have satisfactory knowledge on scientific agricultural practices, the practice of ancient method of cultivation was still abundant on the rural areas, because of which the farmers were not getting the satisfactory results which they should have got on the same cultivating area. So it was necessary to aware about the benefits of the precision farming; how this concept really works and the advantages that could be taken through these approaches.

Keywords: Precision Farming, agriculture extension, economy**EFFECT OF POSTHARVEST PUTRESCINE TREATMENT ON RIPENING BEHAVIOR AND QUALITY OF GUAVA (*PSIDIUM GUAJAVA* L.) FRUIT****SANDHYA THAPA* AND KALYAN BARMAN****Department of Horticulture, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi, Uttar Pradesh**

Guava is one of the important widely cultivated subtropical fruits, belonging to the family Myrtaceae. The fruit has high dietary value, pleasant flavor and rich in vitamin C. Owing to climacteric in nature, guava ripens very fast after harvest leading to rapid softening and making the fruit highly susceptible to attack by disease causing pathogens. Guava has a very short shelf life at ambient conditions due to which a significant portion of its production is lost after harvest. Hence, an investigation was carried with an objective to delay ripening and preserve the delicacy of fruit after harvest for a longer duration by postharvest treatment of putrescine. Guava fruits of cv. Lucknow-49 were harvested at physiologically mature stage and treated with aqueous solution of putrescine (0.5, 1.0 or 1.5 mM) by dipping them for 5 minutes. The control fruits were treated with distilled water for the same duration. After treatment, fruits were air-dried and stored at ambient conditions. Results revealed that 1.0 mM putrescine treatment was most effective in delaying ripening and preserving fruit quality than control and other treatments up to 12 days of storage. Putrescine 1.0 mM treatment retained maximum chlorophyll content (0.53 mg/ g FW) while, control fruits had the highest carotenoids content (1.37 mg/ g FW) at the end of the storage. Malondialdehyde content of guava under this treatment was recorded minimum (2.67 μ mol/ g FW), which indicated delayed senescence compared to control and other putrescine-treated fruits. Guava fruits treated with 1.0 mM putrescine also recorded maximum retention of ascorbic acid (110 mg/ 100 g FW) however; significant difference in total soluble solids and titratable acidity was not recorded among different putrescine treated fruits. The present study indicated that postharvest immersion treatment of 1.0 mM putrescine can be beneficially exploited to extend shelf life of guava fruits up to 12 days during storage at ambient conditions.

RESIDUAL EFFECT OF ORGANIC AND INORGANIC FERTILIZER SOURCES OF NITROGEN PLANT STAND ON WHEAT CROP**SANDEEP KUMAR*, GRISH GOYAL*, RAJ KUMAR**, DURGESH KUMAR** AND DEEPAK KUMAR RAWAT*******Department of Agronomy*, Department of Soil conservation and Water Management**, Department of Crop Physiology***, C.S.A. University of Agriculture and Technology Kanpur-2 India**

A field experiment was conducted during two consecutive years (2015-16 and 2016-17) at SIF of C.S. Azad University of Agriculture and Technology, Kanpur. The experiment was conducted in split plot design involving 5 treatments of nitrogen through organic manures (no-organic as control, FYM @ 25 and 50% RDN, vermicompost @ 25 and 50% RDN) in main plots and 4 treatments of nitrogen rates through inorganic fertilizer viz., 50, 75, 100 and 125% RDN assigned to sub-plots replicated thrice. Results obtained during both the years as well as pooled analysis revealed that residual effect of organic and inorganic sources of nitrogen treatments did not influence significantly the plant population of wheat recorded at germination, while number of shoots at maximum tillering stage and number of ear-heads at harvest were influenced significantly due to all treatments during both the years and on pooled basis. All the organic treatments recorded significantly maximum number of shoots 415.14, 450.06 and 432.60 at VC @ 50% RDN, maximum tillering stage and number of ear-heads 371.51, 396.51 and 384.01 at harvest over the control during both the years and on pooled basis. Application of FYM @ 50% RDN to preceding crop recorded significantly maximum mean number of shoots 426.79, 463.48 and 445.14 at maximum tillering stage and number of ear-heads 384.04, 415.23

and 399.64 at harvest being higher by 10.80 and 13.25% over the control plot, closely followed by FYM @ 25% RDN and vermicompost @ 50% RDN. Minimum number of shoots at maximum tillering stage and number of ear-heads at harvest were recorded under the control plots during both the years and on pooled basis. A perusal of results clearly indicates that number of shoots 421.24, 452.37 and 436.81 at maximum tillering and number of ear-heads were recorded 376.86, 400.45 and 388.66 at par values with 125% RDN and 100% RDN, while 100% RDN recorded significantly higher mean values over 75% RDN and 50% RDN which were increased by 2.23 and 5.11% in case of number of shoots at maximum tillering and 2.44 and 6.29% number of ear-heads in corresponding rates during both the years and on pooled basis.

Keywords: FYM (Farm yard manure), RDN (recommended dose of nitrogen), N (Nitrogen), VC (vermicompost), organic manures and inorganic manures

HETEROSIS BREEDING IN CUCURBITACEOUS CROPS

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Vegetables occupying an important place in crop diversification play a key role in food, nutritional and economic security of our country. During 2016-17 (2nd Adv. Est.), the area under vegetables is estimated about 10.30 million hectares with a production of 175 million tonnes and productivity 17.80 tonnes/ ha in India. Cucurbits belong to the family Cucurbitaceae, include about 118 genera and 825 species. The unripe fruit is commonly eaten as vegetables. In India, a number of major and minor cucurbits are cultivated, which share about 5.60 % of the total vegetable production. Heterosis plays a major role in improving cucurbitaceous vegetables by development of hybrids. **An increase in vigour due to crossing and decrease in vigour due to inbreeding are manifestation of same phenomenon i.e. heterozygosis. The term heterosis can be defined in terms of superiority of F₁ hybrid over better parent. Since, the better parent may fall on either extreme, depending upon the traits, heterosis may manifest in anyone of the two directions, positive or negative. The utilization of heterosis or hybrid vigour as a means of maximizing the yield of crops has become one of the most important techniques in plant breeding. The exploitation of heterosis is much easier in cross pollinated crops and most of the gourd being monoecious, provide ample scope for the utilization of hybrid vigour on commercial scale. Further, the diversified parents from different locations with high yield and quality would also pave way for the development and release of hybrids through heterosis breeding.**

Keywords: Cucurbits, heterosis, nutritional and diversification.

RECENT ADVANCES IN PHOTSENSITIZERS FOR DYE SENSITIZED SOLAR CELLS

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The world-wide power consumption is expected to double in the next three decades, it is still a challenge to exploit the non-pollutant, sustainable and safe energy sources. Among all the renewable power sources, solar energy is the most easily exploitable, abundant and cleaner source of energy. The direct transformed of sun energy (light) into electric is a photovoltaic technology (PV) and called solar cell, the dye sensitized solar cell (DSSC) is a third generation of this PV. DSSCs contain five main components connected in a series to form PV devices namely, the conducting substrate, Nano-structure material, dye, electrolyte and counter electrode. Each component has its rolls, however sensitizer is a key in absorbing sunlight and transforming it into electric energy. Common dyes include synthetic (ruthenium polypyridine complexes, porphyrin and phthalocyanine dyes) and natural dyes (chlorophyll, anthocyanin and bettaline...etc.). Recently, Grätzel group an efficiency of $\eta = 11.8\%$ reported by Grätzel group using Ru-based dye (Black dye N749) and $\eta = 12.3\%$ for Z991 dye-based DSSCs. Still Ru based dyes have complicated synthetic routes, high in cost and contain Ruthenium which is a heavy metal that can be harmful to the environment. In contrast, attention has been given on organic dye due to easily designing, low in cost and different in styles with molar extinction coefficient. Recently, molecularly engineered porphyrin dye (organic compounds), coded SM315, which features the prototypical structure of a donor- π -bridge-acceptor and both maximizes electrolyte compatibility and improves light-harvesting properties. Using SM315 with the cobalt (II/III) redox shuttle resulted in dye-sensitized solar cells that exhibit a high open-circuit voltage V_{OC} of 0.91 V, short-circuit current density J_{SC} of 18.1 mA cm^{-2} , fill factor of 0.78 and a power conversion efficiency of 13%. Naturally, vegetable, fruits, leaves, root and flower are containing pigment such as, chlorophyll, betaline, anthocyanin which can extract and simply employed in the dye sensitized solar cell (DSSC) for direct harvesting the photons from the sun light. Though, by chemically engineering the dyes, there is plenty of room for improvement. XiaoFeng Wang (2006) for example used chlorophyll sensitizers in combination with carotenoids (having conjugated double bonds) to form charge transfer complexes with the TiO_2 layer and hereby achieved an efficiency of 4.2%. Thus, the structural optimization of natural dyes is a promising way to improve efficiency of DSSC. Even though, the efficiency of natural sensitizers in DSSC is still lower than synthetic dyes, but the focus on natural pigment is considerably growing due to their low cost, simple extraction, environmentally friendly and alternative to a rare and expensive Ru based -dye complexes.

Keywords: dye sensitized solar cells, inorganic dye, organic dye, natural dye

MORPHOLOGICAL AND PHYSIOLOGICAL CHARACTERIZATION OF EMS INDUCED MUTANTS OF HEXAPLOID WHEAT (*TRITICUM AESTIVUM* L.).

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Wheat (*Triticum aestivum* L.) is one of the most important cereal crops cultivated worldwide. It is the staple food for approximately 1.2 billion people of the world. With the increasing population, improvement of both quantity as well as quality of crop is of great importance. Therefore, in our present investigation, screening of previously developed mutant population was done for lodging tolerance as well as high yielding property including a previously selected wheat mutant (M1) which was characterized by cultivating under different plant densities, nitrogen and NPK gradients in comparison to control plants *i.e.* DPW 621-50 and HD-2967. The mutant line (M-1) was found to show superior performance in terms of lodging tolerance and high tillering capacity without compromising yield in comparison to both the controls (DPW 621-50 and HD 2967) under all the experimental conditions used in the present investigation. Therefore, mutant M1 may be directly utilized as a cultivar followed by its AICRP/State Varietal Trials evaluation or may also be utilized as a donor parent for the development of improved lodging tolerant and high tillering genotype.

Keywords: mutants, lodging tolerant, high tillering genotype

STANDARDIZATION OF PLANTING GEOMETRY AND NUTRITION IN VEGETABLE TYPE DOLICHOS BEAN VAR ARKA AMOGH IN THE NORTHERN DRY ZONE OF KARNATAKA

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Dolichos bean (*Dolichos lablab* L.) is one of the most potential crop to serve humanity at global level with multipurpose uses, occupies a unique position both as vegetable and pulse purpose among the legumes. In Karnataka, it contributes a major share, nearly 90 per cent in terms of both area and production but average productivity is quite low (12 t/ha) due to several production constraints. Planting geometry and nutrient management are very important production constraints for enhancing the productivity. Hence, standardization of spacing and nutritional doses in order to optimize the production potential of vegetable type dolichos bean (var Arka Amogh), two years field experiments were undertaken during *rabi* 2016 and 2017. The result of spacing experiment revealed that, dolichos bean crop spaced at 60 × 30 cm gave significantly maximum pod yield per plant as well as all the growth parameters except plant height which were on par with 45×30 cm whereas, narrow spacing 30 × 15 cm recorded significantly maximum pod yield per hectare. However, higher B:C ratio (5.46:1) was recorded in wider spacing 30×30 cm. While, interaction effect of NPK showed that, all the growth, yield and total NPK uptake by plants were significantly maximum in 25: 75: 50 kg NPK per hectare but it was on par with 25: 75: 25 kg NPK per hectare, recorded 18 per cent more yield and B:C ratio (5.17:1) compared to recommended fertilizer dose (25: 50: 25 kg NPK/ha). Hence, profitable cultivation of dolichos bean can be obtained in wider spacing 30 × 30 cm and 25: 75: 25 kg NPK per hectare at Arabhavi condition, Belgaum district, Karnataka.

FISH LICE *ARGULUS FOLIACEUS* INFECTION IN THE GILLS OF GOLD FISH *CARASSIUS AURATUS*

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Crustacean parasites have been a problem for marine as well as fresh water fishes. *Argulus foliaceus* a common fish lice is cosmopolitan in distribution and a major problem for fresh water aquaculture as well as recreational fisheries and aquarium fisheries. In present study *Argulus foliaceus* was found infecting the gills and skin of aquarium gold fish *C. auratus*. Generally 2-10 mature adult parasites per fish were recorded showing 10% of parasitemia. Severe effects were observed in behavior of infected fish like sluggishness, erratic swimming, scrapping of body along the walls of aquarium and letharginess. Infected fish consumed less food than normal fish and became bottom dwelling. Skin and gills showed severe damages along with hemorrhages at the site of infection. Effect of parasite on general health of fish and remedial measure have been discussed.

Keywords: *Argulus foliaceus*, *C. auratus*, parasite, gills and skin pathology

HISTOPATHOLOGICAL EFFECTS OF COPPER ON GILLS OF FRESHWATER STINGING CATFISH, *HETEROPNEUSTES FOSSILIS* (BLOCH.)**SANDEEP SHUKLA^{1*}, SHAREEF AHMAD², ANAND MISHRA³, ARTI SHUKLA⁴, MADHU TRIPATHI¹ AND SANJIVE SHUKLA²**¹Department of Zoology, University of Lucknow, Lucknow-226007 (U.P.), ²P.G. Department of Zoology, B.S.N.V.P.G. College, Lucknow-226001 (U.P.), ³Department of Zoology & Environmental Science, Gurukula Kangri Vishwavidyalaya, Haridwar-249404 (Uttarakhand), ⁴Department of Environmental science, BBAU Lucknow-226025(U.P.)

Natural and anthropogenic activities led to in formation of metals in surface aquatic bodies like ponds, rivers, lakes etc. Copper, a “grey listed” heavy metal, is an essential micronutrient required for many physiological and biochemical processes in animals of different taxa. But it becomes highly toxic when present in higher quantities. Freshwater catfish *H. fossilis* subjected to sub-acute concentration of 54.90 mg/l of copper sulphate (25% of 96hr LC50) for 10, 20 and 30 days respectively. There was marked histopathological changes in gills like infiltration of cells, distention of lamella, vacuolization of epithelial cells, necrosis and hyperplasia after 10 exposure; clubbing of secondary lamella, reduction of inter lamellar spaces, damage to chloride and goblet cells, swollen gill tip after 20 day; bulging of tip, acute hyperplasia, separation of epithelial layers after 30 day. Complete loss of histo-architecture of gill tissue was noticed at this stage due to severe necrotic and degenerative changes. Underlying mechanism of copper toxicity affection osmoregulation and respiration in freshwater catfish in reference to fish quality production in freshwater aquaculture has been discussed.

Keywords: *H. fossilis*, histopathology, gills, copper sulphate, copper toxicity**ACCUMULATION OF MINERAL-N IN SOIL PROFILE, PLANT N UPTAKE, N USE EFFICIENCIES AND YIELD OF WHEAT CROP UNDER DIFFERENT NITROGEN MANAGEMENT AND TILLAGE PRACTICES*****SAMARESH SAHOO, P. MUKHOPADHYAY, P.M. BHATTACHARYA AND A. K. SINHA**
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A field experiment was conducted on wheat during 2016-17 winter season at Research farm of the University, Pundibari (26°23'N, 89°23'E; 41 m above msl), Cooch Behar, West Bengal, India. The experiment was laid out in a split-plot design with tillage (two; zero and conventional hereafter referred as ZT and CT) as main plot and N application rates (four; 0, 60, 120, and 150 kg ha⁻¹ referred as N₀, N₆₀, N₁₂₀ and N₁₅₀) as sub-plot treatments and each replicated thrice. The climate of this region is sub-tropical and per humid in nature with high annual rainfall (3124.85 mm; average of 15-year data), moderate temperature in summer and cold in winter. Soils of the area are sandy loam in texture and acidic in nature and belong to taxonomic class Aquic Ustifluvents (USDA). Results revealed that accumulation of mineral nitrogen (min-N) in soil profile (0-90cm) was significantly higher in CT than ZT treatment plots both at 46 DAS and 84 DAS of wheat, the increase over ZT being 58% and 44 % respectively; but at the harvest stage an opposite trend was noted. Min-N accumulation in soil also varied significantly amongst N application rates with its highest value at N₁₅₀ followed by subsequent reductions with decreasing N levels at all stages of wheat growth, except at harvest where N₀ level had the highest accumulation (341.06 kg ha⁻¹) which is ascribed to poor growth and very low plant N uptake. No significant effect of tillage was found on grain yield but plots under CT recorded significantly higher plant N uptake over ZT. Of the N application levels, N₁₂₀ produced the highest grain yield and it was significantly higher than all other N treatments. ZT showed highest nitrogen use efficiencies (AE, PE and ARN) as compared to CT, whereas maximum values of AE (36.28) and PE (29.59) was observed at N₁₂₀ and these were significantly higher than all other N treatments. As anticipated, highest ARN value was seen at N₆₀ followed by its decrease with increasing levels of N application. From the results, it is inferred that plots under ZT combined with N application @120kg ha⁻¹ proved superior to all other treatment combinations in respect of crop yield, Nitrogen use efficiencies, plant N uptake and water storage in soil profile.

Keywords: Tillage, N rates, Agronomic efficiency (AE), Physiological efficiency (PE), Apparent recovery of N (ARN), Water storage, Soil profile.**COCONUT HUSK: A NEW ECO-FRIENDLY APPROACH****SAMPA SARKAR^{*1} AND BINITA BAIDYA²**¹Department of Floriculture, Medicinal and Aromatic Plants, ²Department of Pomology and Post-Harvest Technology
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Planting is very important to lead life on earth. But due to increase in soil pollution the rate of growth and yield of plants is greatly reduced. So, it is important to invite soil less agriculture and roof top gardening. The volume of wastes generated in the world over has increased over the years due to increase in population, socioeconomic activities and social development. These wastes come from agricultural, industrial, commercial as well as construction activities. One of the most attractive options of managing such wastes is to look into the possibility of waste minimization and re-use. Now a days coconut husk is used as most popular growing media which is totally eco-friendly. Chemical analysis of the coconut husk ash shows that it contains 62.43%, 17.9% and 8.79% of

K₂O, SiO₂ and CaO respectively, which corroborate the fact that coconut husk ash is a pozzolanic material. Other hand coconut husk ash has effect on Atterberg limit, compaction and California bearing ratio of soil. The addition of coconut husk ash increases the plastic limit but reduces the plasticity index of the lateritic soil. Based on the reserach, it is very clear that coconut husk ash increases the California bearing ratio and can therefore be used to improve soils with low CBR values but unsuitable for stabilizing soils with extremely high liquid limits. Also therefore necessary to recommend coconut husk ash as a stabilizing agent for improving soils with low California bearing ratio and to increase and decrease the plastic limit and plasticity index of soils respectively. The increase and decrease in maximum dry density might be as a result of binding action and complete reaction of calcium hydroxide on clay soil and coconut husk ash respectively.

Keywords: Coconut husk, CBR, Pozzolanic

A THREAT TO THE EXISTENCE OF CATERPILLAR FUNGUS (*CORDYCEPS SINENSIS*) IN THE HIMALAYAS OF NEPAL DUE TO CLIMATE CHANGE

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Climate change has already subjected to impact the ecosystem and species in the today's era and likely to impact more and more in future if some strict action are not taken into consideration .Caterpillar fungus (*Cordyceps sinensis*) also popularly known as Yarsagumba, a chinese unique popular herbal medicine found in the Himalaya of Nepal, Tibet, Bhutan, India has fallen in the trap of climate change. The popular CF is in diminishing condition. The lifecycle is greatly disturbed as there is rise in the temperature in the Himalaya area and the disturbed rainfall pattern and overgrazing has led to the fall of CF population. According to the data from Tibetan plateau (2001-2012) the rise in the temperature was between 0.3⁰c -0.6⁰c above 3000m and in the same decade the rise in the global temperature was by 0.2⁰c. In the context of Nepal Himalayathe mean annual maximum temperature had increased by 0.6⁰c per decade during 1997-2000. Similarly, climate model projection for Nepal shows rise in temperature of 0.5⁰c -2,0⁰c by 2030's ; 1.7⁰c-4.1⁰c by 2060's and 3.0⁰c-6.3⁰c by 2090's which is clear sign of increase in global warming and threat to the existence of CF in the Himalaya of Nepal.

Keywords: Caterpillar fungus, climate change

EFFECT OF PLANTING LAYOUTS ON GROWTH, YIELD AND QUALITY OF SUMMER SESAMUM (*SESAMUM INDICUM* L.) AND INCIDENCE OF PEST AND DISEASE IN RELATION TO WEATHER PARAMETERS

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The field experiment was conducted during summer 2014 on sesamum, *Sesamum indicum* L. with an objective to study the effect of weather parameters on growth, yield and quality of summer sesamum and pest and disease incidence on summer sesamum in relation to weather parameters. The results of the study indicated that all the treatments were significantly influenced. Amongst the treatments ,sowing of sesamum on ridges and furrows at 45 x 10 cm² spacing was found significantly superior in plant height (99.85 cm), number of functional leaves plant⁻¹ (91.36), leaf area plant⁻¹ (8.70 dm²), plant spread plant⁻¹ (42.96 cm), number of branches plant⁻¹ (6.75), number of capsules plant⁻¹ (58.14), dry matter plant⁻¹ (20.17 g), seed weight plant⁻¹ (3.84 g) and grain yield (850.33 kg ha⁻¹) . The incidence of pests viz., leaf hopper (*Orosius albientus*), bihar hairy caterpillar (*Spilarctia oblique*) and pod bug (*Elasmolomus sordidus*) were observed positively correlated with maximum temperature, minimum temperature, morning relative humidity, evening relative humidity and bright sunshine hours except leaf hopper and in disease sesamum phyllody same results were observed.

STRATEGIES AND WAYS TO DOUBLE THE INCOME OF WOMEN DAIRY FARMERS

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Dairy has the potential to provide effective employment opportunities for about more than 16.50 million people. Gender equality in dairy sector plays a major role to double women's income and directly empowering them for sustainable development. Women covers nearly half of the entire population and empowering them by doubling their income is considered to be an active part of all development initiatives in the country. Dairy industry can readily bring socio-economic transformation. Dairy co-operatives now cover 45% of the dairy business, whereas unorganized sectors account for only 28%. Approximately 1.5 crore people are employed in the dairy business. In order to double female dairy farmers' income focused efforts should be directed towards the development of female dairy farmers by making them adopt newer technologies in breeding, housing, feeding, rearing and health care of milking animals so as to ensure substantial growth in milk output. Improved compliance to milk food legislation and

conforming to international standards will also aid in improving export avenues for dairy products. Dairy industry developed on modern processing lines has acquired the newer technologies and engineering capabilities that now it is in a position to even export such technologies to other nations.

Keywords: Dairy, double, empowerment, equality, gender, income, women

FALL ARMYWORM *SPODOPTERA FRUGIPERDA* (J.E. SMITH) (LEPIDOPTERA: NOCTUIDAE): AN IMPENDING THREAT TO MAIZE FARMING IN NEPAL

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Fall Armyworm *Spodoptera frugiperda* (Lepidoptera: Noctuidae) is an invasive insects, native to tropical and sub-tropical regions of Americas. It is polyphagous: causes serious economic damages on 80 plant species; however, it prefers maize. First outbreak of FAW was first reported by scientists of IITA in Central and Western Africa in early 2016, which had quick invasion and spread throughout sub-Saharan region threatening livelihood of small-holder farmers with 20–50% production loss. In 2018, ICAR reported its arrival in Indian subcontinent—Karnataka State India. Now, it has already been detected in other South Asian countries. Trade of agricultural commodities and its phenomenal natural migration, more than 100 KM with in a night, have made it able to spread in alarming rate. This infers that FAW can spread to other states of India and neighboring countries, including Nepal. Annually, Nepal imports tonnes of maize seeds and grains from India and other infested countries. At the mean time, our quarantine system is not effective, which has taken Nepal into risk of FAW invasion. Moreover, climatic suitability of few regions intensify risk. In infestation, crop productivity is drastically reduced which may lead to food insecurity, collapses of maize-based industries and business, economic woes, and political instability. This insect is serious matter of concern for authorities in Nepal and all South Asian maize growing countries. Single control is not effective; so, integrated management is necessary. IPM entails cultural practices, use of biological agents, resistant varieties, and synthetic pesticides as last resort. Hence, prompt concern, action, and area-wide management is essential in South Asia.

Keywords: Fall armyworm, invasive, maize, threat, management

EVALUATION OF GENETIC VARIABILITY PARAMETERS FOR YIELD AND ITS CONTRIBUTING CHARACTERS IN BREAD WHEAT (*TRITICUM AESTIVUM* L. EM. THELL)

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The present experiment was carried out during Rabi 2017-2018 were evaluated for genetic variability parameters in bread wheat for yield and its contributing characters at Norman E. Borlaug Crop Research Centre, G.B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The investigation was carried out in Randomized Block Design (RBD) with three replications and observations studied were recorded on fifteen traits. In the studied material, significant genotypes difference for various yield and its contributing traits showing adequate genetic variability. In general, Phenotypic Coefficient Variation (PCV) was higher than Genotypic Coefficient Variation (GCV) for all the traits studied. The Genotypic Coefficient Variation (GCV) was higher than Environmental Coefficient Variation (ECV) for most of the characters studied. For phenol color reaction, the magnitude of PCV and GCV was highest followed by number of effective tillers/plant and number of grains per spike. For grain yield/plant, high heritability was obtained followed by grain weight per spike and biological yield/plant. For number of grains per spike, highest genetic advance per as mean value were estimated followed by 1000 grain weight and plant height. In general, high heritability and high genetic advance are the important parameters for improvement through mass selection due to additive gene action effects whereas, high heritability with low genetic advance due to high environmental effects showed the preponderance of non-additive gene action.

Keywords: Genetic variability, genetic advance, yield, heritability, quality, bread wheat

PRECISION FARMING-AN EMERGING TECHNOLOGY FOR SUSTAINABLE GROWTH

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Precision Farming is the technology based on farm management system to identify, analyse and manage spatial and temporal variability within fields for optimum productivity and profitability, sustainability and protection of the land resource by minimizing the production costs. Increasing environmental consciousness of the general public is necessitating us to modify agricultural management practices for sustainable conservation of natural resources such as water, air and soil quality, while staying economically profitable. The use of inputs (i.e. chemical fertilizers and pesticides) based on the right quantity, at the right time, and in the right place. This type of management commonly known as “Site Specific Management”. The productivity gain in

global food supply have increasingly relied on expansion of irrigation scheme over recent decades, with more than a third of the world's food now requiring for irrigation for production. All-together, market based global competition in agricultural products is challenging economic viability of the traditional agricultural system, and requires the development of new and dynamic production system. The global food system faces formidable challenges today that will markedly over the next 40 years. Much can be achieved immediately with current technologies and knowledge, given sufficient will and investment. But coping with future challenges will require more radical changes to the food system and investment in research to provide new solution to novel problems. The decline in the total productivity, diminishing and degrading natural resources, stagnating farm incomes, lack of eco-regional approach, declining and fragmented land holdings, trade liberalization on agricultural limited employment opportunity in non-farm sector, and global climate variation have become major concerns in agricultural growth and development. Therefore, the use of newly emerged technology adoption is seen as one key to increase agricultural productivity in future.

STUDIES ON WEED FLORA, GROWTH, YIELD AND YIELD COMPONENTS OF RABI ONION AS INFLUENCED BY HERBICIDES

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Weed management study on onion (*Allium cepa* L.) was conducted at Agricultural Research Institute, Patna under Bihar Agricultural University, Sabour, Bhagalpur for two consecutive rabi seasons of years 2016-17 and 2017-18 to find out the effective method of weed control in onion. The experiment was in randomized block design replicated thrice with eight different treatments having combinations of weed free throughout the crop period (T₁), two hand weeding at 20 and 40 days after transplanting (T₂), glyphosate @1kg a.i./ha 15 days before transplanting (T₃), pendimethalin @1kg a.i./ha as pre-emergence i.e., 3 days within transplanting (T₄), oxyfluorfen @ 250 gm a.i./ha as post emergence i.e., 30 days after transplanting (T₅), pendimethalin fb oxyfluorfen (T₆), glyphosate fb pendimethalin fb oxyfluorfen (T₇) and control (T₈). The test crop (Patna Red) was transplanted in January in both the years. The effect of pre- or post-planting application of selected herbicides on growth and yield of onion and weeds was investigated and the results revealed that weed competition throughout the season reduced onion yield by 83 % and lowered onion quality. All herbicides and their combinations increased onion growth and yield over the weed infested control. Pre-plant incorporation of glyphosate registered lower yield than two hand weeding. Pre-emergence application of pendimethalin (at 1kg a.i./ha) and post emergence application of oxyfluorfen (250 g a.i./ha) was also effective, and increased onion yields compared to weed-infested onion plots. Of all the herbicides tested the combination of pre-plant incorporation of glyphosate (at 1 kg a.i./ha) fb pendimethalin (at 1kg a.i./ha) and oxyfluorfen (at 250 g a.i./ha) were the best treatment (T₇) so far the yield and weed control in onion is considered. Almost twelve different types of weed flora belonging to eleven families were observed in the experimental field. B:C ratio (2.92) was also up to the mark when the combination of these three herbicides were used.

Keywords: Onion, Herbicides, B:C ratio, economics.

ASSESSMENT OF EFFECT OF *PROTOMYCES MACROSPORUS* INFECTED CORIANDER PLANTS ON VIABILITY OF SEEDS AND SPREAD OF STEM GALL OF CORIANDER

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The role of fruit infection for seed viability and transmission of the fungus is inadequately known. Therefore, an assessment was made for the spread of pathogen and viability of seeds, collected from different degree of infected plants part. The experiment was carried out during 2014-2015 in green house and laboratory conditions. The seeds sample were collected from healthy stem, infected stem, infected stem + leaves, goose-neck infected plants and galled seed plants. The seeds sample were air-dried and stored at room temperature (23-28 °C). The viability of seeds from each of the above lots were tested in 3.0 Kg sterilized soil, where sixteen seeds were sown in separate pots with three replication and seedlings were allowed to grow for over 60 days. The percent seed germination and spread of stem gall were recorded. The results of experiments showed that the healthy plants seeds were found germinated 94.8 percent followed by 80 percent in stem and goose-neck infected plants, 70 percent in stem +leaves +neck infected plants, 60 percent in partially hypertrophied seed and 20 percent galled seeds. The infection percent were found highest (85-90%) in hypertrophied seeds and partially hypertrophied seeds. The lowest seedling infection was observed in apparently healthy seeds (5-10%) in comparison to stem infected plant seeds (30-40%) and mixed infected plant seeds (40-49%).

Keywords: Coriander, viability, infected plants, germinability and seed yield

EFFECT OF PLANTING LAYOUTS AND MULCHES ON GROWTH, YIELD AND QUALITY OF SUMMER SESAMUM (*SESAMUM INDICUM* L.) IN RELATION TO WEATHER PARAMETERS

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The present investigation on “Effect of planting layouts and mulches on growth, yield and quality of summer sesamum (*Sesamum indicum* L.) in relation to weather parameters” was conducted in experimental farm, Agronomy, College of Agriculture, Pune during summer, 2014. The experiment was laid out in split plot design with twelve treatment combinations in three replications. The treatments comprised were four planting layouts viz., ridges and furrows at 45 x 10 cm², ridges and furrows at 30 x 15 cm², flat bed at 45 x 10 cm², flat bed at 30 x 15 cm² and three mulches viz., no mulch, soybean straw mulch @ 5 t ha⁻¹ and sugarcane trash mulch @ 5 t ha⁻¹ with same plant density maintained in net plot. The gross plot size was 4.50 x 3.60 m² and net plot size was 3.90 x 2.70 m² for spacing 45 x 10 cm and 3.6 x 3.00 m² for spacing 30 x 15 cm². Sesamum seed was sown on 9th March, 2014 @ 2.5 kg ha⁻¹. The recommended dose of fertilizer (50:00:00 Kg N, P₂O₅ and K₂O ha⁻¹) was applied uniformly to all the treatments. It was harvested the crop on 14th June, 2014 and threshed on 24th June, 2014. The all growth characters viz., plant height (99.85cm), number of functional leaves plant⁻¹ (91.36), leaf area plant⁻¹ (8.70 dm²), plant spread plant⁻¹ (42.96 cm), number of branches plant⁻¹ (6.75) were recorded significantly the highest with planting layouts of sesamum sown on ridges and furrows at 45 x 10 cm² as compared to other planting layouts. Similarly significantly more number of capsules plant⁻¹ (58.14), dry matter plant⁻¹ (20.17 g) and grain yield (850.33 kg ha⁻¹) was also obtained when sesamum sown on ridges and furrows at 45 x 10 cm². Among the mulches, the application of sugarcane trash @ 5 t ha⁻¹ significantly showed higher morphological growth parameters like plant height plant⁻¹ (101.47 cm), number of functional leaves plant⁻¹ (92.68), maximum leaf area plant⁻¹ (8.83 dm²), plant spread plant⁻¹ (43.19 cm), number of branches plant⁻¹ (6.78) and the yield parameters such as number of capsules plant⁻¹ (58.81), dry matter plant⁻¹ (20.35 g), seed yield plant⁻¹ (4.02 g) and test weight plant⁻¹ (3.52 g) resulted in higher seed yield (886.76 Kg ha⁻¹) with higher gross (Rs. 70939 ha⁻¹) and net monetary returns (Rs.33779 ha⁻¹) with benefit : cost ratio (1.90) when compared with other two mulch treatments. The combined effect of planting layout as ridges and furrows at 45 x 10 cm² along with the application of sugarcane trash mulch @ 5 t ha⁻¹ showed higher growth characters like plant height plant⁻¹ (101.89 cm), number of functional leaves plant⁻¹ (90.45), leaf area plant⁻¹ (9.04), plant spread plant⁻¹ (44.68 cm), number of branches plant⁻¹ (6.89), dry matter plant⁻¹ (20.34 g) and the yield contributing characters such as number of capsules plant⁻¹ (58.96), seed yield plant⁻¹ (4.12 g), resulted in higher seed yield (934.50 kg ha⁻¹) as compared to the other treatment combination. The higher gross (Rs.74760 ha⁻¹) and net monetary returns (Rs. 37200 ha⁻¹) was also obtained in planting layout as ridges and furrows at 45 x 10 cm² in sugarcane trash mulch @ 5 t ha⁻¹. Therefore, from the experiment it could be concluded that the sesamum sown on ridges and furrows at 45 x 10 cm² with sugarcane trash mulch @ 5 t ha⁻¹ gave higher productivity in summer season with low incidence of major pests and diseases below ETL.

Keywords: Planting layout, Mulching, Growth, Yield, Quality, *Sesamum*

DOUBLING FARMERS INCOME THROUGH AGRI-TOURISM: NORTH EAST INDIA PERSPECTIVE

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Present day Agriculture is under stress in terms of farmer's earnings and vagaries of nature. Agri-tourism acts as a support system which will be supplementary to the agricultural activities. The local community also benefits as this is a way of complementing their incomes which are mostly dependent on low skilled jobs. It also helps in diversifying and strengthening the rural market through job creation. The North Eastern states have large number of villages that have been identified for tourism mainly because of the ecological beauty and the handicraft of the region. The manmade parks, sanctuaries and sharing of 96% international boundaries with Nepal, Bhutan, China, Myanmar and Bangladesh have also made the region as a hot spot of tourism. As these economies are female led, these rural tourist sites provide additional income to them. It provides great opportunity for womenfolk to contribute to the mainstream economy and promotes gender empowerment. Encouragement of Agri-tourism can play a major role in the upliftment of living standards of inhabitants. The major focus in developing Agri-tourism is on identifying the potency of Key Result Areas for rural tourism which has the ability to attract tourists and make the village viable in financial terms thereby creating niche local markets for rural youth. Sustainable development which is the core of all developmental policies is achieved with tapping this sector which aids in capacity building in these sites in terms of culinary skills, soft skills, etc., which also offers indirect employment.

Keywords: Agri-Tourism, North East India, Employment, Skill development

OCCUPATIONAL HAZARDS OF FARM WOMEN OF WEST BENGAL: THE AGONY AND UNDERSTANDING**RITI CHATTERJEE* AND SANKAR KUMAR ACHARYA******Senior Research Fellow (PhD Scholar)* and Professor and former head**, Department of Agricultural Extension
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Indian Farm women are very much engaged in various agricultural operations. And they have to perform a sequential work mostly through manual efforts. Besides, work in agriculture involves exposures to a lot of hazards including dust, noise, thermal stress, pesticides and other agro-chemicals, and ergonomic risk factors. As a result, they have elevated rates of injuries and illnesses. So, agricultural works are associated with several occupational disorders among the farmers and agriculture farming involves several types of hazardous activities including prolonged and awkward postures these often cause musculoskeletal disorders among them. Farm women perform many strenuous activities like spading, carrying seeds, uprooting, transplanting saplings, harvesting or cutting crops, carrying crops, threshing, sweeping and winnowing. A study on this topic, was carried out at Pandua Block in Hooghly district of West Bengal with objectives to assess the extent of occupational hazards on the farm livelihood and their health parameters and way of living as indication to this harm. In order to collect the reliable experimental data, the selected parameters were taken, like: Height, Weight, B.M.I., Blood report, Perceived physical problems, functional literacy, mental stress, frequency of visit to doctor, nutritional issues, daily calorie intake level, levels of agro-chemicals used, size of holding, annual income and expenditure etc. Majority of the population under study are poor, undernourished farm women. They are extremely exposed to many agro-chemicals, scorching sun and rain with heavy work load leading to fever, stomach problems, skin abnormalities, weakness, musculoskeletal disorders like back pain, knee pain, gynaecological problems (in case of farm women), respiratory hazards etc. So, it should be recommended that there is a great need to create awareness among the farm women about the low cost improved technologies related to agricultural operations which can significantly improve the livelihood security and working conditions of farm women.

Keywords: Farm women, Indian agriculture, livelihood, occupational hazards**MITIGATION OF ARSENIC CONTAMINATION THROUGH DIFFERENTIAL APPLICATION OF SILICON, PHOSPHATE AND SULPHUR UNDER WATER MANAGEMENT STRATEGIES IN SELECTIVE SOILS OF NADIA DISTRICT, WEST BENGAL****ARNISHA MANDAL¹, DEBASHIS GHOSH², PRAVAT UTPAL ACHARJEE³****Department of Agricultural Chemistry and Soil Science, BCKV, Nadia, West Bengal, India**

Considering the enormity of human health hazards associated with contamination of food chain with arsenic, an incubation experiment in the laboratory and two pot culture experiment in the greenhouse were conducted to study the behaviour of change in available As content of soil under the influence of different water management practices and application of silicon, phosphorus and sulphur and to explore the possibilities of mitigating As accumulation in rice grains. Arsenic contaminated surface soil collected from farmer's field at village Ghentughachi (block Chakdah, district Nadia, West Bengal, India, located at 23°02'7.1"N latitude and 88°35'4.8" E longitude at an altitude of 9.75 m above mean sea level, was used for laboratory incubation as well as the two greenhouse experiments. In the incubation experiment the soil was incubated with 2 levels of P, Si and S under two moisture regimes Viz., submerged and saturated, for 120 days in the laboratory and soil samples collected at 30 days interval were analysed for available arsenic content and available P, Si and S contents of the soil. The interaction between water management and silicon application showed significant influence on available As content of the soil during different stages of rice growth. Keeping the soil saturated during vegetative or reproductive stage and application of fertilizer Si effectuated significant decrease (55.28% during tillering; 26.88% during flowering and 18.52% during harvest) in the available As content of the experimental soil. In this interaction water management played major role in determining the level of available As content of the experimental soil. The highest grain yield of rice at harvest was observed under saturated water management imposed during flowering stage (beyond 65 DAT) with application of 250 mg Si and 20 mg S kg⁻¹ soil (CSF_{S₂₀Si₂₅₀}) and the lowest grain yield under saturated water management without application of either S or Si (CS_{S₀Si₀}). While application of only S or Si could not improve rice grain yield, application of both S and Si not only compensated for the possible ill effects of limited water supply, these treatments under CS water regime resulted in 4.43% and under CSF water management 5.88 to 6.98% increase in grain yield with respect to control (CP). Application of both, S and Si resulted in significant increase in grain yield of rice in this experiment.

POTENTIAL OF MUNICIPAL BIO-WASTE PREPARED IN BIO-DEGRADABLE BAGS IN MITIGATING DIFFERENT LEVELS OF ARSENIC IMPREGNATED SOILS, COLLECTED FROM NADIA DISTRICT, WEST BENGAL

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Disposal of Municipal Solid Waste (MSW), comprising everyday items discarded by the public, poses a formidable challenge to the municipal authorities across the globe because of the environmental issues and financial involvement associated with it. Field level surveys during 2013-2014 revealed that, a total of approximately 4837 MT of MSW out of 1.76 MMT of waste (at the rate of 0.35 kg/cap/d) is generated every day in the metropolitan area of Kolkata alone. Proper disposal of MSW under the backdrop of poor collection and inadequate transportation and unscientific disposal causing adverse impact on all components of the environment and human health is one of the major environmental problems of Indian mega cities including Kolkata. A report by World Bank forecasting on MSW generation and composition at both country and regional levels for 2025 revealed that specifically in the low and middle-income countries MSW comprise high percentage of organic matter within the urban waste stream, ranging between 40 and 85 % of the total. Since role of Organic Matter in soil is of paramount importance, use of MSW integrated with chemical fertilizers in Mali resulted in improvement in soil organic matter, total N, available P and K and increased the soil pH; significant increase in the levels of soil OC, N, P, K, Cu and Zn, enhancement of soil organic matter and decrease in NO₃-N due to its immobilization by MSW. Application of MSW compost resulted in significant decrease in soil bulk density; decrease in soil pH; significant increase in maize yield; significantly higher build-up of ammonium and nitrate nitrogen, available P and K in rice fields; significant increase in growth parameters, germination of seeds, chlorophyll contents and yield of rice. These results indicate potentiality of the municipal wastes as source of carbon and nutrients but also the negative impact of heavy metal contamination, which needs to be monitored. Thus, the current study has been envisaged to evaluate the effect of compost prepared from municipal source separated bio-wastes collected in BASF's ecovio® certified compostable waste bags integrated with chemical fertilizers in a rice-wheat cropping sequence. The dynamics of different plant nutrients in a variety of soils viz., acid soil, alkaline soil, saline soil, neutral alluvial soil, soil impregnated with arsenic has been observed in terms of the changes in soil physical quality parameters along with the changes in different soil microbial quality parameters. The potentiality of mitigating arsenic in the soil and the crop produce has been analysed through this experiment.

SQUARE FOOT GARDENING

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Square foot gardening (SFG) is an intensive and new method of kitchen gardening. It was first developed by Mel Bartholomew and also published a book "Square foot gardening" in 1981. (Bartholomew, 2011). This method of gardening requires four feet square raised bed of 6-12 inches height that needed to be separate into sixteen blocks of one foot squares size and each of the squares is planted with different crop species. 1-16 plants can be accumulated in each square based on their specific requirement and morphological attributes. (Jeremy, 2010) Compost, peat moss, vermiculite in equal ratio is use to prepare the growing media replacing the soil. Among the all other organic nutrient sources, vermicompost is considered one of the easily available cheapest media for growing crops. Adaptation of this soilless media Square foot gardening (SFG) becomes completely weed-free, less probability of soil born disease and pest. (Douglas, 2018). Cabbage, cauliflower, broccoli, swiss chard, Bush bean, pepper, beet, onion, carrot and radish can be grown in this system. But, these small beds are not ideal for vine crops like pumpkin and perennials like asparagus. The main aim of the square foot garden is to increase the production in a limited cultivatable land area i.e., increase yield per square foot, produce more bio mass with high nutritional value, maximize the utilization of available nutrient and water use efficiency. This system can be a good alternative in hilly areas like north eastern Himalayan region in India where there land for cultivation is in scarce and can be good supplement to socio-economy status of those localities.

Keywords: Square foot gardening (SFG), new system, soilless, organic manner, yield and crop rotation

EVALUATION AND CHARACTERIZATION OF BRINJAL GERMPLASM FOR GROWTH AND FLORAL MORPHOLOGY IN TERAI REGION OF WEST BENGAL

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Assessment of genetic resources is an important and starting point of crop improvement programme. The present study was undertaken at the Instructional Farm of UBKV, Pundibari, Coochbehar, West Bengal during 2015-2018 for seventeen (17) different morphological parameters as well as for studying floral biology and biochemical parameters of brinjal. Thirty brinjal germplasms collected from different parts of West Bengal evaluated under field trial revealed that some genotypes like UBB-8,

Bholanath and Joshna were resistant against fruit and shoot borer while showing good yield. The quality response in terms of good size and shape of fruit, colour, anthocyanin content, total phenol, total soluble sugar and dry matter content was also assessed. The genotypes like Balasi, Bholanath and Tufanganj were found most promising. The study of floral biology revealed that in genotypes Ashapuri Changa, Jhuri begun, Black Beauty and Tufanganj the flowers were long styled which is considered good for better fruit setting as compared to medium and short styled flowers. Moreover the flowering biology of eggplant and the influence of flower heterostyly are directly proportional to yield.

Keywords: Brinjal, germplasm, floral morphology.

DROUGHT STRESS AND ITS TOLERANCE MECHANISM IN PLANTS

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Drought is a period or conduction of unusually dry weather condition within a geographic area where there is a lack of precipitation. Drought stress in plants may be induced by many environmental factors such as low or no rainfall, high salt concentration water or nutrient solution, low temperature etc. Plant growth reduction under drought stress may be attributed to loss of turgor, resulting in obstructed cell elongation. Relative water content, stomatal conductance and rate of transpiration are the important factors that influence plant water relations. All these were reported to be declined or suppressed under drought condition in different crops like rice, wheat, potato etc. Nutrient relations in plants also get affected at drought stress due to limited nutrient uptake and their transport that may be related to limited availability of energy for assimilation of nutrients. Possible reasons behind declined photosynthesis under drought condition in plants are lower rubisco activity and reduced activities of major enzymes like PEPcase, PPDK etc., which result in limited carboxylation. Rate of respiration, on the other hand, gets increased under drought stress, leading to an imbalance in the utilization of carbon resources, reduced production of adenosine triphosphate and enhanced generation of reactive oxygen species. Generation of reactive oxygen species (ROS) is well-known in plants at drought stress. Chief mechanisms for drought resistance in plants include antioxidant defense, membrane stability and osmotic adjustment. Antioxidant defense involves induction of enzymatic activities of superoxide dismutase, catalase, peroxidase etc., where non-enzymatic mechanism includes involvement of glutathione, cysteine, ascorbic acid, carotene etc. Osmotic adjustment refers to accumulation of compatible solutes of higher concentration in cytoplasm and vacuole to maintain cell turgor, contributing to a reduction in the plant water potential. These osmotic solutes include simple sugar (glucose, fructose); sugar alcohols (glycerol and methylated inositols); complex sugars (trehalose, raffinose and fructans); quaternary amino acid derivatives (proline, glycine betaine, β -alanine betaine, proline betaine). So, introduction of these traits will be helpful for successful breeding programme for developing genotypes with improved tolerance mechanism.

Keywords: Drought; ROS; antioxidant defense; compatible solutes

PHYSIOLOGICAL AND BIOCHEMICAL STUDIES OF DROUGHT STRESS ON SEEDLING GROWTH IN MUNGBEAN [*VIGNA RADIATA* (L.) WILCZEK]

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Water deficit and salt stresses are global issues related to survival of agricultural crops and sustainable food production. Drought stress occurs when the available water in soil is reduced and atmospheric condition causes continuous loss of water by transpiration and evaporation. The general complexity of drought is often aggravated under conditions of erratic and unpredictable rainfall and by the occurrence of high temperature, high levels of solar radiation and poor soil characteristics. A key to progress towards breeding for better crop varieties under drought stress is to understand the biochemical, physiological and molecular machinery that are induced under such stress. The present experiment was envisaged to study the physiological and biochemical changes in selected tolerant and susceptible genotypes to have an understanding of physiological basis of drought tolerance. The drought stress was imposed using a solution of polyethylene glycol (PEG) 6000 creating an osmotic potential of -1.5 MPa. A control set containing distilled water was also prepared for comparison. The mean data in all the cases were subjected to statistical analysis following completely randomized design (CRD) using INDOSTAT version 7.1 software. Physiological studies indicated that the susceptible genotypes (Pusa 1172, IPM 9901-10, IPM 9901-6 and Pusa 1132) in the present experiment showed greater osmotic shock and leaf membrane damage under drought stress than the four tolerant ((Pusa 1131, Meha, Pusa 9531 and NVL 638)) genotypes. The chlorophyll stability index (CSI) of the tolerant genotypes showed less reduction under stress. The tolerant genotypes registered much greater accumulation of proline in their leaves than the susceptible ones and showed better osmotic adjustment. The higher activities of ROS scavenging enzymes, SOD, GPOX and catalase helped the tolerant genotypes to combat against drought-induced oxidative stress in much better way than the susceptible ones.

Keywords: Drought; physiological and biochemical changes; tolerant genotypes; CSI; scavenging enzymes

EFFECT OF PACLOBUTRAZOL ON THE BIOCHEMICAL ASPECTS OF MANGO (*MANGIFERA INDICA L*) CULTIVAR “HIMSAGAR” UNDER WEST BENGAL SITUATION

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The growth of mango cultivation occur every year due to different varieties have regular bearing habit but alternate bearing varieties give production one year interval. Here it was observed that the better production needs sufficient assimilate storage of plants. On the other hand, sufficient assimilates were seen in fruiting year plant twigs. This assimilate storage helps to convert vegetative shoot to normally reproductive shoot process of which is hampered in off years due to lack of assimilate storage. But the change of assimilate level is very less in case of regular varieties. After photosynthesis, from photosynthates different micro molecules are produced and stored in plants. Present investigation showed that the said storage materials- starch, sugar and protein level stay in high level. The vegetative shoot is converted in to reproductive shoot because of the storage materials. Starch levels are observed very high in different parts of reproductive shoot. We had arranged different experiments to search the role of starch or the other assimilates in case of fruit production. Other efforts are also done to test the role of soluble sugar and soluble protein. Different biochemical analyses were performed during investigation to acquire knowledge of the importance of assimilates in over all reproductive shoot formation. Trials were also done to check the type of plant part in which paclobutrazol stored assimilates.

Keywords: Paclobutrazol; alternate bearing habit; assimilates; starch

SCREENING OF DROUGHT TOLERANT SUGARCANE CULTIVAR UNDER SUB-TROPICAL CLIMATIC CONDITION

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Sugarcane (*Saccharum* spp. Complex) an important field crop in the tropical and subtropical zone of India. Drought tolerance is a very important factor considering the actual climate change scenario throughout the world. In subtropical region, water requirement of sugarcane ranges from 1500-1700 mm in a crop season. An experiment was conducted in spring season under normal and drought conditions during 2015-16 to 2017-18 at Genda Singh Sugarcane Breeding & Research Institute, Seorahi, Kushinagar, U.P. Ten elite sugarcane varieties viz. CoSe 01424, CoSe 01434, CoSe 08452, CoSe 11451, CoSe 11452, CoSe 11454, CoSe 13451, CoSe 13452, CoS 08272 and CoS 08279 were laid out in randomized block design with three replications to comparison of growth and quality characters of early and mid-late maturing varieties on their relation with production. The experimental findings on the basis of pooled data of three years revealed that CoS 08279 produced significantly higher germination (41.98 per cent) and cane yield (69.95 t/ha) over remaining tested varieties in drought condition. Sucrose per cent was significantly affected in drought condition by tested varieties and recorded significantly higher in CoS 08272 (17.31 per cent) as compared with other remaining tested varieties. Consequently the variety CoS 08279 was better performed in case of cane yield but in terms of juice quality variety CoS 08272 gain more sucrose percent in drought condition, concluded that both varieties could better performed for cane grower and sugar industry to gain higher cane production and sugar recovery.

Keywords: Drought tolerance, Sugarcane, Cane yield, Screening, subtropics

ROOT DISTRIBUTION OF TREES AND INTERCROP PERFORMANCE IN SOME AGRISILVIHORTICULTURAL MODELS

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The agrisilvihorticultural practices are important for enhancing farm productivity and obtaining more ecosystem services. The present investigation was carried out at Orissa University of Agriculture & Technology, Bhubaneswar on 3-year old agrisilvihorticultural models which consisted of silvicultural species such as Eucalyptus (JK - 6 clone) and 3 horticultural species such as jackfruit, cashew and mango and 4 intercrops such as arhar, groundnut, blackgram and cowpea. The spacing of eucalyptus-eucalyptus and fruit tree-fruit tree was 8m × 7.5m. Eucalyptus was common in all models in the middle of fruit trees to be harvested under simple coppice system of 4-year rotations to get interim return and to reduce shade effect on others. The 12 agrisilvihorticultural models exerted significant variation from one another with regard to root distribution of fruit trees, intercrop yield and net return at the age of 3 years. The shoot growth and root distribution were comparatively more in jackfruit followed by cashew and mango trees. The rooting intensity and density reduced gradually with increase of distance from tree trunk in all models. At 2m and 3m distance comparatively more rooting intensity and density were found at 15-30cm and 30-45cm depth than 0-15cm depth. No significant variation in growth of eucalyptus was obtained under different models. The yield of cowpea (pod yield) was significantly higher over others followed by groundnut, arhar and blackgram. Blackgram with eucalyptus + cashew recorded maximum yield loss (11.21%) whereas cowpea with eucalyptus + cashew registered lowest yield loss (1.27%). Among

the intercrops comparatively more yield loss occurred in blackgram and less in cowpea. The net return from intercrops ranged from 1400 to 36920 Rs ha⁻¹. Arhar with eucalyptus + mango exhibited significantly higher net return over others while blackgram with eucalyptus + cashew generated lowest net return.

Keywords: Agroforestry, agrisilvicultural model, root, intercrop yield

STUDIES ON WEED FLORA, GROWTH, YIELD AND YIELD COMPONENTS OF RABI ONION AS INFLUENCED BY HERBICIDES

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Weed management study on onion (*Allium cepa* L.) was conducted at Agricultural Research Institute, Patna under Bihar Agricultural University, Sabour, Bhagalpur for two consecutive rabi seasons of years 2016-17 and 2017-18 to find out the effective method of weed control in onion. The experiment was in randomized block design replicated thrice with eight different treatments having combinations of weed free throughout the crop period (T₁), two hand weeding at 20 and 40 days after transplanting (T₂), glyphosate @1kg a.i./ha 15 days before transplanting (T₃), pendimethalin @1kg a.i./ha as pre-emergence i.e., 3 days within transplanting (T₄), oxyfluorfen @ 250 gm a.i./ha as post emergence i.e., 30 days after transplanting (T₅), pendimethalin fb oxyfluorfen (T₆), glyphosate fb pendimethalin fb oxyfluorfen (T₇) and control (T₈). The test crop (Patna Red) was transplanted in January in both the year. The effect of pre- or post-planting application of selected herbicides on growth and yield of onion and weeds was investigated and the results revealed that weed competition throughout the season reduced onion yield by 83 % and lowered onion quality. All herbicides and their combinations increased onion growth and yield over the weed infested control. Pre-plant incorporation of glyphosate registered lower yield than two hand weeding. Pre-emergence application of pendimethalin (at 1kg a.i./ha) and post emergence application of oxyfluorfen (250 g a.i./ha) was also effective, and increased onion yields compared to weed infested onion plots. Of all the herbicides tested the combination of pre-plant incorporation of glyphosate (at 1 kg a.i./ha) fb pendimethalin (at 1kg a.i./ha) and oxyfluorfen (at 250 g a.i./ha) were the best treatment (T₇) so far the yield and weed control in onion is considered. Almost twelve different types of weed flora belonging to eleven families were observed in the experimental field. B:C ratio (2.92) was also up to the mark when the combination of these three herbicides were used.

