

## EFFECTS OF DIFFERENT LEVELS OF CALCIUM AND PHOSPHOURS ON PERFORMANCE AND BLOOD PARAMETERS IN COMMERCIAL BROILERS

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The experiment will be conducted on seventy two healthy day old chicks of same hatch Procured and randomly divided into three treatments and one control group. They will be further divided into six sub groups with three chicks in each to serve as replicate. Chicks will be accommodated in cages with required floor space. All the birds will be reared under similar managerial conditions. Broiler starter and finisher ration as per BIS standard will be prepared. Chicks will be starter ration up to three weeks and then finisher ration up to six week of age. Ration and clean water will be offered *ad lib*. A bulb of 25 watt will be left on in each cage during night to maintain optimum temperature. T<sub>1</sub> (control feed without supplementation), T<sub>2</sub> control feed + 0.50% dry powder of calcium), T<sub>3</sub> (control feed + 0.50% dry powder of phosphorus), T<sub>4</sub> (control feed + 0.50% dry calcium + 0.50% dry phosphorus). The data on body weight of DOC, weekly body weight, feed consumption and gain in body weight will be recorded. At the end of experiment nine birds from each group will be randomly selected, slaughtered and blood samples will be collected with the help of anticoagulant for determination of blood parameters as follows. In whole blood Calcium level, blood Phosphorus level Statistical analysis. The data obtained on various parameters will be, collected tabulated and statistically analyzed by analysis of variance (ANOVA) technique as per Snedecar & Cochran (1994).

## FALSE SMUT DISEASE OF RICE AN EMERGING THREAT IN INDIA

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Rice (*Oryza sativa* L., Family : Poaceae) is the world's most important crop, staple food for more than half of the world's population and its production has direct effect on food security. Among the fungal diseases rice false smut caused by *Ustilaginoidea virens* (Cooke) (Takahashi) gained a high attention as high disease incidence in the fields and reduction of yield due to disease and the status of disease become minor to major. Now a day the climatic conditions in major rice growing states changes and became favourable *i.e.* >90% relative humidity, frequent rainfall and increasing in temperature. As these epidemiological factors provide higher disease incidence which cause reduction in yield. The management strategy for rice false smut also a challenging aspect three major strategies for disease management – genetic resistance, chemical control, and cultural control – only the latter two have produced limited measures of success regarding the management of false smut because in resistance of any germplasm only the F1 shows resistance but F2 and F3 progeny shows susceptibility for disease. some fungicides like copper hydroxide 77 WP @ 2 g, carbendazim 12% + mancozeb 63% @ 1.5 g, trifloxistrobin 25% + tebuconazole 50% @ 0.4 g, tebuconazole 250 EC @ 1 ml and carbendazim 50 WP @ 1 g l-1 of water are recommended for foliar application at booting, pre- and post-flowering stages of rice suggested. Cultural control options may provide the most immediate and cost-effective remedy for false smut.

**Keywords:** Epidemiology, Disease incidence, F1, Germplasm etc

## RECENT ADVANCE IN PEST MANAGEMENT FOR SUSTAINABLE AGRICULTURE

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Pest management is an important component of agriculture production system and helps in improving income and life style of farmers by reducing the loss in yield. Since a long time the insect pest were being controlled with application of broad spectrum insecticide in a very judicious way which leads to the problems of resistance, resurgence, hazard to humans, non-target animals and environment. This above problems including decreasing soil productivity and many more for which we need to change from a conventional agricultural system to one that is sustainable. Sustainable agriculture tries to establish a good balance between the need for food production and the preservation of the ecological system within the environment. It is a system of agriculture that is ecologically, economically, and socially viable, in the short as well as long term. Now a day, many approaches are being developed for managing pest, that are based on understanding the pest biology and ecology, hence promote ecological balance, therefore, are sustainable. This include biotechnological approaches such as RNA interference and development of transgenic plant based on protease inhibitors, lectin, enzyme, etc., biorational approaches such as use of semiochemical, insect growth regulators, chitin synthesis inhibitors. Biological approach including predators, parasitoids and pathogens is a core component in sustainable agriculture. A number of plants are known to possess insecticidal property and are used for management of pest. All of these new advancements in pest management will fuel the futuristic approach where the application of chemical insecticide will no longer be needed. Thus the integration of all these approaches with each other will lead to ecofriendly management pest and make the agricultural system sustainable.



**BIOPOTENCY OF *PSEUDOMONAS FLOURESCENS* FOR THE MANAGEMENT OF ROOT-KNOT NEMATODE, *MELOIDOGYNE INCOGNITA* ON *VIGNA RADIATA* L.****Amir Khan, Moh. Tariq, Mohd Asif and Mansoor A. Siddiqui**

Section of Plant Pathology and Plant Nematology, Department of Botany, Aligarh Muslim University, Aligarh, India (202002).

Root-knot nematode, *Meloidogyne incognita* is among the most important pest of vegetables, pulses and other commercial crops worldwide. The present investigation was carried out to evaluate the efficacy of biocontrol agent, *Pseudomonas fluorescens* for the management of root-knot nematode, *M. incognita* infecting mung bean under glasshouse condition. Results showed that highest enhancement in plant growth parameters viz., plant length (cm), fresh weight (g), dry weight (g), number of flower and pods, pollen fertility (%), chlorophyll content (mg/g), carotenoid content (mg/g), nitrate reductase activity ( $\mu\text{m g}^{-1}\text{h}^{-1}$ ) and highest reduction in pathological parameters viz., number of galls, number of eggmasses and number of eggs was found when *P. fluorescens* was applied alone. Least was recorded in those plants inoculated alone with 1500 second stage juveniles of *M. incognita*. Concomitant and sequential treatment of *P. fluorescens* with *M. incognita* also improved growth and growth yielding attributes of mung bean. Hence, it may be concluded that biocontrol agent *P. fluorescens* is better substitute against nematicide for the effective management of root-knot nematode, *M. incognita* and reduce environmental hazards for ecologically safe environment.

**Keywords:** Biocontrol agent, Growth parameters, *Meloidogyne incognita*, *Pseudomonas fluorescens*.**MANGROVE DIVERSITY AND ITS ASSOCIATED SPECIES IN COASTAL HABITATS OF GULF OF KHAMBHAT, GUJARAT, WEST COAST OF INDIA****Jitendra Kumar Singh and Bhawana Pathak**

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Mangroves are among the world's most threatened, dynamic and extraordinary ecosystems on earth, located at the interface of land and sea in tropical intertidal regions, which offer a considerable array of ecosystem goods and services. They are highly sensitive to environmental change and act as good bio-indicators of the environmental quality and health of any coastal ecosystem. The present ecological study was initiated to know the current status of mangrove species and associated plant species at Gulf of Khambhat region of Gujarat, India study was carried out for a period of one year from January 2014 to December 2014 at four different site (i.e. Bhavnagar, Bharuch, Surat and Navsari) with reference to its management and conservation. 16 species (6 mangrove species and 10 associated plant species) was recorded. 15 species occurred at Navsari, whereas 7, 6 and 10 species occurred at Bhavnagar, Bharuch and Surat respectively. Out of six true mangrove species, *Avicennia marina* was found to be most dominant and abundant mangroves occurring among all the four study locations. The most abundant and dominant flora species associated with mangroves were *Suaeda maritime* and *Sesuvium portulacastrum*. Most of the mangrove species are very rare at state level. Therefore, Gujarat mangrove forest habitats need to be protected and managed for mangrove conservation.

**Keywords:** Coastal ecosystem, mangroves, species diversity, mangrove conservation**CINNAMIC ACID PREVENTS DIABETIC PATHOPHYSIOLOGICAL COMPLICATION AND INHIBITS NON-ENZYMATIC GLYCATION BY BINDING TO SUBDOMAIN IIA OF HSA: A MECHANISTIC APPROACH****Faizan Abul Qais<sup>1</sup>, Md Maroof Alam<sup>2</sup>, Imrana Naseem<sup>2</sup>, Iqbal Ahmad<sup>1</sup>**<sup>1</sup> Department of Agricultural Microbiology, Aligarh Muslim University, Aligarh, UP, India<sup>2</sup> Department of Biochemistry, Faculty of Life Sciences, Aligarh Muslim University, Aligarh, UP, India

Under hyperglycaemic conditions non-enzymatic glycation of proteins gives rise to advanced glycation end products (AGEs). The AGEs thus formed generate free radicals, which foster the development of diabetes and its associated complications. Inhibition of glycation is expected to play a role in controlling diabetes. Several plant derived antioxidants including cinnamic acid (CA) are known for limiting AGE formation, however, the mechanism involved is poorly understood. Therefore, we aimed to investigate the possible mechanism of inhibition of AGEs formation by CA through various experimental approaches. Glycation of HSA was achieved by incubating the reaction mixture with glucose for 30 days at 37°C. The protein samples were tested for levels of free lysine & thiol group, carbonyl content and reactive oxygen species (ROS). Interaction between CA and HSA was also studied through various biophysical techniques. Thermodynamic studies showed strong exothermic interaction between CA and HSA. The positive value of  $T\Delta S^\circ$  and negative value of  $\Delta H^\circ$  indicates that HSA-CA complex is mainly stabilized by hydrophobic interaction and hydrogen bond. Further, molecular docking reveals that CA binds to HSA subdomain IIA (Sudlow's site I) with a binding energy of  $-7.0 \text{ kcal mol}^{-1}$ , nearly the same as obtained in isothermal titration calorimetry (ITC) and fluorescence spectroscopy. Results of various spectroscopic techniques along with molecular docking and examination of many biomarkers highlights the role of CA in preventing disease progressi



**HARVESTING OF RAIN WATER AS *IN AND EX SITU*: A SOURCE FOR SUPPLEMENTAL IRRIGATION****Vishal Kumar, Dharminder, Deshraj Yadaw and R. K. Singh**

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As soon as rain drops comes in contact of soil surface some portion of rainfall, get infiltrated into the soil and excess water gets lost from field as run-off, which ultimately become the part of reservoirs and ditches etc and a portion of infiltrated water eventually reached to surface water sources (inter water) like reservoir. The loss of water takes place in several ways namely run-off, evaporation, uptake through weeds etc. In Indian good crop harvest is dependent on monsoon, uneven distribution of rainfall leads to reduction in economical yield and in adverse condition complete crop failure is also observe. India receives average rainfall of 1194 mm per year which account 400 mha-m water and out of this 150 mha-m water is lost as flow in ocean. We can harvest this water through various agronomical measures like agronomical (mulching, tillage practices, contour farming, strip farming etc.) and agrostological practices (dealing with grasses). Run-off water can be preserved either *in situ* (like ridge & furrow method and broad bed furrow method show better rain water storage and provide sufficient soil moisture in crops duration) and *ex situ* (rain water stored in reservoir or ditches) based on situation and utilized for irrigation during uneven rainfall and long dry spells. This water could be stored for providing life saving or protective irrigation to the crops grown in dry land areas.

**Keywords:** Run-off, reservoirs, infiltrations, ground water, agronomic measures, rain water storage**BIOREMEDIATION OF PESTICIDES USING MICROBES IN TWO PHASE PARTITIONING BIOREACTOR****Raman Kumar Ravi and M. H. Fulekar**

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Since the period after the Second World War, pesticides has become vital component of modern agriculture and are widely used for the control of weeds, diseases and pests of cultivated plants all over the world. But their indiscriminate use and persistent nature has posed serious problem to the biological diversity. According to World Health Organisation data, only 2-3% of the pesticides applied for mitigation of pests are effectively utilized at target point whereas rest remains in environment causing surface runoff, leaching and percolation into soil water environment leading to biota and finally human being through food chain. Pesticides toxicity depends on various factors such as the route of exposure, concentration of pesticides and time of exposure. Bioremediation is found to be an eco-friendly, cost-effective, highly efficient technology for treatment of pesticides polluted soil using microbial culture as compared to the physical and chemical methods. Biodegradation is sensitive to different parameters such as concentration of pesticides, microbial biomass, temperature and pH changes. Nowadays bioreactors are commonly used for bioremediation, which may be any vessels in which microbes or microbes free enzymes transform raw materials into biochemical products and or less undesirable by-products. Biodegradation in Two Phase Partitioning Bioreactor facilitates degradation of high level of pesticides concentration using microbial culture. The Two Phase Partitioning Bioreactor works in aerobic condition with stirrer for agitation of biomass and ensuring continuous contact of microorganism in aqueous phase with pesticides contaminant in organic phase. The present paper is a concept of utilising the bioreactor for effective bioremediation of pesticides at lab scale using bacterial strain, which can be further utilised in field through bioaugmentation.

**Keywords:** Bioremediation, Pesticides, Two Phase Partitioning Bioreactor, Microbial culture**EFFECT OF VARIETIES TO VARYING LEVELS OF SULPHUR FERTILIZATION ON GROWTH, YIELD ATTRIBUTE AND YIELD****Lali Jat<sup>1</sup>, S. S. Yadav<sup>2</sup>, M. L. Jat<sup>3</sup>, B. C. Dhayal<sup>4</sup> and, Sanju Choudhary<sup>5</sup>**

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A field experiment was conducted at Agronomy farm, S.K.N. College of Agriculture, Jobner (Rajasthan) during *khariif*, 2015 on loamy sand soil. The experiment comprising of four levels of sulphur (0, 20, 40 and 60 kg/ha) and four sesame varieties (RT-125, RT-127, RT-346 and RT-351) thereby making 16 treatment combinations was laid out in randomized block design and replicated thrice. Results showed that progressive increase in level of sulphur upto 40 kg/ha significantly increased the growth and yield attributing characters of sesame *viz.*, dry matter accumulation, branches/plant, number of capsules/plant, number of seeds /capsule and test weight over preceding levels. It also recorded significantly higher seed (778 kg/ha), stalk (2505 kg/ha) and biological yield (3283 kg/ha) of sesame over control and 20 kg/ha. However, it was found at par with 60 kg/ha, wherein the maximum values of growth and yield attributes as well as yield were obtained. Variety RT-351 was found significantly superior among all the varieties with respect to growth and yield determining characters of sesame. It also improved the seed, stalk and biological yield to the extent of 11.7, 10.5 and 10.8 per cent over RT-127 and 26.4, 21.3 and 22.5 per cent over RT-125, respectively. It also represented significant improvement in nutrient uptake, oil content in seed and oil yield and fetched the maximum net returns of ` 52073/ha with the highest B: C ratio (2.74) among all the varieties.



## INFLUENCE OF DIFFERENT HARVESTING TIMES ON POST-HARVEST QUALITY OF GARLIC DURING STORAGE

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The pre-harvest inputs influence the storage behaviour and quality of garlic directly or indirectly. The garlic crop is less perishable and also has better storage life than other vegetables but various cultural practices like choice of variety, soil type, irrigation frequency, fertilizer application, harvesting stage, *etc.* affects the shelf life of garlic. As early or delay in harvesting could increase post-harvest losses and deteriorates the quality during storage, therefore the investigation was done at Research Farm of the Department of Vegetable Science, CCS Haryana Agricultural University, Hisar during *rabi*2013-14 to observe the influence of different time of harvesting on quality of garlic during storage (*Allium sativum* L.). The experiment was laid out in Randomized Block Design with four replications. Five treatments of harvesting time *viz.*, harvesting the garlic crop 150, 157, 164, 171 and 178 days after planting were applied. The total soluble solids(%) were recorded at monthly interval during 240 days of storage. The total soluble solids at the end of storage period *i.e.* 240 days were found better (40.11 %)with treatment where harvesting was done 171 days after planting, which was found statistically at par with treatment where harvesting was done 164 days after planting (39.78 %). The minimum total soluble solids (35.13 %)at 240 days of storage were recorded with treatment where harvesting was done at 150 days after planting. Therefore, based on the present investigation, it may be conclude that for better quality of garlic, harvesting should done 164 days after planting.

**Keywords:** Garlic, bulb, harvesting time, quality, total soluble solids

## GOLD COATED NANOPOROUS MEMBRANE BASED SOLID PLATFORM FOR RAPID DETECTION OF MESOTHELIN AS A POTENTIAL CANCER BIOMARKER

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Biocompatible functional solid state nanopores (SSN) have emerged as an excellent biorecognition element for electrochemical sensing of biomolecules in recent years. In this study a gold coated nanoporous (30, 50, 80, 100 nm) polycarbonate track etched (PCTE) membrane based electrochemical biosensor was developed for label free detection of a mesothelin; a tumor biomarker. To select the best nanopore, varying pore size membranes having immobilized anti-mesothelin were exposed to mesothelin antigen and resistance was compared. The antigen-antibody interaction was monitored with the aid of specially designed electrochemical cell with electronic circuit. A partial blockade in ionic trafficking across the nanoporous membrane observed upon binding of antigen-antibody on to the coated nanopore. The reduction in pore diameter was observed as a function of resistance with respect to time across nanopore matrix. Cancer biomarker mesothelin was successfully assayed up to nano-gram level in phosphate-buffered saline (PBS) and cross selectivity was adjudged by prostate specific antigen. The developed biosensor shows astounding ability to sense the biomarker with better resolution with pore size of 30 nm than 50, 80 and 100 nm. The reproducibility showed that the device is capable to detect up to nano scale (1 ng/ml) with a significant detection range of 20 µg/ml to 1 ng/ml.

## RESPONSE OF AONLA CULTIVARS TO SOFTWOOD GRAFTING

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The present investigation consists of evaluation of softwood grafts for success, initial growth and survival of nine different aonla varieties *viz.* Banarasi, Chakaiya, NA-4 (Kanchan), NA-5 (Krishna), NA-6, NA-7, NA-10, Anand-1 and Anand-2 at nursery stage as treatments and replicated thrice in Completely Randomized Design (CRD) under shade net house conditions. The results of the present investigation showed minimum (10.37) days for sprouting of grafts and maximum graft success (91.10) per cent was recorded in grafts of variety NA-7. The maximum values of growth parameters like height of sprout (15.50 cm), number of leaves per graft (21.86) and graft diameter (5.43 mm) were also observed in grafts of variety NA-7. The significantly maximum leaf area per leaf and leaf area per graft was recorded in grafts of variety NA-4 (Kanchan). The favorable stionic ratio (close to one) was noticed in grafts of variety NA-7, Banarasi and Chakaiya. The maximum survival percentage was recorded in grafts of varieties NA-7 and Banarasi. Hence, it can be concluded that, considering the overall performance of grafts of different aonla varieties studied, the grafts of varieties NA-7 and Banarasi have performed better for most of the traits under this study.

