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## 2<sup>nd</sup> International Conference

On

**Recent Advances in Agricultural, Environmental &  
Applied Sciences for Global Development**

**(RAAEASGD-2019)**

**27-29, September, 2019**

**SOUVENIR**

**Organized by**



Agro Environmental Development Society  
(AEDS), Majhra Ghat, Rampur UP, India  
([www.aedsi.org](http://www.aedsi.org))

**Co-Organized by**



**Dr. Yashwant Singh Parmar University of Horticulture and Forestry,  
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**In Association with**



**Plant Pathology Research Institute,  
Agricultural Research Center,  
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**2<sup>nd</sup> International Conference**  
**On**  
**Recent Advances in Agricultural, Environmental &**  
**Applied Sciences for Global Development**  
**(RAAEASGD-2019)**

**September 27-29, 2019**

**Organized by**



**Agro Environmental Development Society (AEDS)**  
**Majhra Ghat, Rampur, UP, India**  
**([www.aedsi.org](http://www.aedsi.org))**

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**Tribhuvan University, Institute of Forestry,**  
**Pokhra Campus-53271, Nepal**  
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**Venue:**  
**Venue: L.S. Negi Auditorium, Dr. Yashwant Singh Parmar University**  
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### Message

It gives me immense pleasure to know that Agro Environmental Development Society (AEDS) is organizing 2<sup>nd</sup> International Conference on "Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development (RAAEASGD-2019) during September 27-29, 2019 at Dr. Y.S.Parmar University of Horticulture and Forestry, Nauni, Solan in Himachal Pradesh and a souvenir is also being published to mark this event.

With the extensive deliberations on different aspects of challenges in contemporary world, the participating delegates will be able to upgrade their professional skill besides sharing their professional knowledge with fellow participants. I hope the conference shall be attended by professionals to discuss thread bare all aspects to come out with effective modes for the benefit of mankind and will be helpful in promoting the scientific awareness and sustainable development of agriculture and environment for the welfare of human being.

My best wishes for the resounding success of the Conference.

*कलराज मिश्र*  
(Kalraj Mishra)



**Dr Yashwant Singh Parmar University of Horticulture and Forestry**  
**डॉ. यशवंत सिंह परमार औद्यानिकी एवं वानिकी विश्वविद्यालय**  
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**डॉ. परविंदर कौशल**  
**Dr Parvinder Kaushal**  
**कुलपति**  
**Vice Chancellor**



**Message**

It is indeed a matter of great pleasure and pride that **Agro Environmental Development Society (AEDS)**, Majhra Ghat, Rampur, Uttar Pradesh is organizing '**2nd International Conference On Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development**' at the main campus of Dr Y. S. Parmar University of Horticulture and Forestry at Nauni, Solan from September 27-29, 2019. Organization of seminars and symposia is an important activity which helps in harnessing the research and communication skills of scientists, researchers and students. Such scientific gatherings are important part of the academic pursuit which opens new vistas for the scientists. The topic of the conference is very relevant because multi-disciplinary interactions are more useful to take a holistic view of a problem. After the industrial revolution in Europe, environment has been the main causality, thus forcing all the countries to build a consensus to combat the same. All climate models predict that there will be more extreme weather conditions, with more droughts, heavy rainfall, and storms with changing climatic conditions in future. In the last two decades, we are observing the adverse effects of climate change on agriculture forcing us to re-orient our research strategies. I am happy that environment, agriculture and other applied sciences will be discussed in a cohesive manner in this conference. The present conference will certainly enrich knowledge of our researchers and students through deliberations and discussion of experts especially coming from different parts of the country and abroad.

I applaud the efforts of the Society, Organizing Committee and Local Coordination Committee for putting their best efforts in making all possible arrangements for this conference. I convey my good wishes for a grand success of this conference and hope that serenity of the campus and the state as a whole will make their visit memorable.

Dr Parvinder Kaushal



**Dr. J.N. Sharma**  
Director of research  
Dr. Y.S. Parmar University of  
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## MESSAGE

From a begging bowl to self sufficiency in food grain production alongside tremendous growth in horticulture sector is a success story in itself in Indian agriculture. India ranks first or second in the production of many agriculture commodities, nevertheless their productivity per unit area is quite low as compared to other countries, in some cases even the world average. It has been traditionally a major employer of the burgeoning population in the country till recently, where around 56% of the workers have been engaged in the farming and ancillary activities and contributing only 14% to the GDP. In the changing world and national scenario, agriculture profession/farming has to be more remunerative for its sustainable growth. Horticulture which has been perceived as a growth engine for agriculture could be instrumental in achieving it and more so doubling the farmers' income by 2022, a well cherished goal of Hon'ble Prime Minister. Farm mechanization and other modern technologies have to be adopted to compete with other sectors and make it more profitable enterprise thus making it attractive to the new generation. Production of residue free and nutritious food is another challenge coupled with protecting the environment from the generation of greenhouse gases from farm activities at the same time. Environmentalists have already questioned the development and use of most of the biotechnological approaches and have till now been successful in halting the progress in this direction, which were once cherished as important tools for mitigating the world hunger. Notwithstanding the above challenges, I am still hopeful that the agriculture scientists will rise to the occasion and develop suitable eco-friendly farm technologies and make farming community acquainted with them to make it a viable employment option. At the same time, the central and state governments will also come up with requisite policies to revamp this important sector.

I am pleased to know that Agro Environmental Developmental Society (AEDS) is organising a three days 2nd "International Conference on recent Advances in Agricultural, Environmental and Applied Sciences for Global Development (RAAEASGD-2019)" at Dr. Yashwant Singh Parmar University of Horticulture and Forestry Nauni, Solan (HP) India on September 27-29, 2019. I hope that all the burning issues related to agriculture and environment will find place in the three days deliberations and valuable recommendations will emerge to revolutionize agriculture while protecting environment at the same time. As a Local Co-ordination Committee Chair, I welcome all the delegates coming from far off places including the foreign participants to this campus at Nauni. I hope your stay will be comfortable and fruitful here. I also want to thank the organizers for selecting this venue for this important conference and wish all the success.

**J.N. Sharma**





**Professor and Head,  
Department of Plant Pathology &  
Co-Chairman  
Local Coordination Committee**

## **MESSAGE**

Innovations and new findings in science are important for the welfare of the society. Discussions in any form and fora by the scientists are vital for the acceptability and growth of the new concepts and ideas. Every such effort should be recognized and encouraged which takes thought process forward. I appreciate the efforts of Agro Environmental Development Society (AEDS), Majhra Ghat, Rampur, Uttar Pradesh which has taken a nice initiative to discuss all these issues on a single platform and is organizing '**2nd International Conference On Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development**' in the serene campus of Dr Y. S. Parmar University of Horticulture and Forestry on September 27-29, 2019 at Solan, Himachal Pradesh. The Society (AEDS) plans to build a movement across the country to identify emerging technologies and their transmission to fellow scientists, policy makers, extension personnel and peasantry for production of nutritionally rich food, which is safe for human consumption without affecting the environmental. Non-Government Organization like academic societies are excellent fora of discussion and knowledge dissemination which help in developing the intellect of a researcher. Organization of seminars and symposia are an important area of work of these academic societies which help in harnessing the research and communication skills of researchers, particularly young scientists and students. The topic of the conference is very pertinent keeping in view the needs of our country as all these issues affect the common man. We need an integrated approach of all stakeholders for the development and progress of the science. Governments can be flag bearer to identify the thrust areas to focus the developmental needs. Resource rich private entities need to contribute generously to such developmental needs such as education, science, health and environment. I hope that the participants will make best use of this conference to exchange their ideas and develop new vistas for their future endeavors in all the important fields put on discussion.

I appreciate the efforts of the Society, Organizing Committee and Local Coordination Committee for putting their best efforts in making the arrangements for this conference. I convey my good wishes for successful organization of this conference.

**(Dr H.R. Gautam)**



**एग्रो एनवायर्नमेंटल डेवलपमेंट सोसाइटी (ए.ई.डी.एस.)**  
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**डॉ. छत्रपाल सिंह**

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## **MESSAGE**



*It is a matter of great pleasure for me to welcome all of you on the occasion of 2nd International conference on "Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development (RAAEASGD-2019)" which is organizing during September 27-29, 2019 by Agro Environmental Development Society, Majhra Ghat, Rampur, Uttar Pradesh, India at Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh in association with Plant Pathology Research Institute, Agricultural Research Center, Cairo University Giza, Egypt & Tribhuvan University, Institute of Forestry, Pokhara Campus, Nepal. India. On behalf of the organizing committee, I warmly welcome to all the Guests, Participants, Delegates, Researchers, Scientists and other stake holders of this conference. I am highly grateful to all the honored guests and eminent scientists from India and abroad for sharing their valuable time and ideas during the conference. I am also thankful to the Director Research and Hon'ble Vice Chancellor, Dr. YSPUHF, Nauni, Solan, HP, India for their constant encouragement and valuable suggestions for organizing this International Conference and the members of Local Coordination Committee, members of organizing committee and various other committees who worked with us for the grand success of this International Conference. The main objective of this Conference is to bring together all the interdisciplinary ideas from the field of Agriculture, Environment and Applied Sciences for the Sustainable Development. The conference will include 10 sessions with invited speakers from abroad and India and exclusive poster and oral presentations.*

*Once again I wish to all of you for three day wonderful stay in this beautiful lap of nature.*

**Dr. Chhatarpal Singh**  
**President, AEDS**



## Agro Environmental Development Society (AEDS), Majhra Ghat Rampur-244922, UP, India



Md. Nadeem Akhtar  
**Convener**  
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### MESSAGE

This is a matter of great honour that Agro Environmental Development Society, Majhra Ghat, Rampur, UP, India and Dr. YSPUHF, Nauni, Solan, HP, India is jointly organizing the 2nd International conference on "Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development (RAAEASGD-2019)" at Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh, India during 27-29 September'2019. On this auspicious occasion, I warmly welcome all the stake holders from India and abroad. The organization of such a mega event will provide us an opportunity to assemble the learned delegates coming from different parts of our country and abroad like Egypt, China, Nepal, Bangladesh and Canada. Organization of such mega event is impossible without team work. In this event we are indebted to the Chief Patron Honb'le Vice Chancellor Dr. Parvinder Kaushal and other university authorities for their kind support and cooperation. I sincere thanks to all the members of various committees for their invaluable support and suggestions to make this conference a grand success.