Keywords –Onion, Herbicides, B:C ratio, economics.

PRODUCTION OF AGRI-BIOCHAR FROM THE PYROLYSIS OF WASTE ORGANIC MATERIAL AND ITS UTILIZATION FOR ACID SOIL MANAGEMENT

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Soil acidity is one of the major constraints in crop production throughout the world. Approximately 95 per cent soils of North-Eastern Region (NER) of India are acidic, with nearly 65 per cent soils under strong acidity with pH less than 5.5. For managing soil acidity, liming is the conventional practice; however it may not be economical in the regions where it is expensive. Agri-biochar may be an alternative cheap and good organic source to overcome this problem. The NER produces huge quantity of crop residue/weed biomass which is traditionally burned to provide a fast way to clear the agricultural fields that causes loss of valuable biomass, nutrients and release of toxic gases including GHGs. There is an immense scope for converting millions of tonnes of crop residues/weed biomass into agri-biochar that can be utilized for managing soil acidity. There are many ways to produce agri-biochar but all of them involve heating biomass with little or no oxygen to drive off volatile gasses, leaving carbon behind. Pyrolysis is a process of the decomposition of biomass without combustion at controlled temperature. To optimize the dose of agri-biochar (B) in combination with vermicompost (V) and graded recommended doses of N, P, K fertilizers (F) for maximizing tomato (cv. Megha Tomato-2) productivity and improving soil acidity indices in NER, a field experiment was conducted during rabi season of 2017-18 at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, CAU, Umiam (Barapani) involving sixteen treatments in RBD with three replications. The results indicated that plant height, number of fruits/plant, fruit size and fruit yield of tomato was superior with the application of B (4 t/ha) + RDF (100% NPK) + V (2.5 t/ha) and soil acidity indices also improved significantly over control plots.

Keywords: Agri-biochar, acidic soils, north eastern region, tomato productivity, soil acidity indices.

GLOBAL FOOD SECURITY AND CHALLENGES**SANGEETA****Home Science (food & nutrition), Ramabai Govt women P.G. College, Akbarpur –Ambedkarnagar (U.P.)**

Food is our basic need, every human being on this planet need food to live, all the foods we grow to eat is provide various kinds of nutrients which are nessecery for healthy life. In this world many people are still do not have required amount of calorie in their daily diet, because of unavailability of food and equally some are throwing foods in garbage as waist in their daily life this figure is very critical. If we try to identify the reason behind this are unequal distribution of money and foods to all to survive their best life as human being, low agricultural production of crop to fulfill the needs of all, limited area of agriculture, techniques and education about how to grow best crops and vegetables in available land. Population is increasing rapidly across the world but the production is being shorter than the before because land are being used in residential purpose. The whole world is facing problem to feed rapidly increased population, many data shows that this crisis will increased day by day till 2050 it is expected to reach around 10billion. This term is used for the world as triple burden on the countries, and because of insufficient food intake problem of malnutrition, micronutrients deficiency and crisis of global hunger is rising. No country confronts these tremendous challenges alone nor should it. Now there is need to promote such a sustainable agriculture to solve the food security problem around the world.

Keywords: Global Hunger, Food Security, Malnutrition, Sustainable Agriculture.

LOTUS FIBER: A ECO FRIENDLY TEXTILE FIBER**SANGITA TOMAR, NIRMALYADAV****Department of Textile and Apparel Designing, I.C. College of Home Science, CCS HAU, Hisar, Haryana, India**

Lotus fiber (*Nelum bonucifera*), (*nelumbolutea*) extracted from the stems of lotus which grow naturally on Burma lakes, especially on Lake-Inle. Almost all parts of lotus, i.e., leaves, flowers, seeds, and stems can be used for edible and medical purposes as well as clothing purpose .this is only the fiber that is the nano-fiber from natural fiber that is why it is called eco friendly fiber. It is antibacterial and self cleaning as well as super-hydrophobic quality containing plant. That lotus fiber is consist of cellulose, hemicellulose, fat waxy, lignin, ash, pectin, amino acids and so on, (cellulose is the main ingredient). Stems of the lotus plants are collected from the lake for the fiber making process. Take the stems bunches and mark a slight cut around them , pulled and broken it in to the parts. Twisted to expose fibers and windup on a role in the form of yarn . The material made by this fiber is light in weight and breathable. It can be dyed by both natural and chemical dyes. The resulting fabric has the appearance of antique linen or raw silk, it is soft, exceptionally breathable and crease-resistant. Due to the hand holding process it is more expensive, that's why it is not so popular in world. Around 30 kg of stems is needed to produce 250 meters of thread. The development of this fiber will give the people, to work in the original environments. It will become the means to support future generations, thus allowing this art to survive and increase their family income status.

Keywords- lotus fiber, properties, structure, environment, eco-friendly

EVALUATION OF ENHANCED SEED TRESTMENTS ON VIGOUR POTENTIAL OF WHEAT SEED PRODUCED UNDER ZERO TILLAGE AND NORMAL CONDITION**¹SANJAY KUMAR SHARMA *, ²RASHMI PRIYADARSHI****¹Research Scholar Department of Seed Science and Technology, BAU, Sabour, Bihar, India, ² Research Scholar, Department of SSAC, DRPCA, Pusa, Bihar, India**

Wheat is a one of the most important cereal crops in India. Seed is a basic and vital input for sustained growth in agricultural productivity and production since ninety percent of the food crops are grown from seed . Good quality seed can increase yields by 5-20 percent. The Zero tillage is one of the agro techniques under resource conservation agriculture where seed is sown without doing any tillage practices. The study entitled was carried out at BAU, Sabour, Bhagalpur, Bihar in rabi season. Single seed lot of DBW 14 was treated with different seed enhancement treatment viz., KNO₃ (T1, 2.0%, 18h), Hydration-Dehydration (T2, H-D, 8h), CaCl₂ (T3, 2.0%, 12h), seed dressing with Bavistin (T4, 2 gram per kg of seed), hydration with KNO₃ (2.0%) followed by Bavistin (T5, 2 gram per kg of seed), hydration with distilled water followed by Bavistin (T6, 2 gram per kg of seed), hydration with CaCl₂(2%) followed by Bavistin (T7, 2 gram per kg of seed). Treated seeds were sown in the plot size area of 7x4 m² with a spacing of 20x10 cm. Seed lots were adjusted in six number of plots. Processed seeds were examined for the quality parameters and data were recorded on 100 seed weight (g), germination (%), seedling dry weight (mg), seedling length (cm), [seedling vigour index-I (Germination × seedling length), seedling vigour index-II (Germination × Seedling dry weight) , mean emergence time, and field emergence index . Single lot of wheat variety DBW 14 was sown under two different tillage conditions after treatments with different seed enhancement agents with the objective to assess their effect on seed vigour potential. Seed vigour potential of seed lot produced under zero tillage was comparatively inferior to that of normal tillage. Treatment with KNO₃ (2%) significantly improved followed by combined treatment of KNO₃ (2%) and Bavistin, (2g/kg of seed) of all the seed vigour potential parameters

found lower in zero tillage condition in comparison to normal tillage. All the pre-sowing seed enhancement treatment were found significantly improve the seed quality in all terms of wheat when was raised under normal tillage condition. Seed treated with KNO_3 (2.0%) exhibited better quality which is followed by CaCl_2 (2%), CaCl_2 (2%) followed by seed dressing with bavistin, distilled water, seed dressing with bavistin, distilled water followed by seed dressing with bavistin, CaCl_2 (2%) followed by seed dressing with bavistin that scored nearly similar values and were at par to control. It was concluded from the present study that seed vigour potential of seed lot produced under zero tillage was comparatively inferior to that of normal tillage.

Keywords: Wheat, Seed, Enhancement, Tillage, Vigour

SCREENING OF WHEAT VARIETIES FOR RESISTANCE TO SPOT BLOTCH DISEASE

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Leaf blight or spot blotch of wheat caused by *Bipolaris sorokiniana* appears in all growth stages and susceptibility increase with increase in plant age. The disease caused yield loss up to 60% according to the variety and weather factors. The cultivation of wheat in West Bengal is increasing, but the crop produced low yield due to increase in disease like spot blotch. Very limited research has been carried out with regards to epidemiology and management of this disease in different locations (Kumar et. al, 2010). To determine the resistance level to spot blotch field screening of 151 wheat varieties against *Bipolaris sorokiniana* was conducted at Kalyani. Among the 151 genotypes screened, no genotypes were immune, six genotypes (HS 507(C), HD 3043 (C), HS 629, HS 645 and NH-10-VHA) were found to be moderately resistant and others are susceptible and moderately susceptible. These lines can further be exploited in breeding program.

Keywords: *Bipolaris sorokiniana*, genotype.

PROBIOTIC DAIRY FOODS AND ITS'HEALTH PERSPECTIVE

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Modern consumers are increasingly interested in their personal health, and expect the food that they eat to be healthy or even capable of preventing illness. And as a result of *probiotic* foods, of late have become are now part and parcel of one's daily life. According to FAO & WHO (2001), "*Probiotics* are live micro-organisms that when administered in adequate amounts confer a health benefit on the host". With the changing life-style, it becomes a natural tendency for people to look towards the healthy food that suit better to their life-style. Health is a state of complete physical, mental, and social well-being and not merely the absence of disease or infirmity" - (WHO, 1946). Dairy based probiotic perfectly fits into the food system and it further promoted the wellness and health among consumers. Indian *probiotic* industry accounts for less than one per cent of the total world market turnover as published in a new market research report, ('Probiotics Market', 2009&2014). With more inclination towards urban life, hectic work schedule, certainly, the health food sector, like probiotic dairy foods have shown promising growth and impacts as well. *Probiotics* are sometimes referred as magic bullet as it has numerous advantages including strengthening immune system and improving the GUT environmental condition. With increasing prevalence of life-style diseases in India, one out of four Indians is at risk of dying from 'Non-Communicable Diseases' (NCD) like diabetes, cardio-vascular ailments or cancer before the age of 70, according to an study of various global and domestic organizations. Thus, in the current scenario, dairy based products play an important role in delivering *probiotic* bacteria to human providing the health benefits. With so much potential and market prospect in the field of *probiotics*, it can be easily assessed that this novel concept has far reaching and more impact among the health concern people.

Keywords: Probiotics, Probiotic dairy foods, Non-Communicable Diseases (NCD), Health

EVALUATION OF MICROCLIMATIC VARIABILITY AND THEIR CONSEQUENT EFFECT ON MUSTARD YIELD UNDER COMPLEMENTARY APPROACH

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An experiment was conducted during *rabi* season of 2017-18 at Kalyani'C' Block Farm (22.57° N latitude and 88.20° E longitude) of Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal, India, to investigate the modulation in microclimatic parameters and their subsequent effect on yield attributes of mustard through complementary strategy. Two promising mustard varieties; B-9 (V_1) and B-85 (V_2) were sown with three companion crops such as Pea (C_1), Marigold (C_2) & Garlic (C_3) under border planting (A_1 ; mustard guarded by companion crops) and row sowing (A_2 ; 2M:1C) and replicated twice under Randomized Block Design. Among different micro-environmental factors, soil temperature was recorded from three depths such as 5 cm, 10 cm and 15 cm and gradual decrease in temperature

were observed as depth increased. V_2 experienced maximum soil temperature of 23.2°C than V_1 (21.4°C) at 90 DAS. C_3 in association with A_2 recorded maximum soil temperature under V_2 (25.4°C) than V_1 . Significant variation in canopy temperature and PAR interception (PARI) within the crop was also noticed. Periodic observations revealed that V_2 experienced maximum canopy temperature (25.6°C) in crop sown in row with garlic having less PARI. Individual treatments and their interactions significantly influence the seed yield of mustard. V_1 yielded more (9.75 q/ha) in comparison to V_2 (7.71 q/ha) under varied microclimate. Among three companion crops, mustard under border row planting with pea produced maximum yield (9.81 q/ha) followed by marigold (8.97 q/ha) and garlic (7.41 q/ha). Different yield attributes of mustard such as no. of branches/plant, no. of silique/plant, 1000-seed weight etc. were measured at harvesting which showed that V_1 performed better in respect of yield factors. Thus, it can be concluded that modification in crop microclimate as an adaptation initiative to combat climate change may alter different microclimatic parameters near the ground gradually amplifying yield attributes of mustard.

Keywords: Mustard, Companion crops, Microclimate, PARI, Climate change.

CROP DIVERSIFICATION: AN IMPORTANT WAY-OUT FOR DOUBLING FARMERS INCOME

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In the past five decades or so, increasing agricultural production and ensuring food security was the main concern for agricultural development. To the great satisfaction, Indian farmers with the help of agricultural scientists and policy makers could achieve that by bringing 'Green Revolution' and 'Rainbow Revolution'. This not only brought smiles to the face of millions of Indians, but also established India as the self-sufficient country in agriculture and face-lifting of Indian agriculture in world map was made possible. These strategies involved an increase in productivity through intervention of better crop production technologies and varieties, among few others. It showed 45% increase in per person food production, which has made India not only food self-sufficient at aggregate level, but also a net food exporting country. Most importantly, during the last half century, India's food production multiplied 3.7-fold. However, the strategies could not recognize the need to raise the farmer's income and there was no direct relation to promote farmers welfare.

CLIMATE CHANGE MITIGATION AND NATURAL RESOURCE MANAGEMENT FOR DOUBLING FARMERS INCOME BY 2050

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The impacts of climate change on agriculture production system may possibly include the development challenges of ensuring food security and reducing poverty. We show the possible impacts on quality food grain production are expected by the year 2050. This paper reviews the knowledge on effects of climate change on agricultural production system in India and the consequences for policy and research. The results of many research and governmental policies indicated that combination of overall approaches may leads more profitable than conventional agricultural production system. Governmental policy will also need to be concerned with agricultural strategies to mitigate climate change through reduction in green house gas (GHG) emissions like; carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), while an increase in carbon sequestration in agricultural soils. The policies to support adaptation and mitigation to climate change will need to be linked closely to the development of agri-environmental production system. Climate change urgently needs to be assessed at the level of the household, so that poor livelihoods and vulnerable people dependent on agriculture can be appropriately targeted in research and development activities whose aim is poor livelihood improvement. Research will have to be promoted to deal with the effect on secondary factors of agricultural production, on the quality of produce and animal production. There is also a need to study combined effects of adaptation and mitigation strategies for doubling farmers income and include assessments of the consequences on current efforts in agricultural policy to develop a sustainable agriculture production system that also conserve environmental and social values in the rural society.

BIO-RESOURCE FLOW UNDER INTEGRATED FARMING SYSTEMS IN NORTH EASTERN REGION OF INDIA

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Over the ages, tribal farmers developed some potential indigenous farming systems in the region using their ingenuity and skill. In North-East India, the concept of Integrated Farming System (IFS) helps to safeguard the agricultural systems with biodiversity value since, majority of the population in the region depends on agriculture for their livelihood but there is a very poor complimentary interaction between the various farming components which results in under/over utilisation of natural resources with poor land and crop productivity. Farmers manage several organic and mineral resources in order to attain their production goals. However, the net flow of resources is not equal for the various fields belonging to a single farm household but varies

substantially, creating areas with carbon and nutrient accumulation and depletion. Economic and ecological access to food could only be ensured by adopting farming system approach consisting of change from commodity- based to resource-based planning and integrated use and management of land, water and human resources. Sustainable development in agriculture must include efficient soil, water crop and pest management practices, which are environmentally friendly and cost- effective. According to this concept, integration usually occurs when outputs (usually by-products) of one enterprise are used as inputs by another within the context of the farming system. Recycling of biological resources, wastes and by-products improves natural resources and income. Farmers of North Eastern Region generally do not apply any external input for crop production, hence, recycling of in-situ/ex-situ of biomass are crucial for sustaining soil health and farm productivity in Hill ecosystem.

Keywords: Bio-resource flow, sustainable income, economic efficiency, nutrients, integrated farming system

COMPOSITION OF VERMICOMPOST AND USE IN AGRICULTURE

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Vermicomposting is the process of producing organic fertilizer or the vermicompost from bio-degradable materials with earthworms. Vermicomposts have higher level of available nutrients like carbon nitrogen, phosphorous and potassium, calcium and derived from the wastes. In vermicomposting three varieties of earthworms used such as *Eisenia fetida*, *Eudrilus eugeniae* and *Perionyx excavates* in the vermicomposting of plant debris, cattle dung and was tepapermixture of waste paper, plant debris and cattle dung in the ratio of 1:1:1 was found to be the best ratio than 3 (paper waste): 2 (cattle dung) and 5 (plant debris). In 60 days time excellent quality and quantity of compost was produced by three earthworms. The ranges of EC, pH, C/N and germination index were 7.5-4.9 ms/cm, 5.6-7.53, 30.13-14.32% and 12.8-58.4%, respectively. The C/N value showed that the vermicompost was stable Vermicompost is accepted as humus biofertilizer, soil fertility booster, soil activator and soil conditioner with required plant nutrients of storage polysaccharides and structural polysaccharides, vitamins, enzymes, growth regulators and beneficial microorganisms like nitrogen fixing, phosphate solubilising, denitrifying, decomposing bacteria and methanogenic bacteria “The Green Revolution” that was promoted in early part of 20th century was a boost to food production without foreseeing its ill-effects. The present trend about was to focus on recycling and the recovery of waste as new materials or as energy. Advantages of vermicompost include enriching soil, increasing harvest yields and suppressing plant disease, vermicomposting enriching soil increasing plant growth and yields and suppressing disease. Damping off, seed borne such as *Pythium phytophthora*, rhizoctonia species successfully suppress these diseases.

Key words: Vermicompost; Plant debris; Paper waste; Cattle dung; *Eisenia fetida*; *Eudrilus eugeniae* and *Perionyx excavates*

PRODUCTIVITY OF MUNGBEAN (*VIGNA RADIATA* L. WILCZEK) AS INFLUENCED BY FERTILITY LEVELS AND STRESS MITIGATING CHEMICALS

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jodhpur in Jaipur district of Rajasthan during *kharif* season of 2017 on loamy sand soil. The experiment consisted of four fertility levels (control, 50% RDF, 75% RDF, 100% RDF) and stress mitigating chemicals (control, 75 ppm SA, 75 ppm SA + 2% Urea and 500 ppm Thiourea). The total 16 treatment combinations were tested in randomized block design with three replications. Results indicated that the application of 75% RDF being at par with 100% RDF, significantly increased the number of pods/plant, seeds/pod, test weight, seed, straw and biological yield. Results further revealed that among stress mitigating chemicals 500 ppm thiourea remaining at par with SA + 2% Urea significantly increased the yield determining characters of mungbean viz., number of pods/plant and seeds/pod over lower levels. It also recorded significantly higher seed, straw and biological yield.

Keyword: Mungbean, stress mitigating chemicals, fertility levels

DEVELOPMENT OF DESIGNS USING TRADITIONAL KASHIDAKARI EMBROIDERY MOTIFS

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The beautiful and intricate Kashmir embroidery known as ‘*Kashidakari*’ is recognized everywhere for its beauty of craftsmanship, selection of motifs, choices of colour, texture, etc. Motifs used in traditional embroideries found on textiles are often symbolic, based on religious and cultural background. Now, as the traditional embroideries are widely used and adopted as per the latest trends one of them is *kashidakari* embroidery. Secondary sources like books, research dissertation, websites, museums and craft fairs were explored and 200 traditional motifs of *kashidakari* embroidery were collected. Out of 200 motifs, top ranked ten motifs

as per experts preferences, were selected for designs development. Thirty designs were developed using selected motifs with the help of Corel DRAW X3 software. The design catalogue was prepared that included collected traditional motifs and developed innovative designs using selected motifs which could be assessed as and when needed. The study concluded that all the developed designs using traditional motifs were highly liked and these developed designs can be used for designing of different textile products.

Keywords: Kashidakari embroidery, traditional motifs, designs, CAD software.

NEMATODE COMMUNITY ACT AS INDICATORS OF POLLUTION

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Nematode communities showed possibilities to be good indicators of different kind of disturbances in ecosystems. Soil nematodes are ubiquitous; they are well adapted to a wide range of environmental conditions; and they respond rapidly to disturbance. Some groups of nematodes can survive under disturbed environmental conditions such as global climate change, which also in the last decades influenced the water regimes of soil, which is crucial for a nematode survival. There are differences in feeding behaviour and predominantly, omnivore and predators have great sensitivity to disturbances. Structure of nematode communities can reflect differences in agro ecosystem conditions, organic adding, heavy metal compounds, soil tillage system, air pollution, river pollution, and different kind of environmental monitoring. Above that, they play a great role in soil nutrition cycle, especially free living nematodes. For those reasons, nematode communities have potential to serve as very good biotic indicators of soil processes. In addition, nematodes are transparent, their diagnostic internal features can be dissection, and their life course is short. These features enhance their bio indicator potential for assessment of environmental health. In recent years, the relationship between heavymetal contamination and soil nematodes has attracted increasing attention.

Key words: Nematode, Predatory, Pollution, Indicator.

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Keywords: Nematode, Predatory, Pollution, Indicator

NUTRITIONAL CHARACTERISTICS OF QUINOA (*CHENOPODIUM QUINOA WILD.*)

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Quinoa (*Chenopodium quoin Wild.*) a starchy, dicotyledonous indigenous plant of the Andean region is a pseudo cereal widely cultivated in South America. In India, the quinoa is cultivated in Andhra Pradesh, semi-arid Rajasthan and Uttarakhand, in between October and March (rain fed crop). Quinoa is also an excellent example of "functional food" which may help reduce the risk of various diseases. This grain has attracted attention as a new food resource, because of the quality and nutritional value of its proteins. It is mainly rich in lysine, making its protein more complete than most vegetables, having in particular amino acid composition close to the ideal protein balance recommended by the Food and Agriculture Organization (FAO) and similar to milk. It exhibit anti-oxidative, anti-hypertensive, anti-diabetic properties Quinoa grains as a functional ingredient were used in gluten free infant foods, soups, noodle, sweets, and beverages, malted quinoa in beer manufacture and bakery products. The germination of quinoa seeds has been reported to improve the protein digestibility, mineral bioavailability, vitamin, antioxidant activity, flavanoids, phytosterols, and polyphenols. The White quinoa seeds were analyzed for the physical properties like hydration capacity (34 %), swelling capacity (56%) and water absorption capacity (110 %). it also contains protein 13.5%, fiber 8 g, fat 8.85

%, calcium 57.3 mg, iron 10.68 mg, methionine 5.6g, lysine 10.2g, phenol 17.2 mg, flavonoid 37.2mg and antioxidant activity DPPH method (Gallic acid equivalent mg/ml) 14.27% per 100 gm. The anti-nutritional factor (saponin) in quinoa was found to be 2.8 % which was reduced to 0.18 % by sequential washing and soaking of quinoa in distilled water. The germination of quinoa seed was kept at 20°C for two days reduces the maximum of saponin content. Due to the high cost and little knowledge of its benefits, it is not widely used by consumers. Since it has high commercial value and excellent nutritional quality, the present study aims to evaluation on functional, nutritional benefits and its anti-nutritional factors which may increase the awareness of quinoa for consumption.

EFFECT OF FEED SUPPLEMENT ON NUTRIENT UTILIZATION AND MILK PRODUCTION IN CATTLE

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The present investigation entitled was carried out in the department of A.H. & Dairying at dairy farm during year 2017-2018 at C.S.A. University of agriculture and technology Kanpur (208002). The major problem of lower milk production at dairy farm. Twelve Sahiwal cows were selected for trial. A balanced diet was one which supplies all the nutrients necessary to nourish the animal properly during twenty four hours period. Four cows in each group T₁ was served as control group whereas T₂ and T₃ groups were provided 50 and 75 gm Dugdh Ganga Mineral supplement, respectively. The animals of all the groups were fed according to ICAR feeding standard. Water was provided ad libitum twice daily. The average dry matter consumption per day per animal was recorded 9.17 ± 0.17, 9.18 ± 0.062, and 9.16 ± 0.091, kg in T₁, T₂ and T₃ groups, respectively. The dry matter consumption (gm/day) by the animal in all the groups. Significant higher (p<0.005) DCP and TDN intake was observed in T₃ group as compared to other groups of Sahiwal cows. The dry matter digestibility was observed 60.16 ± 1.84, 62.06 ± 0.06, and 62.76 ± 0.81, in T₁, T₂ and T₃ groups, respectively. The digestibility coefficient of crude protein was 60.83 ± 1.84, 61.68 ± 0.57, and 63.13 ± 0.81 in the observed T₁, T₂ and T₃ respectively. The digestibility coefficient of ether extract in three groups, viz., T₁, T₂ and T₃ were 65.25 ± 1.41, 66.33 ± 0.44 and 67.66 ± 0.62 respectively. The digestibility coefficient of Crude fiber was 53.66 ± 1.76, 56.04 ± 0.52 and 57.37 ± 0.74 in group of T₁, T₂ and T₃, respectively. The digestibility coefficients of Nitrogen free extract were 62.23 ± 1.6, 64.31 ± 0.50, and 66.55 ± 0.70, in T₁, T₂ and T₃ group of respectively. The organic matter digestibility was 60.49 ± 0.70, 61.79 ± 0.47, and 63.04 ± 0.11 present in animal of group T₁, T₂ and T₃ respectively. The average weekly milk production lit/day were 41.30 ± 0.192, 44.50 ± 0.118 and 48.49 ± 0.333 in T₁, T₂ and T₃ respectively. The higher milk productions were recorded in T₃ groups among the other groups. Digestibility coefficient of DM, CF, NFE, and Organic matter were also higher in group T₃. It was concluded that the feed supplement (Dugdh Ganga) were found beneficial for proper milk production and nutrient utilization without any ill effect.

ADVANCES IN IMPROVING SUGAR RECOVERY AND PRODUCTIVITY OF SUGARCANE IN INDIA

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Among the sugarcane growing countries, the highest sugar recovery of about 14% is being obtained in Australia. South Africa, Brazil, USA, and Columbia also recorded high recovery of about 11-12% as against about 10.17% in India. India is unique for being the second largest producer and biggest consumer of sugar in the world. During 2017-18 cane productivity of 72.5t/ha was recorded in India. There is a vast difference in recovery from one state to another or from subtropical to tropical part of India. Similarly, within state the recovery varies significantly from one factory to another factory. Though, the recovery is dependent on factors like varieties, agronomic package of practices and processing and mill management. In India, sugarcane is cultivated from 8° N to 30° N latitudes covering a large variation in climate, soil, spread of crop and its productivity. Sugar recovery in sugarcane growing districts fluctuates between 5.75 to 11.45 per cent affecting sugar production in the country in an erratic fashion. If one looks into the recovery scenario of the country for the past 60 years, it will appear that the recovery has been ranging from 9.5 to 10.3 per cent with 0.025 per cent compound growth rate only. Although the area under this crop is maximum in the alluvial soil tract of subtropics, the cane yield is the highest in the humid tropics of peninsular India. Besides this, sugar recovery is also influenced by biotic and abiotic stresses. Post harvest management of sugarcane also plays an important role in realizing better sugar recovery by the sugar factories. A study in Maharashtra has indicated increase in sugar recovery due to sub-soiling (Jagtap *et al.*, 1991). Pol in cane 14.2(%) found in simultaneous planting of sugarcane + wheat (Dec.) as compared to wheat (Dec.)-Sugarcane (April) with pol in cane 12% (Saini *et al.*, 2008). Sugar recovery mainly depends on sugarcane variety, condition of the crop at the time of harvest, weather conditions prevailing during the crop growth and duration of the crushing season (Rao *et al.*, 1979). It may be concluded that by selecting a variety, planting methods, fertilizer application methods, harvesting time, mill efficiency will help greatly in achieving the higher sugar recovery.

STUDIES ON THE BIO-EFFICACY OF CARBOSULFAN IN COTTON (*GOSSYPIUM ARBOREUM*)

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Experiment was conducted during *Kharif* 2014 and 2015 at research farm of Regional Agriculture Research Station, Khandwa (M.P.) with seven treatments namely, untreated control, carbosulfan 25 EC 250 g a.i., carbosulfan 25 EC 312 g a.i., carbosulfan 25 EC 375 g a.i., fipronil 5% SC, imidacloprid 17.8 % SL and thiamethoxam 25% WG./ha. These seven treatments were tested under randomized block design (RBD) with three replications against aphids and thrips, and also observed the phytotoxicity effect of different chemical treatments on cotton plants as well as record their impact on natural enemies of cotton pests like, *Coccinellid* beetles and *Chrysoperla* populations. Seeds of cotton CV. Bunny Bt (BG II) were sown in both experimental years. All the treatments were sprayed when target insect pests incidence was above Economic Threshold Level (ETL) and second application of spray was applied 15 days after first application. Phytotoxicity assessment in cotton was undertaken with by testing three different doses of carbosulfan 25% EC was applied on crop. Phytotoxicity observations were recorded at 1, 3, 5, 7, 10 and 15 days after application of the chemical. The level of phytotoxicity was estimated by visual assessment. The highest percent control of aphids recorded in treatments carbosulfan 25% EC @ 1500 ml/ha after second application. While similarly significantly lowest thrips incidence was recorded in carbosulfan 25 EC @ 1500 ml/ha after both application. Effect of carbosulfan 25 % EC against natural enemies revealed that there is no significant change observed in the population between the insecticidal treatments and the untreated control. Carbosulfan 25% EC @ 1500 ml/ha has recorded significantly highest yield of 16.80 g/ha (2014) and 18.71 g/ha (2015). It was at par with the treatments of carbosulfan 25% EC @ 1250 ml/ha. There was no phytotoxicity symptoms were observed on cotton plants after application of carbosulfan 25% EC @ 1250 ml/ha (x dose) and 2500 ml/ha (2x dose) at 1, 3, 5, 7, 10 and 15 days after application.

Keywords: Phytotoxicity, Natural Enemies, Aphid and Thrips

DROUGHT STRESS AND ITS TOLERANCE MECHANISM IN PLANTS

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Drought is a period or conduction of unusually dry weather condition within a geographic area where there is a lack of precipitation. Drought stress in plants may be induced by many environmental factors such as low or no rainfall, high salt concentration water or nutrient solution, low temperature etc. Plant growth reduction under drought stress may be attributed to loss of turgor, resulting in obstructed cell elongation. Relative water content, stomatal conductance and rate of transpiration are the important factors that influence plant water relations. All these were reported to be declined or suppressed under drought condition in different crops like rice, wheat, potato etc. Nutrient relations in plants also get affected at drought stress due to limited nutrient uptake and their transport that may be related to limited availability of energy for assimilation of nutrients. Possible reasons behind declined photosynthesis under drought condition in plants are lower rubisco activity and reduced activities of major enzymes like PEPcase, PPDK etc., which result in limited carboxylation. Rate of respiration, on the other hand, gets increased under drought stress, leading to an imbalance in the utilization of carbon resources, reduced production of adenosine triphosphate and enhanced generation of reactive oxygen species. Generation of reactive oxygen species (ROS) is well-known in plants at drought stress. Chief mechanisms for drought resistance in plants include antioxidant defense, membrane stability and osmotic adjustment. Antioxidant defense involves induction of enzymatic activities of superoxide dismutase, catalase, peroxidase etc., where non-enzymatic mechanism includes involvement of glutathione, cysteine, ascorbic acid, carotene etc. Osmotic adjustment refers to accumulation of compatible solutes of higher concentration in cytoplasm and vacuole to maintain cell turgor, contributing to a reduction in the plant water potential. These osmotic solutes include simple sugar (glucose, fructose); sugar alcohols (glycerol and methylated inositols); complex sugars (trehalose, raffinose and fructans); quaternary amino acid derivatives (proline, glycine betaine, β -alanine betaine, proline betaine). So, introduction of these traits will be helpful for successful breeding programme for developing genotypes with improved tolerance mechanism.

Keywords- Drought; ROS; antioxidant defense; compatible solutes

STUDIES OF AGRICULTURAL SOIL OF DISTRICT SAHARANPUR FOR INCREASING THE PRODUCTIVITY

SATYA PRAKASH & ASHOK SINGH

K.V.K. Saharanpur, S.V.P.U.A. & T, Meerut U.P.

A reconnaissance Study Was Carried out at Soil Testing Lab of Krishi Vigyan Kendra Saharanpur U.P. to know the Soil status of district Saharanpur U.P. against Availability of Organic matter, Ph range and Micronutrients particularly Cu,Zn, Fe and Mn. Total 22 Soil sample were collected From different Blocks covering whole district and analysed for DTPA extractable Micronutrients

and evaluated their status in agricultural soil. The result revealed that Ph range was going to up in comparison to neutral soil it range found 7.42-8.53 and Organic matter is decreasing and it became average 0.27-0.56 mean value 0.415% and Micronutrients available Zn, Cu, Fe, and Mn ranged ppm with the mean value (86, 10, 64,53) and 6.62ppm respectively and require their judicious application while available Cu, Fe and Mn were found adequate in the soil. due to low Organic matter the water holding capacity of soil decreasing resulting number of irrigation increasing so that the cost of cultivation also increased. It is recommended that Farm Yard Manure, Green manure or Organic manure are needed for sustainable agriculture in Future. If Ph is more than 8.30 than reclamation is needed through Gypsum or any other amendment.

VARIETAL PERFORMANCE OF BOTTLE GOURD IN WESTERN PLAIN ZONE OF UTTAR PRADESH

SATYA PRAKASH B.P.SHAHI

Krishi Vigyan Kendra Saharanpur, S.V.P.U.A. & T. Meerut U.P.

A field experiment was conducted on the varietal performance of Bottle gourd in Saharanpur under Western plain zone of Uttar Pradesh by Krishi Vigyan Kendra at Farmers field during 2016-17 & 2017-18 in Zaid season. The experiment was conducted at Twelve Farmers Field covering six Blocks of Saharanpur District. Under this trial six varieties of Bottle gourd were evaluated. The study revealed that variety NDBGH-4 gave the highest yield 535q/ha and minimum yield 475q/ha. The average yield was 498.7q/ha and other varieties like Narendra Rasmi gave the yield 388.17 q/ha and Pusa Hybrid-3 gave the yield 362 q/ha respectively. The yield of variety NDBGH-4 was 28.47% Higher in comparison to other variety like Narendra Rashmi. And net return variety NDBGH-4 was Rs 2.48 lakhs/ha and C: B. ratio was found 1:3.4 and in Narendra Rashmi gave the net return Rs 1.73 Lakh/ha and C: B. ratio was 1:1.50. The yield, net return and B.C.R. of variety NDBGH-4 was significantly Higher in the Comparison of other varieties evaluated under trial. So that on the basis of the performance it is suggested that Bottle gourd variety NDBGH-4 is the best for western Plain Zone for the maximum return.

REVOLUTION OF FLORICULTURE THROUGH NATURALLY VENTILATED POLYHOUSE IN THE DISTRICT SAHARANPUR U.P.

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A Study was Conducted During 2016-17 & 2017-18 in the Saharanpur District To Evaluate the Progress and Role Of Naturally Ventilated Polyhouse during the Joint Verification Promoted by Department of Horticulture with the Technical Supported by Krishi Vigyan Kendra Saharanpur. During Study it were found that in 2013-14 there was only 5 polyhouse in the District Saharanpur and Farmers were Earning 3- 4lakhs from 4000square meter Poly house Annually and due to Insect, Pest & disease about 38- 42 percent crops were damage. Resulting Net Income of Farmers were reduced. To Keeping of Above View Department of Horticulture Promoted The Naturally Ventilated Polyhouse With the Technical Support of KVK Scientist Under National Horticulture Mission. Due to technical Support of KVK Scientists Insects, Pests & Disease Losses reduced and it became 5-6% and Now farmers are growing Gerbera, Roses & Carnation and gaining 12-14 Lakhs per 4000 Squares Meter Annually. Due to Good return Farmers started to establish the Naturally Ventilated Polyhouse and now it became Total 57 in the Distt Saharanpur. On the Above basis Result revealed that Revolution of Floriculture Through Naturally Ventilated Polyhouse in the District Saharanpur is Possible and Farmers are getting Good Returns From Floriculture.

CONSTRAINTS IN ADOPTION OF IMPROVED SUGARCANE CULTIVATION TECHNOLOGY BY SUGARCANE GROWERS IN EAST CHAMPARAN DISTRICT OF BIHAR STATE

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The present investigation was carried out during the year of 20016-2017 in four selected villages at Kotwa block in East Champaran district of Bihar state. 30 respondents were selected from each village by using simple random sampling procedure, thus the total 120 respondents were considered for the study. Information relating to various problems faced by the sugarcane growers was enlisted in pre-tested interview schedule. Oral interview was schedule was used to collect data from one hundred twenty (120) respondents who were randomly selected. The data were analyzed statistical percent and mean score analysis. The results of study revealed that in economical constraints majority of respondents had strongly agree (81.67 per cent) face in high cost of input in cultivation of sugarcane followed by strongly agree In socio cultural constraints most of respondents (74.16 per cent) face in continuous adoption of traditional packages It is observed that, strongly agree the technical constraints majority of respondents (85.00 per cent) face lack of knowledge about insect pest. In Technical constraints, Majority of respondents (90.84%) had faced the lack of knowledge about Improved implements and spraying instruments are not available in rural area and also observed that majority of respondents (88.33%) faced constraints in post harvest was Non availability of juice extractor at village.

Key word: Constraints, Production technology, Sugarcane growers.

ADVANCED PRODUCTION TECHNOLOGY OF CUCUMBER UNDER GREENHOUSE CONDITION

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Cucumber is one of the most important cultivated greenhouse crops. Most varieties are female hybrid cultivars, but monoecious cultivars are still in use in some South East European countries. Cucumber cultivation as for other fast-growing vegetables is characterized by technologies designed to increase intensive production. Cultural practices aim to provide an appropriate root medium, balanced root or leaf growth, balanced source or sink development, and a good harvesting rate of high-quality fruits. The most important growing practices are micro climate control, fertigation and training system. The basic principle of a training system is to uniformly maximize the leaf interception of sunlight throughout the green house. The selection of a system will largely depend on the greenhouse facility, the production system, and grower preference. A vertical cordon system trains plants vertically to an overhead wire. Once the plants reach the wire, they are topped and then pruned using an umbrella system a second popular training system is the V -cordon. Through pruning growing point of the main stem is removed when one or two leaves have developed above the wire. Two lateral branches near the top of the plant are allowed to grow and are trained over the overhead wire, in downward direction. Cucumber is very sensitive to both biotic and abiotic stresses, and serious problems can arise in the case of inappropriate crop management. The development of the fruit is depends on the constant production of leaf axils. If too many fruits are set at once, fruit thinning is necessary to avoid malformed and non-marketable small fruit. Such fruit, as they appear, should be removed. Harvesting may begin 50 days to 65 days after planting. Harvesting is done three to four times per week. 8-10 kg fruits produce per plant.

CROP RESIDUE AND WATER MANAGEMENT IN RICE-WHEAT SYSTEM

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Crop residue management is posing a serious problem in the rice (*Oryza sativa*)–wheat (*Triticum aestivum*) cropping system, which is widely practised in the Indian Subcontinent and China, and covers about 22.5×106 ha. The problem is serious because there is very little turn-around time between rice harvest and wheat sowing. Three practices, namely, residue removal, residue burning and residue incorporation were important components of residue management. Results of various research on residue management showed that both rice and wheat residues can be safely incorporated without any detrimental effects on the crops of rice or wheat grown immediately after incorporation. Incorporation of crop residue also improved soil fertility status as judged by organic carbon and available phosphorus and potassium contents. Residue incorporation should be preferred over residue burning, which results in the loss of valuable plant nutrients and is both an environmental and a health hazard. The incorporation of rice straw in wheat and wheat straw in rice also caused yield reductions. However, yield reductions can be overcome by either allowing some time between incorporating residues and sowing the next crop or by composting rice straw or adding farmyard manure (FYM). High crop yields were obtained from the combined long-term use of fertilizers and crop residues. Control of weeds, diseases, and pests is important for the success of residue management practices. A mold-board plow or disk can incorporate residue into the soil. It has been observed that Wheat residue retained affects yield parameters, yield and water use efficiency of irrigated wheat. It has reported that soil physico-chemical properties at harvest of rice has improved by recycling of crop residue.) They find that residue retention improves the water stability of aggregates, clod breaking strength and soil organic carbon (%) in a silty loam soil under rice-wheat cropping system. However, Rice Straw Application enhance Soil Physical Properties in Rice–Rice Cropping System over a 10-Year Period on a Clayey Soil if applied as Rice straw to meet 50 % N. In view of above, it may be concluded that the crop residue incorporation improve physical, chemical and biological properties of soil. In long-term incorporation of crop residue increase the productivity. Overall, incorporation of crop residue increased the productivity. Incorporation should be done at least 10 days and preferably 30 days before the establishment of succeeding crop.

GROWTH AND YIELD BEHAVIOR OF URAD BEAN (*VIGNA MUNGO*) AS INFLUENCED BY SOWING AND IRRIGATION METHODS AND NUTRIENT MANAGEMENT PRACTICE IN NORTH WESTERN PLANE ZONE

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The cultivation of *kharif* urdbean in western Uttar Pradesh faces the problem of water logging and poor aeration which adversely affects the growth in flat field conditions. Clay loam soils with good moisture holding capacity may be use to grow the crop by opting land management practices viz., ridge and furrow (Thakur *et al.*, 2011) and broad bed which may helps to increase the income to the farmers besides preventing land degradation due to runoff, erosion and compaction etc. Low and imbalanced use of nutrients is one of the reasons for low productivity and depletion in soil fertility. In North-Western India urdbean is often sown under marginal and sun-marginal lands. Thus, the balanced and efficient fertilizer nutrition is needed, which could be achieved

through combined use of NPK with bio fertilizers generally supplied with sub-optimal doses of fertilizers leading to low productivity of the crop. Sulphur (S) and iron (Fe) deficiency is interestingly being reported from different zones of the country essentially due to increased crop yield coupled with intensive agriculture and a drastic shift from low analysis fertilizers to high analysis fertilizers which contain little or no elemental S. Sulphur and iron deficiency is wide spread in Indian soils, and until its correction the optimal gains from intensive N, P and K investments will not be achieved. Various scientists have worked upon land configuration and nutrient management. Tomar *et al.* (2015) observed that performance, productivity and profitability improved by land configuration and nutrient management option. Raised bed sowing proved its superiority over flat bed by producing higher grain yield besides, empowering growth, yield attributes, nodulation, nutrient uptake and qualities. Patel *et al.* (2010) revealed that application of 40 kg S ha⁻¹ as gypsum + elemental sulphur (1:1) and 25 kg FeSO₄ ha⁻¹ as basal application significantly increased growth parameters and yields. Moreover, it also maximized significantly the nutrient uptake of nitrogen, phosphorus, potassium, sulphur and iron (Meena *et al.*, 2013). In view of the research findings observed by different workers on growth and yield behavior of urad bean as influenced by sowing methods and nutrient management practice in North Western Plain Zone suggests that urad bean can be successfully grown under semi arid conditions of Uttar Pradesh on raised beds along with sulphur @ 40 kg ha⁻¹, iron @ 2.5 kg ha⁻¹, nitrogen @ 20 kg and phosphorous @ 40 kg ha⁻¹.

META-ANALYSIS – A NEW DIMENSION OF RESEARCH IN AGRICULTURE

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In this era of information, a lot of information is available a click away. Research scholars come across the problem of conflicting results for similar objectives while reviewing the literature. Meta-analysis provides a scientific method for integration of various studies. In this paper we have given a brief introduction to the theory of meta-analysis. A stepwise methodology is also included which will come handy to the readers while performing one for their own purpose. We have tried to explain the use of the methodology with the help of a case study in the end of this paper for the purpose of illustration.

DOUBLING FARMER'S INCOME BY 2022 THROUGH LIVESTOCK INTERVENTION

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Agriculture has been a way of life and continues to be single most important livelihood by the masses. In the recent past, the sector has been facing regular distress and crisis posing a severe threat to peasants in practicing agriculture as a main source of livelihood. Under this perspective, the Government of India in 2016 announced to double the farmers income by 2022 by shifting the focus from agricultural output and food security to income security. Over 60 percent of the country's workforce depend on agriculture as livelihood, while agriculture and allied activities contribute to only a little over 15 per cent to India's Gross Value Added (GVA). The income of a farmer in India is less than \$2 per day. According to NSSO survey in 2014, the income of an average farm household is about Rs 6000 (\$90 per month) only 50 percent of which comes from farming. Last time, the attainment of doubling farmer's income in India was accomplished in 13 years. However, there are still many challenges before farmers such as increasing input costs, absence of market infrastructure, irrelevance of minimum support price, non realization of benefits from insurance. This challenge is so huge to double the farmer's income within six years by 2022 which requires a compound annual growth rate of 12.25% from the base year 2016. Livestock constitutes 30% of the total income from agriculture sector. This sector has experienced growth rate of 4.5% during 2000-01 to 2013-14. Maintaining the same growth in livestock sector in the coming years will raise total farm income by 10.8 percent in seven years and 16.6% in ten years period. Therefore, augmenting the contribution of Livestock sector will help in the doubling farmer's income. This article discusses the pathway and strategies for doubling the income of farmers by 2022 and also highlights the bottlenecks in its efforts to achieve this ambitious plan.

YARTSA-GAMBOO –AN ECOFRIENDLY ENTOMO-FUNGAL COMPLEX

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Cordyceps sinensis is a fungus parasitizing the larvae of a moth of the genus *Thitarodes* (*Hepialus*), which lives in alpine grasslands of the Indian Plateau. Collection and trade of the caterpillar fungus is one of the most important sources of income for pastoral Indian hilly communities. Indian hilly know the fungus as Yartsagambou, "summer grass-winter worm", and often derive over 50% of their annual cash income from its collection in spring and summer. Written records in Pithoragarh date back at least 500 years, but the market is driven by Chinese consumers, who know it as chongcao (dongchongxiacao), a highly valued tonic in

Traditional Chinese Medicine. A field study in Laspa in Uttarakhand and other sites in Ralam (India), analyzed the local market, and the quantity and value of the harvest. Results are contrasted to Chiplakot and Laspa market prices, which peaked at 40,000 INR/kg in 2003/4. Now at 2019 the market value of the product is 10,0000/kg. Such information as is available regarding *Cordyceps* collection in other plateau regions, such as Taklakot and adjacent Autonomous region as well as the Himalayas, is integrated. The Yartsagamboo is ecofriendly and environment friendly in nature, due to its species extraction the other species are suffers who depends upon them to survive. The YG is also known as **panacea** of all **ill**. In India and adjoining countries now the mixture is commercial cultivated in the labs at large scale and farmers for the commercial purposes especially for making the product as energy booster, muscle booster, toxic removal and stamina booster.

Key words: Yartsa gamboo, ecofriendly, high hill, market, cultivation etc.

EFFECT OF NITROGEN AND PHOSPHORUS LEVEL ON K & S CONTENT AND THEIR UPTAKE AT DIFFERENT GROWTH STAGES OF POPCORN (*ZEA MAYS* VAR. *EVERTA*) IN SOUTH SAURASHTRA REGION OF GUJARAT, INDIA

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Among all maize corn Popcorn is one of the major ones, which is popular as a snack food in many parts of World. Popcorn is also known as popping corn. Popcorn Size of kernels is small but the endosperm is hard. It's kernels are composed of hard starch, when heated, swell and burst. Popcorn balls are were hugely popular around the turn of the 20th century. A field experiment was conducted in 2013-14 to investigate effect of different levels of potassium and sulphur on content and uptake of nutrients (N, P, K and S) in different plant parts, at different growth stages of popcorn (*Zea mays* var. *everta*) at the Instructional Farm, College of Agriculture, Junagadh Agricultural University, Junagadh during *rabi* season. The experiment consisted of four levels of nitrogen (0, 90, 120, 150 Kg N ha⁻¹) and four levels of phosphorus (0, 45, 60, 75 Kg P₂O₅ ha⁻¹) making sixteen treatment combinations tested in factorial randomized block design with three replications. The results indicate that application of 150 Kg N ha⁻¹ and 75 Kg P₂O₅ ha⁻¹ remain significantly unaffected on concentration of potassium and sulphur in leaves, stem and root part of plant at 30 DAS and 60 DAS of popcorn. The concentration of potassium in leaves, stem, root part and grain of the plant did not significantly influenced due to various level of Nitrogen and phosphorus application at harvest. The interaction effect of nitrogen and phosphorus was found to be non-significant in respect of potassium and sulphur content at 30DAS, 60 DAS and at harvest.

Keywords: popcorn, Nitrogen, Phosphorous, content, uptake

GENETIC DIVERSITY AND RELATIONSHIP ANALYSIS AMONG PEA GENOTYPES (*PISUM SATIVUM* L.) BASED ON MORPHOLOGICAL TRAITS

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The present investigation was carried out to identify the nature and magnitude of genetic divergence among fifty five genotypes of Pea for eleven morphological traits using Mahalanobis D² statistics. Based on cluster analysis, the genotypes were best fitted into six clusters. The maximum and minimum genotypes grouped in cluster III (14) and minimum were grouped in Cluster IV (4) respectively. The maximum intra-cluster distance was shown by cluster I (D² 2.543) indicating maximum difference among the genotypes within and the minimum value was shown by cluster II (D² =1.827). Maximum value of inter-cluster distance (D²=6.471) was recorded between cluster I and cluster IV revealing that the genotypes of these clusters were highly diverse from others and can be used as divergent parents for hybridization and selection. Further, on the basis of variation in cluster means for different character the genotypes in cluster I had highest mean values for number of pods per plant, green pod yield per plant, shell weight per plant and seed yield per plant. Whereas, the genotypes of cluster IV showed maximum mean for days to 50% flowering, plant height, length of first fruiting node and number of seeds per pod. Thus, for getting high heterosis for recovering transgressive segregants, genotypes from cluster I and IV can be used as distant parents in any breeding programme for successful pea improvement.

Keywords: Pea, Genetic Diversity, Morphological Traits

MOLECULAR IDENTIFICATION AND CHARACTERIZATION OF YELLOW VEIN MOSAIC VIRUS (YVMV) IN ABELMOSCHUS ESCULENTUS IN JORHAT, ASSAM, INDIA**SHANKAR HEMANTA GOGOI*, PALASH DEB NATH****Department of Plant Pathology, Assam Agricultural University, Jorhat- 785013, Assam, India**

Begomoviruses transmitted by whitefly (*Bemisia tabaci* Genn, Family-Aleyrodidae) cause severe damage to crop plants showing varying symptoms in different crop species. Okra Yellow Vein Mosaic Virus (OYVMV) is one of the most devastating diseases reported in okra (*Abelmoschus esculentus*) cultivation worldwide. The OYVMV disease was first reported by Kulkarni (1924) from Bombay, India. The extent of losses due to the disease depends upon the stages of plant growth at which infection takes place. In this study, OYVMV disease symptoms were evaluated in field conditions and molecular detection and characterization was done in lab condition. Symptoms observed in the field were viz. very mild symptoms, initial vein clearing; leaf veins completely yellow and inter-veinal regions remain green or normal; whole leaf yellow coloured, leaf margin start drying. Diseased samples collected from the location were subjected to PCR amplification with OYVMV specific primers to identify the disease infection. PCR analysis result showed a clear band of 800bp band in Agarose gel electrophoresis, confirms the presence of OYVMV in diseased plants. All symptomatic samples showed positive results for OYVMV specific primer while the healthy samples showed negative results. Sequencing was done and the OYVMV sequence showed 92.91-97.99 % similarities with other isolate present in the NCBI database. Further phylogenetic analysis reveals that OYVMV Jorhat isolate was closely related with West Bengal isolate i.e KJ462082.1 (Bhendi yellow vein mosaic virus isolate WB1 segment DNA-A).

Keywords: Begomoviruses, *Abelmoschus esculentus*, OYVMV, PCR, Sequencing, Phylogenetic analysis

ECONOMICS OF PRODUCTION AND MARKETING OF MANGO IN DISTRICT LUCKNOW, (U.P.)**SHARAD YADAV, KULDEEP MAURYA, AMREES VERMA AND AJAY SINGH***

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The present study was undertaken to know the growth trend, cost and returns, producer's share in consumer's rupee and problem in production and marketing of mango in district Lucknow, Uttar Pradesh. Data pertained for the year 2015-16. The growth trend during 2005-2015 of area, production and productivity of mango in district Lucknow recorded 0.69%, 3.0% and 2.3% respectively. The productivity of mango in district Lucknow was 20.08 tons/ha. The study of economics of production reveals that during establishment period the cost came Rs. 122050/ha of which 50.38% i.e. Rs. 61500 incurred during first year with average cost Rs. 30572.50/ha for first four years. The average fruiting period cost came Rs. 35740 for different age group orchards. The returns from 11-15 year aged orchard recorded maximum i.e. Rs. 418000/year. The average benefit-cost ratio was calculated 1:10.76. The maximum producer's share in consumer's rupee was calculated in channel III i.e. 78.71%. The price spread was in the range from 21.29% to 23.27%. Incidence of pest and diseases, irregular bearing, fruit drop are the main constraints of production.

EFFECT OF DIFFERENT PRUNING INTENSITIES ON GROWTH AND YIELD OF NECTARINE (PRUNUS PERSICA L.VAR. NUCIPERSICA) CV. SNOW QUEEN**¹SHARBAT HUSSAIN, ¹RIFAT BHAT, ²KHALID RASOOL DAR, ¹MOHAMMAD TOUSEEF ALI, ¹AB WAHEED WANI AND ²SHEERAZ WANI**

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The present investigation was carried to evaluate the effect of different pruning intensities on growth and yield of nectarine cv. Snow Queen at fruit research farm, SKUAST-Kashmir Shalimar Srinagar during the year 2016 and 2017. The experiment was laid out in randomized complete block design with nine pruning treatments and three replications. The results obtained revealed that there is a significant increase in shoot growth and leaf area with highest pruning intensity viz., 2/3rd head back and 20 % thinning out. The results further revealed that with the increase in pruning intensities total yield was reduced however, marketable yield of quality fruits were increased. Highest total yield was obtained in those treatments where minimum pruning intensity i.e. 10 % and 20 % thinning out of the plants was performed.

Keywords: Growth, Yield, Nectarine, Pruning, Pruning intensity.