**Keywords:** Aonla, Softwood Grafting, Variety, Root Stock, Scion-Stick





**CLIMATE CHANGE IMPACT ON RIVERINE SYSTEMS OF INDIA****Mahendra Pal<sup>1</sup>, H. K. Kardani<sup>1</sup>, V. Sarman<sup>1</sup>, Krishna<sup>1</sup>, N. Harika<sup>1</sup>**

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Rivers provide a special suite of goods and services valued highly by the public. The diverse river system in India harbour one of the richest fish genetic resources in the world. Rivers exhibit a complex mix of artisanal, subsistence and traditional fisheries. Climate change will add the presenting risk and also magnify it so it will alter the rainfall season, the runoff pattern, temperature. It also disturbs the biological communities and ecological linkages. The impact is manifested in the breeding failure, geographic shift of fishes, altered species richness, habitat loss/gain and increased invasion of exotic species. Lowflows in rivers would be more severe along with ageneral water stress. Increase in water temperature, extreme events like flood and drought, storms and water stress are important climate variables to riverine fisheries. They require specific adaptation actions. The establishment and management of a natural riparian zone and vegetation is a strategy to reduce climate change effect on rivers.

**Keywords:** climate change, fisheries, rainfall, river, snow, species, temperature.**GROWING MORE RICE WITH LESS WATER****Deo Narayan Singh<sup>1\*</sup>, Subodh Kumar<sup>2</sup> and Deepak Kumar Jaiswal<sup>3</sup>**<sup>1</sup>Assistant professor, Department of Agronomy, UP College, Varanasi.<sup>2</sup>Assistant professor cum junior scientist, Department of Agronomy, BKSCOA, Dumrao Buxar, BAU, Sabour, Bihar.<sup>3</sup>Research scholar, Department of Entomology and Agricultural Zoology, I. Ag. Sc., Banaras Hindu University, Varanasi.

Rice (*Oryza sativa*) is the staple food of more than half of the population of the world, is an important target to provide food security and livelihoods for millions. Imminent water crisis, water-demanding nature of traditionally cultivated rice and climbing labour costs hike the search for alternative management methods to increase water productivity, system sustainability and profitability. Considering the food basket of India, rice cannot be replaced by other arable crops. To withstand the scarcity of water, growing of rice as direct seeded rice (DSR) is one of the best options for the areas where rainfall occurrence do not support the growing of conventional rice. DSR refers to the process of establishing the crop from seeds sown in the field rather than by transplanting seedlings from the nursery. Direct seeding avoids three basic operations, namely, puddling (a process where soil is compacted to reduce water seepage), transplanting and maintaining standing water; thus saves water, labour and time.

**EFFECT OF PRUNING AND PLANT SPACING ON THE YIELD ATTRIBUTES AND QUALITY IMPROVEMENT IN HIGH DENSITY PLANTING OF GUAVA (*PSIDIUM GUJAVA* L.)****Anjali Tripathi, S. K. Sehrawat, D. S. Dahiya and Anuradha Bishnoi**

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The present investigation was conducted during the year 2016-2017, to examine the effect of pruning and plant spacing on the yield attributes and quality improvement in high density planting of guava cv Hisar Safeda. Pruning was done in the month of mid April at two levels 50 percent of last season growth and non-pruned with different plant densities. The observations clearly revealed that fruit set percentage per plant, yield per plant and quality were increased with pruning treatments in comparison with non pruned one in both rainy and winter season crop. Pruning is the most important practices of guava that helps in encouraging the new growth, more flowering and fruiting in current season crop. Maximum number of fruits per plant, yield per plant and quality characteristics like fruit TSS and firmness were obtained with wider spacing and pruning treatments of the plants. The winter season crop found superior than rainy season in terms of yield and quality characteristics. Shoot pruning at 50% last season growth in the month of April reduced the flowers per plant and yield per plant in rainy season crop but increased the flowers per plant and yield per plant in winter season crop than un pruned plants. Rainy season fruits were found more insect infected, watery, poor in quality and have less shelf life.

**Keywords:** Guava, Pruning, Plant densities, Yield, Quality**LIFE CYCLE AND SEASONAL ABUNDANCE OF YELLOW STEM BORER, *SCIRPOPHAGA INCERTULAS* (WALKER) IN RICE (*ORYZA SATIVA* L.)****Ingle Dipak Shyamrao, M. Raghuraman and Santeshwari**

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The yellow stem borer, *Scirpophaga incertulas* (Walk) is widely distributed in rice growing areas in all tropical and sub-tropical regions. It has been considered a major and monophagous pest of the rice growing areas. Its feeding start from seedling to reproductive stage and reduces tillers of rice crops. Feeding rates of first and second instars consumed 20 per cent of the larval total consumption. Caterpillar bore into stem and feed inside, as a result, central shoot withers and produce a dead heart at vegetative stage and older instar larvae produces white ear at reproductive stage. To understand about life cycle and



management practices of YSB is to help to reduce the yield losses. In present study was discusses about life cycle and seasonal abundance and occurrence of yellow stem borer.

**Keywords:** Life cycle, rice, *Scirpophaga incertulas* (Walk.), seasonal abundance.

## **ROLE OF FUNGAL COMMUNITY IN THE FORMATION OF COMPOST WITH LOW COST INPUT**

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The hazardous effects of chemical fertilizers are rapidly increasing day by day and benefit-cost ratio of cultivation is also getting lesser by these. So it is a requirement to have renewable and ecofriendly nutrient sources for plants. Composting can be a best solution for it. It is an age old practice for biological conversion of organic waste to humus, compost is also found naturally but the rate of formation i.e., decomposition is slow (approx. 1 year). Considerable research has therefore been done to accelerate the composting process. Scientists of Indian Agriculture research institute, have isolated efficient fungal cultures, prepared a consortium and being used as compost inoculant, which enhanced the rate of decomposition. Selection of these fungi was on the basis of their cellulolytic/ xylanolytic/ lignolytic enzyme production potential and compatibility testing. The fungal consortium contains *Trichoderma viridi*, *Aspergillus awemori*, *Aspergillus nidulans*, and *Phanerochaete chrysosporium* as four promising lignocellulolytic fungi. The production of compost from agricultural residues (like Paddy straw, dried leaves etc.) and agro-industrial wastes is an important means of recovering organic matter and is also an effective method of waste management. Improving soil fertility by compost application is gaining more importance due to emphasis on sustainable agriculture. By this way “Best of waste” is being created and it should be extended to all farmers’ community for their awareness. The studies related to these approaches, for the sustainable management of natural resources can make future disease free, natural disasters free and all the hazardous effects of conventional farming can also be reduced.

**Key words:** Sustainable, Fungus, Agro-residue, Natural resources.

## **DOUBLE HAPLOIDS AND IT'S APPLICATION IN CROP IMPROVEMENT**

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A plant or line obtained by doubling the chromosome number of a haploid plant is called double haploid. Doubled haploid methodologies have now been applied to over 250 species. Double haploid (DH) breeding helps in accelerating conventional plant breeding programmes and make early release of cultivars with superior and desirable traits. DHs are important constituent of germplasm and help in complementing back cross breeding by transferring genes of interest between wild relatives thus breaking genetic barriers. On the other hand unique complete homozygous nature of DHs, less time requirement to produce a large number of DHs, absence of heterozygosity and efficiency over conventional systems in DHs make them very valuable material for very important genetic and molecular studies. DHs play a very important role in the field of plant breeding, genetics and genetic engineering. The utility of DHs in cultivar development, back crossing, genome mapping, hybrid sorting, mutation research, evolutionary studies, gene identification, cytoplasmic research and transgenic plant development make them the best material for genetic improvement and genetic studies.

**Keywords:** Double haploid, Homozygous, cultivar development

## **STAY GREEN: AN INDICATOR TRAIT FOR HEAT TOLERANCE IN WHEAT (*TRITICUM AESTIVUM* L.)**

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Wheat is the most widely grown crop worldwide. In this era of climate change wheat production is threaten by many abiotic and biotic stresses, heat and drought stress being the most devastating abiotic stress. Early maturing and stay green are two such traits which are dependent on the crop growth duration. An early maturing variety escapes the terminal heat stress but, the studies have shown that long duration variety yield more than early maturing one. Hence the varieties which can stay green even at heat and drought stress condition by altering its physiology and morphology needs to be exploited for development of stress tolerant varieties. These types of selection and exploitation are still awaited in wheat cultivars. Stay green is classified into two classes , functional stay green : in which leaves photosynthesize longer contributing to higher yield and non-functional stay green : in which plants remain green but lack photosynthetic competence. The stay-green trait is the result of alterations in hormone metabolism and signalling, particularly affecting pathways involving cytokinins and ethylene. Members of the WRKY and NAC families, and other senescence-associated transcription factors result in stay-green. Along with yield, association of stay-green trait with other traits like Canopy Temperature Depression, spot blotch resistance *etc.* have also been reported. Stay green trait can be measured by various methods like Leaf Area under Decline (LAUD), Normalized difference vegetative index (NDVI)/ Spectral reflectance measurement, leaf area under greenness (LAUG). *etc.* QTLs for stay green on the chromosomes 1AS, 3BS and 7DS have been reported. The QTLs were named as QSg.bhu-1A, QSg.bhu-3B and QSg.bhu-7D. The QTL QSg.bhu-3B and



Qsg.bhu-7D were placed in the 3BS9-0.57-0.78 and 7DS5-0.36-0.61 deletion bins, respectively. All the above studies show that stay green trait can be exploited to develop heat tolerant wheat cultivars in the near future.

**Keywords:** Stay Green, Heat Stress, QTL, *Triticum aestivum*

### **CROP INSURANCE SCHEMES: THEN AND NOW**

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India is an agrarian country where 58 per cent of the population is engaged in agriculture and allied activities for their livelihood. In our country, agriculture production and farm incomes are frequently affected by natural disasters like flood, drought and earthquake etc. The crop insurance could, therefore, be considered as hedge to protect farm economy from the adverse effect of crop failure. The idea of crop insurance in India was conceptualized in 1920s when J. S. Chakravarti proposed an agricultural insurance scheme based on rainfall approach. National Agricultural Insurance Scheme (NAIS), 1999, Weather Based Crop Insurance Scheme (WBCIS), 2008 and Pradhan Mantri Fasal Bima Yojana (PMFBY), 2016 were the major insurance schemes implemented in Himachal Pradesh from time to time. Maize, paddy, wheat, barley, ginger, tomato, capsicum, potato, apple and mango were found the major crops covered under crop insurance schemes in Himachal Pradesh. Besides apple and mango, WBCIS has been extended to peach, plum and kinnow. Recently, Pradhan Mantri Fasal Bima Yojana (PMFBY) has been implemented to remove the flaws in previous schemes. The following study is based on both primary and secondary data and was conducted in Panchrukhi block of H.P. in the year 2016 revealed that insurance coverage eligibility provided after one month of sowing of a specific crop, no coverage for destruction by stray & wild animals, limited crops being covered under the scheme and some of the major hazards like storm are not covered under the scheme were reported the major constraints by farmers. Inadequate field staff, lack of enthusiasm and high targets to be achieved within the given time framework were the major constraints faced by the implementing agencies. Agriculture/Cooperation Department of the states in consultation with Insurance Agencies shall work out appropriate plan for adequate awareness and publicity three months prior to the start of coverage period.

**Keywords:** Insurance, beneficiaries, maize, paddy, Himachal Pradesh

### **EFFECT OF CARRIER AND LIQUID BASED *RHIZOBIUM* AND PSB ON GROWTH AND YIELD OF BLACK GRAM (*VIGNA MUNGO* L. HEPPER)**

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The experimental field was leveled and well drained. The soil was clayey in texture, low in nitrogen, very low in phosphorous, high in potash and slightly alkaline in reaction. The environmental condition prevailed during experimental period was favourable for normal growth and development of blackgram crop. The experiment was laid out in a Randomized Block Design and variety BDU-1 as a test crop along with 7 treatment combinations. The treatments are RDF+ *Rhizobium* (CB) (T<sub>1</sub>), RDF + PSB (CB) (T<sub>2</sub>), RDF + *Rhizobium* (CB) + PSB (CB) (T<sub>3</sub>), RDF + *Rhizobium* (L) (T<sub>4</sub>), RDF + PSB (LB) (T<sub>5</sub>), RDF + *Rhizobium* (LB) + PSB (LB) (T<sub>6</sub>) and RDF Only (25:50:00 NPK kg ha<sup>-1</sup>) (T<sub>7</sub>). Each experimental unit was replicated thrice. The gross and net plot size was 4.8 m x 4.5 m and 4.2 m x 4.1 m, respectively. Sowing was done 14<sup>th</sup> July 2014 by drilling method with spacing of 30 cm x 10 cm. The recommended cultural practices and plant protection measure were undertaken. The recommended doses of fertilizer (25:50:00 kg NPK ha<sup>-1</sup>) were applied at the time of sowing through urea and SSP. The crop was harvested on 28<sup>th</sup> Sept 2014. Application of RDF + *Rhizobium* (LB) + PSB (LB) (T<sub>6</sub>) recorded significantly higher growth, yield, quality contributing characters and N, P and K content in soil after harvest of blackgram followed by application of treatment RDF + *Rhizobium* (CB) + PSB (CB) (T<sub>3</sub>) and RDF + *Rhizobium* (L) (T<sub>4</sub>).

### **STUDIES ON EFFECT OF MAGNETIC TREATMENT ON YIELD AND YIELD CONTRIBUTING CHARACTERS OF PADDY (*ORYZA SATIVA* L.)**

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An experiment entitled "Studies on effect of Magnetic treatment on yield and yield contributing characters of Paddy (*Oryza sativa* L.) was conducted at Agricultural Research Botany farm, College of Agriculture, Dapoli to study on effect of magnetic treatment on biochemical traits and yield of paddy (*Oryza sativa* L) during *Kharif* 2014-15. Magnetic exposure at different time intervals were applied before sowing of seeds. The experiment consisted of 7 treatments laid out in randomized block design with three replications. The experiment consisted of 7 treatments comprising rotation without magnet for 15 minutes and rotation with magnet for (15, 30, 45, 60 and 90 minutes). Among the all treatments, T<sub>6</sub>(rotation with magnet for 90 minutes) showing higher Yield and yield attributing characters *viz.* days required for 50% flowering, number of grains, length of panicles, fertility% of grains, 1000 grain weight and yield per plot and yield per ha.

**Keywords:** Magnetic, growth, paddy



**CHANGING ENVIRONMENTAL SCENARIO TRIGGERS DIVERSE STRESS RESPONSES IN FISHES****S. Srivastava**

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One of the major consequences of global warming has been climatic change, which has influenced almost all aspects of biotic existence. Sudden changes in environmental conditions has put all life forms, whether terrestrial or aquatic under stress, to which they must respond for survival. Aquatic organisms like fish, experience the stress comparatively more, considering their proximity to their environments. Variations in temperatures, dissolved oxygen concentrations, dissolved carbon dioxide concentrations, pH, pollutant solubilities and the like in water cause tremendous environmental stress to fish and elicit varied physiological, biochemical, behavioural and genetic stress responses. The study focuses on the diverse environmental stressors and the associated stress responses and takes an overview of environmental management programmes for proper sustenance and development of fish species.

**Keywords:** climate change/ stressor/ stress response**STATISTICAL DOWNSCALING: A METEOROLOGICAL FUTURE PREDICTOR TECHNIQUE UNDER CLIMATE CHANGE CONDITION****Dinesh Kumar\*, R M Singh, Bhaskar Pratap Singh, Anshu Gangwar and Raj Bhadur**

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Global Climate Models (GCMs) used for climate studies and climate projections are run at coarse spatial resolution and are unable to resolve important sub-grid scale features such as clouds and topography. To overcome this problem downscaling methods are developed to obtain local-scale weather and climate, particularly at the surface level, from regional-scale atmospheric variables that are provided by GCMs. Two main forms of downscaling technique exist. One form is dynamical downscaling, where output from the GCM is used to drive a regional, numerical model in higher spatial resolution, which therefore is able to simulate local conditions in greater detail. The other form is statistical downscaling, where a statistical relationship is established from observations between large scale variables, like atmospheric surface pressure, and a local variable, like the wind speed at a particular site. The problem of coarse grid data can be solved by downscaling GCMs to local and basin scale with the help of dynamic or statistical downscaling techniques that bridge the large-scale atmospheric conditions with local scale climatic data. Future values of the large-scale variables obtained from GCM projections of future climate are then used to drive the statistical relationships and so estimate the smaller-scale details of future climate.

**Keyword:** Climate change, dynamical downscaling, Global Climate Models (GCM), statistical downscaling**SOCIO-ECONOMIC TRANSFORMATION AND INDUCTION EFFECT OF TRAINEES AFTER RECEIVING MUSHROOM PRODUCTION ENTERPRISE IN SAHIBGANJ DISTRICT OF JHARKHAND****Maya Kumari \*, Adarsh Kumar Srivastava \*\*, Nidhi Sinha \*\*\*Anita Kumari \*\*\*\* and Baby Mandal \*\*\*\*\***

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Social transformation under Indian condition is very slow process. It required a considerable period of time and is affected by social-political situation of the village. The present study was made on the basis of a 15 days training program conducted by the Krishi Vigyan Kendra, Sahibganj (Jharkhand), in 2014-15 in mushroom production. There were 75 randomly selected respondents from the village Chanan from Borio block of Sahibganj district participated under these training program. Also 75 respondents from village Lohanda, block Sahibganj were selected as a control group, who did not receive such type of training till the time of interview. The results thus, obtained indicate that respondent's perception with regard to their social mobility was not conspicuous, as most of the changes expected of is less than 25%. However, the changes that have been expressed by the beneficiaries may be attributed to the positive effect of mushroom production training shared their ideas most frequently with family members and relatives followed by neighbors and friends. The ratio of sharing the training knowledge was found to be 1:3. In case of linkage of trainees with K.V.K, maximum number of trained entrepreneurs had high level of linkage followed by medium level of linkage. While in untrained entrepreneurs, maximum number of entrepreneurs had low level of linkage followed by medium level. However, beneficiaries had good opinion in all the selected areas which ranged between 05 to 65%.

**AGRICULTURAL BIODIVERSITY CONSERVATION, DEVELOPMENT IN SUSTAINABLE AGRICULTURE****Jyoti Chauhan<sup>1</sup>, Sneha Kumari<sup>2</sup> and Rajesh Singhal<sup>1</sup>**<sup>1</sup> Research Scholar, Department of Plant Physiology, I.Ag.Sc., BHU, Varanasi 221005<sup>2</sup> Research Scholar, Department of Agronomy, I.Ag.Sc., BHU, Varanasi 221005



The late twentieth century model of land is used for biodiversity conservation. The Millennium Ecosystem Assessment state about agriculture that has dramatically increased its ecological dysfunctions. Mostly Rural communities depend on main components of biodiversity and sustainable agriculture. Fortunately, many conservation practices are use for managing to host wild biodiversity of many types, either neutral or even artificial methods. The Convention on Biological Diversity (CBD), which was adopted at the 1992 UNCED Earth Summit and to which Germany and most other countries of the world are signatories. We highlighted some evidence for the importance of soil biodiversity to sustaining (agro) ecosystem functioning and explore directions for future research. Many studies showed that soil biodiversity supports several ecosystem functions simultaneously, underpinning its crucial role in ecosystems worldwide. There is evidence for soil biodiversity stability to stress and disturbance, but until now the mechanism is not yet fully understood. We assess the potentials and limitations for successful conservation of biodiversity in productive agricultural landscapes, the feasibility of making such approaches financially viable, and the organizational, governance and policy frameworks needed to enable eco agriculture planning and implementation at a globally significant scale. We conclude that effectively conserving wild biodiversity in agricultural landscapes will require increased research, policy coordination and strategic support to agricultural communities and conservationists. The Earth's biological diversity has suffered massive losses in recent decades, putting the resources vital to life on the planet at great risk.

