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# World Food and Agriculture Conference

April 15 - 17, 2019 New Delhi, India



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# **World Food and Agriculture Conference**

**April 15 - 17, 2019 New Delhi, India**

**Scientific Abstracts**

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## Effect of Nk Fertilizers On Growth Of Crossandra (*Crossandra Infundibuliformis L.*) and Nk Content in Soil After Harvest

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The effects of nitrogen fertilizer (0, 50, 100, 150 kg/ha) and potassium fertilizer (0, 60,120,180 kg/ha) applied in 30 DAT, 90 DAT and 150 DAT and 210 DAT on Crossandra were studied at college of Horticulture, Venkataramannagudem to observe the impact of nitrogen and potassium on plant growth, nitrogen & potassium content in soil after harvest. Plant height (38.06 cm), number of branches (5.85), plant spread (183.88cm<sup>2</sup>), number of leaves (103.74), leaf area (674.97 cm<sup>2</sup>), spike length (8.41cm), spike girth (3.93 cm), number of spikes/plant (36.39) were highest with 150 kg nitrogen + 60 kg potassium/ha treatment. The application of 150 kg N/ha + 180 kg K/ha recorded the highest nitrogen content (271.33 kg/ha) and potassium content (377.23 kg/ha) in soil after harvest.

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## Development of Rapid and Novel Method for Detection of Insect Infestation During Storage of Wheat and Maize Using Dielectric and Thermal Properties

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Effective detection of insect infestation and control will protect the grains and contain post-harvest losses. Manual sieving method is the most prevalent method to detect the level of infestation. Since human intervention is involved. This method is laborious, need skilled manpower and susceptible to variation. Which affect the insect control process this lead to much storage loss. To predict or detect the level of infestation, various advanced techniques are being explored and most of them are in the research stage. With this purview, a study has been under taken to explore the possibilities of using thermal and dielectric properties for the detection of level of infestation. The thermal properties are measured using a KD2 Pro Thermal Properties Analyzer. And an experimental compaction setup was designed and fabricated especially to measure the dielectric properties with help of LCR meter. The experimental design was made with full factorial design with 10 replications. The level of significance was evaluated with the help of multivariate ANOVA. Partial least square regression (PLS) was employed to develop a model for predicting level of insect infestation in the grains with the identified parameters. All these statistical analysis were done using SPSS.

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## Evaluation of open pollinated families for Early Growth Traits in *Gmelina arborea* Roxb. ex Sm.

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*Gmelina arborea* is one of the medium to large sized tree belongs to family Lamiaceae. It is suitable for general utility purposes mainly light construction, structural works and general carpentry. Therefore, its wood can be used for a variety of purpose. Due to its enormous implication study of open pollinated families for early growth traits was carried out in *G. arborea* to capture better performing families from Western Ghats of Karnataka, India. Significant variation observed in open families from the Karnataka viz., Honnavar, Katgal, Sirsi and Coorg for early growth attributes. The maximum seedling height (47.76 cm and 82.23 cm) and number of leaves (7.65 and 8.57) were observed at 30 DAP and 180 DAP in Sirsi population and collar diameter (3.27 mm and 6.42 mm) at 30 DAP and 180 DAP in Coorg and Katgal population and survival per cent 99.56 and 90.67 in Coorg and Honnavar population. However least growth traits were recorded for seedling height (42.00 cm and 75.53 cm) at 30 DAP and 180 DAP in Honnavar and Katgal population. Whereas minimum collar diameter (2.96 mm and 6.18 mm) and number of leaves (6.37-7.27) were recorded at 30 DAP and 180 DAP in Katgal population, while minimum survival percentage (99.56 %) and 89.33% were recorded in Sirsi population. The seedling height has strong genetic influence. Therefore studies on open pollinated families for early growth attributes showed wide variation which might be due to variability of site. Hence, these kinds of variations could be captured and utilized for further tree improvement programme of *G. arborea* in Karnataka state of India.

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## Assessment of yield losses due to shoot and fruit borer, *Eariasvittella*(Fab.) in okra

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An experimentation was done to observe the efficacy of some insecticides against shoot and fruit borer, *Eariasvittella*(Fabricius) of okra during *kharif* season 2016 at the Horticulture farm, Department of Horticulture, College of Agriculture, Indira Gandhi Krishi Vishwavidyalaya (IGKV) Raipur, Chhattisgarh. The insecticidal treatments BAS 450 01 I 300 SC @18.5g.a.i./ha was found to be most effective as it recorded minimum fruit damage (14.29%) followed by Chlorantraniliprole 18.5% SC @25g.a.i./ha (15.68%). BAS 450 01 I 300 SC @12.5g.a.i./ha (16.33%) and BAS 450 01 I 300 SC @6.5g.a.i./ha (18.74%) was found statistically on par with each other, followed by Cypermethrin 10% EC @ 70g.a.i./ha (21.14). Maximum healthy fruit yield recorded from the treatment BAS 450 01 I 300 SC @18.5g.a.i./ha (155.99 q/ha), followed by Chlorantraniliprole 18.5% SC @25g.a.i./ha (155.10q/ha), Cypermethrin 10% EC @70g.a.i./ha (154.99q/ha)

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## Dry Spell Analysis for Different Districts of Chhattisgarh State (India)

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**T**rend analysis of dry spell in in different districts has been divided in two parts i.e. Less than critical value and more than critical value, Mann-Kendall test has been applied to understand the significance of dry spell. Dry spell analysis was found that Balodabazar, Bilaspur, Dhamtari, Jashpur, Mahasamund, Raigarh and Raipur Districts showed the negative significantly negative trend with 1% significant level for Highest spell, Total spell and Total days into < Critical value. Most of districts showed the negative trend of highest spell in less than critical value. Than similarly Bilaspur, Gariaband, Dhamtari, Jashpur, Mahasamund and Raigarh showed significantly 1% level for positive significant Highest spell, Total spell and Total days  $\geq$  Critical value.

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## Performance Evaluation of Subsurface Drainage System in Agricultural Research Station Malnoor Under Upper Krishna Command

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A study was conducted to ensure the impact of subsurface drainage system on salt affected soils in the UKP command area, Karnataka. The mean pH of samples ranged from 8.21 to 8.71 before sowing to 8.58 to 8.95 after harvesting, before sowing the electrical conductivity ranged from 8.84 to 12.09 dS m<sup>-1</sup> and after harvesting 7.25 to 12.06 dS m<sup>-1</sup>. Similarly, the Ca<sup>2+</sup>+Mg<sup>2+</sup>, Na<sup>+</sup> and K<sup>+</sup> values were in the range of 34.68 to 39.76, 7.80 to 10.92 and 0.12 to 0.16 Meq/100g before sowing of crops, after harvesting of the crops results obtained were in range of 34.44 to 37.62, 7.10 to 9.40 and 0.20 to 0.27 Meq/100g. The ESP values were in the range of 17.99 to 21.45 before sowing and 17.07 to 19.90 after harvesting of crop. The drain discharge was observed with an weighted average discharge of mains was 0.50 mm d<sup>-1</sup> and 0.44 mm d<sup>-1</sup> for the laterals. The ionic composition of leachate was dominated by sodium, while the anionic concentration of leachate was dominated by chlorides and bicarbonates. The salinity of leachate with mean EC of 9.68 dS m<sup>-1</sup> in collector mains and 9.44 dS m<sup>-1</sup> in laterals. The total amount of salt removes was observed to be 3.22 and 5.20 t during the study period. The water table in between the laterals followed elliptical pattern with its position deeper directly over the SSD lateral line (21.7-24.3 cm, bgl) compared to water table nearer to the ground level at the centre (11.2-13.3 cm, bgl) at L/2 and 2L/3 positions. The *in-situ* hydraulic conductivity with average of 0.067 m d<sup>-1</sup> before sowing, and improved slightly (14.92%) after the harvesting to 0.077 m d<sup>-1</sup>. The geometric mean estimates of areal hydraulic conductivity obtained with 90 per cent confidence limits ranged from 0.69 to 1.280 m d<sup>-1</sup> (K) and 0.88 to 1.620 m d<sup>-1</sup> (K<sub>p</sub>). Further, the areas estimates of K were far greater (15 to 16 times) than the *in-situ* measurements of K. The infiltration rate was very low due to considerable amount of clay (32-41%) and it improved slightly (by 5.45%) due to SSD system after the harvesting (2.90 mm h<sup>-1</sup>) compared to that before sowing (2.75 mm h<sup>-1</sup>). The B:C ratio, NPV, IRR and payback period were 1.55, Rs. 2,20,832, Rs.104 per cent and 2 for the life span of 50 years for SSD system. Finally the yield was observed to be 62.00 q ha<sup>-1</sup> as compare to pre drainage conditions of 42.01 q ha<sup>-1</sup>.

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## Cis-genesis role in sustainable crop improvement

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Cis-genesis is the genetic modification of a recipient plant with a natural gene from a crossable sexually compatible plant. Concept of cis-genesis introduced by Dutch researchers Schouten, Krens and Jacobsen. Cis-genesis is the production of genetically modified crops/plants using donor DNA fragment from the species itself or from a cross compatible species. The newly introduced gene is unchanged and includes its own introns and regulatory sequences and is free of vector DNA, except T- DNA border sequences that flank the cisgene. Application of cisgenic techniques enhances the possibility to introgress the preferred genes into the novel cultivars, without disturbing their favourable characteristics. Direct transfer of desired genes through cis-genesis into an existing variety without altering any of the properties is enviable for the consumers. In conventional hybridization programmes, there is linkage drag, where there is inheritance of thousands of unwanted genes to the progeny. Several backcrossed generations are required to get rid of such kind of undesired genes. Cis-genesis overcomes the problem of linkage drag, thus saves a lot of time. As though there are several advantages of cis-genesis, it also includes some of the disadvantages like less transformation efficiency, traits outside the sexually compatible gene pool cannot be introduced. Thus, if we expand our area of research towards cis-genic approach and if it has been exempted from the regulatory framework of GM technology it is anticipated that cis-genesis may wipe out the likely uncertain outcomes and the social beliefs that public have in their mind regarding GM technology. Therefore, cis-genesis will be playing an important role in sustainable crop improvement.

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## Factors Affecting the Perception of Paddy Growers towards Improved Production Technologies

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The present study was conducted during 2014-15 in Tungabhadra project area of Raichur district in Karnataka state to assess the association between personal, socio-economic, psychological and communication characteristics of paddy growers and their perception level regarding improved production technologies. One hundred and eighty paddy growers from Manvi and Sindhanurtalukas were interviewed using a pre-tested interview schedule. It was noticed that around 50.00 per cent of the paddy growers had high level of perception and high level of knowledge and 27.62 per cent of the farmers had medium levels of perception and knowledge. The chi-square test was applied to know the association and the value obtained was 21.04 which is highly significant at one per cent level indicating that perception and knowledge levels of paddy growers were closely associated with each other. Among 17 variables selected for the study, four variables namely annual income, achievement motivation, innovative proneness and mass media participation were found to be significantly associated with the perception level of paddy growers towards improved production technologies at five per cent level of probability. The remaining two variables namely, education and farming experience were found to be significantly associated with perception at one per cent level of probability.

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## Effect of spacing and periodical staggered nipping on *Botrytis* disease incidence and quality of castor (*Ricinus communis* L.)