QUALITY MANAGEMENT IN POME FRUITS (APPLE AND PEAR)

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Fruit quality is the degree of excellence or superiority includes many parameters such as fruit size, fruit shape, fruit weight, fruit colour, fruit firmness, soluble solid contents etc. All these attributes gives the fruit degree of excellence and economic value. The development of high quality fruit is influenced by many practices like mineral nutrition, plant growth regulators, irrigation techniques, tree training and pruning, crop load management etc. Result of these practices depends on their magnitude, duration, plant stage. Genotype (cultivar and rootstock) has an important role in flavour quality, nutrient composition and post harvest life potential. The fruits from dwarfing rootstocks had more fruit weight, fruit colour and firmness as compared to the semi-dwarfing rootstocks. Training and pruning plays a significant role in quality improvement of fruits by improving the light distribution into tree canopy. Pruning increase the leaf to fruit ratio and thus increase the fruit weight, size, colour and TSS. Early thinning had a positive effect on fruit quality, resulting in larger fruit with high sugar levels.

IMPORTANCE OF BIOFERTILIZERS IN QUALITY FRUIT PRODUCTION OF TEMPERATE FRUIT CROPS

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India having 2.27 per cent of the total land area, feeds more than 16 per cent of world population. Such a huge population magnifies the demand for more food from shrinking cultivated area which requires huge amount of fertilizers and other inputs. The chemical fertilizers have played a very significant role in intensive food production, which has brought many fold increase in production, but large scale use of chemical fertilizers causes problem of ground water and environmental pollution through leaching, volatilization, denitrification and wastage of nutrients. Indiscriminate use of chemicals contributed in loss of soil biological dynamism and productivity along with addition of salts to the soil. To revive the soil health and living an alternate source has become essential, so concept of biofertilizer came forward, which can be a good supplement for a chemical fertilizers. Biofertilizers or microbial inoculants are carrier based ready to use live bacterial or fungal formulations, which on application to plants, soil or composting pits, help in mobilization of various nutrients by their biological activity and plays a very significant role in improving soil fertility by fixing atmospheric nitrogen both in association with plant roots and without it, producing numerous plant growth regulators, protecting plants from phytopathogens by controlling or inhibiting them, improving soil structure and bio remediate the polluted soils by sequestering toxic heavy metal species also, they are environmental friendly playing a significant role in crop production. Nitrogen fixing bacteria and phosphate solubilizer are the main biofertilizers for temperate horticultural crops. The integration of biofertilizers with organic manures and inorganic fertilizer can achieve the highest fruit yield with improved fruit quality and soil fertility status of fruit crops.

Keywords: Biofertilizers, temperate fruits, yield, quality, soil health.

EFFECT OF CADMIUM CHLORIDE ON OPERCULAR BEAT RATE AND OXYGEN CONSUMPTION OF FRESHWATER STINGING CATFISH *HETEROPNEUSTES FOSSILIS*

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Heavy metals are well known for their adverse physiological and behavioural effects on aquatic organisms. Aquatic organism directly depends upon water for their all physiological needs. Gills are the primary site of contact of any waterborne pollutant and these pollutants cause many degenerative changes in gills, which results in alteration in histology and physiology of gills. Some of these changes are observable and can be recorded without sacrificing the animals, like opercular beat, oxygen consumption, morphological and behavioural changes etc. Many adverse effects has been observed during study due to acute () and sub-acute () exposure of cadmium chloride on *H. fossilis*. A gradual decrease were observed in oxygen consumption (mg/l/gm body weight /hr) during acute (24, 48, 72 & 96 hr) and sub-acute (10, 20 and 30 day) exposure. Similarly significant increase in opercular beat rate were observed during acute and sub-acute exposure. Fish gills are the primary site of metal exposure that ultimately results in respiratory dysfunction. Mucous is a glycoprotein which get coagulate and precipitated on gill surface in presence of metal leads to

asphyxiation and thereby followed by increased opercular beat. Other possible mechanisms like AChE activity, for these changes have also been discussed.

Keywords: *H. fossilis*, Cadmium chloride, Gills, Oxygen consumption, Opercular beat rate.

ESTIMATION OF SOIL CARBON CONTENT AND NUTRIENTS IN STAND AGES OF AGRO-FORESTRY SPECIES OF BIHAR

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An experiment was initiated from kharif season of 2013 at Krishi Vigyan Kendra farm, Munger district under the ages of Bihar Agricultural University, Sabour, Bhagalpur, Bihar with the objective of estimating soil carbon content and available nutrients in different stand ages of the agro-forestry species suitable for agro-climatic zone III A of Bihar. Results of the experiment indicated that total % soil organic carbon content measured from 0-15 cm soil depth was found to be of maximum value in case of sahjan, jamun, eucalyptus, prosopis and karanj forest species while that of minimum value was noted from semal, arjun, mahogany, neem and kadam forest species. Total soil carbon content (%) was also observed maximum in sahjan, jamun, eucalyptus, prosopis and karanj forest species while that of minimum content was noted from semal, arjun, kanak champa, kadam and mahua forest species. The purpose of this experimentation was to determine the capacity of different species of forest trees under which the carbon stocking power was found to be of more value and by how much they found to be performed under the red soil conditions. The pH of the soils is slightly acidic to neutral in reaction and found normal in electrical conductivity value. The oxidizable organic carbon content was also found to be low to medium in range as seen in most of the cases and decreases with the increasing soil depth. Total soil organic matter content was found as negatively and significantly correlated to bulk density of the soil. The DMRT test was oftenly used hereby statistically to compare the means between different treatments and t-test value was applied to compare the means between various soil depths.

Key words: Agro-forestry species, Dry land, Forest, Soil organic carbon, Soil organic matter

ECONOMIC ANALYSIS OF IMPACT ASSESSMENT OF PRODUCTION TECHNOLOGY OF PADDY CULTIVATION IN NASIK REGION OF MAHARASHTRA IN INDIA

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The study aimed to assess the impact assessment of production technology of paddy cultivation in Nasik region of Maharashtra for the year 2016-17, based on the data of costs and returns. Analytical techniques like benefit-cost ratio (BCR), technology adoption index, yield gap, etc. were exercised to have the extent of economic impact of improved paddy technology. The results indicated that the high adopter group earned the net profit of ₹22298.09/ha (BCR=1.32) compared to ₹3629.3/ha (BCR= 1.06) for low adopter group. Average technology adoption index was 71.57 per cent indicating that the farmers adopting recommended production technology of paddy could get yield of 41.63q/ha. Factor share analysis showed that contribution of Char-sutri method (a production technology) to the total yield was the highest yield (i.e. 32.84 per cent) which was followed by urea (19.76 per cent), doses of manures (12.02 per cent), intercultural operation, planting distance, transplanting time contributes about 8.09 per cent etc. respectively. Estimates of yield gap analysis proved existence of yield gap in all level which ranged from 41 percent (low adopter) to 23 percent (high adopter). So, reduction or bridging up the yield gap may be utmost priority to increase the overall production and income of the farmers.

Key words: Production technology, Benefit-cost ratio, Yield gap, Adoption index

ADVANCES IN DAIRY SCIENCE AND TECHNOLOGY FOR ENHANCING THE FARMERS INCOME

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Dairy farming is a class of agriculture or an animal husbandry enterprise for long term production of milk. According to National Dairy Development Board - India has now become world largest producers of milk accounting for 20% of world production. In 2016-17 India producing 165.4 million tonnes of milk with the growth rate of 5.3 % providing per capita availability of 355 gram/day and in 2017-18 producing 176.3 million tonnes of milk and per capita availability of 375 gram/day. Dairy programming faces many challenges, including the need for higher-quality evaluations with cost-effectiveness analyses and consideration of the dual burden of under- and over nutrition. Technology in dairy sector is playing a huge role in producing high yields and it is making cows happy and healthier. Access to information and improved communication is a crucial requirement for sustainable dairy development. There is a concern that the gap between the 'Information – rich' and 'Information – poor' is getting wider. Farmers are the traditional innovators, and are actively engaged in communication about innovation. ICT provides a new channel

for this type of communication. It can help farmers by boosting the production of milk or monitoring the herds by embracing the digital trends dairy farmers are making a great business throughout the world. Technological progress in processing and packaging has contributed to expansion of trade in dairy products. Dairy processing plants in the developing world, with generally lower labour costs, use much more manual labour in the packaging departments, and hence generate much more employment.

Key words: Dairy industry, Problems, Participation, Rural farmers.

PRODUCTIVITY AND PROFITABILITY OF URD (*VIGNA MUNGO L.*) AS INFLUENCED BY PUSA HYDROGEL UNDER RAINFED CONDITION IN HILLY REGION OF UTTARAKHAND

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An On Farm Trial (OFT) was conducted to evaluate the effect of PUSA Hydrogel in urd (*Vigna mungo L.*) in rainfed condition of the hilly region of Uttarakhand during 2017-18 and 2018-19 in 1 ha area during kharif season by KVK, Tehri Garhwal. It is situated in Western Himalayan Region. In the hills of Uttarakhand, farmers usually grow rice, wheat, millets, vegetables and pulses. But sometimes the production is not found satisfactory. The major constraints responsible for this untapped production are adverse weather condition and inappropriate production practices. Major part of the hills of Uttarakhand is rainfed and farmers totally depend on rainfall for irrigation. There is a considerable scope for enhancement in crop productivity by conserving water in the field. So use of PUSA Hydrogel along with traditional method to conserve the moisture in the field was studied. The results reveal that during 2017-18, the no. of pods per plant (12.1), no. of seeds per pod (8.2) and yield (9.6 q ha⁻¹) of the urd crop with traditional method with PUSA Hydrogel @ 2.0 kg ha⁻¹ is more than the traditional method (farmers practice) and during 2018-19, the no. of pods per plant (11.8), no. of seeds per pod (8.5) and yield was 9.5 q ha⁻¹ which is also more in traditional method with PUSA Hydrogel. Similarly the Benefit: Cost ratio (B:C Ratio) in crop grown with PUSA Hydrogel was 1.18 during 2017-18 and 1.19 during 2018-19 as compared to in traditional method (farmers practice) which is 1.12 during the 2017-18 and 1.13 during 2018-19. The percent yield was increased in both the years as crop grown with PUSA Hydrogel. Thus the technology of PUSA Hydrogel was found better in increasing production of the pulses under rainfed condition in hills of Uttarakhand.

AN INVESTIGATION OF BIOCHEMICAL PARAMETERS HYBRID RICE VARIETIES IN THE FAIZABAD REGION OF EASTERN UTTAR PRADESH, INDIA

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The experiment was carried out at the Department of Biochemistry of Narendra Dev University of Agriculture and Technology, Narendra Nagar (Kumarganj), Faizabad as a part of PhD work. The seven varieties of hybrid rice namely- Dhani, US-312, 6201, 6302, 6444, JK-401, PHB-71 and 3 check varieties namely-Swarna, Sambhamah and Pusa Basmati were purchased from local market at Kumarganj, Faizabad from year 2012 to- 14. The results highlighted that, the variety Pusa Basmati found highly superior overall the varieties and noticed, highest reducing sugar (0.34%), protein (8.43%), tryptophan (0.21 /16g N), and methionine (2.16 g/16g N) content. The highest (1.80 %) total mineral content found in Sambhamah followed by (1.66 %) Pusa Basmati and found highly significant and superior over 6201 and lysine (2.13g/16g N) followed by (1.92g/16gN) 6444 over US-312. The highest (74.71%) carbohydrate content was recorded in Swarna followed by (72.92%) Dhani and highly superior over 6302. Like wise the variety PHB-71 found highest (1.52%) total sugar content followed by (1.25%) Pusa Basmati and highly superior over 6302.

Keywords: -Carbohydrate, Protein and Total Mineral, Tryptophan, Methionine and Lysine

DYNAMICS OF SOIL NITROGEN AND PHOSPHORUS VIS-À-VIS NUTRIENT REGIMES IN LOWLAND RICE CULTIVATION

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Nitrogen (N) and phosphorus (P) are essential macronutrients for growth and development of plants. Excess N & P in soils causes environmental problems and their deficiency or toxicity in soils causes various physiological issues in plants. The understanding of the labile pools of organic carbon, N and P in the soil matrix as plant growth medium is needed for enhancing productivity and to reduce the nutrient losses. Physical and chemical properties of soils vary spatially due to the nature of soil parent material and soil position in the landscape and water table fluctuations while temporal variation in soil nutrient labile pools is one of the most dynamic features of nutrient cycling in flooded ecosystems. Patterns of variation in N are related to Organic Carbon content and mineralization processes in the soil; while that of P was affected by flood-induced anaerobic conditions and soil pH. Besides, Rice (*Oryza sativa L.*) crop requires large amount of N and P for their potential growth and yield. So, the application of N and P

through external inputs is inevitable to meet the nutrient demand during the crop growth stages. However, due to flooded conditions in lowland paddy fields and heavy rains in places like NE regions, a large amount of the labile pools of nutrients very often gets diluted. As a result, this solution N and P labile pools may vary with different depths and crop growth stages which ultimately affects its growth and yield. Thus, the research was aimed at the availability of soil solution N and P in low land rice cultivation which is found to be variable at time scale and has relationship with crop uptake and growth. Thus, this experimentation was done to collect the solution water at different depths and periodic intervals through installation of PVC pipes and record the amount of Available N and P in solution form which might seep down into different depths especially after heavy rainstorms and thereby cause variations in their availability over time factor. The results indicate that low to moderate percolation through clay loam soil ;leading to significant N losses but P losses are comparatively less.

Keywords: Deficiency, Dynamics, Physiological, Solution, Temporal, Toxicity

MULCHING TYPE-INDUCED SOIL MOISTURE AND TEMPERATURE REGIMES OF SOLANACEOUS VEGETABLES (TOMATO AND CAPSICUM) UNDER IRRIGATED CONDITION

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The present investigation was carried out to study the performance of tomato and capsicum under open field condition with different plastic mulches. The experiments were conducted at Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during the period of April 2017 to September 2017. The data on soil temperature and moisture content under different mulch materials, recorded during the cropping period for 10-15 cm soil depth. The highest soil temperature was recorded under black mulch followed by silver black polythene mulch and no mulch plot. The soil moisture content was higher under silver black mulch followed by black mulch and no mulch plot. The silver black mulching conserved more soil moisture and maintain high soil temperature, provided better crop growth attributes, while black plastic mulching check the weed growth. Therefore, the plastic mulch performed best in reducing soil-water consumption and increasing yield as compared to non-mulched plots.

Keywords: Mulch; soil temperature; soil moisture; water consumption

EFFICACY OF CALOPHYLLUM INOPHYLLUM (SUR HONNE) OIL AS ALTERNATIVE FUEL IN SOURCE IN DIESEL EN ENGINE

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The natural resources of fossil fuel are dwindling day by day. The crude oil prices have increased immensely and the fossil fuels are depleting. Global warming has become a global concern, which is highly contributed by the emissions of fossil fuel combustion products. In this context, bio-fuel has emerged as an alternative fuel for petroleum. Bio-fuels are having environmental benefits as they are made from renewable sources. Bio-diesel is biodegradable and it can be used in most diesel engines with minimum alterations in the engine manifold. 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 present paper discusses with to obtain the operating characteristics of the variable compression ratio (VCR) engine run by chosen esterified edible oils, and the results are compared with esterified *Calophyllum inophyllum* (Sur honne) oil and their blends with diesel in varying proportions.

Keywords: Calophyllum Inophyllum, Transesterification, Compression Ratio, Automotive fuel, Edible oil, Bio-diesel, Bio-fuel.

SCREENING OF NUTRIENT APPLICATION ON MORPHOLOGICAL & BIOCHEMICAL GROWTH OF TOMATO PLANTS

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Essential plant Nutrient application plays a major role in the development and growth of plants. The source and the quality of nutrient applied on the crop determines its morphological growth, quality and the quantity of the biochemical content in the produced fruit that we consume in our everyday life. To analyse the effect of different nutrient application on morphology and biochemical properties, few distinct varieties of tomato plants were undertaken and were treated with different fertilizers. Each

treatment was replicated to minimise the errors. Pot experiment was conducted in isolation and observations of the trials were recorded. The experiment was run with the objective to know the morphological and biochemical characteristic at different days of plant life. Plant growth parameters such as Plant height, leaves, branches, flowers and fruits were observed, recorded along with Shelf life of fruit was studied. The biochemical aspects such as chlorophyll, lycopene and carotenoids were analysed with the help of lab experiments by the UV-VIS spectroscope method. The purpose of this method was to study the available quantity of nutrients, present in the plant along with its product at different stage of the plant growth and at different days after harvesting of the fruits. By studying all these parameters, it will become easy to determine and understand what we produce and consume. The following study will also be beneficial to the farmer for selecting the type, source and quantity of the nutrient to be applied so that it may also be profitable for prolong tomato production and high economic returns.

Keywords: Nutrient, Morphology, Shelf life, Chlorophyll and Lycopene

DIRECT SEEDED RICE A SUSTAINABLE RICE PRODUCTION SYSTEM AND THEIR RELEVANCE IN PRESENT AGRICULTURE

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Rice (*Oryza sativa* L.) second most important cereal crops of the world after wheat. It is the staple food crop for people of south, south-east and East Asia where about 90% of the world's rice is produced and consumed. Among the cereals, rice is the leading crop worldwide and more than half of the human race depends on rice for their daily sustenance. World's rice demand is projected to increase by 25% from 2001 to 2025, to keep pace with population growth and therefore, meeting ever increasing rice demand in a sustainable way with shrinking natural resources is a great challenge. In Asia commonly rice is grown by transplanting seedlings into puddled soil. Conventional rice production system is water, labor and energy-intensive and is becoming less profitable as these resources are becoming increasingly scarce. It also degrades the physical properties of soil, adversely affects the performance of succeeding upland crops. To address this issue it required a major shift from puddle transplanted to direct seeded rice cultivation. The direct seeded rice cultivation is a very old traditional practice of sowing of rice and most commonly followed in Asian countries in low land rice cultivation ecosystem. The direct seeded rice combining with conservation agriculture gaining importance to address the rising water and labour scarcity. Direct seeding can be done by three ways (1) Dry- DSR, in which dry rice seeds are drilled or broadcast on unpuddled soil either after dry tillage or zero tillage or on a raised bed, (2) Wet-DSR, in which sprouted rice seeds are broadcast or sown in lines on wet/puddled soil, and (3) Water seeding, in which sprouted rice seeds are broadcast in standing water. The published research shows the benefit of direct seeding compared to transplanting includes saving in irrigation water, similar yield, higher economic returns, reduction in methane emission. Despite these benefits, the yields have been variable in some regions, especially with dry seeding due to uneven and poor crop stand, higher spikelet sterility, poor weed control, crop lodging, and poor knowledge of water and nutrient management. Thus getting more benefit from direct seeding it is important to careful management of weeds, nutrient especially nitrogen and water.

Keywords: Direct seeding, Economics, Natural Resource, Nutrient, Methane Emission.

ANALYSIS OF SOCIO-ECONOMIC FACTORS AND CONSTRAINTS FACED BY HYBRID PADDY GROWERS IN UDHAM SINGH NAGAR DISTT. OF UTTARAKHAND

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A study was conducted to evaluate status and constraints faced by hybrid paddy growers in Udhm Singh Nagar district of Uttarakhand. A three stage sampling technique was employed for constructing sampling plan of the study. Probability Proportion to size method technique was followed to select respondent which make a sample size of 60 farmers comprising of 28 small, 17 medium and 15 large farmers selected from 4 villages. The result reveals that medium and large farmers were literate and were more financially viable than the small farmers. Majority of the farmers were paddy growers and had an operational land holding of less than 2 hectares. In hybrids, PA6444 was the most popular on sample farms followed by Pant sanker1, Pant sanker3 in terms of acreage. High cost of hybrid seeds was restricting farmers from adopting hybrid rice technologies. Thus the subsidy should be provisioned on seeds of hybrid rice for its popularization among the rice growers. There is a need to follow a strong extension program in the area regarding improved cultivation practices of hybrid rice. Production constraints are discouraging the growers to augment the production of hybrid rice. There is need to evolve a package of practices of crop operations based on mechanical techniques to reduce unit cost of seed production. Strengthening of input delivery system in the area is urgently required. Also, less expensive and effective measures for the control of serious insect-pests and diseases should be undertaken. Motivation of the dealers and retailers is the need of the hour.

CHANGING PURVIEW OF FARMERS BY LAND USE PLANNING IN DIARA REGION OF BHAGALPUR DISTRICT**SHIVAM KUMAR, CHAITALI KUMARI, S. K. TYAGI****Department of Extension Education, Bihar Agricultural university, Sabour, Bhagalpur, Department of Agronomy, Bihar Agricultural university, Sabour, Bhagalpur**

North Bihar is a flood-prone area. Bhagalpur district of Bihar faces constant problem of flooding by River *Ganges*. Almost every year some part of cultivable land is lost in the river but on the other hand, with flood water sand comes in force and gets deposited on the land which makes the land highly fertile and rich in alluvial soil. It is called *Diara* land. *Diara* is the piece of land that has got created in the middle of the river *Ganges* as a result of deposition of sands over the decades and becomes a boon for farmers. For few years crops like maize were grown by the farmers on some areas but most of the lands were left uncultivated due to constant flooding by river water. Recently, this area has been used by some vegetable growers and they have received a remarkable profit by vegetable cultivation. *Diara* land has been recognised as vegetable growing region and acts as a good source of income. Mostly contact farming is done in this area, landless labourers or other small farmers take land on lease from owners and use it to grow vegetables. Every kind of seasonal vegetables like pointed gourd, sponge gourd, ridge gourd, brinjal, etc. can be grown on these land. Farmers earn Rs.50000 per *bigha* to Rs. 1 lakh per acre from *diara* land. The profit is equally distributed between land owners and vegetable farmers. The transportation to nearest market is also feasible through river channels and is easier for farmers. Owing to reputation of vegetables in *diara* region, Bihar government has started its ambitious scheme of establishing organic vegetable hub on the all banks of river *Ganges* from Patna to Bhagalpur.

Keywords: contact farming, *Diara*, vegetable cultivation, boon

ADOPTION OF SUITABLE CROPPING SYSTEMS IN DRYLAND AREAS TO UPLIFT THE LIVELIHOOD OF FARMERS OF BUNDELKHAND REGION**SHIVAM SINGH¹, CHANDRAKANT CHAUBEY², J.N. PATHAK³, A. K. CHAUBEY⁴, M.P. SINGH⁵, AMIT MISHRA⁶ AND J.K. TIWARI⁷**

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The Bundelkhand region of India is deprived in adoption of recent technological advancement in agriculture. The region belongs to rainfed farming and has a diverse type of climatic condition. The region has on an average 850 mm annual rainfall (June to September) and lacks proper groundwater recharge due to hardpan in the subsurface. The entire region has acute water scarcity, particularly in summers. Moreover, only 25 % of the irrigation facilities have been developed. In rainfed regions, the mono-cropping system is dominant- i.e. fallow in kharif and single crop in rabi. Where as in the irrigated areas multi cropping sequences practiced by farmers that is mainly rice / wheat based. Hence, it is utmost important for the improvement of livelihood of farmers in dryland areas to develop water harvesting structures and adopt efficient water management practices. There is a great potential to adopt short and medium duration varieties of oilseeds and pulses according to irrigation water availability and soil fertility level. The possible alternative adaptation of suitable varieties of oilseed / pulses will change the prevailing mono-cropping to more profitable double cropping system. This will ensure the higher income of the farmers and also provide longer period vegetative cover to soil and reduce the erosion. Therefore, it is necessary to promote pulse and oilseed based cropping system and incorporation of high value medicinal and aromatic crops in cropping system. Adoption of these cropping system will sustain productivity and profitability from the per unit of land. The other way, i.e. improving irrigation facilities at farmer's field through micro irrigation infrastructure development, timely availability of the drought-resistant high yielding short duration varieties to farmers may bring a good change in the Bundelkhand cropping system.

DRIP IRRIGATION AND ITS IMPACT ON FRUIT CROPS**SHIVAM¹, AKASH SHARMA², MANMOHAN LAL³**

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Drip irrigation has potential to save water by allowing water to *drip* slowly to the roots of plants, either from above soil surface or below the surface. Water saving, higher yield and quality are the main objectives of drip irrigation. Drip irrigation is reported to save 75 % of irrigation water. An experiment was carried out to determine the effect of different irrigation system on phenotypic characteristics of Crimson Lady peach and an experiment revealed that surface and sub surface irrigation system recorded maximum fruit weight (141 g & 141 g) and highest marketable yield (22.1 & 20.7) as compared to other treatments Bryla *et al.* (2005). Veverka and Pavlacka (2012) carried out the study on the effect of drip irrigation on the yield of apple cultivars viz. Golden Delicious and Gala. For the purpose of study three different drip-flow rates: 1.6 l/hour (reduced), 2.3 l/hour (standard) and

3.5 l/hour (increased) were used and study revealed that with increased rate of drip irrigation flow apple cultivar Gala showed the significant increased in yield (30.2 t/ha) during. They also reported that apple cultivar Golden Delicious also showed maximum yield (23.5 t/ha) with the use of an increased drip flow rate.

Keywords: Drip irrigation, Fruit crops

ORGANIC FARMING OF VEGETABLES

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India with varied agro-climatic zones is amenable to grow a wide variety of vegetable crops. Vegetables are important constituents of Indian diet as they are rich source of carbohydrate, proteins, vitamins, minerals, glucosinolates, antioxidants and fibre etc. vegetables and fruits are consumed for nutrition, maintenance of health and many for their therapeutic values and prevention of diseases. The indiscriminate use of chemical inputs in agriculture fears/concerns the contamination of foods with agrochemicals and also the pollution of environment, soil and water and therefore made us to think about alternate form of agriculture to produce food free of contaminants. Besides in the present era of global warming and climate change, the face of agriculture has to be more environment friendly, hence the main emphasis should be for development of production technologies which are sustainable in long run. Organic agriculture is one among the broad spectrum of production methods that are supportive of the environment and restricts the use of synthetic inputs. The primary goal of organic vegetable production is to optimize the health and productivity of interdependent communities of soil, plants, animals and people. With the increasing awareness about the safety and quality of foods, long term sustainability of the system and accumulating evidences of being equally productive, the organic farming has emerged as an attractive source of income and also ensures a profitable livelihood option for small and marginal farmers. India with its varied climate and variety of soils has an enormous potential for organic production of vegetables and generate revenue through export. Thus in order to feed the increasing population, the only solution is the vertical expansion or by increasing the productivity per unit area per unit time. Our strategy should be to produce more vegetables from less land, less water with less pesticides use and with less detrimental to soil and environment as well. Organic vegetable cultivation offers one of the most sustainable farming systems with recurring benefits to not only long-term soil health but provides a lasting stability in production by importing better resistance against various biotic and abiotic stresses.

Keywords: environment, organic farming, soil, vegetables, sustainable

USE OF VERIFICATION SCORES FOR ANALYZING THE USABILITY OF MEDIUM RANGE FORECAST

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Medium range forecast is provided by National Centre for Medium Range Weather Forecasting using T-80 model. These forecasts are value added and then disseminated to the State Agricultural Universities (SAUs) who prepare Agromet Advisory Bulletins (AABs) using the weather data. These are prepared by scientists of different disciplines who collect their knowledge and disseminate its application in form of these bulletins to the farmers who can accordingly use it for further adaptation of proper management strategies under the changing weather conditions. These applications can be further made accurate by verifying the present value added forecast against the observed weather data at different stations. These data are verified using the IMD error structure along with the various skill scores which assure further accuracy. These scores include Hanssen and Kuipers score (H.K.) and Ratio score (RS) for rainfall. Further for maximum and minimum temperature, wind speed and direction and cloud cover correlation coefficient and root mean square error along with chi square has been used. It depicted the forecast to be provided with more accuracy as it degraded for the particular parameter during the particular season. It can further be improved if provided at block level thus reducing the variability.

Keywords: verification, medium range weather forecast, Hanssen and Kuipers score and Ratio score

PRECISION FARMING: AN APPROACH TOWARDS SUSTAINABILITY

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Advancement of technology has lead to the development of new trends in the agriculture sector. Precision farming or site specific farming plays an important role in balancing the ecosystem. In this system inputs used in crop production are used in an environment friendly way. It works on the principle of “Application of the right thing in the right place at the right time”. New information technologies are used to make better decisions about many aspects of crop production which provide the variety of services such as Information services, Traceability systems, Precision irrigation, monitoring, controlling and management of the

agricultural field. Precision agriculture is used to identify and take into account soil and yield variability within a single field. Satellite farming helps in observing, measuring and responding to inter and intra field variability in crops. It can be used to guide and better define the farmer's decisions. Precision agriculture practices to apply nutrients, water, seed and other agricultural inputs to grow more crops in a wide range of soil environments. More targeted use of inputs reduces the losses from excess applications and from reduction of losses due to nutrient imbalances, weed escapes, insect damage. Quality of land and water is maintained due to balanced use of fertilizers and pesticides. Precision agriculture as a crop management concept, can meet much of the increasing environmental, economic, market and public pressures on arable agriculture. It would be a viable alternate to improve profitability and productivity.

Keywords: Satellite farming, Crop management, Traceability, Quality

EVOLUTION OF GROWTH AND YIELD OF STEVIA (*STEVIA REBAUDIANA* BERT.) AS INFLUENCED BY SPACING AND LEVELS OF NITROGEN

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Stevia is a crop of recent domestication in India, acts as alternative source of sugar in many developed as well as developing countries. It has achieved economic importance due to the different natural sweet compounds called steviol glycosides (SG) which are obtained from its leaves. Stevia is also known as the "sweetest plant of the world". Stevia can play an important role in India which tops the diabetic population in the world with 30 million patients, and this is expected to increase to 80 million by 2025 as per the reports of World Health Organization. It is widely used by diabetic patients. Several benefits includes improved energy levels, anti-glycemic, anti-hypersensitive, reducing obesity, improved energy levels etc. An investigation was carried out during *Zaid* season 2018 on clay loam soil, at the Crop Research Farm, Department of Agronomy, Naini Agricultural Institute, Sam Higginbottom University of Agriculture, Technology and Sciences, Prayagraj, (U.P.). The soil was basic in reaction (pH 7.8), low in organic carbon content (0.3 %), available nitrogen ($183.50 \text{ Kg ha}^{-1}$), available phosphorus (15.63 Kg ha^{-1}) and available potassium ($197.63 \text{ Kg ha}^{-1}$). The experiment was laid out in randomized block design with three replication and nine treatments. The treatment consisted of T_1 (50 kg N ha^{-1} at $30 \text{ cm} \times 20 \text{ cm}$ spacing), T_2 (50 kg N ha^{-1} at $40 \text{ cm} \times 20 \text{ cm}$ spacing), T_3 (50 kg N ha^{-1} at $50 \text{ cm} \times 20 \text{ cm}$ spacing), T_4 (75 kg N ha^{-1} at $30 \text{ cm} \times 20 \text{ cm}$ spacing), T_5 (75 kg N ha^{-1} at $40 \text{ cm} \times 20 \text{ cm}$ spacing), T_6 (75 kg N ha^{-1} at $50 \text{ cm} \times 20 \text{ cm}$ spacing), T_7 (100 kg N ha^{-1} at $30 \text{ cm} \times 20 \text{ cm}$ spacing), T_8 (100 kg N ha^{-1} at $40 \text{ cm} \times 20 \text{ cm}$ spacing), T_9 (100 kg N ha^{-1} at $50 \text{ cm} \times 20 \text{ cm}$ spacing). The perusal of data reflects that maximum plant height (51.24 cm) and dry matter accumulation ($40.74 \text{ g plant}^{-1}$) was observed in treatment T_9 i.e., 100 kg ha^{-1} Nitrogen at ($50 \text{ cm} \times 20 \text{ cm}$) spacing, from the result it is concluded that treatment T_7 i.e., 100 kg ha^{-1} Nitrogen at ($30 \text{ cm} \times 20 \text{ cm}$) spacing was found to be the best treatment for obtaining fresh highest biomass yield (24.35 t ha^{-1}), fresh leaf yield (10.54 t ha^{-1}), dry leaf yield (2.63 t ha^{-1}), fresh stem yield (13.81 t ha^{-1}), net return ($\square 2,21,864 \text{ ha}^{-1}$) and B:C ratio (1.72) for stevia because of N application and planting density gave better response. Nitrogen and plant density affects canopy development, radiation interception, effects cell elongation as well as it is the principle component of proteins, dry matter production, chlorophyll which leads to progressive increase in internodal length, protein synthesis and photosynthetic area leading to higher plant height.

Keywords: Stevia, Glycosides, Spacing, Nitrogen.

VALUE ADDITION IN FLOWER CROPS

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Flowers are more perishable in nature. Because of perishability, extend the flowers value by value addition. Value-addition is any step taken to increase the value of raw product anytime between harvesting and sales of the final product. Value addition in flowers can be done by three ways viz. fresh flowers, dried flowers and processed products. Fresh flowers used for floral arrangement, bouquets, garlands, corsages, wreath, buttonhole, gajra, veni, etc. In the present era, we can use natural flowers and their drying techniques to make long term natural value-added products. In India, dry flowers contribute 71% of total export. Dried flowers also useful for making greeting cards, wall hanging, book marks, potpourri, floral jewelry, etc. Using flowers and their parts become a premier choice for so many prospects like essential oil, perfume, concrete, rose water, herbal tea, gulkhanda, Jam, jelly, flavours, essence, natural dye, food colours, pharmaceutical and nutraceutical compounds, etc. Value addition increase the economic value and consumer appeal of floricultural commodities. Value added products more demanded nowadays that offer higher return, open new markets, create brand recognition and add variety to farm operation. Availability of raw materials, cost effectiveness and usefulness of the product are the major consideration for value added products. In terms of essential oil, India holds second position in the world. Many sun, press, oven drying and for oil extraction water, steam, solvent extraction methods used for making value-added products. There is a vast opportunity in floriculture trade at entrepreneurial level for rural people besides growing and selling flowers so, proper funding for research in value addition is must since this industry shows great

opportunity to urban, rural areas and cottage industries. Value addition is great way for diversify production so, eventually increase flower growers.

MUTATION BREEDING IN CROP IMPROVEMENT ACHIEVEMENTS AND SCOPE

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Mutation refers to sudden heritable change in the phenotype of an individual. In the molecular term, mutation is defined as the permanent and relatively rare change in the number or sequence of nucleotides. Hugo de Vries (1900) for the first time used the term mutation for the appearance of new types in evening primrose (*Oenothera*) plant. Mutation action of X rays was discovered by Muller on *Drosophila*, and of gamma-rays and X-rays in 1928 by Stadler in barley. Mutation does occur in nature (Spontaneous mutation) as well as can be artificially induced by various mutation agents (induced mutations). Induced mutations are of two types, viz., macro- mutation and micro- mutation. The change in base sequence of a gene may occur due to the following: base substitution, base addition or deletion, Transposition and trinucleotide repeat expansion. Generally, mutation has harmful effects on organisms, and they reduce the viability of the individual that carry them. Based on their effect on viability, mutation are classified as, lethal, sublethal, sub vital and vital. Various radiation and chemicals are used as mutagens. Mutagens are of two types, physical mutagens, and chemical mutagens. A mutation breeding programme should be clearly planned and should have adequate facilities for effective screening of large populations. Induced mutations play an important role in crop improvement. The future applications of genetic engineering technology rely heavily upon mutagenesis on the gene. Application to the improvement of both sexually and vegetatively propagated crop plants.

CHARACTERIZATION AND ASSESSMENT OF GENETIC DIVERGENCE IN BREAD WHEAT (*TRITICUM AESTIVUM* L.)

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The present investigation entitled “Characterization and Assessment of Genetic Divergence in Bread Wheat (*Triticum aestivum* L.)” involving forty four genotypes was aimed to study the genetic divergence analysis. The traits under study were days to 50% flowering, days to maturity, plant height, number of productive tillers per plant, spike length, total number of spikelets per spike, number of grains per spike, biological yield per plant, grain yield per plant, harvest index, 1000 seed weight and protein content. The maximum inter cluster D2 value observed between cluster I and VI followed by cluster II and III, cluster III and VI, cluster II and V, cluster IV and V, cluster II and VI, cluster II and IV, cluster IV and VI, cluster III and IV, cluster V and VI, cluster I and IV, cluster I and II, cluster III and V, cluster I and III and lowest was recorded between cluster I and V. The group constellation clustering patterns of the genotypes are presented in Cluster III has maximum (12) genotypes followed by cluster V (9), cluster IV (7), cluster VI (6) genotypes. Cluster I and II has (5) genotypes each. The plant height contributed maximum divergence followed by number of grains per spike, harvest index, days to 50% flowering, 1000 seed weight, grain yield per plant, days to maturity, spikelets per spike, productive tillers per plant, protein content and spike length can be used for selecting parents from distinctly placed clusters to obtain high heterotic effects and transgressive segregants.

Keywords: Transgressive segregants, traits, genotypes, divergence

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as, lethal, sublethal, sub vital and vital. Various radiation and chemicals are used as mutagens. Mutagens are of two types, physical mutagens, and chemical mutagens. A mutation breeding programme should be clearly planned and should have adequate facilities for effective screening of large populations. Induced mutations play an important role in crop improvement. The future applications of genetic engineering technology rely heavily upon mutagenesis on the gene. Application to the improvement of both sexually and vegetatively propagated crop plants.

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Keywords: Transgressive segregants, traits, genotypes, divergence

MOLECULAR CHARACTERIZATION OF REACTIVE OXYGEN SPECIES (ROS) DETOXIFYING ENZYMES IN *TRITICUM AESTIVUM* L.

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The plants have evolved various classes of antioxidants to overcome the oxidative stress caused by the over production of harmful reactive oxygen species (ROS) generated under adverse conditions. Herein, we have identified and characterized four major enzymatic antioxidant gene families in the genome of *Triticum aestivum* including *superoxide dismutases* (*TaSODs*), *glutathione peroxidases* (*TaGPXs*), *ascorbate peroxidases* (*TaAPXs*) and *catalyses* (*TaCATs*). In total, 23 *TaSODs* (14 *TaCu-ZnSOD* and 9 *TaFe-MnSOD*, based on the metal cofactor), 14 *TaGPXs*, 27 *TaAPXs* and 13 *TaCATs* were derived from different chromosomes of A, B and D sub-genomes of *T. aestivum*. The gene structure analysis revealed the occurrence of maximum eight, seven, five, eleven and seven introns in *TaCu-ZnSOD*, *TaFe-MnSOD*, *TaGPX*, *TaAPX* and *TaCAT* genes, respectively. The proteins encoded by these genes were analysed for various physicochemical properties, conserved motifs and domains, their sub-cellular localization etc. The phylogenetic analysis suggested the conserved nature of these gene families during the course of evolution. The occurrence of several growth and development, light, stress and hormone responsive *cis*-acting elements in the promoter region of these genes suggested their diverse biological roles. Further, the transcriptional profiling of these gene families in various tissues and their developmental stages, and under biotic and a-biotic stress conditions showed their involvement in growth and development, and stress conditions. Interactome analysis decrypted the putative interacting partners of these genes which are involved in downstream signalling pathways. The present study provides a valuable insight into the role of *TaSODs*, *TaGPXs*, *TaAPXs* and *TaCATs* in *T. aestivum*, which might be useful in selecting the aspirant genes for the development of stress tolerant agriculturally and horticulturally important crop plants in future studies.

Keywords: Antioxidants, Development, Growth, Stress, Transcriptional profiling.

EFFECT OF FEEDING FENUGREEK SEED POWDER AND VITAMIN E ON GROWTH PERFORMANCE, FEED CONVERSION EFFICIENCY AND CARCASS PARAMETERS IN BROILER CHICKS

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The study was conducted on the data collected from the experimental growth performance, feed conversion efficiency and carcass parameters of Cobb-400 strain of broiler work was carried out under PRTC at S.V.P.U.A.&T. Meerut. Total 120 broiler chicks were selected randomly and used for the study purpose and divided into four equal groups, each were fed different diets (T₁ Basal ration, T₂ Basal ration + Fenugreek seed powder @ 02g/kg of feed, T₃ Basal ration + vitamin E @ 50 mg/kg of feed and T₄ Basal ration + Fenugreek seed powder 2g/kg + vitamin E 50mg/kg of feed) The Body weight gain (BWG), feed conversion efficiency (FCE), Dressing percentage, Giblet weight percentage and intestinal viscera percentage were measured. The average BWG was found 1947.57±0.62, 2094.900±1.28, 2110.03±0.73 and 2186.43±0.53 g in T₁, T₂, T₃ and T₄ group, respectively. The BWG up to 6 weeks of broiler chicks of all the treatment groups differ significantly (P<0.05) with each other. The average FCE was found 1.76±0.00, 1.68±0.00, 1.67±0.00 and 1.65±0.00 in T₁, T₂, T₃ and T₄ group respectively. The FCE up to 6 weeks of broiler chicks of all the treatment groups differ significantly (P<0.05) to each other. At the age of 6 week dressing percentage, giblet weight percentage and Intestinal viscera percentage of broiler fed diet T₁, T₂, T₃ and T₄ was found 68.02±0.78, 68.56±0.57, 68.19±0.51 and 68.78±0.55; 3.33±0.11, 3.55±0.03, 3.45±0.12 and 4.34±0.13; 3.21±0.08 3.55±0.18, 3.82±0.03 and 4.10±0.05 respectively. The findings of present study in respect with all parameters included in the study indicated that incorporation of fenugreek seed powder (FSP) and Vita. E in combination could be effectively use in the ration of broiler chicks to improve performance. The optimum levels adjudged from present study are 2g./ kg FSP and 50mg. / kg. Vita.E combination.

Keywords: Fenugreek seed powder, vita. E, growth performance, FCE and Carcass Parameters.

ROLE OF BIOTECHNOLOGY IN DEVELOPMENT OF FRUITS AND VEGETABLES

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Biotechnology is a new aspect of biological and agricultural science which provides new tools and strategies in the struggle against world's food production problem. Biotechnological tools have revolutionized the entire crop improvement programmes by providing new strains of plants, supply of planting material, more efficient and selective pesticides and improved fertilizers. Therefore an immediate need is felt to integrate biotechnology to speed up the crop improvement programmes. Many genetically modified fruits and vegetables are already in the market in developed countries. More recently, the term has come to mean the collection of techniques that allow the direct manipulation of specific pieces of genetic material within and between organisms. The requirement of fruits and vegetables is increasing proportionally with the increasing population in the country. Although conventional plant breeding techniques have made considerable progress in the development of improved varieties, they have not been able to keep pace with the increasing demand for fruits and vegetables in the developing countries. Though the first transgenic crop to reach the market was the Flavr Savr tomato, and sweet corn, potato, squash and papaya varieties engineered to resist insects and viruses have been approved for commercial use and marketed, papaya is the only horticultural crop for which transgenic varieties have achieved a significant market. To provide virus free plants in citrus, shoot tip grafting technique can be successfully employed while embryo-fruitful results in mango breeding.

Keywords: Biotechnology, Fruits, Vegetables, Varieties

IMPACT OF CLIMATE CHANGE ON THE INSECT PESTS AND ITS NATURAL ENEMIES

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The increase in global average temperature, changes in the rainfall pattern and extreme climatic events are the evidence of the occurrence of climate changes. Insect are good indicators of current human driven climate change. Some abiotic parameters are known to have direct impact on the insect population dynamics through modulation in developmental rates, survival, fecundity, voltinism and dispersal. Among the abiotic factors temperature is one of the important factor that leads to certain decline in the population of insect pest in the ecosystem. Upon this, elevation in carbondioxide also showed impact on pest population abundance, increased in Carbon : Nitrogen in plants makes for poorer forage of insects. In some natural enemies like mealybugs, parasitism is reduced under conditions of water stress associated with draught conditions due to improved immune response. Hence, climate change plays an important role in the population dynamics of insect-pest including natural enemies.

Keywords: Climate change, Insect pests, Natural enemies, Population dynamics.

INTEGRATED NUTRIENT MANAGEMENT IN CEREAL CROPS**SHRIMANNARAYAN DUBEY¹, SUDHAKAR SINGH² AND NANDAN SINGH³****^{1, 2, 3}Research Scholar, Department of Agronomy, NDU&T, Ayodhya, India, Narendra Deva University of Agriculture & Technology, Narendra Nagar, (Kumarganj), Ayodhya-224229 (Uttar Pradesh) India.**

Integrated nutrient supply which involves the conjunctive use of fertilizers and organic sources assumes great importance in recent years due to consistently increasing trend in the cost of fertilizers. Eight years of study on INM in rice-wheat at Jabalpur (Vertisols) revealed that conjunctive use of 5 t FYM and 6 t green manure with 90 kg N ha⁻¹ not only sustained the productivity but also saved nearly 90-100 kg ha⁻¹ yr⁻¹ fertilizer N. (Singh *et al.*, 2001). Yadav *et al.*, 2009 reported that Continuous rice-wheat cropping system had variable effects on soil fertility depending on soil types, nutrient application and productivity levels. Application of FYM (12 t ha⁻¹) with 75% NPK improves the fertility status and also recorded higher grain and straw yield of wheat than 100% NPK (Singh, M.V., 2008 Ram *et al.*, 2006). Application of 100% NPK + FYM (10 t ha⁻¹) recorded significant increase in biological parameters viz. soil microbial biomass carbon (SMBC), soil microbial biomass nitrogen (SMBN) and dehydrogenase activities (DHA) to the extent of 8.8, 9.8 and 9.0% compared to 150% NPK through chemical fertilizers without organics (Katkar *et al.*, 2011). Application of NPK and FYM amended soil have higher microbial biomass in wheat (Majundar *et al.*, 2008). Application of 100 % NPK + 50% N through FYM showed beneficial effect on plant height and dry matter accumulation at harvest in wheat. (Kumar, P. *et al.* 2005). Application of 100% NPK + 10 t ha⁻¹ FYM significantly improved the availability of micronutrients (Zn, Fe, Mn and Cu). Thus, these results suggest that integrated use of chemical fertilizers, organic manures including green manure and recycling of crop residues, assume greater significance of improving efficiency of chemical fertilizers in soil.

PROSPECTS OF SUSTAINABLE SUGARCANE FARMING WITH ITS FUTURE STRATEGIES TO ENHANCE SUSTAINED PRODUCTIVITY AND INCOME OF FARMERS**SHRIPRAKASH YADAV^{*1}, SONIA AND SATENDRA KUMAR²,****¹Scientific Officers: U.P. Council of Sugarcane Research, Shahjahanpur, U.P., ²Scientific Officer: G.S.S.B.R.I., Seorahi, Kushinagar, U.P.**

India is the second largest producer of sugarcane (18.18%) and sugar (15.81%) and top most consumer of the sugar in the world. The northern states having subtropical climate particularly Uttar Pradesh plays important role in improving national sugarcane productivity is obvious. Now days stagnation in sugarcane crop yield (72.37 t/ha) and sugar recovery (10.61%) in U.P. with decline in the factor productivity have raised a question during green revolution period. In order to maintain sugarcane crop sustainability with conserving natural resources like soil, water, air etc., applied researches are being conducted in different disciplines. Crop rotations, integrated nutrient management strategies and green cane harvesting have been resulted to increase irrigation and drainage efficiency, improvement in organic matter, its better effect on soil properties and sugarcane nutrition.

The sustainable sugarcane and sugar production is yet another viable, feasible, economical and environmentally sound approach based on the principle of “more with less” in agriculture. This also improves the productivity of water, land, labour, cane and sugar production with improving economic status of cane growers in the country. Strategies for achieving these objectives involves usage of less seeds, less water and optimum utilization of fertilizers, land with organics and biofertilizers. Recent technologies have revolutionized Agriculture and Environment and also hold the promise of developing sustainable agriculture, reducing environmental pollution and generation of sustainable bio - fuels with far reaching benefits for the society at large. A new modified trench method of cane planting with wider spacing (120 -150 cm) by raising plantlets through space Transplanting method (STP) is an part of management strategies have been conducted at research farm of U.P. Council of Sugarcane Research, Shahjahanpur, U.P. Resulted that application of 10t/ha FYM/ Compost + recommended NPK fertilizers on soil test basis + biofertilizers (*Azotobacter*+ P.S.B) @ 10 kg/ha each recorded significantly better cane yield (113t/ha). Soil health and physico – chemical parameters have also improved by this treatment as compare to the treatment in which only recommended NPK fertilizers were applied through inorganics.

Keywords: Sustainable sugarcane agriculture, farming, productivity, ecofriendly, subtropical regions, natural resources, biofertilizers.

CLIMATE CHANGE: IMPACT ON CEREALS AND ADAPTATION STRATEGIES IN AGRICULTURE**SHRUTI SUMAN*, SANJAY KUMAR, MAINAK GHOSH AND SHASHANK TYAGI****Department of Agronomy, Bihar Agricultural University, Sabour, Bhagalpur, Bihar (813210)**

Climate change is documented as one of the most serious environmental, societal and economic challenges that the world is facing today. It is now world-wide proved that the earth's climatic system has demonstrably changed on both global and regional scales since the pre-industrial period. Changes in climate can be expected to have significant impacts upon crop yields through changes in both temperature and moisture. As climate patterns shift, changes in the distribution of plant diseases and pests may also have

adverse effects on agriculture. At the same time, agriculture proved to be one of the most adaptable human activities to varied climate conditions (Mendelsohn *et al.*, 2001). The purpose of mitigation and adaptation measures is therefore to attempt a gradual reversal of the effects caused by climate change and sustain development under the inescapable effects of climate change. The important mitigation and adaptation strategies required to cope with anticipated climate change impacts include adjustment in sowing dates, breeding of plants that are more resilient to variability of climate, and improved agronomic practices like conservation agriculture which offers us an opportunity to sustain the productivity over years, reducing GHG emissions, improving energy use efficiency, and sequestering carbon in the soil under different cropping systems. Besides, the proper understanding of climatic conditions and efficient utilization of natural resources are, therefore, of great concern for the improvement and sustainability of agricultural production by maintaining the food security with high economic yield and lowering the GHG emission. Zheng *et al.* (2011) concluded that low light intensity resulted in increased chlorophyll and decreased net photosynthetic rate (Pn) which ultimately lead to low yield of wheat. Likewise, there are several research has been conducted which showed the impact of climate change on cereals. This paper will aim to show the result of previous work done by several scientists and will explore more about findings of mitigation and adaptation strategies of climate change in Agriculture.

SEED SOURCES VARIATION FOR DIFFERENT GROWTH TRAITS OF *ACACIA NILOTICA* LINN

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The experiment was conducted to study seed sources variation in *Acacia nilotica* collected from twenty locations of Uttar Pradesh. The seed source of S₁₇ (Pukhraya) was found best seed source under green house environment in comparison to others for germination and seedling growth. Higher PCV were observed than the corresponding GCV for all the morphological and biomass traits studied under green house and field environment indicating that the characters have interacted with the environment to some degree. High percentage of heritability coupled with moderate intensity of genetic gain, was observed for seed germination traits, which signifies that germination is under strong genetic control and good amount of heritable additive genetic component can be exploited for improvement of this species in both environment. On the basis of morphological and biomass traits twenty superior trees progenies under green house and field environment were grouped in to eight clusters. Cluster pattern proved geographical diversity need not necessarily be related genetic diversity. Maximum percent contribution towards divergence was shown by seedling height under both the environment.

Keywords: Seed Sources, PCV, GCV, Divergence, *Acacia nilotica*

EFFECT OF BIO-CONTROL AGENTS TREATMENTS ON MAIZE SEED VIGOUR BY STANDARD METHODS

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Maize is one of the most important cereal crops in the world. This crop is subjected to as many as 112 diseases and among them, more than 70 are seed borne on a global basis. Fungal infection is the most widespread in stored grain and appears as mold or caking on the affected ear or grain. The biocontrol management not only preserve the surrounding but also reduces the potential for air and ground water contamination, maintains or increases the cost-effectiveness of disease management programs and reduces or eliminates issues related to pesticide residue. Therefore, the seed treatments were done with two bio-control agents, *Trichoderma harzianum* and *Trichoderma asperellum*. The seed quality was measured as by nine parameters was recorded by multi-pots tray and paper rolled method. In case of original seed treatments with *Trichoderma harzianum* (Th) showed range of per cent germination 67.00±18.58 (V8) to 96.00±3.27 (V4), germination index (seed per day) 5.11±1.00 (V2) to 7.25±0.94 (V1), accumulative speed (seed per day) 10.08±2.23 (V2) to 15.80±1.73 (V1), coefficient of germination rate (%) 7.85±1.89 (V10) to 17.95±1.45 (V8)], fresh weight (g) 9.85±2.73 (V10) to 15.67±1.15 (V7), dry weight (g) 2.37±0.24 (V5) to 4.03±0.29 (V7), seedling length (mm) 195.62±35.18 (V5) to 297.50±20.62 (V2), seed vigour index–seedling length 15765.77±2546.64 (V5) to 25275.00±7646.67 (V7), and seed vigour index–dry weight 179.45±100.27 (V10) to 380.02±55.79 (V7) and *Trichoderma asperellum* (Ta) seed treatment was achieved highest values of per cent germination 92.00±8.64 (V7), germination index (seed per day) 7.25±1.05 (V1), accumulative speed (seed per day) 16.37±2.44 (V1), coefficient of germination rate (%) 14.75±1.61 (V11), fresh weight (g) 15.33±1.44 (V7), dry weight (g) 3.94±0.37 (V7), seedling length (mm) 253.21±8.64 (V1), seed vigour index–seedling length 22608.62±3942.72 (V1) and seed vigour index–dry weight 364.94±66.23 (V7). In case paper rolled method of original seed treatment with *harzianum* (Th) and *harzianum asperellum* (Ta) excelled significant superior performance by contributing per cent germination 94.00±5.16 (V12) and 93.00±8.25 (V6), fresh weight (g) 12.25±1.26 (V1) and 13.00±0.82 (V3), dry weight (g) 3.68±0.38 (V1) and 3.90±0.24 (V3), seedling length (mm) 197.50±56.79 (V9) and 181.25±17.50 (V12), seedling vigour index- seedling length 18000.00±5275.15 (V9) and 16760.00±2475.05 (V6) and seedling vigour index- dry weight 341.70±17.73 (V4) and 355.80±46.99 (V6).

Keywords: Maize, *Trichoderma harzianum* and *Trichoderma asperellum*, Germination and Seed vigour index

EFFECT OF SEWAGE SLUDGE AND HEAVY METAL ACCUMULATION ON SOIL AND PLANT PRODUCTIVITY

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Use of sewage sludge in agriculture is an alternative disposal technique for this waste. Sewage sludge contains high nutrient and organic contents and is now being recycled and beneficially applied to agricultural land worldwide in increasing amounts. Metals in sewage sludge are generally organically bound and generally less available for plant uptake than the more mobile metal salt impurities found in commercial fertilizers. Sewage sludge amendment modified the physico-chemical properties of soil, thus increasing the availability of heavy metal in soil and consequently with higher accumulation in plant parts. Sewage sludge had a positive but short residual effect after only 1- year Application. Results indicate that relatively low application rates of sewage sludge could be used for several years to maintain crop production. However with higher rates of application, heavy metal accumulates in levels toxic to humans. For safe agricultural use of sewage sludge, regular Monitoring of soil and crop edible parts for heavy metal accumulation is necessary.

Keywords: Recycle, residual effect, physico-chemical properties, toxic, monitor.