I am again delighted to welcome you all to this conference for enjoyable stay and pray almighty to bless us for making this conference a great success

(Md. Nadeem Akhtar)  
**Convener**  
**RAAEASGD-2019**



**Dr. Vishal M. Balaramnavar**  
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## **MESSAGE**

Dear delegates

Warm greetings!!!

On behalf of Agro Environmental Development Society, I would like to cordially welcome you to the 2nd International conference entitled "Recent Advances in Agricultural, Environmental & Applied Sciences for Global Development (RAAEASGD-2019)". The last decade has seen not only medical and allied health field but agricultural and environmental sciences have invested significant time and effort into the area of assistive technology. This is a welcome change for the entire humanity where we see clear opportunities and areas of larger networking between various players in this multi domain/ sectoral industry. Our Prime Minister Shri Narendra Modi Ji also said in COP Paris recently that "India has set a goal to reduce greenhouse gas emission intensity of its GDP by 33-35 percent below 2005 levels by 2030". This conference with the theme "Advances in Agricultural, Environmental & Applied Sciences for Global Development" is the right platform to bring various researchers, scientists, academicians and stakeholders under one roof to discuss and take constructive steps to achieve one common goal to make the advances in all these sectors with care of environment. The national policy on our beloved Modi Ji's endeavour to make India plastic-free and achieve climate goals soon but we have a long way to go but with our assistive technology, conference pertaining to environmental and applied sciences its not that much long what I think. The thematic talks and the planery sessions will drive you through the multi sectoral emergence in this new world. This could be the second consecutive conference of its kind in the region where everyone could have opportunity to showcase and present their ideas, thoughts, developments that could lead to a meaningful life in the community. We are trying our best to ensure that your time and stay in the city of Nauni, Solan during the conference be one of the most memorable one and you go back with rich information and as a proud member of our family. I welcome you, your family and friends again to this wonderful gathering and make the maximum out of it. I thank each and every one of you who are contributing to the success of the conference and looking forward to seeing you all soon.

**Dr. Vishal M. Balaramnavar,**  
**Joint Organizing Secretary,**  
**RAAEASGD-2019, Solan, Himachal Pradesh,**  
**India.**



Souvenir is available on website :  
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## Climate Change Scenario: Effects on the Environment and Possible Mitigation Measures

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Atmospheric compositions are changing continuously as a result of human activities. Earth's climate has changed before many times in the last two billion years. At present something important is different this time. The topic was discussed in relation to (i) The Evolution of the Earth (ii) Increase of Human Population (iii) The CO<sub>2</sub> Concentration (iv) An attempt to propose the possible mitigation measures including CAM plants cultivation to overcome the problem. The evolution of the earth, particularly the ancient and the future continent of the planet and the time span from about 20 kyr BP to the present, was discussed. The evidence for climate and chemistry from a number of different sources permits to know the environmental conditions in fair detail for a period substantially longer than that in recorded human history. The history of human population growth was calculated by extrapolation from census figures that exist for the present-day agricultural societies and by examination of archaeological remains.

Atmospheric CO<sub>2</sub> Concentration has gone both up and down during the long geologic history of the earth and the human inputs of CO<sub>2</sub> are one-way flux to the atmosphere, due principally to burning fossil fuel and deforestation, and to other land use conversions. The total human induced emissions of CO<sub>2</sub> were relatively constant from 1780 to 1860. Recent estimates suggest that the gross CO<sub>2</sub> emissions from deforestation and land use changes during the 1980s are appx. 1.6 Gt. of C per year. It was concluded that changes in carbon dioxide is a key factor in climate change and have had an important influence on climate, at least for the past 160 thousand years.

Abundance of CO<sub>2</sub> was relatively high during the warmer Cretaceous and Eocene epochs. – interrupting measurements of isotopic composition (<sup>13</sup>C) of organic material from plankton preserved in ocean sediments laid down during the Cretaceous and concluded that the level of CO<sub>2</sub> during the Cretaceous was 4 to 12 times higher than today. It appears from the data that a value between about 600 and 700 ppm may have applied during the most recent warm period of the Eocene. Evidence showed that temperature has decreased by about 3°C over the past 6000 years

Coal produces major amounts of CO<sub>2</sub>, CO, hydrocarbons, NO, SO<sub>2</sub> and soot during combustion; and methane is emitted into the atmosphere during the mining and processing of coal. Sea Level Rise occurred rapidly during warm period between 10,000 and 7000 years ago, reaching within about 15 meters of its present value at the end of this period. The subsequent rate of increase of sea level was relatively modest, suggesting that the ice sheets had reached closed to their present interglacial configuration by 7000 years ago. From sea level studies of Bangladesh, it was postulated an inundation of up to one third of the country due to 1m and 3 m rises in relative sea level by estimating the area below the 1m and 3 m contour lines due to changes in river gradients, sedimentation and drainage; the primary of impact of global mean sea level on Bangladesh will be an increase in flooding in the depressed basins upstream rather than only at the coast or within the tidal limits.

The warmest temperatures during the past 10,000 years occurred and the peak temperatures were observed during the period known as Hypsithermal, about 8000 to about 5000 radiocarbon years from now. Greenhouse gas emissions by the developing countries have committed us to a mean sea level rise of only 2.7 to 3.5 cm by 2030 and 5.0 to 6.5 cm by 2100.

Global climate change will increase the stress on agricultural systems, potentially decreasing yields at the very time when demand for food is growing dramatically. The question that requires an answer includes: **Are we approaching catastrophic climate change? Will the ends of the Earth occur?** The answer is very complex but not uncertain.

**Keywords:** Earth Evolution, Population, CO<sub>2</sub> Concentration, CAM Plants Cultivation.





## Comparative Study of Natural Resources and Ecological Conditions, Plant Community Types and Diversity of Sundarbans Mangrove and Deciduous Forests

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Plant community types of halophytes of different ecological zones of Sundarbans mangrove forests and deciduous forest were evaluated. Dominant plant species of the ecological zones of mangrove forest and the nature of adaptation were done. Formation of consociation in the Polyhaline zone and also to a lesser extent in Mesohaline zone of the halophytes was observed. In contrast, the Oligohaline zone exhibited mixed plant community. Seasonal variations of soil chemical conditions particularly salinity of water and soil were found highly variable. It was noted that exchangeable calcium is the dominant cation followed by magnesium. Salinity (conductivity) in the river water from selected locations showed strong seasonal variation and was several times higher in the Oligohaline zone at the end of the March (late winter) than in the monsoon season. Unavailability of fresh water supply from upstream through the river Ganges due to Farakka Barrage is responsible for such increase of salinity. Germination behavior of *Heritiera fomes* and *Xylocarpus granatum* in relation to salinity were investigated to explain the nature of adaptation. Variation of pneumatophores of the various species were discussed. Seedlings of *Sonneratia apetala* planted (monoculture) in the Oligohaline zone in the experimental plot showed vigorous growth within three years. Redox potential measurements were taken in different ecological zones to explain the aeration status of soil environment to explain the growth status of plants. Low redox potential values in the top dying areas of *Heritiera fomes* were observed. Plant species from the quadrats of circular plots of 2m radius were recorded and Diversity was measured by  $H'$ , the Shannon-Wiener Index. Ecological diversity was measured based on rarefaction of the actual samples,

$$E(S) = \frac{1}{S} \left\{ 1 - \left[ \frac{(N - n_i)}{N} \right]^n \right\}$$

The diversity values showed correlation with the ecological conditions. The rarefaction methodology was compared with a number of diversity indices using identical data and was found to be influenced by sample size. The abundance of species ranked from most to least abundant (in geometric series) was also calculated as

$$n_i = N C_k K (1 - K)^{i-1}$$

Deciduous forest is dominated by *Shorea robusta* (Sal) with a number of associated species. Profile diagram were prepared to bring the of physiography to a sharper focus.

The data were also analyzed with the log series and the Q statistic to bring plant diversity of the halophyte and deciduous forest to show the variation. The result indicated a strong diversity of the halophytes of Sundarbans mangrove forest. Plant succession pattern and the plant composition in Oligohaline and Mesohaline zones were evaluated.

**Key Words:** Mangrove and Deciduous Forests, Edaphic Features, Species Diversity

## Chemical screening and identification of picroside-i and kutkoside containing accessions of *Picrorhiza kurroa* royle ex benth grown in nepal

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*Picrorhiza kurroa* Royle ex Benth (family Scrophulariaceae), commonly known as Kutki, is a medicinally revered herb which grows in the Himalayan region at elevation ranging from 3000 to 5000m. Its rhizomes are used extensively in traditional medicinal systems. *P. kurroa* also constitutes an important group of medicinal plants used by different community in Nepal. AS a



consequence of over harvesting of wild stock and shortage of natural populations, *P. kurrooa* is listed as a threatened medicinal plant species of Nepal. Picroside-I and kutkoside are the bioactive marker metabolites of kutki. 36 accessions of *P. kurrooa* growing at different altitudes (3170 to 4414m) picroside-I, 0.77 to 4.88%; kutkoside, 0.52 to 8.91% and kutkin, 2.10 to 11.37% in Far Western Development Region and Mid-Western Development Region of Nepal were screened for picroside-I and kutkoside content. The rhizomes were shade dried, milled, defatted, and extracted with hot methanol. The extracts for picroside-I and kutkoside content were analyzed by HPTLC method validated for linearity, precision, specificity and accuracy according to ICH, 1995 guidelines. Separation and quantification of picroside-I  $R_f$  (0.55) and kutkoside  $R_f$  (0.41) was achieved on precoated silica gel 60F<sub>254</sub> aluminium plates using mobile phase chloroform-methanol (75:25, v/v) in a twin trough chamber saturated for 20 minutes. Kutkin content was observed to vary with the altitude. Picroside-I, kutkoside and kutkin ranged 0.77 to 4.88%; 0.52 to 8.91% and 2.10 to 11.37% respectively. ANOVA analysis revealed significant variation in the content of kutkoside and kutkin with altitude. However, no significant variation in the content of picroside-I with the altitude was observed. Six chemically superior accessions of *P. kurrooa* containing high kutkin content were identified for their conservation and cultivation.