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The field experiment was conducted during the *kharif* seasons of 2013 and 2015 at ZARS, University of Agricultural Sciences, Gandhi Krishi Vigyan Kendra, Bengaluru on red sandy clay loam soil to know the influence of periodical staggered nipping and spacing on *Botrytis* disease infestation and quality of castor. Nipping and different spacings in castor significantly influenced the disease incidence and castor oil yield. Periodical staggered nipping leaving one spike in each branch recorded lower *Botrytis* disease scoring (2.71) and chaffiness (6.43 %) as compared to non-nipping treatments. This treatment also recorded significantly higher oil content (44.34 %) and oil yield (7.75 q ha<sup>-1</sup>). Among the different spacing levels lower *Botrytis* disease scoring (3.17), chaffiness (11.61 %) and significantly higher oil content (44.29 %) were noticed with the spacing of 120 x 45 cm. Whereas, significantly higher oil yield was recorded in the spacing of 90 x 45 cm (6.91 q ha<sup>-1</sup>). Interaction effects between periodical staggered nipping and spacing were not significant.

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## Studies on different plant population and periodical staggered nipping on yield and economics of castor (*Ricinus communis*)

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Field experiment was conducted during the *kharif* season of 2013 and 2015 at ZARS, Gandhi Krishi Vigyan Kendra, University of Agricultural Sciences, Bengaluru on red sandy clay loam soil which was medium in available NPK, to evaluate the influence of periodical staggered nipping and spacing on growth, yield and economics of castor production. The experiment on response of castor to staggered nipping and spacing was laid out in factorial RCBD design with three replications and nine treatment combinations. Nipping and different spacings in castor significantly influenced the seed yield and net returns. Periodical staggered nipping leaving one spike in each branch recorded significantly higher seed yield (17.47 q ha<sup>-1</sup>) and net returns (₹35,979 ha<sup>-1</sup>) as compared to non-nipping treatments. The same treatment also recorded significantly reduced infestation of *Botrytis* disease (2.71) and chaffiness (6.43 %). Among the different spacing levels significantly higher seed yield and net returns were obtained with the spacing of 90 x 45 cm (15.67 q ha<sup>-1</sup> and ₹31,105 ha<sup>-1</sup>, respectively). The interaction effects between nipping and spacings were non-significant.

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## **Influence of protective irrigation, nipping and chilli intercropping on yield, economics and disease incidence of castor (*Ricinus communis*)**

**SUNIL KUMAR, K and H.S. SHIVARAMU**  
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Field experiment was conducted during the *kharif* season of 2013 and 2015 at ZARS, Gandhi Krishi Vigyan Kendra, University of Agricultural Sciences, Bengaluru on red sandy clay loam soil which was medium in available NPK, to evaluate the influence of periodical staggered nipping, intercropping of chilli and protective irrigation on growth, yield and disease incidence of castor production. Experiment on protective irrigation, nipping and intercropping of chilli in castor was laid out in factorial RCBD with twelve treatment combinations and replicated thrice. Protective irrigated castor recorded significantly higher seed yield (17.76 q ha<sup>-1</sup>) and net returns (₹ 55,702 ha<sup>-1</sup>) compared to rainfed castor. Nipping leaving one spike in each branch recorded significantly higher seed yield (20.49 q ha<sup>-1</sup>), net returns (₹ 65,439 ha<sup>-1</sup>) and reduced *Botrytis* disease (2.53) and chaffiness (6.36 %). Intercropping of chilli in castor recorded significantly higher castor equivalent yield (27.74 q ha<sup>-1</sup>) and net returns (₹ 60,043 ha<sup>-1</sup>) compared to sole castor. The interaction effects between protective irrigation, nipping and chilli intercropping were not significant.

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## Constraints in the Adoption of Indigenous Technical Knowledge In Agriculture

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Indigenous Technical Knowledge refers to the knowledge of indigenous people as well as any other defined community. It is dynamic and not static, as the word 'traditional' community implies that it is used synonymously with 'traditional and local knowledge' to differentiate the knowledge developed by a given community from the international knowledge systems. The farmers are facing several constraints in adoption of Indigenous Technical Knowledge kept in their order of magnitude under each heading. Bio-physical Constraints are Poor water retention capacity of the soils, soil fertility variation and appearance of periodic drought spells the major constraints in agriculture in order of magnitude respectively. followed by Thematic Constraints like High cost of neem products was the major constraint in agriculture. Whereas Micro Level Constraints like Farmer's traditional belief was the major constraint in agriculture followed by poor economic status of the farmers, farmers are not willing to take risk and illiteracy. While Technological Constraints Lack of proper technology for Integrated Pest Management was the major technological constraints in agriculture, followed by lack of sufficient number of bio-gas plants for preparation of slurry as a organic manure. Lack of technology on vermicompost preparation, lack of short duration varieties, lack of sound research and development on ecological farming practices, lack of availability of bio-fertilizer such as blue green algae, azolla, rhizobium, azospirillum etc., lack of pest and disease resistant varieties and lack of technology on green manure / green leaf manure methods were the other constraints

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## Carbon farming can help solve climate change

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Under the 2015 Paris agreement, nations pledged to keep the average global temperature rise to below 2C above preindustrial levels and to take efforts to narrow that increase to 1.5 c. to meet those goals we must not only stop the increase in our green house gas emissions, we must also draw large amounts of carbon dioxide (CO<sub>2</sub>) from the atmosphere. The simplest, most cost effective and environmentally beneficial way to do this is right under our feet. we can farm carbon by storing it in our agricultural soils. Soils are traditionally rich in carbon .they can contain as much as five per cent carbon by weight, in the form of soil organic matter- plant and animal matter in various stages of decomposition. But with the introduction of modern agricultural techniques, including the plow, soil organic matter content has dropped by half in many areas of the world, including parts of Canada. that carbon once stored in the ground, is now found in the atmosphere and ocean as CO<sub>2</sub> and is contributing to global warming. The organic compounds found in soil are the glue that hold soil particles together and help give the soil structure. like the walls of a building, this structure creates openings and passage ways that allow the soil to conduct and store water, contain air, resist soil erosion and provide a habitat for soil organisms. Plowing breaks apart soil aggregates and allows microorganisms to eat the soil organic compounds. In the short-term, the increased microbial activity releases nutrients, boosting crop productivity. in the long term the loss of structure reduces the soil ability to hold water and resist erosion. ultimately crop productivity drops.

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## The Impact of Bt Cotton on Poor Households in Rural India

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Several recent studies have analysed the impact of genetically modified (GM) crops on farm productivity in developing countries many of studies focused on insect-resistant *Bacillus thuringiensis*(Bt) crops, especially Bt cotton, because this technology has been adopted already by millions of small-scale farmers around the world, including in China, India, South Africa, Mexico, and Argentina. The available evidence shows that the concrete impacts vary seasonally and regionally, according to the underlying agro-ecological and socioeconomic conditions. On average, farmers growing Bt cotton benefit from insecticide savings, higher effective yields through reduced crop losses and net revenue gains, in spite of higher seed prices The impact of genetically modified (GM) crops on the poor in developing countries is still the subject of controversy. While previous studies have examined direct productivity effects of *Bacillus thuringiensis*(Bt) cotton and other GM crops, little is known about wider socioeconomic outcomes. Bt cotton adoption increases returns to labour, especially for hired female workers. Likewise, aggregate household incomes rise, including for poor and vulnerable farmers. Hence, *Bt* cotton contributes to poverty reduction and rural development. Hardly any previous research has been carried out on the wider socioeconomic outcomes of GM crops at the micro level in developing countries. The resulting knowledge gap has contributed to uncertainty and to overly precautionary attitudes in research and regulatory policies. Our results for Bt cotton in India cannot simply be generalised to other examples, because impacts always depend on the concrete technology and institutional framework. Nonetheless, the fact that GM crop applications can help reduce poverty as such has wider implications and might further the debate about the role of agricultural biotechnology for sustainable development.

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## Global Warming and its Impact on Agriculture

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Global warming is the ‘talk of the town’ in this century, with its detrimental effects already being brought to limelight by the recurring events of massive floods, annihilating droughts and ravaging cyclones throughout the globe. ‘Global warming is as an increase in the average temperature of the earth’s atmosphere, especially a sustained increase great enough to cause changes in the global climate’. Climate is one of the main determinants of agricultural production. Throughout the world there is significant concern about the effects of climate change and its variability on agricultural production. India is one of the most important countries in the world with regard to climate change sources and impacts. With a large and growing population, India’s emissions of greenhouse gases are increasing. Major causes for climate change are emission of greenhouse gases, deforestation, land use change, energy usage and vehicular usage. Human activities such as burning fossil fuels like coal, oil and natural gas are increasing the amount of carbon dioxide (CO<sub>2</sub>), the main greenhouse gas responsible for global warming. India’s share of CO<sub>2</sub> in the total emissions in the world is very insignificant in per-capita terms. The per-capita emission of an Indian citizen is 1.18 tons of Carbon dioxide whereas his counterpart in USA contributing 19.1 tons. In some study revealed that, in all rain fed crops yield reduction was very high to the extent of 59.96 per cent in cotton crop since it is a sensitive crop to drought, followed by wheat, sorghum and groundnut to the extent of 48.68 per cent, 43.03 per cent and 34.09 per cent respectively. In case of in maize only 14.09 per cent of yield reduction was registered. Agricultural sector emitted 371.7 Mt of CO<sub>2</sub> eq. comprising 13.84 Mt of CH<sub>4</sub> and 0.227 Mt of N<sub>2</sub>O. Enteric fermentation constituted 61 per cent of the total CO<sub>2</sub> eq. emissions from this sector and 20 per cent of the emissions were from rice cultivation. Agricultural soils emitted 16 per cent of the total CO<sub>2</sub> eq. emission from agriculture (INCCA, 2010). The remaining 3 per cent of the emissions are attributed to livestock manure management and burning of crop residues in field. Global warming is a reality and its affects have been intensifying day by day. Many reports revealed that Indian agriculture has affected significantly by climate change especially most visible results are seen in case of maize and cotton. Hence there is need for popularizing mitigating strategy which includes agronomic and strategic measures.

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## Sustainable Agriculture and Livelihood Security in India

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Sustainable agriculture is farming in sustainable ways (meeting society's food and textile needs in the present without compromising the ability of future generations to meet their own needs) based on an understanding of ecosystem services, the study of relationships between organisms and their environment. Sustainable agricultural practices are intended to protect the environment, expand the Earth's natural resource base, and maintain and improve soil fertility, promote environmental stewardship. Enhance quality of life for farm families and communities. Increase production for human food and fiber needs. As demand for food increase and climate change and ecosystem degradation impose new constraints, sustainable agriculture has an important role to play in preserving natural resources, reducing greenhouse gas emissions, halting biodiversity loss and caring for valued landscapes. Sustainable agriculture, its roles in rural livelihood security, and major issues in sustainable agriculture. The majority of the people in India makes out their existence directly or indirectly from farm related economic activities because agriculture is an integral part of everyday life in Indian sub-continent, not only for it employs about 70 percent of workforce of the country, but also for it provides food to the population, raw materials for the industries, wood for fuel and shelter, herbs for medicines, and above all means of sustenance and livelihoods. Agriculture sector for developing economies like India is primary source of livelihood in both farm and non-farm sectors and sustainability in agriculture sector means boosting up the rural livelihood system. Livelihood refers to adequate stock and flow of food and cash with an individual to meet their basic needs and livelihood security means secured ownership of, access to, resources and income earning activities, including reserves and assets to offset risk, ease shocks and meet contingencies. Sustainable agriculture and rural development are integral and necessary components of sustainable development. Sustainable agriculture involves all three pillars of development-economic, social and environmental. Agriculture and rural development are sustainable when they are ecologically sound, economically viable, socially just, culturally appropriate humane and based on a holistic scientific approach.