INTEGRATED USE OF AZOLLA BIO-FERTILIZER (AZOLLA PINNATA) AND UREA FOR HIGHER RICE (ORYZA SATIVA L.) YIELD AND IMPROVING SOIL ACIDITY INDICES**SHUBHAM SINGH* AND SANJAY-SWAMI****School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Central Agricultural University, Umiam-793103, Meghalaya**

A field experiment was conducted during *kharif* 2017-18 to investigate the impacts of integrated use of azolla bio-fertilizer (*Azolla pinnata*) and urea on rice (*Oryza sativa* L.) yield, and improvement in soil acidity indices under low land acidic soil condition of Meghalaya. Six treatments viz., control (T₁), fresh azolla incorporation @ 16000 kg ha⁻¹ (T₂), 30 kg N ha⁻¹ through urea (T₃), 60 kg N ha⁻¹ through urea (T₄), 30 kg N ha⁻¹ through urea + azolla incorporation @ 16000 kg ha⁻¹ (T₅) and 60 kg N ha⁻¹ through urea with azolla incorporation @ 16000 kg ha⁻¹ (T₆) were tested in Randomized Block Design with four replications. Application of 60 kg N ha⁻¹ through urea along with azolla incorporation @ 16000 kg ha⁻¹ (T₆) produced highest grain yield (4.2 t ha⁻¹) followed by T₅ and T₄. The soil acidity indices reflected highest improvement with azolla bio-fertilizer incorporation @ 16000 kg ha⁻¹ (T₂) over all other treatments indicating that azolla bio-fertilizer can be an alternative option for acid soil management.

Keywords: Soil acidity, azolla incorporation, rice yield, soil acidity indices.

BREEDING FOR COLOUR RICH VEGETABLE VARIETIES TO COMBAT MALNUTRITION AND HIDDEN HUNGER: CURRENT APPROACHES AND ACHIEVEMENT**SHUBHAM SINGH, ABHILASH SINGH, SANDEEP YADAV,*JITENDRA KUMAR AND *MOHIT LAL****Vegetable Science, G.B Pant University of Agriculture & Technology, Udhm Singh Nagar, Pantnagar - 263145 (U.K), India, *Department of Vegetable Science, College of Horticulture and Forestry, *Narendra Deva University Agriculture and Technology, Kumargaj (AYODHYA) - 224229 (U.P.) India**

Vegetables are fundamental components of humans diets. They not only are important sources of essential vitamins and minerals, but also contains a wide variety of secondary metabolites important to human health (Chiu et al., 2010). The phytochemical impart health benefits and provide protection against certain degenerative diseases like Blindness, cancer, diabetic. Vitamin-A deficiency is quite problem in developing country like Africa and south east Asia and 140 million preschool-aged children and 1.2 to 1.3 million children affected every year (UN –SCN 2004), hence these problem can be combat by developing colour rich nutritional vegetable varieties. Pigments in plants have four major classes: chlorophylls, carotenoids, flavonoids, and betalins. Colour rich vegetables attract visitors and eaters (Chen, 2015). Among the carotenoids, B-carotene (pro-vitamins A) is precursor of Vit-A and orange and yellow colour vegetables are like orange carrot (3000-6000 µg/100gm), orange cauliflower (Or gene linked SCAR marker) having (80-320 µg/100gm), yellow cucumber (22-48 µg/100gm), yellow potato (200-500 µg/100gm), orange tomato (3000-4500 µg/100gm) are highly revered as a “good for the eyes”. Lycopene is the antioxidant red pigment in vegetables such as tomato and watermelon (Faree et al., 2010). Flavonoids, a group of secondary metabolites belonging to the class of phenyl-propanoids have the widest colour range, from pale-yellow to blue (Tanaka et al., 2016). Anthocyanin, naturally occurring pigment with high antioxidant responsible for red, blue, purple colour in vegetables like eggplants, onion, red cabbage, purple cabbage (Zhang et al., 2016). In the recent year certain improved anthocyanin concentration (100gm) in vegetables crops like purple carrot (200-350mg), purple potato (17-20mg), red flesh potato (20-38mg), red onion (25-40mg), red cabbage (200-3320mg), purple tomato (20-60mg). In research purpose various mutants and transgenic gene identified like Or (cauliflower), (Zhou et al., 2008) and MYB (red cabbage and purple cauliflower), Aft, Abg, atv (tomato) respectively. Colourful vegetables can be breed by the use of different breeding methodology like Selection, Hybridization, Somaclonal variation and transgenic breeding but now days transgenic breeding is the main approach to enhance the colour of the vegetables. Till date numerous transgenic lines have been developed mainly Tomato, Egg plant, Sweet pepper, potato etc.

MOLECULAR BREEDING FOR IMPROVEMENT OF FRUIT QUALITY AND SHELF LIFE IN TOMATO**SHUBHAM SINGH, ABHILASH SINGH, SANDEEP YADAV, *JITENDRA KUMAR AND *MOHIT LAL****Vegetable Science, G.B Pant University of Agriculture & Technology, Udhampur Singh Nagar, Pantnagar - 263145 (U.K), India, *Department of Vegetable Science, College of Horticulture and Forestry, *Narendra Deva University Agriculture and Technology, Kumarganj, (AYODHYA) - 224229 (U.P.) India**

Tomato (*Solanum lycopersicum* L.) is an important solanaceous vegetable crop grown throughout the world for its versatile uses. It is one of the important "Protective Food" as it possesses much quantities of vitamins and minerals and sometimes rightly referred to as "Poor Man's Orange". Traditional genetic studies had identified several genes controlling fruit shape in tomato such as *pr* (pyriform), *o* (ovate), *bk* (beaked tomato), *n* (nipple-tip tomato), *f* (fasciated) and *lc* (for locule number). The major fruit-shape QTL termed ovate, controlling the transition from round to pear-shaped fruit, was mapped, cloned and characterized at the molecular level (Tanksley, 2004). Fruit size this is another important trait has been studied very extensively and several QTLs including fw1.1 (explaining 17% of the variation), fw1.2 (13%), fw2.1 (12%; previously known as locule number, *lc*), fw2.2 (23%), fw3.1 (12%) and fw11.3 (37%; previously known as fasciated, *f*), of these QTLs, fw2.1 (*lc*) and fw11.3 (*f*) are associated with an increase in locule number. One of the major QTLs, fw2.2, which was detected in many QTL studies in tomato, has been cloned and characterized. Molecular breeding for better fruit colour is an active area of research and several major genes with significant contribution to high levels of fruit lycopene (e.g., *hp-1*, *hp-2*, *dg* and *Ogc*) and other carotenoids (e.g. beta-carotene, *B*) were previously identified and mapped onto the classical linkage map of tomato (Giovannoni *et al.*, 2004). Molecular breeding for mapping of several ripening mutants such as never ripe (*Nr*), nonripening (*nor*), ripening inhibitor (*rin*), albacaca (*alc*) and uniform ripening (*u*) genes, loci and QTLs. Among the major ripening genes, at least one (*rin*) has been used in marker-assisted breeding (Doganlar *et al.*, 2008). The use of genetic markers to identify QTLs controlling complex traits in tomato started in the 1980s. A complete RFLP linkage map of tomato was used to identify and map QTLs for fruit quality characteristics, including fruit size, pH, and soluble solids content. In parallel with gene discovery, we must identify appropriate germplasm containing desirable alleles. Those alleles must be evaluated for their quality traits in multiple elite cultivars. As appropriate alleles are identified, progress should be very rapid and the consumer will reap the benefits of our scientific endeavor.

COMPARITIVE STUDIES ON YIELD ATTRIBUTES AND NUTRIENT STATUS OF TURMERIC (*CURCUMA LONGA* L.) THROUGH DIFFERENT FERTILIZER PRESCRIPTION METHODS IN AN ACID ALFISOL**SHUBHAM^{*1} AND SHALINI SINGH²****¹Department of Soil Science, CSKHPKV, Palampur (H.P.) 176062, ²Department of Horticulture, SVPUA&T Meerut (U.P.)**

The present experiment was carried out to determine the effect of prescription based fertilizer application on turmeric crop in Randomized Block Design (RBD) with eight treatments comprising control, farmer's practice, general fertilizer dose, soil test based fertilizer application and fertilizer application based on STCR approach with FYM for yield targets of 10, 20, 30 and 40 t ha⁻¹. The soil of the experimental site was found Typic Hapludalf, acidic in reaction, medium in organic carbon and medium in available N, high in P, low in K initially. Plant and soil samples (0-15 cm) taken after the harvest of turmeric were analyzed for yields, nutrient uptake and soil parameters. The study revealed that the target yield of 30 t ha⁻¹ resulted in turmeric rhizome (228.5 q ha⁻¹) and straw yield (16 q ha⁻¹) which was significantly higher over the treatment comprising of 20 t ha⁻¹ target. Farmer's practice treatment significantly improved the nutrients uptake over control treatment. The status of available N (392 kg ha⁻¹), available P (42 kg ha⁻¹) and available K (194 kg ha⁻¹) nutrients in soil was improved in target yield of 40 t ha⁻¹. Likewise micronutrient cations Fe, Mn, Zn and Cu uptake by turmeric rhizome and straw was also higher in target yield treatment of 30 t ha⁻¹ as compared to target yield of 10 t ha⁻¹ and 20 t ha⁻¹, respectively. Treatment of target yield of 20 t ha⁻¹ excelled all other treatments in terms of benefit: cost ratio (3.15) followed by soil test based treatment (3.04) and the least in control (1.97).

Key words: STCR, turmeric, fertilizer, rhizome

EFFECT OF INOCULATION AND N LEVELS ON YIELD AND PROTEIN CONTENT IN TUBER OF WINGED BEAN [*PSOPHOCARPUS TETRAGONOLOBUS* (L.) DC]**SHWETA KUMARI, S. S. PRASAD AND S. JHA****Department of Soil Science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar – 848 125**

Winged bean has assumed considerable importance as a protein rich multipurpose crop. One of the primary products of winged bean is its tuber. Yield potential of 11.0 ton of fresh tuber ha⁻¹, having protein content up to 10.9 per cent on fresh weight basis is an added advantage. An experiment was carried out in the research farm of Tirhut Collage of Agriculture, Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar during 2015-16 and 2016-17 with an aim to assess effect of inoculation

either singly or dual and initial requirement of N fertilizer on yield and protein content of winged bean tuber. Twelve treatments comprising four inoculants (no-inoculation, *Rhizobium* alone, *Bacillus* alone and *Rhizobium*+*Bacillus*) in combinations with three nitrogen levels viz., 0, 20 and 40kg ha⁻¹ replicated thrice. Phosphorus, potash and sulphur were applied @ 60, 40 and 20kg ha⁻¹, respectively. The effect of different treatments on yield of tuber ranged from 29.00 to 93.34q ha⁻¹ with its protein content of 12.57 to 19.07%. The individual effect of either seed inoculation or N application significantly increased both tuber yield and its protein content. Among inoculation treatment irrespective of N levels, inoculation with either *Rhizobium* alone or in combination with PGPR significantly increased tuber yield and protein content over control whereas inoculation of PGPR alone did not affected significantly. The highest tuber yield of 70.01q ha⁻¹ was recorded in the dual inoculation of *Rhizobium*+PGPR with increase of 61.54% tuber yield over no inoculation and it was found significantly higher over seed inoculation of *Rhizobium* alone. Similar trend in protein content with highest protein content of 17.55% followed by 16.98% was observed but it was found statistically *at par*. Among N levels irrespective of inoculation, highest tuber yield of 68.96q ha⁻¹ was noted with lower dose of nitrogen application, i.e., @ 20kg ha⁻¹ with 88.06% increase over control. The treatment, 20kg N ha⁻¹ application was found statistically significant with N application of 40kg ha⁻¹. Similarly, highest protein content of 17.72% followed by 17.24% was recorded in same treatments as observed in case of yield and both of these treatments stood statistically *at par* to each other. Interactions effect of inoculation and N levels i.e., IxN, was found to be significant in case of tuber yield whereas in case of protein content, it was non-significant. Highest tuber yield (78.17q ha⁻¹) was recorded where seed were inoculated with *Rhizobium*+PGPR along with 20kg N ha⁻¹ was applied and the treatment was found statistically *at par* to the treatment where seed were inoculated with *Rhizobium* alone with the same N dose.

NON TISSUE CULTURAL CLONAL PROPAGATION IN A CONTINUOUS AND EXPONENTIAL FASHION IN AN ENDANGERED HIMALAYAN MEDICINAL PLANT, VALERIANAJATAMANSI

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The theme in the present study is to develop a novel process for enhanced mass-clonal propagation in *Valeriana jatamansi*, an endangered medicinal plant in a continuous and exponential fashion. For the first time, the Quality Planting Material (QPM) production from 1-2 node containing aerial cutting and its comprehensive growth parameters in different environmental condition exploring different growth media except MS media was documented in a non-tissue cultural and un-conventional propagation methods. Based on result, the artificial soil formulation composed of Perlite, peat moss and vermiculite with controlled environment of 3000 lux of light intensity, 14-hour light condition per day, 70% of Relative Humidity reflected better initial growth parameter, a greater number of branching and a greater number of aerial node production etc. The growth of plant could be potentially utilized for root harvest or alternatively the aerial node present in side branches could be potentially utilized for next round of Quality Planting Material production and the mother plant without branches potentially explored for QPM for the main field plantation without any hardening process as an extra step. The rate of QPM was calculated to be better rate than MS based tissue culture approach and did not require any acclimatization, hardening and sophisticated facilities.

Keywords: *Valeriana jatamansi*; Aerial node; Mass clonal-propagation;

STUDY AND ANALYSIS OF PHYTOCHEMICAL PROPERTIES OF NEEM (AZADIRACHTA INDICA) LEAVES

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Medicinal plants are now getting more attention than ever because they have potential of myriad benefits to society or indeed to all mankind, especially in the line of medicine and pharmacological. The present study was conducted to determine the Phytochemical properties present in Neem Leaf by utilizing standard methods and protocols. Phytochemical analysis of methanolic leaf extracts of *Azadirachta indica* has shown the presence of biological compounds like, Alkaloids, Flavonoids, Saponins, Tannins, Steroids, glycoside, etc which are then compared to aqueous leaf extracts of the plant. Phytochemical analysis includes the estimation of chlorophyll content, carbohydrate content and proline content. The result suggests that the *Azadirachta indica* extracts contain plenty of phytochemicals with antimicrobial, anti-inflammatory and antioxidant properties. Neem leaf used by many people as an alternative treatment for a variety of health benefits and skin irritations, Neem leaf extract is a common supplement in our local supermarkets and drug stores. This study therefore has provided some biochemical basis for ethno pharmacological uses of *Azadirachta indica* leaves in the treatment and prevention of various diseases and disorders.

Keywords: Phytochemical, Saponins, Steroids, ethno pharmacological.

ROLE OF CAD IN LANDSCAPE GARDENING

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The concept of computer aided designing for landscape gardening is comparatively new. Beginning of CAD was traced in 1960. In 1983 ArchiCAD developed software for apple Macintosh and CAD progressed from 2D to 3D in 1985. Now each generation of CAD has become more powerful and more user friendly. Today, CAD systems are covering most of the activities in the design cycle, they are recording all product data, and they are used as a platform for collaboration between remotely placed design teams. CAD providing many advantages to a landscaper. CAD systems have the ability to provide a digital prototype of the product at early stages of the design process, which can be used for testing and evaluation. There are two main components of CAD system, i.e., software and hardware. AutoCAD is probably the most widely used landscape graphic software at the present time and it comes with the library of plants to introduce in the design. It includes powerful 2D graphics, strong 3D drawing and solid modeling functions. There are some major steps in designing landscape through CAD viz. conducting a site inventory and analysis, determining your needs, creating functional diagrams, developing conceptual design plans and drawing a final design plan. Drawing errors can be corrected easily through CAD. Similarly it required skillful and well trained person for handling. Landscaping through CAD gives various career options i.e. community planning and residential design, land development, state park design, golf course architect, work in consultation, design of resorts and theme park, university campus planner, operator etc. The current development of computer technology has brought increasing benefits to landscape design and its status is also on the rise. Landscape designers can use computer to perfect the design plans, improve working efficiency and optimize the interests.

BIOFORTIFICATION: A TOOL FOR WORLD'S FOOD SECURITY

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Biofortification is a very practicable and also cost-effective way of providing micronutrients to populations that are having limited access to diverse diets and other micronutrient interventions which are very costly for most of the population of the world. There are many companies which make use of the plant breeding techniques to address micronutrient deficiency around the globe since 2003. HarvestPlus and its partners have demonstrated that this agriculture-based method is capable of reducing micronutrient deficiency very efficiently. All over the earth more than 20 million farmer households are now growing and consuming biofortified crops. This practice is more evident in the developing countries. Given the strength of the evidence, attention should now shift to an action oriented agenda for scaling biofortification to improve nutrition of human globally. To reach out to one billion people across the world by 2030, there are three key challenges: 1) mainstreaming biofortified traits into public plant breeding programs; 2) building consumer demand; and 3) integrating biofortification into public and private policies, programs, and investments. While many building blocks are in place, institutional leadership and funding are needed to continue to move forward towards this aspiring objective.

Keywords: Biofortification, micronutrient, biofortified crops

DIFFERENT LEVELS OF NITROGEN ON CROP GROWTH OF FINGER MILLET

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The experiment was conducted at Birsa Agricultural University Farm Ranchi, during kharif (rainy) season of 2009. The experiment was conducted in Randomized Block Design with three replications and twenty treatment combinations consisting of four nitrogen levels (0, 20, 40 and 60 kg N/ha) and two medium duration finger millet genotypes (RAU-8 and BM-2). Finger millet genotypes respond positively to nitrogen levels and application of 40 kg N/ha manifested significantly higher grain yield (20.71 q/ha) and straw yield (54.12q/ha) of finger millet also improved significantly only upto 40 kg N/ha resulting is significantly higher plant height (104.95 cm) and dry matter accumulation (20.50 g/plant). Among genotypes, BM-2 was found superior comparable to RAU-8. Genotype BM-2 has outstanding performance in respect plant height (95.21cm) and dry matter accumulation (19.76 g/plant), grain yield (19.54 q/ha) and straw yield (52.44 q/ha).

IMPACT OF PESTICIDE RESIDUES ON ENVIRONMENT

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Pesticides may be defined as the chemicals, which are used to kill the pests, thus help to protect the plants, animals and human beings from attack of various pests. Depending on the pest to be killed, pesticides may be categorized into insecticides (for insect pest), weedicides (to kill weeds), fungicides (to kill fungi), miticides (to kill mites) etc. Use of various pesticides has helped to

improve world food production greatly. But, when they are applied in large amount, and their residues accumulate on the plant parts as well as on the soil, then may cause an adverse impact on various living organisms and the environment too. Pesticide residues enter the environment by various means, like: spray drift, vaporization, run-off, leaching etc. Some of the insecticides like organochlorines may persist in soil and water for a longer period of time. The toxicity of such pesticide residues shows undesirable effects, that may happen on non-target organisms/ livings, and also causes severe contamination of surface and ground water (i.e. non livings). Moreover, these persistent pesticides continue to accumulate and thus undergo the process of bio-magnification. Humans can also be exposed to these chemicals via the water and food, contaminated by their residues. It may lead to damage to kidneys, liver, lungs, and other body organs. So, due to their well known ability to cause so many negative health and environment effects, their side effects are one of the major risk factors for environmental health. To prevent these effects, pesticide residues should be analysed properly by various suitable methods, and their limit then should be kept below the MRL (Maximum Residue Limit), already set by the national and international legislations. A proper and regular pesticide residue monitoring programme can help to assess and protect the environment and the life of living beings.

Keywords: Pesticide, pest, persist, leaching, legislations.

OFF-SEASON VEGETABLE CULTIVATION UNDER PROTECTED STRUCTURES: A PROMISING TECHNOLOGY FOR DOUBLING FARMERS INCOME

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The demand for fresh vegetable prevails round the year but supply is restricted to cultivation season. The performance of the different vegetable crops is highly influenced by changes in climatic vagaries like fluctuation in temperature, light, humidity, wind velocity etc. that adversely affect the growth, physiological process, flowering, fruit setting and finally yield and economic return. The unpleasant climate drastically reduced the total production or even result in total crop failure. To increase the availability of the fresh vegetables beyond normal season, promotion of off-season cultivation is the need of the hour. Summer crop of winter season vegetables under open field condition is not possible as scorching sun and higher day and night temperature adversely affects the vegetative growth, prompted flower and fruit drop. Again cultivation of summer crop during winter months in open field suffers from low temperature, cold waves and freezing injury. By adopting proper protection technologies and providing favourable environment, the crops can be raised during off season. With the introduction of shade net which partially control the temperature and light and creates a favourable environment for crop growth that enables raise the crop under intense summer months with desirable yield and quality. Again polyhouse maintained higher temperature and light intensity compared to outside during winter months which favours the growth and yield of summer season vegetables. The full paper discussed the different aspects of off-season vegetable cultivation to make the production system economically viable and remunerative.

Key words: Off-season vegetable cultivation, agro shade net, poly house, temperature and light.

PROFITABILITY OF ORGANIC FARMING IN RAINFED CONDITIONS OF WESTERN HIMALAYAN REGION OF INDIA

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Rising cost of production and degradation of natural resources are of major concern during recent time which can be efficiently managed by adoption of resource conservation technologies under organic agriculture, but data on such resource conservation techniques are limited. Therefore, the present study was undertaken for five years (2013-14 to 2017-18) to identify efficient resource conservation options in organic agriculture under rainfed conditions of western Himalayan region of India. Eight treatments consisting of different resource conservation practices viz., basmati rice-wheat-*Sesbania* (green manure) system (T₁); system of rice intensification (SRI) rice raising technique-wheat-*Sesbania* (T₂); direct seeded rice (DSR)- wheat(zero tillage)-*Sesbania* system (T₃); DSR-wheat-moong on broad bed and furrow system (T₄); DSR- vegetable pea- cowpea on broad bed and furrow system (T₅); DSR- chickpea –moong on broad bed and furrow system (T₆); DSR + soybean on furrow in raised bed system-vegetable pea + mustard (T₇) and Rice + pigeon pea- cow pea + okra mustard on furrow in raised bed system (T₈) were accommodated in a randomized block design with 3 replications during *kharif* (rainy) and *rabi* (winter) seasons. As the main challenge for the organic production is farm based input production and disease management, treatment T₇, T₆, T₅ and T₂ showed promising results to increase farmer's profitability with small or marginal land holdings under organic production system.

Keywords: Organic Agriculture, Direct seeded rice, Broad bed and furrow system, Furrow in raised bed system, *Sesbania*, green manuring, System of Rice Intensification and Zero tillage.

QUANTITATIVE INTER-RELATIONSHIP BETWEEN DIFFERENT CONSTITUENT OF JERSEY AND SAHIWAL CROSS BRED COW MILK DURING LATE LACTATION PERIOD

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The general quantitative relation amongst the constituents of milk is both of physical and commercial interest and helpful in detecting abnormal milk. In the present investigation, 45 samples of Jersey and Sahiwal cross bred cow milk were analyzed for different constituents (Fat, Protein, Casein, Lactose, Chloride, SNF and T.S.) in late stage of lactation that is one hundred fifty days to end of lactation. The Protein–Fat relationship, Lactose–chloride relationship and Fat-SNF relationship were calculated. The average value of Koestler No was 3.181, lactose chloride No was 5.57, CMS No was 7.11, SNF Fat No 8.06, Protein fat No 1.57 and casein–fat No was 1.63.

REDUCED SILICON LEVEL: A CAUSE FOR REDUCED PRODUCTIVITY OF RICE

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Besides decrease in nitrogen level in soil, reduced silicon level is also a major cause for reduced productivity of rice. Silicon is required for sustainable production of rice and may be a limiting factor in rice crop under intensive rice cultivation. Silicon uptake takes place as Si(OH)_2 by rice which is higher than other micronutrients (IFA, 1992). A grain yield of 5 ton per ha depletes 230 to 470 kg Si per ha. (Amarasiri and Perera 1975, CRRI, 1976). Si supplied during tillering to elongation leads to elongation leads to better yield attributes. It also improves light interception (Savan. et. al 1997). It enhances optimum utilization of N and P. It improves the resistance and tolerant capacity against biotic and abiotic stresses like Fe and Mn toxicity by improving oxidation power of roots, panicle blast, brown spot, stem borer etc. The reduction in crop available Si in soil is limiting factor for decline in productivity. It enhances the thickness of culm walls and size of vascular bundles. It also provides the mechanical support and reduces lodging. High intensive irrigated rice crop has led to rapid decline in Si level but is possible to give sustainable yield under the high fertilizer input. Survey of soil plant Si profiles is necessary in intensively rice cultivated regions. Because of its importance region specific integrated nutrient management system (INMS), proper crop rotation and recycling of silicon in hulls and straw back to production field could be a solution for declined rice production and helps to maintain sustainable rice production.

Keywords: limiting factor, intensive, sustainable, INMS.

STRATEGIES FOR CLIMATE CHANGE MITIGATION THROUGH IMPROVED LAND USE PRACTICES IN SUB-HUMID TROPICS OF CHHATTISGARH, INDIA

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Anthropogenic activities are primarily responsible for alarming rates of increase in the concentrations of green house gases in the atmosphere and consequently the global warming. According to 6th assessment report (AR) of Intergovernmental Panel on Climate Change (IPCC), the earth's temperature had already increased by $1.0 \pm 0.2^\circ\text{C}$ above preindustrial area and likely to further rise by $1.5 \pm 0.2^\circ\text{C}$ between 2030 and 2052 if it continues to increase emissions at the current rate. Excessive tropical deforestation, faulty land use practices, increased fossil fuel burning, rapid industrialization and urbanization witnessing further elevating the emissions of the harmful green house gases. The brunt of climate change is now clearly visible and negative impacts are well recognized across the world. Tropical countries inhabited by poor farming communities are highly vulnerable to climate change as their livelihoods and economy are intricately linked to agriculture and forestry activities. Tropical ecosystem, one among the important terrestrial ecosystems recognized by unique diversity and complexity is at high risk to climate change. The continuing efforts of UNFCCC through international conventions on climate change made possible to compel most of the tropical countries to initiating strong mitigation strategies to stabilize the levels of GHGs by reducing the sources and expanding sinks in a phased manner by evolving action plans and national policies. Net emissions of CO_2 from land use conversion represent a significant driver and proximate cause of climate change in tropics including India. Improved and diversified land use practices would contribute in minimizing the GHGs mainly the CO_2 levels through C sequestration in soil and vegetation. The wholehearted afforestation, reforestation, regeneration, plantation, agroforestry and sustainable agricultural practices not only help in mitigation of CO_2 concentrations in the atmosphere but also synergistically improve the adoption under scenario of climate change. Besides, such activities provide many economic benefits to the societies through augmented production of food, fuel, fodder, timber, medicine, fibre etc. and also render ecosystem services by improving soil fertility, stabilizing the slopes, replenish soil and water conservation, better nutrient cycling, C sequestration, recreation benefits etc. India is facing the plight of climate change, the extreme weather events such as droughts, cyclones, floods, hailstorms etc. at frequent intervals are posing alarming threat to all aspects of ecosystem health, habitability, food security and livelihoods. The potential risk and vulnerability on fragile ecosystems

could hamper progress and economic development. India accorded many international agreements for stabilizing the rising levels of GHGs through its proactive national action plan for mitigation and adaptation to climate change. The strategic actions were initiated for improving the potential of C sequestration by increasing trees outside the forests and also promoting plantations and agroforestry under Green India mission to achieve a target of 33% of tree cover. Further, the national mission on water and sustainable agriculture were evolved to improve existing practices to tackle unforeseen future negative impacts of climate change. There is need to develop sustainable management practices for improving land use practices and enhancing C stocks across the country to reduce risk and vulnerability. Tree farming on ecologically fragile regions not only improve habitability but also improve soil organic C and ultimately the fertility for better plant growth and development. Soil organic matter is a large and dynamic reservoir of C and is a major part of the global C cycle. Restoring soil C is essential to enhancing soil quality, sustaining and improving food production, maintaining clean water, and reducing increases in atmospheric CO₂. The management of organic C and nutrient pools in soils not only affects the plant survival and its growth but also influences the allocation patterns of carbon in different plant components. The increased research for evolving relevant technologies and exploitation of their potentials need to be understood for improved C storage in different regions of India. Despite the growing concern and scientific relevance, only limited studies were conducted on C sequestration but none of them clearly address the mitigation potential of different land use systems with managerial interventions. Therefore a long term study was planned and conducted in Chhattisgarh, Central India to evaluate the potentials of C sequestration in different land use systems and effects of managerial interventions for enhancing C sequestration. The results of our study indicated that C stocks in dense forests (cover > 40%) ranged from 114 Mg ha⁻¹ to 152 Mg ha⁻¹, open forests (cover 10-40%) 68 -158 Mg ha⁻¹, degraded forests 15 -54 Mg ha⁻¹ and plantations 44 -78 Mg ha⁻¹, traditional agroforestry systems 8- 21 Mg ha⁻¹, agricultural lands 0.5-7.5 Mg ha⁻¹ under natural conditions. In contrary, the C stocks in well managed dense forests ranged from 180-216 Mg ha⁻¹, plantations 86.2-119 Mg ha⁻¹, scientific agroforestry systems 24-42.1 Mg ha⁻¹ and improved agricultural systems 11.5-26.5 Mg ha⁻¹. The C sequestration in managed dense forests ranged from 8.5 to 17.4 Mg ha⁻¹ yr⁻¹, open forests 5.4-8.5 Mg ha⁻¹ yr⁻¹, plantations 5.5 -14.4 Mg ha⁻¹ yr⁻¹, agroforestry 2.5 t-10 Mg ha⁻¹ yr⁻¹ and agriculture lands 0.5-4.0 Mg ha⁻¹ yr⁻¹. Soil C accumulation was significantly higher in upper layers (0-20 cm) and decreased with soil depth. Relatively higher soil C was found in dense forest compared to open forest and plantations, while agricultural lands showed lowest C stocks. The soil C at 0-20 cm depth in well protected and managed forests ranged from 28- 41Mg ha⁻¹, plantations 18-26 Mg ha⁻¹, agroforestry 12-21 Mg ha⁻¹, agricultural lands 9-11 Mg ha⁻¹. The soundly managed systems yielded 25-38% higher soil C in forests, 12-22% in plantations, 15-21% in agroforestry and 10-12% in agricultural lands. Soil C sequestration in managed systems ranged from 1.6-4.2 Mg ha⁻¹ yr⁻¹. The net C (Vegetation + Soil) storage in scientifically managed forests ranged between 208-257 Mg ha⁻¹, plantations 94-145 Mg ha⁻¹, agroforestry 36.2-63 Mg ha⁻¹ and agricultural lands from 20-37 Mg ha⁻¹. The net C sequestration in managed dense forests ranged from 10.5 to 20.4 Mg ha⁻¹ yr⁻¹, open forests 7.4-9.6 Mg ha⁻¹ yr⁻¹, plantations 6.5 - 16.4 Mg ha⁻¹ yr⁻¹, agroforestry 3.65 -10 Mg ha⁻¹ yr⁻¹ and agriculture lands 1.2-4.8 Mg ha⁻¹ yr⁻¹. The stand age and composition of vegetation played a significant role in the C sequestration. The paper discusses management implications for improving C sequestration across land use systems to increase mitigation potential to climate change and also achieving ecological and economic benefits for sustainable development.

Keywords: Agroforestry; C stocks ; C sequestration; C trading; Green House Gases (GHGs); Plantations; Soil Carbon pools

INTEGRATED NUTRIENT MANAGEMENT IN CHICKPEA (*CICER ARIETINUM* L.)

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A field experiment entitled “Integrated Nutrient Management in Chickpea (*Cicer arietinum* L.)” was carried out during *rabi* season of 2017-18 on calcareous clayey soil at Junagadh. The experiment was laid out comprising ten treatments in randomised block design with three replications. The experimental results revealed that significantly higher values of growth parameters viz., plant height, number of branches per plant, number and dry weight of root nodules, dry matter production and yield attribute viz., pods per plant along with higher seed yield (2228 kg/ha) and stover yield (3436 kg/ha), quality parameter viz., protein content, soil and plant chemical analysis N, P, K content, uptake and availability in soil, microbial counts (VAM, *Rhizobium*, PSB and KSB) in soil after harvest and net return (Rs.68141/ha) were recorded significantly higher under the treatment RDF + VAM + *Rhizobium* + PSB + KMB (soil application). With regard to economics, the highest B:C ratio (2.81) was realized with the application of 75% RDF + VAM + *Rhizobium* + PSB + KMB (soil application). Based on one year experimental results, it seems quite logical to conclude that higher production and net returns from chickpea (Gujarat Gram-5) can be obtained by the application of RDF + soil application of VAM @ 0.25 kg/ha + soil application of *Rhizobium* + PSB + KMB @ 3 L/ha each while maximum benefit cost ratio (B:C) can be obtained by the application of 75% RDF + soil application of VAM @ 0.25 kg/ha + soil application of *Rhizobium* + PSB + KMB @ 3 L/ha each on medium black calcareous clayey soil under South Saurashtra Agro-climatic Zone.

Keywords: RDF, VAM, *Rhizobium*, PSB, KMB, Chickpea, Integrated, Yield

FUMIGANT ACTIVITY OF ORANGE JASMINE, *MURRAYA PANICULATA* (L) JACK. ESSENTIAL OIL AGAINST ALMOND MOTH, *CADRA CAUTELLA*

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Plant secondary natural insecticides are chemicals extracted from plants called botanical insecticides and used as potential alternative to synthetic or chemical pesticides which is an excellent component of integrated pest management. Identifying and evaluating plant secondary natural insecticides is the important feature for developing novel botanical insecticides. Leaves of Orange Jasmine, *M. paniculata* (L) Jack were selected for current study. The essential oil of *M. paniculata* was obtained by hydrodistillation extraction method. The fumigant activity was investigated at different concentrations viz., 16, 20, 28, 36 and 60 µl/lit of air using gas-tight flat bottom flasks (250ml) against different stages viz., eggs (2-3 days old), larvae (5-7 days old), and adult (2-3 days old). The mortality was recorded after 24, 48 and 72hrs of exposure time. For eggs, mortality was evaluated based on hatchability after treatment. Studies revealed that *M. paniculata* essential oils exhibited good fumigant activity. After 24, 48 and 72 hrs of treatment at 60µl/lit dose the mortality for larvae were 23, 63 and 70%, and for adults were 33, 87, 100%, respectively. Similarly, the mortality for eggs was 52 and 55.67%, respectively, after 24 and 48 hrs of treatment at 60 µl/lit dose. Gas chromatography-mass spectrometry (GC-MS) analysis of essential oil revealed 32 volatile components. The major components were germacrene-D (23.9%), alpha-zingiberene (23.3%), beta-caryophyllene (17.2%), trans-nerolidol (13.2%), humulene (4.28%), delta-elemene (4.06%) and γ -Murolene (3.42%)

LAND SUITABILITY EVALUATION FOR SOHAG-RED SEA ROAD SIDES, EASTERN DESERT, EGYPT

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The investigated area was a part of Sohag-Red sea road in Wadi Qena which considered a promising for horizontal agricultural expansion policy in Egypt. It lies between the 26°.75, 26°.65 latitudes (N) and 32°.7, 32°.9 longitudes (E) in an area about 204 km². The studied area was divided into six physiographic units viz., Wadifloor (WF), Low elevated sand sheet (LSS), High elevated sand sheet (HSS), Bajada (B), Piedmont (P) and Tableland (TL). Seventeen soil profiles were selected to be representative for the physiographic units of the studied area. Soil samples collected, prepared and analyzed for soil physical and chemical properties. Land suitability evaluation for different crops was applied using Agricultural Land Evaluation System (ALES) software which designed for arid and semi-arid regions. The obtained results showed that the studied area is moderate suitable (S2) for Sunflower and Olive crops, marginally suitable (S3) for Wheat, Barley, Maize, Peanut, Onion, Fig and Datepalm and not suitable (N) for Bean, Cotton, Potato, Tomato, Pepper and Alfalfa. The general dominant limiting parameters affecting land suitability are soil pH, EC, OM, CEC, CaCO₃, ESP and texture. Arc GIS 10.0 used for generating suitability maps for different crops in the investigated area. The obtained results and maps may be helpful for decision makers for best selection of cultivated crops to achieve efficient reclamation plans.

Keywords: Wadi Qena, GIS, ALES, Land suitability, mapping.

MONITORING OF NON TIMBER FOREST RESOURCES OF TROPICAL FOREST ECOSYSTEM USING SATELLITE REMOTE SENSING, GIS AND GROUND BASED INVENTORY

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Since time immemorial, the forests provided variety of timber and non-timber forest products to human societies for their existence and livelihood. Non timber forest products (NTFPs) are also known as non-wood forest products and defined as goods of biological origin other than wood, derived from forests, other wooded lands and trees outside the forests, which include sources of plant and animal origin. It include fruits, flowers, tubers, bark, leaves, grasses, medicinal plants, mushrooms, seeds, nuts, rhizomes, corms, bamboo, firewood, fodder, fiber, oils, tannins, dyes, gums, resins, oleo-resins, honey, lac, shellac, skins, fishes, insects, horns etc. For the poorest households, NTFPs can play a critical role in providing both food and income. So managing these NTFPs for sustainable supply effectively requires a comprehensive inventory of the resource and cost-effective tools for regular monitoring. Mapping NTFPs using satellite remote sensing can overcome problems but it requires high-resolution images that have appropriate spectral characteristics. This paper provides an overview of the use of remote sensing and field techniques for Monitoring of Non Timber Forest Resources.

Keywords: Geospatial techniques, High resolution data, Indigenous communities, Mapping

USE OF PHYTO COSMETICS FROM PLANTATION SPICES MEDICINAL AND AROMATIC CROPS**A ANJANEYULU****Department of Plantations, Spices, Medicinal and Aromatic and Crops, Bidhan Chandra Krishi Viswavidyala, Mohanpur, Nadia, West Bengal, India**

Cosmetics are substances that are used to enhance the odor and appearance of human body. FDA defines cosmetics as "intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body's structure or functions." The use of plants is as old as mankind and in the coming years, the market will see many new products containing natural oils and herbs. Plants were once the main source and foundation of all cosmetics; the pharmaceutical industry also uses a number of plants for drugs that are not suitable for use in cosmetic products. For skin treatment cocoa butter is used widely as an emollient and cosmetic preparations, and a source of natural antioxidants (Dweck, 1997b), turmeric powder is also used as a paste to treat skin ulcers and to help heal extensive skin (Shah, 1982), aloe gel can be applied as an emollient for burns, sunburn and mild abrasion, and for inflammatory skin disorders but also reduce the acne, spots and pimples, used for anti-aging treatment. For hair growth and color, the compound henna one, a brown powder isolated from the leaves, is responsible for the red colour in henna, if the hair is dyed with henna and then treated with a hot decoction of (*Allium cepa* onion) skin (Tonnesen, 1992), a coppery colour will be obtained, many medicinal and aromatic crops can be used for different purposes as a cosmetic. Natural ingredients are everywhere and continually gaining popularity, and the use of plant extracts in cosmetic formulation is on the rise. A cosmetic formulation including active principles of natural origin can protect the skin against exogenous or endogenous harmful agents, and help to remedy many skin conditions. In addition, natural products can be used in hair care, and as hair colorants or dyes. Aromatic plants and oils have been used for thousands of years, as incense, perfumes, cosmetics, and for their medicinal and culinary applications. In the future, it is possible that many new plants, extracts and oils of commercial significance will be identified, and many botanicals uses and claims of many wide spread herbs will be proven new isolation and extraction techniques will be shown to give higher quality products.

Keywords: Aloe gel, Anti-aging, Antioxidants, Cocoa butter, Cosmetics, Emollient.

NEW PEST RECORDS OF ALEYRODID FAUNA ON *FICUS BENJAMINA* FROM NORTH WESTERN UTTAR PRADESH (INDIA)**HINA ANJUM, ZOFISHAN BADER AND S.I. AHMED****Aligarh Muslim University, Aligarh, 202001**

The aim of this study was to explore the Aleyrodid fauna, infesting *Ficus benjamina* in Aligarh, UP. Four species belonging to the different Genera were found infesting *ficus benjamina* trees of various age groups in and around Aligarh. The survey was conducted from 2018-19. All the four species are described and illustrated with their dominance and evenness in each of selected study sites. These four species have been recorded for the first time in north western Uttar Pradesh which enriches the existing information on the species diversity of Aleyrodid fauna.

BIOLOGICAL WEED MANAGEMENT THROUGH RICE- DUCK FARMING**AJIT KUMAR PASWAN AND DINESH MAHTO****Krishi Vigyan Kendra, Jehanabad (BAU Sabour) Bihar**

The On Farm Trial was conducted at farmers field to assess the Biological Weed Management through Rice- Duck Farming. In this trial Following results were obtained. Results reveal that the paddy plots treated with Bispyribac Sodium were recorded highest yield (42.20 q/ha) and cost benefit ratio (2.27) followed by manually weeded plots, the yield recorded as 40.40 q/ha and cost benefit ratio (2.11). Whereas the plots with duck weeded were recorded the lowest yield (29.5 q/ha) and cost benefit ratio (1.90). The observation on rice-duck weed management was such that no weeding being done due to late onset of rainfall and low rainfall this year. Weeding through duck was not performed due to absence of stagnant water in the rice field. Hence, rice- duck weed mangement is not recommended for Jehanabad district of bihar. Therefore it can be concluded that Herbicidal weed management can be followed in paddy.

STUDIES ON GENETIC VARIATION, HERIDITY AND GENETIC ADVANCE IN PEA (*PISUM SATIVUM* L.) FOR PHENOTYPIC CHARACTERS

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An experiment was carried out to determine the magnitude of genetic variability, heridity and genetic advance as a mean for 55 pea genotypes using 11 quantitative characters viz., days to 50% flowering, Plant height, number of first fruiting node, length of first fruiting node, number of pods per plant, length of pod, width of pod, number of seeds per pods, green pod yield per plant, seed yield per plant and shell weight per plant. The ANOVA showed significant differences between all genotypes indicating the considerable variability among the genotypes. The phenotypic coefficient of variation (PCV) was quite higher than the genotypic coefficient of variation (GCV). High value of GCV and PCV was recorded for seed yield per plant, number of pods per plant, shell weight per plant, green pod yield per plant, plant height, length of first fruiting node and number of first fruiting node. All the characters showed high magnitude of heritability in broad sense (>60%) ranged from 83.91% (width of pod) to 98.84% (number of pods per plant). Moreover, a high heritage and genetic advancement were observed as a mean percentage (> 20 %) for all characteristics except in the days of 50 percent flowering which suggest that these characters are Genetically controlled by additive gene effects. The genotypes which showed superior results for the objectives under study are VRP-383, VRP-311, VRP-320 and Kashi Shakti and can be utilized for further breeding programme of pea.

SOIL AND WATER MANAGEMENT STRATEGIES FOR SUSTAINABLE HILL AGRICULTURE

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The rising population and reduction in the amount of land and some other resources have created tremendous pressure on current agricultural producers to meet the increasing food demands. To cope with this challenge, certain key inputs, such as fertilizers and other chemicals, are overused, which are worsening the surroundings. This intensive agricultural production without adherence to ecological sustainability has led to declining soil health, land degradation and severe environmental problems. The concept of agricultural sustainability and various soil and water management strategies that have been designed to optimize crop yield under sustainable environmental conditions, including integrated nutrient management (INM), integrated soil fertility management (ISFM), integrated soil-crop system management (ISSM), water harvesting and watershed management. Soil management strategies aim to improve crop productivity and reduce deterioration of land by optimizing various characteristics of soil such as its biological, physical, chemical and hydrological properties, through balanced nutrient management (Esilaba *et al.*, 2005). Soil and water management strategies also comprise of innovative approaches, like incorporating fertilizer at depths below the ground surface, adding urease inhibitors, or applying coated urea, which may enhance the uptake of nutrients. These modifications may inspire growers to give more attention to long-term policies, which are also environment friendly, instead of only considering the yield associated returns (Zhang *et al.*, 2012). The results obtained from the experiment conducted by Avasthe *et al.* (2013) have shown that drip irrigation is of immense value in hilly area fruit production and must be promoted for both water conservation and higher income. Combination of FYM and inorganic fertilizers increased the yield by 35% on average in maize-millet and by 16% on average in rice-wheat cropping systems (Sherchan *et al.*, 1999). So, integrated use of chemical fertilizers and organic source of nutrients enhances productivity and quality of crops and sustain the fertility status of soil.

Keywords: Sustainability, Strategies, Water harvesting, INM, ISFM, ISSM.

MOLECULAR DIAGNOSIS OF FUNGAL PLANT PATHOGENS

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Diseases cause major economic and production losses in the agricultural sector worldwide. Monitoring plant health and detecting the pathogen at early stage are essential to reduce the disease spread, and facilitate effective management practices. At present, 1.5 million species of fungi are estimated and among these less than 5% have been described. Identification of fungi responsible for plant diseases is the cornerstone of plant pathology discipline. The main goal of all diagnostics methods is to identify disease-causing organism. Basic methods used to detect the organism mostly rely on microscopic, cultural and morphological approaches that require extensive time, labour and classical taxonomy knowledge. These approaches can lead to the unreliable results as they are based on phenotypic characters which tend to change with environment and experts in fungal identification are also required for effective results. Due to the conventional methods limitations, molecular techniques came in to use for the investigation, identification and classification of pathogen. These techniques includes southern hybridization, *in situ* hybridization, fluorescence *in situ* hybridization, microarray, Loop-mediated isothermal amplification (LAMP), PCR technology which includes

multiplex PCR, nested PCR, real-time PCR and reverse transcriptase (RT)-PCR and DNA barcoding (nucleic acid-based methods) which allow the determination of closely related species and detect the minute quantity of pathogen even when no visible sign is present. DNA-based methods for plant disease diagnoses are based on genotypic characters and give fast, highly specific and effective results.

ROLL OF SALICYLIC ACID IN PLANT DEFENCE AGAINST PHYTOPATHOGENS

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Many species of bacteria, fungi, viruses and nematodes attack plants often with devastating impact. From germination onwards, plants are vulnerable to different types of pathogens that may be present in the habitat and to environmental factors that compromise plant immunity. Plant defense against these stresses is mediated through various signaling pathways that lead to the production of many defensive proteins and non-protein compounds. Plant phytohormones such as abscisic acid, jasmonic acid, ethylene and salicylic acid (SA) are important components of different signaling pathways involved in plant defense. SA mediates the phenylpropanoid pathway, while as JA mediates the octadecanoid pathway Salicylic acid (SA), a plant hormone plays an important role in induction of plant defense against a variety of biotic and abiotic stresses through morphological, physiological and biochemical mechanisms. Plants responded very quickly to SA and showed higher induction of peroxidase (POD) and polyphenol oxidase (PPO) activities, besides the higher accumulation of phenols, H₂O₂ and proteins. Plant defense mechanisms and specifically on the role of salicylic acid (SA) in disease and abiotic stress management, the signaling pathways involved in chemical responses to pathogens with a specific focus on the role of SA in those pathways

Key words: Plant pathogen, salicylic acid, Plant defence, immunity levels and/or perception

ADVANCED PATHOLOGICAL TECHNIQUES FOR DETECTING INFECTIOUS DISEASE PATHOGENS

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Detection and surveillance for emerging and re-emerging pathogens need a multidisciplinary approach. Plant diseases are responsible for major economic losses in the agricultural industry worldwide. Monitoring plant health and detecting pathogen early are essential to reduce disease spread and facilitate effective management practices. DNA-based and serological methods now provide essential tools for accurate plant disease diagnosis, in addition to the traditional visual scouting for symptoms. Although DNA-based and serological methods have revolutionized plant disease detection, they are not very reliable at asymptomatic stage, especially in case of pathogen with systemic diffusion. They need at least 1–2 days for sample harvest, processing, and analysis. In present era, various modern methods are available based on nucleic acid and protein analysis and different innovative approaches currently under development. Modern findings are the following: (1) novel sensors based on the analysis of host responses, e.g., differential mobility spectrometer and lateral flow devices, deliver instantaneous results and can effectively detect early infections directly in the field; (2) biosensors based on phage display and biophotonics can also detect instantaneously infections although they can be integrated with other systems; and (3) remote sensing techniques coupled with spectroscopy-based methods allow high spatialization of results, these techniques may be very useful as a rapid preliminary identification of primary infections. Serological and PCR-based methods are the most available and effective to confirm disease diagnosis, volatile and biophotonic sensors provide instantaneous results and may be used to identify infections at asymptomatic stages. Remote sensing technologies will be extremely helpful to greatly spatialize diagnostic results. These innovative techniques represent unprecedented tools to render agriculture more sustainable and safe, avoiding expensive use of pesticides in crop protection.

Keywords: DNA-based methods, Immunological assays, Spectroscopy, Biophotonics, Plant disease, Remote sensing, Volatile organic compounds, Commercial kit

EFFECT OF AGRI-SILVI-HORTICULTURAL SYSTEM ON SOIL MOISTURE CONTENT AT DIFFERENT DEPTHS

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The present study was conducted at Research Farm, Department of Forestry CCS HAU, Hisar to analyze the effect of agri-silvi-horticultural system on soil moisture content at different depths (0-15, 15-30, 30-60 & 60-90 cm). There were five irrigations in all 3 systems i.e. Kinnow + Eucalyptus + wheat, Kinnow + wheat and control (devoid of trees), applied during sowing of wheat and then applied in the interval of one month. Moisture content was increased significantly with increase in soil depth but it decreased under tree integrated system and maximum decrease was observed under Kinnow + Eucalyptus + wheat system. There was slight difference between first and second irrigation which shows more moisture content relative to succeeding 3 irrigations which have similar trend under all systems. During first irrigation, mean soil moisture content was significantly higher under control (12.6%)

followed by Kinnow + wheat (11.7%) and it was lowest under Kinnow + Eucalyptus + wheat system (10.7%). Similarly at second irrigation, mean soil moisture content was significantly higher under control (11.7%) followed by Kinnow + wheat (10.7%). Significantly lowest was under Kinnow + Eucalyptus + wheat system (10.0%) as compared to control. In succeeding three irrigations, mean soil moisture content was statistically at par with each other in all the systems. Based on above study, results showed that there was more uptake of moisture under tree based system which is due to deep and proliferated root system of tree component as compared to sole crop.

Keywords: Depth, Irrigation, agri-silvi-horticultural, Kinnow, wheat, Eucalyptus

ROLE OF QUALITATIVE SEED CANE PRODUCTION AND VARIETAL BALANCE: ALSO FUTURE NEEDS FOR SUGAR MILLS AND SUGARCANE GROWERS IN UTTAR PRADESH

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Balanced varietal planning with an adequate proportion of high sugared and high yielding sugarcane crop in each factory area is required so that sugarcane with maximum sucrose content is supplied throughout the crushing period to realize optimum recovery. Since, ratoon occupies more than 50 percent area; emphasis should be laid on raising ratoon productivity by adopting proper management practices. This needs to be taken up on a priority basis because the future hopes are pinned mainly on sugarcane ratoon. Strict follow up of pre harvest maturity survey, harvesting schedule and supply management in proper sequence is needed. Scientific regulation of cane supply to factories with minimum time lag between harvesting and milling, drawl of cane from economic distance and strict regulation on the physical quantity of the cane should be followed. Cane crushing during hot summer months should be avoided. If milling is to be continued under specific circumstances, suitable varieties, agro and chemical technology, quick and efficient supply of canes should be followed. The author's experience has shown that seed cane production in sugarcane is a profitable entrepreneurship. Progressive farmers and unemployed youth can make use of the growing demand for disease free planting materials and capitalize on it. There would not be any problem in disposing-off the seed cane, if the new and improved sugarcane varieties are chosen for seed production. Role of quality planting materials have helped quick spread of improved varieties in the subtropical states.

Keywords: Qualitative seed cane production, Varietal balance, Seed cane, Three tier programme.

AGRIBUSINESS MANAGEMENT: EMERGING AREAS AND OPPORTUNITIES

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Agriculture has now been playing a vital role in the economic growth of developing countries including the growing industrialization and its importance has increased agricultural products in the several folds. Moreover, now, the food and food products import-export policies also play an important role in the overall development of any country. In addition to changing nature of the rural economy, it leads to have shifts from subsistence farming to commercial food enterprises. In the developed countries, agribusiness is defined as the total output arising from farm production and product processing at both pre and post farm gate levels. In developing countries like India, the agribusiness sector encompasses four distinct sub-sectors viz. agricultural inputs, agricultural production, agro-processing and marketing and trade. Agribusiness is emerging as a specialized branch of knowledge in the field of management sciences. Likewise, agribusiness can be defined as science and practice of activities, with backward and forward linkages, related to production, processing, marketing, trade, and distribution of raw and processed food, feed and fibre, including supply of inputs and services for these activities. For improving the efficiency of the marketing system, there is a need of substantial investment in marketing infrastructure, both physical and institutional. The investment needs and opportunities for investors are in the following areas: Production, - Production of high-yielding seeds, Production of high-quality planting material, Organic farming, Production of microbial cultures and vermin-compost, Floriculture.

Keywords: Agriculture, Agribusiness sector, Economic growth, Infrastructure.

MEMBRANE TECHNOLOGY IN LIQUID FOOD PRESERVATION

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The conventional juice preservation techniques such as pasteurization/ sterilization use heat during the processing. The juices and herbal beverages phytonutrients, water soluble vitamins are heat sensitive. If the aforesaid beverages processed conventional methods freshness, aroma, flavour and color that also adversely affected. So there is warranting other non thermal techniques.

Membrane processing is a good alternative for juice concentration and clarification compared to conventional practices with retention of high quality nutritional values. Now a day it is extensively used in Dairy and Beverages industries. The popularity is going up day by day in the beverages industries because it require shorter processing time, less manpower and energy efficient comparatively other techniques.

AGRONOMIC AND PHYSIOLOGICAL CHARACTERS OF GRASS HALOPHYTES UNDER DIFFERENT STRESS CONDITIONS

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An experiment was conducted during 2014-15 at the micro-plot research area of ICAR-Central Soil Salinity Research Institute, Karnal, titled as “Agronomic and Physiological Characters of Grass Halophytes under Different Stress Conditions”. The experiment was laid out in factorial randomized block design with three halophytes namely *Dicanthiummannulatum*, *Suaedanudiflora*, *Urochondrasetulosa* with six salt stress treatments [pH2 – 7.0 and ECe – 0.43 (Control), pH2 - 9.5 and pH2 - 10.0 (sodic soil), ECe – 15 dsm-1, ECe-25 dsm-1 and ECe-35 dsm-1 (saline soil)]. Agronomical and physiological parameters of above said halophytes were studied at monthly interval. Fresh weight (FW) and dry weight (DW) of halophytes was affected by the different stress conditions. In *Dicanthiummannulatum* and *Suaedanudiflora* FW and DW had shown variations in different salt stress conditions whereas stress conditions did not had much effect on *Urochondrssetulosa*. Number of tillers per plant increased with the increasing sodic stress in case of *D. annulatum*, but decreased with increase in saline stress. *U. setulosa* also showed increased number of tillers in sodic stress upto pH2 9.5 and thereafter it decreased. Across different salinity level, number of tillers in *Suaedanudi flora* did not show any significant effect. Gas exchange parameters like stomatal conductance, photosynthetic rate and transpiration rate was found to be decreased across different salt stress conditions. Sodium content in these halophytes varied with stress condition. The sodium content in these halophytes had also shown variations under different stress conditions. In *U. setulosa*, the sodium content increased within creasing salinity level i.e. at ECe 35dS/m was 4.70 % which was highest in comparison to control. Higher K⁺ content was observed in control treatment in *D. annulatum* (2.15%) and *Urochondra* (0.63%), which decreased with salt stress. However, in case of *Suaeda* higher values of K was estimated in salinity stress up to ECe: 25 dS m⁻¹.