**Keywords:** eco agriculture, landscape, biodiversity conservation, agricultural production, underpinning

## **ECONOMIC ASPECTS OF MUSTARD CULTIVATION IN MEERUT DISTRICT OF WESTERN UTTAR PRADESH**

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Mustard belong to cruciferae family and genus Brassica. Mustard (*Brassica juncea*) is also known as Rai or laha. According to various scientists, Mustard is originated from china and spread over India from there. India is one of the largest producers of mustard in the world. In India mustard is mainly grown in North West part of India, Rajsthan, and U.P. is the major mustard producing state in the country. Rajsthan is the largest mustard producer in the country with a contribution of (54%) to the country's total mustard production followed by Punjab and Haryana which simultaneously contributes (14%) In India, area under mustard was 6051 million hectares and its production was 7.67 million tones with productivity 1179 kg, /ha in 2010-11 (Directorate of Economics and statistics, New Delhi). While area, production and productivity in U.P. were 0.61 million hectare, 0.68 million tones and 1113 Kg /ha respectively. (2009-10 Directorate of Economics and statistics, New Delhi). During the same period area, production and productivity of Mustard in Meerut District was 0.004438 million hectare, 0.0574351 million tones and 1324 kg/ha respectively (2009-10) It is observed that marketing practices for disposal of mustard are traditionally done. The marketing aspect is as important as, production itself. Prevalent marketing infrastructure facilities are insufficient to provide the adequate price to the producers of the mustard crops. Sardhana block of Meerut District of Uttar Pradesh was randomly selected. Ten villages were selected randomly, from Sardhana & Sharurpur Khurd block. A separate list of mustard growers of ten selected villages were prepared with their size of holding and were classified in to four categories i.e. marginal (below-1ha), small (1-2), medium (2-4), and large (4 ha and above), in all 100 farmers were selected which consist of 50 marginal, 20 small, 16 medium and 14 large farmers. Simple tabular and functional analysis was used to analyze the data. The cropping intensity of different size group of farms, which was found highest on marginal farms (221.22 per cent) followed by small (202.46 per cent), medium (190.17 per cent), and large farms (182.48 per cent) respectively. The overall average of cropping intensity on sample farms was worked out to 192.55 per cent. On an overall average per farm and per hectare investment on sample farms were found to Rs. 662156.83 and Rs. 350613.88 respectively. On an overall average cost of cultivation per hectare of mustard crop came to Rs. 50310.84. The net income, family labour income, farm business income and farm investment income were found to Rs.11221.73, Rs.14586.79, Rs.31237.94 and 27872.88 respectively. Cobb Douglas production was fitted to found out resource use efficiency in mustard crop. Per hectare gross income was taken as independent factor and input costs of human labour, manure & fertilizers, tractor labour irrigation, plant protection, and seed, six independent input factors for mustard crop. The test of significance (t test) was used for testing the regression co-efficient and  $R^2$  measure the fitness of overall function was also applied. Linear model in best fit for arriving trend in area, production and productivity in the study area. Area under mustard crop slightly decreased with time in the study area. Channel-I was found more efficient as compared to channel-II, and channel-III because of no middleman found was resulted less marketing cost in channel-I. Average marketing costs increased as increase in number of intermediaries under channel-II, and channel-III. By comparing retailer marketing margins was found maximum having 3.35 per cent in channel-III followed by 3.27 per cent, channel-II respectively. The producer's share in consumer's rupee was found maximum 95.82 per cent in channel-I followed by 90.59 per cent, and 83.53 per cent under channel-II, channel-III respectively. Producers share in consumer rupee decrease with increase in number of intermediaries.



**FARMERS' AWARENESS TOWARDS INTEGRATED NUTRIENT MANAGEMENT (INM)****Anil Kumar Rohila\*, P. S. Shehrawat, J. S. Malik and Krishan Yadav**

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The present research was undertaken to study the awareness of farmers' awareness towards integrated nutrient management (INM). Present study was conducted in Haryana state in 2017. Total 180 respondents were interviewed for the study. Present study concluded that farmers' awareness level was high in case of 'do you know INM increase the crop yield?' with weighted mean score (WMS) 2.02 and rank order 1<sup>st</sup> followed by 'do you know that 'INM sustain the soil health?' and 'do you know about organic manures and fertilizers?' with WMS 1.96 and 1.93 and 2<sup>nd</sup> and 3<sup>rd</sup> rank orders. 'Do you know about balanced use of fertilizers?', 'do you know time and method of application of manures and fertilizers?', 'INM increase the organic matter' with rank orders 4<sup>th</sup>, 5<sup>th</sup> and 6<sup>th</sup> and WMS 1.93, 1.86 and 1.82, respectively. 'Do you know percentage of N/P/K in different fertilizers?', 'are you aware from bio fertilizers i.e. Rhizobium, Azotobacter, Azospirillum?' and 'do you know about primary and secondary nutrients?' with WMS 1.59, 1.32 and 1.31 while rank orders were 7<sup>th</sup>, 8<sup>th</sup> and 9<sup>th</sup>, respectively. Awareness level was low in case of 'do you know about essential micronutrients?' with WMS 1.30 and rank order 10<sup>th</sup>. Independent variables such as age, education, land holding, farming system, farm power, mass media exposure, extension contact, innovation proneness were significant correlated with dependent variable. Cropping system, irrigation facilities and economic motivation were not significant with dependent variable whereas R-square value was 0.46.

**Keywords:** Awareness, Fertilizers, Management and Nutrient**TO STUDY THE INTERACTION EFFECT OF DATES OF SOWING AND VARIOUS NUTRIENTS ON SEED QUALITY OF MUSTARD VAR. "BASANTI" [BRASSICA JUNCEA L. (CZERN & COSS).]****Anubhav Kumar<sup>1</sup>, C.B. Singh Gangwar<sup>1</sup>, Poonam Singh<sup>1</sup>, Anurag Kumar<sup>2</sup>, and Anand Kumar Yadav<sup>3</sup>**Department of Seed Science and Technology<sup>1</sup>Department of Genetics & Plant Breeding<sup>2</sup>C.S.A. University of Agriculture and Technology Kanpur<sup>1</sup>N.D. University of Agriculture and Technology Faizabad<sup>2</sup>Indian Institute of Pulse Research Kalyanpur Kanpur<sup>3</sup>

An experiment was carried out at Seed Testing Laboratory, Department of Seed Science and Technology, C. S. A. University of Agriculture and Technology Kanpur during 2015-16. Quality Seed of Mustard var. "Basanti" was sown during 1<sup>st</sup> week of November and III<sup>rd</sup> week of November with the nutrient levels (1) RNPk (60:40:40 kg ha<sup>-1</sup>), (2) RNPk + 40 kg S ha<sup>-1</sup>, (3) RNPkS + 20 kg ZnSo<sub>4</sub>ha<sup>-1</sup>, (4) RNPkS +25 kg ZnSo<sub>4</sub> ha<sup>-1</sup>, (5) RNPkS + 20 kg ZnSo<sub>4</sub> ha<sup>-1</sup> + 5 kg FeSo<sub>4</sub>ha<sup>-1</sup>, (6) RNPkS + 20 kg ZnSo<sub>4</sub> ha<sup>-1</sup> + 10 kg FeSo<sub>4</sub>ha<sup>-1</sup> (7) RNPkS + 25 kg ZnSo<sub>4</sub> ha<sup>-1</sup> + 5 kg FeSo<sub>4</sub>ha<sup>-1</sup> (8) RNPkS + 25 kg ZnSo<sub>4</sub> ha<sup>-1</sup> + 10 kg FeSo<sub>4</sub>ha<sup>-1</sup>. These two date sown seed with different nutrient levels were tested for germination, root length, shoot length, seedling length, seedling dry weight, seed vigour index I and II, 1000 seed weight and oil content %. On the basis of performance it was concluded that I<sup>st</sup> week of November and nutrient level 60:40:40:40 (RNPkS) kg + 25kg ZnSo<sub>4</sub> + 5kg FeSo<sub>4</sub> ha<sup>-1</sup> gave the best interaction performance. So this combination can be recommended for getting better seed quality and oil content in mustard var. "Basanti".

**INVITRO EVALUATION OF VARIOUS FUNGICIDES AGAINST EARLY BLIGHT PATHOGEN OF TOMATO CAUSED BY ALTERNARIA SOLANI****Anuj Bansal, V. Tilak Chowdary and Rohit Rana<sup>1</sup>**

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Tomato is one of the major vegetable crops grown in India, which is attacked by several pathogens resulting in huge economic losses, early blight of tomato caused by *Alternaria solani* is one among them causing considerable economic losses. In the present experiment we have evaluated six fungicides at various concentrations against the pathogen in invitro by food poison technique. Among them mancozeb and copper oxy chloride have shown better results at 0.2% concentration by inhibiting the mycelial growth upto 68% and 46% respectively when compared to the control.

**APPLE GROWING IN WARM CLIMATE IN INDIA: A GAME CHANGER****<sup>1</sup>Abhilash Padhan, <sup>1</sup>C. Abid Hussain and <sup>2</sup>Amit Kumar Singh\***

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The subtropical region in India lie between latitude 150 and 300 north of equator covering north Indian plains, the Gangetic basins, large parts of eastern states, eastern and western ghats, Nilgiri region etc. In this zone spring is generally frost free and chilling availability ranges from 50 to 500 hours. This region is thus not considered suitable for temperate fruits but grows several low chilling varieties of peach, plum, apricot, almond, pear, apple and nuts. These areas being closer to the markets, offers better production potential than those in higher hills. The winters are relatively warm, but not as hot as the summer season. Production of apple in subtropics may seem fanciful to be initiated, but it is a practice that has existed in localized regions for generations. In areas of warm region of India, for example, chemical treatments are regularly applied to supplement the effects of limited chilling. Because temperature declines with increasing elevations, many microclimates exist in the subtropics where temperate-zone fruits are not currently grown, but could be. Due to development of low chilling apple varieties, apples can be cultivated in tropics and subtropics of India which constitutes North Indian plains, parts of eastern states, eastern and Western Ghats, Nilgiri hills. Winter chilling requirements for most of low chilling apple varieties are 500 to 1000 hrs. below 45 °F (7 °C). There are relatively few varieties adapted to mild winter climates (chill hours below 500 hrs). The cultivar like Beverly Hills, Gordon, Tropical Beauty, Anna, Dorsett Golden, and Ein Sheimer having potential to grow under low chilling requirement.

### **IN VIVO EFFICACY OF CHEMICALS AND BIOCONTROL AGENTS ON DAMPING OFF OF CHILLI (*CAPSICUM ANNUM* LINN.)**

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Chillies (*Capsicum annum* linn.) belonging to family Solanaceae. It contains not less than 12% of non volatile ether soluble extractives. It is an important crop in Preparation of soups, chilli sauce, spicy water etc in country. It was prone to many pathogens viz. fungal, bacterial, and viral and other pathogens also but fungal pathogens were more prominent. Under fungal pathogen *Pythium aphanidermatum* which cause damping off of chilli seedlings causes more than 70% loss in the yield of chilli. Various biocontrol agents and chemicals were used for the managing this disease. Under biocontrol various biocontrol agents used viz. *Trichoderma viride*, *Pseudomonas fluorescense*, Carbendazim, Mancozeb, carbedazim + mancozeb and *Trichoderma harzianum* were used. Among these biocontrol agents *T. viride* shows maximum inhibition of fungus in vivo as a biocontrol and among fungicides Carbendazim + Mancozeb was observed best.

**Keywords:** Biocontrol agents, Seedlings, In vivo, Pathogen etc.

### **ASSESSMENT OF PROMISING SUGARCANE VARIETIES TOWARDS THE INCIDENCE OF MAJOR INSECT PEST IN THE CLIMATE OF WESTERN U.P.**

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Numerous insects and pest are reported to affect the sugarcane crop, this is a leading crop of west Uttar Pradesh agriculture and extending economical substance to the formers. The onset of incidence are dependent of many factors, of which are climate and gemology of the crop is major. A number of varieties suitable for cultivation in this zone are recommended and there is sufficient degree of variations are observed among them. Keeping this fact in consideration the present study was undertaken at sugarcane research centre, Muzaffarnagar farm between the year 2012 to 2015, with eighteen varieties, i.e. (CoS. 06279, 06287, 07240, 08272,08276,08279,08452,08458,09232,10232,10249.CoSe.05460,08455,CoS.92423,96268,CoJ.64,CoS. 767 and CoS.96275). Last 5 Varieties were standard. the replicated trial was conducted in Randomized Block Design (R.B.D.) and the observations were made for the incidence of different borers (Shoot borers and Top borers) during hot weather conditions, the weather reported congenial of incidence. The comparative analysis revealed that the incidence of Shoot borer (*Chillo infuscatellus*, *Snellen*) is less than 10%, which were minimum ,among test varieties. During hot weather, these varieties depict differential behavior toward Top borer (*Sciropophaga nivella*) incidence. It was observed less than 10% ( i.e. less susceptible) in two varieties (CoS. 06287 and CoSe. 05460), 10 varieties were marked as moderate susceptible for top borer with an incidence of 10.10-15% (CoS.07240,08272,08276,08279,08452,10249,92423,96268,767 and CoS 96275) and rest of 6 varieties were susceptible for top borer with an incidence of more than 15.1% (CoS.06279,08458,09232,10232, CoSe. 08455 and CoJ. 64). At last it was concluded that the scouting played an important role for screening of insect pests resistances varieties.

**Keyword:** depict, scout, screening Shoot borer, Top borer

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

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The fruit fly *Bactrocera zonata* population was evaluated by putting methyl eugenol traps in guava orchards. Six traps were mounted at three different places in orchards. The observations were started from 2<sup>nd</sup> fortnight of October during 2009 and 2010. During first year i.e., 2009 *B. zonata* population showed negative and significant correlation with maximum temperature (-



0.68) but minimum temperature (0.16) represented positive non-significant correlation. The correlation coefficient indicated significant positive correlation of fruit fly population with relative humidity (maximum 0.74 and minimum 0.79). In the year 2010 the sp. showed negative but significant correlation with maximum temperature (-0.47). The correlation coefficient was found significant and positive correlation with minimum temperature (0.49). The same trend of correlation coefficient was found significant and positive correlation with minimum temperature (0.49) like previous year. The significant positive correlation observed between population of *B. zonata* and relative humidity (maximum 0.79 and minimum 0.83).

### **BIO-NANOPARTICLES FOR RESIDUAL PESTICIDE ABATEMENT**

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Pesticides are excessively used for managing the pests in agriculture and public health, that's why, a part of this is found in the drinking water. Both Surface and ground water contain this residual pesticide as they are used widespread. Most of the pesticides are resistant to biodegradation and are found to be carcinogenic in nature even at trace levels. Standard methods of pesticide removal are disadvantageous due to their inherent time consumption or expensiveness. Nanoparticles assuage both of these drawbacks and hence, they can be effectively utilized for the mineralization of pesticides. The application of chemically synthesized nanoparticles now a days considered as toxic in the nature, in contrast to this, nanoparticles may synthesis from living organisms and it considered as bio nanotechnology. Bio nanotechnology is a sustainable method as it is a safe process, energy efficient, reduces waste and lessens greenhouse gas emissions. As a major contrast, microbes are used in the production of these nanoparticles mostly metallic nanoparticles. Microbes synthesize these nanomaterial as a part of defense mechanism. These nanoparticles are ecofriendly as no harmful chemicals are utilized and can be mass produced due to high multiplication rate of microbes. The bio-nanoparticles can be used in multiple application in agriculture to sustain the production and environment, one of the major concern that utilizes the use of these metallic nanoparticles is for the degradation of residual pesticides present in ecosystem.

**Keywords:** Bio-nanoparticles, pesticide, sustainability, microorganism and mineralization.

### **BIODIVERSITY AND CONSERVATION STRATEGIES OF ENDANGERED MEDICINAL PLANT SPECIES**

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Biodiversity refers to large number genetically diverse population of rare and threatened plant species from around the world. India is one of the major country having 12 mega diversities with 10 bio geographic regions. India is the rich source of plant biodiversity having different climatic condition as well as altitudinal variations, coupled with varied ecological habitats contributing to the development of rich vegetation. World Health Organization has recorded 21000 plant species of medicinal plants around the world. In India, about 2500 plant species of medicinal plant are being used in indigenous system. Medicinal plants occupy a vital sector of health care system in India which represents a major natural national resource. Medicinal plants are of various uses curing different ailments such as, wounds, cuts, fever, diarrhoea, ulcers, swelling, bone fractures, potency, antidote, skin care, night blindness, toothache, asthma, cough & cold etc. The red data book has listed 427 Indian Medicinal plant entries as endangered species, of which 28 are considered extinct, 124 endangered, 81 rare and 34 insufficiently known. Therefore, it is necessary to maintain as well as conserve plant species. There are various different strategies such as micro propagation, in vitro seed germination, dual culture with symbiotic fungi as well as callus regeneration for conservation of plant species or germplasm conservation. Hence, there is an immense need for conservation of diversity of medicinal plant for the present and future generations, by adapting the above suitable strategy with most appropriate method of conservation.

### **COMPETENCY OF THE EXTENSION PERSONNEL**

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The combination of observable and measurable knowledge, skills, abilities and personal attributes that contribute to enhanced employee performance and ultimately result in organizational success. A Competency is a Criterion for Success. Competencies are specific work behaviors distinguishing high and low job performance. Competency is a determining factor for successful performance. The focus of the competency is Behavior which is on application of skills, job, attitude and knowledge. The ability to integrate knowledge and skill to perform a task under the varied circumstances of the real world. A competency is a qualification to perform, not the actual performance. Competencies do not establish baseline performance levels; rather they are used to raise the bar on employee performance. Competency data can be used for employee development, compensation, promotion,





training and new hire selection decisions. Competency determine the employee's career movement and also the reward to be earned. Competencies refers to skills or knowledge that leads to superior performance. Competencies are individual abilities or characteristics that are key to work.

Keywords: Competency, Extension Personnel, Knowledge, Skill and Attitude

## EFFECT OF BORON TOXICITY ON MORPHO-PHYSIOLOGICAL AND BIOCHEMICAL PARAMETERS IN WHEAT (*TRITICUM AESTIVUM* L.)

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Wheat is the staple food of around 40% of world population. Boron (B) toxicity is an important agricultural problem which highly limits the area, production and ultimately productivity of agricultural food products such as wheat in different part of world. The main reason of this toxicity is B rich irrigation water, fertilizers, sewage and sludge, surface mining, industrial use and fly ash. The morpho-physiological and biochemical parameters were highly affected by toxic level of boron. Leaf area and biomass were decreased remarkably. Chlorophyll a, b and total chlorophyll content was varied significantly, where chlorophyll b content was surprisingly higher. These conditions led to limited photosynthesis and affected yield. The B toxicity pushes the plants into certain abiotic stress. So it is obvious that it must affect the proline content. From this study it has also been found that the proline content was amazingly different. Our results indicate that these parameters could be used to evaluate the stress level as well as to develop models that could help prevent the damage inflicted by B toxicity in wheat plants.