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## Advances in Genetic Engineering and Biotechnology for Improvement of Horticultural Crops

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The main problem of genetic improvement of most fruit crops is their long juvenile period. This problem further aggravates by selflessness, inter and intra specific incompatibility, high heterozygosity, sterility etc. Conventional breeding method of genetic improvement would not be a better option owing to its difficult, expensive and time consuming breeding techniques. Alternatively, non-conventional breeding method like recombinant DNA, a genetic engineering approach, is more precise in correcting the deficiencies in commercial cultivars or root stocks without disturbing their desirable genetic makeup. Transgenic plants develop through a number of gene delivery methods, the most common of which is *Agrobacterium* and particle bombardment mediated gene transfer. Generally, two tissue culture methods have been used for regeneration of transgenic plants: organogenesis and somatic embryogenesis. Genetic engineering technique has been used for resistance of a number of important diseases and pests. One successful example is transgenic papaya expressing coat protein of papaya ring spot virus (PRSV) against PRSV developing two cultivars 'Sun Up' and 'Rainbow'. Despite the usefulness of genetic engineering in many aspects, public of many countries are reluctant to adopt such technique on the ground of their risk to health and environment linked to the introduction of transgene into crop species of genetic material derived from alien organisms. To overcome the notorious aversion against transgenic, new genetic engineering approach, namely 'cisgenesis' and 'intrageneration' has been proposed. The acceptance of science-based approaches like cisgenesis or intrageneration or use of selection marker free transgenic will encourage confidence, and bring the benefits of GM-products to consumers.

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## Study of Heterosis for yield attributing characters in mungbean (*Vigna radiata* L. Wilczek)

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Studies of heterosis in 28 F1 hybrids obtained by crossing eight genetically diverse parents in a half diallel mating design generate information on “Heterosis in mungbean (*Vignaradiata* (L.) Wilczek)”. Eight parents, ML-131, BM-4, ML-5, Pusavishal, Malviyajyoti, Pairymung, K-851, TARM-1 hybridization was carried out. Between parent differing in agronomic and physiological traits were evaluated for various selected traits like 50% of flowering, plant height, primary branches per plant, number of cluster per plant, number of pod per plant, pod length, number of seed per pod, days of maturity, 100 seed weight and seed yield per plant. The cross ML-131 X TARM-1 exhibited highest seed yield per plant and high heterosis (17.01\*\*). On the basis of *per se* performance for seed yield per plant, five best high yielding identified hybrid are ML-5 x Malviyajyoti, Pusavishal x Malviyajyoti, ML-131 x ML-5, ML-5 x Pusavishal, ML-131 x K-851. Recurrent selection or biparental mating for branches per plant, number of pods per plant and seed yield should be recognized as the ideal breeding approach for mungbean improvement programme.

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## Performance of Carrier, Liquid and Foliar Biofertilizers on Sweet Pepper (*Capsicum Annum L.*)'

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The investigation was conducted at the Department of Agricultural Microbiology, IGKV, Raipur during 2017-18. The main objectives of the investigation was to study the isolation of foliar *Azotobacter* and *Azospirillum* isolates from sweet pepper leaf of different locations, characterization and screening of isolates for selecting most promising effective isolates in order to formulate foliar liquid biofertilizers with carrier in polyhouse grown sweet pepper. Treatments were T<sub>1</sub> uninoculated control, T<sub>2</sub> Lignite based *Azotobacter*+*Azospirillum*, T<sub>3</sub> Lignite based *Azotobacter*+*Azospirillum*+PSB, T<sub>4</sub> Liquid based *Azotobacter*+*Azospirillum*, T<sub>5</sub> Liquid based *Azotobacter*+*Azospirillum*+PSB, T<sub>6</sub> Foliar *Azotobacter*+*Azospirillum*, T<sub>7</sub> Foliar *Azotobacter*+*Azospirillum* and lignite based *Azotobacter*+*Azospirillum*+PSB, T<sub>8</sub> Foliar *Azotobacter*+*Azospirillum* and liquid based *Azotobacter*+*Azospirillum*+PSB, replicated 3 times in the Completely Randomised Design. 5 isolates of foliar *Azotobacter* and *Azospirillum* obtained from samples collected from Raipur and Durg districts of Chhattisgarh plains. Results revealed that application of different forms of biofertilizers improved crop growth and yield. The highest fresh fruit yield (1219 gm/plant), highest population density of these N fixers and N accumulation by fruit (2.02 g/plant) was from T<sub>8</sub> followed by T<sub>7</sub>, T<sub>6</sub>, T<sub>4</sub> and T<sub>5</sub>. Increasing population of foliar *Azotobacter* and *Azospirillum* was from 30 DAT to 45 DAT that decreased at later stages. Findings conclude that foliar *Azotobacter* and *Azospirillum* multiplies and persist on leaf of sweet pepper providing more use efficiency of BFAN to foliar inoculated crop resulting better performance and increased ecofriendly production of sweet pepper by liquid and lignite carrier based biofertilizer.

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## Trend Analysis of Extreme Rainfall Events in Chattisgarh State

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The observed trends in high rainfall events during southwest monsoon period and on annual basis under four categories viz., 25-50 mm, 50-75 mm, 75-100 mm and > 100 mm per day in different districts of Chhattisgarh was worked out and it is subjected to Mann-Kendall test of significance. Results indicated that there is generally no significant trend of changes in the events of 25-50 mm, 50-75 mm, 75-100 mm and more than 100 mm per day in most of the stations during southwest monsoon period. However, significant increasing trend in 25-50 mm category has been noted in Bemetara, Korba and Kondagaon districts. On annual basis, significant increasing trend is found in Kawardha district while Balodabazar, JanjgirChampa, Koriya, Surajpur showed significant decreasing tendency under 50-75 mm category. The trend in number of rainfall days under 75-100 mm category showed significant increasing trend in Bemetara and Mahasamund districts and significant declining trend is observed in JanjgirChampa, Kondagaon and Surajpur districts. It was concluded that the trend of rainfall will affect the water requirement in future. It is suggested that water saving practices or techniques for water conservation should be adopted and creating new drainage canals may assist the farming community to drain.

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## Effect of Bio Fertilizer on Rooting of Air Layered Plants of Guava (*Pisidiumguajava L.*)

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An investigation on “Impact of Indole butyric acid and bioinoculant on survivability of transplanted air layered plants of guava (*pisidiumguajava L.*) ” was undertaken in the Department of Horticulture, College of Agriculture, Gwalior, (M.P.) during the year of 2016-17. The growing of guava air layers in polybags containing B<sub>3</sub> growing media (Soil + Sand + Vermicopost + Azotobacter + PSB ) significantly improved the primary root (7.71/plant) and secondary root (13.00/plant), length of primary root (2.77 cm) and length of secondary root (2.00 cm) contents in guava leaves. To increase the proportion of saleable plants, soil + Sand + Vermicompost + Azotobacter + PSB found the best treatments to get the highest of saleable plants. Collectively B<sub>3</sub> proved the best combination for improving the survival and proportion of saleable plants of guava to be planted. This combination was also found to be the most economic treatment for air layers.

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## **A Study on Utilization of information and Communication Technologies by the Extension Personnel of State Department of Agriculture in Tamil Nadu**

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The traditional agriculture is transforming into hi-tech agriculture and also the need for updated (latest) information is essential for increased agricultural production and productivity, eventually giving a lucrative yield and income to the farming community. Indian agriculture is facing a multitude of problems to maximize the productivity. Due to several reasons, the majority of the farming community are not getting upper bound yield despite successful research on new agricultural practices. One of the reasons is that appropriate and timely advice about farming is not reaching the farmers. Several IT based interventions in agriculture and allied fields were taken up across the globe and were found to be successful. At present the extension personnel in department of agriculture has the major responsibility of transferring technologies to the farming community from time to time. But at this juncture the extension agents face number of problems in contacting farmers and the researchers due to physical distances and lack of transportation etc., Hence, the application of ICT offers excellent possibilities, for strengthening TOT between research and extension system and further onward transmission to the end-users. So there exist need to understand and measure the utilization of ICT tools by the extension personnel is highly needed. Hence, the present study was taken up to assess the utilization of ICT tools by the extension personnel of state department of agriculture in Tamil Nadu. This study was conducted in Cuddalore district of Tamil Nadu. The study revealed that around half (50.00 per cent) of the extension personnel had medium level of ICT utilization pattern followed by high (30.00 per cent) and low levels (20.00 per cent).

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## Role of Seed Treatment in Quality Seed Production

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Good quality seed is the basic and essential input for sustainable agriculture in India. The response of all other remaining inputs depending on quality of seed. Seed industries (both public and private sectors) playing very important role in the growth of agriculture in India. Seed quality plays an important role in agriculture, so maintaining seed quality by using different techniques or by using different chemicals plays a crucial role. For maintaining quality, seed treatment also to be considered. Seed treatment means application of biological, physical and chemical (fungicide, insecticide) agents or combinations, to seed so as to disinfect and disinfest seeds from seed borne or soil borne pathogenic organisms and storage insect and to improve the establishment of healthy plants. The use of seed treatment technologies, including fungicidal, neonicotinoid insecticide treatments, is an effective tool to provide the necessary protection of seeds for a strong, healthy start. Seed protection ensures that the plant has a greater opportunity to grow a strong root system which is the foundation of a healthy, productive plant. More than 95 percent of modern seed varieties or hybrids, combined with seed treatments, produce a mature plant. Seed treatments also reduce the environmental impact of the production process by decreasing the number of spray applications of agrichemical products and lessening exposures to non target species including humans and pollinators. Potential soil surface exposure is reduced by more than 90 percent compared to other application methods such as in furrow applications or broadcast sprays. Seed treatments have been used for decades and thanks to advances in the technology for seed treatment, small amount (mg) of active ingredient are now used per individual seed.

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## Hnrnp Like Proteins: Regulators of Post Transcriptional Cellular Gene Expression Mechanisms

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**R**NA-binding proteins (RBPs) regulate the life cycle of messenger RNAs (mRNAs) and various aspects of post-transcriptional regulation. Eukaryotic post-transcriptional RNA processes are accompanied by RBPs known as heterogeneous nuclear ribonucleoproteins (hnRNPs). Plant hnRNP-like proteins are involved in the regulation of gene expression at the post-transcriptional level including pre-mRNA splicing, 5' capping, polyadenylation, RNA modification, transport from the nucleus to the cytoplasm localization of mRNA, mRNA stability, turnover, and translation initiation. There is much to explore especially on the interaction between hnRNP-like proteins with other regulatory factors or their target mRNAs, the structural arrangements of these proteins in the RNP complex assemblies and the mechanisms involved. By combining high throughput sequencing, genomic and proteomics approaches such as RNA immunoprecipitation, crosslinking immunoprecipitation, photoactivatable ribonucleoside enhanced cross linking immunoprecipitation, should provide more comprehensive information on the structure and mechanism of RNP complexes comprising of plant hnRNP-like proteins, the co-factors and the target mRNAs that orchestrate a network of post-transcriptional regulatory mechanisms.