EFFECT OF DIFFERENT LEVELS OF NITROGEN ON GROWTH AND YIELD IN POTATO (*SOLANUM TUBEROSUM* L.) CV. KUFRI KHYATI

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The present investigation was carried out at Main Experiment Station, Department of Vegetable Science, Narendra Deva University of Agriculture & Technology, Kumarganj, Faizabad (U.P.), during the year 2014-15 and 2015-16. The seven treatments were evaluated on cv. Kufri Khayti in Randomized Block Design with three replications. The study revealed that almost yield attributes are influenced by increasing different levels of nitrogen and found significantly higher by the increasing of the levels of nitrogen. The yield attributes viz., Number of tubers per plot (grade wise), Weight of A,B,C and D grade of tubers per plot (kg), Total number of tuber per plot, Total yield of tubers per plot (kg) and tuber yield per hectare recorded maximum with the application of treatment (T₅) 200 kg N/ha during both the years (2014-15 and 2015-16). The study further revealed that the treatment T₅ also had maximum net return and cost benefit ratio during both the years of investigation.

Key words: Potato, Kufri Khayti, Growth attributes, Yield and nitrogen levels

BIODIVERSITY CONSERVATION THROUGH AGROFORESTRY

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The expanding human and live stock population increase pressure on the natural resources and causes their degradation and biodiversity loss also. The acknowledgment that biodiversity loss and human prosperity is connected together both in biological and financial terms has expanded the degree of secured regions around the world. Agroforestry is unpredictable framework and has potential to conserve biodiversity. Through various helpful impacts and components diversification helps in biodiversity conservation. Agroforestry, as part of a multifunctional working landscape, can play an important role in conserving and even improving biodiversity from ranches to the landscape level in both tropical and temperate areas of the world. It is imperative that sustainable consumptive use approaches that can combine production and conservation capacities are additionally essential in conserving biodiversity in human dominating landscape.

Keywords:- Biodiversity Conservation, Agroforestry, Landscape

STANDARDIZATION OF A PROCESS FOR THE PRODUCTION AND APPLICATION OF A CONSORTIA OF ALKALI THERMOSTABLE ENZYMES FOR PULP BIOBLEACHING

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Indian pulp and paper industry is one of the fastest emerging business sector of the country which has shown tremendous growth in last few years. Paper industry is highly varied and provides abundant opportunities for the use of microbial enzymes in processes, such as biopulping, biobleaching, de-inking, pitch removal, fiber grafting, paper coloration, and bioremediation of effluents. Although applications of enzymes for these processes are still at budding stage, currently the most important application is eco-friendly biobleaching of pulp. Bioprocessing of pulps using microbial enzymes for biobleaching is one of the most suitable biological applications for the pulp and paper industry. Lignolytic (laccase) enzymes helps directly in the removal of lignin from the pulp and hemicellulolytic (xylanase, mannanase) enzymes increases the access of bleaching chemicals to the lignin layer by opening the pulp structure. Bacterial enzymes are preferred as they can work at high temperature and pH at which the pulp is processed in industry. A number of bacterial enzymes have been explored individually for pulp biobleaching. Some report have also reported the use of combination of these enzymes but produced by different bacteria which make their application economically unviable. Therefore there is a need to isolate a bacterial strain producing a cocktail of hemicellulolytic and lignolytic enzymes and standardizing a procedure for their application in pulp and paper industry to make the whole process of paper making eco friendly. In the present study, *Bacillus* sp. LXM 55 MTCC 12897 was isolated from effluent of paper mill which produced a cocktail of lignolytic (Laccase) and hemicellulolytic (Xylanase+Mannanase) enzymes. All the enzymes were found to be active in the temperature (37°C-70°C) and pH (highly alkaline) range which was suitable for their application in pulp and paper industry. Conditions were standardized for the over production of enzymes in solid state fermentation as well as submerged fermentation by using classical and statistical methods. Characterization was done and results indicate that enzyme was stable in the presence of various halides, metal ions and surfactants. Significant reduction in chlorine use and kappa number was achieved by pretreating the pulp with cocktail of enzymes. Therefore this cocktail of enzymes is highly suitable candidate for developing a cleaner and economical process for Pulp bleaching.

EFFECT OF AGRICULTURAL WASTES ON VERMICOMPOST PRODUCTION

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Background and objectives: Management of agricultural and food waste from farm and kitchen is a big problem in waste management. Vermicomposting can be an effective means to manage such degradable wastes. It is the process of conversion of biological waste into high quality manure by the use of Earthworms. Epigeic species of earthworms were used for vermicomposting, of which *Eisenia fetida* are considered the most effective ones. A research was carried out in Agriculture and Forestry University, Chitwan, Nepal to assess the manuring potential of different agricultural wastes through vermicomposting using *Eisenia fetida* species of earthworms. We hypothesize that the nutrient content of agricultural wastes after Vermicomposting will be superior to that of cow dung alone. Materials and Method: Plastic bins were used for Vermicomposting with 200 earthworms in each bin except for control treatment. The research was carried out in completely randomized design, which consisted of eight treatments with three replication for each. Six different agricultural wastes (*Lantana camara*, Banana pseudo stem, *Ageratum conyzoides*, Mycostraw, vegetable wastes, Garden wastes) having cow dung as base food material and cow dung alone were used as substrates for Vermicomposting and compared for Nitrogen content with cow dung manure. The Nitrogen content of all vermicompost samples were found significantly higher than that of cow dung manure. Among the vermicompost sample, it was found highest in *Ageratum conyzoides* followed by *Lantana camara*. Hence, we can recommend farmer to use Vermicompost in place of chemical fertilizer to promote healthy and organic agriculture produce.

Keywords: Vermicomposting, Earthworm, Substrate, Vermicompost

DOUBLING FARMERS' INCOME: TRENDS, CHALLENGES AND STRATEGIES

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Green revolution paved a path for a quantum leap in food production assuring world food security. In many countries, there has been a rapid depletion in agriculture's natural resource base, jeopardizing future productivity because of intensive crop production. So, to achieve the projected demand over the next 40 years, farmers in the developing world must double food production, an

unnerving challenge due to the combined effects of climate change and growing competition for available resources. Since the last 50 years, food production has multiplied 3.7 times while the population increased by 2.55 times. But over the years, the farmer's income remained low in comparison with the income from non-agriculture work which led to farmers' distress. In the past few decades, India's focus has largely presided towards the use of innovative technologies, subsidies on chemicals and irrigation, and price support from government agencies to substantially increase the production and productivity of agricultural produce. Innovative technologies as high-tech agriculture, crop diversification, integrated farming systems, natural farming, etc. can double the incomes. The adoption of improved inputs, emphasis on micro-irrigation, environment-friendly automation and mechanization, use of nanotechnology inputs, climate forecast, GPS, drones and other machineries and tools common to agriculture, protected agriculture, indoor multi-storey soilless urban farming, hi-tech greenhouse enhance farmers' income forming the base of high-tech agriculture otherwise called as 'future farming'. Present-day production practice is aided with information and communication technology. Crop diversification, in the form of fruits, vegetables, floriculture, medicinal and aromatic plants and introduction of non-farm enterprises and value-addition could boost farmers' economy by the adoption of high-tech agriculture, enhancement of rainwater use efficiency, organized marketing to escape distress sale, creation of storage facilities to avoid market gluts. Proper vision and strategic efforts in a mission mode, can foresee agriculture as an engine of national economic growth.

Keywords: Hi-tech agriculture, crop diversification, nanotechnology, drones, GPS, soilless urban farming, value addition

MECHANIZED PADDY CULTIVATION- A STUDY IN GANJAM DISTRICT OF ODISHA

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The present study entitled "Mechanized paddy cultivation- A study in Ganjam district of Odisha" was conducted in Surada and Dharakote blocks of Ganjam district. Two gram panchayats from each blocks were selected purposively. Three villages from each gram panchayats were selected randomly. 120 numbers of respondents were selected through disproportionate random sampling procedure @ 10 numbers from each one of the 12 villages. Specific objectives of the study were: (1) to study the extent of adoption of mechanized farming by the paddy growers (2) to study the use of extension tools and techniques by the extension functionaries for promotion of farm mechanization. The data was collected through pre-tested structured interview schedule. The collected data was tabulated and statistically analysed with the help of suitable statistical tools and techniques such as Frequency, Percentage, Mean score, Standard deviation etc. The findings of the study revealed that, majority of the respondent farmers have adopted water pump (89.16)% and cage wheel (85%). Most of the respondent farmers were unaware about paddy grain dryer (84.16)% and combine harvester (60%). For promotion of farm mechanization in the study area, public extension system, seed company, fertilizer company, pesticide company, dealers of farm machinery and equipments have used various extension tools and techniques like electronic media, printed mass media, campaign, exhibition, method demonstration, result demonstration, skilled training, group discussion, meeting, exposure visit, internet and written material etc.

REVIEW ON AQUACULTURE AND FISHERIES IN NEPAL: STATUS AND PROSPECTS

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¹Can Tho University, Vietnam, ²Agriculture and Forestry University, Rampur, Chitwan

Nepal is rich in water resources. A large number of river-rivulets, lakes, reservoirs and swampy wetlands are the major assets, which have a large potential to flourish aquaculture and fisheries. The total aquaculture and fisheries production was 77,000 tons in the year 2017 is par satisfactory. The per capita fish availability is 3.01 kg, which is very low considered to the average per capita consumption and availability of the developing countries. The growth rate of the fisheries subsector is 10.79% in 2016/17 will not be enough to increase total production, five times of present production by 2031/32. The climatic and geographical variation offers a suitable condition for fish species production. Still, the fish supply cannot meet the national demand. Lack of skilled labor, rigid plan and policies, farm mechanization and advanced technology, improved seed, and quality feeds are the major constraints that hinder the growth of the aquaculture sector. In this paper, the author, provide future perspectives, which can be of substantial value to different stakeholders involving in aquaculture and fisheries. Various aspects of aquaculture development through a synergistic approach by incorporating social, economic and environmental components dealing with poverty alleviation, sustainable development and climate change. The future interventions in aquaculture development imparts huge impacts on sustainable livelihood through food security, nutrition, and health. Aquaculture has been the promising sector for the economic upliftment by providing economic opportunities to marginalized 24 ethnic groups, which are involved in fisheries sector. Moreover, increasing the contribution of AGDP and the national economy through import substitution. Nepal also possess to be the international hub of cold fresh water fisheries production in Asia. The key priorities of aquaculture development in Nepal is also discussed with respect to experience and learning from the Aquaculture developed countries.

Keywords: Water Resources, Aquaculture, Priorities, Economy, Health

WIRELESS SENSOR NETWORK (WSN), AN EFFICIENT TECHNOLOGY IN PEST MONITORING**SUCHISMITA BALABANTARAY****Department of Entomology, College of Agriculture, Odisha University of Agriculture and Technology, Bhubaneswar**

India is an agricultural country which depends mainly on agriculture and crops for its economic survival. Wireless sensor network (WSN) is an emerging technology all over the world. WSN has proved to be very useful in specific applications requiring monitoring of real time data. Integrated Pest Management (IPM) is an efficient and environmentally sensitive approach to insect control that relies on a mixture of common pest control practices. IPM programs use current, comprehensive information on the life cycles of pests and their growth and interaction with environment. The level at which pests will either become an economic threat is critical to guide future pest control decisions. Not all insects, weeds, and other living organisms require control. Development in wireless sensors technology techniques enable us to take better decision based on information received from data monitoring. WSN with prediction algorithm and application promising us to (i) reduce cost and efforts to control pests, (ii) real time monitoring and analysis of their behaviour and activities, (iii) provide a platform for studying and applicable solution to similar problem with some desired extensions.

NOVEL: PERFECT ILLUSTRATION OF WASTE TO WEALTH**SUCHISMITA JENA^{1*}, T.R. AHLAWAT² AND C.S. DESAI³****^{1*} NAHEP-CAAST Project, ²Department of Fruit Science, ³Department of Post-Harvest Technology, Navsari Agricultural University, Gujarat, 396450, India**

Being one of the most important, gigantic and oldest cultivated fruit crops, banana, is grown in almost every tropical and subtropical regions of the world. Its fruit is cheapest, plentiful and most nourishing among all fruits. Apart from fruit, it generates huge quantity of biomass of 50 to 60 t/ha as pseudostem, leaves and suckers, which is absolute waste in most of the states. The farmers are incurring heavy expenditure on the disposal without getting any income. These free wastes could be utilized to produce different bio-products which will contribute directly to our national economy as well as ensure eco-friendly environment. Sap obtained from pseudo-stem is a good source of plant nutrients such as N, P, K, Ca, Mg, S, Fe, Zn and Cu along with growth promoting hormones like Cytokinin, Napthalene Acetic Acid and Gibberellic Acid *etc*, hence can be used as an organic liquid nutrient. It can save 20-40% dose of chemical fertilizer with yield advantage of 10-15% when being used as liquid nutrient either through drip system or drenching to the crops. After extraction of the sap the scutcher can be used for the vermicomposting. Navsari Agricultural University has patented the organic liquid nutrient product and named it as NOVEL. Around 18 companies in India are commercially manufacturing this product under license from the University. This sap can also be used as mordant in textile dying. This can be a win-win situation for banana growers. Looking at this perspective, growers and entrepreneurs should avail this golden opportunity and transform banana waste into commercial valuable products.

Keywords: waste utilisation, banana pseudostem, NOVEL, liquid nutrient**ECO-FRIENDLY HYDROPONIC STRUCTURE WITH NUTRIENT FILM TECHNIQUE FOR CULTIVATION OF FENUGREEK****SUCHITA V. GUPTA¹, SANJAY B. LOKHANDE¹, M. B. NAGDEVE², BHAGYASHREE N. PATIL², AJAY Y. TALOKAR³, MRUDULATA M. DESHMUKH³****Department of Farm Structures, College of Agril. Engg and Tech, Dr. PDKV, Akola.**

The three green, white and without covering hydroponic structures with nutrient film technique were designed and developed at Department of Farm Structure, Dr. PDKV, Akola. A field experiment was conducted to study the growth and quality of fenugreek under controlled atmosphere in the hydroponic structure. The experiment was laid out in randomized block design. The structure was made up of PVC pipe with the dimensions of 1400 mm long and 970 mm wide and at a height of 1800 mm. The diameter of PVC pipe was 75mm. The study revealed that temperature, relative humidity, light intensity and CO₂ concentration inside the green hydroponic structure was favorable for the growth of fenugreek in the summer season. The results of biometric characteristics and quality parameters were analyzed by using design expert software. The temperature was 1-2⁰C more in the white hydroponic structure as compared to green color hydroponic and 8-10⁰C less as compared to open field and light intensity was found 10 percent less in green and white as compared to the open field. The Relative humidity inside the green and white color hydroponic structure was observed 30-35% greater as compared to open structures. The Biometric characteristics of fenugreek like plant height, number of leaves and stem diameter were found maximum in green hydroponic structure as compared to white hydroponic structure and open field. The Yield of Fenugreek was found two times more in green hydroponic structure as compared to the open field. Quality of fenugreek on the basis of moisture content, iron content, chlorophyll content, and yield were found maximum in green and white both hydroponic structures. The total cost required for hydroponic structure was Rs. 32113/- (Thirty two thousand one hundred thirteen only).

Keyword: Hydroponic Structure, Shade net, temperature, Relative Humidity, Nutrient Content

STUDY OF GONADOSOMATIC INDEX AND MATURATION OF AN INDIAN MAJOR CARP *LABIO ROHITA* IN BIHAR INDIA

SUDAY PRASAD and PARAS NATH

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Gonadosomatic index is a tool for measuring the reproductive ability of animal and correlation with ovary development. The systematic supervision for obtaining high yield of fish production ultimately calls the adequate and in-depth study of reproduction mechanism. The present study was undertaken to sketch accurate spawning period of *L. rohita* in South Bihar. This is reported in terms of gonadosomatic index which convey the relative change in gonad weight to the percentage of body weight. Gonadosomatic indexes (GSI) of an Indian Major Carp (IMC) *Labeo rohita* in spawning season i.e. from April to August 2018 have been reported. Ovarian mean weight of the carp *L. rohita* ranges from 77.87 - 91.13 g. the present study showed that the gonad of the reported fish increases with the increase in size and weight of fish. The average weight and length of fish were ranged from 526.63 – 647.88 g and 32.34 - 38.43 cm, respectively. The gonad attained the maximum weight 141.63 in May and minimum 77.13 in August. The peak value of GSI was observed only from May to June indicate only two months of spawning period of the said species. The present study indicates a new line for *L. rohita* seed production and culture in Bihar agro-climatic condition. The details of the observations have been discussed in the present communication.

Keywords: Fresh water fish, *Labeo rohita*, gonadosomatic index, spawning, Bihar,

EFFECT OF SILICON ON YIELD INCREMENT AND BIOTIC STRESS TOLERANCE IN *ORYZA SATIVA* UNDER CONDITIONS OF WATER STRESS

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Silicon is the second most abundant element in earth's crust. Not being considered as an essential element, it has largely been neglected by the plant physiologists since ages and thus its prospective benefits in agriculture remains hidden. Silicon is recognized to conjoin with the mitigation of biotic as well as abiotic stresses. The present study was conducted out to examine the importance of Si in yield heightening and to induce biotic stress tolerance under water stressed conditions in five rice genotypes. Two year field experiment was conducted with four treatments viz T1-control, T2-0.6% silicon spray (ortho Silicilic acid) at tillering, PI, 50% flowering and milky grain stages, T3-Si + water stress by withholding irrigation 12 days before flowering and 10 days after anthesis, T4-water stress only. Fertilizers were applied at the rate of 100kg N/ha, 45kg P/ha and 60kg K/ha. Observations recorded for yield revealed an enhancement of upto 25% under silicon spray treatments as compared to control. In addition to significantly increasing biomass yields under deficit irrigation, Si fertilization has been tremendously effectual in diminishing the incidence of blast, leaf folder, yellow stem borer and bacterial blight. Si, thus, proves itself to be an essential element for rice production and silicate fertilizer application in paddy fields can be an encouraging scheme to eradicate adverse consequences of biotic and drought stress.

EFFECT OF BORON, UREA AND GA₃ ON THE VITAMIN C CONTENT OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*)

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Acclaimed widely as one of the most fastly popularized vegetable, Broccoli (*Brassica oleracea* var. *italica*), is undoubtedly one of the most nutritious vegetable too. It is also rated as one of the most remunerative cole crops. Vitamin C, also known as ascorbic acid, is necessary for the growth and development of the body as well as it plays a very significant role in the immune system of the body. It is an essential vitamin, as it cannot be produced by the body so must be supplemented from outside. Broccoli is a good source of Vitamin C. To assess the impact of foliar spray of boron, Urea and GA₃ on Vitamin C content in of broccoli cv. FIESTA under Ranchi condition, experiments were carried out at the Department of Horticulture, Birsa Agricultural University, Ranchi, Jharkhand during winter season of 2013-14 and 2014-15, The experiment was done in Randomized Block Design having sixteen different treatments with three replications. It was recorded that Boron, Urea and GA₃ all had affected the Vitamin C content of Broccoli. Treatment T₁₅: (Urea 0.5%)+GA₃(75ppm)+B as borax (2%) had resulted in highest Vitamin C Content i.e. 83.42 mg/100 g, which was recorded at par with T₅ i.e. GA₃@50ppm, T₉, B as borax@ 2.0% and T₁₄: (Urea 0.5%)+GA₃(50ppm)+B as borax (1.5%).. However T₃, Urea (1.5%) had recorded the lowest value.

Key words: Broccoli, Foliar spray, Vitamin C.

EFFECT OF BORON, UREA AND GA₃ ON THE VITAMIN C CONTENT OF BROCCOLI (*BRASSICA OLERACEA* VAR. *ITALICA*)**¹SUDHA VERMA, ¹S.SENGUPTA, ¹K.K. JHA,, ²VARSHA RANI AND ¹RAVIKANT RAJAK****¹ Department of Horticulture, Birsa Agricultural University, Kanke, Ranchi****²Department of Crop Physiology, Birsa Agricultural University, Kanke, Ranchi**

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Key words: Broccoli, Foliar spray, Vitamin C.

HOLISTIC APPROACH AS CARBON SEQUESTRATION IN SUSTAINING THE SOIL HEALTH AND ENVIRONMENT**SUDHAKAR SINGH¹, SHRIMANNARAYAN DUBEY² AND NANDAN SINGH³****Department of Agronomy, NDU&T, Ayodhya, India**

Recent reports from the Intergovernmental Panel on Climate Change (IPCC) suggest that even if substantial reductions in anthropogenic carbon emissions are achieved in the near future, efforts to sequester previously emitted carbon will be necessary to ensure safe levels of atmospheric carbon and to mitigate climate change (Smith *et al.* 2014). Research on sequestration has focused primarily on Carbon Capture and Storage (CCS) and reforestation with less attention to the role of soils as carbon sinks. Recent news reports of melting glaciers and ice sheets coupled with a decade of record-breaking heat underscores the importance of aggressive exploration of all possible sequestration strategies. Soils have the potential to sequester carbon from the atmosphere with proper management. Based on global estimates of historic carbon stocks and projections of rising emissions, soil's usefulness as a carbon sink and drawdown solution appear essential (Lal, 2004, 2008). Since over one third of arable land is in agriculture globally (World Bank, 2015), finding ways to increase soil carbon in agricultural systems will be a major component of using soils as a sink. A number of agricultural management strategies appear to sequester soil carbon by increasing carbon inputs to the soil and enhancing various soil processes that protect carbon from microbial turnover. Uncertainties about the extent and permanence of carbon sequestration in these systems do still remain, but existing evidence is sufficient to warrant a greater global focus on agricultural soils as a potential climate stability wedge and drawdown solution. Furthermore, the ancillary benefits of increasing soil carbon, including improvements to soil structure, fertility, and water-holding capacity, outweigh potential costs.

EFFECT OF SINGLE SUPER PHOSPHATE AND ROCK PHOSPHATE APPLICATION ON PHOSPHORUS TRANSFORMATION IN RICE GROWING SOIL***SUDIP SARKAR¹, N. SURBALA DEVI²****¹Department of Soil Science, Dr. Rajendra Prasad Central Agricultural University, Pusa, Bihar -848125, India.****² Department of Soil Science and Agricultural Chemistry, Central Agricultural University, Imphal -795004, India**

A pot trial was carried out at central agricultural university farm to check the influence of single super phosphate (SSP) and rock phosphate (RP) application in various combinations on transformation pattern of phosphorus (P) fractions by rice soil. Results exposed application of P enhanced inorganic P forms includes saloid-P, Al-P, Fe-P, Ca-P, reductant soluble-P (RS-P), active P, total inorganic P, total P and available P than untreated soil. Saloid-P, Al-P, Ca-P and available P found highest on 50th day and for Fe-P 75th day with slow decrease afterwards. Applied P firstly stored as saloid-P, Al-P, Fe-P and Ca-P and later a portion of stored P taken up by rice or converted to RS-P. Soil organic-P concentration slowly dropped up to 100th day with little rise at harvest due to mineralization of organic P and lastly immobilization of P. A declining trend of total-P found over the entire rice growing period. Significantly higher accumulation of saloid-P, Al-P, Fe-P, active P, total inorganic P and available P was detected in soil fertilized with 50% recommended dose (RD) of P₂O₅ from SSP + 50% RD of P₂O₅ from RP. Though, Ca-P concentration was more in soil fertilized with 25% RD of P₂O₅ from SSP + 75% RD of P₂O₅ from RP. Combined application of SSP and RP at 1:1 gives better results and helps to maintain a constant pool of available P. RP is poor source of available P for crop growing but its efficiency rises when it applied with SSP.

Keywords: Phosphorus transformation, single super phosphate, rock phosphate, rice soil

CLIMATIC CHANGE ITS VARIATIONS AND ITS IMPACT ON HORTICULTURAL CROPS AND FOOD SECURITY IN MID HILL DISTRICTS OF NEPAL

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Agriculture is the backbone of Nepal economy, but due to the global warming and climate change it is being highly vulnerable. Increase in amount of CO₂ emission and greenhouse gases are the main causes of climate change and it largely affect temperature, irregular distribution of precipitation, which ultimately have a great impact on the agricultural system in Nepal. The climatic variation has brought serious challenges for farmers to catch up market demand with the timely production of produce in a season. There is vast diversity in the geographical divisions of Nepal, from flat land *terai* belt, hilly region and Himalayas. Due to the variation in topography the effects of climate change has caused considerable impact of cropping system. From the past decade, it has been observed that, horticultural crops specially grown in open field condition are being severely affected by adverse climatic conditions. The variations have observed in incidence of physiological disorders, insect-pest and diseases in fruit trees, vegetables and flowers. Quality deterioration and untimely production of horticultural produce is a major concern today due to rising temperature. Insight in this, study on climate change and its impact on horticultural crop will provide some measure to farmers to limit the effect of climate change and create sustainability in the production of horticultural crops.

Keywords: Climate Change, Impact, Horticultural crops, Quality, Nepal

ZEOLITIC FARMING: A NEW STEP TOWARDS SUSTAINABLE AGRICULTURE

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Zeolites are a large group of aluminosilicate minerals with different chemical composition and out of more than forty naturally occurring zeolites, clinoptilolite is well known. High CEC, large surface area and presence of pores and voids are the key characteristics of zeolite materials. Structurally, these are tectosilicates exhibiting an open three-dimensional structure containing cations needed to balance the electrostatic charge of the framework of silica and alumina tetrahedral units. Due to presence of voids and large surface area they can hold water upto 60% of their weight. Total porosity, water holding capacity, field capacity and available moisture increases whereas runoff decreases by application of clinoptilolite. High base saturation and high CEC their application improve chemical properties of soil. Since, void diameter ranges from 0.3 to 0.8 nm, they also fix NH₄⁺ ion and hence reduces volatilization and nitrification. They can be used as both carriers of nutrients and a medium to free nutrients. Surface modified zeolite offers a great promise for slow release of nitrogen use of clinoptilolite in combination with rock phosphate significantly enhanced uptake of phosphorus by exchanged induced dissolution. Zeolite incorporation in soil was found to increase crop yields and to promote nutrient-use efficiency. Zeolite also work as slow release delivery systems based on organo-zeolite reduces mobility but increases efficacy of 2,4-D. Hence, it is evident that use of zeolite is an area of vast opportunities and still less exploited in agriculture. The key challenges ahead are to ensure that these techniques are cost-effective and user-friendly so that they provide attractive options for adoption.

Keywords: Zeolite, efficacy, 2,4-D, Clinoptilolite

ANALYSIS OF PROFITABILITY OF PROCESSED FISH MARKETERS IN GASHUA, YOBE STATE NIGERIA

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The need to preserve fish for later usage from excess catch is inevitable. Value addition extends the shelf life of fish product which would have been lost to spoilage. This study examined the profitability and socio-economic characteristics of processed fish marketers in Gashua, Bade Local Government Area, Yobe State, Nigeria. Random sampling technique was used in selecting fifty marketers that provided the primary data for this study. The data were collected using well-structured questionnaire through personal interviews and observations. Data were analyzed using descriptive statistics, budgetary analyses and profitability ratios. Results showed gender sensitiveness by men, 16% of fish markets had secondary education, average household size of 10 persons and mean years of experience 10 years. The gross margin of ₦127,535 and net profit margin ₦102,535, benefit cost ratio of 1.98 and 0.82 rate of return on investment. This research concludes that, fish marketing is a business with high profit, but the rate at which fuel wood is used should be reduced while innovating into solar dryer is imperative as there is ample solar energy to be tapped for this purpose in the area.

Keywords: Profitability, processors, fish marketers

EFFECT OF FERTILITY LEVELS AND VARIETIES ON GROWTH, FORAGE YIELD AND QUALITY OF CLUSTER BEAN (*CYAMOPSIS TETRAGONOLOBUS* L.)

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An investigation on "Effect of fertility levels and varieties on growth, forage yield and quality of cluster bean (*Cyamopsis tetragonolobus* L.)." cluster bean Varieties under Graded Levels of NPK alone" under adoptive climatic conditions of Northern part of Madhya Pradesh was carried out during *Kharif* season 2016 at the Research Farm, College of Agriculture, R.V.S.K.V.V., Gwalior (M.P.). The experiment was laid out in randomized block design (F.R.B.D.) replicated three times with 12 treatment combinations, namely T₁ (BG-1 +100%NPK), T₂ (BG-2 +100 % NPK), T₃ (BG-1 + 125 % N : 100 % P : 100% K), T₄ (BG-2 +125 % N : 100 % P : 100% K), T₅ (BG-1 +100 % N : 125 % P : 100% K), T₆ (BG-2 +100 % N : 125 % P : 100% K), T₇ (BG-1 +100 % N : 100 % P : 125% K), T₈ (BG-2 +100 % N : 100 % P : 125% K), T₉ (BG-1 +125 % N : 125 % P : 100% K), T₁₀ (BG-2 +125 % N : 125 % P : 100% K), T₁₁ (BG-1 + 100 % N : 125 % P : 125% K) and T₁₂ (BG-2 +100 % N : 125 % P : 125% K). In respect to Plant height, number of branches per plant, green fodder yield and total green fodder yield were maximum in Variety V₂ compared to V₁. Similarly V₂ showed higher plant N, P, and K, more moisture content in green fodder, and available N, P, and K in soil over V₁. Fertility level F₅, recorded significantly higher plant height and produced higher number of branches at Ist and IInd cut, respectively and significantly maximum green fodder yield than rest of other fertility levels. Higher value of organic carbon (gm/kg), available N and P (Kg/ha) in surface soil were statistically superior in F₅ over other treatments; whereas application of F₆ was recorded significantly higher value of available potassium (Kg/ha) in surface soil. Similar trend was recorded for N, P and K in fodder with respective fertility level. The treatment combinations T₁₀ followed by T₉ showed higher plant height, no. of branches, green and total fodder yield, maximum N, P and moisture content in green fodder in both cutting were recorded over other treatment combination. Maximum potassium content (%) in green fodder was recorded in T₁₂ followed by T₁₁ which are statistically significant over other treatment combination. Higher available N and P in soil were recorded with T₁₀ followed by T₉, which showed statistically significant relationship. While higher available K in soil was recorded with T₁₂ followed by T₁₁.

ORGANIC AGRICULTURE IN NORTH-EAST REGION OF INDIA: SCOPE AND CONSTRAINTS

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Keeping the hazardous effects of inorganic fertilizers and the agro-chemicals on environment as well as on the human health, it is an urgent need for the developing country like India to shift to the organic agriculture. There is lot of scope for promotion of organic agriculture in the North Eastern Region of India which accounts 7.64% of the total area of the country. Agriculture is by far the most important occupation of the people of this region. Majority of the farming community is resource poor and purchase of fertilizers and chemicals in adequate quantities is beyond their capacity, therefore, the use of inorganic fertilizers and chemicals is meager in this region. The farmers in general and hill farmers in particular are also having apathy towards use of agro-chemicals. Secondly, the region has not tested the fruits of green revolution and is, therefore, by default organic in nature which can be easily converted in organic agriculture. It is assumed that the difference in production gap due to adoption of organic agriculture is expected to be negligible; rather there is scope for enhancing productivity with good organic management, the organic premiums would boost earning of the hill farmers. Thirdly, it is an added advantage that all the households are maintaining livestock producing sufficient quantity of on-farm manures, which could be efficiently used for organic agriculture. Moreover, the north-eastern states being the one of the mega biodiversity receiving very high rainfall (2000-11000 mm per annum) leads to profuse production of biomass. Some of these species could be efficiently used in organic production. The major constraints associated with promotion of organic farming in the region are the identification of the potential areas for organic food production; research, development and extension strategies for promotion of organic cultivation; human resource development in production of organic inputs like bio-fertilizers, vermi-compost, botanicals for pest management, etc.; assistance to farmers in post harvest handling, processing and value addition, identifying certification agency within the region, and reduction of certification cost and creation of infrastructure and mechanisms for marketing of organic produce.

Key words: Organic agriculture, North-East India, scope and constraints, etc.

DEVELOPMENT OF A VALUE ADDED AMLA PRODUCTS**SUMAN DEVI^{*1}, ENA GUPTA²****1. Department of Food Science, C. S. A. University of Agriculture and Technology, Kanpur****2. Department of Food and Nutrition, University of Allahabad, Allahabad-211002, India**

Emblica officinalis commonly known as Indian gooseberry or Amla, is perhaps the most important medicinal plant in the Indian traditional system of medicine, the Ayurveda. Vitamin C, tannins and flavonoids present in amla have very powerful antioxidant activities. Due to rich Vitamin C, amla is successful used in the treatment of Diabetes mellitus. It is one of the oldest Indian fruits and considered as “wonder fruit for health”. Amla pulp of fresh fruit contains 200–900 mg/100 g of vitamin C. Ascorbic acid retention was found to be decreased with increase in temperature. The fruit is highly perishable in nature and is available for short period from October to January. The excellent nutritive value and therapeutic value of amla fruit. Processed form of Amla fruit like murabbas, candy, dried chips, jelly, sauce, pickle, squash and syrup. Therefore, present study was undertaken to develop a value added Amla products. Amla bhujia was prepared from gram flour, amla pulp or amla powder with spices. Amla was incorporated at different form (powder and pulp). Amla Bhujia prepared was done using nine point hedonic scale. The Comparison of three samples B₁ (Gram flour with amla pulp), B₂ (Gram flour, amla powder, spices, oil with citric acid) and B₃ (Gram flour, amla powder, without citric acid). The result of study was revealed that according to sensory evaluation of amla bhujia were most overall acceptability for sample B₁ (gram flour with amla pulp) by judges using 9 point hedonic scale Whereas Amla products beneficial to health and combat the nutrition.

Keywords: Amla; Medicinal uses, Diseases, Vitamin C, Sensory

SURVEY AND INCIDENCE OF ROOT KNOT DISEASE IN VARANASI**SUMIT KUMAR PANDEY AND R. K. SINGH****Department of Mycology and Plant Pathology, Institute of Agricultural Sciences, Banaras Hindu University, Varanasi**

Tomato (*Solanum lycopersicum* L.) is an important popular vegetable crop grown in the world. Being a relatively short duration crop with high yield and returns, its cultivation area is expanding regularly. Prevention of pests and diseases in tomato are extremely important. Tomato plants are susceptible to several fungi, bacteria, viruses and nematodes. Root-knot nematodes (*Meloidogyne* species) are microscopic and parasitic which can be found in the roots of infected plants. Under *Meloidogyne* genus, there are about 98 species and common species encountered by farmers are *M. incognita*, *M. javanica*, *M. hapla*, and *M. arenaria*. Root knot nematodes (*Meloidogyne* species) are known to attack tomato in many different parts of the world. They cause galls (infected swellings) on plant roots. Tomatoes are host to several species of root-knot nematodes (*Meloidogyne* species). Biological control of disease by using nematophagous fungi seems to be safe, eco-friendly and need based. These fungi comprise more than 700 species found in all major taxonomic groups including lower (oomycetes, chytridiomycetes, zygomycetes) and higher fungi (ascomycetes, basidiomycetes and deuteromycetes). The nematode trapping or predaceous fungi, endoparasitic fungi, and fungi that produce metabolites toxic droplets to kill nematodes. A preliminary survey was carried out to find the status of the root knot nematodes associated with the root zone of tomato in 30 locations in and around Varanasi district (Uttar Pradesh). Total 1068 root samples were collected and 575 root samples were detected to be infected with root-gall diseases in all fields surveyed in thirty locations. Therefore, overall incidence of the disease was 54%. Locations wise variations in the incidence of the disease were, found. On the basis of perineal pattern characteristics the two species of root-knot nematodes *Meloidogyne incognita* and *M. javanica*, were identified to infect tomato in different locations included in the surveyed fields. Both the species were either found singly or in mixed population. Maximum root-gall disease was found in village Gahura followed by Bhoranpur, Bahupur, Bandepur villages whereas minimum in Kaparphorvan village followed by Sajai and Siharva villages.

APPLICATION OF PULSED ELECTRIC FIELD TECHNOLOGY IN FOOD PRESERVATION**SUNIL¹, NEELASH CHAUHAN², VIPUL CHAUDHARY¹, VAISHALI¹, VIKRANT KUMAR¹ AND PUJA³****Department of Agricultural Engineering (Process and Food Engg.), Sardar Vallabhbhai Patel University of Agriculture and Technology, Meerut (U.P.)**

Pulsed electric field (PEF) technology is a non-thermal food preservation method that involves the use of short electricity pulses for microbial inactivation while imposing minimal detrimental influence on food quality. This technology has the major advantage to provide high-quality foods to the consumers. PEF is claimed as superior to thermal processing and preservation methods because it reduces detrimental changes in food quality and nutrition and keeps physical and sensorial attributes of food. PEF technology has wide range of applications ranging from liquid or semi-solid foods to solid foods. Most PEF studies have captivated on application of high voltage pulses for microbial inactivation milk and dairy products, egg products, juices and other liquid foods. However, most researchers have mainly focused on the aspect of food preservation with special reference to the microbial control and a lesser information is presented about the effect of PEF on food composition, quality and acceptability. Recently, some investigations have been conducted to evaluate the potential of PEF for improving food processing efficiency like

enhancement of juice extraction and escalation of the food dehydration or drying. Application of PEF technology has been extensively demonstrated for the pasteurization of various food products like juices, milk & dairy products, soup and liquid eggs. However, it has several limitations such as product must be free from air bubbles and must have lower electrical conductivity.

Keyword: Pulsed electric field, Microbial inactivation, Food preservation and Applications

IDENTIFICATION OF AROMATIC, SEMI-DWARF AND PHOTO INSENSITIVE SEGREGANTS OF RICE THROUGH MARKER ASSISTED SELECTION

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Rice is the most staple food grain crop of India. Growing rice is an inevitable part in more than half of the world population who depends on it as their staple food. Rice consumers all over the world have strong preferences for the aromatic rice, it commands premium price in national as well as international market, have superior nutritional value and better amino acid profiles. The aroma is mainly due to accumulation of a compound, 2-acetyl-pyrroline (2AP), the main aromatic compound for popcorn like fragrance in all aromatic rice. Katarni rice is a famous aromatic landrace of Bihar having a problem of lodging and photosensitivity resulting in its low productivity and restricted cultivation. Marker assisted selection was employed to select semi-dwarf and aromatic progenies in the BC_1F_2 and F_3 population in a cross of Katarni with a rice variety Rajendra Sweta which was used as donor parent for photo insensitivity and semi-dwarf trait. 51 plants selected on the basis of 1.7% KOH sensory test for aroma in BC_1F_2 population whereas 31 plants were selected in F_3 population. 50 plants selected on the basis of PCR amplification of *badh2* gene specific primer in BC_1F_2 population whereas 25 plants in F_3 population. Finally 49 plants of BC_1F_2 and 25 plants of F_3 population selected on the basis of foreground selection of *badh2* & *sd1*. Aroma is the monogenic recessive to non-aromatic. The segregation ratio of non-aromatic to aromatic plants was 3:1 F_2 plants confirming the monogenic inheritance of aroma. The selected plants will be further evaluated in next generation for homozygous plant for earliness and semi-dwarf trait.

Keywords: Aroma•2-acetyl-1-pyrroline•*badh2* gene•Foreground selection•Frequency distribution,•Marker assisted selection,•*sd1* gene•Rice.

ADOPTION OF TECHNOLOGY IN THE AGRICULTURE SECTOR

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India's population is expected to reach 1.5 billion by 2025, making food security most important social issue and food production will have to be increased substantially, to meet the requirements of an increasing population. In rural areas, there are number of people who are residing in the conditions of poverty and backwardness. Agriculture is the primary occupation of the individuals in rural areas, hence, usage of technology and modern and innovative techniques and methods will prove to be advantageous for improvement in the living conditions of the individuals and in alleviating the problems of poverty. Employed in the agricultural sector and farming practices need to possess knowledge and information, how to make best use of them. Agriculture is regarded as a primary occupation of the individuals in rural areas. To feed the increasing population, it is essential to introduce modern and innovative techniques in the agricultural sector. New technologies are required to encourage the yield frontiers to an advanced stage, make use of the inputs resourcefully and diversify to a more sustainable and higher value cropping patterns. These are all knowledge intensive technologies that require both a strong research and extension system and skilled farmers. In addition, it also requires a strengthened interface, where emphasis is put on communal exchange of information, bringing advantages to all. Making use of resources in an effective manner is stated as the driving force behind the use of agricultural technologies. Several resource conservation technologies are, green manure, crop rotations etc. improvement in the agricultural growth is an essential aspect for leading to overall growth and development of the country. The reason being, this sector sustains livelihood of 65 percent of the population. However, the contribution of agriculture towards Gross Domestic Product (GDP) is 14 percent. Several revolutions in agriculture have taken place to boost the sector. These include Green Revolution, Evergreen Revolution, Blue Revolution, White Revolution, Yellow Revolution, Bio-technology Revolution, Information and Communications Technologies (ICT) Revolution. The main areas that have been taken into account are, factors relating to adoption of technologies, types of technologies, technologies used in the agricultural sector, advanced agricultural technologies used in the present existence, areas of information technology and role of information technology in agricultural education management. Usage of technology would enhance in sustaining livelihood opportunities for the farmers. The significance of usage of technology in the agricultural sector has been recognized with the main purpose of meeting the food requirements of the individuals. India has made progress in agriculture, but productivity of the major agricultural and horticultural crops is low in comparison to other countries.

Keywords: Technology; Production; Sustainable Farming Systems; Information Technology

PROSPECT OF HORTICULTURAL SECTOR IN INDIA

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Horticulture has become a key driver for economic development in many of the states in the country and it contributes 30.4 per cent to GDP of agriculture. Horticultural crops play a unique role in India's economy by improving the income of the rural people. Cultivation of these crops is labour intensive and as such they generate lot of employment opportunities for the rural population. Fruits and vegetables are rich source of vitamins, minerals, proteins, and carbohydrates etc. which are essential in human nutrition. Thus, cultivation of horticultural crops plays a vital role in the prosperity of a nation and is directly linked with the health and happiness of the people. Globally, India is the second largest producer of fruits and vegetables. It is the largest producer of mango, banana, coconut, cashew, papaya, pomegranate etc., in the world and the largest producer and exporter of spices. It ranks first in productivity of grapes, banana, cassava, peas, papaya etc., in India is huge demand for the horticultural products and it is growing at a considerable rate in both the rural and urban households and among both the poor and rich households. Thus, every effort should be taken to increase the area and output of the horticultural crops, which are considered as high value crops, since it will considerably increase the income levels of the farmers in the country. The production of horticultural produce has increased 7-fold which ensured nutritional security and employment opportunities in the country.

Keywords: Horticulture, Agriculture, GDP, Nutrition, Global.

EMPOWERMENT OF FARMWOMEN THROUGH SELF HELP GROUPS (SHGS) FOR REDUCING DRDGERY AND INCREASING INCOME

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This article is based on field study carried out in Gorakhpur District of Uttar Pradesh, where it was observed that farmwomen belonging to all categories of caste with primary education or even illiterate under the banner of self-help groups (SHGs) had been earning not only income but also feeling empowered. Regarding, empowerment, it was reported that almost all women were attending open Gram Sabah meeting and sharing their views. Even it was reported that all freely talk to bank managers, block officials and others. In this article, few cases are presented based on field study. This article deals with how self-help groups (SHGs) have facilitated to improve economic condition and thus they felt empowered as their husbands used to take their suggestions for family matters.

Key words: Empowerment, Income, Gorakhpur, PRDF, Economic condition and SHG.

IMPORTANCE OF ARID REGION IN INDIA

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Arid lands are among the world's most brittle ecosystems, made more so by periodic droughts and increasing overexploitation of meagre resources (FAO (1989) Arid zone forestry. FAO conservation guide No. 20. FAO, Rome, p 143). Arid zone is characterised by extremes of temperature, low and erratic rainfall, high wind velocity, high evapotranspirational losses of water and light sandy soil with very low water holding capacity and poor fertility status. Looking to the very dismal future scenario of water in arid zone, growing of less water-requiring crops with high application efficiency is necessary. Drought-hardy crops especially perennial fruits with deep root systems are capable of surviving extreme radiation and temperatures and provide income security, nutritional security and food security. Ber, pomegranate, custard apple, aonla and date palm are the major fruit crops which are commercially grown in arid regions. In this chapter, major findings of research on abiotic stresses on major arid zone fruit crops are summarised.

Keyword-Arid Zone, Semi arid Region Fruit Yield, Drought Stress, Date Palm

STUDY ON TECHNOLOGICAL GAP AND CONSTRAINTS ANALYSIS IN CAULIFLOWER GROWERS OF WESTERN UTTAR PRADESH

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The study was conducted in Hapur and Saharanpur districts of western Uttar Pradesh entitled “Study on technological gap and constraints analysis in cauliflower growers of Western Uttar Pradesh” with the objectives, of socio-economic characteristics of the cauliflower growers, utilization of information sources by the cauliflower to access the knowledge communication behavior and constraints encountered by the farmer in cauliflower cultivation & marketing and suggestions suitable extension strategies for promotion of quality cauliflower production. The total sample size was of 160 cauliflower growers for the study. The result of the study depicted that the majority of the respondents 51.25 percent were belong to lower middle age group ranging from 30-45 years. Maximum 76.87 percent respondents were belonged to other backward caste. The majority of the cauliflower growers were literate. The majority of 71.25 percent respondents were belonged to joint family system and interested for cauliflower growing. The maximum 61.87 percent respondents of the cauliflower growers were having either medium size (5-8 members) of the family. The maximum 62.50 percent respondents were having mixed houses. 80.00 percent respondents were depending upon agriculture. The maximum 43.75 percent cauliflower growers were having 01-02 ha of land hold. The rental irrigation sources of in the study area. The farmers prefer private agro chemical distributors as a top most source of information and neighbors was secondary source of information and the maximum cauliflower growers were using news paper and T.V. as a mass media source of information. The knowledge level of farmers about seed treatment, nursery management, diseases control and insects/pests control in cauliflower crop was low, and highly technological gap was found in seed treatment followed nursery management. Unavailability of quality chemical at Govt. sale center, lack of knowledge about bio-fertilizers, fluctuation in the prices, lack of Govt. initiative in funding of loans and granting of subsidies problems in remote areas were all the most constraints. Highest majority of cauliflower growers were suggesting that availability of quality inputs at proper time on Govt. sale centre's and developed government tube well in every village.

Keywords: socio-economic, knowledge, communication behavior, constraints.

ADOPTION OF TECHNOLOGY IN THE AGRICULTURE SECTOR

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India's population is expected to reach 1.5 billion by 2025, making food security most important social issue and food production will have to be increased substantially, to meet the requirements of an increasing population. In rural areas, there are number of people who are residing in the conditions of poverty and backwardness. Agriculture is the primary occupation of the individuals in rural areas, hence, usage of technology and modern and innovative techniques and methods will prove to be advantageous for improvement in the living conditions of the individuals and in alleviating the problems of poverty. Employed in the agricultural sector and farming practices need to possess knowledge and information, how to make best use of them. Agriculture is regarded as a primary occupation of the individuals in rural areas. To feed the increasing population, it is essential to introduce modern and innovative techniques in the agricultural sector. New technologies are required to encourage the yield frontiers to an advanced stage, make use of the inputs resourcefully and diversify to a more sustainable and higher value cropping patterns. These are all knowledge intensive technologies that require both a strong research and extension system and skilled farmers. In addition, it also requires a strengthened interface, where emphasis is put on communal exchange of information, bringing advantages to all. Making use of resources in an effective manner is stated as the driving force behind the use of agricultural technologies. Several resource conservation technologies are, green manure, crop rotations etc. improvement in the agricultural growth is an essential aspect for leading to overall growth and development of the country. The reason being, this sector sustains livelihood of 65 percent of the population. However, the contribution of agriculture towards Gross Domestic Product (GDP) is 14 percent. Several revolutions in agriculture have taken place to boost the sector. These include Green Revolution, Evergreen Revolution, Blue Revolution, White Revolution, Yellow Revolution, Bio-technology Revolution, Information and Communications Technologies (ICT) Revolution. The main areas that have been taken into account are, factors relating to adoption of technologies, types of technologies, technologies used in the agricultural sector, advanced agricultural technologies used in the present existence, areas of information technology and role of information technology in agricultural education management. Usage of technology would enhance in sustaining livelihood opportunities for the farmers. The significance of usage of technology in the agricultural sector has been recognized with the main purpose of meeting the food requirements of the individuals. India has made progress in agriculture, but productivity of the major agricultural and horticultural crops is low in comparison to other countries.

Keywords: Technology; Production; Sustainable Farming Systems; Information Technology

STUDY THE ADOPTION AND DEMONSTRATION OF INTEGRATED PEST MANAGEMENT PRACTICES IN WHEAT CROP IN DISTRICT KANNAUJ (U.P.)

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The present studies on the “Study the adoption of integrated pest management practices in wheat crop in district kannauj (U.P.)”. were collected out in csuat (kanpur). The study revealed that presents study was conducted in kannauj district of uttar pradesh. This district was selected because, the area under wheat cultivation is more in this district and it is also home district of investigator so he did not faced any communication problem with farmers. The kannauj district 8 community development blocks out of which two blocks namely kannuaj and chhibramau were randomly selected. Data collection was done through a questionnaire which was developed in 2014. A total number 120 of wheat growers were selected. Variables of annual on-farm income, using level of information sources and communication channels, viewpoint of extension agents and level of knowledge were significantly and positive correlated with- adoption of IPM measures. The results of regression analysis shoewed that level of knowledge explained 56.67% of variation in the adoption level of sustainable IPM practices. Respondents were of this age group, along with this 33.33% respondents were old age group and the remaining 10% were young age group. For the purpose of study education is taken as an individuals ability or level of ability to read nd write. It sis recommended that to reach farmer audiances with extension IPM education programmes, greater considerations should be given to farmer and farm backgrounds, current use of IPM practices and preferences for educational formats.

Keywords: IPM, communication, adoption level, Extension education

RESPONSE OF GROWTH PARAMETERS BY APPLICATION OF PLANT GROWTH REGULATORS IN BOTTLE GOURD PRODUCTION DURING SUMMER SEASON

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The present experiment was conducted at Research Farm of Department of Vegetable Science in Chaudhary Charan Singh Haryana Agricultural University, Hisar to find out the effect of plant growth regulators during 2016-2017. The treatments comprised plant growth regulators (Ethrel @ 100 ppm, Ethrel @ 200 ppm, GA₃ @ 25ppm and GA₃ @50ppm) with control (water spray). The seeds of variety Pusa Summer Prolific Long (PSPL) were sown at the spacing of 2.5 m between rows and 0.60 cm between plants. Length of vine was maximum reduced (385.11 cm) and maximum branches (7.47) with foliar spray of ethrel @ 200 ppm which is at par with ethrel spray @ 100 ppm (396.22 cm & 6.97 respectively) as compared to water spray treatment (451.00 cm & 6.18 respectively). While, length was found to be maximum (551.45 cm) when GA₃ was applied @ 50 ppm followed by GA₃ @ 25 ppm (488.00 cm). Foliar spray of GA₃ @ 25 & 50 ppm resulted significantly higher number of branches (6.49 & 6.77) than control treatment. Among growth regulators minimum inter-nodal distance (12.61cm) was found with the application of ethrel @ 200 ppm followed by ethrel @ 100 ppm and control treatment (13.14 & 14.14 cm) respectively, whereas, it was recorded maximum (15.44 cm) with GA₃ @ 50 ppm.

PROCESSING FOOD INDUSTRY: A EMERGING SECTOR FOR SKILL DEVELOPMENT IN INDIA

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India has the second largest producer of food with arable land of 161 million hectares and has the highest acreage under irrigation. Next to China, India ranks second largest food producer in the world and has the potential to immerge the biggest with its food and agricultural sector. The industry has very low processing level i.e 2.2% for fruits and vegetables, around 35% in milk, 21% in meat and 6% in poultry products, which is significantly lower by international standards. For e.g. processing of agriculture produce is around 40% in China, 30% in Thailand, 70% in Brazil, 78% in the Philippines and 80% in Malaysia. While processing of food to consumable standards are at levels of up to 80% in some developed countries, the overall processing level in India has recently reached 10%. Processing of food products plays an important role in the conservation and effective utilization of fruits and vegetables. India's strong agricultural base, variety of climatic zones and accelerating economic growth holds significant potential for food processing industry that provides a strong link between agriculture and consumers. India accounts for less than 1.5% of international food trade despite being one of the world's major food producers, which indicates huge potential for both investors and exporters. Value addition to agriculture produce in India is just 20% with wastage estimated to be valued at around US \$13 billion. Food-processing industry is facing constraints like non-availability of adequate infrastructural facilities, lack of adequate quality control & testing infrastructure, inefficient supply chain, and seasonality of raw material, high inventory carrying cost, high taxation, high packaging cost, affordability and cultural preference of fresh food. Unprocessed foods are prone to spoilage by biochemical processes, microbial attack and infestation. Good processing techniques, packaging, transportation and storage can

play an important role in reducing spoilage and extending shelf life. The challenge is to retain the nutritional value, aroma, flavor and texture of foods, and presenting them in near natural form with added conveniences.

Keywords: Processing, Food Industry, Emerging sector, skill development.

RAINFALL VARIABILITY AND AGRICULTURAL PRODUCTION: STRATEGIES TO MITIGATE THE IMPACT AND PROTECTION OF SMALL FARM AGRICULTURE

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The monsoon is the life blood for farming in India, which accounts about 15% of the country's Gross Domestic Product (GDP). Agriculture and allied rural industries in India are heavily depend on rainfall, nearly 50 percent of the cultivable lands in India are rainfed. India gets nearly 70 to 80 percent of its annual rainfall during the north-east monsoon between June to September. Rainfall is the only source of water for producing crops in rainfed areas India and about 263 million farmers are depending on rainfall for cultivation. The selection of crop and planting of kharif (July to October) and summer crops such as rice, pulses, sugarcane and oilseeds begins with the arrival of monsoon in June. A well-distributed and timely monsoon increases farmers income through increased farm out-put, thereby increasing the demand for consumer and automotive products in rural markets. In the Northern part of India states like Uttar Pradesh (UP), Haryana and Punjab have plenty of water resources for irrigation; nearly 80% of cultivable areas in those regions under irrigated in and only 20 percent of the land comes under dryland or rainfed agriculture. On the other hand, Southern India farmers mainly depends on rainfall or monsoon period. In Southern India, places like Maharashtra, Kerala, Karnataka and Madhya Pradesh are drought prone zone and water deficit is a common problem in these regions due to failure of monsoon. A recent study shows that poor irrigation availability in southern India due to failure of monsoon, for example in Maharashtra: 18%, Kerala: 19%, Karnataka: 30% and MP: 44%. In the year 2002 food grain production declined by 18% and food inflation rose by 1.8%. Similarly, in 2004 food grain production declined by 7% and food inflation rose by 2.6% respectively. The failure or delay in monsoon leads to a shortage of food grain production, which causes India to import more food grain and inflation, which influences Reserve Bank of India's decision on interest rates. Due to this problem, customers postponed the availing of loans due to high rates. Double whammy happened in the banks as customers flee from availing loans and many existing customers default on their loans. Failure in monsoon forces the government to take measures like farm loan waivers, thereby putting pressure on fiscal discipline. Over the period, there has been several issues related to agricultural production and farmers suicide due to failure in monsoon in India. Hence the study focuses on 1) To study the economic impact of rainfall variability on agricultural production, 2) To analyse the coping strategies of farms to tide over water shortages/surplus, and 3) To suggest strategies to mitigate the impact of rainfall variability to protect the livelihood small farm agriculture.