**Key words:** wheat, boron toxicity, leaf area, biomass, chlorophyll, proline, abiotic stress.

## EFFECT OF ALKALI WATER AND GYPSUM APPLICATION ON RICE-WHEAT CROPPING SYSTEM

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The experiment was conducted during 2015-2017 in *kharif* and *rabi* season on Crop Research Station, Nawabganj, C.S. Azad University of Agriculture and Technology, Kanpur to carry out the "Effect of Alkali water and gypsum application on rice-wheat cropping system" on rice and wheat crop with seven treatments i.e ; Control (Sodic water) (T<sub>1</sub>), Gypsum Beds Treatment of sodic waters (T<sub>2</sub>), Soil Application of gypsum (25% gypsum Requirement) (T<sub>3</sub>), Soil application of gypsum (25% GR) + GBT of Sodic water (T<sub>4</sub>), Soil application of gypsum (50% GR) (T<sub>5</sub>), Soil Application of gypsum (50% GR) +GBT of Sodic water (T<sub>6</sub>) and Soil application of gypsum (100% GR) (T<sub>7</sub>) in Randomized Block design (RBD) with four replications. The results showed higher grain production in rice and wheat was recorded 47.41, 38.43 q ha<sup>-1</sup> and straw yield was recorded 54.78 and 43.63 q ha<sup>-1</sup> at (T<sub>6</sub>) respectively with the application of (SA of gypsum (50% GR) + GBT) of Sodic water in comparison to control (T<sub>1</sub>). Application of these recommendation in Sodic water dominant area to gating maximum yield and maintain soil health it is also sustain crop production very profitable for marginal farmers.

## ZINC AND ITS IMPORTANCE FOR HUMAN HEALTH: AN INTEGRATIVE REVIEW

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Since its first discovery in an Iranian male in 1961, zinc deficiency in humans is now known to be an important malnutrition problem world-wide. It is more prevalent in areas of high cereal and low animal food consumption. The diet may not necessarily be low in zinc, but its bio-availability plays a major role in its absorption. Phytic acid is the main known inhibitor of zinc. Compared to adults, infants, children, adolescents, pregnant, and lactating women have increased requirements for zinc and thus, are at increased risk of zinc depletion. Zinc deficiency during growth periods results in growth failure. Epidermal, gastrointestinal, central nervous, immune, skeletal, and reproductive systems are the organs most affected clinically by zinc deficiency. Clinical diagnosis of marginal Zn deficiency in humans remains problematic. So far, blood plasma/serum zinc concentration, dietary intake, and stunting prevalence are the best known indicators of zinc deficiency. Four main intervention strategies for combating zinc deficiency include dietary modification/diversification, supplementation, fortification, and bio-fortification. The choice of each method depends on the availability of resources, technical feasibility, target group, and social acceptance. In this paper, we provide a review on zinc biochemical and physiological functions, metabolism including, absorption, excretion, and homeostasis, zinc bio-availability (inhibitors and enhancers), human requirement, groups at high-risk, consequences and causes of zinc deficiency, evaluation of zinc status, and prevention strategies of zinc deficiency.

**Keywords:** Zinc absorption, zinc bio-availability, zinc deficiency, zinc intervention, zinc nutrition, zinc requirement



## **IMPACTS OF CLIMATE CHANGE ON WATER RESOURCES IN RELATION TO MONSOON OF HARYANA REGION**

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The vulnerability of an Indian subcontinent to the impact of changing climate is of vital importance because the major impact of climate change on this continent would be on the hydrology, affecting water resources and its agricultural economy. The present studies in regions of Haryana highlighted the climate change and its impacts on the water resources with a special emphasis on floods and droughts events. Various Deterministic models are calibrated and validated for the selected regions and used to simulate the hydrological response of the region considered changing climatic scenarios. During the monsoon months, increase in precipitation is projected by about 27 percent (178 mm), most of this results in runoff 57 percent (102 mm) and base flow 4 percent (7 mm) contributing to the stream flow. About 2 percent (4 mm) of this increase in precipitation is contributed to the groundwater recharge. Increase in evapotranspiration is projected by 34 percent (19 mm). It has been observed that the impacts of climate change are not uniform over the country and varying across in various regions of Haryana.

## **CLIMATE RESILIENT VARIETIES: THE WAY TO COMBAT CLIMATE CHANGE**

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The people of world get 75 percent of their sustention, either directly or indirectly from three crops, viz. rice, wheat & maize. These crops differ in their climatic requirement and economic importance. The world's rising population is predicted to reach 11.2 billion by the end of this century, which would require more food crop to sustain their life and in a report of world bank, it was estimated that, global food production must increase by 70% in the next 35 years to fulfill the food demand. The change in global climate patterns which is attributed to the increased level of atmospheric green house gases produced by the use of fossil fuels, faulty agricultural practices etc. would reduce the production of food crops drastically in forthcoming years. There is an urgent need to adopt new sustainable methods of agriculture practices in order to achieve the increase food demand. Climate-smart agriculture is an approach that helps to transform and reorient agricultural systems under the new realities of climate change. it involves various approaches like sustainable increase in productivity, strengthening resilience to climate change and climate resilient varieties and reducing agriculture's contribution to climate change. The climate resilient varieties have the ability to survive disruption anticipate, adapt and flourish in the face of climate change. The climate smart agriculture requires an extensive research work and use of it will make possible to produce such genotypes of plants which can be grown successfully in adverse climatic conditions. The detail of the paper will be discussed.

**Keyword:** Global Warming, Climate Smart Agriculture, Sustainable Agriculture, Rising Population.

## **COMMUNICATION TECHNOLOGIES FOR AGRICULTURAL EXTENSION IN INDIA**

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The potential role of agriculture as an engine for economic development. Agricultural technologies, such as fertilizers, seeds and cropping techniques. Public-sector programs have attempted to overcome information-related barriers to technological adoption by providing agricultural extension services. The rapid spread of information and communication technologies (ICT) in developing countries like India offers a unique opportunity to transfer knowledge via private and public information systems. The general extension approach uses specialists to provide a sort of services to farmers, from technology transfers to advisory services and human resource development. ICTs have been used in advisory service provision. Radio and TV Programme and Mobile telecenters regularly have provided agricultural information like price, quality, weather condition etc.

**Keyword:** Agriculture Extension, ICT, Services

## **CONSERVATION AGRICULTURE: PRECISION AGRICULTURE (SAVE ENERGY, SAVE MONEY)**

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Precision agriculture, also known as "site-specific crop management," is an information- and technology-based agricultural management system used to identify, analyze, and manage variability within fields for optimum profitability, sustainability, and environmental protection. Fields often vary in soil types, elevations, soil chemistry, fertility, and productivity. By applying precision agriculture practices, producers are able to specify the farm input needs (including nutrient and pesticide application, tillage, and irrigation) throughout an individual field. Precision agriculture has emerged during recent years as an improved management strategy to apply agricultural inputs at proper place, time and dose rather than applying uniformly over large



frame precision agriculture is not a technology but management of crops/ farms to respond to variability by using advanced technology. Global Position System (GPS) has made it economically possible for producers to use new precision tools, techniques, and services to enhance their efforts to save energy and reduce costs. These include yield monitoring, grid soil sampling, variable-rate application of nutrients, remote-sensing applications, soil electrical conductivity (EC) monitoring, and zone soil sampling. PA methods promise to increase the quantity and quality of agricultural output while using less input (water, energy, fertilisers, pesticides, etc.). The aim is to save costs, reduce environmental impact and produce more and better food. The methods of PA rely mainly upon a combination of new sensor technologies, satellite navigation and positioning technology, and the Internet of Things. In addition to cutting production costs and saving energy, precision agriculture reduces environmental pollution and improves water quality by reducing nutrient runoff. Other benefits include:

- Improved crop yield
- Reduced compaction by limiting traffic to specified travel lanes
- Increased opportunity to operate equipment after dark
- Labor savings through reduced implement overlap, and
- More accurate farming records

Future benefits of this study: Precision agriculture can make a significant contribution to food security and safety, Precision agriculture can promote more sustainable ways of farming, Precision agriculture will trigger wider societal changes.

**Keywords:** precision, save energy, GPS.

### CONTRIBUTION OF AGROFORESTRY IN FUELWOOD CONSUMPTION AT DIFFERENT ALTITUDINAL ZONES OF GARHWAL HIMALAYA

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In recent decade, climate change is one of the debatable issues worldwide, having direct and indirect impacts on the human being as well as on natural ecosystem. In Himalayan region, trees at agroforestry field are alternative source of fuelwood as a provisioning service which helps in improving the livelihood of the farmers by reducing the need of commercial energy sources. The present study was undertaken to assess the contribution of agroforestry in fulfilling the demand of the fuelwood at different altitude of Garhwal Himalaya. Multistage random sampling was used to select the agroforestry dominated villages followed by agroforestry farmers during 2015-17. Fuelwood consumption by households was estimated using the weight survey method for a period of 24 hrs. The results revealed that fuelwood consumption from agroforestry (capita<sup>1</sup>day<sup>-1</sup>) increases with altitude upto 1201-1600 m altitude and then declined at the peak (i.e. >1600 m) while the fuelwood consumption from forest increases with altitude. The estimates of the study will be helpful in quantifying the contribution of agroforestry in fuelwood consumption. Thus the share of agroforestry may be helpful in framing the policies regarding the adoption of agroforestry as a tool for providing the protective and productive services for adaption to changing climate as well as reducing the anthropogenic pressure on forest at high altitude of Himalayan region.

**Keywords:** Adaptation; Agroforestry; Climate change; Fuelwood consumption; Himalayan region

### STRUCTURAL PARAMETERS FOR SCREENING OF DIFFERENT VARIETIES OF CHILLI (*CAPSICUM ANNUM* L.)

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An experiment entitled, Structural and functional parameters for screening of different Chilli varieties was carried out during 2015-16 in the field of Research Farm, J.N.K.V.V., College of Agriculture, Tikamgarh (M.P.). The experiment was laid out in RBD with ten varieties viz. Pusa Jwala, Pusa Sadabahar, JM-218, JM-283, Sonakshi-44, Divyajyoti, Classica-152, Natasha-727, Suryamukhi and Prajwala and three replications. The plant growth of different varieties at different growth intervals was statistically analyzed. The results show that the variety Prajwala recorded as the tallest (61.43 cm height at 90 DAT stage) one at every stage over the other varieties, the variety JM-283 recorded as the highest no. of branches (26.07 plant<sup>-1</sup> at 90 DAT stage) one at every stage, the variety Prajwala recorded as the highest no. of leaves (82.71 plant<sup>-1</sup> at 90 DAT stage) one at every stage, variety Sonakshi-44 recorded as the highest leaf area at 30 DAT stage but at 60 and 90 DAT stage, highest leaf area was recorded by Natasha-727 variety. The highest no. of leaves at 90 DAT stage was recorded up to 685.26 mm<sup>2</sup>, being significantly higher over the remaining varieties. The parameter fruit yield plant<sup>-1</sup> Prajwala produced significantly higher fruit yield plant<sup>-1</sup> (786 g) as compared to all the varieties. The second best variety was Natasha-727 producing (713 g fruits plant<sup>-1</sup>). The third best variety was Classica-152 (676 fruits plant<sup>-1</sup>). Pusa Jwala produces significantly lowest fruits yield (129 g fruits plant<sup>-1</sup>), closely followed by Pusa Sadabahar (143 g fruits plant<sup>-1</sup>), respectively.

**Keywords:** Chilli, Varieties, Structural & Screening



**IMPACT AND CONSTRAINTS OF TOILET SCHEME FOR RURAL WOMEN'S SECURITY IN INDIA****Dipika Sachan and Pratibha Singh**

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The Swachh Bharat Mission of urban and rural areas aims to cover almost 1.04 crore households in order to provide them 2.6 lakhs of public toilets, 2.5 lakhs of community toilets together with the solid wastes management in every town. Community toilets have been planned to be built in the residential areas where availability of individual household toilets is difficult and public toilets at designated locations including bus stations, tourist places, railway stations, markets, etc. Cleanliness programme in the urban areas (around 4,401 towns) have been planned to be completed over five years till 2019. The costs of Programmes are set like Rs 7,366 crore on solid waste management, Rs 1,828 crore on public awareness, Rs 655 crore on community toilets, Rs 4,165 crore on individual household toilets, etc. Programmes which have been targeted to be completed are complete removal of open defecation, converting unsanitary toilets into flush toilets, eradicating manual scavenging, bring behavioral changes among public, and solid waste management. The Ministry of Human Resource Development has launched Swachh Vidyalaya Programme under Swachh Bharat Mission with an objective to provide separate toilets for boys and girls in all government schools within one year. The Programme aims at ensuring that every school in the country must have a set of essential interventions that relate to both technical and human development aspects of a good Water, Sanitation and Hygiene Programme.

**Keywords:** Swachh , Toilets, Programme and stations.**EFFECT OF ORGANIC AND INORGANIC NUTRIENT SOURCES ON TOTAL CHLOROPHYLL CONTENT AND YIELD IN TARAORI AND TYPE-3 BASMATI RICE VARIETIES****Dipti Bisarya<sup>1</sup>, Deepti Shankhdhar<sup>1</sup>, M.K Nautiyal<sup>2</sup>, D. K. Singh<sup>3</sup> and S. C. Shankhdhar<sup>1</sup>**<sup>1</sup>Department of Plant Physiology, College of Basic Sciences and Humanities<sup>2</sup>Department of Genetics and Plant Breeding, <sup>3</sup>Department of Agronomy, College of Agriculture,

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Rice is the major staple food crop in India, occupying around 45 m.ha., and contributing about 100 million tones to the total food grain production. Introduction of high yielding varieties and increased use of chemical fertilizers and pesticides have lead to several harmful effects on the soil environment ultimately reducing the productivity of the soil by affecting the soil health. It is felt that organic farming may solve all these problems by protecting/sustaining soil health. Significant improvements in soil properties have been reported in several organic farming experiments because organic manures not only act as the source of nutrients, but also provide micronutrients and enhance the microbial population of soils which help in mobilizing native nutrients in soil-plant system and also improve the efficiency of applied nutrients. The present investigation was carried out to understand the effect of different organic and inorganic nutrients on physiology of Taraori and Type-3 basmati rice varieties. The experiment was laid out in split plot design during kharif season of 2015 & 2016 at Breeder Seed Production Centre, GBPUA&T, Pantnagar, India. The experiment was conducted with different nutrient sources *i.e.* farmyard manure (FYM), vermicompost (VC), green manure (GM), NPK mixture, urea and muriate of potash (MOP) and two irrigation methods *i.e.* alternate wetting and drying (AWD) & continuous flooding (CF) and establishment methods were System of Rice Intensification (SRI), Direct Seeded Rice (DSR)+Soy & Transplanted rice. The treatments were T<sub>1</sub>: GM+FYM (AWD), T<sub>2</sub>: Organic (AWD), T<sub>3</sub>: FYM+VC (AWD), T<sub>4</sub>: SRI, T<sub>5</sub>: DSR+Soybean, T<sub>6</sub>: Organic control (CF), T<sub>7</sub>: Chemical control (CF), T<sub>8</sub>: Integrated (CF). The findings suggest that significantly higher grain yield was found in T<sub>8</sub> which was *at par* with T<sub>1</sub>, T<sub>3</sub> and T<sub>7</sub> among the sole crop of basmati rice in both years whereas in establishment methods DSR reported the highest yield in 2016 as compared to other establishment methods. Among the varieties Type-3 had significantly higher grain yield in both the years than Taraori basmati rice variety. Total chlorophyll was significantly higher in T<sub>4</sub> among the treatments whereas among the varieties Type-3 had higher total chlorophyll as compared to Taraori basmati rice variety.

**Keywords:** Organic farming, basmati rice, irrigation and physiology**EFFECT OF ORGANIC MANURE BASED ON DISTILLERY COMPOST, INORGANIC FERTILIZER AND FARM YARD MANURE ON THE YIELD QUALITY OF INDIAN MUSTARD (*BRASSICA JUNCEA L.*)****Santosh Kumar, Rajeshwari Sharma, Mahesh Kumar\* and V. K. Dwivedi\*\***

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The experiment was laid out in Randomized block design during the crop season of 2004-05 and 2005-06 at the research farm of J.V.P.G. College, Baraut, Baghpat (U.P.) comprising 10 treatments with 3 replication. DEBPCFYM, combinations of DEBPC ÷ FYM and inorganic fertilizer significantly increased seed yield. Biological yield and quality content of Indian mustard. Among the various treatments, application of FYM 5t/ha + DEBPC 3t/ ha recorded highest seed yield, biological yield and all the quality contents in both the years.





**Keywords:** Distillery compost, FYM, Urea, Indian Mustard.

### **INDUCED MUTAGENESIS IN RICE FOR ISOLATION OF NON LODGING MUTANTS IN ADT-45 VARIETY USING ELECTRON BEAM AND GAMMA RAYS AND ITS CHARACTER ASSOCIATION STUDIES**

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This experiment was conducted during 2013 to 2016 at the Agricultural College and Research Institute, Madurai, Tamil Nadu, India. Lodging in cereal crops causes significant economic losses associated with reduced yield, grain quality, and harvesting efficiency. Lodging is a complex phenomenon as it interferes with water and nutrients uptake, reduces light interception, provides conducive environment for foliar diseases, increases harvesting cost and decreases grain yield. ADT-45 is the one of the leading varieties mostly preferred by farmers of Tamil Nadu and considered as one the best suitable variety with good quality rice which fetches very high price for the farmers due to its medium slender grain type but the only lacuna is it is susceptible to lodging. Hence in the present investigation, ADT-45 variety was treated with electron beam and gamma rays to produce lodging tolerance mutants. An association study was carried out between lodging angle with different lodging related morphological traits. The traits plant height, culm height, 1<sup>st</sup> internodal length, 2<sup>nd</sup> internodal length, 3<sup>rd</sup> internodal length, 4<sup>th</sup> internodal length, 5<sup>th</sup> internodal length had a significant direct correlation with lodging angle. While the traits 1<sup>st</sup> internode diameter, 2<sup>nd</sup> internode diameter, 3<sup>rd</sup> internode diameter, 4<sup>th</sup> internode diameter, 5<sup>th</sup> internode diameter, K and Si had significant negative correlation with lodging angle *i.e.*, increase in the lodging angle (lodging susceptible) internodal diameter, K and Si content get reduced.