**Key-words:** *Picrorhizakurrooa*, Picroside-I, Kutkoside, Kutkin.

### **Effect of opening pattern and placement of spawn packet on bump initiation and yield of shiitake (*Lentinus edodes*) mushroom under bangladesh conditions**

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The experiment was conducted to find out the appropriate opening pattern and suitable strain. The experiments consists of eleven types of opening pattern (top open place on floor, top open place on rack, total open and covered with polypropylene bag place on floor, total open and covered with polypropylene bag place on rack, only cotton plug open and place on floor, no open and place on floor, only cotton plug open and place on rack, no open and place on rack (control), total open and place on rack, total open and place on floor, no open and place on culture house floor) and two strains (Le 8, Le 16) of shiitake mushroom were used as treatment. Time required for bump formation, time required for bump formation after treatment, time required from opening to first harvest, time required for harvest was found lowest from the treatment combination Le 16 with T<sub>5</sub> (only cotton plug open and place on floor) and those parameters were highest except time required from opening to harvest in the treatment T<sub>8</sub> (where spawn packets were no open and place on rack i.e. control) with the strain Le 8. Yield attributes of two strains such as diameter and thickness of pileus were significantly higher in T<sub>9</sub> when packets were total open and place on rack with Le 16 and diameter of stalk was higher in treatment T<sub>5</sub> where only cotton plug open and place on floor with Le 8. The highest length of stalk (1.88 cm) was found from the treatment combination of Le 16 with T<sub>2</sub> (Top open and place on rack.). The highest number (62.00) of fruiting body, the highest number (37.25) of effective fruiting body, highest yield (193.00g) and highest biological efficiency (110.30%) were recorded from the strain Le 16 with treatment T<sub>5</sub> (Only cotton plug open and place on floor) and those parameters were lowest from the treatment combination of Le 8 with T<sub>10</sub> (Total open and place on floor). In general, performance of Le 16 was better than Le 8 in terms of yield and yield contributing characters. Strain Le 16 and treatment T<sub>5</sub> i.e. only cotton plug open and place on floor may be recommended to grow shiitake mushroom under Bangladesh conditions.

**Key words:** Opening, pattern, Placement, Bump, Yield, *Lentinusedodes*



## Impacts of Herbivores and Fungal Pathogens on Invasive Alien Species of Central Nepal,

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Invasive and naturalized alien species in Nepal have become a great problem. They are highly problematic near the construction sites and human settlements. Additionally, they are responsible to cause severe damages to our ecosystem and contribute a huge amount of economic loss. It has been considered that the invasive species spreads rapidly because they are comparatively less damaged by herbivores than the native species. *Ageretina adenophora*, *Ageratum conyzoides*, *Bidens pilosa*, *Parthenium hysterophorus* are some of the problematic invasive species distributed along road side, fallow land, agroecosystems and forests. This study was conducted in Chobhar area of Kirtipur Municipality. This is a historical place and affected by such invasive and naturalized alien species. The main aim of the study was to compare herbivory damage among four problematic invasive species (*A. adenophora*, *A. conyzoides*, *B. pilosa* and *P. hysterophorus*) in the site and to identify the fungal pathogens from the leaves of IAPS for its biological control. The study was conducted from September to November, 2018. Quadrats of size 1×1 m<sup>2</sup> were laid in fallow land, forest and along road side of north and south side of Chobhar, Kirtipur, Kathmandu. Twenty-two quadrates were laid in each site. Three plants were selected from each quadrat to count number of healthy and herbivory infected branches and leaves. Insect damages in leaves, leaf rolling, galls, tumors, leaf spots rather than fungus, bites, leaves curling and blights were considered as the damage, and percentage of damaged branches and leaves were calculated. Damage in case of branches was found maximum in *B. pilosa* in fallow land. Similarly, *A. adenophora* inside forest was highly damaged by herbivores. In case of *A. conyzoides* severe damage was found in the road side north but the highest level of herbivory damage in *P. hysterophorus* was found maximum in road side south. Similarly, in case of leaves, damages was found maximum in *B. pilosa* from RoadNorth, while in case of *Ageratum conyzoides* & *Ageretinaadenophora* maximum damages were calculated from RoadNorth, Finally, from Road South severe damages was found in *P. hysterophorus*. It concludes that the invasive alien species are also damaged by herbivores but the damage level is affected by aspect and habitat types.

Along with herbivory damaged assessment, also 26 fungal infected IAPS leaves were collected randomly during the field survey and were cultured in PDA and were identified. A total of 17 fungi were identified. Further studies are recommended for additional information in herbivory damages and fungal identification. This work might be helpful for biological control of IAPS to economic level and also herbivory assessment will be helpful to know the current status of herbivory damages on selected IAPS.

**Key-words:** Alien species, herbivory damage, fungal pathogens, PDA, aspect, habitats, biological control.

## Subsequent Agricultural Land Abandonment Harbor Distinct Soil Fungal Communities in Middle Mountain Region of Central Nepal.

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Land-use change is one of the leading cause of biodiversity loss worldwide. In addition to aboveground changes, modification in belowground soil fungal communities have been documented from several studies. Land-abandonment and subsequent succession of abandoned land to forest areas are predominant in middle mountain region of Nepal because of several socioeconomic reasons. Consequently, we studied the soil fungal communities in different land-use types namely; agricultural land, short term abandoned land, long term abandoned land, short term regenerated forest and long term regenerated forest. We identified 25 permanent plots (5 replicates of each land use types) in study sites and soil samples were collected. Next generation sequencing (NGS) method was used to monitor the fungal community in these soil samples. We found that agricultural land, abandoned land and forest harbor distinct soil fungal communities.

**Keyword:** Land-use, Soil fungi, NGS, abandonment



## Tree disease in managed community forest and national forest of chitwan district, nepal

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To find out disease incidence in community managed forest and national forest a study was conducted. During present study a survey was made along the community forest a sample plot size of 20×25m in the national forest up to the 198m. in order to collect Forest diseases, were as community managed forest upto the height of 560m Disease of the forest was enumerated with habit, habitat, substrate and % of damaged, with soil characteristic for information. Altogether 13 diseases were identified. These are Dieback, Root rot, Heart rot, Blister bark disease, Sal borer, Canker, Leaf blight, Leaf Skeletonizer, Leaf mine, Shot hole, Scald, Downey mildew, Powdery mildew etc. During study it was found that regeneration of Sal was also effected by different types of foliar diseases. The present study revealed that destructive anthropogenic and natural impacts coupled with overexploitation of forest resources have caused severe damage to the forest ecosystem. Sal is usually harvested for construction works, fuel wood, timbers and furniture making purposes. The rapidly expanding agriculture in the forest land is a significant threat to the Sal forest ecosystem Due to illegal cutting, encroachment of forest areas, and illegal poaching of wildlife, the Sal forest is losing biodiversity at an alarming rate. The present status of the Sal forest ecosystem has been briefly discussed with diseases in this paper. During the research regarding the present threats to the Sal forest ecosystem of Nepal this study recommends adoption of a sustainable forest management strategy based on scientific forest management concepts of advanced silviculture.

**Keywords:** Sal forest; Dominant tree diseases, Threats; Biodiversity; Anthropogenic impacts; Conservation; Sustainable management; Shorea robusta

## Reduction of browning in aonla juice with anti-browning agents during storage at room temperature

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Though aonla (*Emblicoefficialis* Gaertn.) is a rich source of antioxidant phytochemicals like polyphenols and ascorbic acid, its juice suffers from browning during storage. The present study was undertaken to find out suitable anti-browning agent for reducing browning during storage of aonla juice (cv. Chakaiya) at room temperature (25–42 C) up to 8 months (February – September). The role of individual phenolic compounds and organic acids in browning was also studied. Ascorbic acid, citric acid, oxalic acid and L-cysteine were tried as anti-browning agents. Individual phenolic compounds and organic acids in juice samples were identified and quantified by high performance liquid chromatography (HPLC). Eight month storage study of juice at room temperature revealed the maximum retention of vitamin C (539 mg/100 ml) was achieved with L-cysteine and that of polyphenols (2.33%) with ascorbic acid, while the lowest NEB (0.153 OD) was recorded with oxalic acid. HPLC analysis of different phenolic compounds confirmed the role of gallic acid in browning of aonla juice as it increased significantly during storage period. Minimum increase of gallic acid was noticed in juice containing L-cysteine as anti-browning agent. Citric acid was the major organic acid detected in aonla juice, but organic acids did not play any role in browning of juice. Oxalic acid and L-cysteine could be used to check browning in aonla juice during storage.