INTEGRATED NUTRIENT MANAGEMENT IN GROUNDNUT (*ARACHIS HYPOGAEA* L.) IN NEH REGION

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Groundnut is an important oilseed crop grown all over India. It is cultivated for its kernel which is rich in oil (45-50%) and protein (20-25%) along with thiamine, riboflavin, nicotinic acid and vitamin-E. The NEH region is a non-traditional area for groundnut production but the crop has been gaining popularity among farmers due to its multiple benefits as food, feed, oil, cover crop and restoring soil fertility. However, the yield of groundnut in farmers' field is low due to lack of improved technology available with them and improper nutrient management. According to study, crop yielding 1.9 t ha⁻¹ removed 170 kg N, 30 kg P₂O₅, 100 kg K₂O, 39 kg Ca, 15 kg S, 20 kg Mg besides other micronutrients. No single source is capable of supplying plant nutrients in adequate amount and balanced proportion. Therefore, for sustaining soil fertility, and to supply plant nutrients in balanced proportion for optimum growth, yield and quality of crop in an integrated manner in a specific agroecological situation is to practice integrated nutrient supply through combined use of biological and organic sources of plant nutrients. Plant nutrient sources like organic manure, fertilizers, biofertilizers, weed biomass, etc. can be applied to the soil in such a way that nutrient removed by the crop are less than that compensated and there is gradual increase in soil reserve. The beneficial effect of application of *Rhizobium* and phosphate solubilising bacteria in groundnut in terms of yield, nutritional quality and net returns and was also reported previously. The effect of combined application of organic and inorganic sources of nutrients on enhanced growth and yield of groundnut as well as improvement of soil quality was previously reported.

PHENOTYPIC AND BIOCHEMICAL DIVERSITY STUDIES IN PEACH AND NECTARINE GENOTYPES IN THE SUB-TROPICAL REGIONS OF PUNJAB, INDIA**SWAPNIL PANDEY^{*1}, ANIRUDH THAKUR², GIRJA SHANKER TEWARI³ AND VISHAL NATH⁴**^{*1,2}Dept of Fruit Science, PAU, Ludhiana, Punjab, India, ³Dept of Soil Science, GBPUAT, Pantnagar, Uttarakhand, India⁴Director, ICAR-NRC on Litchi, Muzaffarpur, Bihar, India

Peach (*Prunus persica* L. Batsch) and Nectarine (*Prunus persica* var *nucipersica*) is the third most abundant fruit worldwide, after the apple and pear. The present study was conducted on four hybrids and six cultivars of peach and nectarine. The main objective of this work was to study the phenotypic variability in agronomical and biochemical fruit quality traits. Agronomical traits such as fruit weight and size (length and breadth); and the analysis of fruit quality parameters [firmness, total soluble solids (TSS), titratable acidity (TA) and ripening index (RI)] were determined. Biochemical fruit quality traits such as ascorbic acid, total phenolics and the relative antioxidant capacity were evaluated. Such phonemics analysis is an obligatory requirement for identification of molecular markers for distinct fruit quality traits and for selection of appropriate parents for future breeding programs. Results showed that the cultivars exhibited wide phenotypic variation in agronomic and biochemical traits. These should be considered in the current breeding programs to select cultivars with high health-enhancing properties and good postharvest performance.

Keywords: Peach, Nectarine, TSS, Phenols, Antioxidant**CLIMATE CHANGE AND GLOBAL WARMING: POLICIES, PLANNING AND MANAGEMENT****SWATI GARBYAL AND RITU MITTAL****Punjab Agricultural University, Ludhiana, Punjab**

Earth provides enough to satisfy every man's needs, but not every man's greed. (Mahatma Gandhi) Global climate change is one of the major concerns of the present world. Climate change occurs when changes in atmosphere system result in new weather patterns that last for couple of decades, or may be for millions of years. The balance between entering and leaving the energy from Earth, and the passage of the energy through the climate system, determines Earth's temperature. When the incoming energy is greater than the outgoing, earth's energy budget is positive and the climate becomes hot. If more energy goes out, the energy budget is negative and earth experiences cooling. As this energy moves through Earth's climate system, it creates Earth's weather and this long-term averages of weather are called "climate". Changes in the long term average are called "climate change". Both natural factor and human factors are responsible for climate change. Human activities (industrialisation, transportation, agriculture, etc) are presently driving climate change through global warming. Global warming is a gradual increment in the overall temperature of the earth's atmosphere generally attributed to the greenhouse effect caused by increased levels of carbon dioxide, CFCs, and other contaminants. Global warming is anticipated to have a number of consequences on atmosphere. Ongoing effects include rising sea levels due to thermal expansion and melting of glaciers and ice sheets, and warming of the ocean surface, prompting increased temperature stratification. Climate change will continue, and accelerate, in the years ahead, with serious impacts on the health of our oceans, forests, freshwater, and our towns and cities and will have serious consequences unless strict policies and plans to reduce global warming are not taken. Therefore, there is a need for action, regardless of the uncertainties of anticipated changes, yet action requires concrete settings to facilitate expectant measures by the decision/policy makers. In order to resolve the issue, one should search for certain solution, to rectify this issue.

Keywords: Global warming, climate change, green house emission, temperature.**MINERAL CONTENT ADVERSELY AFFECTED BY VARYING CONCENTRATION OF CR (VI) IN SORGHUM BICOLOR (L.).****SWEETYSIHAG*, AND U. N. JOSHI****Department of Chemistry and Biochemistry, CCS Haryana Agricultural University, Hisar (Haryana) - 125004, India**

Sorghum (*Sorghum bicolor* L.) moench is the world's fifth most important cereal crop, behind rice, corn, wheat and barley and the third leading crop in the USA. It is cultivated for food, feed, fodder and the production of alcoholic beverage, but extensively grown for fodder in north India during summer and *khari* season due to its greater adaptability, high fodder yield, better palatability, quality and digestibility. It gives higher fodder yield under adverse and poor management conditions. But it is affected by environmental factor such as heavy metals that reduce its productivity. The present investigation had been planned to find out toxic effect of chromium (VI) on sorghum which is an important fodder crop. Sodium, chromium and Zinc content were increased, whereas potassium and iron content decreased with increasing concentration of Cr (VI). A pot experiment was conducted to determine the effects of varying Cr (VI) levels [0.0–4.0 mg Cr (VI) kg⁻¹ soil in the form of potassium dichromate] on the quality parameters and mineral content of sorghum. The present investigation showed that the mineral content contains micronutrients (chromium, zinc and iron) and macronutrients (nitrogen, sodium and potassium) estimated at different growth stages, i.e. 35 DAS,

70 DAS and 90 DAS (Days after sowing) that were adversely affected with an increase in Cr (VI) levels from 0.0 to 4.0 mg Cr (VI) kg⁻¹ soil.

Keywords: Macronutrients, Micronutrients, Chromium toxicity, Sorghum bicolor.

BEHAVIOURAL INTENTIONS OF URBAN PEOPLE REGARDING ORGANIC FOOD CONSUMPTION IN EASTERN INDIA

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The ushering of twentieth century had experienced a number of social, economic and ecological ill-effects of high input intensive agriculture- at this juncture organic agriculture can be viewed as an alternative to cope up with the challenges of high input intensive conventional agriculture. In India, growth of organic markets is noticed due to increasing health consciousness. Although people are aware but consumption of organic food is still near to the ground. Hence, the present study was undertaken to understand the behavioural intentions of urban people in the access and consumption of organic food. The study was conducted in one metro city Kolkata and one non-metro Ranchi in the eastern part of India with a total sample size of 270. In this study, 'Theory of Planned Behaviour' was used to study the intentions of urban respondents regarding the consumption of organic food. This theory relates beliefs with behaviour. Attitude was found to be the most influencing factor leading to behavioral intentions in consuming organic food over subjective norms and perceived behavioral control. The RMSEA value the used in model is 0.077 which is less than 0.08 indicating that this TPB model shows a good fit in the context of behavioural intentions towards consumption of organic food. In connection with the behavioural intentions, the willingness to pay for organic foods was also checked. The results depicted that respondents of Kolkata were not willing to pay too high price for organic foods, they prefer to consume and purchase organic foods if their price are more or less the same as that of conventional foods. In case of Ranchi, respondents mostly preferred to pay a lower price for organic foods as compared to conventional foods. The research findings will help to formulate appropriate strategies that will lead to increased consumption of organic food.

Keywords: Organic foods, Consumption, Behavioural intentions, Willingness to pay, Attitude, Urban people

DEVELOPMENT AND EVALUATION OF VALUE ADDED SQUASH VARIANTS FROM GREEN MANGO-MINT BLENDS

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Mango (*Mangifera indica* L.) belongs to family Anacardiaceae and is rich in a variety of phytochemicals and nutrients. The fruit pulp is high in prebiotic dietary fibre, vitamin C, polyphenols and carotenoids. The young and the unripe fruits of mango are acidic in taste and are utilized for various culinary purposes. The ripe fruits are used in preparing various processed products such as ready-to-serve (RTS) drink, nectar, squash, jam, cereal flakes, custard powder, baby food and toffee. Mint (*Mentha viridis* L.) belongs to family Lamiaceae and has common name 'Paudina'. Mint leaves contain a number of vitamins and minerals, which are vital to maintain a good health. Spices are used as one of the safest and effective remedies in curing various diseases and its long-term consumption is not known to produce any side effect. Stevia, a natural sweetener has been approved by USFDA and generally recognized as safe (GRAS) ingredient for its use in a wide range of food products. Honey is a sweet viscous yellowish liquid with appealing flavours, which is elaborated by the honeybee from the nectar of plants. Beside antioxidants, acids (primarily gluconic acid), protein, minerals, flavonoids, vitamins and enzymes are also found in honey. In the twenty-first century, people have become more concerned about their diet, health and wellness. Consumer awareness concerning juice beverages has increased the number of positive attributes desired for these products, apart from refreshment. Fruit mixtures present a series of advantages, such as the combination of different aromas and flavours, and the sum of its nutritional components. Therefore, blending of mature green mango pulp and mint leaves paste with spices, low calorie ingredients and honey is a convenient and economical alternative for its utilization in the development of value added nutritive and therapeutic beverages.

A STUDY ON GENDER DIFFERENCES IN PSYCHOLOGICAL WELL-BEING

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The aim of the present study was investigated to psychology well-being of gender Difference. To draw the sample, government senior secondary schools from two villages namely Sakedri and Raipurani from rural area and sector 6 and sector 7 from urban area were randomly selected. A total of 600 school students (males= 300; females=300) from Government Senior Secondary Schools in Panchkula (Haryana). All adolescents were studying in 11th and 12th class aged between 15 to 18 years old. Ryff's Psychological Well-Being Scale developed by Ryff (1995) was used to assess the psychological well-being of children. In this

research psychological well-being Inventory was used for data collection Data was analyzed by “t” test. The purpose of this study was to access school adolescent’s psychological well-being. Gender differences were observed that boys and girls differed significantly on autonomy ($z=2.14$, $p<0.05$), environment mastery ($z=3.00$, $p<0.05$), personal growth ($z=3.33$, $p<0.05$), purpose in life ($z=3.40$, $p<0.05$) and self-acceptance ($z=2.30$, $p<0.05$). Mean scores disclosed that girls had more environment mastery ($M=36.00$), personal growth ($M=35.31$), purpose in life ($M=63.42$) and self-acceptance ($M=49.54$) while less autonomy ($M=35.45$) and positive relation ($M=32.83$) as compare to boys.

Keywords: psychological well-being, adolescents, gender differences

A REVIEW ON APPLICATION OF HIGH THROUGHPUT MOLECULAR BREEDING APPROACHES FOR SPICE CROP IMPROVEMENT

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Along with conventional approaches biotechnological interventions like in- vitro conservation, synthetic seed, somaclonal variation, protoplast fusion and development of transgenic crops have huge potential in conservation of spices, production and genetic improvement in spice. For production of secondary metabolites, flavor and coloring components transformed cell culture, transgenic approach are being attempted. Molecular markers and maps are being generated for genome sequencing, varietal identification, assessment of genetic variability and marker assisted breeding. Genomics, transcriptomics and proteomics study is being used as an important tool for identification and utilization of novel genes. Because of their commercial importance, intensification of biotechnological approaches in spice breeding is essential in the coming decade. Molecular or DNA markers viz., RAPD, AFLP, ISSR, SSR, sequence data from mitochondrial, chloroplast DNA and ribosomal DNA etc. are being used for molecular profiling, studying inter relationships among different species, varietal identification, estimating genetic purity, checking adulteration, mapping and tagging of genes of agronomic importance.

Keywords: Spices, Molecular Breeding, Gene Mapping, DNA markers

SUPERIORITY OF WAVELET NEURAL NETWORK OVER TRADITIONAL NEURAL NETWORK FOR PREDICTION OF RUNOFF TIME SERIES

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The runoff prediction in river is useful to properly manage the water resource, to predict the inflow into the reservoir and to design efficient flood warning system in a river basin. For that purpose, data driven models like artificial neural network (ANN) can be used successfully as it requires less field data compared to other physical models. Also, these models have low error and high speed response in prediction. Hence, this artificial intelligence technique was applied for prediction of runoff time series for Koyana river basin which is an important tributary of Krishna river of India. Fourteen years rainfall and runoff data from 1998 to 2011 were used to construct different neural network models. Gamma test was used to select the best input combination of rainfall and runoff with sufficient lag. Firstly, simple ANN models were generated by varying number of neurons from 1 to 30 in the hidden layer and then best model was selected on the basis of higher Correlation Coefficient (R) and lower Root Mean Square Error (RMSE). Secondly, by using wavelet theory, the input time series of rainfall and runoff with sufficient lag selected as per gamma test were decomposed into approximate and detail time series sub-signals with haar wavelet and then these sub-signals were fed to ANN as input to form hybrid (W-ANN) network models. The results indicated that wavelet coupled artificial neural network models (W-ANN) have higher accuracy and plays significant role to improve the performance of runoff prediction as compared to simple ANN models.

Keywords – Rainfall-runoff modeling, Artificial Neural Network (ANN), Black box models, Wavelet transform.

NITRIC OXIDE IMPROVES PHOTOSYNTHETIC EFFICIENCY UNDER CADMIUM STRESS THROUGH INCREASED NITROGEN AND SULPHUR ASSIMILATION IN MUSTARD

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The role of nitric oxide (NO) in cadmium (Cd)-induced effects on photosynthesis was examined in mustard (*Brassica juncea* L.) plants. Exposure of plants to 50 μ M Cd stress enhanced superoxide production, accumulation of H_2O_2 , lipid peroxidation and reduced photosynthesis and growth. However, the exogenous application of sodium nitroprusside (SNP, a donor of NO)

ameliorated Cd-induced oxidative damages through stimulation of proline accumulation, activation of proline metabolism enzyme glutamyl kinase (GK) and reduction of the proline oxidase (PROX) activity. NO also increased the activities of enzymes of sulphur assimilation like ATP-sulfurylase (ATP-S) and serine acetyl transferase (SAT) and the content of reduced glutathione (GSH). Further, application of NO to plants grown under Cd stress increased the activities of antioxidant enzymes such as glutathione reductase (GR) and ascorbate peroxidase (APX), reduced oxidative stress and increased photosynthesis and growth. A key role of NO in the reversal of Cd-induced photosynthetic inhibition was clearly seen and it can be suggested that NO-induced reversal of drought-inhibited photosynthesis and growth attributes in mustard involves enhanced production of GSH and proline.

Key words: Cadmium, Nitric Oxide, Photosynthesis, Proline, Sulphur

INDIGENIZATION TECHNOLOGY INCREASED THE YIELD OF BLACK PEPPER USING DECOMPOSED WOOD IN POOR FERTILITY AND WATER STRESS SOIL IN HILLY AREA

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The climate of Garo Hills district of Meghalaya in North Eastern Region, India is the gift of god. It has the tropical climate which is suitable for horticultural crops influence throughout the year. Black pepper plantation seems to offer a better venture for earning good amount income by tribal horticulture farmers in rural hilly area. Dryness and less nutrient content in the soil are the common problem in the horticulture orchard. Farmers are gradually adopting different indigenization technology to combat the climatic vagaries and emerging challenges in black pepper production. The study was conducted on the indigenization technology adopted by a group of hilly Garo tribal farmers for increasing the yield of black pepper through decayed/decay wooden log in the West Garo Hills district of Meghalaya. The present paper was a single village study to trace out the farmers modification (termed as indigenization) in black pepper cultivation using decay wooden log and used an index to measure extent of modification. Information was collected through a pre-tested schedule prepared for this purpose. The study reported that using of dry and decayed wooden log beside the side of the plant in soil increased the fertility status and moisture retention capacity of the soil. It was also observed that it improved plant growth, increased the size of berries and length of fruit bearing vine and minimized the mortality rate of the plants in water stress area. The study revealed that yield of black pepper of improved variety increased up to 2-2.8 kg of berries/ha and in traditional variety recorded is 1.7-1.98 kg of berries/ha. Creating awareness and validation of this innovative indigenization technology will help many black pepper growers for large scale adoption.

Keywords: Indigenization, black pepper, decayed wooden log, yield, soil fertility, moisture stress, hilly Garo tribe.

POPULATION DYNAMICS AND BIO-EFFICACY OF SOME NEWER INSECTICIDES AGAINST APHID (*APHIS GOSSYPID*) IN TOMATO

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An experiment was conducted at District seed farm, Bidhan Chandra Krishi Viswavidyalaya, Kalyani, Nadia, West Bengal to know the effect of abiotic factors on incidence of aphid and to study the bio-efficacy of certain new insecticides. Seasonal incidence data revealed that the aphid incidence started from 48th standard week, 2.50 per three leaves; with peak population attained by 7th standard week i.e. 12.19 per three leaves when average temperature, relative humidity and Bright sunshine were 21.9°C, 66.83% and 5.6 Hrs respectively. Again, population gradually declined from 8th to 10th standard week attaining lowest population in 10th standard week. Correlation studies revealed that the aphid population had a significant positive correlation with temperature difference and maximum temperature while significant negative correlation with relative humidity. On the contrary it showed non-significant positive correlation with temperature (minimum, average) and bright sunshine Hrs. The insecticidal efficacy results revealed that Imidacloprid 30.5SC @ 160ml/ha showed maximum population reduction of (88.73%) followed by Flonicamid 50WG @ 300g/ha, Clothianidin 50 WDG @ 500g/ha, Dimethoate 30 EC @ 1000ml/ha, Difenthiuron 50WP @ 1000g/ha, Dinotefuran 20SG @ 500g/ha, Spinosad 45SC @ 100ml/ha gave population reduction of 88.71%, 83.39%, 79.84%, 79.51, 76.14 and 63.04% respectively over control.

Keywords: Tomato, Aphid, bio-efficacy, Population Dynamics.

DEFORESTATION AROUND THE WORLD AND ITS IMPACT ON SOIL FERTILITY AND QUALITY**THOKCHOM DORENCHAND SINGH AND SANJAY-SWAMI****School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, (Central Agricultural University-Imphal), Umiam (Barapani) - 793103, Meghalaya, India**

Deforestation means the conversion of forest to other land use or the long-term reduction of the tree canopy cover below the minimum 10 percent threshold. It includes areas of forest converted to agriculture, pasture, water reservoirs and urban areas. The causes of deforestation are hurricanes, natural fires, pests, agricultural expansion, cattle ranching, logging, unpriced forest goods and services, concentration of land ownership, weak or non-existent ownership, population growth and density and economic growth. The soils under natural forest showed higher sand and lower clay and silt fraction's than that of soils under cultivation. A pattern of increased bulk density and decreased porosity values was observed for the samples of cultivated sites compared to those of the adjoining forest soils. The rainfall runoff experiments indicate that runoff content of the natural forest soils was higher than the garden and cultivated land soils. pH values was high under cultivation than the forest soils. The cultivated soil manifested a considerable increase in the values of C:N ratio with the adjoining forest soils. The conversion of forest land to the cropland induced a drop in the amount of CEC. Soil organic C, POC, and MOAC losses under longer periods of cropping are probably due to decreases in the above ground net primary production (ANPP), increases in the mineralization rate due to higher temperature and aeration. The microbial community i.e., the fungal and bacterial population was also significantly lower in both surfaces (0-10 cm and 10-20 cm) of hill positions in the deforested land compared to natural forest. Microbial/biochemical indicators showed perceptible deterioration in the topsoil due to deforestation. In general, deforestation provides some advantages to human but it deteriorates soil fertility and quality significantly. So we need to stop deforestation and search for new way for our mankind.

Keywords: Deforestation, soil physical, chemical and biological property.

ROLE OF BIODYNAMIC FARMING IN SUSTAINABLE AGRICULTURE**¹TIKENDRA KUMAR YADAV, ²ASHVIN KUMAR MEENA, ³SHIV POOJAN YADAV AND ⁴NUPUR SHARMA****^{1,2,3}Department of Agronomy, Institute of Agricultural Sciences, Banaras Hindu University Varanasi (UP)****⁴S.M.S.(Agronomy)K.V.K. Sawai Madhopur (Raj.)**

Biodynamic agriculture is a form of alternative agriculture very similar to organic farming, but it includes various esoteric concepts. This concept drawn from the idea of Rudolf Steiner. Initially developed in 1924, it was the first of the organic agriculture movements. It treats soil fertility, plant growth, and livestock care as ecologically interrelated tasks, emphasizing spiritual and mystical perspectives. Bio-dynamics has much in common with other organic approaches – it emphasizes the use of manures and composts and excludes the use of artificial chemicals on soil and plants. Biodynamic agriculture differs from many forms of organic agriculture in its spiritual, mystical, and astrological orientation. Methods unique to the biodynamic approach include its treatment of animals, crops, and soil as a single system, an emphasis from its beginnings on local production and distribution systems, its use of traditional and development of new local breeds and varieties. Some methods use an astrological sowing and planting calendar. Biodynamic agriculture uses various herbal and mineral additives for compost additives and field sprays; these are prepared using methods that are more akin to sympathetic magic than agronomy. No difference in beneficial outcomes has been scientifically established between certified biodynamic agricultural techniques and similar organic and integrated farming practices. As of 2019, biodynamic techniques were used on 187,549 hectares in 55 countries. Germany accounts for 45% of the global area. Biodynamic methods of cultivating grapevines have been taken up by several notable vineyards. There are certification agencies for biodynamic products, most of which are members of the international bio-dynamics standards group Demeter International. In common with other forms of organic agriculture, biodynamic agriculture uses management practices that are intended to "restore, maintain and enhance ecological harmony. Central features include crop diversification, the avoidance of chemical soil treatments and off-farm inputs generally, decentralized production and distribution, and the consideration of celestial and terrestrial influences on biological organisms. Cover crops, green manures and crop rotations are used extensively and the farms to foster the diversity of plant and animal life, and to enhance the biological cycles and the biological activity of the soil. Disease and insect control are addressed through botanical species diversity, predator habitat, balanced crop nutrition, and attention to light penetration and airflow. Weed control emphasizes prevention, including timing of planting, mulching, and identifying and avoiding the spread of invasive weed species. Compared to non-organic agriculture, bio-dynamic farming practices have been found to be more resilient to environmental challenges, to foster a diverse biosphere, and to be more energy efficient.

IN-VITRO EVALUATION OF PLANT EXTRACTS FOR ECO-FRIENDLY MANAGEMENT OF ALTERNARIA BLIGHT OF MARIGOLD

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Marigold belongs to Asteraceae family. Blight disease of marigold is one of the important diseases caused by many species of *Alternaria*. The present investigation is to know the *in-vitro* effect of different plant extracts on the growth of *Alternaria* spp. responsible for blight of marigold. Six locally available plant extracts namely; Eucalyptus (*Eucalyptus globulus*), Garlic (*Allium sativa*), Mint (*Mentha spicata*), Turmeric (*Curcuma longa*), Onion (*Allium cepa*) and Adulsa (*Justicia adhatoda*) were tested with different concentrations against the growth of the pathogen. It was observed that garlic at 1, 3 and 5% concentrations gave growth inhibition per cent as 41.17, 60 and 76.86% respectively. Adulsa at 5, 10 and 15% concentrations showed 42.35, 53.72 and 69.02% inhibition per cent respectively. Remaining plant extracts showed less than 35% inhibition on growth of the pathogen at all the levels of concentrations. At 5, 10 and 15% concentrations of eucalyptus showed 17.25, 21.96 and 34.11% inhibition per cent followed by mint 3.91, 10.58 and 24.7% inhibition per cent, turmeric 4.31, 9.41 and 18.03% inhibition per cent and onion 0%, 7.44 and 15.29% inhibition per cent respectively. All treatments had positive impact in inhibiting the growth of the pathogen. Higher the rate of concentration, higher the rate of inhibition per cent of the pathogen was observed with all the treatments used.

Key words: *Alternaria* spp., Plant extracts, Inhibition per cent.

DIRECT AND RESIDUAL EFFECT OF ORGANIC SOURCE OF NITROGEN ON RICE BASED CROPPING SYSTEM

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Rice is one of the most important staple food crops in the developing countries including India as well as in many different parts of the world. After the green revolution country has faced several problems with the sustainable agriculture, national food security, decline in production and productivity growth rates, deterioration of soil fertility, increased production costs which lead to non-viable enterprise. With the current awareness of food safety sustainable and eco-friendly agriculture, organic farming became significant to minimize those problems. In an experiment conducted during winter season, it was found that the cumulative effect of farmyard manure (FYM) and green manuring (GM) were more effective than the direct and residual effects. GM was found to be significantly superior to FYM which increased the productivity, nutrient uptake, grain quality in rice-wheat cropping system. However, highest productivity grain quality and nutrient uptake were observed when N was supplied through GM + FYM + Biofertilizers. It was also observed that the effect of organic nitrogen (N) along with bio-fertilizers gave the highest rice grain equivalent yield, benefit cost ratio, etc. Supplying nitrogen through Biological Nitrogen Fixers (BNF) was one of the major emphases internationally for sustainable environmental development as it can be used as the potential source of N in agriculture. The combined application of NPK along with organic manures (GM or FYM) also significantly increased the paddy and straw yield of rice. Integrated fertilization showed significant residual effects on grain and straw yield of wheat. The application of organic manures NPK + FYM showed both direct and the residual effects on rice and wheat yields.

Keywords: Eco-friendly agriculture, organic farming, FYM, green manure, bio-fertilizers, rice-wheat cropping systems, biological nitrogen fixers, integrated fertilization.

SOIL FERTILITY STATUS OF THE DISTRICT KUSHINAGAR, U.P.

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The major mandatory activity of KVKs are OFTs, FLDs and trainings soil testing laboratory is neglected due to unavailability of any budget from any sources myself along with CSISA taken soil samples from farmers fields in 2018 in the month of May and June we can say "Jeth ki dupahari" maximum samples were analysed by me in my laboratory at Krishi Vigyan Kendra (ICAR-IIVR), Sargatia, Seorahi, Kushinagar-274406 (U.P.). According to the results the soil status of Krishi Vigyan Kendra (ICAR-IIVR), Sargatia, Seorahi, Kushinagar-274406 (U.P.) is very low to high in 14 blocks. The major problem of Kushinagar is waterlogging due to river budhi gandak, soil digging, undulated topography in the district. Soil health cards distributed among farmers on the occasion of World Soil Day 5 th December 2018. Physically soil texture is clay loam to sandy loam soil fertility status regarding major and micronutrients low to high in the all blocks and in case of biological properties excellent population of earthworms and fungi were recorded due to energy source in soil is sugarcane residue. Soil colour varied from whitish to grey measured by Munsell colour soil chart. Soil colour, structure, BD, WHC, Plasticity, elasticity, PH, EC etc. have been recorded during the experimentation.

INFLUENCE OF ORGANIC AND INORGANIC PLANT NUTRIENT SOURCES ON NUTRIENT CONTENT AND UPTAKE IN WHEAT (*TRITICUM AESTIVUM* L.)

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An investigation was carried out to study the influence of organic and inorganic plant nutrient sources on nutrient content and uptake in wheat (*Triticum aestivum* L.) of variety HUW-533. The pot culture experiment was laid in Completely Randomized Block Design with twelve treatments replicated three times. N, P, K were applied through urea, single super phosphate and muriate of potash, respectively. While the total amount of organics were applied 7 days before sowing of the wheat. The results indicated that the application of N through 120 kg ha⁻¹ by urea and 10 kg ha⁻¹ through different organic sources increase the N, P and K contents significantly (except K in grain) in grain and straw. Poultry manure resulted in higher N content in grain and straw; however the uptake was maximum in grain as carpet waste and in the straw as poultry manure but total uptake of N were maximum and minimum recorded in the treatment of 100% NPK + 10 kg N ha⁻¹ through C.W. and control, respectively. Total P and K content and their uptake were maximum in the treatment of in grain and straw. The results of N content in the treatments were at par; most of the similar trends were found in the case of P and K content.

Keywords: Organic sources, Inorganic sources, Nutrient content, Uptake, Wheat.

FREIND & FOE (SOWING PRACTICES) FOR WHEAT YIELD AND SOIL HEALTH

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An experiment have been conducted during the year 2018 to 2019 in the season rabi at different farmers field in different villages in the district Sultanpur, U.P. to assess the Freind & Foe for Wheat Yield and Soil Health. Physically two types of soil texture like sandy loam to clay loam have been selected during site selection in the month of July to November sowing of wheat is completed between dated 01-30.11.2018 and harvesting of wheat is completed between dated 20-27.04.2019, high yielding variety HD 2967 have been taken for trial. Results indicated that T₃: (wheat sowing by zero till machine) gave the highest yield q/ha followed by T₂: (wheat sowing by seed drill machine) q/ha with in comparison to T₁: Sowing by cultivator by broadcasting q/ha, minimum yield of wheat recorded in farmers recent technology by sowing of wheat by rotavator (T₀). It was also observed that Zero-tillage wheat reduced the cost of cultivation Rs/ha and increased yield over farmers practices. Soil sample have been taken randomly from farmers fields before and after experimentation and analysed in the laboratory of KVK(ICAR-IIVR), Kushinagar. Improvements in soil health recorded in the treatments of Zero tillage over other treatments during experimentation. We can say the sowing of wheat by zero tillage is friend of farmers over recent technologies of farmers in lowland areas (Clay loam soils).

SOIL CONSERVATION PRACTICES FOR WHEAT YIELD AND SOIL HEALTH

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KVK(ICAR-IIVR), Kushinagar conducted an on farm trial during the years 2018 to 2019 in the season rabi at five farmers field in different villages like Dhaurhara, Parsauna & Sandikhurd in the district Kushinagar, U.P. to assess the Soil Conservation Practices for Wheat Yield and Soil Health. Physically two types of soil texture like sandy loam to clay loam have been selected during site selection in the month of July to November sowing should be done from 20-25.11.2018 and harvesting should be done in 15-20.04.2019, high yielding variety HD 2967 have been taken for trial. Results indicated that T₂: (100 per cent paddy straw, residue management and wheat sowing by zero till machine) gave the highest yield i.e. 45.55 q/ha with B:C. ratio 3.55 followed by T₁: (50 per cent paddy straw, residue management and wheat sowing by zero till machine) i.e. 35.53 q/ha with B:C ratio 3.0 in comparison to T₀: farmers practice (100 per cent paddy straw burning and wheat sowing by broadcasting) i.e. 30.25 q/ha with B:C ratio 1.55. It was also observed that Zero-tillage wheat with mulching reduced the cost of cultivation Rs/ha and increased yield over farmers practices. At village Sandikhurd, Padrauna, Kushinagar farmers provided better response over other villages during experimentation. Soil sample taken before and after experimentation and analysed in the laboratory of KVK(ICAR-IIVR), Kushinagar. Improvements in soil health recorded in the treatments of mulching 100 per cent over other treatments during experimentation.

Key words: Zero-tillage, mulching, wheat yield and soil health

SURVEY WORKS OF SALT AFFECTED SOILS

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I have visited places from 01.05.2019 to 07.05.2019 in the district of Kushinagar, Lucknow, Barabanki, Amethi, Sultanpur, Jaunpur, Varanasi, Mau, Balia and Deoria. I have taken feed back from farmers in field and in train on salt affected soils. Actually, before fifty years maximum salt crust appears on the top of the soil surface but presently non of the field is affected by salts this is due to the higher cropping intensity and increase in population of human per unit areas in the districts. Major problem in soil health is due to residue burning in Kushinagar and Deoria it indicates higher content of OC % in the soils compare to other districts. In the other district residue burning is not problems soil poor in OC % due to parent material is salt. Cropping pattern is different in the districts. In barabanki Mentha-Paddy-Wheat is summer crops grown by farmers but in Kushinagar Sugarcane is major crop during the years.

DETECTION OF SUB CLINICAL MASTITIS IN DAIRY CATTLE BY SURF FIELD MASTITIS TEST UNDER FIELD REGION

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Sub clinical mastitis (SCM) is considered as a hidden disease in dairy cattle, as no symptoms are seen neither in milk nor in udder. It can be diagnosed by several diagnostic tests, among which surf field mastitis test (SFMT) is one of them. So, present experiment was done to evaluate the effect of SFMT for the detection of SCM. The study was done on 100 dairy cows at surrounding villages of Nadia district, West Bengal. Animals were selected randomly and milk samples were checked by SFMT beside the cow under field region and noted in score. Milk sample was cross checked by somatic cell count to know the efficacy of SFMT. The data analysis revealed that the animals had high SCC found to be positive for SFMT. It was also analyzed that milk thickened with the increase of SCC, which denoted the higher SFMT score. Therefore, it can be concluded that SFMT can be used as an diagnostic test as it was proved to be safe, easy and quick test for the detection of SCM in the dairy cattle.

ROLE OF SOME SPECIFIC MOLECULES IN PLANT-PARASITIC INTERACTION

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Plants in their life cycle communicate with a multitude of diverse organisms. Plants exhibit two types of interactions with microbes: (1) highly specialized interaction, where specific mutualistic activities are found and (2) commensalism, where the pathogen is benefited without giving any benefit to host. Some specific molecules of pathogen origin have some specific function in this regard. Flagellin, a classic PAMP (Pathogen associated molecular pattern), is the basic protein subunit of the bacterial flagellum. A *Pseudomonas syringae* pv *tabaci* strain lacking flagella was reported to successfully infect *Arabidopsis*, while the wild-type strain containing it, could not infect *Arabidopsis*. Lectins that refer to glycoproteins of non-immune origin or as binder of agglutinate cells (e.g., RBC, bacteria and viruses), were also found to be involved in insect-parasite interactions. Lectins probably function as determinants of pathogen transmission by arthropods. Nematode-secreted cell wall (CW) modifying enzymes such as endoglucanases, pectolytic enzymes, cellulase, polygalacturonases, xylanases and expansins function in penetration and migration. Chorismate Mutase (CM) affects cellular metabolism by suppressing salicylic acid. Chorismate-derived compounds like indole-3-acetic acid (IAA) and salicylic acid were reported to induce defense in plants against nematode. Root diffusates that contain plant hormones auxin and cytokinin have role in triggering a rapid alteration of the surface cuticle of sedentary plant-parasitic nematodes, whereas, stylet-secreted antibodies encoding a thioredoxin peroxidase suppress host defense. Flavonoids being secondary metabolites, act as signal molecules, phytoalexins, detoxifying agents, stimulants for germination of spores etc. Legume-rhizobial nodulation involving signaling process starts with signal of flavonoid and isoflavonoid compounds liberated through the plant roots. Flavonoid induces rhizobial nodulation genes (nod-genes) involved in the synthesis of lipochitooligosaccharide signals, called Nod factors, which induce the accumulation of flavonoids resulting in the secretion of more flavonoids by the root and this process goes on. This review concludes that host resistance against plant pathogens is very specific and very complex in nature. Host resistance, considered as one of the best protection measures can be attributed to identification of specific molecules of parasitic origin.

Keywords- Plant-microbe interaction; PAMP; chorismate mutase; flavonoids; nod factors

SEED PRIMING AND ITS IMPORTANCE IN FIELD CROPS

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Seedling emergence and stand establishment, two major events in crop for obtaining better yield, are suppressed in adverse climatic conditions. In this regard, seed priming may possess a pivotal role for better crop stand and getting higher yield. Seed priming is a process which increases the germination percentage and reduces the time of emergence. During priming process, seeds are soaked in different hypertonic solutions. Seed priming also regulates the temperature and seed moisture content. It has been reported to develop strong resistance against disease and insect attack. Primed seeds have much growth potential and give more production as compared to non-primed seeds. Among different categories of priming, hydro-priming can be helpful for obtaining good crop establishment in many tropical crops such as sorghum, rice, maize and pigeon pea. In osmo-priming, pre-sowing soaking of seeds is done in different solutions like sugar, polyethylene glycol (PEG), glycerol, sorbitol etc. followed by air drying. It was reported to improve seed germination rate as well as overcome adverse climatic condition. PEG-induced germination is the most common osmo-priming method followed in different cereals and pulse crops. It can also improve activity of different enzymes like superoxide dismutase (SOD), peroxidase (POD), dehydrogenase, amylase etc., leading to better seed vigour. Halo-priming includes soaking of seeds in solution of inorganic salts i.e. NaCl, KNO₃, CaCl₂, CaSO₄ etc. Improved germination and enhanced enzymatic activity were reported in halo-priming. Bio-priming involves seed imbibitions with bacterial inoculation of seed such as *Rhizobium*, *Pseudomonas* etc. Practice of bio-priming resulted in increase and uniformity in germination. It was also successful to develop resistance in plants to seed-borne pathogens and also abiotic stress like salinity. Seed treatment with different hormones i.e. salicylic acid, GA₃, kinetin, etc. to promote the establishment of the seedlings is also known. From this review, it can be concluded that seed priming may bring the best possible solution in germination and better performance of seeds especially when crops are grown under unfavorable conditions.

Keywords: seed priming; germination, PEG, enzymatic activity

DETERMINATION OF 'ENERGY' REQUIREMENT FOR COOKING IN RURAL HOUSEHOLD OF ORISSA, INDIA

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In rural areas, domestic cooking fuels emphasize the predominance of wood, animal residues, and bio-mass etc. These are also in short supply, because of quantum of energy input, those are locally available at zero-cost and manner of their use. This research study aims at determining actual fuel energy requirement to meet the cooking need of rural household in Orissa. The work was carried out in three steps; Data collection for determining the common food items of rural household, observation for determining energy requirement for cooking in field condition, and experiment for determining actual energy requirement in controlled laboratory condition. Households from both coastal and hilly region were selected for such purpose. The results revealed that available energy i.e. energy input per day was more in comparison to actual energy requirement for cooking common food items. The available energy expenditure was influenced significantly by family size and farm size, but useful energy expenditure was influenced by only family size. Size of landholdings, and types of location had a significant effect on determination of cooking energy efficiency. In the study coastal area household had a higher efficiency than hill households. Standardization of cooking for a standard meal in different Chula design and different pot design in controlled condition revealed that very less energy input was required for cooking in comparison to energy input measured in village condition. The efficiency was maximum 17.484% in improved Chula and 13.704% in traditional wooden Chula, against actual requirement cooking efficiency was found 3.25%, where loose bio-mass was used as fuel. (Maximum 5.305 MJ was required for cooking of a standard meal). Hence it indicates the wastage of energy during cooking in village condition against the actual requirement.

EFFECT OF DIMETHOATE, GARLIC AND NEEM CAKE EXTRACTS ON APHID, APHIS GOSSYPHII GLOVER (HEMIPTERA: APHIDIDAE) OF OKRA (*ABELMOSCHUS ESCULENTUS* L.)

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A field trial was conducted at Hamelmalo agricultural college with the objective to study the occurrence and management of aphid (*Aphis gossypii*) on okra. The effect of dimethoate, neem cake, and garlic oil extract were tested with the objective to compare efficiency of the treatments in controlling the population of aphids. The experiment was laid out in a Randomized Block Design with four replications. The sprays were done in ten days interval whereas counting of nymph and adult population on leaves and flower was done three times before and after each spray. The result of the studies showed that the population of aphids was highly controlled from the beginning of the first spray in dimethoate while the botanical pesticides showed effective control starting from the second spray. As regard the effect of the treatment on average yield (Kg/ha) of okra, dimethoate gave increased yield by 4.05% in contrast to neem. Dimethoate was also found to give higher pod number per plot compared to both neem and garlic

extract. But stastically both dimethoate and neem gave the same result in yield, so economically neem was found to be the most profitable.

Keywords: Okra, Aphid, Dimethoate, neem cake and garlic

MORPHOLOGICAL AND PATHOGENIC VARIABILITY OF *ALBUGO CANDIDA* ISOLATES CAUSING WHITE RUST IN RAPESEED AND MUSTARD

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Rapeseed and Mustard is a Rabi season crop. More than twenty diseases are known to affect the rapeseed and mustard in India, but diseases like White rust and Downy mildew are the major consequences because of their global distribution and heavy yield losses. In Manipur, mustard is one of the important leafy vegetables prefers by everyone, but due to white rust its quality and yield is affected. Therefore the present work is undertaken to study the Morphological and pathogenic variability of *Albugo candida* isolates in Manipur. Studies on morphological variability of sporangia of seven isolates of *A. candida* revealed slightly spherical in shape. The size of sporangia varied in different isolates and was ranged from $13.22 \times 11.69 - 18.50 \times 12.96 \mu\text{m}$. Among seven isolates, Mayang Imphal, Wangoi, Iroisemba, Lilong, Vajing have approximately similar size of sporangia, whereas slightly smaller sporangia was found in Wangjing and Kakching isolates. The germination percentages among isolates were ranged from 58-80% after 7hrs of incubation at 10°C . Pathogenic variability of all *Albugo candida* isolates showed creamy white pustules, however the size of the pustules in all isolates ranged from 1-5mm in diameter. The smaller size pustules (1-2.5mm) were observed in Wangjing, Kakching and Lilong, medium size pustules (1-3.5mm) were observed in Mayang Imphal, Wangoi and Iroisemba and larger size pustules of 1-5 mm in diameter were observed in Vajing.

Keywords: *Albugo candida*, Isolate, Pustule and Sporangia.

NUTRITIONAL COMPOSITION OF RICE BRAN: TOWARDS NUTRITIONAL THERAPY

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Rice bran could be a by-product created throughout the method of milling. The bran constitutes nearly 7%-8.5% of the whole grain. The bran consists of the pericarp, tegmen (the layer covering the endosperm), aleurone, and sub-aleurone. Proximate analysis of rice bran by various researchers shows that rice bran is highly enriched with vitamins including vitamin E, thiamine, niacin, also minerals like aluminium, calcium, potassium, sodium, zinc etc. Apart from vitamin and minerals rice bran is also rich in protein, fiber, moisture and ash. Various antioxidants like tocopherols, tocotrienols, oryzanol that inhibits platelet aggregation and prevents cardiovascular diseases are present in the rice bran oil. Rice bran also contains polyphenols (ferulic acid, caffeic acid, salicylic acid), phytosterols (β -sitosterol). Despite of the massive scientific proof on rice bran bioactivity, it still remains underutilized in human health and nutrition as a result of it's thought of as animal feed and is understood to undergo hydrolytic rancidity after processing from whole grain rice. GC-MS, UPLC-MS/MS (ultra-performance liquid chromatography-tandem mass spectroscopy) and metabolomics analysis of rice bran revealed a huge number of metabolites that were clustered into several metabolic pathways including amino acids, carbohydrates, cofactors, vitamins, lipids, nucleotides, peptides, secondary metabolites, xenobiotics etc. In the present investigation we put our efforts to analyze various nutritional parameters of a high yielding rice variety, Ranjit of Assam state. The chemical and mineral composition of rice bran on dry weight basis showed 9.83% moisture, 4.91% reducing sugar, 34.22% carbohydrate, 14.07% crude protein, 7.45% crude fiber, 7.32% ash, 22.43 mg/100g Fe, 1.09 g/100g P, 20.39 mg/100g Na, 1.51 g/100g K, 69.10 mg/100g Ca, 5.09 mg/100g Zn, 0.83 mg/100g Mg. Similarly phytochemical and rice bran oil analysis resulted in 18.04% oil, acid value of 1.11 mgKOH/g oil, iodine value of 88.83 mgI₂/g oil, saponification value of 155.40 mgKOH/g oil, phenol content of 529 mg/100g and an antioxidant activity of 44.81% DPPH inhibition. These metabolites found in rice bran are likely to work synergistically to contribute to rice bran's functional food properties which make the biochemical composition of rice bran an attractive research platform to work with. These investigations will help in discovering multiple nutritional therapies and medical application.

Keywords: phytochemicals, phenols, antioxidant activity, % DPPH inhibition

EFFECT OF FATTY ACID SUPPLEMENTED DIET ON GONADAL DEVELOPMENT AND STEROID HORMONE PROFILE OF LABEO ROHITA

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The *Labeo rohita* is one of the popular and fast growing fishes being cultured in tropical and subtropical regions. In the present study, male and female rohu of more than two years old from the same year class weighing 1.4 –1.5 kg having no external symptoms of gonadal maturity were stocked and fed twice a day @ 3% of body weight for 60 days. Histological observation of

gonadal development and corresponding changes in sex steroid levels from different maturity stages of *Labeo rohita* male and female were studied after 45 days of sampling. The results after 45 days showed that the nutritional quality of the fatty acid supplemented diet considerably influenced phenotypic parameters, GSI, Follicular development and significantly variation in hormonal changes in *L. rohita*. In terms of phenotypic maturation, fish fed on fatty acid supplemented diet showed higher average final weight of 2.03 ± 0.17 kg for females and 1.65 ± 0.10 kg for males while for the control, the average final weight were 1.85 ± 0.60 kg for females and 1.48 ± 0.09 kg for males. The result showed that fish fed on fatty acid supplemented diet had mature ovaries characterized with yellow colour while those fed on control diet had ovaries growing in size, with colour brown to yellowish. The gonado somatic index (GSI) of fatty acid supplemented diet fed fish was higher (3.5 ± 0.56) compared to fish fed on control diet (1.6 ± 0.62). There were higher levels of 648.12 ± 166.8 pg/ml for estradiol was observed in fatty acid supplemented diet compared to 462.68 ± 151.3 pg/ml in case of control diet. The progesterone level of 0.54 ± 0.09 ng/ml was observed in fish fed on fatty acid supplemented diet compared to 0.27 ± 0.05 ng/ml of the control diet. Histological studies also proof that fatty acid supplemented group have advance gonad development with maximum number of mature oocyte were as control group shows secondary level of maturity (developing oocyte). The results showed that the fatty acid supplemented diet fed group gave better performance with an average milt output of 8.75 ± 1.89 ml compared to 7.87 ± 1.60 ml of the control.

Keywords: Labeo rohita, gonad, maturation, sex steroid, histology, nutrition, fatty acid supplemented diet, broodstock diet

NANO TECHNOLOGY AND INNOVATIVE APPROACHES TO ARGUMENT TO PHOTOSYNTHESIS

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Nanotechnology encompasses the concepts of science, engineering, and technology to fabricate products at nanoscales. Nanotechnology can be defined as manipulation of matter at atomic or molecular level. Engineered particles that are of 1 to 100 nm in size in at least one dimension are called “nanoparticles”. Nanoclays and Nano membranes, which are made of carbon nanotubes (CNTs), are used to filter organisms and molecules out of water, and perform better than bacterial and viral filters. Quantum dots, which are semiconducting particles exhibiting quantum mechanical properties, are a source of cheap renewable energy. The interface between plant organelles and non-biological nanostructures has the potential to impart organelles with new and enhanced functions. Here, single-walled carbon nanotubes (SWNTs) passively transport and irreversibly localize within the lipid envelope of extracted plant chloroplasts, promote over three times higher photosynthetic activity than that of controls, and enhance maximum electron transport rates. The SWNT–chloroplast assemblies also enable higher rates of leaf electron transport *in vivo* through a mechanism consistent with augmented photo absorption. Concentrations of ROS inside extracted chloroplasts are significantly suppressed by delivering poly (acrylic acid)– Nanobionics engineering of plant function may contribute to the development of biomimetic materials for light-harvesting and biochemical detection with regenerative properties and enhanced efficiency.

Keyword: Nanotechnology, light-harvesting, Photo absorption, Nanobionics

NANO FERTILIZER A BREAKTHROUGH IN AGRICULTURE: A REVIEW

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In the last 10–15 years the world population has escalated at a breakneck pace which has necessitate the scientists and farmers to improve the agriculture productivity to satisfy the food needs of billions of people. In order to do so, the use of chemical fertilizers has been adopted intensively as it provide full-fledged macro and micro nutrients and has an axial role in enhancing the food production. Although the fertilizers play an important role, its unceasing use has an adverse impact, both on natural resources and human health. Therefore, it is not an acceptable option for sustainability. For the development of agriculture sector with the minimum damage to agro ecology, nano-fertilizers could be a promising alternative. Since fertilizers are the main concern, utilization of nano based fertilizer would be advantageous in agriculture. Nano fertilizers are synthesized or modified form of traditional fertilizers, fertilizers bulk materials or extracted from different vegetative or reproductive parts of the plant by different methods with the help of nanotechnology. It contains one or more of macro and micronutrients, growth promoters encapsulated in nano scale polymers, which will have a slow and a targeted efficient release. When comparing to chemical fertilizers several studies revealed that nano fertilizers increases the Nutrient use efficiency by 3 times, increase soil fertility, yield and quality parameters of the crop, they are nontoxic and less harmful to environment and humans, they also minimize cost and maximize profit. However, the growth and yield of the crop downturns when applied at higher dose similar to chemical fertilizers. Here we review the nano fertilizer, its uses, advantages, disadvantages and functions.

Keywords: Chemical fertilizers, nano fertilizers, nanotechnology.

QUANTIFICATION AND COMPARISON OF ENDOGENOUS ABSCISIC ACID CONTENT IN COLOURED VARIETIES OF CAPSICUM (*CAPSICUM ANNUUM*)

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Absciscic acid (ABA) is a potential plant hormone, whose role has been widely studied in several cereal and horticultural crops in relation to stress, dormancy, germination etc. but its role in fruit developmental stage is still not clear. So the present work is focused mainly on the study of ABA role in different fruit developmental stages. To confirm its activity ABA was estimated in five fruit developmental stages in coloured varieties. Fruit diameter, respiration rate, abscisic acid content, total chlorophyll and total carotenoid, have been measured in each stage. Quantification of ABA during developmental stage showed that its level was maximum in breaker stage followed by full ripe stage. Respiration rate was higher in earlier stages later it decreased up to two fold in fifth stage. Total chlorophyll was reduced in successive developmental stages while carotenoid was increased. Results suggested that ABA is involved in capsicum fruit ripening and developmental stages as it varies concomitantly with carotenoid content and fruit growth.

LAND USE PLANNING IN NEPAL: PROCESS AND PRACTICES

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Even though planning process particularly economic development plan and its implementation in Nepal has been initiated with first five-year plan in 1952/54, land resource planning was overshadowed and only regional level data base on land use, land system and land capability were produced by Land Resource Mapping Project in 1983/84 and made available for planners and decision makers for sectoral planning in regional scale. During past different policies and national planning efforts, some attempts were made for balanced use of country's existing natural resources but Nepal has not practiced land-use planning for the country as a whole at local scale. It is initiated only after ninth five year plan (1997-2002) with the establishment of National Land Use Program under Ministry of Land Reform and Management and formulation of National Land Use Policy 2012 and its revision in 2015 after great earthquake. Land use council, Land use technical committee, District level land use monitoring committee and VDC/municipality level land use committee are institutional set ups for implementing planning works done by National Land Use Project at local levels, district and VDC. Resource maps produced by different international agency associated with India, Canada, USA, Japan and Finland were seemed as basis for formulation of local level land use plans. Presently National Land Use Project (NLUP) has prepared land resources maps, geo-database and reports almost half of total VDCs of the country moreover in Terai region. Seven components of land resources required for local level land use planning prepared by NLUP are present land use map, soil map, land capability map, hazard risk map, land use zoning map, cadastral superimpose on land use zoning map along with its geo-database and report except VDC profile and these are open for public use specifically over the study area. These map, database and reports are available for public use at discount price particularly for government institution and university students and researchers.

Keywords: Land Use, Planning Process, Policy, Institutional Set up, National Land Use Project

MICRO – IRRIGATION FOR AGRICULTURAL GROWTH

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India accommodates more than 17% of world's population, but the country has only 4% water resources and 2.5% land resources of the world. Water is scarce natural resource and there is a huge demand – supply gap to meet the requirements of various sectors. The highest current water demand in country is around 80% for the agricultural production and other sectors (industrial demand, public water supply). Demand management is resources and according to National Water Policy (2012) by Ministry of Water Resources, Government of India, water saving in irrigation has been given vital role to achieve water use efficiency. Micro irrigation is an innovative water saving technology in which water is directly supplied to the crops with very less conveyance and evaporation losses. Micro-irrigation is considered as a prudent irrigation technology promoted nationally and internationally to achieve higher cropping intensity and irrigation intensity. Different types of systems are drip irrigation, sprinkler irrigation, micro-sprinkler, porous pipe system rain gun etc. Benefits of Micro Irrigation – Increase in water use efficiency, Energy efficiency, Fertilizer use efficiency, Productivity increase, Irrigation cost saving. Micro-irrigation technology promotion has been given special importance in Pradhan Mantri Krishi Sinchayee Yojana (PMKSY) with aim of extending irrigation cover (Har khet ko Pani) and improving water use efficiency (Per Drop More Crop) to improve various water development and management activities.

Keywords: Micro-irrigation, Productivity, Benefits, Efficiency, Development.