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## Metabolomics: A Viable Option for Crop Improvement

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Metabolomics approaches enable the parallel assessment of the levels of a broad range of metabolites and have been documented to have great value in both phenotyping and diagnostic analyses in plants. These tools have recently been turned to evaluation of the natural variance apparent in metabolite composition. Here, we describe exciting progress made in the identification of the genetic determinants of plant chemical composition, focusing on the application of metabolomics strategies and their integration with other high throughput technologies. Metabolomics represents an important addition to the tools currently employed in genomics-assisted selection for crop improvement. The ongoing efforts to elucidate the metabolic response to biotic and abiotic stresses indicate that metabolomics-assisted breeding might also be useful in the development of crops that are more resistant to these stresses. The application of post-genomics tools should accelerate the selection process and the combined use of metabolomics, genome sequencing and high-throughput reverse genetics will probably considerably shorten the time required for the production of elite lines.

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## Advanced Applications of Transcriptome Analysis by RNA Sequencing

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Genome-wide analyses and high-throughput screening was long reserved for biomedical applications and genetic model organisms. With the rapid development of next-generation sequencing and simultaneous maturation of bioinformatic tools, this situation has dramatically changed. RNA-seq is now being used widely for uncovering multiple facets of transcriptome to facilitate the biological applications. The main applications of this technology are differential gene expression analysis, alternative splicing analysis, variants detection and allele-specific expression, pathway analysis, co-expression network analysis and applications combining various experimental procedures. There are a vast number of different tools at different steps of the RNA-seq work flow that will influence the outcome of the experiment. The tools and pipeline for analysis should be chosen based on purpose and requirement for the precise analysis of biological complexity. As the field matures, we can hope to see methodological standardization, which will be highly welcomed by in the biological sciences.

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## Growth, Yield and Quality of Young Tea Plants (*Camellia sinensis*(L.) O. Kuntze) Inter-Planted in Arecanut Garden.

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The investigation was conducted during March 2016 to May 2017, at Instructional plot of the Department of Plantation Crops and Processing, Faculty of Horticulture, UBKV, Pundibari, Cooch Behar, West Bengal, India, the investigation was to observe the growth, yield and quality of young tea (*Camellia sinensis*(L.) o. kuntze) Inter-Planted in Arecanut Garden, with application of organic and inorganic fertilizer in arecanut garden. The experiment was laid out in Randomized Complete Block Design (RCBD) with five treatments T<sub>1</sub> (Control), T<sub>2</sub> (FYM@ 2.0kg+1/2 RDF), T<sub>3</sub> (VC@ 1.0kg+1/2RDF), T<sub>4</sub> (FYM@2.0kg+RDF), T<sub>5</sub> (VC@1.0kg+RDF), with four replications. Results showed that there was no statistical significant difference among the treatments on 30 days after planting, in case experiment results were varied significant difference with application of manures and fertilizers inter planted in arecanut garden among the treatments from 60 to 360 days after planting, comprising with treatment T<sub>5</sub> (VC+RDF) gave best results of growth parameters like maximum leaf area 37.60 cm<sup>2</sup> and plant spreading 1475.26 cm<sup>2</sup> was recorded, whereas minimum leaf area 35.85 cm<sup>2</sup> and plant spreading 1277.33 cm<sup>2</sup> was recorded by T<sub>1</sub> (control) on 360 days after planting. Numbers of two leaf and a bud was recorded from 90 to 360 days after planting and there was significantly varied among the treatments. Number of two leaf and a bud (372.25) was recorded maximum in T<sub>5</sub> (VC+RDF) followed by 302.75 two leaf and a bud in T<sub>4</sub> (FYM+RDF) and 285.25 two leaf and a bud in T<sub>3</sub> (VC+1/2 RDF) whereas the minimum number of 245.25 two leaf and a bud was recorded in T<sub>1</sub> (control) on 360 days after planting. The maximum number of two leaf and a bud was recorded during the active growth period of plants but minimum number of two leaf and a bud was recorded during the winter months compared to sunny days. With respect to quality parameters chlorophyll content of leaf, there was no significant differences among the treatments. Whereas high fertilized treatments showed maximum chlorophyll content.

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## Molecular characterization of mango cultivars using simple sequence repeats (SSR) markers

Sridhar D\*, Ghosh B, Kundu S, Hasan MA

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In this study, genetic diversity of mango cultivars was assessed by employing twenty-two simple sequence repeat markers, with high polymorphic information content. Characterization was done in sixteen mango cultivars collected from orchard of All India Coordinated Research Project on Fruits at Regional Research Station, Gayeshpur, Nadia, West Bengal. Out of 22 SSR markers, eight microsatellites were amplified and produced 27 alleles in sixteen cultivars. The total number of alleles varied from 2 to 4 with an average number (3.38) of alleles per locus. High level of polymorphism was observed with EF592182 primer (4 alleles per locus). Further, null alleles were also observed among the mango cultivars with SSR primers. High PIC value of EF592182 primer indicated to that highly informative. From the Jaccard's pair wise similarity coefficients, Jaccard's Similarity Coefficient values ranged from 0.03 (between KanchanKosa and Chatterjee, KanchanKosa and Sarikhas) to 0.88 (between Ranipasand and GulabKhas). UPGMA clustering reflects the history of breeding and selection of the cultivars studied, grouping the cultivars according to geographical origin and type. The dendrogram generated from the Unweighted Pair Group Arithmetic Average (UPGMA) cluster analysis broadly placed 16 mango cultivars into five major clusters. The dendrogram revealed that Ranipasand and GulabKhas were the most similar cultivars with 88 % similarity.

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## Intercropping - Method of Cropping

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India is a developing country, it has agricultural based economy. Today, India ranks second in worldwide farm outputs. Traditional farming known as high-input system for food production. For reduction of input cost and increase in production, productivity is not possible through this Conventional farming system but it possible through intercropping. Small farmers have limited landholding therefore there is a critical need to improve land use efficiency (LUE), through intercropping of companion crops. The total yield of intercropped crops was greater than sole cropping, shown by Land equivalent ratio (LER) greater than 1. The overall advantage of intercropping ranged from 35 to 58%. Intercropping is the growing of two or more crop species simultaneously (co-growth) in the same field area. It is widely practicing in developing countries such as China, India, Indonesia, Niger, Mali and Ethiopia. This method works based on the ecological principles of competition, complementarity and facilitation. A major benefit of intercropping is increase in production per unit area compared to sole cropping through the effective use of resources, including water, nutrients and solar energy. It also provides an important pathway to reduce soil erosion, fix atmospheric nitrogen, lower the risk of crop failure through disease, pest and weeds and increase land use efficiency. There are many kinds of intercropping including cucurbits/okra, wheat/maize, wheat/soybean, maize/faba bean, maize/potato, wheat/sunflower, wheat/vegetable and maize/vegetable systems. Traditional farming replaced by intercropping has increased crop yield per unit area.

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## Molecular characterization of mango cultivars using simple sequence repeats (SSR) markers

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## **Influence of Paclobutrazol as Foliar Spray on Quality parameters of Tuberose (*Polianthes tuberosa* L) var. Prajwal**

**Vinod Kumar Nellipalli\* and Arun Kumar Pal**

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A field experiment was carried out in Horticulture Research Farm, Bidhan Chandra KrishiVishwavidyalaya, Mohanpur, to study the effect of paclobutrazol as foliar spray at different dates, on growth, flowering and bulb yield of tuberose (*Polianthes tuberosa* L.) var. Prajwal. The experiment was carried out during the year 2016 - 2018 (March - March) to find out the suitable dose of paclobutrazol and amicable time of its spraying, to get maximum flower production. The experiment was laid out in augmented factorial randomized block design with three replications. The first factor contains three different doses of Paclobutrazol application  $P_1$  (100 ppm),  $P_2$  (200 ppm),  $P_3$  (300 ppm) as foliar spray and the second factor is with three different times of Paclobutrazol application i.e.,  $S_1$  (45 DAP),  $S_2$  (65 DAP),  $S_3$  (85 DAP). A control plot is made without any application of paclobutrazol to observe the difference in the treatment effect. Combining the two-year data, the pooled data reveals that, the self-life of spike and the weight of spike was observed maximum with the application of 200 ppm paclobutrazol at  $S_2$  (65 DAP) respectively. While the vase life of spike and floret diameter was observed maximum with the application of 300 ppm paclobutrazol at  $S_2$  (65 DAP). It can be concluded that, the quality flowers of tuberose var. Prajwal could be observed with the application of paclobutrazol @ 200 ppm at 65 days after transplanting (DAP).

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## Impact of Weather on Population of Leaf Folder During Kharif Season at Raipur Station

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Rice crop is attacked by more than hundred insect species, of which fifteen are of major economic importance. Among these insect-pests, leaf folder is noticed as regular insect-pest. Leaf folder is a complex of species. Leaf folder causes damage to crop from the month of August to October with moderate to severe infestation. The losses due to these insect pests were more contributed to yield reduction at vegetative phase (50%) than the reproductive (30%) or ripening phase (20%). Climatic factors such as temperature, rainfall and relative humidity greatly influence the outbreak of the insect population. It is difficult to find a direct cause and effect on the relationship between any single factor and pest activity because the impact of meteorological factors on pests is usually compounded. The field experiment was carried out during *kharif* 2016 at Research Farm of Department of Entomology, College of Agriculture, IGKV, Raipur (Chhattisgarh) and weekly light trap data on population of Leaf folder insect for last eighteen years were also collected from this department. The meteorological data on maximum and minimum temperature (°C), morning (maximum) and evening (minimum) relative humidity (%), sunshine hours and rainfall (mm) of each day were obtained from the meteorological observatory of Agro-meteorology Department, Raipur IGKV (C.G.). Correlation analysis was carried out between weather parameters and populations of leaf folder during kharif season of 2016 as per standard method. The result revealed that population of Leaf folder was positively correlated with relative humidity and rainfall and negatively correlated with maximum, minimum temperature and but all the correlation was non-significant. It is concluded from the result that relative humidity and rainfall was favourable for leaf folder population incidence.

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## Effect of Honey Bee (*Apis mellifera*) Pollination on Yield and Yield Attributing Parameters of Onion (*Allium cepa* L.)

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Onion, *Allium cepa* L. is a biennial crop grown primarily for the purpose of seed production. The pollination activity of wind has little effect on onion pollination because of its sticky pollen and protandrous nature of the flowers. The insufficient pollination and poor quality seeds cause difficulties in hybrid seed production as a result both the seed industry and onion seed producers are increasingly confronted by the serious economic problem of disappointing seed yields in commercial onion fields. The honeybees are primary pollinators for the majority of the world's angiosperms and are effective pollinators on onion because both pollen and nectar are available from the plant. The European or western honey bee *Apis mellifera* L. (Hymenoptera: Apidae) is the most commonly managed pollinator worldwide. Thus, to increase or retain higher productivity of onion, effective pollination by various insect pollinators, particularly honeybees, needs to be ensured and its impact be analyzed. And here lies the immense scope of exploiting honeybees in enhancing crop productivity. Keeping this view in mind, the present investigations were carried out at the Raninagar village of Chakdaha block in Nadia district of West Bengal to study the effects of managed honeybee pollination on yield and quality of onion seeds with three treatments viz., Plants caged in nets without any pollinator ( $T_1$ ), plants caged in nets with only honey bee (*Apis mellifera*) as pollinator ( $T_2$ ), and plants open to all pollinators ( $T_3$ ). Pollination had no impact on number of umbels produced/plant. Both honey bee pollination and open pollination resulted in 77.45% and 87.68% increase, respectively, in seed yield of onion. The numbers of pods / umbel (220.78), number of seeds/umbel (802.21), thousand seed weight (3.23g) and seed germination (76.00%) were also increased significantly due to pollination. Open pollination showed better performance than honey bee pollination under net, though not at a significant level, in all these aspects except seed germination.