**Keywords:** Aonla, juice, storage, browning, anti-browning agents



## Carbon Sequestration Potential of Mango (*Mangifera indica* L) Orchards in Subtropical Region

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Impact of global climate change is radically affecting vegetation and food availability. In order to cope up with the need of food and nutritional security, area under fruit tree plantations is gradually increasing. Involvement of tree species has been recognized well in reducing carbon dioxide emissions as well as enhancing carbon sinks. However, with exception to forestry species, meagre attention has been paid to reveal the contribution of fruit tree species in carbon sequestration. Mango (*Mangifera indica* L) is an important fruit tree crop of India. In India 2516 thousand ha area is under mango cultivation. Average age of mango orchards is more than 50 years. Mango trees contribute considerably in carbon sequestration during their entire life span. Therefore, it is imperative to estimate contribution of mango orchards in carbon sequestration. With a view to find out carbon sequestration potential of mango orchards/ trees, an experiment was conducted for three consecutive years i.e., 2016 – 2019 in mango plantation. Non destructive method was applied for approximation of carbon sequestration potential of mango trees. Mango trees were divided into three age groups viz., 5-15 years, 15-25 years and > 25 years. Girth of trees at ground level/ base was found to vary from 1.29 – 2.49 m, diameter 0.41 – 0.79 m and plant height 6.99 – 12.19 m. Total dry weight of trees was 360.42 – 2094.64 kg. tree<sup>-1</sup>. Carbon content in trees was found to be in the range of 180.22 – 1047.32 kg. tree<sup>-1</sup>. Carbon sequestration was estimated with the help of allometric equation which varied 18.87 – 109.71 kg. tree<sup>-1</sup>.year<sup>-1</sup>. Average carbon sequestration by approximately 35 year old mango trees was found to be 46.45 kg CO<sub>2</sub> per year. In addition to their primary role in fruit production and increasing farmer's profitability, mango orchards contribute considerably in carbon sequestration and mitigating the adverse impact of climate change. Fruit tree crop plantations may provide a sustainable alternative to sequester carbon and mitigate the negative impact of climate change in the years to come.

**Key words:** Carbon sequestration, mango, plantations, subtropical region, evergreen.

## Influence of Different Planting Times on Growth and Flowering of Gaillardia Local Cultivars

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Gaillardia is one of the hardiest summer annuals grown in different climatic conditions on variety of soils with a remarkable flowering period. Due to its year round cultivation, attractive flower colour it is often used as a substitute to chrysanthemum or marigold whenever these flowers are in short supply or out of season. A field experiment was carried out was carried out at Floricultural Research Station, Sri Konda Laxman Telangana State Horticultural University, Rajendra nagar, Hyderabad during September, 2018 to June, 2019. The experiment was laid out in Factorial Randomized Block Design with two cultivars viz. Local yellow, Local red (with yellow tip) and five different times of planting viz. 1<sup>st</sup> week of October, 1<sup>st</sup> week of November, 1<sup>st</sup> week of December, 1<sup>st</sup> week of January, 1<sup>st</sup> week of February replicated thrice. Based upon the results it can be concluded that, both the cultivars of gaillardia namely Local yellow and Local red (with yellow tip) performed good with respect to growth and flower yield. Among different planting times, 1<sup>st</sup> week of January performed good with respect to growth and flowering parameters and can be the optimum time of planting for higher flower yield in gaillardia local cultivars followed by 1<sup>st</sup> week of November and 1<sup>st</sup> week of December which are on par with each other. 1<sup>st</sup> week of January recorded maximum plant height (36.90, 43.60 and 61.90 cm), number of branches per plant (8.13, 11.95 and 18.20) at 60, 90 and 120 DAT along with



maximum number of flowers per plant (162.66), flower yield per plant (365.28g/plant) flower yield per hectare (219.08 q/ha) and Flower diameter (5.46 cm).

**Keywords:** Gaillardia, Planting time, Cultivars

### **Development of aonla, guava, bael, papaya and carrot candy mix for nutritional enrichment of rural children**

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Aonla, guava, papaya, bael and carrot are very rich in nutritional composition and have high medicinal values. Value added and processed products from these fruits can add value to the daily diet and alleviate malnutrition among rural population in addition to the several health benefits. These fruits are rich source of antioxidants, Vitamin A, Vitamin C, Vitamin E, riboflavin and fair amount of iron. Guava, papaya and carrot are used for table purpose and all are used in the development of value added products such as jam, jelly, squash, slices, bar, RTS, candy etc. These fruits and vegetables complement each other in terms of nutritional value. Making a diversified product with goodness of all these commodities and its storage study up to the six months was the objective of this work. Organoleptic quality of the candy mix was evaluated by using nine point hedonic scales. No microbial growth was observed during entire storage period. Hundred gram of candy mix consist 8.01 per cent moisture, 2.45mg / 100 gm carotene and 280mg / 100 gram ascorbic acid. Hundred grams of candy mix provide fifty per cent of the total carotene and seven times higher ascorbic acid than the Recommended Daily Allowance for Indian diet. As candy is popular among children this candy mix can be used as nutritional supplement in diet for reducing malnutrition in rural children.

**Key words:** Candy mix, nutritional composition, aonla, bael, malnutrition.

### **Overall Rice biodiversity at Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh**

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Rice (*Oryza sativa* L.) is the staple food of more than three billion people in the world, most of who lives in Asia. It is the beginning point of food harbor and is thoroughly associated with conventional ethnicity and traditions. Chhattisgarh is very rich in rice biodiversity and popularly known as "Rice Bowl of India". Germplasm and their wild relatives acquired important genes and replaced by elite high yielding semi dwarf rice varieties which is leads to severe declining in variability of the crop.

As a result, it was essential to collect and conserved the naturally occurring genetic variabilities. In this context, collection and characterization of rice accessions for various Agro-Morphological traits is essential for identification of donors/unique lines among the diverse germplasm for their extensive utilization in rice improvement programme. At present about 23000 land races of rice are conserved and maintained at Indira Gandhi Krishi Vishwavidyalaya, Raipur, in Department of Genetics and Plant Breeding. Late Dr. R. H. Richharia and his associates collected over 18000 rice accessions of indigenous germplasm from Madhya Pradesh during year 1972 to 1981. Out of these about 15,000 accessions were from Chhattisgarh. Out of total accession 4557 accessions comes under early group, 5069 accessions comes under medium group , 7915 accessions comes under late group & rest of the germplasm are the research entries from various projects, few breeding materials and wild rice.

The major purpose of varietal characterization is to establish the distinctiveness between the germplasm and also to establish their unique detection profiles on the basis of grouping individuality of germplasm. Some of the rice accessions are of unique characteristics as follows:



1. Double grain quality type: as in Do-dana and Ram-Laxman
2. Clustered spikelet: as in Amaruthi, Koudidhool, Nariyalphool, Chhindguchhi etc.
3. Spikelets with typical long sterile glume: as in Suapankhi, Pankhi, Mainagali, Udanpakheru, Ramalichonch, Pakshiraj etc.
4. Some wild rice species having leaves with undeveloped ligule like *Oryza officinalis*, *O. latifolia*.
5. Accessions with longest grain like Dokra-dokri and that with shortest grain like Ramjeera
6. Accessions with scented grains like Badshahbhog, Atmasheetal, Tulsimanjari, Jauphool, Kadamphool, Tilakasturi, Barhasal etc.
7. Extra Early accessions like Sathia and late accessions like Korma, PTB 33 etc.
8. Bold grained and suitable for Poha (Rice flakes) like Hathipanjara, Barhasal (Scented flakes), Roti, Cheptigurmatia, Uraibutta, Makdo etc.
9. Nutrient rich rice accessions
  - a. Ganga balu, Kadamphool, Dubraj, Rani Kajal with high iron,
  - b. Lalu 14, Ramkajri, Banaspati, Badshahbhog, Dokradokari with high zinc content,
  - c. Vishnubhog, Jalpa and wild rice like MS-9, VS-55, and V.S.R-67 with high protein
  - d. Safari, Laycha, Naina Kajal and other wild rice like V.S.R.-5, V.S.R.-9 with high lysine content.

Till to date based on morphological and agronomical characteristics four catalogues had been published with characterization of about 22,000 accessions of early and medium and late group rice. Publication of above mentioned unique rice germplasm is also being done and which is very informative for breeders and researchers to utilize it in rice improvement programme. Since 1982 these germplasms are being utilized for release of new varieties in rice like Kranti, Cross 116, Madhuri, Mahamaya, Indira, Karma Mahsuri, Maheshwari, IGKVR-1 (Rajeshwari), IGKV R-2 (Durgeshwari), Indira Barani Dhan-1, Dubraj Selection-1, Badshahbhog Selection-1, Vishnubhog Selection-1 Tarunbhog selection-1, Chhattisgarh Madhuraj55, Chhattisgarh Sugandhitbhog, and Chhattisgarh Devbhog.

The medicinal rice are being used by tribal farmers for curing various ailment in their day today namely, Gathuvan, Lycha, Maharaji, Danwar, Baisur, Resari, Sarai Phool, Bhejari etc. The medicinal properties of above rice varieties needs to be validate. The collaborative research work between BARC, Mumbai and IGKV, Raipur, experiment were carried out to evaluate the anti-cancer efficacy to extract isolated from medicinal varieties of rice. Among the medicinal varieties three varieties Gathuvan, Lycha and Maharaji were selected for experiments and research work is going on.

**Key words:** Germplasm, Collection and characterization, , rice, wild rice, medicinal.

### **Strategic Application of Bioagents for Biological Management of Root-knot nematode , *Meloidogyne incognita* infesting pomegranate**

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The statistical design field experiment was conducted during Ambia bahar 2012 to 2015 for the biological management of root-knot nematode , *Meloidogyne incognita* infesting pomegranate. It was the evident that the split application of Phule *Trichoderma* plus *Pacilomyces lilacinus* ( cfu  $2 \times 10^6$ ) ( 10 kg at bahar and 10 kg at 90 days after bahar) were found to be effective and showed 76.29 to 71.82 per cent reduction of root knot nematode at intermediate stage and split application treatment. However, the treatment of Phule *Trichoderma* plus *Pacilomyces lilacinus* ( cfu  $2 \times 10^6$ ) was also found effective for the control of root galls and egg masses of root knot nematode at intermediate stage. The split treatment of Phule *Trichoderma*



plus also found superior in recording highest marketable yield of pomegranate with gaining maximum cost benefit ratio of 1:2.89 followed by *P. chlamydosporium*

**Keywords-** Bioagent, *Trichoderma viridae*, *Pacilomyceus lilacinus*, root knot nematode

### **Evaluation of promising genotypes of ber (*Zizyphus mauritiana* Lamark) against its pest complex.**

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The investigation on evaluation of promising genotypes of ber against its pest's complex were carried out at AICRP, Arid Fruit Zone Project, Department of Horticulture, MPKV, Rahuri, Dist. Ahmednagar, Maharashtra during 2016. Among the twenty genotypes screened against pest complex, the genotype Chandegaon Sel., and Chalisgaon were found significantly superior in registering least damage due to leaf eating caterpillar and fruit damage due to fruit borer and stone weevil. Moreover, these genotype were visually found free from powdery mildew disease. Which could be used as best source of resistance in future. The data on pest infestation due to leaf eating caterpillar, leaf webber, fruit borer and stone weevil amongst twenty genotype showed the non-significant correlation with periodically observations with meteorological data.