OPTIMIZATION OF DOUBLE EMULSION BASED LOW FAT FUNCTIONAL MAYONNAISE USING DAIRY PROTEIN-POLYSACCHARIDE COMPLEXES

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Over the past few decades, human lifestyles have changed drastically due to sedentary life style and industrialization which have led to increased lifestyle-related and degenerative diseases. Nowadays, with increased awareness and interest among consumers in health-enhancing bioactive food components they have moved towards preventative health care. With increased regulatory clarity in food safety and standards, people have shifted to better alternatives such as functional foods from medicine. Water-in-oil-in-water ($W_1/O/W_2$) double emulsion matrices have immense potential for application in functional food formulations to reduce oil and salt concentrations, mask unacceptable flavors/odors through compartmentalization and as vehicles for encapsulation and controlled release of bioactive molecules. The current study was aimed to optimize a double emulsion-based low fat functional mayonnaise containing bitter melon extract, whose bioactive molecule Charantin has reported anti-diabetic properties. The double emulsion matrix was optimized with the ingredients in the following range: NaCl (3-5%, w/w), polyglycerolpolyricinoleate (PGPR, 2-4%, w/w) and different levels and types of 1:2::protein:polysaccharide complexes (sodium caseinate/WPC-80 - β -pectin/gum arabic) using full factorial design. The deciding attributes were turbidity, zeta-potential, apparent viscosity and visual observance (sedimentation stability). The optimized matrix consisting of bitter melon extract (55.2%, w/w), sodium caseinate (1.5%, w/w), β -pectin (3%, w/w), salt (3%, w/w) and PGPR (4%, w/w) had higher zeta potential (-30.33 ± 0.18 mV), turbidity (1.18 ± 0.03 cm⁻¹), apparent viscosity (2060 ± 17.32 cP) and was stable for almost one month at 37°C, when compared to other combinations ($p < 0.001$). The study resulted in an optimized double emulsion containing bitter melon extract as a potential delivery vehicle to incorporate the antidiabetic herbal component in functional foods, without altering their sensory properties.

CORRELATION AND PATH ANALYSIS FOR YIELD AND FIBRE RELATED TRAITS IN INTERSPECIFIC (*G.HIRSUTUM* L. X *G.BARBADENSE* L.) HYBRIDS OF COTTON UNDER RAINFED SITUATION

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The study on nature and degree of association of component traits with yield assumes greater importance for fixing desirable trait which plays a decisive role in influencing the yield. Path coefficient analysis permits the separation of direct effects from indirect effect and gives more realistic relationship of the characters and helps in effective selection. Correlation studies made with parents, F₁'s of 17 (lines) $\times$ 3 (testers) and five check hybrids in interspecific crosses of cotton (*Gossypium* spp) revealed that number of bolls per plant (0.912), boll weight (0.651), seed index (0.201), number of monopodia per plant (0.161) along with fibre strength (0.194) and 2.5% span length (0.185) showed significant positive association with seed cotton yield per plant at genotypic level indicating that these characters can be improved simultaneously. The direct and indirect effect of path analysis revealed that the number of bolls per plant, plant height, seed index, ginning outturn, boll weight and fibre strength are the major yield contributing traits in interspecific crosses and should be considered for improving yield under wide hybridization in cotton. The correlation and path analysis revealed that simultaneous selection based on number of bolls per plant, boll weight, seed index and fibre strength may be promising in improving the seed cotton yield per plant. Principal component analysis showed the variation (79.905%) by components 1 to 5 that exhibited Eigen value ≥ 1 . Cluster analysis based on various morphological traits assorted into three main clusters. This enables to choose diverse genotypes for generation of desirable population and selection.

Keywords: Correlation, Cluster Analysis, Eigen Value, Path Analysis and Principal Component Analysis

LAND RESOURCES LAND USE PLANNING AND MANAGEMENT IN NEPAL

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Land is the basic natural resources for the sustainable economic growth where all the human activities take place. The scientific land use planning and management is essential for the overall economic growth. Keeping this in view Nepal Government has laid down on the exercise of Land Use Planning and Management from the fifth five year plan (1970-1975) to the fifteenth five year plan (2019-2024). In this scenario, the present paper tries to review the land use change policies for best utilization and conservation of arable land. The research is based on text-mining method for information retrieve. It concludes that only the changing policy is not sufficient but issues related to abandonment of farm land, internal migration and development paradigm should be changed from the strategic level. The uncontrolled and haphazard encroachment in state land and cultivated land is increasing. This is really a challenge to the country where only 27 per cent land is under cultivation and agricultural sector contribute 32 per cent in national economy. Similarly, due to internal and external migration, the land abandonment process is increasing in the country. The situation will lead to scarcity of fertile land resources; severe threat to food scarcity. In order to

manage such risks a national Land Use Policy , 2013 A.D (2069) was adopted to prioritize the protection of arable lands ensuring food security. So strong mechanism to control such land use changes are very crucial to manage food deficit in the country.

Keywords: land use, agricultural land, policies, food scarcity

ASSESSMENT OF HEAVY METALS IN FLY ASH AND SELECTED PLANTS OF KASIMPUR, ALIGARH, INDIA

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Fly ash is an industrial waste. It is generated in huge quantities mainly from the thermal power plants as a byproduct. Fly ash includes several heavy metals of environmental concerns. Increased use of fly ash in agriculture may result in the accumulation of toxic metals in the soil and eventually by plants, causing toxicities to them by altering normal growth and development. This study was carried out to analyze concentration of heavy metals in fly ash generated from Kasimpur thermal power plant, Aligarh and 8 selected plants growing in ash pan spread in several km² area. The samples of fly ash were analyzed on Atomic Absorption Spectrometer (GBC, 932 Plus; GBC Scientific Instruments, Braeside, Australia) to determine the quantities of Cadmium, Chromium, Copper, Lead and Nickel. Levels of these metals were found both in fly ash and plants. The plants collected from the site were; *Achyranthes aspera*, *Calotropis procera*, *Chenopodium album*, *Cirsium arvense*, *Croton bonplandianum*, *Datura stramonium*, *Parthenium hysterophorus* and *Saccharum munja*. High concentrations of Cr and Cu were found in *C.arvense*. Ni concentrations were highest in *C.bonplandianum* whereas concentrations of Pb and Cd were higher in *S.munja* as compared to other plants. Plants growing naturally on fly ash dump sites accumulate metals without showing toxicity due to evolved metals tolerance mechanisms which alter their physiological/ biochemical pathways to encounter heavy metal stress. The environmental load of toxic metals can be reduced through successive cultivation of selected hyper-accumulator plant species as they have a well-developed root system. Screening of plant species growing on ash ponds, for metal absorption capacity and root-to-shoot transfer coefficient could be a viable approach to identify plants efficient in phytoremediation.

EFFECT OF VOLATILE AND NON – VOLATILE COMPOUNDS PRODUCED BY TRICHODERMA SPP. AGAINST COLLAR ROT OF CHILLI CAUSED BY SCLEROTIUM ROLFSSII SACC

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Chilli is an important vegetable crop that is severely affected by collar rot disease caused by *Sclerotium rolfsii*. Volatile and non-volatile substances secreted by biocontrol agents are very effective in the management of many fungal plant pathogens. The present study deal with in-vitro antagonistic efficacy of six *Trichoderma* isolates viz., *Trichoderma ovalisporum*, *Trichoderma harzianum*, *Trichoderma koningiopsis*, *Trichoderma asperellum*, *Trichoderma atroviride* and *Trichoderma hypocreia* against *Sclerotium rolfsii* tested by using poison food technique method. The results revealed that some isolates are very effective in reducing the mycelial growth of the pathogen. The volatile compounds secreted by *Trichoderma asperellum* showed 34.90% inhibition over control. However, the non-volatile compounds secreted by *Trichoderma harzianum* showed significant inhibition percentage of 16.08% and 41.57% at 7.5% and 15% concentration respectively. *Trichoderma hypocreia* and *Trichoderma atroviride* were found ineffective against the pathogen.

Keywords: *Sclerotium rolfsii*, *Trichoderma* spp, Volatile, Non-Volatile.

APATANI'S PADDY CUM-FISH CULTURE TECHNOLOGY: AN IMPORTANT TOOL FOR POVERTY ELEVATION AND NUTRITIONAL SECURITY IN N.E.R INDIA

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Rice-based fish farming is the main source of earning in many parts of the world and fishing from the rice-based farming systems is often carried out on regular, occasional or part-time basis, making a significant contribution to livelihood generation and nutritional security of not only the poor farmers of far flung areas but also a good source of income for others also. Having rice in the fields and fish in the water is an epitome of abundance and sufficiency. No other combination would seem to be so fundamental and nutritionally complete in the Asian context. Fish culture in rice fields provides the means for the contemporaneous production of grain and animal protein on the same piece of land and in this environmentally conscious age, few other food production systems seem more ecologically sound and efficient. The farmers from Apatani valley (26°50' -98°21'N latitude and 92°40' and 94 ° 21'E longitudes at) placed between River Panior and Kamla at an altitude of 1554 m. of district Lower Subansiri Arunachal Pradesh, N.E.R India have practiced a very unique traditional rice-based fish farming practice in their waterlogged rice-fields which not only provides a good economic return to them but also an excellent example of very low-cost fish farming technology for rest of the world. The total water area of Apatani Plateau is 715.7 ha and rice-fish culture covers

approximately 592.0 ha. where some local fishes as well as all the strains of Common carp (*Cyprinus carpio*) are grown along with local rice cultivars, viz. *Amo*, *Mypia* and *Pyapee* in addition to millet and various type of vegetables on the field dykes. Since aquaculture requires so many resources such as pond, land, water and other inputs, and sometimes it seems that the poor farmer cannot afford the requirements for the same, in this context the rice-fish culture may become an appropriate technology for them to meet out their family needs by the access of common water resources available in their rice-fields. This type of farming system provides not only the fresh supply of fish and vegetable for their own use to improve their nutritional status but also helps in socio-economic upliftment by selling the surplus produce. The above fact indicates that this type of agro-ecosystem is a very good example of ecologically sound and sustainable farming system for the farming community from others hilly states of the country where the climate is suitable for such type of farming.

Keywords: Rice-fish culture, epitome, contemporaneous, environmentally conscious, waterlogged, agro-ecosystem etc.

MANAGEMENT OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* BY SEED DRESSING WITH BIO AGENTS AND PESTICIDES ON OKRA

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Experiment was under taken for evaluating some bioagents and pesticides as seed dressing against *Meloidogyne incognita* infecting okra. The seeds of okra (cv. Pusa Sawani) were treated with *Pseudomonas fluorescence* @ 10 g/kg seed, *Trichoderma viride* @ 10 g/kg seed, *Trichoderma harzianum* @ 10g/kg seed, carbosulfan 25 DS @2% (w/w), malathion 50 EC @2%(w/w) and dimethoate 30 EC@2% (w/w) before sowing of seed. Inoculated and uninoculated control was also kept. Each treatment was replicated four times. The pots were arranged in CRD on floor. Significant improvement in all the growth characters and reduction in the host infestation by the nematode was observed all treatments compared to inoculated control. Maximum plant growth has superior in *Trichoderma viride* treated seed. However, the treated seed with carbosulfan was found more effective in reducing the nematode reproduction. The encouraging results with the application of bioagents as seed dressing for management of root-knot nematode indicated that the use of bioagents for nematode management is an ecofriendly approach and can be one of the potential alternatives of the pesticides.

EFFECT OF PHYTOGENIC FEEDS ON PERFORMANCE OF BROILERS

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An experiment was conducted to evaluate the effect of phytogenic feed additives on growth performance of broilers in Konkan climatic conditions. Day-old broiler chicks of Vencobb-400 strain (162 numbers) were randomly divided into nine treatment groups with three replications of 18 chicks in each treatment group using Factorial Randomized Block Design. In order to evaluate seasonal impact of phytogenic feed additives research was conducted in summer (S₁), rainy (S₂) and winter season (S₃). The control group (T₀) fed on basal diet without any supplementation and other eight treatments groups were supplemented with 0.1 per cent Fenugreek Seed Powder (T₁), 0.2 per cent FSP (T₂), 0.1 per cent Guduchi Stem Powder (T₃), 0.2 per cent GSP (T₄), 0.1 per cent FSP and 0.1 per cent GSP (T₅), 0.1 per cent FSP and 0.2 per cent GSP (T₆), 0.2 per cent FSP and 0.1 per cent GSP (T₇) and 0.2 per cent FSP and 0.2 per cent GSP (T₈). The results obtained revealed that inclusion of 0.2 per cent Fenugreek Seed Powder (FSP) and Guduchi Stem Powder (GSP) in broiler feed had significant effect (P<0.05) on live body weight, body weight gain, Feed intake and feed conversion ratio of experimental broiler birds in winter season (S₃) than other dietary treatments and seasons. The water consumption was significantly (P<0.05) lower in broiler birds fed with 0.2 per cent each of FSP and GSP in winter season. The average rectal temperature was found lower in T₃ (40.46°C) and T₆ (40.08°C) than treatment T₈ (40.56°C) and other dietary treatments. The respiration rate was found to be significantly lower (P<0.05) in treatment T₈ (35.67 breath/min) than other treatments. The chicks fed with 0.2 per cent each of FSP and GSP showed highest net profit than other dietary treatments in rainy season followed by summer and winter season in Konkan region. The present study concluded that supplementation of FSP and GSP at 0.2 per cent each in broiler diet can improved the growth performance in terms of body weight gain, feed consumption, feed conversion ratio and livability thereby reducing the production cost and increasing the net profit in broiler birds in Konkan climatic conditions.

PRODUCTION POTENTIAL, ECONOMICS AND ENERGY USE EFFICIENCY OF PROMISING RICE (*ORYZA SATIVA* L.) GENOTYPES AS INFLUENCED BY VARYING LEVELS OF NITROGEN UNDER LOWLAND TRANSPLANTED ECOSYSTEM OF MIDDLE INDO-GANGETIC PLAINS

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Performance of eight rice (*Oryza sativa* L.) genotypes ('IR 83383-B-B-129-4', 'IR 83387-B-B-27-4', 'IR 88867-9-1-1-4', 'IR 88964-24-2-1-4', 'IR 88964-11-2-2-4', 'IR 88966-39-1-4-4', 'Rajendra Sweta' and 'Rajendra Bhagwati') were evaluated under four varying levels of nitrogen application i.e. control, 50% RDN (60 kg N/ha), 100% RDN (120 kg N/ha) and 150% RDN (180 kg N/ha) during the rainy seasons of 2016 and 2017 on clay-loam soil in lowland transplanted ecosystem of middle Indo-Gangetic Plains. Results revealed that application of increasing levels of nitrogen increases yield attributes and economics of rice genotypes. Among the levels of nitrogen, significantly higher grain yields (5.19 t/ha) and net returns (₹52260/ha) had recorded with 180 kg N/ha. Application of 150% RDN had recorded to increase the yields to the tunes of 98.9, 51.8 and 13.8%, respectively over the control, 50 and 100% RDN. Crop productivity (40.6 kg/ha/day), dry matter efficiency (114.3 kg/ha/day) and economic efficiency (₹409/ha/day) had also recorded significantly higher with 180 kg N/ha. Across genotypes, significantly higher grain yields and net returns associated with 'IR 83383-B-B-129-4' (4.27 t/ha and ₹38181/ha). Crop productivity (33.9 kg/ha/day), dry matter efficiency (95.9 kg/ha/day) and economic efficiency (₹288/ha/day) had also markedly higher under 'IR88964-11-2-2-4' but being on a par with 'IR83387-B-B-27-4', 'IR88867-9-1-1-4', 'IR88964-24-2-1-4'. Carbohydrate equivalent yield (4.06 t/ha) and carbon output (6.42 t eq.CO₂/ha) had significantly higher with 150% RDN. Across genotypes, 'IR83383-B-B-129-4' had higher carbohydrate equivalent yield (3.34 t/ha) and carbon output (5.23 t eq.CO₂/ha), respectively but being statistically similar with 'IR 83387-B-B-27-4' and 'IR 83929-B-B-291-2-1-1-2'. In energetics, gross energy output (193874 MJ/ha), net energy returns (154617 MJ/ha), energy use efficiency (4.94), energy profitability (3.94), energy productivity (0.372 kg/MJ/ha), energy intensity in economic terms (4.58 MJ/₹) and energy output efficiency (1518 MJ/ha/day) had significantly higher with higher levels of nitrogen (180 kg N/ha). Reverse trends were followed in case of energy intensity in physical terms, which had higher with preceding levels of nitrogen. Across genotypes, 'IR83383-B-B-129-4' had higher gross energy output (157888 MJ/ha), net energy output (124319 MJ/ha), energy use efficiency (4.60), energy profitability (3.60), energy productivity (0.346 kg/MJ/ha) and energy intensity in economic terms (3.95 MJ/₹) but being on a par with 'IR83387-B-B-27-4'. However, significantly higher energy output efficiency were associated with 'IR 88964-11-2-2-4' (1274 MJ/ha/day) but being on a par with 'IR83387-B-B-27-4', 'IR88867-9-1-1-4' and 'IR88964-24-2-1-4'. Hence, it may be concluded that growing of advanced breeding rice line 'IR 83383-B-B-129-4' along with application of 150% RDN is an ideal approach to achieve the higher productivity, profitability and energetics under lowland transplanted condition of middle Indo-Gangetic Plains of Eastern India.

Production potential, economics and energy use efficiency of promising rice (*Oryza Sativa* L.) genotypes as influenced by varying levels of nitrogen under lowland transplanted ecosystem of middle Indo-Gangetic Plains

EFFECT OF PACLOBUTRAZOL ON THE BIOCHEMICAL ASPECTS OF MANGO (*MANGIFERA INDICA* L) CULTIVAR "HIMSAGAR" UNDER WEST BENGAL SITUATION

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The growth of mango cultivation occur every year due to different varieties have regular bearing habit but alternate bearing varieties give production one year interval. Here it was observed that the better production needs sufficient assimilate storage of plants. On the other hand, sufficient assimilates were seen in fruiting year plant twigs. This assimilate storage helps to convert vegetative shoot to normally reproductive shoot process of which is hampered in off years due to lack of assimilate storage. But the change of assimilate level is very less in case of regular varieties. After photosynthesis, from photosynthates different micro molecules are produced and stored in plants. Present investigation showed that the said storage materials- starch, sugar and protein level stay in high level. The vegetative shoot is converted in to reproductive shoot because of the storage materials. Starch levels are observed very high in different parts of reproductive shoot. We had arranged different experiments to search the role of starch or the other assimilates in case of fruit production. Other efforts are also done to test the role of soluble sugar and soluble protein. Different biochemical analyses were performed during investigation to acquire knowledge of the importance of assimilates in over all reproductive shoot formation. Trials were also done to check the type of plant part in which paclobutrazol stored assimilates.

Keywords: Paclobutrazol; alternate bearing habit; assimilates; starch

COMPARATIVE STUDY ON ACADEMIC STRESS AMONG ADOLESCENTS AS PER GENDER**VANDANA¹ AND KRISHNA DUHAN²****DEPARTMENT OF HUMAN DEVELOPMENT AND FAMILY STUDIES, COHS, CHAUDHARY CHARAN SINGH HARYANA AGRICULTURAL UNIVERSITY, HISAR**

Adolescence is a period of rapid change and time of searching personal identity. This stage is called as the period of "stress and storm". During this stage adolescents face many psychological problems viz stress, anxiety, aggression, undesirable complexes even sometimes depression and frustration. Academic stress is defined as the anxiety and stress that arises from schooling and education. Now a day there is often a lot of pressure that comes along with pursuing a degree and one's education. It may be studying, homework, tests, labs and reading etc. The study aimed to assess the academic stress among adolescents as per gender in Hisar city of Haryana state. A total sample of 200 respondents was taken randomly in the age group of 16-18 years i.e. 100 respondents from rural and 100 respondents from urban area. To draw rural sample government senior secondary school from 'Dobhi' village was taken randomly and to have the urban sample two schools i.e. government girl's senior secondary school, Sushila bhawan and government senior secondary school, Jhajpool were selected randomly. With regards to gender, equal sample size was taken. Tool used for the research was Academic stress scale by Rao (2012). Research findings revealed that higher percentage of urban respondents (47%) had moderate and high (42%) level of academic stress than rural respondents. Further with regards to gender, rural and urban female respondents had moderate level of academic stress than male respondents of both areas. Study found significant mean differences in academic stress among rural male and female respondents and urban male and female respondents.

Keywords: Adolescence, academic stress, frustration, aggression.

EFFECT OF PLANT GROWTH REGULATORS ON THE GROWTH AND DEVELOPMENT OF INSECT PESTS.**CHETHANKUMAR N****DEPARTMENT OF ENTOMOLOGY, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-13.**

Plant growth regulators (PGRs) have been widely used to obtain high levels of agricultural productivity. They are a group of natural compounds used widely in plant production to control plant growth and development processes. Plant growth regulators (PGRs) like coumarin, kinetin, gibberellic acid (GA3) and indole-3-acetic acid (IAA), have been found to influence the growth and development of insects. They exert a significant inhibitory influence on the growth and development of the insect pests. Coumarin caused 100% mortality in insect eggs, first and second instars. Coumarin also has highest inhibition capacity of pupal formation and maximum prolongation in the total developmental period. Gibberellic acid has great capacity to increase the larval period at high doses. Similarly, Indole-3-acetic acid (IAA) is induced changes in reproductive potential of first generation (F1) and egg hatching time, larval and pupal developmental time, adult emergence time, adult longevity, female sex ratio, adult weight and size of second generation (F2). Among the four PGRs investigated, coumarin was the most potent, followed by kinetin, gibberellic acid, and, finally, indole-3-acetic acid. Recently, PGRs were proposed as successful chemosterilants against insect pests that could be used in integrated pest management programs.

Keywords: plant growth regulators, coumarin, kinetin, gibberellic acid and indole-3-acetic acid

QUALITY CHARACTERISTICS OF BANANA BASED MILK SMOOTHIES PREPARED FROM INDIGENOUS COW'S MILK**BRIJESH KUMAR, V. P. SINGH* AND V. PATHAK****U.P. PT. DEEN DAYAL UPADHYAY VETERINARY UNIVERSITY & GO ANUSANDHAN SANSTHAN, MATHURA, U.P. 281001**

Study was undertaken to assess the quality characteristics and suitability of milk of Harijana, Sahiwal and Cross breed cows for development of milk smoothie. The 125 g milk of Harijana, Cross breed and Sahiwal breeds of cow were taken separately for preparation of milk smoothies. Smoothies were prepared using 75 g of banana in each formulation. The sugar was standardized for all three variants of milk smoothies. Finally four percent sugar was used in subsequent experiments. At last sodium alginate @ 0.1 percent was added to the formulation to make the desired consistency. The standard protocol was followed for assessment of milk smoothies. Statistical analysis was performed using SPSS (version 16.0) software. In general all the formulations and recipes were liked by the panelists and showed more or less similar nutrient status. But four percent level of sugar was selected for formulation of recipes of banana based milk smoothies for each breed of cow based on sensory evaluation. On physico-chemical characteristics basis, non significant ($P < 0.05$) differences were observed in the smoothies of Harijana, Cross breed and Sahiwal milk smoothies except in mean values of moisture, protein and solid-not-fat. The percent mean values of moisture was significantly ($P < 0.05$)

lower while solid-not-fat was significantly ($P<0.05$) higher in Cross breed milk smoothies as compared to the smoothies of other breeds of cows. The sensory profile of all the smoothies prepared with banana and milk of all breeds standardized with two percent sugar level showed nonsignificant ($P>0.05$) differences with other. However, banana and Sahiwal milk based smoothies were selected because of nonsignificantly ($P>0.05$) higher scores of sweetness, acidity, consistency and overall acceptability scores than others.

EVALUATION OF PROMISING BRINJAL HYBRIDS FOR WESTERN PLATEAU REGION OF JHARKHAND

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Development of hybrid variety is the most important breeding objective of brinjal (*Solanum melongena* L.) with the prime focus on resistance to abiotic and biotic stresses viz. heat tolerance, frost tolerance, resistance to fruit and shoot borer, resistance to phomopsis blight and bacterial wilt. Improvement in its nutrition quality is considered as another important breeding objective along with the exploitation of heterosis. An experiment was designed for breeding of brinjal in diallel fashion without its reciprocals for the crossing of seven genotypes which comprises desirable characters. All seven parents and 21 F_1 were evaluated and four promising hybrids were selected for evaluation. An evaluation trial was carried out during *rabi* 2017-18 at Zonal Research Station, Chianki, Palamau, Jharkhand. Altogether seven entries viz., CBH-25, CBH-5, CBH-6, CBH-9, Swarna Pratibha (OP- check), Swarna Shakti (F_1 -check), BE-706 (Pvt. F_1 - check) were laid out in randomized block design with three replications. Observations were recorded for nine important characters. Statistically analyzed data revealed that almost all characters showed significant effect. Out of seven entries of F_1 hybrids of brinjal, the entry CBH-6 gave significantly highest yield (554.81 q/ha) followed by CBH-5 (549.99 q/ha) and Swarna Shakti (540.36 q/ha) which were statistically at par. As far as earliness is concerned, CBH-6 also showed significantly earliest in first flowering (70.67 DAS), highest number of primary branches (5.93), average fruit weight (208.33 g) and yield per plant (2.497 kg/plant). Hence, CBH-6 may further evaluate in different locations and promoted for the development of a hybrid variety and also utilize this cross to obtain promising segregants in the subsequent advanced generations.

Keywords: *Brinjal, Solanaceae, Hybrid, Evaluation.*

ADOPTION OF IMPROVED PRACTICES IN SERICULTURE -A STUDY ON TREE MULBERRY IN KARNATAKA INDIA”

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Sericulture is an agro based labour intensive industry providing gainful employment for rural people. It is one of the promising enterprises supporting agriculture which may substantiate the income of small and large farmers. Sericulture enterprise in its totality is a long chain industry from mulberry cultivation to fabric making. This study was undertaken to study the adoption of improved practices and the problems faced in tree type mulberry and to identify reasons for shifting to tree type cultivation of mulberry over row system among Sericulturists. The present study was conducted in Chikaballapur and Kolar districts of Karnataka, in India during 2017-18. The sample selected for the study was 120 respondents. The statistical tools used were Frequency, Percentage, Mean, Standard deviation, Correlation and Multiple regression analysis. The results of the study indicated that more number of sericulture farmers constituted under medium level of overall adoption followed by high and few farmers had low level of overall adoption of improved sericulture practices. Out of several improved cultivation practices in tree mulberry, majority of sericulture farmers had adopted mulberry variety, method of pruning, method of planting etc. The major constraints perceived by the sericulture farmers were scarcity of labourers, lack of knowledge on correct dose of NPK, shortage of irrigation water and lack of knowledge on pests and diseases control etc. The constraints in silkworm rearing were high fluctuation of prices, high transportation cost, lack of information on market price, etc. Majority of the sericulturists expressed reasons for shifting to tree type mulberry cultivation over row system includes drought tolerant, good cocoon yield, less labour requirement, less susceptible to diseases and pests, less chemical fertilizer requirement and high water use efficiency (1:3). Hence, farmers can be educated on improved practices including wider spacing through on farm trainings in large scale to raise mulberry under dry land conditions. So, those farmers can learn to survive under rain fed conditions in sustainable manner.

Key words: Sericulture, tree type mulberry, cocoon, improved practices and adoption

USE OF PHYTO COSMETICS FROM PLANTATION SPICES MEDICINAL AND AROMATIC CROPS

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Cosmetics are substances that are used to enhance the odor and appearance of human body. FDA defines cosmetics as "intended to be applied to the human body for cleansing, beautifying, promoting attractiveness, or altering the appearance without affecting the body's structure or functions." The use of plants is as old as mankind and in the coming years, the market will see many new products containing natural oils and herbs. Plants were once the main source and foundation of all cosmetics; the pharmaceutical industry also uses a number of plants for drugs that are not suitable for use in cosmetic products. For skin treatment cocoa butter is used widely as an emollient and cosmetic preparations, and a source of natural antioxidants (Dweck, 1997b), turmeric powder is also used as a paste to treat skin ulcers and to help heal extensive skin (Shah, 1982), aloe gel can be applied as an emollient for burns, sunburn and mild abrasion, and for inflammatory skin disorders but also reduce the acne, spots and pimples, used for anti-aging treatment. For hair growth and color, the compound henna one, a brown powder isolated from the leaves, is responsible for the red colour in henna, if the hair is dyed with henna and then treated with a hot decoction of (*Allium cepa* onion) skin (Tonnesen, 1992), a coppery colour will be obtained, many medicinal and aromatic crops can be used for different purposes as a cosmetic.

Natural ingredients are everywhere and continually gaining popularity, and the use of plant extracts in cosmetic formulation is on the rise. A cosmetic formulation including active principles of natural origin can protect the skin against exogenous or endogenous harmful agents, and help to remedy many skin conditions. In addition, natural products can be used in hair care, and as hair colorants or dyes. Aromatic plants and oils have been used for thousands of years, as incense, perfumes, cosmetics, and for their medicinal and culinary applications. In the future, it is possible that many new plants, extracts and oils of commercial significance will be identified, and many botanical uses and claims of many wide spread herbs will be proven new isolation and extraction techniques will be shown to give higher quality products.

Key words: Aloe gel, Anti-aging, Antioxidants, Cocoa butter, Cosmetics, Emollient.

STABILITY ANALYSIS FOR CHICKPEA CROP

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Fourteen chickpea genotypes were evaluated using Randomize complete block design (RCBD) with three replication for evaluating genotype X environment interaction (GEI) and yield stability across 6 environment during 2015-2016 in Chhattisgarh. The objectives were to compare various statistical methods of analyzing yield stability and to determine the most stable parametric procedure to evaluate and describe yield stability and to determine the most suitable parametric procedure to evaluate and describe yield stability of chickpea genotypes performance under Chhattisgarh condition. Several statistical analysis were conducted: Coefficient of variation, regression coefficient (b_i), deviation from the linear response (λ_i), Lin and Binn's cultivar superiority measure (P_i). No significant correlation between Lin and Binn's cultivar superiority measure (P_i) and Finlay and Wilkinson procedure (b_i) with the other measurement were found. Thus these two procedures are not recommended for use on their own as a measurement of yield stability. Conclusively, it is suggested that the use of appropriate statistical techniques is necessary for identifying the most adapted, responsive and stable genotypes in the final phase.

Keywords: Chickpea, genotype-environment interaction, Stability

EFFECT OF YIELD ATTRIBUTES AND ECONOMICS OF SOYBEAN AS INFLUENCED BY FERTIGATION ON DIFFERENT GROWTH STAGES

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The Productivity and economics of soybean as influenced by fertigation on different growth stages was carried out during *Kharif* season of 2016 at the Research cum Instructional Farm, Indira Gandhi Krishi Vishwavidyala, Raipur. Raipur situated at latitude of 21°4' N longitude of 81°35' E and altitude of 290.20 m above mean sea level. The experiment was laid out in randomized block design (RBD) with three replications. The treatment comprised nutrient combination of 50% RDF as basal + 50% RDF through Fertigation at flowering, 50% RDF as basal+50% RDF through Fertigation at pod initiation, 50% RDF as basal+50% RDF through fertigation at grain filling, 100% RDF as basal+ Irrigation at flowering, 100% RDF as basal +Irrigation at pod initiation, 100% RDF as basal +Irrigation at grain filling and 100% RDF as basal. The results revealed that the maximum number of pods per plant, seed per plant, 100-seed weight, yield attributes, seed yield, stover yield, harvest index and economics of soybean production in terms maximum gross return (Rs. 84708 ha⁻¹), net return (Rs.64756 ha⁻¹) and benefit: cost ratio (3.25) was recorded under T₃-50% RDF as basal+50% RDF through fertigation at grain filling stage in soybean.

Keyword - Soybean, yield attributes, fertigation, grain filling, economic.

CLIMATE SMART AGRO-TECHNIQUES FOR LIVELIHOOD SUSTAINABILITY UNDER RAINFED AGRO-ECOSYSTEM

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Scientific inventions and industrialization have led human species to greater heights and progress, but at the cost of Mother Nature. Over exploitation and ignorance have impaired the environment surrounding us which has led to the climate change. National Aeronautics & Space Administration (2015) has reported an increment in global temperature by 1.7°F over the last century. CO₂ level in the air has also been reported at their highest in 650,000 years. It has been projected that agriculture will be affected massively by this climate change and farmers living in the world's driest areas will be the extreme sufferers. United Nations' Food and Agriculture Organization has estimated that around 570 million farms are to face the threat of climate change. Projected decline in the yield of crops by 2050 is 10-12% in Rice & Wheat and 3-4% for coarse cereals due to climate change. Global consumption pattern shows that agriculture production needs to be increased by 70% to meet increasing food demand by 2050 (FAO, 2016). This presents a critical challenge to global food security and agriculture. Rainfed agriculture plays a significant role in global food production. Out of the total arable lands in the world 80.6% is rainfed. In India itself it covers around 82 million hectares of land constituting nearly 56% of the net cultivated area. These areas contribute almost 100% of forest production, 80% horticulture, 85% of coarse cereals and 77% of oilseeds among others. Further it supports 40% of human population & contributes 40% of food grain as well (Rao *et al.*, 2016). But extreme climatic events, uncertainty of monsoon and several edaphic constraints common to this regions impedes the development of sustainability and resiliency in the livelihood of the people. Therefore, climate smart agricultural practices could be a viable option to reconcile agriculture with its environment and overcome the imposed constraints of climate change in rainfed areas. Climate smart agriculture is an approach to identify production systems that can best respond to the impact of climate change and to adjust these systems to suit local environment now and in near future. It aims at sustainable increase in the production and income, adapting & building resilience to the impacts of climate change and reducing GHGs emission wherever possible. Soil and water management, SSNM, resilient crop and cropping systems, watershed management, Alternate land use planning, crop diversification and legume incorporation in crop rotation, small farm mechanization are some of the location specific climate smart practices that are applicable under rainfed situations. There is a need to upscale these technologies for realizing the goals of livelihood security and build climate smartness.

FOREST AND SUSTAINABLE LIVELIHOOD SYSTEMS**AKANSHA KHARKWAL****DEPARTMENT OF EXTENSION AND COMMUNICATION MANAGEMENT, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, PUNJAB**

A livelihood system encompasses the capabilities, material and social resources, and activities required for a particular means of making a living. A livelihood is sustainable when it can cope with and recover from the stresses and shocks and maintain or enhance its capabilities and assets both now and in the future without undermining the natural resource base (Chambers & Conway, 1998). Arnold (1998), in examining the contribution of forests to sustainable livelihoods, defines forests "to include all resources that can produce forest products. Forests cover 31 percent of the world's land surface, just over 4 billion hectares. As forest expansion remained stable, the global net forest loss between 2000 and 2010 was 5.2 million hectares per year. India has 7,08,273 sq. km. of forest that is 24.39% of India is Forested. Between 1990-2000 (10 years) India gained an average of 361500 hectare/ year of forest area and the annual reforestation rate is 0.57%. Ministry of Environment, Forest & Climate Change (MoEFCC) has released India State of Forest Report (ISFR), 2017. According to the report the total forest cover in India has increased by 8021 sq. km. The report also revealed state wise status of India. There are 15 States/UT of India which has above 33 % of geographical area under forest cover and 5 north eastern states where the forest cover has been decreased. If countries are able to pursue inclusive green growth strategies that overcome some of the more severe trade-offs between growth and forest protection, the deforestation that has historically accompanied development in many countries could be slowed, making an important contribution to climate change mitigation. If the world is to confront the challenges of mitigating and adapting to climate change while meeting the demands of a rapidly-growing global population, it is vital that we find the balance between conserving and regenerating forest areas with economic growth for poverty reduction.

ENHANCING THE ECONOMY OF FARMER THROUGH PROCESSED MUSHROOM PRODUCTS**BASANTA PANDEY¹, SANGAM ADHIKARI¹, SAMBIDDHA THAPA¹, SUSHANT RAMAN NEPAL¹, AMRITA SINGH¹, SUDEEP PATHAK²****¹DEPARTMENT OF AGRICULTURE & FORESTRY, TULA'S INSTITUTE, DEHRADUN****²BFIT GROUP OF INSTITUTION, DEHRADUN**

Mushroom cultivation has been growing as one of the most emerging trend among the farmers of today. Thousands of farmers have been trained for the cultivation of mushroom and have been successfully running the business. However the cultivation have

been mostly confined only for the purpose fresh vegetables. During favorable seasons, the production of mushroom increases but due to the lack of knowledge on post harvest management, the farmers are compelled to sell it in low cost or gets damaged. The post processing of mushroom not only saves the farmer from selling at low price but also increases the nutritive and economic value of the mushroom. The fresh mushroom can be dried or made powder for different use or even it can be used as fresh vegetable too. The mushrooms can be converted into pickles, cookies and many other products through value addition because of which not only fresh mushrooms get saved from damaging but also it increases its economic value. The processing of mushroom is economical and easy process. The proper handling and post processing of mushroom can even double the value of normal fresh mushroom which gives more benefit to the farmers and can have the good earning. The post processing products of mushroom amplifies the living standard of the farmer which automatically increases the national economy of the country.

Keywords: Mushroom, Post-harvest, Economy

ENVIRONMENTAL IMPACT OF SOIL AND FERTILIZER PHOSPHORUS

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Increasing human population placed stress on the environment, as well as shifting in land use pattern to increase food production influence significantly. Dynamics of soil and over applied nutrient Phosphorus (P) to crop lands creating extensive problems to terrestrial ecosystem including the buildup of soil P and natural trace contaminants contained in the P fertilizer materials such as cadmium, Arsenic, lead, uranium and radium. When over application of P sources to soils it leads to accumulation of P in surface soils and it trends to transport of P from the terrestrial to aquatic environment in surface and subsurface runoff. It depends on the P content of surface soils and any surface soil contains over 60 mg P kg⁻¹ boosting the P loss with surface runoff. P is considering as the limiting nutrient that controls eutrophication of fresh water bodies and it has recommended a limit for controlling eutrophication of 0.05 mg P kg⁻¹ for total phosphorus in streams that enter lakes and 0.1 mg P kg⁻¹ for total phosphorus in flowing streams. Numerous water quality problems have been associated with eutrophication such as algal blooms can cause fish kills and may harm wildlife and livestock by reducing the oxygen content of water (anoxia) or through the production of toxins. Lakes may become dominated by algae and coarse, rapidly-growing fish while high value edible fish, submerged macrophytes, and benthic organisms disappear. Therefore It emphasis that better P management plan is vital to accomplish the increasing crop demand in the world as well as control the hazardable effects on the environment.

GROWTH AND YIELD PARAMETERS OF RICE AS INFLUENCED BY DIFFERENT FERTILIZER RECOMMENDATION APPROACHES UNDER SYSTEM OF RICE INTENSIFICATION

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The present study was conducted (*kharif* 2015) at the Experimental Farm of Department of Soil Science, CSK HPKV, Palampur to study the effect of different approaches of fertilizer application on yield, growth and yield parameters of rice under System of Rice Intensification (SRI). There were eight treatments (control, farmers' practice, general recommended dose, soil test based, yield targets 3.5, 4.0, 4.5 and 5.0 t ha⁻¹ which are replicated thrice in a randomized complete block design (RCBD). All the levels for prescription based fertilizer application gave significantly higher biomass yield as compared to other approaches of fertilizer application barring few exceptions. Further, treatment for yield target of 5.0 t ha⁻¹ resulted in maximum growth (plant height, total number of effective tillers, panicle length, 1000 grain weight, spikelet fertility percentage, number of grains per panicle), grain (4.46 t ha⁻¹) and straw (10.03 t ha⁻¹) yield. However, Soil test crop response (STCR) approach for transplanted rice worked satisfactorily up to yield target of 4.0 t ha⁻¹ beyond which deviation in yield from targeted yield was more than 10 per cent.

Keywords: Fertilizer recommendations, yield, growth parameters, SRI, STCR.

RELATIONSHIP OF SULPHUR FRACTIONS WITH MECHANICAL SEPARATES OF DIFFERENT TEXTURED SOILS OF HIMACHAL PRADESH

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Sulphur (S) fractions were studied in the present investigation entitled "Relationship of sulphur fractions with mechanical separates of different textured soils of Himachal Pradesh" to assess the S behaviour of the soils of different textures. Eighty soil samples (0-0.15 m depth) were collected from different districts of Himachal Pradesh varying in soil pH, organic carbon (OC), cation exchange capacity (CEC) and clay content and their S fraction behaviour was studied. The textural classes ranged from sandy loam to clay. All fractions of sulphur viz.; available sulphur, water soluble sulphur, heat soluble sulphur, organic sulphur and

total sulphur correlated positively and significantly with clay. Available and heat soluble sulphur had negative and significant relationship with sand but water soluble, organic and total sulphur had non-significant and negative correlation with sand. In case of silt, organic sulphur had negative and significant correlation, whereas, with other sulphur fractions viz. available, water soluble, heat soluble and total sulphur, the relationship was found to be negative and non-significant. On the contrary, clay fraction of fine, medium and coarse textured soils showed significant and positive relationship with all sulphur fractions.

Keywords: Sulphur, fraction, different textured soils

SOIL ACIDITY MANAGEMENT UNDER HILL ECOSYSTEM

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The hill region soils are generally acidic in nature due to wash out of the basic cations present in the soils. The low productivity of the agricultural sector in hilly areas is largely attributed to low and decreasing soil fertility due to many factors such as soil acidity, soil erosion, continuous cropping and inadequate sustainable soil fertility management. Soil acidity is a major problem for agricultural productivity worldwide. Acid soils account for about 4 billion hectare of the total world land area. Most acid soils are found in South and North America, Asia and Africa, due to extensive weathering and leaching. About 21 million ha of acid soils are found in North Eastern Region (NER). In Assam, more than 60% of soils are affected by soil acidity problem. Soil acidity affects crops in many ways and its effects are mostly indirect, through its influence on chemical factors such as aluminum (Al) and manganese (Mn) toxicity, calcium (Ca), phosphorus (P) and magnesium (Mg) deficiencies and micro-biological processes. Extensive review has been done from published and unpublished literature since three and a half decade to highlight the trend, development and soil acidity management under hill ecosystem. These include use of acid tolerant germplasm; improved agronomic, cultural and biological practices and balanced use of fertilizers. Benefits of soil ameliorant such as lime etc were found to enhance soil health by improving soil pH, base saturation, calcium and magnesium. Besides, reduction in Aluminium and Manganese toxicity it induces increased P uptake in high P fixing soil through its beneficial effect on plant rooting environment.

Key words: soil, acidity, nutrients, lime, hill region

PROTEOMICS: NEW TOOL FOR CROP IMPROVEMENT

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A sharp decline in natural resources such as arable land and water along with a continuous steep increase in global food demands have exerted a pressure on farmers to produce more with fewer resources. A viable solution to release this pressure is to speed up the plant breeding process by employing biotechnology in breeding programs. Proteomics has progressed at a tremendous pace since the year 2000, and that has resulted in establishing and understanding the proteomes of tissues, organs, and organelles under both normal and abnormal (adverse) environmental conditions. Established proteomes have also helped in re-annotating the genome of many crops and revealing the new role of previously known proteins. The progress of proteomics had recognized it as the stepping stone for many crops. Proteomics refers to the systematic analysis of protein profiles of entire cells, tissues, organisms, or species. It represents the protein counterpart to the analysis of gene function. Proteomics is an attempt to describe or explain biological state and qualitative and quantitative changes of protein content of cells and extracellular biological materials is under different conditions to further understand biological processes. Proteomics-based discoveries in model crops are likely to be translated in improving other crop plants and vice versa against ever-changing environmental factors. The differentially regulated proteins in response to various biotic and abiotic stresses in different tissues have also been summarized, indicating key metabolic and regulatory pathways. Proteomics helps to envisage a significant role of biotechnology in addressing the global ground level problem of food security, to meet the demands of the increasing human population which is expected to reach six to nine billion by 2040. Translational proteomics intends to improve crop tolerance to biotic and abiotic stresses, to achieve yield stability in agricultural production, to advance sustainable development.

Keywords: biotechnology, crop improvement, proteomics, sustainable agriculture

EFFECT OF CLIMATE CHANGE ON HORTICULTURAL CROPS

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Climate change and global warming is the major concern of humanity in 21st century. It increase the greenhouse gases like nitrous oxide ,carbon dioxide .ozone and methane which may increase the temperature, decreasing water potential, increases biotic and abiotic stress. Climate change and global warming has direct impact of horticulture crops. Production is very low due to climate change but high temperature affect the solanaceous fruit, vegetables suffer many physiological disorder like fruit cracking, fruit abscission. Air pollution increased the intensity of certain physiological disorder of mango like black tip of mango under open filed condition production of horticultural crops will be severely affected. In Himalayan region, ice meting due to increasing of temperature will reduce the chilling injury for the flowering of many horticultural crops like apple orchid etc. Due to severe cold wave production of horticulture crop yield losses upto 10-100% which is depend upon a variety. There is a need to protect our precious crop against the climate change. Reduces the global warming and maintained climate change to adopt the conservation of agriculture, reforestation etc. Under stress condition developed the new cultivars of horticultural crops tolerant to high temperature, resistant to pests and diseases, short duration and producing good yield as well as adoption of hi-tech horticulture and judical management of natural resources will be the main strategies to meet this challenge.

Keywords- Climate change, Horticultural crops.

GONADOTROPIN RELEASING HORMONE AND ITS RECEPTORS INTERACTION IN CLARIAS MAGUR BY IN-SILICO, IN-VITRO AND IN-VIVO TESTING TO FIND POTENT MEDICINE FOR REPRODUCTION.

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Catfishes were commercially very important and the present catfish production in India is 279684 tonnes (DAHDF annual report, 2016). The Asian catfish *Clarias magur* which is commonly known as magur is widely distributed around world and endemic to India, Nepal, Sri Lanka, Bangladesh, Pakistan, Thailand, Laos, Cambodia, Vietnam Myanmar, Singapore, Malaysia and Indonesia. *C. magur* has high consumer preference due to its superior taste and nutritional value. This fish fetches good price due to live marketing . This species has been declared endangered by IUCN due to drastic decline in natural population. Its aquaculture practice is not popular mainly due to non-availability of quality seed as effective induced breeding protocol is infancy stage. Induced breeding involves administration of pituitary extract or synthetic gonadotropin releasing hormone (GnRH) and its analogues to mature brooders, which results in maturation of the gametes in the gonads and finally release of sperms and eggs for external fertilization. The administration of GnRH hormone and its analogue which is currently available in market fails to induce release of milt from mature magur males, making it necessary to sacrifice them for collection of sperms. This will affect the breeding efficacy and larval survival. This also constraints genetic selection of this species for improved traits. Recently at Fish Genetics and Biotechnology Division, CIFE, India the full sequences of *C. magur* of Gonadotropin releasing hormone receptor (GnRH-R) was generated. Successful breeding and quality seed production technology go a long way towards developing a sustainable production system for any commercially important fish. Although GnRH is a conserved molecule, it is possible that the *C. magur* GnRH and other relevant enzymes/hormones have significantly different binding affinities to heterologous receptors. More potent bio-molecules are required for magur and this can be done by implementing the concepts of structural biology to identify and design new molecules targeted to specific needs. In this context, the present study is planned to study the GnRH hormone and receptor interaction which leads to helps us to find out new potent GnRH analogues.

Key words: *Clarias magur*, Gonadotropin releasing hormone, GnRH-R, GnRH analogues.

ROLE OF P AND K FRACTIONS IN SOIL

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~~Phosphorous and potassium are the major nutrient required by the plant after that of nitrogen. They play a key role in the growth and maintenance of plants in agricultural ecosystem. Depending upon soil type, soil fertility and cropping system only 10-29% of fertilizer P is taken up by a crop and rest may accumulate as less soluble forms such as calcium-P, aluminium-P, iron-P, saloid-P and reductant soluble-P. Inspite of high fixation capacity and low recovery of added P, its significant build up in soils has been observed. Total soil-P in soil ranges from 0.01 to 0.30% and occurs in three forms soil solution P, organic P and inorganic P. Organic P. But, the plants mainly depend upon inorganic P forms for their P requirement.~~

Potassium in comparison to P exists mainly in four different forms viz. water soluble-K, exchangeable K, fixed K and trapped between layer of expanding lattice clays. Under severe K depletion, the requirement of K by crops is met from inherent K reserves (non-exchangeable potassium pool) of soils. Only 1-2% of total K contribute for available K which exists in two forms, viz., water soluble and exchangeable. Impact of cropping intensity on the changes of P forms in the soil showed the buildup of organic and labile P fraction in the 0-15 cm soil layer. Long term application of P and K leads to their accumulation in soils as less soluble products, thus affecting the availability of their fractions present in soil. Dynamic equilibrium reactions occurring between different forms of P and K had a profound effect on the productivity and fertility of the soils which in turn depends on the fate of applied nutrients and release from non-exchangeable forms to exchangeable form. The knowledge of different fraction of P and K is important for their availability in the soil.

MONITORING POTASSIUM RELEASE KINETICS OF SOILS UNDER SALINE AND SODIC ENVIRONMENT

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The present research was conducted to study the influence of long-term poor quality water and crop residue incorporation on potassium release kinetics of the soil through a field investigation. The long-term experiment had 16 treatments involving four irrigation water qualities: canal water irrigation (SW1), sodic water (SW2), sodic water plus gypsum (SW3) and saline water (SW4). The crop residue treatments were wheat straw @ 6 t ha⁻¹ to rice crop (T1), rice straw @ 6 t ha⁻¹ to wheat crop (T2), both rice and wheat straw @ 6 t ha⁻¹ each (T3) and the unamended control (T4). The non-exchangeable K extracted by 0.01 M CaCl₂ solution at different time intervals (0.25, 0.50, 1, 2, 4, 8, 16, 32, 64, 128, 192, 264 hours) was in studied sixteen K-treated soils. During the initial hours of reaction period (0.25 hours), K released ranged between 4.1 and 7.1 × 10⁻² cmol kg⁻¹ of soil. After 264 hours of reaction period, maximum amounts of non-exchangeable K was released in SW1T3 treatment followed by SW3T3 treatment whereas, non-exchangeable K release was the minimum in SW2T4 treated soils. To work out kinetic parameters for K release in experimental soils, five different kinetic models ranging in complexity viz. first order equation, zero order equation, power function, Elovich equation and parabolic diffusion model. Although all these models described the non-exchangeable K⁺ release kinetics, comparisons of (R²) and (SE) values indicated that the simple Elovich model best represented the cumulative release of K⁺ in 0.01 M CaCl₂ solution. Elovich equation is applied, where initial release was rapid and levelled off with time suggesting faster desorption initially, followed by more gradual desorption in later stages. The constant 'b' represents the slope, it is index of non-exchangeable K release rate. Higher value of b in SW1T3 treated plots represent higher K supplying power of the soil. Higher value of 'a' and 'b' was observed under simple Elovich function model than other kinetics models. The study showed that adverse effects of saline and sodic irrigation on K fertility can be more effectively managed by incorporation of crop residues than application of potassic fertilisers.

CLIMATE SMART AGRO-TECHNIQUES FOR LIVELIHOOD SUSTAINABILITY UNDER RAINFED AGRO-ECOSYSTEM

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Scientific inventions and industrialization have led human species to greater heights and progress, but at the cost of Mother Nature. Over exploitation and ignorance have impaired the environment surrounding us which has led to the climate change. National Aeronautics & Space Administration (2015) has reported an increment in global temperature by 1.7°F over the last century. CO₂ level in the air has also been reported at their highest in 650,000 years. It has been projected that agriculture will be affected massively by this climate change and farmers living in the world's driest areas will be the extreme sufferers. United Nations' Food and Agriculture Organization has estimated that around 570 million farms are to face the threat of climate change. Projected decline in the yield of crops by 2050 is 10-12% in Rice & Wheat and 3-4% for coarse cereals due to climate change. Global consumption pattern shows that agriculture production needs to be increased by 70% to meet increasing food demand by 2050 (FAO, 2016). This presents a critical challenge to global food security and agriculture. Rainfed agriculture plays a significant role in global food production. Out of the total arable lands in the world 80.6% is rainfed. In India itself it covers around 82 million hectares of land constituting nearly 56% of the net cultivated area. These areas contribute almost 100% of forest production, 80% horticulture, 85% of coarse cereals and 77% of oilseeds among others. Further it supports 40% of human population & contributes 40% of food grain as well (Rao *et al.*, 2016). But extreme climatic events, uncertainty of monsoon and several edaphic constraints common to this regions impedes the development of sustainability and resiliency in the livelihood of the people. Therefore, climate smart agricultural practices could be a viable option to reconcile agriculture with its environment and overcome the imposed constraints of climate change in rainfed areas. Climate smart agriculture is an approach to identify production systems that can best respond to the impact of climate change and to adjust these systems to suit local environment now and in near future. It aims at sustainable increase in the production and income, adapting & building resilience to the impacts of climate change and reducing

GHGs emission wherever possible. Soil and water management, SSNM, resilient crop and cropping systems, watershed management, Alternate land use planning, crop diversification and legume incorporation in crop rotation, small farm mechanization are some of the location specific climate smart practices that are applicable under rainfed situations. There is a need to upscale these technologies for realizing the goals of livelihood security and build climate smartness.

EPIGENETICS FOR CROP IMPROVEMENT

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Epigenetic variations are the potential resource for enhancing crop performance in varied ways as improving crop tolerance to biotic and abiotic stress, enhancing photosynthetic rate and yield of crop plants, developing resilience to climate change, improving nutritional value etc. Plant breeding relies on generation of genetic variability through hybridization for development of improved crop varieties and utilize biodiversity present in land races and species. Genomic tools as MAS(marker assisted selection), targeting induced local lesions in genomes (TILLING), Microarrays are boon to plant breeders in their pursuit for improving crop traits. However to cope successfully with the present and future challenges facing sustainable production in face of rising population and climate change, novel sources of variation need to be tapped today. DNA methylation, histone modifications, RNA interference are epigenetic marks that can be harnessed as alternative tools for crop genetic improvement. Tissue culture induced Somaclonal variations contribute towards epiallele polymorphism. Epiallele diversity is novel tool for modulating gene expression in crop in response to stress and developmental stages and assist plant breeding. Genes involved in de novo methylation as well as maintenance and removal of methylation have been identified and opens new avenues for improvement of agronomic traits. Paramutations, Chromatin remodelling and genomic imprinting also hold tremendous potential for epigenetic engineering for creation of novel useful traits in crop plants.

Key words: epigenetics, breeding, nc RNA, methylation, histone, chromatin

PANCHAGAVYA (COWPATHY): A TRADITIONAL APPROACH TOWARDS TOMORROW'S SUSTAINABLE AGRICULTURE

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Sustainability in agriculture is one of the major concerns of humanity as on today. The current global scenario firmly emphasizes the need to adopt eco-friendly agricultural practices for sustainable food production. Traditional agriculture has been generally considered everywhere as a joint effort of man and cattle. In recent past, a great deal of importance has been given to individual animal product and formulation. Among the liquid formulations, the most widely mentioned and discussed is Panchagavya. This traditional organic input has been mentioned in Ayurveda, prepared by using five components derived from cow viz. milk, curd, ghee, urine, dung and all these five products are individually called 'Gavya' and collectively termed as 'Panchagavya' (Mathivanan *et al.*, 2006). Besides these five components, enriched panchagavya also contains some additional components like coconut water, sugarcane juice or jaggery, banana and toddy. Coconut water is a cheaper substitute for kinetin which increases the chlorophyll content of rice (Raut and Vaidya, 2017). Panchagavya as an organic preparation has a versatile role on soil, plant, human and animal. The increasing concern for environmental safety and global demand for chemical residue free food has evoked keen interest in crop producers to produce eco-friendly products. So it is necessary to use natural products like Panchagavya to produce chemical residue free food crops and hence Panchagavya can play a major role in organic farming. It plays a crucial role in each and every component of crop management like integrated soil fertility management (Condron *et al.*, 2010), integrated nutrient management, integrated pest management and integrated disease management. Plants sprayed with Panchagavya produce bigger leaves and develop denser canopy with increasing rate of yield. It increases immunity power in plants thereby confers resistance against pest and diseases. Panchagavya also has a great impact on human and animal health. It holds an important place in Ayurvedic medicine due to its disease curing properties. Ancient Indian scriptures such as Bhel sanhita, Kashyap sanhita, charak sanhita, Sushrut sanhita hail about glory of the mixture of cow's five essences- the panchagavya. It is believed that consumption of panchagavya results in removal of physical as well as mental disorders and acts as an enhancer of physical strength and life span.