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## ***In vitro* evaluation of bio-agents against *Rhizoctoniasolani* (kuhn) causing rice sheath blight disease**

**Kishan Kumar Sharma and Dr. V. A. Patil**

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The six different bio-agents viz., *Trichoderma viride*, *T. harzianum*, *Trichoderma longibrachiatum*, *Pseudomonas fluorescens* I, *Pseudomonas fluorescens* II and *Bacillus subtilis* were evaluated against *Rhizoctoniasolani* through dual culture technique. Among six different bio-agents *Trichoderma viride* showed maximum (74.44 %) growth inhibition of the pathogen and appeared to be the most superior in its efficacy over all the antagonists tested. This was followed in sequence by *T. harzianum* (68.14 %), *T. longibrachiatum* (67.41 %), *Pseudomonas fluorescens* I (56.66 %), *Pseudomonas fluorescens* II (55.74 %) and *Bacillus subtilis* (47.77 %) were in decreasing order for per cent growth inhibition of *Rhizoctoniasolani*.

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## Efficacy of herbicide combination and sequential application on weed complex and production potential of hybrid maize (*Zea mays* L.)

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A field experiment was carried out at Agronomy Main Research Station, OUAT, and Bhubaneswar during kharif, 2016. The soil of the experimental field was sandy loam in texture, acidic in reaction (pH 4.68) and available nitrogen (233.0 kg/ha), phosphorus (23.2 kg/ha) and potassium (153.1 kg/ha). The experiment was laid out in randomized block design with ten treatments and three replications. The herbicides in combination and sequential application comprised of atrazine @ 1.0 kg/ha as pre-emergence (PE) at 1 days after sowing (DAS), atrazine @750 g/ha+ pendimethalin @750 g/ha as PE at 1 DAS, atrazine @750 g/ha + 2,4-D amine salt @ 400 g/ha as post emergence (PoE) at 25 DAS, halosulfuron @ 60 g/ha as PoE at 25 DAS, tembotrione @120 g/ha as PoE at 25 DAS, atrazine @ 1.0 kg/ha as PE at 1 DAS followed by halosulfuron @60 g/ha at 25 DAS, pendimethalin @1.0 kg/ha as PE at 1 DAS followed by atrazine @ 750 g/ha + 2,4-D amine salt @ 400 g/ha as PoE at 25 DAS and atrazine @1.0 kg/ha as PE at 1 DAS followed by tembotrione @120 g/ha at 25 DAS were tested with hand weeding at 20 and 40 (DAS) and un-weeded control. The crop growth and yield attributes and grain (7.0 t/ha) and Stover yield (7.57) of hybrid maize were enhanced with herbicide combination of atrazine @750 g/ha+ pendimethalin @750 g/ha as PE at 1 DAS. It was followed by atrazine @1.0 kg/ha as PE at 1 DAS with sequential application of tembotrione @120 g/ha as PoE at 25 DAS being comparable with hand weeding at 20 and 40 DAS. The uninterrupted growth of weeds in the crop resulted in yield reduction by 35.89%. Maximum nutrient (14.03 kg N, 3.73 kg P and 17.98 K kg/ha) was removed by weed in un-weeded control treatment. The herbicide combination of atrazine @750 g/ha+ pendimethalin @750 g/ha as pre emergence at 1 DAS recorded the highest uptake of nutrients (158.05 kg N, 65.95 kg P and 153.84 K kg/ha) by hybrid maize followed by atrazine @1.0 kg/ha (PE) at 1 DAS followed by tembotrione @120 g/ha (PoE) at 25 DAS. Herbicide combination of atrazine @750 g/ha+ pendimethalin @750 g/ha as PE at 1 DAS registered the maximum gross return (Rs100292.00) and net return (Rs68472.00/ha) with enhancement of B: C ratio (3.15).

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## Effect of pH on survival and mortality of *Steinernemacarpocapsae* and *Heterorhabditisindica* under laboratory conditions

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The present studies on the effect of pH on survival and mortality of *S. carpocapsae* and *H. indica* were conducted during 2017-18 at the Bio control laboratory, IGKV, Raipur, which depicted a gradual increase in percentage survival of IJs of *S. carpocapsae* with increasing pH from 4.00 to 9.00 except at pH 7.00. Highest survival was found at neutral pH 7.00 *i.e.* 99.31 per cent of the IJs of *S. carpocapsae* followed by 98.93 and 98.75 at alkaline pH 9.00 and 8.00 respectively, and lowest survival was found at acidic pH 4.00 *i.e.* 96.43 per cent. In case of IJs of *H. indica* with highest survival was found at pH 5.00 *i.e.* 88.81 per cent followed by 85.50 per cent at pH 6.00 which reduced to 81.93 per cent at pH 7.00 and lowest survival was observed at pH 4.00 *i.e.* 62.12 per cent. Thus, pH 7.00 was the optimum level of pH for maximum survival of the *S. carpocapsae* while pH 5.00 was most suitable for *H. indica*.

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## To Study the Biophysical Characteristics of Field Bean Genotypes Influencing Infestation of Spotted Pod Borer(*Maruca vitrata* Fab.)

Mamta Paikra\*, Moumita Mandal, Sonalika Kolhekar and G. K. Chandrakar  
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The present study was made to evaluate biophysical characteristics of field bean influencing the infestation of spotted pod borer (*Maruca vitrata* Fab.). The experiment was conducted during 2017-18, at college of agriculture, IGKV, Raipur, Chhattisgarh. By growing a total of 118 genotype accessions on July, 2017 in an augmented design. The results indicated that all the tested genotypes were significantly different in relation to spotted pod borer population at pod stages of the crop. The minimum spotted pod borer infestation was related on IS-32 genotype (16.25%) followed by IS-115 (16.43%) and maximum spotted pod borer infestation on IS-37 (44.28%) and followed by IS-44 (42.02%) during kharif, 2017-18 respectively. The relationship between pod length and spotted pod borer infestation exhibited significant positive correlation ( $r = 0.848$ ), however, non-significant negative correlation with pod width ( $r = -0.445$ ). Flower colour grouped into 2 colour i.e. white and purple. White colour flowers were mostly preferred for spotted pod borer and showed highest infestation of field bean genotypes. Pod colours of field bean were grouped into 7 pod colours. Out of 118 genotypes there were viz., 34 white, 23 light green, 46 dark green, 2 dark red, 1 purple, 7 purplish white and 5 purplish green genotypes showed moderately susceptible to *M. vitrata*(Fab.).

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## Feeding Potential of Coccinellid Predator, *Menochilussexmaculatus*(Fabricius) (Coleoptera: Coccinellidae) on Anola Aphid, *Schoutedeniaemblica*

Sonalika Kolhekar\*, Saurabh Padamshali, Mamta Paikra, and Jayalaxmi Ganguli

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The laboratory studies conducted on the feeding potential of the coccinellid predator, *Menochilussexmaculatus* (Fabr.) on anola aphid, *Schoutedeniaemblica* revealed that the neonate grub just after hatching start feeding on chorion of the eggs, and then feeds on the aphids. The feeding potential increased consequently from 1<sup>st</sup>, 2<sup>nd</sup>, 3<sup>rd</sup>, and 4<sup>th</sup> instar by consuming an average number of  $31.00 \pm 0.51$ ,  $24.75 \pm 0.18$ ,  $37.5 \pm 0.73$  and  $50.37 \pm 0.67$  aphids/day respectively. Maximum number of aphids was consumed by adult of  $92.74 \pm 0.03$  aphids/day.

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## Pest succession of major insect pest of Cabbage

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Studies on insect pest succession and field incidence revealed that The seasonal incidence and sequence of appearance of major insect pest species damaging cabbage under Jabalpur area showed that the order of seasonal appearance was Painted bug, *Bargradacruciferarum* (Hemiptera: Pentatomidae), Tobacco caterpillar, *Spodopteralitura* Fab. (Lepidoptera: Noctuidae), Gram pod borer, *Helicoverpaarmigera* (Hubner) (Lepidoptera: Noctuidae), Flea beetle, *Phyllotretacruciferae* (Coleoptera: Chrysomelidae), Aphid, *Lipaphiserysimikalt.* (Hemiptera: Aphididae), Diamond back moth, *Plutellaxylostella* (Lepidoptera, Plutellidae) and cabbage Head borer, *Hellulaundalis* (Lepidoptera: Crambidae) and two natural enemies Spider (Unidentified) and Lady bird beetle, *Coccinellaseptumpunctata* were also found.

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## Approaches towards Doubling Farmers' Income with climate resilient management practices

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Share of India from agriculture in Gross Value Added (GVA) is just 15% (GoI, 2017a), when 55% of its population is involved in the occupation of agriculture and allied sectors. More than that 45% of agricultural land belongs to 85% of SF/MF leading the farmers surviving under poverty with no income security at the end of the day. It is matter of debate among scientists whether the target announced by GoI (2016) for doubling farmers' income within limit of 6 years (by 2022) is going to be successful or not. But with the positive thoughts some approaches were suggested to reach the target. Because the supply of food for the increasing population is not met as per the demand due to several internal and external factors, like improper cultivation practice, monoculture, negative impacts of climate changes etc., managing food security and its sustainable development is one of the biggest challenges in India. The growth rates in income of farm households across major states of the country varied from 6.71 per cent in West Bengal to 17.48 per cent in Haryana in the period between 2002-2003 and 2012-2013. First approach of increase in crop yield can be possible by (a) bridging yield gap through reducing water shortage, proper supply and use of inputs and by (b) biotechnological approaches that involve crop and livestock production by enhancing yields, nutritional profile, stress tolerance and crop protection and also GM crops. Secondly, water management is very important for proper use. Thirdly, a secured income from millets cultivation can be ensured as these crops need minimum input to provide the maximum possible yield. Besides, these are rich source of iron, zinc, copper etc. the forth approach of climate resilient management practices include cultivation of legume crops, intercropping, balanced nutrient application, land management etc. Lastly, the most important approach for doubling farmers' income by stabilizing their income and risk management can be fulfilled by enough supply of irrigation at need, crop diversification, and livestock. Though some threatening constraints like low minimum support price (MSP), non-remunerative price in the market, low share of farmers in final price, high and increasing input cost, absence of market infrastructure are present there, but with the hope a helping hand from government of India by providing an enabling environment and ensuring farmers to bear the input cost can certainly reach the target of doubling farmers' income.

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## Impact Evaluation of Preserved Foods Prepared Using Aloevera Extract

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Aloe Vera (Liliaceae) family is a nutritive being an excellent source of Energy, Vitamin A, Vitamin C, Calcium, Phosphorus, and antioxidant. Aloe Vera extracts which can be utilized as a functional ingredient in certain food preparations. Aloe Vera contains numerous vitamins and minerals, enzymes, amino acids, natural sugars and agents which may be anti-inflammatory and anti-microbial. It contains mainly Vitamin A and Vitamin C also an antioxidant. When freshly consumed Aloe Vera gives little bitter taste. In order to increase the acceptability of the preserved products like mixed fruit jam, pineapple squash and tomato ketchup, aloe Vera extract was prepared with boiled water in order to remove the bitter taste. Daily 50ml dosage of Aloe Vera extract was recommended. Hence in the present study Aloe Vera extract was incorporated in preserved foods in order to increase the nutritive value of it. The Aloe Vera extract incorporated preserved foods was prepared in various proportions like 35ml, 40ml, 45ml and 50ml in samples like mix fruit jam, pine apple squash, and tomato ketchup respectively. The best product was selected through sensory evaluation based on the appearance, colour, texture, flavor and taste. When compared with the standard, best products like Mixed Fruit Jam, Pineapple Squash, and Tomato Ketchup has highest score in overall acceptability and, selected as the best product, which was taken for further study of nutrient analysis and shelf life analysis. Popularization was done for a total population of 30 members and most of the school going children was answered positively for the product. Cost analysis was same for both standard and sample product; so the cost is affordable and can be given for all income groups peoples.