**Keywords-** ber, *Zizyphus mauritiana* Lamk, fruit borer, stone weevil, leaf webber

### **Climate Change: A Threat to Agriculture and Livelihood Security of Farming Community**

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India is a country of diverse climate. The climatic, edaphic and socio-economic diversity of the Indian crop production system is marked with various cropping systems. Cropping activities go on all round the year in India provided water is available for crops. However, climate is the most dominating factor influencing the adaptability of a crop to a particular region. The yield potential of a crop mainly depends on climate. Indications of climatic change are already perceptible and evidence of climate change can be observed from existing changes in agricultural patterns. Climate change is a change in weather patterns that lasts for long period of decades to millions of years. The term climate change has become synonymous with anthropogenic global warming. Changing climate has a great impact on rainfall, droughts, floods, sea level, temperature, agriculture and grasslands. Prevailing trends of climate change pose a great threat to the production and productivity of major cereal crops in India. A large area of land under agriculture is expected to undergo changes in rainfall patterns, temperature and extreme events over the next several decades thus making agriculture more risk prone. Hence, to forestall the ill effects of climate change, more attention has to be paid to improved technologies and mitigation strategies to sustain the productivity and to ensure food and environmental security to the country. Agriculture represents a core part of Indian economy and provides food and livelihood activities to much of the Indian population; climate change is expected to impact on agricultural productivity and shifting cropping patterns. Therefore, attention needs to be given to develop simulation crop models along with scientific research driven initiatives for ensuring food and livelihood security.

**Keywords:** Climate change, Cropping pattern, Global warming, Food security, Simulation models





## Integrated Nutrient Management for Improving Soil Health and Enhancing Agricultural Productivity

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Soil is the foundation for almost all land use systems and soil health is a crucial indicator of sustainable land use. Soil health or quality reflects the capacity of soil to sustain plant and animal productivity while maintaining water and air quality within natural or managed ecosystem boundaries. However, deterioration of soil quality due to various anthropogenic activities is a pressing ecological concern these days as soil is vital for food production. Soil health is imperative for sustaining agricultural productivity; it indicates productivity level of a soil for a given crop. Therefore, it becomes mandatory to develop strategies for managing and enhancing soil health. Integrated nutrient management (INM) is definitely one of the most effective strategies for improving soil quality along with enhancing soil productivity and fertility. Improving soil health can influence profitability in agriculture production by increasing plant vigour, yield and reducing input costs. Integrated nutrient use comprises of efficient management of all the major plant nutrient sources for sustaining fertility, productivity and health. In simple words it is the conjugation of inorganic and organic plant nutrient sources for supplementing plant growth. The integrated use of organic and inorganic plant nutrients have shown an increase in agricultural productivity than when either of the sources is applied alone. The basic objective of INM is to make balanced nutrient supply to crop that maintains and also improves the soil health status over a long term basis. At present there is a dire need to adopt strategies that can sustain agricultural production without compromising the quality of natural resource base particularly in areas where soils are exhausting rapidly due to intensive cultivation practices. Thus, INM can serve as the best remedy for enhancing soil fertility, productivity and soil health over a long run.

**Keywords:** Soil health and quality, Integrated nutrient management, Sustainability

## Antibacterial and antibiofilm efficacy of thyme oil against *Staphylococcus aureus* and *Staphylococcus epidermidis*

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The present study was aimed to study the efficacy of thyme essential oil against acne associated microorganisms *Staphylococcus aureus* and *Staphylococcus epidermidis*. The antibacterial activity was determined in terms of minimum inhibitory concentration (MIC). Effect of thyme oil on biofilm formation of *S. aureus* and *S. epidermidis* was evaluated. The MIC of thyme oil was found to be 0.06% (v/v) and 0.19% (v/v) against *S. aureus* and *S. epidermidis* respectively. Thyme oil was found to inhibit biofilm formation by 43-46% and biofilm eradication by 67-69% in both the tested bacteria. Scanning electron microscopy along with time kill analysis and salt tolerance assay revealed that thyme oil acts on cell membrane of bacteria by altering its integrity. The results of the present study confirmed that thyme oil could work as a promising anti-acne agent.

**Keywords:** Antibacterial, Thyme oil, *Staphylococcus aureus*, Anti-acne.

## Bioactivity and GC-MS profile of Orange jasmine, *Murrayapaniculata* leaf essential oil

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Botanical insecticides based on compounds or extracts obtained from plants are considered to be one of the promising components in integrated pest management which aims at optimum utilization of resources to achieve ecofriendly and economically viable pest management. Screening of plant extracts and/or essential oil derived from it is considered to be most



important step to identify plants possessing insecticidal properties. In present study essential oil from leaves of *Murrayapaniculata* were obtained through hydro distillation method and subjected to GC-MS analysis and evaluation of its fumigation and insect growth regulatory (IGR) activity. The fumigant activity analysis against Almond moth, *Cadrapautella* revealed egg stage as more tolerant ( $LC_{50}$  after 48 hrs 14.370 and after 72 hrs 10.383  $\mu\text{l}/250$  ml air) whereas adults as most susceptible stage ( $LC_{50}$  after 48 hrs 5.644 and after 72 hrs 4.725  $\mu\text{l}/250$  ml air). IGR activity against 3<sup>rd</sup> instar larvae of *Spodoptera litura* showed very high larval mortality (60-80 per cent at 1-8 mg/100gm concentration), influence on larval duration and adult emergence. The GC-MS analysis of essential oil of leaves revealed presence of 32 chemical compounds of which germacrene-D (23.9%),  $\alpha$ -zingiberene (23.3%),  $\beta$ -caryophyllene (17.2%) and trans-nerolidol (13.2%) were dominant compounds. The present studies revealed that essential oil from leaves of *M. paniculata* possessed both fumigant as well as IGR activities and can be further explored for evaluation against other insect pests.

**Key words:** *Murrayapaniculata*, fumigation, insect growth regulatory, essential oil

### Impact of stubble burning (rice-wheat cropping system) on environment and its management

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Rice-wheat system with an area of 11 million hectares is the extensively practiced cropping system in north-western states of India. This generates a huge amount of agricultural wastes in the form of straw and stubbles. The agricultural residue mainly are utilized as animal fodder, roofing and shedding of homes, cattle shed, domestic fuel usage and raw material for small-scale industries. Still, a bulky part of the stubbles as well as straw is not employed and remains in the agricultural farms bringing trouble for the farmers, which leads to stubble burning. *In situ* burning of crop residue is one of the adopted method to clear the agricultural field promptly and allocating tillage practices for sowing of next crop. This incident is spread universal and also significantly degrade the air quality throughout the globe. So, Burning of farm residues from rice-wheat cropping system at a large scale is an issue of great concern which results in problems like atmospheric pollution, health risks and deteriorating soil health. The crop residue burning can be curtailed by off-farm utilization (straw removal), *in-situ* management (straw incorporation and straw mulch/surface retention) of crop residue and by following government policies for environmental conservation and sustainable future.

**Keywords:** stubble burning, rice-wheat system, environment, management

### Ligninolytic Microbes: An eco-friendly tool for bioremediation of paper and paper mill effluent

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Pulp and paper industries in India are one of the most polluting industries. Due to complex and toxic nature of wastewater, their complete degradation using convention biological process (e.g. activated sludge process or aerated lagoon) is not easy. Hence, the existing treatment system needs to be augmented with specific microbes to improve the treatment efficacy for the safety of environment and human health. Bacteria with ligninolytic enzymatic system are being explored for application in paper industry wastewater treatment. We have isolated two ligninolytic bacterial strains (*Paenibacillus* sp. and *Serratia liquefaciens*) with laccase and lignin peroxidase activity. These bacterial strains were evaluated for the treatment of pulp and paper mill effluent in batch culture. These isolates were effectively reduced pollution parameters (colour 68-72%, lignin 54-58%, phenol 86%-95 and COD 78-85%) after 144 h of treatment at  $34\pm 1^\circ\text{C}$  and 120 rpm. The toxicity assessments carried out with treated and untreated effluent by studying the *Vigna radiata* (L.) seed germination and *Allium cepa* (L.) chromosomal aberration assay, which showed significant reduction in phytotoxic, cytotoxic and genotoxic effects of effluent.

**Keywords:** Bioremediation, Ligninolytic bacteria, Phytotoxicity, Genotoxicity, Cytotoxicity.



## Effect of Expansion Activities of National Highway-154 on Ambient Air Quality

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Road expansion activities are often proposed as a solution to traffic congestion and as a means of stimulating economic growth. Moreover, these activities are an important source of various pollutants into the atmosphere and can have a substantial temporary impact on air quality. Air quality deterioration due to road expansion activities has become one of the most serious problems in the whole world and has resulted in huge threat to well being of human and its environment. The study was conducted in the year 2016 and 2017 at four sites during pre and post monsoon season with three periodic assessments (1<sup>st</sup>, 15<sup>th</sup> and 30<sup>th</sup> days of the month) to assess the ambient air quality in National Highway-154. The Highway is being upgraded from its present two to a four lane layout divided carriageway and has led to deteriorate the air quality of the region. Air quality status was assessed alongside highway expansion activities based on air pollutants like particulate matter less than 10 micron (PM10) in size, nitrogen dioxide (NO<sub>2</sub>), sulphur dioxide (SO<sub>2</sub>) and volatile organic compounds (VOCs). Elevated concentrations of PM10, NO<sub>2</sub>, SO<sub>2</sub> and VOCs around the road indicated that vehicular emissions are the main source of these pollutants in the region. NO<sub>2</sub> ranged from 16.96 to 26.33 µg m<sup>-3</sup>, SO<sub>2</sub> varied from 3.72 to 7.94 µg m<sup>-3</sup>, VOCs ranged from 5.03 to 8.01 µg m<sup>-3</sup>, respectively and were below the prescribed permissible limits. In addition, air quality deterioration was observed due to PM10 concentration, which ranged from 74.56 to 116.77 µg m<sup>-3</sup> and have crossed the permissible limit (100 µg m<sup>-3</sup>), as prescribed by National Ambient Air Quality Standards (NAAQS). Therefore, study suggests that the road expansion activities are causing negative impacts on air quality, which has to be reduced for the sustainable development of the region.