Key words: Panchagavya, sustainability, liquid formulation, organic farming.

MANAGEMENT OF SOIL ACIDITY UNDER HILL ECOSYSTEM

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The hill region soils are generally acidic in nature due to wash out of the basic cations present in the soils. The low productivity of the agricultural sector in hilly areas is largely attributed to low and decreasing soil fertility due to many factors such as soil acidity, soil erosion, continuous cropping and inadequate sustainable soil fertility management. Soil acidity is a major problem for agricultural productivity worldwide. Acid soils account for about 4 billion hectare of the total world land area. Most acid soils are found in South and North America, Asia and Africa, due to extensive weathering and leaching. About 21 million ha of acid soils are found in North Eastern Region (NER). In Assam, more than 60% of soils are affected by soil acidity problem. Soil acidity affects crops in many ways and its effects are mostly indirect, through its influence on chemical factors such as aluminum (Al) and manganese (Mn) toxicity, calcium (Ca), phosphorus (P) and magnesium (Mg) deficiencies and micro-biological processes. Extensive review has been done from published and unpublished literature since three and a half decade to highlight the trend, development and soil acidity management under hill ecosystem. These include use of acid tolerant germplasm; improved agronomic, cultural and biological practices and balanced use of fertilizers. Benefits of soil ameliorant such as lime etc were found to enhance soil health by improving soil pH, base saturation, calcium and magnesium. Besides, reduction in Aluminium and Manganese toxicity it induces increased P uptake in high P fixing soil through its beneficial effect on plant rooting environment.

Key words: Soil, acidity, nutrients, lime, hill region

CARBON SEQUESTRATION AND IT'S EFFECT ON CLIMATE CHANGE AND GLOBAL WARMING

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The drastic increase in concentration of carbon dioxide in the atmosphere since industrialization in the 19th century caused major changes in the environment such as global warming. A changing climate leads to changes in the frequency, intensity, spatial extent, duration, and timing of extreme weather and climate events. Carbon is sequestered to mitigate such major problems by putting carbon into long-term storage. Thus carbon sequestration is one of the methods of reducing the amount of carbon dioxide in the atmosphere. Carbon dioxide is naturally captured from the atmosphere through biological, chemical and physical processes. Plants are capable of effective sequestration and storage of atmospheric carbon in above-ground and below-ground biomass by way of processes of photosynthesis and tree growth. Establishing forest plantations on presently non-forested land provides an energy-conscious world with a clean, efficient means of absorbing some of the excess in atmospheric CO₂. In this study, we compare the total biomass of some major trees which are responsible for high rate of carbon sequestration by non destructive method in an selected area of Sonitpur district of Assam, India. Biomass of the trees are calculated considering the height, girth and wood density of the trees. The main goal of this process is to increase the number of such tree species having the capacity to sequester large amount of carbondioxide to avoid such global changes.

FOREST INSECT PEST STATUS AND THEIR MANAGEMENT IN NORTH EASTERN PART OF INDIA: A REVIEW

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According to the Food and Agriculture Organization, India's forests cover an area of 70.68 million ha, or 23.8 % of the total land area. India has the most rapidly increasing forest resources in the world. However, India is also a country with serious forest pest problems. There are more than 6,000 species of potential forest pests in India, including insects, plant diseases, rodents and lagomorphs, and hazardous plants. Among them, 190 species are considered as economically or ecologically important, and half of these are serious pests, including 76 species of insects. Forest management and utilization have a considerable influence on the stability and sustainability of forest ecosystems. At the national level, forestry policies always play a major role in forest resource management and forest health protection. In this paper, we present a comprehensive overview of both achievements and challenges in forest management and insect pest control in north-eastern part of India. First, we summarize the current status of forest resources and their pests in north-east India. Second, we address the theories, policies, practices and major national actions on forestry and forest insect pest management, including the Engineering Pest Management of north-east, the National Key Forestry Programs, the Classified Forest Management system, and the Collective Forest Tenure Reform. We analyze and discuss five representative plantations - Teak, Sal, Peepal, Albizia and *Lucaenia leucocephala* plantations-with respect to their insect diversity, pest problems and pest management measures.

Keywords: Insect, Lagomorphs, Forest ecosystem.

SOIL LESS CULTIVATION OF VEGETABLES CROPS**DEEPAK RANJAN PRADHAN^{1*} AND DEBASMITA MOHANTY²**^{1*}**DEPARTMENT OF HORTICULTURE, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013**²**DEPARTMENT OF PLANT BREEDING & GENETICS, ASSAM AGRICULTURAL UNIVERSITY, JORHAT-785013**

Traditional agriculture is the cultivation of crops/plants in soil. The plants, in fact, do not need soil to grow but they need its nutrients. In case of vegetation in nutrient solutions or any other substrate (other than soil) containing essential nutrients, the practice is known as soilless gardening/ dirt free farming. Soilless cultivation just bypasses the soil and the plant's requirements are met by nutrient rich substrate. There are three methods for soil less cultivation. In hydroponics, the plants grow on a neutral, solid and inert substrate. This includes materials such as clay balls, sand or even rock wool. A nutrient-enriched aqueous solution provides the plants with the water, oxygen and minerals they need to grow. In aeroponics, no substrate is used. The nutrient solution is permanently and directly sprayed onto the plants' roots. It doesn't need a large space for these techniques and the infrastructure is relatively light (geotextile pots, bags, gutters etc.). These methods work so well in urban spaces, including in gardens, on roofs, on balconies and facades. Aquaponics refers to the combination of hydroponics and aquaculture (fish farming). When combined, these two techniques become complementary, allowing farmers to establish a loop that is almost closed, producing fish and plants. Soilless systems are especially interesting when the arable land is polluted, as is often the case with urban and peri-urban soil. These systems can also be useful in geographical areas where the soil is not fertile or there is no access to soil. Moreover, these systems require less water than soil-based cultivation, which helps preserve this valuable resource. Such systems are also an option in areas with limited access to water resources. A third important advantage is that these systems generate a higher yield compared with traditional agriculture. According to the FAO, the vegetable yield of soilless systems is 20 to 25% higher than in traditional systems, because the former confine the roots in smaller spaces, which means the number of plants per square meter is higher.

Keywords: Aeroponics, Hydroponics, Aquaponics, Soilless Cultivation

MONITORING POTASSIUM RELEASE KINETICS OF SOILS UNDER SALINE AND SODIC ENVIRONMENT**S. CHATTERJEE^{1*}, O.P. CHOUDHARY¹ AND B.S. SEKHON¹****DEPARTMENT OF SOIL SCIENCE, PUNJAB AGRICULTURAL UNIVERSITY, LUDHIANA, PUNJAB**

The present research was conducted to study the influence of long-term poor quality water and crop residue incorporation on potassium release kinetics of the soil through a field investigation. The long-term experiment had 16 treatments involving four irrigation water qualities: canal water irrigation (SW1), sodic water (SW2), sodic water plus gypsum (SW3) and saline water (SW4). The crop residue treatments were wheat straw @ 6 t ha⁻¹ to rice crop (T1), rice straw @ 6 t ha⁻¹ to wheat crop (T2), both rice and wheat straw @ 6 t ha⁻¹ each (T3) and the unamended control (T4). The non-exchangeable K extracted by 0.01 M CaCl₂ solution at different time intervals (0.25, 0.50, 1, 2, 4, 8, 16, 32, 64, 128, 192, 264 hours) was studied in sixteen K-treated soils. During the initial hours of reaction period (0.25 hours), K released ranged between 4.1 and 7.1 × 10⁻² cmol kg⁻¹ of soil. After 264 hours of reaction period, maximum amounts of non-exchangeable K was released in SW1T3 treatment followed by SW3T3 treatment whereas, non-exchangeable K release was the minimum in SW2T4 treated soils. To work out kinetic parameters for K release in experimental soils, five different kinetic models ranging in complexity viz. first order equation, zero order equation, power function, Elovich equation and parabolic diffusion model. Although all these models described the non-exchangeable K⁺ release kinetics, comparisons of (R²) and (SE) values indicated that the simple Elovich model best represented the cumulative release of K⁺ in 0.01 M CaCl₂ solution. Elovich equation is applied, where initial release was rapid and levelled off with time suggesting faster desorption initially, followed by more gradual desorption in later stages. The constant 'b' represents the slope, it is index of non-exchangeable K release rate. Higher value of b in SW1T3 treated plots represent higher K supplying power of the soil. Higher value of 'a' and 'b' was observed under simple Elovich function model than other kinetics models. The study showed that adverse effects of saline and sodic irrigation on K fertility can be more effectively managed by incorporation of crop residues than application of potassic fertilisers.

DIVERSITY OF INSECT PESTS AND ABUNDANCE OF THEIR NATURAL ENEMIES IN BRINJAL CROP***ABHINAV KUMAR¹, INGLE DIPAK S., V². ABARNA³ AND SUNIL VERMA¹**¹**DEPARTMENT OF ENTOMOLOGY AND AGRICULTURAL ZOOLOGY, INSTITUTE OF AGRICULTURAL SCIENCES, BANARAS HINDU UNIVERSITY, VARANASI** ²**DEPARTMENT OF AGRIL. ENTOMOLOGY, BIRSA AGRICULTURAL UNIVERSITY, RANCHI- 834 006**³**DEPARTMENT OF ENTOMOLOGY, AC & RI, TAMIL NADU AGRICULTURAL UNIVERSITY, MADURAI -625 104, TAMIL NADU, INDIA.**

The study on, "diversity of insect pests and abundance of their natural enemies in brinjal crop" was conducted at Horticulture Research Farm, Institute of Agricultural Sciences, B.H.U., Varanasi during Rabi 2017. The seedling of brinjal variety "Kashi

uttam” was transplanted to record the diversity of different insect pests and their natural enemies in the brinjal ecosystem. The diversity of insect pests infesting brinjal during 2017-18 comprised three species of sap sucking insects, the aphids, jassids, and whiteflies as well as the shoot and fruit borer and hadda beetle. On the basis of mean density, aphids had the maximum seasonal mean density 22.56 per 5 plants followed by whiteflies and jassids. The relative density was also the maximum (28.78) for aphids on account of their population abundance. Among the common natural enemies associated with their pests the maximum mean density (12.69) and relative density (34.91) was for the lady bird beetle; however spiders, syrphid fly and rove beetle were also recorded as natural enemies for the major insect pests. The population of sucking pests especially aphids got severely increased during later stage of crop almost after 80-85 DAT, which got checked by various ladybird beetles at the same time the role of spiders can't be ruled out to suppress the jassids population at some extent the population density of syrphids were comparatively lower than Coccinellids and spiders similarly other generalized predaceous insects like rove beetles and some predaceous bugs were scarcely present in the field.

Key words: - Aphids, brinjal, leaf hopper, natural enemies, shoot and fruit borer

GREEN SYNTHESIS OF SILVER NANOPARTICLES ITS CHARACTERIZATION, ANTIOXIDANT PROPERTY AND PHYTOCHEMICAL ANALYSIS

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The study aims at synthesizing silver nanoparticles using leaf extract of *Cymbopogon citratus* along with the evaluation of its antioxidant property. The synthesized silver nanoparticles (having a surface plasmon resonance band centred at 406nm) were characterized using different techniques which included scanning electron microscopy (SEM), transmission electron microscopy (TEM) and x-ray diffractometry (XRD) for their shape and size while fourier transform infrared (FTIR) spectroscopy and energy dispersive x-ray (EDX) spectroscopy was used to determine the functional groups and concentration of metal ions in the nanoparticles, respectively. The data obtained from SEM and TEM revealed the formation of spherical nanoparticles with size ranging from 25-30 nm in diameter while XRD suggested highly crystalline nanoparticles having Bragg's peak at (111), (200) and (220) plane. FTIR confirmed the presence of methoxy and allyl groups in silver nanoparticles. Phytochemical analysis of the leaf extract of *Cymbopogon citratus* also revealed the presence of several bioactive compounds such as polyphenols, proteins, flavonoids, tannins, etc. which were actually the reducing and capping agents of the silver nanoparticles. The antioxidant assay of the synthesized AgNPs indicated that they have a strong antioxidant property as compared to the standard vitamin C.

SILICON BASED DEFENSE RESPONSE IN PLANTS: A PARADIGM SHIFTS IN RESEARCH APPROACH

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Silicon (Si) is the second most abundant mineral element in the earth's crust, and comprises up to 70% of soil mass. In soil, Silicon occurs as its oxides: Silica and Silicates. Concentration of silicon in plants on the basis of dry weight varies between 0.1-10 per cent. Silicon is not recognized as an essential element for general higher plants, it has beneficial effects on the growth and production of a wide range of plant species. Silicon is mostly absorbed by plant roots in the form of non-charged monosilicic acid [Si (OH)₄]. Si is known to effectively mitigate various biotic and abiotic stresses and enhance plant resistance against fungal and bacterial pathogens. The effects of Si on plant-pathogen interactions are analysed, mainly on physical, biochemical, and molecular aspects. In plants most cases, the formation of silica layers inhibits the penetration of fungal pathogen inside the cell. Si also induced biochemical/molecular resistance during plant-pathogen interactions were dominated as joint resistance, involving activating defense-related enzymes activates, such as polyphenoloxidase, glucanase, peroxidase, and phenylalanine ammonia-lyase (PAL); stimulating antimicrobial compound production such as phenols, flavonoids, phytoalexins and PR proteins in plants; regulating the complex network of signal pathways, such as salicylic acid (SA), jasmonic acid (JA), and ethylene and activating of the expression of defense-related genes. Si can act as a modulator influencing plant defense responses and interacting with key components of plant stress signalling systems leading to induced resistance. Priming of plant immune responses, alterations in

phytohormone homeostasis, regulation of iron homeostasis, and networking by defense signalling components are all most mechanisms involved in Si-triggered resistance responses.

EFFECT OF RIDGE AND FURROW SYSTEM FOR SOYBEAN CULTIVATION IN SHIVPURI DISTRICT OF M.P.

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The field study through front line demonstration was carried during the two consecutive *Kharif* 2015 and *Kharif* 2016 to study the effect of ridge and furrow system for soybean crop at farmer's fields in Shivpuri district of Madhya Pradesh under gird agro-climatic zone. Result showed that growth character (plant population, plant height, root length, number of root nodules per plant) and yield contributing character viz., seed yield, straw yield and harvest index (%) found higher in ridge and furrow system over to the normal line sowing method. Net profit was recorded higher under ridge and furrow system as compared to normal flat bed sowing. Average yield for two consecutive year *Kharif* 2015 and 2016 was recorded as 9.01 q/ha and 11.73 q/ha under normal line sowing and ridge furrow system respectively. Average B: C ratio was recorded as 1.99 under ridge and furrow system while 1.54 under normal line sowing system.

Key Words: Soybean, ridge and furrow, normal line sowing, growth and yield character, net profit, B:C ratio

TRICHODERMA: AN EMERGING BIO CONTROL AGENT FOR SAFE FOOD PRODUCTION AND ECOLOGICALLY SUSTAINABLE AGRICULTURE

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Trichoderma species are free-living fungi that are easily found in soil and root ecosystems. They are highly interactive in root, soil and foliar environments, and plays a very important role in production of safe food by avoiding the use of different fungicides and agro chemicals for the management of diseases of economic importance of agriculture with major goal of safe food production with least cost investment. In other hand Trichoderma spp produce a variety of compounds that induce localized and systemic resistance responses in plants against several kind of fungal diseases. Trichoderma have long been recognized as biocontrol agents for the control of plant diseases and for their ability to enhance root growth and development, crop productivity, resistance to abiotic stresses, and uptake and use of nutrients. Among different bio control agent, Trichoderma is most important, having many success stories. They are used for seed treatment, seed bio-priming, seedling dip, soil application and foliar spray. For the management of plant diseases, application of Trichoderma formulations with strain mixtures performs better than individual strains. Whatever limitations Trichoderma bio control agent products may have, it can be addressed by improving biocontrol through manipulation of environment, accurate strain identification by molecular approach, using consortium of beneficial organisms, physiological and genetic enhancement of biocontrol mechanisms. Many small and large entrepreneurs have entered into the commercial production of biocontrol agents, because of its ecological sustainability and huge demand for production of safe and quality products as well as in mixed farming and organic farming.

SYNTHETIC PLANT VIROLOGY FOR NANOBIOTECHNOLOGY AND NANOMEDICINE

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Nanotechnology is a rapidly expanding field seeking to utilize nano-scale structures for a wide range of applications. Biologically derived nanostructures, such as viruses and virus-like particles (VLPs), provide excellent platforms for functionalization due to their physical and chemical properties. Plant viruses, and VLPs derived from them, have been used extensively in biotechnology. They have been characterized in detail over several decades and have desirable properties including high yields, robustness, and ease of purification. Through modifications to viral surfaces, either interior or exterior, plant-virus-derived nanoparticles have been shown to support a range of functions of potential interest to medicine and nano-technology. In this review we highlight recent and influential achievements in the use of plant virus particles as vehicles for diverse functions: from delivery of anticancer compounds, to targeted bioimaging, vaccine production to nanowire formation.

Keywords: Nano-scale, VLPs, Virus

REGIONAL GROUNDWATER RESOURCE MODELLING USING MODFLOW – A CASE STUDY**V. UDAYBHANU PRAKASH AND SASIKALA D****DEPARTMENT OF IRRIGATION AND DRAINAGE ENGINEERING,****KELAPPAJI COLLEGE OF AGRICULTURAL ENGINEERING AND TECHNOLOGY, TAVANUR - 679 573**

Water is the basic need for living organisms. 71% of the earth surface is occupied by water. 96.5 % of the existing water resource is in oceans and rest 3.5% of water is available as fresh water. This fresh water is in the form of polar ice, groundwater, surface water and atmospheric water systems. Industrialization, urbanization and raise in population decreasing per capita of water availability. Water resources were declining gradually whereas population increasing adversely. Groundwater is the only substitute for surface water. Quantifying the water resources is necessary for efficient use of water resources. Groundwater modelling is a tool used to study the groundwater behavior and quantify the groundwater resource. MODFLOW, ARC HYDRO, FEFLOW and HydroGeoSphere (HGS) are some of the software's available for groundwater modelling. For this study, Visual MODFLOW is used to study the groundwater behavior and predict groundwater heads at different scenarios. Andhra Pradesh is known as 'Rice bowl of India'. East Godavari and West Godavari districts contributing maximum production of paddy in Andhra Pradesh. Around 3000TMC of Godavari River is draining into Bay of Bengal. Whereas flow in Krishna River is at critical condition. So, Government of Andhra Pradesh planned to divert surplus water in Godavari River to Krishna River using 'Pattiseema Lift Irrigation Project'. Pattiseema Lift Irrigation project will pump around 100 -150 TMC using 24 motors. To Godavari River West Godavari district in Andhra Pradesh is selected as a study area. West Godavari District is bounded with Bay of Bengal, Upputeru River and Kolleru Lake in South and Godavari River in the East. A model is developed by assigning all boundaries, Aquifer properties and Head observation levels were assigned. Assigned model was kept for Calibration, Validation and Prediction. Model is predicted with different scenarios and is used to study the groundwater behavior at different scenarios. Model is also used to study the effect of 'Pattiseema lift irrigation project' on groundwater recharge.

Spatial and temporal variation of groundwater, identifying the potential groundwater zones to collect the lithology and developing the model for prediction are the different objectives of the study. Spatial and temporal variation of the groundwater heads is studied using a plot between groundwater heads at different locations with respect to time and observed that groundwater vary with respect to topography, climate and soil properties. Potential groundwater zones were identified by developing map using groundwater heads. Different locations were selected and collected well log from Groundwater and Water audit Department, Government of Andhra Pradesh. From lithology data, we observed that major portion of the West Godavari district was occupied by sandstone followed by Clay, Sand, Clayey sandstone, Granite Gneiss and Shales. Model is developed using 55 groundwater heads from 2003 to January 2018. After assigning all inputs to replicate the real conditions, model is kept for Calibration. Model is calibrated with 2003 year data in steady state condition and 2003 to 2007 data in transient state condition. Calibrated model is kept to validation using groundwater heads from 2008 to 2017. In validation new recharge layer is added considering the effect of lift irrigation canal. Validated model is kept for prediction. Model is predicted with increasing pumping rate whereas decrease in recharge for every 5 years. Effect of 'Pattiseema lift irrigation project' is studied using and observed that ground water at different locations in West Godavari District is raised up to 3 m. From this study, observed that West Godavari District is safe with increase in pumping rate up to 2032. This is due to the recharge from Rivers and Lift irrigation canal. Considering the predicted heads and surface water availability, proper cropping pattern can prepare to increase productivity. Conjunctive use of surface and groundwater can adopt in the study area to avoid (eradicate) the water deficiency problem.

INFLUENCE OF CONSERVATION AGRICULTURE ON PHYSICO - CHEMICAL PROPERTIES OF SOIL AT LONG TERM PERIOD**DINESH KUMAR MARAPI^{1*}, HEMANTKUMAR JANGDE¹, BIRENDRA TIGGA¹, MANMOHAN SINGH BISEN², YOGESH KUMAR SIDAR², PANKAJ BHARGAV² AND PAPPULAL BAIRWA³****¹DEPARTMENT OF AGRONOMY, INDIRA GANDHI KRISHIVISHWAVIDYALAYA, RAIPUR****²DEPARTMENT OF ENTOMOLOGY, INDIRA GANDHI KRISHIVISHWAVIDYALAYA, RAIPUR****³DEPARTMENT OF VEGETABLE SCIENCE, INDIRA GANDHI KRISHIVISHWAVIDYALAYA, RAIPUR**

Nowadays, production system is facing numerous challenges and adversely affecting food and nutritional security. Among the challenges, the intensive tillage and excessive use of external inputs are important challenges which leading to degradation of soil through loss of organic matter, soil erosion and compaction and negatively affecting agricultural production. Further, it is associated with natural resource degradation, decline in biodiversity and wildlife population, low energy efficiency and contribution to global warming. Broadly, the intensive tillage is characterised as repeating tillage, straw burning and external inputs. Soil qualities is an indispensable factor for agricultural sustainability as well as restore sustainable crop yields and conservation agriculture (CA) intends to achieve the latter for livelihood security through minimal soil disturbance and crop rotations. CA retains a permanent soil cover through retention of crop residues on soil surface with no till/zero and reduced tillage in order to enhance the natural biological processes above and below the ground. CA include a range of tillage practices i.e. no-tillage, direct-drilling, minimum tillage, ridge tillage that eliminate and/or reduce intensity of tillage operations. Retention of crop residues is release different nutrients through decomposition process as well as reduces bulk density and soil erosion, increased

water table for longer time and improvement of soil structure. Conservation agriculture practices are applicable to virtually all the crops, including cereals, horticulture and plantation crops. However, these are more popular in cereal crops such as maize, soybean, rice and wheat and conservation agriculture practices promises tremendous potential for different soils and agro-ecological zones. Soil management through CA practices improved the physico – chemical properties of the soil by enhancing water-stable aggregates, lower bulk density, labile and total organic carbon fractions and biological soil attribute.

Key words: conservation agriculture, soil quality, physico-chemical properties and no-tillage.

POPULARIZATION OF NUTRITIONAL KNOWLEDGE AMONG THE RURAL WOMEN THROUGH INNOVATIVE APPROACHES FOR ENHANCING THEIR NUTRITIONAL SECURITY AND THEIR IMPACT IN TAMIL NADU, INDIA

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Women are clearly the most critical target group from a nutrition standpoint. The overall nutritional status of women shows that still 50% of all pregnant women are anemic and at least 120 million women in less developed countries are underweight. The present day lifestyle and changed dietary patterns has led to widespread nutritional deficiency. The prevalence of micronutrient deficiency even in the affluent sections of population is a matter of concern. Improving nutrition is a development priority and women are the key to food and nutrition security. They play an important role as producers of food, as managers, as income generators and as providers of care for their families. With this focus the study was conducted in Madurai district of Tamil Nadu to assess the existing dietary pattern and nutritional status and nutritional requirements of women through Anthropometry, biochemical, clinical assessment and dietary survey methods. The results indicated that among the respondents nearly 15.00 percent of them were suffering with chronic energy deficiency having less than 18.5 values of BMI. 31.67 percent of respondents had mild anemia and 11.67 percent were suffered with severe anemia with hemoglobin level of less than 7. Further it was found that the major nutritional requirements needed for the respondents are related to iron and protein rich foods, calcium and millet based food products. To overcome the above situation various innovative extension approaches were conducted to create awareness among the rural women on nutritional importance. Over all 53.37 % of improvement was seen in the nutritional knowledge level of the women respondents after the interventions. Skill on doing value addition in major food groups has increased to 56.67 percent. The overall perceived socio economic impact is approximately 40.00 percent. Frequency of consumption of major food groups and iron and protein rich foods has been increased. Through the establishment of nutritional garden, the intake of greens and vegetables also has increased which gives nutritional security to rural women. The nutrition clubs acted as a platform to transfer home science technologies in the villages. Demonstrations, trainings, Group discussions and field visits, Nutrition mela, technology week, nutrition garden were found to be effective approaches for the popularization of nutritional knowledge.

Key words: women, nutritional status, innovative extension approaches, nutritional knowledge

STUDIES ON LIQUID MANURE BASED DRIP FERTIGATION ON WATER USE QUALITY AND PRODUCTIVITY OF ONION

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An experiment was conducted to study the effect of liquid manures viz. banana pseudostem sap, liquid sheep manure, liquid sheep manure+ 1 per cent bio-fertilizer and nitrogen levels viz. 50 per cent nitrogen through liquid manure+ 50 per cent through urea, 75 per cent (%) nitrogen through liquid manure + 25 per cent nitrogen through urea and 100 per cent (%) nitrogen through liquid manures, farmer's practice and 100 per cent recommended dose of N,P and K @ 20 t ha⁻¹ FYM (INM) on onion crop (*Allium cepa*) var. Palamlohit. The results revealed that application of liquid sheep manure and 1 per cent bio-fertilizer gave significantly higher yield (30.6 t ha⁻¹) and yield attributing characters as compared to farmer's practice. Similar trend was observed for quality parameters viz TSS (10.1 °B) and protein content (1.8%). The treatment liquid sheep manure+ 1 per cent bio-fertilizer resulted in higher nutrient uptake and availability of primary nutrients. Similarly, soil enzymatic activities viz. phosphatase and urease activities were significantly higher in treatment liquid sheep manure+ 1 per cent bio-fertilizer as compared to all other treatments. The study concluded that fertigation with liquid sheep manure + 1 per cent bio-fertilizer resulted in higher water use efficiency and B: C ratio was 5.7.

Key Words: liquid manures, bio-fertilizers, onion, WUE and sheep manures

EFFECT OF ORGANIC SOURCES FYM, VERMI COMPOST AND POULTRY MANURE IN COMBINATION WITH FERTILIZERS ON POD BORER (*HELICOVERPA ARMIGERA*), GROWTH AND YIELD OF CHICKPEA (*CICER AERITENUM*) AT FARMERS FIELD IN VINDHYAN PLATEAU OF MADHYA PRADESH

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Field experiments were conducted for consecutive three years (2013-14 and 2015-16) during *Rabi* season on clay soil at Farmers Field of Vindhyan Plateau of Madhya Pradesh to evaluate the effect of different organic sources (FYM, vermicompost and poultry manure) in combinations with variable levels of recommended fertilizers on Pod Borer (*Helicoverpa armigera*), growth and yield of Chickpea in soybean-chickpea cropping system. The maximum grain yield (2096.67 kg/ha), straw yield (4261.67 kg/ha), net return (Rs.60068.33/ha) and B: C ratio (3.19), with the treatment T₇ application of 75% RDF through organic source + 25% RDF through natural sources + biofertilizer (*Rhizobium* + PSB) (sources poultry manure, N-urea, P-rock phosphate, K-feldspar, S-gypsum) best performance. The next best combination was found with T₆ 50% RDF through organic source + 50% through natural sources + biofertilizer (*Rhizobium* + PSB) (poultry manure, N-urea, P-rock phosphate, K-feldspar, S-gypsum). As compared with RDF through natural resources (N-urea, P-rock phosphate, K-feldspar, S-gypsum), the enhancement in grain and straw yield by best treatment was 18.42 per cent. Thus, the combined use of different organic sources played a significant role in increasing grain and straw yields of chickpea. The population of male moths showed a non significant positive correlation with maximum and minimum temperature as well as relative humidity and rainfall.

PERFORMANCE OF DIFFERENT RICE (*ORYZA SATIVA L.*) VARIETIES UNDER ALTERNATE WETTING AND DRYING METHOD IN PUDDLED SOIL

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A field experiment was conducted on sandy clay soil at Agricultural College farm, Rajendranagar, Hyderabad during *kharif*, 2016 on "Performance of different rice (*Oryza sativa L.*) varieties under alternate wetting and drying method in puddled soil" in a split plot design with three replications. The treatments comprises of three irrigation regimes viz., Alternate wetting and drying irrigation (AWDI) of 5 cm when water level falls below 5 cm from soil surface in field water tube, irrigation of 5 cm, one day after disappearance of water on the surface of the soil (DADSW) and recommended submergence of 2-5 cm water level as per crop stage (RS) as main and four rice varieties of Telangana sona, Kunnaram sannalu, Bathukamma and Sheethal as sub treatments. The seedlings of different rice varieties at 30 days age old were transplanted by adopting a spacing of 15x15 cm. The recommended dose of 120:60:40 N, P₂O₅ and K₂O kg ha⁻¹ was applied. The experimental soil was moderately alkaline in reaction, non-saline, low in organic carbon content, low in available N, medium in available P₂O₅ and K₂O. The data generated in this study were analyzed thorough standard statistical methods. Plant height was not significantly influenced by irrigation regimes and Sheethal and Telangana Sona recorded higher and lower plant height respectively compared to other varieties. Average tillers hill⁻¹ recorded with Telangana Sona (13.5) was on par with Kunaram Sannalu and significantly higher than others. Though Sheethal recorded significantly higher root volume (cm³ hill⁻¹) at 30 DAT (13.6), Kunaram Sannalu (44.7 and 43.3) and Sheethal (44.5 and 43.1) recorded on par and were significantly higher than others at 90 DAT and harvest. Dry matter (kg m⁻²) at 30, 60 and 90 DAT with Bathukamma (0.26, 0.85 and 1.30, respectively), Kunaram Sannalu and Sheethal was on par and were significantly higher than Telangana Sona and Bathukamma was significantly higher (1.42 kg m⁻²) than rest of the varieties at harvest. Significantly higher panicles m⁻² with Kunaram Sannalu, panicle length (22.9 cm) with Sheethal and filled grains (193) panicle⁻¹ with Telangana Sona was recorded than other varieties. Bathukamma recorded significantly higher grain and straw yield (6468 and 7755 kg ha⁻¹) than Telangana Sona, Sheethal and was at par with Kunaram Sannalu in grain yield and on par in straw yield with Sheethal. Significantly higher hulling, milling and head rice recovery percentage (83.2, 69.8 and 64.6) was with Bathukamma than Kunaram Sannalu, Telangana Sona and was at par with Sheethal. Sheethal recorded significantly higher SCMR and LCC rating and Telangana Sona recorded lower than other varieties. Significantly higher water productivity (5.57 kg mm⁻¹) was recorded with Bathukamma than Telangana Sona (5.02 kg mm⁻¹) and Sheethal (4.96 kg mm⁻¹) and was at par with Kunaram Sannalu (5.45 kg mm⁻¹). The N, P and K uptake at 30, 60, 90 DAT and harvest was significantly higher with Bathukamma and Kunaram Sannalu than other varieties and Telangana sona was lower among varieties. Significantly higher gross, net returns (1,10,576 ₹ ha⁻¹ and 70,121 ₹ ha⁻¹) and B: C ratio (2.73) was recorded with Telangana Sona than other varieties. Significantly higher tillers m⁻², root volume, filled grains panicle⁻¹, panicle length, dry matter and grain and straw yield (6289 and 8703 kg ha⁻¹, respectively) and N, P, K uptake was recorded with RS over AWDI of 5 cm submergence when water level falls below 5 cm in field water tube and was on par with AWDI of 5 cm at one DADSW. There was saving of water by 10.8 (1118.1mm) and 11.2 (1113.1mm) percentage, respectively over RS (1253.8 mm), though there was 4 and 6 per cent increase in yield under recommended submergence over AWDI of 5 cm at one DADSW (6049 and 7408 kg ha⁻¹) and AWDI of 5 cm at 5 cm water level fall in field water tube from

surface (5928 and 5839 kg ha⁻¹, respectively). Significantly higher (5.43 kg mm⁻¹) water productivity was recorded with irrigation of 5 cm at one day after DADSW (I₂) than RS (I₃) with 5.02 kg mm⁻¹ and was on par with irrigation of 5-cm when water level falls below 5 cm from soil surface in field water tube with (5.30 kg mm⁻¹). Higher gross returns (1,04,106 ₹ ha⁻¹) and net returns (63,691 ₹ ha⁻¹) and B: C ratio (2.59) were obtained with RS (I₃) and was on par with AWDI of 5 cm one DADSW (I₂) and was significantly higher than irrigation of 5 cm submergence when water level falls below 5 cm in field water tube (I₁). Significantly higher SCMR was recorded with RS and LCC rating other irrigation regimes and there was not much variation between other irrigation regimes. Interaction effect between irrigation regimes and different rice varieties did not influence significantly growth parameters, yield and yield attributes, nutrient uptake, except total N uptake at harvest, post soil fertility and economics. RWC and LWP did not vary much among the treatments. Based the results, it can be concluded that among varieties Bathukamma recorded higher yield and water use efficiency where as Telangana Sona recorded higher net returns and B:C ratio and irrigating the field with one day after disappearance of surface water recorded higher water productivity with saving of 11.2 per cent of total water and 28.5 per cent applied irrigation water and was on par net returns and B:C ratio with recommended submergence of 2-5 cm water level as per crop stage.

IFS- AN INNOVATIVE APPROACH FOR DOUBLING FARMER'S INCOME

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In India, farming is mainly characterized by small, marginal, and fragmented land holdings along with high dependence on monsoon showers. Operating small holdings is quite non beneficial and farming is not a profitable enterprise under this situation. Therefore, the transformation in agriculture production combined with integrated farming system (IFS) approaches is an urgent need as it involves crop cultivation, dairy, poultry, vegetable and fruit production, fishery, agro-forestry, piggery, beekeeping, mushroom cultivation, use of renewable energy sources (like Solar energy, Biogas) etc. For doubling of the farmer's income, a few crucial strategies need to be adopted taking into consideration the basic requirements of the farmers. These strategies can be huge investments in agricultural research and development, adoption of Good Agricultural Practices (GAP), conservation agriculture, judicious use of available resources and inputs, implementation of farmer friendly policies along with improved market and transportation facility, minimum support price (MSP) reform supported by timely availability of adequate bank credits. Smart farming and credit support smart farming are other possible strategies in doubling farmer's income. Mainly, the major causes of agriculture distress are low and highly fluctuating agricultural productivity and farm income which can be increased by augmenting inputs such as irrigation, fertilizers, quality seeds and farm mechanization. Further, adoption of farming system approaches combined with allied innovative approaches holds a vital role to meet the present day challenges in agriculture. The set of services that support diversification with high value crops, agricultural livelihoods and other relevant strategies are in integration with appropriate credit support system as well as implementation of policies like MSP etc. Integrated Farming System is also an eco-friendly approach for doubling farmers' income as in this, waste material of one enterprise acts as an input of another thus making efficient and sustainable use of available farm resources.

GONADOTROPIN RELEASING HORMONE AND ITS RECEPTORS INTERACTION IN FISHES BY SUPERCOMPUTING , IN-VITRO AND IN-VIVO TESTING TO FIND POTENT MEDICINE FOR REPRODUCTION.

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Catfishes were commercially very important and the present catfish production in India is 279684 tonnes (DAHDF annual report, 2016). The Asian catfish *Clarias magur* which is commonly known as magur is widely distributed around world and endemic to India, Nepal, Sri Lanka, Bangladesh, Pakistan, Thailand, Laos, Cambodia, Vietnam Myanmar, Singapore, Malaysia and Indonesia. *C. magur* has high consumer preference due to its superior taste and nutritional value. This fish fetches good price due to live marketing. This species has been declared endangered by IUCN due to drastic decline in natural population. Its aquaculture practice is not popular mainly due to non-availability of quality seed as effective induced breeding protocol is in infancy stage. Induced breeding involves administration of pituitary extract or synthetic gonadotropin releasing hormone (GnRH) and its analogues to mature brooders, which results in maturation of the gametes in the gonads and finally release of sperms and eggs for external fertilization. The administration of GnRH hormone and its analogue which is currently available in market fails to induce release of milt from mature magur males, making it necessary to sacrifice them for collection of sperms. This will affect the breeding efficacy and larval survival. This also constraints genetic selection of this species for improved traits. Recently at Fish Genetics and Biotechnology Division, CIFE, India the full sequences of *C. magur* of Gonadotropin releasing hormone receptor (GnRH-R) was generated. Successful breeding and quality seed production technology go a long way towards developing a sustainable production system for any commercially important fish. Although GnRH is a conserved molecule, it is possible that the

C. magur GnRH and other relevant enzymes/hormones have significantly different binding affinities to heterologous receptors. More potent bio-molecules are required for magur and this can be done by implementing the concepts of structural biology to identify and design new molecules targeted to specific needs. In this context, the present study is planned to study the GnRH hormone and receptor interaction which helps us to find out new potent GnRH analogues.

ROLE OF THE TRICHOME IN PLANT DEFENCE

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Trichomes or plant hairs, common epidermal outgrowths covering majority above ground plant tissues, are presented in extremely large number of plant species and are composed of single-cell or multicellular structures. These structures can be glandular or non-glandular, depending on their morphology and secretion ability. Glandular trichomes can be found on approximately 30% of all vascular plant species, and in a single plant species, several types of trichomes (both glandular and non-glandular) can be observed. Glandular trichomes are characterized by the presence of special cells that have the ability to produce or store huge quantities of secondary metabolites, which contribute to increasing the plant strength to the environment. Its secretion includes mainly terpenoids, but also flavonoids, methylketones, phenylpropanoids and acyl sugars. Trichome can act as an insect resistance mechanism in one of three ways: 1) as a physical barrier minimizing an insect's contact with the host plant, 2) by producing poisonous compounds to insect through contact ingestion and/or inhalation and 3) by producing sticky, gummy or polymerizing chemical exudates which impede the insect. Effectiveness of physical barrier depends on the length, density and orientation of the trichome and on the insect's size, mode of locomotion and type of mouthparts. Longer, denser and/or more erect/rigid hairs may be inferred to provide a better barrier to insect herbivores. Trichome may offer a potential insect resistance mechanism for glabrous crops and/or genotypes. Wild relatives are often a good source of pubescence and have been utilized in several successful breeding programmes. For example, Soybean accessions with greater pubescence have lower susceptibility to lepidopteran pests. In pulse crop, Check pea possess glandular trichomes secrete highly acidic exudate composed of malic and oxalic acid which reduces larval damage of *Helicoverpa armigera*. Similarly, hairiness of cotton confers resistance to *Anthonomus grandis*, *Pectinophora gossypiella* by preventing easy movement. Wild sorghum species with high trichome densities on the lower leaf surface confers ovipositional non-preference for shootfly. Likewise, glandular and non-glandular trichome present in potato and tomato inhibits to colonize the Colorado potato beetle (*Leptinotarsa decemlineata*) and aphids (*Aphis craccivora*, *A. gossypii*, *Myzus persicae*).

Key word:- Trichome, Physical barrier, glandular trichome and non-glandular trichome

EVALUATION OF CHINA ASTER (*CALLISTEPHUS CHINENSIS* L. NESS) VARIETIES FOR GROWTH AND FLOWERING UNDER CHHATTISGARH PLAINS AGROCLIMATIC ZONE CONDITIONS.

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The present investigation was conducted in the year 2015-16 at the Department of Floriculture and Landscape Architecture, IGKV, Raipur for evaluating the performance of China aster varieties. Among the eight varieties studied, the results showed a highly significant variation for various growth, flower, and flower yield parameters among the varieties. Varieties Phule ganesh pink recorded maximum plant height (65.20 cm), plant spread (13.95 cm), number of leaves plant⁻¹ (115.07), number of branches plant⁻¹ (18.80), number of flowers plant⁻¹ (46.87), flower stalk length (30.77 cm), flower diameter (5.54 cm), weight of flower (3.53 g), duration of flower (52.33 days), flower yield plant⁻¹ (94.84 g) also flower yield. However flower yield recorded in Phule ganesh pink (14.23 t/ha) was at par with Phule ganesh white (12.22 t/ha), Arka poornima (12.61 t/ha) and Arka archana (13.94 t/ha). The variety Arka aadya (70.33 days) recorded earlier days to first bud appearance and days to 50 per cent flowering which was at par with Arka archana and Arka shashank. The variety Arka poornima recorded maximum vase life (6.00 days), which was at par with Arka kamini (5.67 days) and Phule ganesh pink (5.33 days).

Key Words: China aster, Growth, flowering, vase life and yield.

IMPROVEMENT IN TILLAGE PRACTICES FOR INCREASING FARM PRODUCTION

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One of the unavoidable part of the farming system is tillage, hence selection of the proper tillage practise for satisfactory production is very necessary. The traditional tillage practises are very time consuming, laborious and uneconomical. Taking in to consideration the current progress of farm mechanisation it become need of an hour for improvement in the tillage practises or to find some new substitute for the traditional one which will be more beneficiary for farmer.

Keeping the above point in view the present investigation was carried out at crop research centre, G. B. Pant University for comparing various tillage practices for sugarcane crop. It was observed that rotavator operation after deep sub-soiling give more production than traditional tillage practise.

Keywords: Tillage, Sub-soiling, Traditional

POST-HARVEST BIOLOGY AND TECHNOLOGY TO ENHANCE SHELF-LIFE OF SAPOTA FRUIT

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Sapota [*Manilkara zapota* (L.) P. Royen] commonly called chiku in India. It is a native of tropical America probably originated in the Southern Mexico and now widely cultivated in the tropics including India, Mexico, Guatemala, Vietnam and Venezuela. Sapota fruit ranks fifth in production as well as in consumption next to mango, banana, citrus and grapes in India. India is the largest producer country of sapota followed by Guatemala and Venezuela. In India, it is mainly cultivated for its delicious fruits, while in South East Mexico and other countries 'Chickle' is commercially produced. The area under sapota cultivation increasing so rapidly owing to a wide range of adaptability, low production cost, high nutritive value, export potential and high economic returns in time. But, post-harvest life of sapota is very short due to its highly perishable nature and other many reasons such as quick ripening, faster senescence, rapid loss of moisture, microbial spoilage, and fruit sensitivity to cold storage, making its commercialization difficult. That is why, sapota need very careful handling during every stages - harvesting, packaging, transportation and storage. Harvesting of fruits is one of the important operation that decide the quality and storage life of fruits. Fruits harvested after optimum stage of maturity usually softens very rapidly and becomes very difficult to handle, meanwhile fruits harvested before physiological maturity may not soften and are usually low in sweetness and high in astringency when ripe with an unpleasant alcoholic taste. Fruits on attainment of harvestable stage do not show green tissue or latex when scratched with a finger nail. The fruits shed off brown scaly external material and become smooth on attainment of physiological maturity. A fruit with a smooth surface, shining potato color, and rounded style end is considered mature. Unfortunately, very little work has been done so far, with limited success, leaving scarce literature published on post-harvest management technologies of sapota. Different pre and post-harvest treatments to reduce metabolic activity and quality loss have been suggested. Moreover, proper storage temperature and packaging may be used to increase the shelf life of fruits. The post-harvest technologies such as ripening retardant treatments (gibberellic acid, CaCl_2 , KMnO_4 , and Chloromequat) at their appropriate concentration, heat treatment, waxing/coating, irradiation, modified atmosphere packaging (MAP), controlled atmosphere storage adopted to enhance the shelf-life of sapota during storage and distribution channel.

POPULATION DYNAMICS OF COTTON LEAFHOPPER ON COTTON GENOTYPES AND THEIR CORRELATION WITH WEATHER PARAMETERS

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Cotton (*Gossypium hirsutum* L.) yield is highly reduced due to attack of sucking insect-pest. Among sucking insect pests, leafhopper *Amrasca biguttula biguttula* (Hemiptera: Cicadellidae), causes loss of plant vitality and drop off cotton bolls, causing up to 30 per cent reduction in yield. So the present experiment was conducted to investigate the performance of cotton genotypes against leafhopper and impact of abiotic factors on the population fluctuation of the pest during *kharif* 2017. The study was conducted at Department of Entomology CCSHAU, Hisar. During the study, incidence of leafhopper was observed throughout the crop season. It was observed that maximum mean population of leafhopper recorded during 28th and 34th standard meteorological weeks. It was also observed maximum mean population of leafhopper recorded in SCS 1211 (3.68 nymphs/leaf) followed by F 2164 (3.40 nymphs/leaf), PBH 47 (3.23 nymphs/leaf). Minimum mean population was recorded in HS 288 (1.17 nymphs/leaf) followed by SUFLUM (1.21 nymphs/leaf) and F 2228 (1.28 nymphs/leaf). Leafhopper population was significantly and positively correlated with the morning and evening relative humidity (RH), while non significant and negative correlated with maximum temperature, rainfall and wind speed. Leafhopper population also showed positive and non significant correlation with minimum temperature.

SOIL AND WATER CONSERVATION PRACTICES ON CROP PRODUCTIVITY AND SOIL HEALTH MANAGEMENT

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Healthy soil is the foundation for profitable, productive and environmentally agricultural systems. Soil works for you if you work for the soil by using management practices that improve soil health and increase productivity and profitability immediately and into the future. A suite of Best Management Practices (BMPs) has been identified and recommended, through several outlets, to farmers to ameliorate these concerns. Soil and water resources are under immense pressure due to ever increasing population thereby ensuing growing demand for food, fiber and shelter. Soil and water resources are being deteriorated due to different anthropogenic and natural factors. However, implementation of soil and water conservation is not an easy process, due to complex, mountainous, fragile ecosystem with inappropriate land management practices and intensive rainfall and steep slope resulting in big gullies, severe soil erosion and poor soil fertility. The aim of this study was to assess farmer's perception on soil and water conservation practices on crop productivity and soil health management and identify major Constraints on soil and water conservation in India. The results indicate that soil and water conservation practices will be more effective at reducing sediment yield. Soil works for you if you work for the soil by using management practices that improve soil health and increase productivity and profitability immediately and into the future.

Keywords- BMPs, Conservation Practices, Crop Productivity and Soil Health Management

BLOOD BIOCHEMICAL PROFILE IN RELATION TO CARBOHYDRATE AND LIPID METABOLISM IN RABBIT

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Rearing of rabbit is an established micro-livestock industry in many countries where rabbit are domesticated for meat. Broiler breeds of rabbits have also been introduced in India to explore its avenue as an alternative source of animal protein. Rabbit mean has high biological value (21%) and low in fat and cholesterol. Rabbit grow rapidly and their rate is comparable to that of broiler chicken (Rao,et.al.,1997). Proper nutrition is one of the important aspects of broiler rabbit production. The protein and energy content of the diet play a vital role in rabbit nutrition. Biochemical characterization of rabbit will help in better understanding of rabbit in relation to growth, meat, fur and wool quality. An attempt was made in present investigation to study the blood biochemical profile in desi rabbit. Study were conducted by taking the biochemical parameters like blood glucose, serum Cholesterol, serum lipid and serum phospholipids to show the effect of honey on rabbit. The honey had significant effect on serum cholesterol and blood glucose, but had non-significant effect of honey on serum lipid and serum phospholipids.

STUDIES ON IDENTIFICATION OF EXISTING AGROFORESTRY SYSTEMS IN NORTH-WESTERN HIMALAYAS, INDIA

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North western Himalaya is basically an agro-ecosystem, where 90 percent of its total population lives in villages, whose economy is dependent on agriculture, horticulture and animal husbandry. The study was carried out in District Shimla of Himachal Pradesh that lies between 30°45" to 31°40" N latitude and 77°0" to 78 °19" E longitude. Study area was divided into five altitudinal zones viz. Zone I (500-1000m amsl), Zone II (1000-1500m amsl), Zone III (1500-2000m amsl), Zone IV (2000-2500m amsl) and Zone V (>2500m amsl). The study showed that there were total seven agroforestry system types identified in the study area. Whereas, five agroforestry systems (AFS) were prevalent in each zone. In altitudinal zone-I and zone-II, most predominant AFS was Agri-silviculture (AS), followed by Agri-horticulture (AH), and Silvi-pastoral (SP). Whereas, in altitudinal zone-III, IV and V, most predominant AFS was Agri-horticulture (AH) followed by Horti-agriculture (HA), and Horti-pastoral (HP).

Keywords: Agroforestry systems, North western Himalaya, Himachal Pradesh, Shimla

STUDIES ON INCIDENCE OF INSECT PESTS IN BRINJAL AND MANAGEMENT OF BRINJAL SHOOT AND FRUIT BORER (*LEUCINODES ORBONALIS* GUENEE)

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The present investigations were carried out during the *Kharif* season, 2017-18 at Student's Instructional Farm, N. D. University of Agriculture and Technology, Kumarganj, Faizabad (U.P.). The incidence of four major insect viz., Jassid (*A. biguttulabiguttula*), White fly (*Bemaciatabaci*), Epilachna beetle (*Henosepilachnavigintioctopunctata*) and brinjal shoot and fruit borer (*L. orbonalis*) were recorded. The incidence of whitefly and jassid were noticed for the first time from 36th SW onwards while Epilachna beetle were seen from 41st SW. The incidence of brinjal shoot and fruit borer was noticed for the first time from 39th SW onwards. Maximum and minimum whitefly population was observed in 42nd SW and 36th SW i.e. 4.40 and 0.53 whiteflies/cage respectively. Maximum and minimum jassid population was observed in 42nd SW and 36th SW i.e. 2.33 and 0.13 jassids/cage

respectively. Maximum and minimum epilachna beetle population was observed in 46th SW and 5th SW i.e. 2.33 and 0.07 beetles/3 leaves respectively. Maximum and minimum shoot infestation was recorded in 48th SW and 4th SW i.e. 7.42 and 0.13 shoot damage/plant respectively. Maximum and minimum fruit infestation was recorded in 48th SW and 4th SW i.e. 8.04 and 0.81 fruit damage/plant respectively. Correlation coefficient was worked out between the incidence of insect pests and abiotic factors. In case of whitefly and jassid, the correlation was positive with minimum and maximum temperature while it was negative with RH and rainfall. In case of epilachna beetle, the correlation was negative with minimum and maximum temperature as well as with RH and rainfall. In case of shoot infestation by BSFB, the correlation was positive with maximum temperature while it was negative with minimum temperature, RH and rainfall. In case of fruit infestation by BSFB, the correlation was negative with minimum and maximum temperature as well as with RH and rainfall. Among bio-insecticides & botanicals evaluated against brinjal shoot and fruit borer (*L. orbonalis*), Emamectin benzoate 5 SG (75 g a.i/ha) treated plots showed lowest infestation and gave higher fruit yield (313.85 q/ha) followed by Spinosad 45 SL (18 g a.i/ha) and NSKE (5%) which gave 300.58 and 284.33 q/ha fruit yield respectively. The least effective treatment was woodash (10 g/plant) and yielded only 225.14 q/ha healthy fruits. The maximum cost-benefit ratio was obtained from Emamectin benzoate 5 SG 75 g a.i/ha (1:26.53) treated plots. Tobacco leaf extract 5% treated plots though ecofriendly but gave least cost-benefit ratio (1:1.27).

EFFECT OF POTASSIUM AND SULPHUR LEVELS ON THE PERFORMANCE OF FORAGE YIELD ON WINTER SEASON BERSEEM (*TRIFOLIUM ALEXANDRINUM* L.) IN BUNDELKHAND SOIL

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This research was conducted with the aim to quantify the effect of potassium and sulphur on yield and composition of Berseem (*Trifolium alexandrinum* L.) during winter season of 2014-15, at Agriculture experimental field, Nehru P.G. College Lalitpur, (U.P.). The treatments consisted of four potassium levels (0, 30, 60 and 90 Kg K₂O ha⁻¹) and four sulphur levels (0, 10, 20 and 40 Kg S ha⁻¹). The experiment was laid out in randomized block design with three replications. Application of 90 kg K₂O ha⁻¹ and 20 kg S ha⁻¹ significantly increased the green foliage and dry matter yield of Berseem. The green foliage and dry matter production at 20 kg S ha⁻¹ was significantly enhanced by 9.9 and 10.9% over control, respectively. The maximum N, P, K and S contents in Berseem plants were recorded with 90 kg K₂O and 40 kg S ha⁻¹, respectively. The interaction between K and S had significant effect on yield and mineral composition of Berseem and maximum yields were recorded under 60 kg K₂O and 20 kg S ha⁻¹ which was statistically at par with 90 kg K₂O and 40 kg S ha⁻¹.

Keywords: Interaction effect K and S Forage Yield, Nutrient Content, Berseem

EVALUATION OF SOAP FLAKE FORMULATION OF PUNGAM (*PUNGAMIA PINNATA* (L.) PIERRE.) OIL AGAINST COTTON MEALYBUG (*MACONELICOCOUS HIRSUTUS*) (GREEN)

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In past few years, crops in tropics suffer heavily due to the infestation of sucking pests rather than leaf feeders and borers and besides direct damage, sucking pests also known to serve as vectors for various viral diseases that increase the loss. As an alternate to chemical insecticides, many researchers have shown that the spray solution of pongam oil helps to control sucking pests. Karanja oil based formulations have great potential for sustainable integrated pest management programmes rather than the synthetic products. But farmers are finding difficult in mixing the pongam oils with water to prepare spray fluid. This improper mixing and application over crops reduces their insecticidal value greatly. To overcome the difficulties, organic based soap flakes of both the oils have been prepared and used. Hence the present study aimed in evaluating the organic soap flake formulation of oils of neem and pongam against polyphagous sucking pests such as mealybugs which are the major problems recently.

Investigation was carried out to formulate an effective bio pesticide formulation against sucking pests of field crops. Pongam oil soap formulations (POSF) were tested against cotton mealybug (*Maconellicoccus hirsutus*) (Green). The formulations were tested for its deterrent, anti-feedant and insecticidal efficacies. More than 80% of the cotton mealybug moved away from the plants treated with pongam oil soaps after 6 hours at 4% concentration. It was increasing as the concentration increases. At 5% concentration 100% deterrent action was noticed after 6h of exposure. At lower concentrations very low per cent mortality (8 to 9%) of cotton mealybug were seen, at the same time phyto toxicity effect were observed in higher concentrations.

Keywords: Pongam, formulations, efficacy, *Maconellicoccus hirsutus*.