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## Morphocultural Characterization of Fungal Pathogen Associated with *Citrus Limetta* Risso.

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Horticulture is the science and art of growing plants (fruits, vegetables, flowers and any other cultivar). It also includes plant conservation, landscape restoration, soil management and garden design. India is the second largest producer of fruits after Brazil. Fruits play an important role in human nutrition by contributing the necessary growth factors such as vitamins and essential minerals in human daily diet maintaining a good and normal health. Rot diseases caused by fungal pathogens provoke severe losses of agricultural and horticultural crops every year (Salman 2005; Parveen et al., 2016). *CITRUS LIMETTA* RISSO belongs to the family Rutaceae. A very common disease in the plant is leaf spot and fruit rot so it has gained least attention of researchers. Citrus leaf plants with leaf spot disease sample leaves were collected from Madekeri district of Karnataka, India. The pathogen was isolated on Potato Dextrose agar (PDA) from surface sterilized small pieces of the leaves and twigs, incubated at 25°C, and three different fungal pathogens were identified i.e. *Aspergillus*, and *Rhizopus* was the cause for the disease according to its morphological and cultural characteristics and study was done based on colony characters. Disease management studies is on process.

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## **Pesticide use, Safety Awareness, Generation And Disposal Methods Among Farming Household in Bade Localgovernment Area of Yobe State, Nigeria.**

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The fast growing demand in agricultural produce as well as increasing utilization of pesticides on farmlands has introduced the problem of management of used pesticides containers in Nigeria. The quantity and generation rate of pesticides containers in Nigeria have increased at an alarming rate over the years with lack of efficient and modern technology for the management of these wastes. This study was carried out to assess pesticide use, safety awareness and disposal methods among farming household in Bade Local Government Area of Yobe State. The findings of this study revealed that Majority of the farmers (72.0%) have knowledge of the dangers associated with improper disposal of used pesticide containers but despite that most of them (51.5%) have recorded cases of ill health associated with improper disposal due to lack of adequate training on pesticide use, management and disposal as claimed by (63.5%) of the respondent and partly because proper disposal methods are not in place for the 36.5% who have been trained to put into practice the knowledge they may have acquired from the trainings organized mostly by NGO's. The study also quantified the amount of pesticide containers generated in the area and proposed appropriate disposal methods of these pesticide containers in order to promote agricultural development and keep the environment clean and safe. It was also estimated that by the year 2030 the quantity of used pesticides containers that would be used in the state would be up to-----The study also revealed the problems faced by the farmers and suggested ways by which used pesticide containers can be effectively managed in Nigeria. Thereby, reducing some major problems associated with improper disposal of waste, such as environmental degradation, pollution, health consequences and resource depletion.

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## **Foliar Application of Salicylic Acid improves Growth and Photosynthesis by reducing Cadmium uptake in *Mentha arvensis* (L.)**

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Contamination of heavy metals poses a great threat to crop production worldwide. We studied the growth, biochemical, photosynthetic and antioxidant responses of mentholmint plants to 50 $\mu$ M Cadmium (Cd) stress in presence/absence of salicylic acid (SA). Cd stress decrease growth and photosynthesis but increase hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>) malondialdehyde (MDA) contents and electrolyte leakage. Foliar SA (10 $\mu$ M) application ameliorated the ill effects of Cd on growth, chlorophyll content, photosynthesis and increased the activities of enzymes of ascorbate glutathione (AsA-GSH) cycle viz- (ascorbateperoxidase (APX), monodehydroascorbatereductase (MDHAR),dehydroascorbatereductase (DHAR) and glutathione reductase (GR). Salicylic acid application to Cd stressed plants had an additive effect on these enzyme activities. Exogenous SA supplementation lowered endogenous Cd content and decreased root to shoot Cd uptake. We concluded that SA is an effective molecule to induce Cd stress tolerance in mentholmint plants.

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## Improvement of crop photosynthetic efficiency through enhanced activity of rubisco

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In order to meet the increasing demand for food from the growing population there will have to be significant increases in yield of the major crops. Among a number of areas being pursued to increase crop productivity and food production, improving photosynthetic efficiency is a clear target, offering great promise. More photosynthesis at leaf level requires emphasis on biochemical and physiological aspects of light capture, more efficient carbon gain, improved nitrogen use efficiency, enhanced enzymatic activity of Calvin cycle, increasing thermo-stability of rubiscoactivase at the current climatic condition and by improving the rubisco function. Among these, the major target to achieve this goal is attributed to improved rubisco function. Ribulose-1,5-bisphosphate carboxylase/oxygenase (Rubisco) catalyzes the first step in net photosynthetic CO<sub>2</sub> assimilation. The enzyme is notoriously inefficient as a catalyst for the carboxylation of RuBP and is subject to competitive inhibition by O<sub>2</sub>. So the success towards improving rubisco function could be integrated with- (i) Improving the catalytic properties of rubisco by engineering rubisco with higher CO<sub>2</sub>-specificities and/or higher catalytic rates through transgenic approaches, (ii) Introducing carboxysomes from cyanobacteria into chloroplasts of CCM-free crops which is predicted to improve yield by up to 60% under hot and dry conditions, (iii) Engineering synthetic photorespiration bypasses and (iv) Engineering synthetic CO<sub>2</sub>-fixation by transferring rubisco-independent CO<sub>2</sub>-fixation pathways to the Calvin cycle observed in bacteria and algae. Recent successes in the field of improving photosynthesis through enhanced function of Rubisco by genetic manipulation through transgenic approaches have been achieved in crops like wheat. The realization of such synthetic CO<sub>2</sub>-fixation pathways and their integration into living organisms still possess several challenges, but will be indispensable for freeing natural photosynthetic CO<sub>2</sub>-fixation from its inherent disadvantages and transforming biology from a tinkering science into a truly synthetic discipline.

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## Interaction of 24-epibrassinolide and spermidine modulate photosynthesis, antioxidant system and yield attributes in *Brassica juncea* L. under Mn stress

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Brassinosteroids (BRs) and polyamines (PA) are well known plant growth regulators that are widely used to surpass different abiotic stresses including heavy metal toxicity in plants. The present study was carried out with an aim that 24-epibrassinolide (EBL) and/or spermidine (Spd) could modulate photosynthetic effectiveness, antioxidant system and yield attributes in *Brassica juncea* under manganese (Mn) stress (150 mg kg<sup>-1</sup> soil). EBL (10<sup>-8</sup> M) and /or Spd, (1.0 mM) were applied to the leaves of *Brassica juncea* plants grown in the presence of Mn (150 mg kg<sup>-1</sup> soil), at 35 days after sowing (DAS). High concentration of Mn (150 mg kg<sup>-1</sup> soil), reduced photosynthetic attributes and yield parameters but increased antioxidant enzyme activity and proline content in the leaves at 45 DAS. Furthermore, foliar spray of EBL and Spd under stress and stress-free conditions improved the photosynthetic traits and yield attributes and further enhanced antioxidant system. Out of the two plant growth regulators (EBL/Spd), EBL excelled in its effects. Moreover, toxic effects generated by Mn stress were completely overcome by the combination of these two plant growth regulators.

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## Plant Growth Regulators (Epibrassinolide and Hydrogen peroxide) Improve Photosynthetic efficiency, Biochemical Attributes and Yield characteristics in Tomato Plants Grown Under Copper Stress

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Plant growth regulators or phytohormones are organic substances produced naturally in higher plants, which modulates a range of biochemical and physiological responses in plants. Therefore, an experiment was conducted to study the role of 24-epibrassinolide (EBL) and hydrogen peroxide ( $H_2O_2$ ) in copper stressed tomato plants. The 20 d old plants were uprooted and dipped in 0, 0.1 mM  $H_2O_2$  for 4 h before transplantation. At 20 d after transplantation (DAT), the plants were exposed to the varying doses of copper (Cu; 10 or 100 mg kg<sup>-1</sup>) applied through the soil. At 30 DAT, plants were treated with water or EBL solution. High Cu stress (100 mg kg<sup>-1</sup> soil) induced a significant reduction in chlorophyll content, rate of photosynthesis and yield attributes. Activities of antioxidant enzymes (catalase, peroxidase and superoxide dismutase) and leaf proline content also increased substantially with increasing Cu stress. On the other hand, treatment of EBL and  $H_2O_2$  under stress and stress-free conditions significantly increased the aforesaid photosynthetic, biochemical and yield attributes. Moreover, EBL and  $H_2O_2$  further accelerated the antioxidative enzymes and proline content, which were already enhanced by the high copper stress. These enhanced antioxidant enzyme activities and accumulation of proline would still have been able to bestow tolerance on tomato plants exposed to higher doses of Cu.

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## Role of extracellular chromate reductase from *Bacillus amyloliquefaciens* for detoxification of hexavalent chromium

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Hexavalent chromium is a toxic heavy metal in environment. To remove it from the system, reduction to the trivalent form using a feasible extracellular chromate reductase is an alternative cost-effective method compared to the conventional physicochemical methods. The maximum chromate reductase production from *Bacillus amyloliquefaciens* was achieved using optimum physico-chemical conditions. Later, a partial purification was performed taking place with ammonium sulfate precipitation, size-exclusion chromatography. The production of chromate reductase was enhanced to a significant level of 54.85 % under optimized set of conditions. Further one step purification was performed and the purity of chromate reductase was checked by SDS-PAGE. The purified protein was examine for chromium detoxification assay and it gave assured to detoxify 63 % of 100  $\mu$ M Cr(VI) within a time period of 24 h. Thus, chromate reductase can useful for the detoxification of Cr(VI) to Cr(III) in Cr(VI)-contaminated environment.

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## Evaluation for *In-Vitro* Antibacterial Activity of Selected Medicinal Plants Against Food-Borne Pathogens

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Folkloric medicinal plants are commonly used all over the world and linked with different cultural believes. In most developing countries, including Ethiopia, where many people live under poor hygienic conditions; and has low access to modern health care system, the chance infection with food borne disease is undoubtedly high. As a result, peoples visit traditional healers as an alternative to the modern health care system. To this effect, five traditional medicinal plants (*Vernoniaamygdalina*, *Nigella sativa*, *Ocimumsauve*, *Rutagraveolens* and *Ocimumlamifolium*) were collected for evaluation of *in vitro* antibacterial activity. Soxhlet extraction method and agar disk diffusion techniques were used to obtain the crude extracts as well as for antibacterial activity test. All the petroleum ether, chloroform and methanol crude extracts of the five medicinal plants and volatile oil were tested against standard reference strains, including *Escherichia coli* (ATCC25722), *Staphylococcus aureus* (ATCC25903), *Shigellasonnei* (ATCC259131) and *Salmonella typhimurium* (ATCC13311). The essential oil extract of *Nigella sativa* seeds showed better activity against the Gram negative bacteria *Salmonella typhimurium* at concentration of 3.7 µl. Based on our observation, it could be concluded that the crude and volatile oil extracts of the plants are candidate products for treatment of gastrointestinal pains having gone through additional investigation on pharmacokinetics and toxicity of the extracts.