**Keywords:** Highway expansion, Ambient air quality, PM10, NO<sub>2</sub>, SO<sub>2</sub> and VOCs, Impact Assessment, Management

## Innovations in seafood processing and packaging

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Seafood includes freshwater or marine animals which are regarded as food for human consumption and divided into two major classes namely finfish (white fish and oil-rich fish) and shellfish (molluscs and crustaceans). It has been considered as a source of high quality proteins, vitamins, minerals and essential fatty acids (omega-3 and omega-6) and constitutes important part of a healthy human diet. According to FAO globally the seafood constitutes 6.70% of the total protein intake and 17% of the total animal based protein intake of the human diet. Seafood is very highly perishable commodity which usually spoils faster than any other muscle foods and enzymatic autolysis, oxidation and microbial growth are the major causes for the fish spoilage. During the spoilage process there is a breakdown and formation of various components like trimethylamine (responsible for characteristic stale fish odor), hydrogen sulphide, methylmercaptan, dimethylsulphide, ketones, aldehydes, esters, acetic acid, butyric acid and propionic acid which are responsible for the changes in odour, flavor and texture of the fish meat. The processing profitability depends upon the appropriate processing and packaging techniques which enables maximal use of raw material. The use of various innovative processing and packaging techniques can extend the shelf life of sea foods and help seafood producers to provide nutritional, minimally processed, high quality and additive-free end product. The various innovative processing techniques which can be employed in seafood processing are high pressure processing, pulse electric field, ultrasound, irradiation, infrared processing, pulsed light technology, microwave processing, ohmic heating, high pressure freezing, high pressure thawing and radio frequency processing. Packaging is a critical factor in the success or failure of any food commodity and the recent packaging technologies like active packaging (scavengers), intelligent packaging (indicators) and anti-microbial packaging have an important role in the preservation and shelf-life extension of fish and fishery products.



**Keywords:** Fish, Packaging, Processing, Seafood, Spoilage

### **Studies On Common Pests Of Geometrid Moths From India**

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The family Geometridae was recognized as a natural unit long before the origin of taxonomy as a science. The moths of family Geometridae are of great economic importance. The caterpillars of this group are commonly known as 'Loopers' due to their characteristic locomotive behaviour. These loopers are defoliators of the leaves of agricultural crops, fruit plants and forest trees. The geometer moths are notorious pests, most larvae feed on the leaves of woody plants (coniferous and deciduous trees, shrubs) some species eat herbaceous plants. Many species are economically important pests of fruits trees, forest trees, and berry crops. Caterpillars of three major Geometrid species such as, *Hyposidrataleaca* Walker, *H. Infixaria* Walker and *Biston suppressaria* Guenée frequently attack tea plantations of sub-Himalayan plains. The caterpillars of *Hyposidrasuccessaria* (Walker) destroy many oil seed crops and sweet potato. The loopers of *Chlorissapunctifimbria* (Warren) attack the leaves of *Acacia nilotica* and *Carissa spinarum*. *Mixochloravittata* (Moore) damage the leaves of many species of *Quercus* and *Castaeacrenata*. The larvae of *Agathiahilarata* Guenée defoliate the leaves of *Nerium indicum* and *Tracheospermum carissa*. Some other important pests of geometrids like *Rhomboristadevexata* (Walker) attack foliage of *Bauhiarivariiegata* and *Jodisaegutaria* (Walker) feeds on plants of families Caprifoliaceae, Cercidiphyllaceae, Rosaceae and Staphyleaceae. The caterpillars of *Antitrygodescuneilinea* (Walker) are serious defoliators of *Anthocephalus cadamba*. The forest trees like *Rumax* sp. and *Acacia catechu* are damaged by loopers of *Anisephyraocularia* Fabricius and *Tramindamundissima* (Walker) respectively. *Ascotisselenaria* is a known pest of coffee in East Africa and Kenya respectively and its larvae feed on leaves, fruits and flowers. The larvae of *Fascellinachromataria* Walker feed upon the cinnamon plants. Immature stages of *Carigescutilimbrata* Prout are known for the damage to various ornamental and forest plants as these heavily feed upon their leaves.

**Keywords:** Geometrid moths, pest, larva, plants.

### **Effect of spray drying on physicochemical properties of Custard apple (*Annona squamosa* L.) pulp**

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The objective of this study was to determine the physical and chemical characteristics of laboratory prepared spray dried custard apple powder and to optimize its yield and other physical properties. The post harvest loss in custard apple (*Annona squamosa* L.) is a major problem in the market supply chain of small farm holders in India. Spray drying is one of the effective post-harvest technology used for making fruit powders of long shelf life. The response surface methodology was used to optimize the spray drying process for development of custard apple (*Annona squamosa* L.) pulp powder. The drying was carried out in a laboratory spray dryer independent variable were different levels of inlet air temperature, outlet and maltodextrin concentration. The responses were moisture%, bulk density, yield, degree of caking, solubility index and dispersibility. The Inlet temperature was kept in the range 100-140°C and outlet temperature was in the range of 70-110°C maltodextrin concentration was in the range of 5-20% along with-it cellulose was also used as carrier agent at 3%. pectinase enzyme 100ppm was used for better juice recovery from pulp. The optimum conditions were found as 140°C inlet air temperature and a maltodextrin concentration of 20% with using desirability function.

**Keywords:** Effect, spray drying, physicochemical properties, Custard apple



## Silver Nanoparticles Impregnated Cellulose Sheet for Drinking Water Decontamination

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Safe and clean drinking water is a fundamental necessity to fast growing population of developing countries where microbial contaminations pose big problems. A green approach for decontamination of water employing a very simple gravity-fed water disinfection unit was developed. The silver nanoparticles (Ag NPs) impregnated cellulosic cotton fibers were prepared using domestic microwave oven. The microwave power and irradiation time were controlled to optimize the size and density of silver NP sovercellulosic cotton fibers. The prepared cotton fabric was characterized through ATR-FTIR, UV-VIS diffuse reflectance spectrophotometer, SEM and TEM investigations. Size of Ag NPs as well as total density of silver atoms on fabric found increased with the increase of microwave power from 100 W to 600 W. The antibacterial efficacy of Ag NPs extracted from Ag NPs cotton fibers was found to be more effective against Gram-negative bacteria than Gram-positive bacteria with MIC of  $38.5 \pm 0.93 \mu\text{g/mL}$  against *Salmonella typhimurium* MTCC-98 and  $125 \pm 2.12 \mu\text{g/mL}$  against *Staphylococcus aureus* MTCC-737. The permeate after filtration through the prepared impregnated fiber at the rate of 100 mL/min was totally devoid of any bacterial cell (*E.coli*). Generation of ROS and free radical were also observed which leads to cell death. Based on the excellent deactivation efficacy suggested that Ag NPs fibers could be used as potentially safe disinfectants for cleaning of medical equipment, hand, wound, water and preservation of food and beverages.

**Keywords:** Silver nanoparticles, Cellulose, Microwave irradiation, Antibacterial efficacy, Cell death, ROS.

## Genetic parameters estimation of some quantitative traits in *Brassica Campestris* var. yellow sarson under irrigated condition

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The present investigation comprising the ten cultivars of *Brassica campestris* var yellow sarson (viz. YSCN 17-1, YSCN-17-2, YSCN-17-3, YSCN-17-4, YSCN-17-5, YSCN-17-6, YSCN-17-7, YSCN-17-8, YSCN-17-9 and YSCN-17-10) were evaluated to know the genetic parameters such as heritability and genetic advance at the Teaching Farm Moundauri of Bidhan Chandra Krishi Viswavidyalaya, Mohanpur, West Bengal during the Rabi 2017-18. The plants were sown under Randomised Block Design in three replications under irrigated conditions. The 12 quantitative characters taken in the present field experiment were days to flower initiation, 50% days to flowering, days to maturity, plant height, siliqua length, primary branch, secondary branch, seed per siliqua, biological yield, seed yield per plant and harvest index. The genotype YSCN 17-1 showed maximum seed yield per plant followed by YSCN 17-2. The ANOVA analysis indicated significant differences among all the cultivars for all the traits under the study. This indicates a wide range of variations among the genotypes. The Phenotypic coefficient of variation (PCV) was reported to be higher than the genotypic coefficient of variation (GCV) for all the characters. The heritability in broad sense was high (> 70%) for all the characters except for days to flower initiation, days to maturity, plant height, seeds per siliqua, biological yield, seed yield per plant and harvest index. The maximum heritability was found for plot yield. The genetic advance as percent of mean ranges from 1.51 to 76.08.