### **INTEGRATED NUTRIENT USE ON WATER USE & WATER USE EFFICIENCY OF HYBRID MAIZE UNDER RAINFED CONDITION IN CENTRAL PLAIN ZONE OF UTTAR PRADESH**

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An experiment was conducted during *Kharif* 2016 on Soil Conservation and Water Management Farm, C.S.A. University of Agriculture & Technology, Kanpur on hybrid Maize with three level of inorganic fertilizers (kg ha<sup>-1</sup>) *i.e.* 100% R.D.F. (100 N + 60 P + 40 K + 20 Z), 75% RDF (75+45+30+15), & 50% RDF (50+30+20+10) along with three levels of organic manure viz; 15, 20 & 25 ton FYM ha<sup>-1</sup>. On the basis of results it can be concluded that the fertility level 100% RDF as water use 328 (mm) & water use efficiency 9.09 (kg ha<sup>-1</sup> mm<sup>-1</sup>) and 25t FYM ha<sup>-1</sup> as water use 327 (mm) & water use efficiency 9.20 (kg ha<sup>-1</sup> mm<sup>-1</sup>) was found better in respect as compared to other combinations of fertility management in respect of water use & water use efficiency ended that growing of hybrid maize crop in *Kharif* season was found most suitable and remunerative in central plain zone of Uttar Pradesh in Kanpur.

### **EFFECT OF SEED SIZE ON GERMINATION OF SEMECARPUSANA CARDIUM (MARKING NUT) IN GARHWAL HIMALAYA**

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The present study was conducted to generate information on effect of seed size on germination of *Semecarpusana cardium* in Garhwal Himalaya. *Semecarpusana cardium* is a medium sized deciduous tree, growing up to 10-15 metres in height. The plant grows naturally in tropical and sub-tropical climate and distributed in sub-Himalayan region, Tropical region, Bihar, Bengal, Orissa and central parts of India. Its an important medicinal plant species possessing Anti-Cancer, Anti-inflammatory and several diseases like skin disease, fungal disease, excessive menstruation, fever, constipation, etc. The experiment was carried out at HNB Garhwal University, Srinagar during 2015-2016 in RBD experimental design with five replications. There were 3 treatments namely T<sub>1</sub> as small seeds, T<sub>2</sub> as medium seeds and T<sub>3</sub> as larger seeds. Estimates of the germination data showed that the germination ranges from 18% - 28% with highest germination on T<sub>13</sub> (28%). Thus the experiment reveals that the seed size plays vital role in germination of *Semecarpusana cardium*.

**Keywords:** Germination, *Semecarpusana cardium*, Seed Size, Garhwal Himalaya



**FAMILY ENVIRONMENT TO INFLUENCE ON ACADEMIC ACHIEVEMENT****Reena\* and Bimla Dhand\*\***Department of Human Development and Family Studies, COHS,  
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Family is a social unit and first place where children live with their parents or guardian and begin to learn the norms and values of the society in which they find themselves. It is the source of early stimulation and experience in children. The family, being a powerful influence on the child and its importance as a primary agent of socialization could in no doubt enhance or hinder the academic achievement of the child depending on the social climate in the family. The home environment means the family background of the students; this includes all the human and material resources present at the home that affects the student's education and living, such as the parent's level of education, their occupation, socio-economic status and socializing facilities available in the house. Thus, the home is the basic institution for providing the child's primary socialization and laying the educational foundation for the child upon which the other agents of socialization are built. Academic attainment is an important parameter used in measuring students' success or failure in a particular subject in school. Success, in an educational institution is measured by academic performance. Poor performance of students has become a common concern of parents, legislators, teachers, counsellors and psychologist. A family is strongly linked to the academic motivation of a child. So, action is needed to promote awareness of the importance of education and family environment as well as ways to safeguard it.

**Keyword:** Family environment, children and Academic achievement.**ADAPTATION TO CLIMATE CHANGE: NECESSITY OF THE TIME IN AGRICULTURE****Chandra Kant Singh**

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Due to climate change, likelihood of further changes occurring and increasing scale of potential climate impacts give urgency to addressing agricultural adaptation. Many potential adaptation options are available for marginal change of existing agricultural systems, for climate risk management. Implementation of these options is likely to have substantial benefits under moderate climate change for some cropping systems. However, there are limits to their effectiveness under more severe climate changes. Agriculture plays a two fold in climate change, one hand, severely by climate change and other hand, significant contributor to greenhouse gas emissions. Adaptation in the agriculture sector means addressing the negative impacts of climate change and making use of the opportunities that often come with a changing climate. The overall aim of adaptation in agriculture is to reduce farmer's vulnerability and improve their adaptive capacity. In addition to all these aspects, it is concrete adaptation options at farm level, as well as community based adaptation approaches. Achieving increased adaptation action will necessitate integration of climate change related issues with other risk factors, such as climate variability and market risk, and with other policy domains, such as sustainable development. To deal with various barriers the effective adaptation will require a comprehensive and dynamic policy approach covering a range of scales and issues, e.g. farmers' understanding of change in risk profiles to the establishment of efficient markets that facilitate response strategies. Multi-disciplinary problems require multi-disciplinary solutions, *i.e.*, a focus on integrated rather than disciplinary science and a strengthening of the interface with decision makers. A crucial component of this approach is the implementation of adaptation assessment frameworks that are relevant, robust, and easily operated by all stakeholders, practitioners, policymakers, and scientists.

**Keyword:** Adaptation, Agricultural sector, Climate change, Climate impacts.**EFFECT OF ENTOMOPATHOGENIC FUNGI ON LIPID PEROXIDATION AND ANTIOXIDANT ENZYMES ACTIVITIES OF *SPODOPTERA LITURA* (FAB.)****Sonam\*, Anoop Kumar\*, Sachin S. Suroshe\*\*, Sagar D\*\*, Jitendra Singh\* and Nashim Ahmad\***

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The tobacco caterpillar, *Spodoptera litura* (Fabricius) is a polyphagous pest known for devastating outbreaks all over the world. In India, across different crops, *S. litura* causes 10 to 30 per cent yield loss. Presently, different parts of the country are witnessing the outbreaks of *S. litura* due to its high fecundity and a short life cycle under sub-tropical and tropical conditions. Of late, *Spodoptera* has become highly resistant to pesticide belonging to different classes including the bio-pesticide. Currently, two broad spectrum entomopathogenic fungi namely *Beauveria bassiana* and *Metarhizium anisopliae* are in the offing for the management of the larval population of many lepidopteran larvae including *S. litura*. So, in order to study the effect of *Beauveria* on lipid peroxidation and antioxidant enzymes activity in *S. litura*, the experiment was carried out. For bioassay respective fungal spore concentration of  $1 \times 10^7$  spores per ml was used against the fourth instar larvae *S. litura*. The findings suggest that the level of immune related antioxidant enzymes *viz.*, Super-oxide-dismutase (SOD), Peroxidase, Catalase and Glutathione-S-transferase (GST) were found to play significant role in treated larvae compared to larvae under control. The findings might give clue about the mechanisms of tolerance in spp. *Spodoptera* against the bio-pesticides.

**Keywords:** Entomopathogenic fungi, *Spodoptera*, Lipid peroxidation and antioxidant enzymes.

## STUDIES ON THE PRODUCTIVITY AND PROFITABILITY OF SESAME BASED INTERCROPPING WITH KHARIF CROPS UNDER DIFFERENT WEED MANAGEMENT PRACTICES

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The experiment was conducted during two consecutive Kharif seasons of 2015 and 2016 at SIF, C.S. Azad University of Agriculture and Technology, Kanpur-208002 (U.P.). The experiment consisted 12 treatments having four intercropping viz; sesame + maize (4:1), sesame + maize (8:2), sesame + urd (4:1) & sesame + urd (8:2) and three weed management practices viz; Hand weeding, Pre-emergence of Pendimethaline 30% EC@3.0L/ha and Early post-emergence of Alachlor 50 % EC@0.75kg/ha replicated four times. The experiment was laid out in Factorial Randomized Block Design. The soil of the experimental field was sandy loam in texture with pH of 7.58 and EC of 0.20 mmhos/m at 25<sup>0</sup>C. The main crop as Sesame of Shekhar variety and sub crops as Maize of P-3441 variety and Urd of Shekhar-2 variety were used in the study year. Result showed that the all weed population were counted lowest Sesame + Urd (8:2) intercropping treatment. The intercropping system influence significantly the growth and yield attributes of sesame, maximum value of these parameters was with Sesame + Urd (8:2) intercropping. The significantly maximum grain and straw yield, Sesame equivalent yield, gross income, net income and B: C ratio of Sesame as main crop was recorded in Sesame + Urd (8:2) treatment over rest treatment, respectively during both the years. The system productivity and system profitability of Sesame as main crop was significantly increased with Sesame + Urd (8:2) compared to as rest intercropping treatment during both years, respectively. The treatment of Sesame + Urd (8:2) was found significantly protein content and oil content over Sesame + Maize (4:1), Sesame + Maize (8:2) and Sesame + Urd (4:1) intercropping treatments, respectively. Among weed management practices in hand weeding reduced weed population over chemical weed management practices as Pre-emergence of Pendimethaline and Early post-emergence of Alachlor, respectively. Significant improvement in growth and yield attributes was recorded with the application of hand weeding. The Hand weeding a positive effect on grain and stover yield, economic as gross income, net income and B: C ratio of sesame when the significant response was noted over Pendimethaline and Alachlor weedicides in both years of study. The response of weed management practices was significantly noted in hand weeding practices in respect to grain and stover yield of sub crops (Maize and Urd). The system productivity and profitability, protein content and oil per cent with hand weeding practices were significantly more than both chemical control of pre-emergence of Pendimethaline and early post-emergence of Alachlor, respectively in both the years.

**Keywords:** Sesame, Maize, Urd, Sesame equivalent yield, gross income, net income, B:C ratio, Productivity, Profitability, Weed management.

## GENETIC EVALUATION OF CUCUMBER (*CUCUMIS SATIVUS* L.) STRAINS FOR DIFFERENT GROWTH, YIELD, QUALITY AND SEED PARAMETERS

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Thirteen strains of cucumber (*Cucumis sativus* L.) were evaluated at Horticultural Research Centre, Department of Horticulture, H.N.B. Garhwal University, Srinagar (Garhwal), Uttarakhand (India) to study the variability, heritability and genetic advance for growth, yield, quality and seed parameters. The analysis of variance revealed highly significant differences for almost all the characters. The perusal of present investigation indicated that the values of phenotypic coefficient of variation (PCV) were higher than the genotypic coefficients of variation (GCV) for all characters studied. The genotypic coefficients of variation and phenotypic coefficients of variation were moderate to low for all the characters except number of nodes bearing first male flower (33.02%, 33.66%). The high magnitude of heritability high estimated genetic advance over mean were found highest for length of fruit (100%, 58.40%), weight of fruit (99%, 39.92%), length of vine (98%, 36.12%), number of seeds per fruit (98%, 50.16%), number of nodes per vine (97%, 53.57%), number of fruits per vine (97%, 44.33%), number of nodes bearing first male flower (96%, 66.74%), TSS (96%, 44.25%), calcium content (95%, 21.75%), number of nodes bearing first female flower (94%, 58.36%), duration of harvesting (93%, 36.04%), total fruit yield per vine (92%, 35.93%) and diameter of fruit (92%, 35.80%) thus indicating that these characters had additive gene effect and therefore, they are more reliable for effective selection.

**Keywords:** Genetic, Phenotype, Coefficient, Variation and Heritability

## GENOME-WIDE SELECTION IN CROP IMPROVEMENT

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Plant breeding largely depends on phenotypic selection in plots and only for some, often disease-resistance related traits, uses genetic markers. The more recently developed concept of genomic selection, using a black box approach with no need of prior knowledge about the effect or function of individual markers, has also been proposed as a great opportunity for plant



breeding. Several empirical and theoretical studies have focused on the possibility to implement this as a novel molecular method across various species. Although we do not question the potential of genomic selection in general, in this Opinion, we emphasize that genomic selection approaches from dairy cattle breeding cannot be easily applied to complex plant breeding. Association analysis is used to measure relations between markers and quantitative trait loci (QTL). Their estimation ignores genes with small effects that trigger underpinning quantitative traits. By contrast, genome wide selection estimates marker effects across the whole genome on the target population based on a prediction model developed in the training population (TP). Whole-genome prediction models estimate all marker effects in all loci and capture small QTL effects. Here, we review several genomic selection (GS) models with respect to both the prediction accuracy and genetic gain from selection. Phenotypic selection or marker assisted breeding protocols can be replaced by selection based on whole-genome predictions in which phenotyping updates the model to build up the prediction accuracy.

**Keywords:** Genome Selection Quantitative Trait Loci, Training Population ,Phenotypic Selection ,Marker Assisted Breeding And Whole-Genome Predictions

## GLOBAL BIODIVERSITY CHANGE

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Global biodiversity change is one of the most pressing environmental issues in the present time. The two components of biodiversity change are biodiversity alterations and biodiversity loss—across four dimensions of biodiversity: species extinctions, species abundances, species distributions, and genetic diversity. Biodiversity is changing at unprecedented rates in human history: Species are becoming extinct or closer to extinction; mean species abundances of several taxa are decreasing; species are shifting their ranges in response to climate change; and domestic and wild genetic diversity are being lost. The major direct drivers of biodiversity change are habitat change and overexploitation. Pollution, exotic species, and disease are also important drivers. Upstream from the direct pressures on biodiversity, there are indirect drivers of biodiversity change. Major indirect drivers for biodiversity include population growth, energy use and energy production, diet, and food demand. Climate change is an emerging driver of biodiversity change. Human population growth and human resource use are the underlying indirect drivers of biodiversity change. There have been some important successes in biodiversity conservation—mainly through species management, protected areas, and increased societal awareness. Farmland abandonment is an opportunity for biodiversity restoration. Biodiversity change should be assessed in relation to its consequences for ecosystem services and species existence values.

**Keywords:** extinctions, species, abundance, range, land-use, climate

## EFFECT OF GLOBAL WARMING: PROSPECTS

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Global warming occurs when carbon dioxide (CO<sub>2</sub>) increase in atmosphere and other air pollutants and greenhouse gasses collect in the atmosphere and absorb sunlight and solar radiation that have bounced off the earth's surface. In latest years, China has taken the front in global-warming pollution, producing about 28 percent of all CO<sub>2</sub> emissions. The United States comes in second in position. Although making up just 4 percent of the world's population, we produce a massive 16 percent of all global CO<sub>2</sub> emissions as much as the European Union in third and India is the fourth place. Every year consequences of global warming, and various agree that environmental, economic, and health consequences are likely to occur if current trends continue. Some effects of global warming on environment -Melting glaciers, early snowmelt, and severe droughts will cause more dramatic water shortages and increase the risk of wildfires, rising sea levels will lead to coastal flooding on the Eastern Seaboard and Gulf of Mexico. Forests, farms, and cities will face difficult new pests, heat waves and increased flooding. All those factors will damage or destroy agriculture and fisheries. Disturbance of habitats such as plant and animal species to destruction. Allergies, asthma, and infectious disease outbreaks will become more familiar due to increased growth of pollen-producing ragweed, higher levels of air pollution, and spread of conditions favorable to pathogens and mosquitoes. Positive effects of climate change are greener rainforests and enhanced plant growth, increased vegetation and possible increases in plankton biomass in some parts of the ocean. Harmful responses may include pollution of fresh water, increased incidence of natural fires, extensive vegetation disappear due to the droughts, change in resettlement patterns of birds and animals, changes in seasonal periodicity, disruption to food chains and species loss.

**Keyword:** Global warming, air pollutants, CO<sub>2</sub> emissions, habitats





**INSECT CONSERVATION: A SYNTHETIC MANAGEMENT APPROACH****Gompa Sowdhamini\*, M. A. Laichattiwari and R. S. Meena**

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Insect diversity is threatened by a range of factors from habitat loss and invasive alien organisms to environmental contamination and biological control. These threats are being supported by the joint impact of habitat loss and global climate change. Recent research on insect conservation has elucidated some basic principles for conservation management. Six basic principles have been outlined for synthetic conservation management of the insects. They are maintain reserves, maintain quality landscape heterogeneity as much as possible, reduce the contrast between remnant patches and neighbouring disturbed patches, outside reserves introduce land sparing i.e. where 'high-yielding agriculture is practiced, requiring a smaller area of land to attain the same yields and therefore leaving greater areas of natural habitat untouched, simulate natural conditions and disturbance, connecting similar patches of quality habitat. These six principles constitute a coarse-filter, landscape approach. Permeating all six is the principle of maintaining healthy population levels, which require the combined support of the metapopulation trio of large patch (habitat) size, good patch quality, and reduced patch isolation. In addition to these six coarse-filter principles is an overlay of the fine-filter, species approach, in which particular species are given focused attention and management.

**Keywords:** Insect conservation, Management strategies, Synthetic management, Threats**EFFECTS OF SOWING DATES ON YIELD ATTRIBUTES AND YIELD IN MAIZE (*ZEA MAYS* L.) HYBRIDS SOWN IN KHARIF SEASON****Govind Prasad\*, Mehar Chand, Pawan Kumar and Ajay Singh**

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A field experiment was conducted during *Kharif* 2012 to study the effect of different dates on yield attributes and yield of different maize (*Zea mays* L.) hybrids. The experiment consists of four dates of sowing (15<sup>th</sup> June, 25<sup>th</sup> June, 5<sup>th</sup> July and 15<sup>th</sup> July) in main plot and five maize (*Zea mays* L.) hybrids of different maturity groups namely, HQPM-1 (long), HM-4 (medium), HM-5 (long), HM-6 (early) and HM-7 (extra early) in sub plot was replicated thrice in split plot design. The 10 days advance, normal and 10 days delayed sowing from normal sowing date being at par recorded significantly higher cob length, cob girth, 100 grain weight, shelling percent and grain yield/ha as compared to delayed sowing by 20 days from normal sowing date. Highest cob length was recorded in HM-4 (15.6 cm) followed by HQPM-1 (14.2 cm), HM-6 (13.4 cm), HM-7 (12.9 cm) and lowest in HM-5 (12.1 cm). Highest shelling percent was recorded in HQPM-1 (67.8 %) followed by HM-6 (65.1 %), HM-4 (63.6 %), HM-7 (62.3 %) and lowest in case of HM-5 (58.5 %). Hybrid HM-5 recorded highest cob girth (4.3 cm), 100-grain weight (27.0 g) and grain yield (7.64 t/ha).

**Keywords:** 100-grain weight, cob girth, cob length, grain yield, maize hybrid**GOVERNMENT POLICIES FOR SUSTAINABLE DEVELOPMENT OF AGRICULTURE****Devegowda S R\*, Mukesh Kumar, Kalpana Kumari and Preeti Lata Singh**

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The word “sustainable development” signifies as development to achieve the certain needs of present situation neither extracting more of present resources nor compromising for future needs, while by transporting the situation in to sustainable development by the government, taking up deterministic policies centered on agriculture in the long term development, sustainable inclusive development to substantial judicious use of resources in agriculture for purpose of creation of hunger free nation. United Nations adopted agenda for sustainable development by 2030, consisting of 17 Goals that address the key concerns of humanity and 169 interlinked targets within these goals that reflect the complex and interrelated nature of social, economic and ecological well-being parameters. Further it aims to relate the sustainable agriculture system with the traditional system and the current system in practice, across the extents of ecological, economic and social sustainability. It also tries to give long term solutions to solve the problems plaguing the system so that sustainable practices can be encouraged and practiced for the overall policies of government for the efficient justifiable development in the economic growth in Indian agriculture.