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## Impact Evaluation of Preserved Foods Prepared Using Aloevera Extract

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Aloe Vera (Liliaceae) family is a nutritive being an excellent source of Energy, Vitamin A, Vitamin C, Calcium, Phosphorus, and antioxidant. Aloe Vera extracts which can be utilized as a functional ingredient in certain food preparations. Aloe Vera contains numerous vitamins and minerals, enzymes, amino acids, natural sugars and agents which may be anti-inflammatory and anti-microbial. It contains mainly Vitamin A and Vitamin C also an antioxidant. When freshly consumed Aloe Vera gives little bitter taste. In order to increase the acceptability of the preserved products like mixed fruit jam, pineapple squash and tomato ketchup, aloe Vera extract was prepared with boiled water in order to remove the bitter taste. Daily 50ml dosage of Aloe Vera extract was recommended. Hence in the present study Aloe Vera extract was incorporated in preserved foods in order to increase the nutritive value of it. The Aloe Vera extract incorporated preserved foods was prepared in various proportions like 35ml, 40ml, 45ml and 50ml in samples like mix fruit jam, pine apple squash, and tomato ketchup respectively. The best product was selected through sensory evaluation based on the appearance, colour, texture, flavor and taste. When compared with the standard, best products like Mixed Fruit Jam, Pineapple Squash, and Tomato Ketchup has highest score in overall acceptability and, selected as the best product, which was taken for further study of nutrient analysis and shelf life analysis. Popularization was done for a total population of 30 members and most of the school going children was answered positively for the product. Cost analysis was same for both standard and sample product; so the cost is affordable and can be given for all income groups peoples.

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## Impairment of *Cronobacter sakazakii* and *Listeria monocytogenes* biofilms by cell free supernatants of lactobacilli of goat milk origin

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Biofilm-associated bacterial infections represent one of the major threats to modern medical treatments. Bacteria encased in biofilm matrix are more resistant towards antimicrobials and thus the capability of microbes to persist and nurture in a biofilm seems to be the foremost aspect of pathogenesis and therapeutic failure. Therefore, there is a pressing demand for new drugs active against microbial biofilms. In the current study, anti-biofilm potential of *Lactobacillus* spp. cell free supernatants (CFSs) against *Cronobacter sakazakii* and *Listeria monocytogenes* was tested at two levels of co-incubation and post incubation treatments. The effect of CFS was determined in terms of quantification of biofilm growth (crystal violet assay), cell viability (MTT method) and ultra-structural changes in biofilms. Three different *Lactobacillus* preparations viz. un-treated cell free supernatant (CFS), neutralized CFS (N-CFS), and heat-treated CFS (H-CFS), were tested for anti-biofilm assays. CFSs of goat milk lactobacilli not only prevented biofilm formation, but also disrupted preformed biofilms. The pathogen's biofilm was also inhibited following neutralization and heat treatment of CFSs. The results were quantitatively confirmed by light and fluorescent microscopy observations. Biofilms developed under static conditions displayed typical compact microcolonies with uniform distribution over the surface, while the CFS-treated biofilms were disrupted and showed presence of dead cells. These studies highlight the anti-biofilm potency of *Lactobacillus* spp. strains of goat milk origin and their potential application in food industries.

**Biography of Speaker/Poster** I am a National Post-Doctoral awardee, currently working on research project entitled 'Proteomic and Genomic insights into the effect of piperine and eugenol on biofilm formation in food borne *Cronobacter sakazakii*' funded by SERB-DST, New Delhi, wherein, I am looking towards the gene expression studies and comparative proteomic analysis on biofilm and virulence of *C. sakazakii* treated with piperine and eugenol. I did Ph.D in Biotechnology (2017) on thesis entitled "Characterization of quorum sensing mediated biofilm formation and its inhibition in *Cronobacter sakazakii* strains". During Ph.D, two research papers were published in peer reviewed medical journal "Virulence" with an Impact Factor of 4.665. Earlier, I am a gold medallist (M. Sc Biotechnology) awardee from Punjab Technical University, Jalandhar.

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## Studies on seed morphological, physiological and biochemical traits of safflower (*Carthamus tinctorius* L.) genotypes in relation to oil content

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The present investigation was carried out with the objectives of (i) studying genetic variability and relationships among seed morphological, physiological and biochemical traits in safflower genotypes and (ii) studying the association of DNA markers (simple sequence repeats-SSRs) with hull type and oil content in a F2:3 segregating population (93 progenies) produced from A1 (low oil/normal hull) x EC-755673 (high oil/striped hull). Range and mean of seed morphological traits in the germplasm set were as follows: length/breadth ratio (1.64- 2.45; 2.07), length x breadth product (17.24-41.60 mm; 30.28 mm), length x breadth x thickness product (43.54- 174.00 mm<sup>3</sup>; 102.43 mm<sup>3</sup>), hull content (29.50 -62.43%; 40.53%), test weight (2.17-5.71 g; 4.18 g) and bulk density (0.40-0.64; 0.54tm-3). Range and mean of seed physiological traits were as follows: germination (90-100%; 95.81), seedling length (15.52-25.96 mm; 21.17 mm), seedling vigour index-I (1417-2405; 2029.03) and field emergence (81-100%; 92.71%). Range and mean of seed biochemical traits were as follows: palmitic acid (3.65-7.53%; 5.68%), stearic acid (1.27-3.28%, 2.37%), oleic acid (12.27- 80.08%; 34.76%) and linoleic acid (13.83-78.66%; 57.20). Simple correlation analysis showed that seed size was positively correlated with test weight ( $r=0.684^{***}$ ) and seedling vigour-II ( $r=0.483^{***}$ ) while negatively correlated with oil content ( $r=-0.754^{***}$ ) among genotype studies. Test weight showed strong negative correlation with oil content ( $r=- 0.509^{***}$ ). Germination of freshly harvested seeds was not correlated with any of the traits including seed size, weight, hull content, hull type, oil content and fatty acid composition. Speed of germination showed strong positive correlation with Length Breath Ratio ( $r=0.472^{***}$ ) and Field Emergence ( $r=0.472^{***}$ ) while it showed strong negative correlation with Seed Breadth ( $r=-0.434^{***}$ ). Seedling vigour based on seedling dry weight and SVI-II had strong positive association with seed thickness ( $r=0.416^{***}$ ), The unsaturated fatty acids, linoleic acid and oleic acid contents showed very strong negative correlation ( $r=-0.999$ ). Oil content showed strong positive correlation with striped hull type ( $r=0.458^{***}$ ) and oleic acid ( $r=0.449^{***}$ ). Marker-trait association was conducted between SSR marker and oil content related traits: oil content per se and striped hull using F2:3 population produced from A1 x EC-755673. Only eight out of 100 SSR primer pairs polymorphic between the parents, which were subsequently used for genotyping 93 F2:3 plants

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## **Role of nitric oxide in improving seed germination and alleviation of copper-induced photosynthetic inhibition in Indian mustard.**

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Copper is an essential microelement associated with different biological processes in plants, apart from its essential role, it is also highly toxic when absorbed in excess by plants and produces reactive oxygen species which are inhibitory to the plant growth. Excess of Cu causes various effects in sensitive plants which mostly depend upon the stage of plant growth that which heavy metal was applied and on the time of action. The present study was carried out to study the effect of NO application in the alleviation of copper (Cu) induced adverse impact on seed germination and photosynthesis of mustard plant (*Brassica juncea* L.). Pretreatment with sodium nitroprusside (SNP), a well-known NO donor significantly improved seed germination and alleviated Cu-accrued oxidative stress in *B. juncea* seeds. However, in the absence of NO, Cu showed a higher reduction in seed germination rate. Further, NO pretreatment increased activities of antioxidant enzymes and sustained the lower level of H<sub>2</sub>O<sub>2</sub>, and thiobarbituric acid reactive substances (TBARS) thereby elevated the antioxidative capacity in Cu-exposed *B. juncea* seeds. NO pretreated seeds also exhibited to retain higher amylase activities required for the proper seed germination when compared with control, i.e., without SNP treatment. The present research also made it evident that NO mitigates Cu toxicity through an improved antioxidant system, photosynthetic efficiency and reducing Cu induced accumulation of reactive oxygen species (ROS) accompanied by the reduction in lipid peroxidation at the vegetative phase of the mustard plant. Based on the results it can be concluded that NO modulated the activities of antioxidant enzymes, improved amylase activity and thereby enhanced the germination of *B. juncea* seeds under Cu stress and NO efficiently counteracts Cu toxicity by up-regulating antioxidant enzymes and reduced ROS accumulation resulting in a higher photosynthetic rate.

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## Evaluation for *In-Vitro* Antibacterial Activity of Selected Medicinal Plants Against Food-Borne Pathogens

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Folkloric medicinal plants are commonly used all over the world and linked with different cultural believes. In most developing countries, including Ethiopia, where many people live under poor hygienic conditions; and has low access to modern health care system, the chance infection with food borne disease is undoubtedly high. As a result, peoples visit traditional healers as an alternative to the modern health care system. To this effect, five traditional medicinal plants (*Vernonia amygdalina*, *Nigella sativa*, *Ocimum sauve*, *Ruta graveolens* and *Ocimum lamifolium*) were collected for evaluation of in vitro antibacterial activity. Soxhlet extraction method and agar disk diffusion techniques were used to obtain the crude extracts as well as for antibacterial activity test. All the petroleum ether, chloroform and methanol crude extracts of the five medicinal plants and volatile oil were tested against standard reference strains, including *Escherichia coli* (ATCC25722), *Staphylococcus aureus* (ATCC25903), *Shigella sonnei* (ATCC259131) and *Salmonella typhimurium* (ATCC13311). The essential oil extract of *Nigella sativa* seeds showed better activity against the Gram negative bacteria *Salmonella typhimurium* at concentration of 3.7  $\mu$ l. Based on our observation, it could be concluded that the crude and volatile oil extracts of the plants are candidate products for treatment of gastrointestinal pains having gone through additional investigation on pharmacokinetics and toxicity of the extracts.

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## Effect of different spacings and pinching times on flowering and yield in China aster (*Callistephus chinensis* L. Nees) cv. Kamini

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An investigation was carried out at college of Horticulture, Rajendranagar, Hyderabad during rabi, 2013-14 to assess the effect of planting distance and pinching on flowering and yield in china aster cv. Kamini. The experiment was laid out in Randomized Block Design with factorial concept and replicated thrice. The study consisted of 12 treatment combination with three spacings (30 cm x 5 cm, 30 cm x 30 cm and 45 cm x 30 cm) and four levels of pinching (pinching at 20 DAT, 30 DAT AND 40 DAT and no pinching). The results revealed that closer spacing of 30 cm x 15 cm recorded significantly minimum days to first flowering (82.30) and 50% flowering (100.42), maximum flower stalk length (37.18 cm), number of flowers per plot (3684.37), flower yield per plot (4.66 kg), flower yield per hectare (14.38 t), seed yield per lot (649.12 g) and seed yield per hectare (2003.46 kg). While wider spacing of 45 x 30 cm recorded maximum flower diameter (6.20 cm), number of flowers per plant (65.88), flower yield per plant (70.56 g), seed yield per plant (12.40 g) and thousand seed weight (1.77 g). Plants pinched at 20 DAT recorded significantly maximum flower stalk length (36.83 cm), number of flowers per plant (70.47), number of flowers per plot (3760.86), flower yield per plant (73.46 g), flower per plot (4.01 kg), flower yield per hectare (12.38 t), seed yield per plant (13.07 g), seed yield per plot (684.02 g) and seed yield per hectare (2161.58 kg) and thousand seed weight (1.78 g) when compared to other pinching treatments. It was concluded that for obtaining higher flower and seed yield per hectare in China aster cv. Kamini planting at a closer spacing of 30 cm x 15 cm and pinching at 20 DAT could be recommended.