**Keyword:** Genetic advance, Heritability, *Brassica campestris*, PCV, GCV.



## Allometric Equations to Predict Biomass Carbon of Important North-Western Himalayan Tree Species in Himachal Pradesh.

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The experiment entitled “Allometric equations to predict biomass carbon of important North-Western Himalayan tree species in Himachal Pradesh” was conducted in Kotgarh Forest Division of Himachal Pradesh to develop allometric models for estimation of biomass carbon of tree species viz., *Pinus roxburghii*, *Pinus wallichiana*, *Cedrus deodara*, *Abies pindrow*, *Picea smithiana* and *Quercus leucotrichophora*. Out of various linear and non-linear functions derived for the estimation of biomass carbon with independent variables, the power function was best fitted for all the species with significant adjusted  $R^2$  with diameter at breast height as independent variable were as: *Pinus wallichiana* (0.99), *Picea smithiana* & *Pinus roxburghii* (0.98), *Abies pindrow* & *Cedrus deodara* (0.97), *Quercus leucotrichophora* (0.96). Similarly, adjusted  $R^2$  values for tree biomass carbon with tree Height as independent variable were as: *Pinus roxburghii* (0.95), *Pinus wallichiana* (0.93), *Cedrus deodara* (0.88), *Abies pindrow* & *Picea smithiana* (0.87), *Quercus leucotrichophora* (0.75). However, Model comparison and selection was based on adjusted  $R^2$ , chi-square test of goodness of fit and thereafter using Theil's-U statistics was cross-validated to ensure further adequacy. The allometric models developed can be utilized for future estimation of tree biomass carbon of these temperate species.

**Keywords:** DBH, Tree height, Theil-U test, Chi-square, Linear, Non-linear.

## Innovative Tools for Detection of Plant Pathogens

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Plant pathogens cause huge losses to agriculture crops throughout the world every year. One of the most important aspects in plant disease management is proper diagnosis or identification of pathogens. Many methods have been developed to identify plant pathogens in past few years. The earliest conventional methods were based on symptom observation, involving field inspections as well as laboratory tests such as pathogen culture on selective media followed by physiological, biochemical and pathogenicity tests, antibody technique (Horsfall and Cowling, 1977). Although conventional methods are reliable, they are time consuming and require experienced plant pathologists to identify the pathogen responsible for the disease. Thus, it is desirable to develop detection methods with higher sensitivity, specificity and speed for plant pathogen identification. Rapid pathogen detection is more crucial due to recent developments in international trade of products, increased human mobility, climate change, emerging pathogens with the resistance to the pesticides, and new regulations limiting the application of toxic chemical materials to prevent the spread of new plant diseases. Additionally, at international borders, the delays in sending sample products to expert laboratories for pathogen diagnosis, especially quarantine pathogens are unacceptable as it may result in long-term economic loss. Some pathogen detection methods are DNA based: fluorescence in situ hybridization (FISH) and the many PCR variants (PCR, nested PCR, cooperative PCR, multiplex PCR, real-time PCR, and DNA finger printing). Others are RNA based: reverse transcriptase-PCR and nucleic acid sequence-based amplification (NASBA). Next generation sequencing (NGS) technologies have a huge potential in the diagnostic space as they can identify multiple pathogens in a single analysis without any previous knowledge of their nature (Rott et al., 2017; Aglietti et al., 2019; Upadhyay and Singh, 2019). These approaches are based on the analysis of volatile compounds and genes as biomarkers of disease, remote sensing (RS) technologies in combination with spectroscopy-based methodologies, and sensors based on phage display and biophotonics. All of these methods can overcome uncertain diagnosis or pathogen taxonomy, enabling a rapid and accurate detection and quantification of pathogens.



## **To study the effect of foliar application of gibberellic acid on growth and development of mango**

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Mango (*Mangifera indica*) being a sub-tropical fruit have an alternate bearing habit and also it responds well the plant growth regulator. Mango has various medicinal properties, be it anti-oxidant properties, anti-inflammatory properties or anti-cancer effects. Gibberellins are the plant hormones that play primary role in stimulating auxin reaction which helps in controlling the growth as well as has direct effect on internode elongation, germination, flowering, fruiting, leaf and fruit senescence, quality and yield. Foliar application of gibberellic acid effects the growth and development of Mango. Studies have been conducted to determine the effect of gibberellic acid, to check the fruit quality, change in flowering pattern and fruit set in mango trees. The response of gibberellins on the floral process mainly depends on the concentrations, growth stage and climatic conditions of the location. It is concluded that gibberellic acid inhibited the floral budding of Keitt mango during September-November-January and July-September-November-January. Also, application of gibberellic acid during flower bud differentiation with a concentration range of 10-75 ppm increasing the fruit set has also been studied. However, high doses of gibberellic acid upto 3000 ppm can lead to delay in flowering.

**Keywords:** Mango, *Mangifera indica*, Gibberellins, Flowering, Flower Bud Differentiation, Senescence

## **A Study on the Constraints Involved in the Adoption of Pisciculture Practices in Puri District Of Odisha**

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Fishing in India is a major industry in its coastal states, employing over 14 million people. In 2016-17, the country exported 11,34,948 metric tonnes of seafood 37,870.90 crore, frozen shrimp being the top item of export. Fish production contributes around 1% to India's gross domestic product and over 5% to the agricultural GDP. Odisha is one of the major maritime States, offering vast scope for development of inland, brackish water and marine fisheries. The State ranks 10th in terms of production of fish and produced 4.50 percent of the total fish production in the country during 2014-15. The study was conducted in Brahmagiri, Gop and Kakatpur blocks of Puri district. Both purposive and multistage random sampling methods were adopted for selection of the district, block, gram panchayat, village and respondents. A total of 100 (One Twenty) number of respondents were selected for the purpose of the investigation. It was observed that non-availability of herbicides, high cost of fish feed, excessive silt deposition and poor water retention capacity of pond and lack of nursery pond were the major resource constraints faced by the respondents. The study also revealed that high expenditure on technology management was the most common technological constraint encountered by the respondents followed by complexity of technology. The study indicated that irregular field visit by extension functionaries was the most common extension constraints as perceived by majority of respondents and ranked I with a mean score of 2.96. Working in the area, so that the fish farmers will adopt recommended practices and harvest desirable quantity of fish not only to increase their standard of living but also take the area as well as the state self-sufficient in fish production, to fulfill at least internal requirements.

**Keywords-** Pisciculture, Shrimp, Inland fisheries, Brackish water fisheries, Marine fisheries and Extension functionaries.

## **Effect of Methyloprophs on Growth and Yield of Mungbean**

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A Pot House Experiment Was Conducted At Department Of Microbiology, College Of Basic Sciences And Humanities, CCSHAU Hisar, To Study The Effects Of Methyloprophs On Growth And Yield Of Mungbean. All The Methyloprophs Were Tested For Plant Growth Promoting Traits Including IAA Production, Phosphate Solubilisation And Siderophore Production. The



## Mapping of sodic soils of uttar pradesh

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Present time in agriculture land is threatened worldwide because of the salt-affected soils. Land affected having the concentration of salt where the Na<sup>+</sup> concentration is higher than the permissible limit. In India, most of the people depend upon the agriculture and due to the increase of population the higher yield require so the farmers use the chemical fertilizer which affects the soil structure and soil fertility and another reason of salt-affected soil is irrigation in India most of the farmer depends on the rainfall or the river. The salinity of soil increase so the fertility of soil decrease due to the higher concentration of soil texture and structure also affect due to the salt stress production of crop decrease. Another factor sodic soil is climate change because climate change increases the atmospheric temperature. Higher atmospheric temperature increases the evaporation rate due to a higher rate of evaporation soil moisture loss very fast which affect the soil composition (Air, Water, Organic matter, Minerals). Agriculture soil converts into sodic soil which is harmful for the crop production. Uttar Pradesh situated on the Indo-Gangetic plain where irrigation is done by the rainwater, river water, and groundwater. Heavy rainfall occurs waterlogging, which enhances soil salinity due to the higher Na<sup>+</sup> conc. Present study monitoring of soil salinity in a different district in Uttar Pradesh, these selected districts are Mainpuri, Kannauj, Etwa, Auriya, Raebareli, Pratapgarh, Sultanpur, Jainpur, Sant Ravi Das Nagar, Azamgarh, Gazipur, Mau and Candauli. In these district higher salinity found because of most of the irrigation practices done by the river and rainfall. So the soil salinity higher in these districts, because of climate change which is responsible for the less rainfall and increasing temperature occurs high evaporation rate decrease the moisture content of the soil. Impact of the lower moisture content on soil composition as well as soil fertility which is reduced the agriculture production.

**Key words:** Mapping, Sodic Soil, Fertility

## Selection of *Apismelliferacolonies* for queen rearing

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The investigations were aimed to select *Apismellifera* L. colonies for queen rearing on the basis of their biological and economical characteristics. Significant variations have been found in various colony parameters viz. colony strength (4.54 to 10.43 no. of bee frames), brood area (1579.49 to 5086.25 cm<sup>2</sup>), prolificness (271.52 to 874.35 no. of eggs laid / per day), pollen stores (79.75 to 401.84 cm<sup>2</sup>) and honey stores (550.00 to 2162.50 g). The overall performance of the colonies was measured by average ranking value obtained by colonies for different colony parameters. They were rated on 1-5 point scale basis. The average score ranged from 1 to 4.8. On the basis of top score, top 12 colonies (M-1, M-2, M-6, M-7, M-8, M-13, M-14, M-15, M-19, M-20, M-22, M-25) were selected for quality queen production with average score between 3 to 4.8.

**Keywords:** *Apismellifera*, queen rearing, colony strength, brood area, prolificness, honey stores and pollen stores





### Response of problematic weeds under elevated temperature and moisture stress

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Indian agriculture is gifted with wide ranges of climate and soil but it is a gamble of monsoon too. The prediction of climate change warned the Indian agriculture that it would suffer in near future with elevated temperature and moisture stress. We have to be wise while selecting our crop and without delay suitable technologies should be adopted to cope up. Under abiotic stress factor weeds are one of the important abiotic factors. It is having high adaptation to any abiotic stress than crops. In this perspective, a study was undertaken in climate control chamber at Agro climate Research Centre, Tamil Nadu Agriculture University, Coimbatore on problematic weeds viz., *Cynodon dactylon*, *Cyperus rotundus* and *Trianthem portulacastrum* to furnish future climate stress scenarios. Trial consisted of three temperature levels (ambient, +2°C and 4°C), two moisture levels (irrigation with 100% ET and 60% ET of previous day). The results indicated that, the growth parameter of all the three weeds responded positively for temperature and negatively for the moisture stress. The early flowering and more number of flowers were observed in treatment with elevated temperature of 4°C with moisture stress  $M_{60}$  in all three genera. Being  $C_4$  pathway plant, all these weeds utilized the moisture and temperature very efficiently and produced more growth. During moisture stress condition as drought escape mechanism, all these weeds put forth early flowering. It is concluded from the study that the high acclimatization capacity of weeds to elevated temperature and ephemeral character towards moisture stress will favor the problematic weeds against crops under projected climate change. Among the three weeds, the *Cyperus rotundus* had high tolerance capacity to elevated temperature than the *Cynodon dactylon* and *Trianthem portulacastrum* and produced more growth.