**Keywords:** Agriculture, Inclusive, Policies, Sustainability.**GENETIC ANALYSES OF RESISTANCE TO SPOT BLOTCH DISEASE IN F<sub>2</sub> GENERATION IN WHEAT****Harsha S\***

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Wheat is one of the most important staple food crop in the world. India is the second largest producer of wheat in the world. Spot blotch, caused by *Bipolaris sorokiniana*, is an important wheat disease in the warmer and humid growing regions of the world. Its importance has increased recently as the production of wheat has expanded into newer growing areas. Surveys indicate that spot blotch has become a serious disease constraint for wheat cropping in several parts of the world. The average yield loss due



to spot blotch in South Asia and India has been estimated to be 19.6% and 15.5%, respectively (Dubin and van Ginkel, 1991). Several attempts have been made to control spot blotch but no single control measure has been successful. Hence an integrated approach with host resistance as a major component is considered necessary (Joshi *et al.*, 2002). Even if it is incomplete, any degree of resistance will complement chemical and other control measures (Joshi and Chand, 2002). Inheritance studies on resistance to spot blotch are limited and the nature of inheritance is still debatable. Reports indicate both monogenic and polygenic types of resistance. However, the experience of wheat workers to achieve partial resistance in breeding populations has suggested a polygenic type of resistance. The present investigation is under taken to further enhance knowledge on the genetics of resistance and susceptible to spot blotch in wheat crop.

**Keywords:** Staple food, Humid, Survey, Integrated, Resistance, Susceptible, Monogenic, Polygenic

### **INTEGRATED DISEASE MANAGEMENT OF TOMATO WILT CAUSED BY *FUSARIUM OXYSPORUM* F. SP. *LYCOPERSICI***

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Tomato (*Solanum lycopersicum* L.) ranks first amongst all the fruits and vegetables as a source of vitamins, minerals and phenolic antioxidants. Tomato production is constantly threatened by biotic constraints, mainly fungal diseases among which Fusarium wilt of tomato caused by *Fusarium oxysporum* f.sp. *lycopersici* causes serious economic loss. Use of bio-control agents alone or in integration with Carbendazim may be advised to the farmer as an eco-friendly approach for profitable farming. *Trichoderma harzianum*, *Bacillus subtilis* and *Pseudomonas fluorescens* were tested *in-vitro* for their antagonistic activity against *Fusarium oxysporum* f.sp. *lycopersici*. The antagonistic potentiality of *Trichoderma harzianum* was determined by dual culture technique that resulted in 25.4% inhibition of the growth of *F.oxysporum* f.sp. *lycopersici* in presence of bio-control agent (*T.harzianum*). Antagonistic activity of bacterial bio-control agents was determined through Well Diffusion Technique and results revealed maximum Zone of Inhibition (ZOI) with *Bacillus subtilis* (29.9 mm) followed by *Pseudomonas fluorescens* (25.6 mm). The effect of *T. harzianum*, *B. subtilis*, *P. fluorescens* and systemic fungicides against *F.oxysporum* f.sp. *lycopersici* was tested in glasshouse and field conditions. Seedling treatment with a combination of *T. harzianum* and Carbendazim recorded better biometrics of tomato crop (root-shoot length, yield, vigour index), germination% and significantly reduced wilt incidence as compared to single application of bio-agents or Carbendazim or of combinations of bacterial and fungal bio-agents. Among the various seedling treatments, a combination of 0.2% Carbendazim and 2% *T. harzianum* recorded the maximum germination percentage (86.70% and 77.73%) and significantly reduced the wilt incidence (13.33% and 22.27%) on tomato in glasshouse and field conditions respectively.

### **STUDIES ON THE EFFECT OF VERMICOMPOST ALONG WITH NPK DOSES ON THE GROWTH AND YIELD OF INDIAN MUSTARD (*BRASSICA JUNCEA* L.) IN EASTERN UTTAR PRADESH**

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A field experiment was conducted during the winter (Rabi) season of 2015-16 at National Post Graduate College, Barahalganj, Gorakhpur on silty-loam soil to study the effect of integrated nutrient management on growth and yield of Indian mustard (*Brassica juncea* L.) under four levels of vermicompost and three levels of recommended dose of fertilizers (RDF). The experiment was laid out in Randomized Block Design (Factorial) with combination of 12 treatments viz.(1) 50%RDF (2) 75%RDF (3) 100%RDF (4) 50%RDF+2t/ha vermicompost (5) 75% RDF+2t/ha vermicompost (6) 100% RDF+2t/ha vermicompost (7) 50% RDF+4t/ha vermicompost (8) 75% RDF+4t/ha vermicompost (9) 100% RDF+4t/ha vermicompost (10) 50% RDF+6t/ha vermicompost (11) 75%RDF+6t/ha vermicompost (12) 100%RDF+6t/ha vermicompost. Result revealed that the seed yield of mustard was recorded maximum 17.4 q/ha at 6 t/ha vermicompost, which was at par 4 t/ha. Calculated gross income (Rs. 41824/ha) and net profit (Rs. 18677/ha) were obtained at 4 t/ha vermicompost, which was at par 6t/ha vermicompost, respectively. Seed yield of mustard increased statistically with increased level of fertility. It was highest 16.55 q/ha at 100% RDF. The maximum expenses (Rs. 20351/ha) on mustard was with 100% RDF and minimum (Rs. 19199/ha) with 50% RDF. Gross return (Rs. 39196/ha) due to sale of seed yield was higher at 100% RDF over other remaining treatment, respectively.

### **ECONOMIC CONTRIBUTION OF WOMEN: AN OVERVIEW**

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Women constitute 48.46 % of India's population but their representation in government and private sector jobs is very limited as it is evident from the census 2011 that Worker Population Ratio (per 1000) is shared by 819 males as against 336 females. This condition is the result of the perception of women contribution in the society i.e., on the ground of gender. Gender refers to the socially constructed roles, behaviours, activities, and attributes that a given society considers appropriate for men and women (WHO). The issue of gender inequality needs to be addressed for harnessing the economic potentialities trapped in women population. Gender inequalities include unequal rights, responsibilities, and opportunities for women and translate to poor



health status, educational attainment, and economic status compared to men. Gender inequality in India is a multifaceted issue that concerns men and women alike. There is a need to provide them equal employment opportunities to play an effective part in the development of society by being economically self-reliant. An analysis is required to look at the potentials of employment in reducing gender inequality.

**Keywords:** Gender inequalities, Employment, Worker Population Ratio, Opportunities

### QUALITATIVE ANALYSIS OF SORGHUM (*SORGHUM BICOLOR* (L.) MOENCH) UNDER DIFFERENT POTASSIUM LEVELS

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Sorghum (*Sorghum bicolor* (L.) Moench) is the fifth important cereal crop which is well adapted to semi-arid regions of the world occupying where salinity and drought are the chief environmental factors affecting crop productivity. It is a basic staple human food for many rural communities in many parts of the world and has a high forage value. In the present study, the effect of different potassium levels (0, 20, 30, 40, 50 and 60 kg K<sub>2</sub>O/ha) were studied on the quality of sorghum variety HJ 541. The highest green fodder yield (494.5 q/ha) and dry matter yield (131.2 q/ha) were recorded with application of 40 kg K<sub>2</sub>O/ha which were significantly superior to 0 and 20 kg K<sub>2</sub>O/ha. Highest crude protein content (13.2 q/ha) and digestible dry matter (66.7 q/ha) yields were also recorded with 40 kg K<sub>2</sub>O/ha which were significantly superior over 0 and 20 kg K<sub>2</sub>O/ha. The HCN content ranged from 35 to 51 µg/g on fresh weight basis and was below the toxic limit. Decreasing trend was observed in HCN content with increasing levels of potassium. Crude protein content and IVDMD were not affected by different potash levels. Highest phosphorous (P) content (0.21 %) and potassium (K) content (1.36 %) were recorded with 50 kg K<sub>2</sub>O/ha and were significantly superior over 0 and 20 kg K<sub>2</sub>O/ha. Similarly, highest P uptake with 50 kg K<sub>2</sub>O/ha and K uptake with 40 kg K<sub>2</sub>O/ha were significantly superior over 0 and 20 kg K<sub>2</sub>O/ha. Therefore, the present study indicated that potassium level at 40 kg K<sub>2</sub>O/ha had the best quality and yield in sorghum among the given treatments.

**Keywords:** Crude protein, potassium, quality, sorghum, yield

### ICT FOR AGRICULTURAL DEVELOPMENT IN INDIA

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Agriculture is one of the divers industry which are increasing rural income as well as long term stability of its natural resources. This can create different activities which will affect farmers, and stakeholder. ICT is any device, tool, or application that permits the exchange or collection of data through interaction or transmission. Information and communication technologies are the incorporated with different devices such as radio, television, mobile phones, computer, and internet. Information and communication technologies are increasing day by day in agriculture sector for obtaining the information about related issues, problems and their solutions. In the context of agriculture development, information and communication technologies have played central role in developing countries like India. Information and communication technologies can be used for distance learning programs. It helps the farmer for learning new approaches and technologies for the use of agriculture development in India. These technologies can provide information on weather, marketing. Empowerment of poor farmers with information and communication assets and services that will increase their productivity and incomes as well as defend their food security and livelihoods. ICT initiatives aim to provide locally relevant content to farmers which help in reducing the expert-farmer gap. All efforts are made to make content relevant, accessible and reliable knowledge sources.

**Keywords:** ICT, Agriculture, Farmer, Market, Income

### ISOLATION, SCREENING AND CHARACTERIZATION OF LACTIC ACID BACTERIA ISOLATED FROM FERMENTED FOOD AND THEIR ANTIMICROBIAL ACTIVITY AGAINST THE FOOD PATHOGENS

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To isolate, characterize and identify lactic acid bacteria (LAB) in fermented food. This study describes a search for lactic acid bacteria capable of exo- polysaccharide production or exhibiting antimicrobial or proteolytic activities. In this study fifty (25) samples were collected from different region, for the isolation of lactic acid bacteria from fermented food and check their ability to inhibit the growth of pathogenic microorganisms. In this study, lactic acid bacteria were isolated using MRS media at 37°C for 48 hour. The isolates was identified by the morphological, and biochemical characterization and produced lactic acid purified by ammonium sulphate precipitation. Antagonistic effects of lactic acid were studied by agar well diffusion method. Lactic acid stability was studied in different temperature and pH. In this study show that lactic acid could be successful use as a food preservative and to increase the life of the food products and function as natural antimicrobial compound.



**BIOFORTIFICATION IN VEGETABLE CROP****Vishal Tripathi and Ashutosh Kumar**

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The developing countries like India face many challenges such as fastest population growth, hunger, malnourishment of vitamin & micronutrients (hidden hunger) etc. For a decade our traditional breeding approach mainly focussed on improving crop productivity, biotic and abiotic stress management etc., against priority towards nutritional security. Vegetables are the principal source of micronutrients and have high potential to alleviate malnutrition, hidden hunger and degenerative disease like cancer etc. One such approach to combat the issue of micronutrient malnutrition is through biofortification, it is a practice of nutrient fortification into vegetable crops using agronomic, conventional and transgenic breeding methods. It provides an excellent chance for vegetable breeders to fulfil human nutritional requirements by making available nutritionally rich vegetable cultivars with added nutraceutical value to the most vulnerable people (especially in remote areas) through inexpensive and cost effective ways compared to any other mode. In agronomical approach, the micronutrients level in edible portion can be increased through application of fertilizers. Crops which have sufficient genetic variation for the micronutrients in the genotypes, parental lines with high vitamin or minerals levels can be inter-crossed over several generations to produce plants that have desired traits. But when there is the unavailability of nutrients sufficient genetic variation in crops, the application of genetic engineering offers valid alternatives for increasing the concentration of micronutrients in the edible crop tissues. In recent years, the improvement in the nutritional quality of vegetables has been added as an additional breeding approach. Thus, Biofortification is an attempt to reach malnourished population by delivering naturally fortified vegetables to people, especially in rural areas. Many crops are being covered in Harvest plus programme recently e.g. Vitamin A fortified Cassava, high iron fortified French bean etc.

**Keywords:** Biofortification, nutrition, malnourishment, vegetable, breeding**THE IMPACT OF CLIMATE CHANGE ON SOILS AND ON THEIR WATER MANAGEMENT****Manish Kumar Yadav, Kailash Chand Yadav, Anil Kumar and Madan Lala Jat**

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Human activities result in changes in the global environment, sometimes with severe consequences for our future life. Changes in the gas composition of the atmosphere – partly due to CO<sub>2</sub> and ‘greenhouse gases’ emission – may lead to a rise in temperature with high spatial and temporal variability, to alterations in the global circulation processes, and to a serious rearrangement of atmospheric precipitation, increasing aridity in some locations. These modifications are reflected sensitively by ecosystems (natural vegetation and land use pattern) and by considerable alterations in soil formation and degradation processes, in soil properties and soil functions. The potential impacts of the forecasted climate change reservoirs are briefly summarized in the present paper with special regard to soil water management, soil moisture regime and their influences on the main soil degradation processes. Based on this analysis, conclusions are drawn regarding the possibilities of sustainable soil moisture and the required measures of rational control: increasing water use efficiency; reducing evaporation, surface runoff, seepage and filtration losses; increasing water storage capacity and available moisture range of soils.

**Keywords:** climate change, soil formation and degradation processes, infiltration, water storage capacity, soil moisture control.**RECENT ADVANCES IN CONSERVATION OF NATURAL ENEMIES****Priyanka, N. N. Singh, Sambhrant Kumar and V. K. Mishra**<sup>1</sup>Department of Entomology and Agricultural Zoology Institute of Agricultural Sciences

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Natural enemies of arthropod pests, which are well known for their efficacy as potential biological control agents, include predators and parasitoids that occur in all production systems from commercial fields to backyards. Their conservation and enhancement is of great utility and cost-effective. Natural enemies suffer severely from the two major factors *viz* the use of broad-spectrum pesticides and absence or destruction habitat that provide food resources, shelter sites, egg-laying places etc., during the vegetation period. Furthermore, unfavorable environmental conditions and lack of overwintering shelters during hibernation are causing high mortality among beneficial insects. Habitat management, a form of conservation biological control, is an ecologically based approach aimed at favoring natural enemies and enhancing biological control in agricultural systems. The goal of habitat management is to create a suitable ecological infrastructure within the agricultural landscape to provide resources such as artificial structure, food, alternative prey or hosts, insectary plants, shelter from adverse conditions, mediating host-prey accessibility, providing host prey finding cues, hedgerow establishment, cultural practices like trap crop, intercrop, relay crop, cover crop for enhancing the natural enemies effectiveness. Rationalizing the use of pesticides and the proper modification of environmental conditions, good synchronization with availability of suitable stages of the pest may conserve natural enemies and increase their efficacy. Plant volatiles also act as feeding and ovipositional attractant also play a critical role as signals in tri-trophic level interactions. Many flowering plants have evolved ways to attract natural enemies, pollinators and insects. The insects they catch are only used as dietary supplements. These plants can be grown in greenhouse also to control pests. The idea for conservation of natural enemy to improve biological control of crop pests is an appealing concept. In light of this crucial role, we suggest ways of manipulating morphological and chemical attributes of a crop plant for a more sustainable and balanced control of insect-pest in agro ecosystem.





## GENETICS OF SOME YIELD AND QUALITY TRAITS IN BASMATI RICE (*ORYZA SATIVA* L.) TO IDENTIFY HETEROTIC COMBINATIONS, USING DIALLEL MATING DESIGN

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The present investigation was undertaken to determine the extent of variability, combined ability effects, and heterosis for different quantitative and qualitative characters in scented Basmati rice (*Oryza sativa* L.) accessions collected from diverse sources. The experimental material consisted of 6 parents and 15 crosses which were planted in Randomized Block Design with two replications during *khari* 2015 at Research Farm, Institute of Agricultural Sciences, B.H.U, Varanasi. The observations were recorded on eight yield traits viz., days to 50% flowering, days to maturity, plant height, main panicle length, effective tillers per plant, number of seeds per panicle, 100 seed weight, and grain yield per plant. Furthermore, the observations on seven quality parameters viz., kernel length, kernel breadth, kernel length after cooking, kernel breadth after cooking, Alkali Spread Value (ASV), and amylose content were also made. Analysis of Variance (ANOVA) for all the eight yield traits showed significant differences among treatments, parents, hybrids and parent vs. hybrids. Similarly, ANOVA for six quality traits revealed significant differences among all the above-mentioned sources except parent vs. hybrids group for kernel breadth after cooking and ASV. The crosses also exhibited considerable variability for all the traits studied, ranging from 2.06 to 2.82 g for 100 grain weight, 104.21 to 151.09 cm for plant height, 14.09 to 36.70 for effective tillers per plant, 23.87 to 36.96 cm panicle length, 102 to 244.26 seeds per panicle, 28.29 to 89.88 g grain yield, 7.04 to 8.79 mm for kernel length, 1.57 to 1.97 mm for kernel breadth, 11.95 to 16.85 mm for kernel length after cooking, 2 to 2.55 mm for kernel breadth after cooking, 3.36 to 6 for ASV, and 19.72 to 27.78 for amylose content. These results indicate that there is ample scope for selection of promising genotypes from the materials under study for yield and quality improvement. Based on the Specific Combining Ability effects (SCA), HUBR10-9 x B 370 was the best specific cross for seeds per panicle, grain yield, amylose content and days to 50% flowering. Maximum significant better parent heterosis values for different characters viz., days to 50% flowering was shown for plant height by HUBR10-9 x Type 3 (47.65\*\*), for effective tillers by HUBR 10-9 x Sanowal Basmati (94.08\*\*), for panicle length by B 370 x T. basmati (13.98\*\*), for seeds per panicle by HUBR 10-9 x B 370 (56.59\*\*), for 100 grain wt. by Type 3 x Sanowal Basmati (21.96\*\*), and for grain yield per plant by HUBR 10-9 x B 370 (141.50\*\*). In the case of quality characters, for kernel length maximum significant better parent heterosis values was shown by B 370 x Sanowal Basmati (22.34\*\*), for kernel length after cooking by B 370 x Sanowal Basmati (15.57\*\*), and for amylose content by HUBR 16 x Type 3 (8.92\*\*). Thus it can be said that the uniqueness of this study lies in crosses having higher positive significant value of SCA effect showed higher heterosis value for all the characters. Careful development of such crosses can be extremely beneficial as it may help to sustain our ever-growing population and reflect India as a major producer of quality rice all over the world.