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## Design and Development of Mono-Wheel Operated Sprayer Cum Weeder

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Now day's scarcity of labour is creating problem during agricultural operation because in agriculture more labour is required. To reduce this problem a weeder cum sprayer was designed, developed in workshop of BRSMCAET & RS, mungeli, IGKV, Raipur. performance of developed mono wheel operated weeder sprayer was evaluated in field of chickpea of size of 10x10 m<sup>2</sup>. Soil condition of the field was observed by taking the observation of bulk density, moisture content and soil resistance. during the field operation moisture content, bulk density and soil resistance were observed 12.63 %, 1.55 kg cm<sup>-3</sup> and 1.96 N cm<sup>-2</sup> respectively. Performance of developed mono wheel weeder sprayer was observed by taking separately observation of weeding and spraying. in field condition speed of operation was observed 1.4 km.h<sup>-1</sup> for both spraying and weeding operation. During weeding operation width of work was 30cm i.e. spacing between row of chickpea and depth of cut was 3-5 cm. Weeding efficiency, plant damage percentage, field capacity and field efficiency were observed 89.104 %, 2.77%, 0.031 ha.h<sup>-1</sup> and 65.54 % respectively. Sprayer boom consist 3 nozzle, distance between two nozzle was 30 cm so the width was calculated 90 cm. Discharge rate, application rate, pressure of nozzle, droplet size, field capacity and field efficiency were observed 0.536 l.min<sup>-1</sup>, 638.09 l.ha<sup>-1</sup>, 3-5 bar, 1-2 mm, 0.075 ha.h<sup>-1</sup> and 56.41 % respectively.

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## Performance Evaluation of Sugarcane Cleaner-cum-Washer for Jaggery Production

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Jaggery (*Gur*) is one of the important products of sugarcane in India. For quality jaggery making, sugarcane needs to be cleaned before crushing. A sugarcane cleaner-cum-washer (SC-c-W) has been developed at ICAR-Indian Institute of Sugarcane Research (IISR), Lucknow for cleaning and washing of sugarcane prior to crushing for jaggery making. The unit consists of six rollers; two feed rollers having rubber flaps for gripping and cane feeding and four scrapping rollers (02 sets of 02 rollers each) having steel wire brush for removal of impurities sticking to sugarcane stalks. Washing arrangement has also been provided at two places. The unit was evaluated for best performance. For this, three combinations of roller speed were evaluated. It was found that the best combination of roller set was that in which upper rollers moved with 50.63 and 75.95 rpm and lower rollers moved with 60 and 90 rpm in 1<sup>st</sup> and 2<sup>nd</sup> set respectively. It was due to differential speed of rollers which gave best rubbing and scrapping action. Maximum capacity (613.61 kg/h) was also obtained with this combination with three canes feeding in single pass. Maximum- 4.338g impurity removal increases with number of cane feeding at a time and maximum- 0.769g impurity removal increases with number of passes from roller I to III. SC-c-W, when used with washer, appeared giving very good results based on visual observation of cleaned canes. The developed machine may also be useful for sugarcane juice vendors.

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## Determination of cropping pattern for large farmers of Dhamtari district of Chhattisgarh

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In agricultural situations, farmers usually faced with the problem of how to allocate their limited production resources among cropping and livestock activities. A survey was conducted to know the cropping pattern used by the farmers of Dhamtari district to know the optimum cropping pattern for them and thereafter its effect on income. Simple random sampling technique were applied to sample farmers of Dhamtari District. The objective is to develop an understanding of utility of farmer's availability resources and then maximization of total profit. Optimum solution with the land holding capital investment and labour as constraints were found. Crops included in the model were Rice, Gram, Sesame and pigeon pea. The maximum profit may be gained according to the proposed optimal pattern. Optimal income of the farmers were increased by 66.62% for the large scale farmers as compared to the existing solutions.

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## Fumigant toxicity of peppermint oil with phosphine gas against pulse beetle, *Callosobruchus chinensis* L.

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The fumigant toxicity of peppermint oil alone (5, 10 and 15 per cent) and in combination with phosphine (4 ppm) towards pulse beetle, *Callosobruchus chinensis* was determined. The research work was carried out at the Regional Research Centre, Amravati (M.S.) during 2017 - 2018. Per cent adult mortality was observed at 20 minutes and 24 hours after exposure to fumigants. It was observed that per cent mortality increased with increase in exposure period and concentration of volatile oil. Maximum mortality (100 per cent) was observed in the treatment peppermint oil 15% + phosphine 4 ppm after 24 hours of exposure. Minimum mortality of pulse beetle (10.00 per cent) was observed in the treatment, peppermint oil 5 per cent after 20 minutes of exposure and it was increased up to 43.33 per cent after 24 hours of exposure to the treatment

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## Effect of Biofertilizers, Organic and Inorganic Manures on Growth and Yield of Ginger

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An experiment was carried out at Horticultural Research Station, Mondouri, BCKV, West Bengal to identify the suitable bio-organic combination for production of organic ginger variety Gorubathan, with three types of biofertilizers namely nitrogenous biofertilizer (*Azotobacter chroococcum*), phosphate solubilizing Bacteria (*Bacillus polymixa*) and potassic mobilizer (*Fraturia aurantea*) with combination of inorganic fertilizer doses (100%, 75% and 50% NPK) and two levels of FYM *i.e.* 15 t and 30 t. The maximum plant height (89.48 cm), leaf number (163.24) and maximum yield (11.22 kg 3m<sup>-2</sup>) were recorded in treatment combination of FYM 30 t ha<sup>-1</sup> + NPK 100% + biofertilizer (*Azotobacter* + PSB + K mobilizer). The plants grown under bio-organic management exhibited better growth and yield as compared to inorganic management and there is a chance of reduction of use of inorganic fertilizer upto 25%, comparing the yield of the crop under 100% recommended dose of fertilizers.

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## Efficacy of tomato endophytes against *Rhizoctonia solani* and their influence on plant growth parameters

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The most widely grown tomato cultivars were susceptible to soilborne infections and especially to *Rhizoctonia* Root Rot disease caused by *Rhizoctonia solani*. This pathogen is mostly known as a damping-off agent but is also responsible for collar and root rots and eventual death of severely diseased plants leading to significant crop yield loss. In pot culture experiment, among all ten fungal endophytes tested, isolates RFBBA-23 and LFDLA-9 showed increased plant growth parameters and bioefficacy against *R. solani* followed by SFDOF-11, RFHKM-9 and LFDKA-20. Among nine bacterial endophytes, isolate SBHKA-2 and RBDDE-14 showed increased growth parameters and antagonistic activity against, *R. solani* followed by RBDLA-5, RBDNA-4 and LBHRA-5. Isolates SFBHU-15 and LBDGP-1 showed the least effect with respect to growth promotion and antagonistic activity.

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## Ferti-Fortification of Cobalt in Chickpea”

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A field experiment was conducted during rabi season of 2015-2016 at College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari to study the “Ferti-fortification of cobalt in chickpea”. There were fourteen treatment combinations consisting of four cobalt application methods and three levels, Control (no seed treatment), Control (seed priming with water), Seed priming at 0.5, 1.0 and 1.5 ppm, Seed treatment at 1, 2 and 3 g kg<sup>-1</sup> seed, Soil application at 50, 100 and 150 g ha<sup>-1</sup>, Foliar application at 0.01, 0.025 and 0.05% were evaluated with randomized block design with three replications. Almost all the growth and yield attributes were significantly affected due to application of cobalt through soil application method followed by foliar application, seed treatment and seed priming methods at lower concentration. As a consequence, significantly higher grain and stover yield (27.80 and 42.59 q ha<sup>-1</sup>, respectively) were recorded with soil application of cobalt at 50 g ha<sup>-1</sup> and which was followed by foliar cobalt application at 0.01%, seed treatment with 1 g kg<sup>-1</sup> seed and seed priming with 1 ppm cobalt. Total N, P, K uptake (136.96, 27.64 and 101.13 kg ha<sup>-1</sup>, respectively), Co uptake (10.03 g ha<sup>-1</sup>), protein content (21.86 %) and yield (6.08 q ha<sup>-1</sup>) were significantly influenced with soil application of cobalt at 50 g ha<sup>-1</sup>. However, significantly higher available cobalt content (1.40 kg ha<sup>-1</sup>) in soil after harvest was found with the application of cobalt at 150 g ha<sup>-1</sup>. From economic point of view, the maximum net realization □ 134176 ha<sup>-1</sup> with BCR of 4.86 was recorded with the application of cobalt through soil application method at 50 g ha<sup>-1</sup> followed by application of cobalt through foliar method at 0.01% (T12) with net realization of 1,33336 ha<sup>-1</sup> and 4.89 BCR value.

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## Agrarian Crisis and Transformation in India

**Bhashkar Sahu<sup>1</sup>, Azlan Khan<sup>2</sup> Gaiind lal<sup>3</sup> and S.B. Nahatkar<sup>4</sup>**

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This paper examines the changes taking place in the agriculture sector in India, especially since the launching of neoliberal reforms in 1991. Indian agriculture continues to employ the vast majority of the people but in recent years it has experienced a slowdown in growth rates. This sector is experiencing unprecedented crisis with low productivity, high rural unemployment and food insecurity. In the past, availability of credits to farmers, along with subsidies on new inputs were as important determinant of investment in agriculture. Since the nationalisation of commercial banks in India in 1969 and until 1980 the country followed the policy known as 'social and development' banking. However, with the launch of liberalisation policies, the government became very critical towards such policies, and it was argued that the banks should function on a commercial basis. India has experienced GDP average growth rates of 7% for the last nearly a quarter century. However, emphasising the overall growth rate can be misleading, as it does not tell us about the sectoral composition of growth. The growth rate in agriculture sector has been much slower. With the modernisation and development of manufacturing and services, the agriculture sector has declined, as happened in the East Asian economies. However, in India the decline in the agricultural contribution to GDP is not accompanied by a similar degree of employment expansion in the manufacturing sector.

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## Effect of Site Specific Nutrient Management (SSNM) on seed cotton yield and nutrient uptake in *Bt* Cotton in *Vertisols* of TBP command area

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A field study for identification of critical nutrient and realization of target yield through site specific nutrient management (SSNM) comprising of five treatments viz., SSNM for target yield of 4 t ha<sup>-1</sup>, N omission, P omission, K omission and farmers' practice was carried out on farmers' fields on participatory mode during 2015-16 on *Vertisols* medium in available P and high in available K in TBP command. Seed cotton yield target of 4 t ha<sup>-1</sup> was achieved with treatment of SSNM (332.8-78.4-106.4 kg N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O kg ha<sup>-1</sup>, respectively) while the significantly lower seed cotton yield was achieved in case of treatment N omission (3597 kg ha<sup>-1</sup>) followed by K omission (3655 kg ha<sup>-1</sup>) than other treatments due to reduced uptake of major nutrient responsible for the seed cotton yield. Nutrient uptake has shown significant differences among the treatments. Significantly higher N, P and K were observed with SSNM treatment (284, 26 and 222 kg ha<sup>-1</sup>, respectively). Besides, SSNM had favorable residual soil fertility than with nutrient omission. Study highlighted need for SSNM for target yields and better residual fertility. N is the most critical element followed by K for higher and sustainable cotton production and soil productivity.

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