**Keywords:** Rice, grain characteristics, cooking quality, general and specific combining ability, heterosis.

## COMPARATIVE PERFORMANCE OF F<sub>1</sub> HYBRIDS OF OKRA (*ABELMOSCHUS ESCULENTUS* L. MOENCH) UNDER NATURALLY VENTILATED POLYHOUSE, SHADENET HOUSE AND OPEN FIELD CONDITIONS

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The field experiment entitled, "Comparative performance of F<sub>1</sub> hybrids of okra (*Abelmoschus esculentus* L. Moench) under naturally ventilated polyhouse, shadenet house and open field condition" was carried out at Department of Horticulture, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli. Dist. Ratnagiri (M.S.) in the year 2014 in Split Plot Design with 3 replications. There were two factors studied in experiment viz. a) growing conditions and b) F<sub>1</sub> hybrids. The growing conditions were taken as main plot treatment and F<sub>1</sub> hybrids were taken as sub plot treatment. Three growing conditions studied were GC<sub>1</sub> (Naturally ventilated polyhouse), GC<sub>2</sub> (Shadenet house) and GC<sub>3</sub> (Open field). The four hybrids used were V<sub>1</sub> (OH-152), V<sub>2</sub> (Bhendi NS- 851), V<sub>3</sub> (Bhendi No- 10) and V<sub>4</sub> (NOH- 1258). The variety V<sub>5</sub> (Varsha Uphar) was used as control. While observing the effect of growing conditions, GC<sub>1</sub> showed the highest plant height (2.00 m), internodal length (8.97 cm), number of nodes (22.36), leaf area (221.97 cm<sup>2</sup>), days to last harvest (109.19). With regard to variation in F<sub>1</sub> hybrids, significantly the highest height of plant (1.66 m) at last harvest and number of nodes (21.79) were observed in V<sub>1</sub>. Further, the highest internodal length (9.09) and the highest leaf area (214.16 cm<sup>2</sup>) was recorded in V<sub>3</sub>. While observing the interaction effect of growing conditions and F<sub>1</sub> hybrids, the highest plant height (2.24 m) at the last harvest is in treatment combination GC<sub>1</sub> V<sub>2</sub>. Lowest internodal length (6.69 cm) is in treatment combination GC<sub>3</sub> V<sub>4</sub>. Fruit yield per plant (0.28 kg), fruit yield per m<sup>2</sup> (2.08 kg), yield per ha (16.47 t) and leaf area (245.86 cm<sup>2</sup>) were the highest in the treatment combination GC<sub>3</sub> V<sub>3</sub>.

**Keywords:** Comparative performance, F<sub>1</sub> hybrids, naturally ventilated polyhouse, shadenet house, open field.



**EFFECT OF NAA AND GA<sub>3</sub> ON GROWTH ATTRIBUTES OF TOMATO (*LYCOPERSICON ESCULENTUM* MILL.)****Jayram Patidar, Rajesh Lekhi and Om Prakash Prajapati**

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This study was conducted with the objective to determine the effects of Gibberellic acid (NAA) and (GA<sub>3</sub>) on growth and yield of tomato. The experiment involve ten number of treatments combination with three replication there were three levels of GA<sub>3</sub> (10 ppm, 15 ppm and 20 ppm respectively) and three levels of NAA (15 ppm, 20 ppm and 25 ppm respectively). In general, it was observed that G<sub>3</sub> (GA<sub>3</sub> @ 20 ppm) was found significantly superior followed by G<sub>2</sub> (GA<sub>3</sub> @ 15 ppm) and G<sub>1</sub> (GA<sub>3</sub> @ 10 ppm) over control. As regards NAA, N<sub>3</sub> (NAA @ 25 ppm) was found significantly superior followed by N<sub>2</sub> (NAA @ 20 ppm) and N<sub>1</sub> (NAA @ 15 ppm) over control. The interaction effect of GA<sub>3</sub> and NAA showed significant effect on various characters. It was revealed that treatment G<sub>3</sub>N<sub>3</sub> (20 ppm GA<sub>3</sub> + 25 ppm NAA) which was at par to G<sub>3</sub>N<sub>3</sub> (15 ppm GA<sub>3</sub> + 20 ppm NAA) in maximum observations while the minimum value was recorded under control.

**Keywords:** Tomato, *Lycopersicon esculentum* Mill, GA<sub>3</sub>, NAA, Spray, PPM, Growth.**FOOD SECURITY AND CROP PRODUCTION SUSTAINABILITY THROUGH BALANCE NUTRITION****Pavan Singh**

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Food security developed over the last 50 or more years addressed primarily the need for the production and access to adequate food grains to feed the world's increasing population. The principal challenges in both systems are similar: (1) there is no compelling evidence for significant increases in the genetic yield potential in both systems during the past 30 years, (2) farm yields are presently about 40-65% of the attainable yield potential, and (3) nutrient management mostly relies on approaches that do not account for the dynamic nature of crop response to the environment. Because average farm yield levels of 70-80% of the attainable yield potential are necessary to meet expected food demand in the next 30 years. Globally the ratio of N: P<sub>2</sub>O<sub>5</sub>:K<sub>2</sub>O changed from 2.5:1.3:1 in the 1980s to 3.6:1.4:1 in 2002 as N consumption outstripped that of K. Balanced and timely application of nutrients needs to be demonstrated through different parameters according to the prevailing agro-climatic conditions. avoided. Food production systems must operate to be socially acceptable, environmentally benign and economically viable. As the availability of land and water resources is rapidly declining, there is urgent need to increase the productivity of remaining natural resources, including energy, while at the same time observing nutrition and environmental needs. Fertilizer can increase food grain production, release marginal lands from production and reduce environmental degradation and reduce the risk and uncertainty associated with the production of agricultural commodities.

**Keywords:** Food Security, Crop Production, Balance Nutrition**PRECISION FARMING IN SOLANACEOUS CROPS****Debarati Datta\*<sup>1</sup> and Sourav Ghosh<sup>2</sup>**<sup>1</sup> PhD Research Scholar, Govind Ballabh Pant University of Agriculture and Technology, Pantnagar, Uttarakhand, India<sup>2</sup> PhD Research Scholar, Indian Agricultural Research Institute, Pusa, New Delhi, Pin-110012, India

Precision Farming' or 'Precision Agriculture' aims at increasing productivity, resource efficiency, decreasing production costs and minimizing the environmental impact of farming. Brinjal, tomato and potato are the important vegetable crops in India. India ranks 2<sup>nd</sup>, 3<sup>rd</sup> and 2<sup>nd</sup> in area, 2<sup>nd</sup>, 2<sup>nd</sup> and 3<sup>rd</sup> in production and 8<sup>th</sup>, 10<sup>th</sup> and 4<sup>th</sup> in productivity for brinjal, tomato and potato, respectively. Vegetables being short duration and high value cash crops have high scope for implementation of precision agriculture (PA) technologies. Vegetables grown with simple PA technologies like drip irrigation, site specific input management, soil map based fertilizer application, LCC, SPAD have been found to be superior than those grown under conventional techniques- both in yield and quality, with much higher Benefit-Cost ratio. Adoption of precision farming leads to about 80 per cent increase in yield in tomato, 34 per cent in brinjal and 52 percent in potato. Increase in gross margin has been found 165 per cent, 67 per cent and 152 per cent in tomato, brinjal and potato production, respectively. Lack of finance and credit facilities have been identified as the major constraints for non adoption of precision farming. Thus, it has been suggested that development of PA societies, strengthening of marketing channels and providing subsidies on water soluble fertilizers and pump sets of drip irrigation will increase adoption of precision farming in India.

**DEVELOPMENT OF TRANSGENIC CHICKPEA (*CICER ARIETINUM* L.) PLANTS WITH *OSRUVB* GENE FOR SALT STRESS TOLERANCE****Preeti and Pushpa Kharb\***

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Chickpea (*Cicer arietinum* L.), also known as bengal gram or channa, is an edible legume. It is a self pollinating diploid (2n=2x=16) with genome size of 740 Mb. In India, it tops the list of pulse crops with a total production of 8.83 million tons with an average yield of 925.5 during 2015-16. In addition to biotic stresses, chickpea faces various abiotic stresses such as drought, cold, terminal heat and salinity etc. Chickpea production is adversely affected due to salinity in arid and semi-arid regions



of the world as salt stress reduces water potential, creates imbalance in ion concentration and causes toxicity. RuvB is a helicase found in bacteria but now several reports show its presence in plants like *Oryzae sativa* where it is required for normal levels of genetic recombination and DNA repair, by which the plant overcomes salt stress. We have developed transgenic chickpea plants with *OsRuvB* gene for salinity tolerance by using in planta transformation method for which patent has been granted (Kharb *et al.*, 2012). The putative T<sub>0</sub> plants were screened by PCR analysis and the PCR positive plants with transformation efficiency of 17% were observed. The plants are further being characterized for integration, expression and transgene copy number using suitable molecular techniques.

### THE ROLE OF REMOTE SENSING IN PRECISION AGRICULTURE

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Advances in technologies have created the possibility to assess the spatial and temporal variability present in the field and manage it with appropriate site-specific practices. Such approach is commonly called Precision Agriculture or site-specific crop and soil management. Precision agriculture is an emerging farm management strategy that is changing the way people farm. At present, there is an increasing commitment to reduce reliance on excessive chemical inputs in agriculture. Numerous technologies such as Global Positioning Systems (GPS), Geographic Information Systems (GIS), remote sensing and simulation modelling have been applied to make agricultural products safer and to lower their adverse impacts on the environment, a goal that is consistent with sustainable agriculture. With increasing population pressure throughout the world and the need for increased agricultural production, there is a definite need for improved management of the world's agricultural resources. To make this happen, it is first necessary to obtain reliable data on not only the types of resources, but also the quality, quantity and location of these resources. Satellite-or aerial-based RS technologies will become important tools in improving the present system(s) of acquiring and generating agricultural and natural resource data. As a results Precision agriculture has emerged as a valuable component of the framework to achieve this goal.

**Keywords:** Sustainable agriculture, Precision agriculture, Global Positioning Systems (GPS), Geographic Information Systems (GIS) and remote sensing.

### EFFECT OF SULPHUR AND ZINC APPLICATION ON YIELD THEIR CONTENT AND UPTAKE BY MUSTARD

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In a field experiment were conducted in two consecutive years i.e. 2013-14 and 2014-15 at Kulbhaskar Ashram Post Graduate College, research farm, Allahabad (UP). Application of four levels of sulphur i.e. 0, 20, 40 and 60 Kg/ha and four levels of zinc i.e. 0, 4, 8 and 12 Kg/ha was applied as per treatment combination, caused significant increased in grain yield with sulphur and zinc levels during both the years. The yield varied from 14.32 to 15.74 q/ha and 15.98 to 18.53 q/ha during first year and second year, respectively and maximum yield was recorded at S4 level and Zn4 levels 15.74q/ha and 18.53q/ha, respectively. Sulphur content and uptake by mustard crop increased significantly with the increasing levels of S and Zn in Soil. The values of Sulphur and Zinc interaction was significant.

### EFFICACY OF BIOPESTICIDES AGAINST TWO IMPORTANT PESTS OF POPULUS DELTOIDES BARTR

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Forest Research Institute, Dehradun

Poplar is a very important and unique agroforestry tree species. During regular surveys in the field this poplar especially *Populus deltoides* was found to be susceptible to insect attack. On identification it was observed that *C.cupreata* and *P.phalanthia* are two important defoliators which often cause severe defoliation and almost 80% defoliation in monsoons. It was also observed that severe and repeated attack adversely reduced the growth and the quality of timber. Therefore a promising strategy with potential to control the damage was worked with biopesticides and minimum or no use of hazardous chemicals/insecticides. Similarly the present study deals with testing the efficacy of botanicals (seed kernels of *Jatropha curcas*, rhizome of *Acorus calamus* and leaves of *Adhatoda vasica*) extracted in different solvents (petroleum ether, acetone, methanol and water) with 6 concentrations in distilled water and compared with commercially available Neemexcel (seeds extracted in methanol) against the most devastating stages i.e. 4th and 5th instar larvae of the defoliators. Observations were taken after 24hrs, 48hrs and 72hrs of the treatment. Results showed maximum mortality of both the pests with the seed extractives of *J.curcas* in petroleum ether at 0.6% of concentration after 72hrs. Extractives in petroleum ether was found to be most effective against the target pests followed by methanol extractives. 0.015% concentration was found as the best dose of Neemexcel after 72 hrs of treatment with maximum mean mortality against the 4th instars larvae of *C.cupreata* and *P.phalanthia*.

**Keywords:** Biopesticides, *C.cupreata*, *P.phalanthia*, concentration



**STRATEGIES FOR PROMOTING AND DEVELOPING FARMER-LED-INNOVATIONS****Akanchha Singh<sup>1</sup> and VLV Kameswari<sup>2</sup>**<sup>1</sup>PhD Research Scholar and <sup>2</sup>Professor

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Sustainability and food security are two of the most prominent issues all across the globe. Most countries are facing the challenges of malnutrition, hidden hunger, climate change, nutritional security etc. In case of India the conditions are so diverse that each and every region has its own specific problems and they cannot have the same solutions. Earlier approaches to finding solutions were top-to down that did not work for specific and local situations. Pro-innovation bias and compatibility issues were also major barriers and this led to realization of the importance of farmer wisdom. Participatory approaches took birth after this and one such approach is farmer-led-innovation. Farmer-led innovation are getting recognition as it promotes social learning, recognition of farmers, effective utilization of local resources and harnessing of local potential. Cost consideration, gap between farmer and researcher, lack of documenting agencies are some of the major challenges hindering the wider acceptance of this approach. However, by adopting innovative strategies to involve farmers in innovation-generation process, rewarding and awarding farmers, like promotion through mass media, organizing national, international conferences, exhibitions and adoption of villages can change the situation. Considering this pertinent issue the paper is an attempt to provide an insight into farmer- led –innovation process, need to encourage this approach of innovation-generation and ways and means of speeding up farmers' engagement in generation of innovation.

**Keywords:** Farmer-led-innovation, Innovation-generation process, Urgency, strategies, Limitations, Organizations**EFFECT OF AUXINS ON PLANT REGENERATION OF WHEAT****Reena Tomer<sup>1</sup>, Nidhi Sharma<sup>2</sup> and Varun Tomer<sup>2</sup>**<sup>1</sup>Department of Microbiology, J.V. College, Baraut- Baghpat, UP, India

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Phytohormones can play significant role in during cyanobacteria mediated transformation. We study effect of three auxins 2,4-D, IBA and NAA used alone on wheat variety C-360, somatic embryogenesis and plant regeneration was studied. Efficiency of growth regulators has been compared at different time intervals. 2,4-D give best yield while IBA shows best proliferation. 2,4-D also give efficient results in inducing nodules in NAA also induce nodules in wheat roots but comparatively less than 2,4-D.

**Keywords:** Auxin, Wheat, Plant growth regulators, Yield.**CURRENT SCENARIO AND FUTURE OUTLOOK OF INERT DUSTS FOR MANAGEMENT OF STORED PRODUCT INSECTS****Rekha G<sup>1\*</sup> and Ramesh Babu S<sup>2</sup>**<sup>1</sup> Research Scholar, Department of Entomology, University of Agricultural Sciences, Raichur, Karnataka<sup>2</sup> Research Scholar, Department of Entomology and Agril. Zoology, Institute of Agricultural Sciences, BHU, Varanasi

Inert dusts have been used traditionally as stored grain protectants. Inert dusts, primarily those based upon activated silica, are finding increasing use as stored grain protect ants in the grain industry. These materials can be classified into different groups depending on their composition and particle size. Non-silica dusts and those composed of coarse grain silicates, such as kaolin and sand, have been used traditionally as grain protect ants by small-scale farmers in the developing countries. More recently, materials including diatomaceous earths and silica aerogels have been used increasingly in commercial storage in the developed countries, replacing conventional chemicals. These materials have been shown to control a variety of common storage insect pests. They are most effective in conditions of low humidity because they induce mortality by causing desiccation; water is lost because the dusts remove the waxy layer of the cuticle of the exoskeleton by adsorption. These materials are most effective when applied as dusts but some retain activity even when applied as water-based slurry. Modern dusts have overcome some of the health hazards resulting from inhalation, and concerns regarding abrasion of grain handling machinery are lessening. Synthetic dusts are effective in controlling primary pests of cereals and pulses, including larger grain borer. Thus, as well as being increasingly used in commercial farms, these materials may well replace conventional chemicals as protectants of stored grain in developing countries. In recent years, awareness of the consequences of environmental pollution, the increasing cost of storage insecticides and the growing problem of insect resistance has led to pest management. Unlike conventional contact insecticides, inert dusts function through their physical properties and are, therefore, generally slower acting. Insect mortality is induced primarily as a result of desiccation: water loss is a consequence of the destruction of the cuticle. Silica aerogels adsorb the waxy particles from the cuticle surface and although diatomaceous earths, having small dense particles of silicon dioxide, were said to abrade the cuticle they also function by adsorption of wax. However, silica aerogels are more effective than diatomaceous earths or other inert dusts, retaining their activity even at elevated levels of relative humidity. Because the action of these materials is not dependent on metabolic pathways, it has been postulated that insects will not be selected genetically by the action of these dusts, so that





physiological resistance will not occur. Nevertheless, it may be possible for insects to develop a behavioural response to the dust and avoid contact. Another advantage over conventional insecticides is the low mammalian toxicity of these materials. In the USA, diatomaceous earths are 'Generally Recognized as Safe' by the US Food and Drug Administration and are registered for use as food additives.

**Keywords:** Inert dusts, pulses, desiccation, protectants, stored product insects.

### **EFFECT OF INORGANIC NUTRIENTS, ORGANIC MANURE AND BIOFERTILIZER ON YIELD AND QUALITY OF WHEAT IN UTTAR PRADESH**

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The current experiment on wheat crop was conducted in the farm of C.S. Azad University of Agriculture and Technology, Kanpur during the Rabi season of 2015-16. The doses of experiment were half of the soil test recommendation, recommended doses are as follows, the half of the recommended doses are 75%, 100% and 125% of soil test recommendation, the recommended doses of N<sub>2</sub>, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O are 75%, 37.5% and 12t/ha FYM an Azotobacter respectively. The results showed that the grain yield ranged from 39.21 to 48.51 q/ha and straw yield from 48.09 to 63.28 q/ha. The N content in grain varied from 1.189% to 1.392%, P from 0.328% to 0.386%, K from 0.218% to 0.317% respectively. It was noted that N content in straw ranged from 0.210 to 0.245% , 0.905 to 1.214% and K ranged from 1.23% to 1.52% was noted that the N uptake ranged from 41.24 to 89.35 kg/ha, P from 11.02 to 22.79 kg/ha, K ranged from 7.23 to 18.92 kg/ha. The starch content varies from 61.68% to 67.32%, amylose from 32.44 to 36.50% and amylopectin from 31.52 to 37.32%. The treatment (125%STR + FYM + Azotobacter) gave the best result in terms of nutrient uptake values and crop quality.

### **ROLE OF ICT IN IMPROVING FARM PRODUCTIVITY**

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Access, efficiency and affordability of agricultural information continue to be a major impediment for raising agricultural productivity among smallholders in India. Recently Information and communication technology (ICT) has provided a possible pathway to ameliorate this scenario. A variety of innovations that integrate ICTs into the dissemination of agricultural information to farmers have been developed at local, national and regional levels. Information and communication technology (ICT) have the potential to provide solution to the existing information irregularity in various lagging sectors like agriculture. India's agricultural sector suffers from low growth rates and low productivity. ITC may play an important role in belief and confidence required to influence the adoption of new approach and actions by small farmers. Increased public and private investments will be necessary to bridge the vital infrastructural gaps. Policy changes may also be needed to encourage better access to high-quality inputs and credit for small farmers.

**Keyword:** ICT, Farmer, Farm, Productivity.

### **CONSERVATION AGRICULTURE FOR IMPROVING PRODUCTIVITY –PROSPECT, CONSTRAINTS AND RESEARCH NEED IN INDIAN CONTEXT: A REVIEW**

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Conservation agriculture (CA) is a sustainable agriculture production system comprising a set of farming practices adapted to the requirements of crop and local conditions of each region. Whose forming and soil management techniques protect the soil from erosion and degradation, improve its quality and biodiversity and contribute to the preservation of the natural resources, water and air, while optimizing yields. Worldwide, conservation agriculture plays a vital role in sustainable agricultural production. Even after realizing the full potential of irrigation, a major part of the farming areas in most of the countries will remain rainfed. Land holdings of poor, small and marginal farmers are mostly dependent upon rainfall. Rainfed areas have, assumed great importance for adequate and equitable food and livelihood security of the increasing population of the country like India. Land degradation is another threat to our food and environmental security. Almost 150 million hectare land is degraded due to erosion, water-logging and salinization. The pace of soil erosion accelerates with increasing slope percentage. Tillage practice in modern agriculture of developed countries had most concern to sustain production in conservation of natural resources. Recycling of crop residues, growing crops of high volume biomass, change in cropping pattern, agro-forestry, Silviculture are the some of the modules in CA. Annually 400 m ha m water is available through rainfall, out of which 75 m ha m water is lost in erosion and courtly facing problem for drinking water, Industrial use and very limited water (30%) is available for irrigation. Harvesting of water in-situ and collecting through various mechanical measures and use of it for at least one protective irrigation during entire life spell needs at most attention in CA. Crop management in changing weather and efficient utilization of bio-diversity to develop ideal plant genotypes for biotic and abiotic stress tolerance is another challenge in CA. India is a rich country for natural resources like soil, water, climate and plant diversity. Climate, soil, water and energy are key inputs



in agriculture production. CA is an approach to managing agro-ecosystem for improved and sustained productivity, increased profits and food security while preserving and enhancing the resource base and the environment through the applying of three CA principles-

1. Continuous minimum mechanical soil disturbance.
2. Maintains of permanent soil cover.
3. Crop system diversity, Crop rotations.

CA principals are universally applicable to all agriculture land scapes and land uses with locally adopted practices. CA enhances biodiversity and natural biological process.

### SCOPE OF NANOTECHNOLOGY IN PEST MANAGEMENT

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Nanotechnology is a promising field of interdisciplinary research. It opens up a wide array of opportunities in various fields like medicine, pharmaceuticals, electronics and agriculture. The potential uses and benefits of nanotechnology are enormous. These include insect pests management through the formulations of nano-material based pesticides and insecticides, enhancement of agricultural productivity using bioconjugated nanoparticles (encapsulation) for slow release of nutrients and water, nanoparticle-mediated gene or DNA transfer in plants for the development of insect pest resistant varieties and use of nanomaterials for preparation of different kinds of biosensors, which would be useful as remote sensing devices required for precision farming. Traditional strategies like integrated pest management used in agriculture are insufficient, and application of chemical insecticides like DDT have adverse effects on animals and human beings apart from the decline in soil fertility. Therefore, nanotechnology would provide green and efficient alternative for the management of insect pests in agriculture without harming the nature.

**Keywords:** Nanotechnology, nanoparticles, encapsulation, pest management.

### EFFECT OF NUTRIENT MANAGEMENT OPTIONS FOR STRVS IN DROUGHT PRONE SITUATIONS

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Natural organic biomass burning creates black carbon which forms a considerable proportion of the soil's organic carbon. Biochars can be produced by 'baking' organic matter under low oxygen ('pyrolysis'). The quantities of key mineral elements within these biochars can be directly related to the levels of these components in the feedstock prior to burning. Their incorporation in soils influences soil structure, texture, porosity, particle size distribution and density. The molecular structure of biochars shows a high degree of chemical and microbial stability. A key physical feature of most biochars is their highly porous structure and large surface area. This structure can provide refugia for beneficial soil micro-organisms such as mycorrhizae and bacteria, and influences the binding of important nutritive cations and anions. This binding can enhance the availability of macro-nutrients such as N and P. Other biochar soil changes include alkalisation of soil pH and increases in electrical conductivity (EC) and cation exchange capacity (CEC). Ammonium leaching has been shown to be reduced, along with N<sub>2</sub>O soil emissions. There may also be reductions in soil mechanical impedance. The physical properties of biochar are key to understanding the way biochar functions within soil and its potential to act as a route to sequester atmospheric carbon dioxide. Incorporation of biochar can influence soil structure, texture, porosity, particle size distribution and density, thereby potentially altering air oxygen content, water storage capacity and microbial and nutritional status of the soil within the plant rooting zone. It is also apparent that the soil water regime can itself modify biochar stability depending on the initial properties of the feedstock used. Biochars produced at lower temperatures and from more labile feedstock are more easily altered. Differences in biochar particle size however over the range of 2 mm to 20 mm do not. At least in some studies appear to have significant influence on crop yields. Biochar is a carbonaceous material which contains polycyclic aromatic hydrocarbons with an array of other functional groups.

**Keywords:** STRVS, Biochar, Drought stress, CEC

### SMART BREEDING: A NEW PLATFORM FOR CROP IMPROVEMENT

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"Stuart breeding", sometimes also called "clever breeding" or "precision breeding". Stands for methodical alternatives to genetic engineering in modern plant breeding. Classical methods - such as crossbreeding of different parent varieties and subsequent selection of progeny - are combined with novel molecular biological approaches. Smart breeding uses molecular-biological methods (e.g. Gene mapping, mutagenesis) to characterize initial plants with desirable breeding properties. Methods of vegetable tissue culturing and subsequent regeneration of intact plants essentially reduce the steps among classical crossbreeding, selection of desirable breeding results and subsequent propagation. The breeding targets, such as e.g. Resistance to diseases and pest infestation, stress tolerance (e.g. Against dryness, salt, heat) or changed components (e.g. Fatty acid pattern) are lastly achieved by



means of classical breeding, i.e. By combination of suitable parent varieties, thus leading to useful, not genetically engineered plants.

**Keywords:** Stuart breeding , clever breeding , crop improvement

## **PROBLEM AND STRATEGIES OF SUMMER VEGETABLE CULTIVATION IN INDIA**

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Warm-season vegetables are most easily damaged by cold temperatures. For this, they are planted outdoors only after the last chance of frost in the spring. Many vegetables require a long growing season to produce fruit and need to be planted as soon as possible to avoid effects of extreme heat in summer. For warm season vegetables, hot conditions are favored for fruit development but restrict flowering and pollination. Vegetable crops are very sensitive to climatic vagaries and sudden rise in temperature at any phase of crop growth can affect the normal growth, flowering, pollination, fruit development. High temperatures can cause significant losses in tomato productivity due to reduced fruit set, and smaller and lower quality fruits. In pepper, high temperature exposure at the pre-anthesis stage did not affect pistil or stamen viability, but high post-pollination temperatures inhibited fruit set. Development of genotypes tolerant to high temperature, moisture stress through conventional, non-conventional breeding techniques, genomics and biotechnology etc. are essentially required to meet summer challenges. Summer vegetable cultivation includes water conservation, increase water absorption, reducing the loss of soil moisture, mulching, use of drip irrigation facilities and use of growth regulators and chemicals. Variety requirements for summer season cultivation are short-stemmed varieties with limited leaf surface minimize transpiration, deep, prolific root systems enhance moisture utilization and quick-maturing varieties are important.

**Keywords:** Summer Vegetables, India, Problem, Strategies.

## **APOMIXIS IS EFFECTIVE STRATEGIES FOR CROP IMPROVEMENT**

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Apomixis is a genetically controlled reproductive process by which embryos and seeds develop in the ovule without female meiosis and egg cell fertilization. Apomixis produces seed progeny that are exact replicas of the mother plant. The major advantage of apomixis over sexual reproduction is the possibility to select individuals with desirable gene combinations and to propagate them as clones. In contrast to clonal propagation through somatic embryogenesis or in vitro shoot multiplication, apomixis avoids the need for costly processes, such as the production of artificial seeds and tissue culture. It simplifies the processes of commercial hybrid and cultivar production and enables a large-scale seed production economically in both seed- and vegetatively propagated crops. In vegetatively reproduced plants (e.g., potato), the main applications of apomixis are the avoidance of phytosanitary threats and the spanning of unfavorable seasons. Because of its potential for crop improvement and global agricultural production, apomixis is now receiving increasing attention from both scientific and industrial sectors. Harnessing apomixis is a major goal in applied plant genetic engineering. In this regard, efforts are focused on genetic and breeding strategies in various plant species, combined with molecular methods to analyze apomictic and sexual modes of reproduction and to identify key regulatory genes and mechanisms underlying these processes. Also, investigations on the components of apomixis, i.e., apomeiosis, parthenogenesis, and endosperm development without fertilization, genetic screens for apomictic mutants and transgenic approaches to modify sexual reproduction by using various regulatory genes are receiving a major effort. These can open new avenues for the transfer of the apomixis trait to important crop species and will have far-reaching potentials in crop improvement regarding agricultural production and the quality of the products.

**Keywords:** Asexual reproduction , Apomixis Meiotic mutants ,Apomeiotic mutants ,Genetic screening, Fertilization-independent seed mutants

## **THE ROLE OF ICT IN INDIAN AGRICULTURE**

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21st Century we are faced new emerging problem of global food demand and exceeding the Earth's carrying capacity with the current way of agricultural production. Given the challenges, the arrival of information communication technology (ICT) is well timed. The benefits of the green revolution greatly improved agricultural productivity. However, there is need of demonstrable a new revolution that will bring lower prices for consumers through reduced waste and more-efficient supply chain management contribute to "smart" agriculture, and incentivize farmers to increase their production. Major impact are to empower poor farmers with information and communication assets and services that will increase their productivity and incomes as well as protect their food security and livelihoods and to harness ICTs effectively used to compete in complex, fast changing global market. An innovative approach is to engage the private sector under public-private partnerships model. ICTs can help to prevent and reduce crop losses through well-planned investments and disaster warnings or timesensitive alerts. Water management and disease or pest prevention are crucial to increased productivity. Advances in ICTs such as GPS, GIS, mediation software, mobile phones and tracker, and satellite imagery have improved smallholders' ability to adjust farm strategies and reduce risk. At the same time, these advances allow governments and their agency development partners to better monitor farm productivity, make more



accurate projections, and plan better for the future. Using a variety of ICTs, producers can better identify, track, and protect their crops, animals, and livelihoods.

**Keyword:** Information communication technology (ICT), Smart agriculture, food security

### **INDIGENOUS TECHNICAL KNOWLEDGE IN AGRICULTURE**

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Traditional Knowledge refers to knowledge inherent in indigenous communities that has been passed to them from their ancestors. The knowledge could be of any type. It could be cultural knowledge, environmental knowledge, and medicinal knowledge and so on. The protection is afforded to Traditional Knowledge with the objective of rewarding the indigenous community for preserving such knowledge and to encourage development and utilization of such knowledge for public good. The term indigenous technical knowledge refers to unique, traditional, local knowledge existing within and developed around specific conditions of women and men indigenous to a particular geographic area. ITK is the information base for a society, which facilitates communication and decision making. Indigenous information systems are dynamic and are constantly influenced by internal creativity and experimentation as well as by contact with external systems. The term indigenous technical knowledge is often camouflaged with the belief that is associated with forthcoming happenings and innovations made by the farmers to solve specific problem. Many definitions have been proposed for indigenous technical knowledge (ITK) systems, but all of them are incomplete, because the concept is relatively new and still evolving. Literature in related fields uses various terms interchangeably to designate the concept of "traditional knowledge (TK)", "traditional ecological knowledge (TEK)", "traditional ecological knowledge and management systems (TEKMS)", "local knowledge (LK)": "indigenous knowledge (IK)", indigenous technical knowledge (ITK)", "community knowledge", "rural peoples knowledge" and "farmers' knowledge (FK)".

**Keywords:** ITK, IK, FK, TEKMS, LK, TEK,

### **RESOURCE CONSERVATION THROUGH LASER LEVELING OF AGRICULTURAL LAND: A REVIEW**

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Adopting climate-smart agricultural practices is essential to equip farmers against changing weather patterns and depleting natural resources. Declining water table and degrading soil health are the major concerns for sustainability of Indian agriculture. Thus, there is need of judicious use of natural resources including conservation of irrigation water through various on-farm water management practices. Land leveling has a major impact on the germination, stand and yield of crops through nutrient water interaction as well as salt and soil moisture distribution pattern. A level soil surface is essential for equal & uniform distribution of irrigation water to the every part of the field. Resource conserving technologies perform better on well leveled fields. Laser controlled leveling technology is currently the best method to grade a field. It is a precision leveling technique used for achieving very fine leveling with desired grade on the agricultural field. It maintains the grade by automatically performing the cutting-filling for leveling operations. The field is cultivated and planked before using the laser land leveler. A grid survey is performed using grade rod to identify high and low spots in the field and mean grade is found. A grid spacing of 10m x 10m is maintained for accurate land survey; however this spacing can be varied depending upon the size of the field. A map is then drawn to identify which areas are high; require soil to be cut and the lows which require soil to be added. Study indicated that, it facilitated optimization of water use efficiency, better crop establishment, less time and water required in irrigation, less effort in crop management, less weed problems, uniformity in crop maturity, easy land preparation, less water requirement for land preparation, reduced consumption of seeds, fertilizers, chemicals and fuel, increase in farming area, assist top soil management, saves fuel/electricity used in irrigation, more uniform moisture environment for crops, good germination and growth of crop, minimizes run-off and water-logging ensuring that farmers use just as much water they need in the optimal way. Use of laser levelers over traditional land levelers reduces emission of greenhouse gases from saving energy through decreased water pumping, reduced cultivation time and better use of fertilizers. Thus, efforts should be made to aware and motivate the farmers for precise leveling of fields using laser leveler for optimization of water, nutrient as well as pesticide use efficiency and crop productivity for higher incomes of farmers.

**Keywords:** Laser leveler, land leveling, Resource conservation, water distribution, water use efficiency

### **AGRI-ENTREPRENEURSHIP DEVELOPMENT THROUGH HORTICULTURE**

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India is known for producing variety of horticultural crops which covers a wide range of fruits, vegetables, tuber crops, flowers, spices, medicinal and aromatic plants. The demand for food is growing while the land and water resources are becoming more scarce and degraded with time. The consumption pattern is also changing which is resulting in increase in demand as well as export opportunities for horticultural crops. Horticulture sector has a potential to absorb and employ huge chunk of unemployed population. In the present situation, farmers are required to develop themselves as entrepreneurs for deriving greater benefits. The new generation of educated farmers and unemployed rural youth has an opportunity to become entrepreneur and adopt horticulture as a business enterprise. Protected cultivation of horticultural crops offers distinct advantages of productivity, quality and





premium market price to the growers. As a result, there has been an increase in area under protected cultivation of different horticultural crops, primarily under vegetables and flower crops. Growers can substantially increase their income by protected cultivation of vegetables in off-season as the vegetables produced during their normal season generally do not fetch good returns due to large availability of these vegetable in the markets. Off-season cultivation of cucurbits under low plastic tunnels is one of the most profitable technologies under northern plains of India. Walk-in tunnels are also suitable and effective to raise off-season nursery and off-season vegetable cultivation due to their low initial cost. Insect proof net houses can be used for virus-free cultivation of tomato, chilli, sweet pepper and other vegetables mainly during the rainy season. These low cost structures are also suitable for growing pesticide-free green vegetables. Low cost greenhouses can be used for high quality vegetable cultivation for long duration (6-10 months) mainly in peri-urban areas of the country to fetch commensurate price of produces. Poly-trenches have proved extremely useful for growing vegetables under cold desert conditions in upper reaches of Himalayas in the country. Besides, other entrepreneurial ventures are quality seed production in net house, plug plant production, production of off-season leafy greens etc.

## **FARMING SYSTEMS TYPOLOGY AND USE OF QUANTITATIVE ANALYSIS TOOLS/MODELS IN FARMING SYSTEM ANALYSIS**

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A farm is conceived as a management unit consisting of a large array of interrelated components of various types. The planning of mixed farming systems with an array of crops, various animal types and a diverse range of other resources is complicated, since it involves many management decisions on resource allocation (Russelle *et al.*, 2007). Traditionally, farmers depend on traditional methods, such as, instinct and experience, and comparisons with neighbors in order to make decisions about which commodities to produce and in what quantities. This does not guarantee optimal crop patterns (Alsheikh and Ahmed, 2002) as these choices and their resulting outcomes are subject to a large range of objectives and constraints. There exists a chain of interactions among the components within the farming systems, and it becomes difficult to deal with such inter-linking complex systems manually. This problem could be overcome by construction and application of suitable whole farm models. Optimization techniques, such as linear programming and compromise programming, fuzzy linear programming, etc. are useful tools for efficient resource allocation under various constraints. Model-based support can be useful in various hierarchically structured planning windows. Farming system typology involves grouping farming systems in terms of their resources and livelihood activities, as well as agricultural management practices, which can be used for planning agricultural interventions. Farming system typologies can be used to explore and assess the possible impact of climate shocks and alternative technological interventions on food security of farm households (Santiago *et al.*, 2017). Recently, various tools have been developed and applied for integrated farming system analysis (Andrieu and Nogueira, 2010; Le Gal *et al.*, 2010; Del Prado *et al.*, 2011) and for the exploration of strategic improvements in farming systems (Groot *et al.*, 2007; Tittonell *et al.*, 2007a, 2007b; Vayssières *et al.*, 2010). Groot *et al.*, (2012) described about Farm DESIGN tool, which supports evaluation and re-design of mixed farming systems in tactical planning processes and supported the analysis of problems in the original farm configuration and indicated avenues for adjustments of the configuration to improve farm performance in terms of various objectives. Farm Design tool was utilized to explore the opportunities for improvement in existing IFS model with the objective of enhancing economic profit, increasing organic matter balance within the land and labour constraint situations. Relatively small modifications in the farm configuration through optimization may result in considerable improvement of farm performance.