**Keywords:** Weeds, future climate, abiotic stress, elevated temperature, moisture

### Studies on High density guava orchard established under organic management system.

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Guava is considered as one of the exquisite, nutritionally valuable and remunerative fruit crop. With ever increasing land costs and the need for early returns on invested capital, there is a worldwide trend towards high density planting. With the growing awareness for safe and healthy food among consumers and growing concern for deteriorating soil health and fertility and depleting natural resources among policy planners, strategies are being drawn to adopt technologies promising safe and healthy food with due respect to the natural resource availability without compromising the productivity and food security. In these concerns, organic farming has emerged as one of the viable options which promises food production in quantity and quality with resource sustainability. The field investigations were carried out to study the effect of FYM and Vermicompost on early establishment of guava high density orchard under organic management cv. (L-49) at Organic Farming Research Centre, SKUAST-J, Chatha, Jammu. The vegetative growth and yield were significantly influenced with different levels of organic sources applied where maximum plant spread (1.03m E-W and 1.38m N-S) and stem girth (3.82cm) were recorded with the application of 15kg FYM + 10 kg vermicompost + organic mulches applied in the first week of July, 2017 similarly the same treatment also showed its superiority on guava yield (16.65 quintals per ha), fruit physical viz fruit set (79.31%), fruit weight (196.46g), pulp weight (163.31g) and chemical characteristics viz. TSS (13.26°B), total sugars (8.73%), Ascorbic acid (217.83mg/100g of pulp) and pectin as calcium pectate (0.77%) respectively. The cost and return analysis determines the economic feasibility of high density plantings. The net income was worked out as a difference between gross income and cost of cultivation at respective costs during first fruiting crop. Major expenditure of Rs. 30000.00 during first year of fruiting was



incurred on hired labour @Rs 150/manday for 200 man-days. The net income per hectare is ranged from minimum of Rs.4480.00 in treatment comprising absolute control (No fertilizer) and maximum of Rs. 36498.00 in treatment comprising 10 kg FYM + 5 kg vermicompost + organic mulching.

**Keywords:** High Density, Organic, Guava, Orchard, FYM, Vermicompost, Orchard establishment

## **Integrated Weed Management: A Systematic Approach to Control Herbicide Resistance in Weeds**

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Problem of weed infestation is as old as agriculture itself and proper solution for weed menace is still not available with us. A real breakthrough in selective weed control was achieved in the year 1945, with the discovery of 2,4-D & MCPA in USA & England independently by P.W. Zimmerman and A.E Hitchcock. Invention of both these chemicals facilitated farmers to control weeds easily by just spraying these chemicals in the fields. They greatly reduced drudgery of farmers and provided a very economical and efficient control of weeds. Vast popularity of these chemicals led to invention of various other herbicides by various Agrochemical Industries. But soon this led to development of a major problem in the areas where regular herbicides were used that the weeds started developing resistance to a particular herbicide. Best example of this problem is development of herbicide resistance in *Phalaris minor* against Isoproturon in North-Western Plains of India. Integrated Weed Management can provide solution to this problem. It can be defined as a system which brings all feasible methods of weed control harmonizing them into a single and co-ordinated system designed to maintain weeds below those levels at which they cause economic loss. In it we follow multiple methods of weed control like Physical Control (Hand weeding, Soil Solarisation, Mulching etc), Cultural Control (Crop rotation, Stale Seedbed, Summer fallowing, etc), Biological control (Use of various bioagents) and at last Chemical control (Use of herbicides). This technique involves using all these methods of weed control and it reduces overdependence of farmers on herbicides. Even in chemical control it is suggested to rotate 3-4 herbicides so that a particular herbicide is used after an interval of 3-4 years. Longer the duration of herbicide rotation, lesser will be risk of development of resistance in weeds. Thus, we can say that Integrated weed management can ensure sustainability of agriculture by reducing weed menace and can ensure that no herbicide resistance is developed in the weeds.

**Key words:** Herbicide Resistance, Integrated Weed management, *Phalaris minor*, 2,4-D, MCPA, Isoproturon

## **Use of Vermicompost to Enhance Soil Health by Increasing Organic Carbon and Micronutrient Reserve in the Soil**

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Before 1960's, farmers in India were practicing natural farming and no agrochemicals were used by them. Soil health was up to the mark at that time but production of the food grains was not up to the mark to feed the rapidly growing population of the country. In order to increase the production of the food grains, Green Revolution was brought in the country. Dwarf and semi dwarf varieties were released by various institutes and chemical fertilizers especially nitrogenous fertilizers were applied to the soil for increasing the production potential of the soils. These days we can see that those areas of the country where best response of green revolution was observed are finding it hard to sustain the productivity and major factor for it is loss of organic matter and micronutrient deficiency in the soil. This is attributed to overdependence of farmers on chemical fertilizers like urea, DAP, MOP, SSP etc which only provide macronutrients to the soil. In order to improve the soil health, special emphasis on organic carbon and micronutrients should be given. Vermicompost is a very suitable product to provide organic carbon and micronutrients to the soil. Nutrient composition of vermicompost is about 2.1-1.5-1.5 (N-P<sub>2</sub>O<sub>5</sub>-K<sub>2</sub>O). Use of only vermicompost to fulfil all the nutrient



requirements of our crops is not feasible and non economical. But we can use vermicompost as a part of Integrated Nutrient Management and can provide 75% of Nitrogen by our synthetic fertilizers and rest 25% using Vermicompost. This much vermicompost is enough to provide adequate organic carbon and micronutrients to the soil. Vermicompost will greatly improve soil health by improving soil Physical, Chemical and Biological properties. This will ultimately help us in getting higher yields from the crops and fulfil the requirements of the growing population of the country sustainably.

**Key Words:** Integrated Nutrient Management, Vermicompost, Soil Health, Micronutrients, Green Revolution

### **Vermicomposting and its application against plant pests**

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Vermicomposting is a specialized and modified method of composting. The process uses earthworms to consume farm wastes and a high quality compost can be obtained within two months or less. Vermicomposting was done by using *E. fetida* grown on cow dung for 90 days and samples were analyzed for total carbon, nitrogen, phosphorus, and potassium by using standard methods and it was found that organic carbon decreased while organic nitrogen, phosphorus and potassium increased. C/N ratio declined during the experiment. Vermicompost is distinguished by the high bio-availability of the nutrients, several enzymes, plant growth hormones, and pest repellants which compost does not contain. Scientists have reported that vermicompost applied to soils have considerable effect on the nematode populations, significantly suppressing plant parasitic species populations. Low substitutions of vermicomposts into soil-less plant growth media can decrease the amount of feeding and damage caused by sucking pests such as mealy bugs and aphids. Main mechanism of pathogen suppression includes “general suppression” based on antibiosis, microbial competition, hyperparasitism, etc. in which microorganisms act as biocontrol agents. This works against propagules of pathogens such as *Pythium* and *Phytophthora*. Mechanisms of arthropod pest suppression may be attributed to changes in the nutrient characteristics and balances of plants in response to vermicompost compared with inorganic fertilizers and possibly the phenolic content of plant leaves, since organic nitrogen is released more slowly from organic vermicomposts than from inorganic fertilizers. This would make plants less susceptible to arthropod attacks.

**Keywords-** Bio-availability, biocontrol, nematode, vermicomposting

### **Adaptation and Age Effect of Spawn Packet on the Growth and Yield of Shiitake (*Lentinus edodes*) Mushroom**

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The present study was conducted at Mushroom Development and Extension Centre, Sobhanbagh, Savar, Dhaka and University of Rajshahi, Bangladesh during the period from October 2012 to March 2013 to determine the right age of spawn packet and to select the best strain for shiitake mushroom cultivation. In this experiment ten different age (40, 50, 60, 70, 80, 90, 100, 110, 120 and 130 days) of spawn packets and two strain (Le 8 and Le 16) of shiitake mushroom were cultured. A wide variation was observed in yield and biological efficiency in different ages. The highest yield (179.50g) and highest biological efficiency (102.60%) were recorded from the treatment combination of 90 days old spawn packet with the strain Le 16 followed by 100 and 110 days old spawn packets with same strain. The lowest yield (36.75g) and lowest biological efficiency (21.00%) were found in 130 days old spawn packet with Le 16 strain. No yield was obtained from the 40 and 50 days old spawn packets. Findings of this study give idea to take decision about the right age and strain of shiitake mushroom which might be helpful for mushroom growers.

**Key words:** Age, Growth, strain, Yield, Mushroom.



## **Precision Farming: The Future of Indian Agriculture**

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Precision agriculture is a popular new concept in production. Precision agriculture can be defined as a comprehensive system designed to optimise agricultural production through the application of crop information, advanced technology and management practices. A truly comprehensive approach to precision agriculture begins with crop planning and includes tillage, planting, chemical applications, harvesting and post harvest processing of the crop. Precision farming makes use of remote sensing to macro-control of GPS to locate precisely ground position and of GIS to store ground information. It precisely establishes various operations, such as the best tillage, application of fertilizer, sowing, irrigation, harvesting etc., and turns traditional extensive production to intensive production according to space variable data. Precision farming not only may utilize fully resources, reduce investment, decrease pollution of the of the environment and get the most of social and economic efficiency, but also makes farm products, the same as industry, become controllable, and be produced in standards and batches.

**Keywords:**

## **The Vertical Garden: A Green Solution for Urban Areas**

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Now-a-days cities from all around the world are suffering from major one effect of development. Especially developing countries like India with major economic cities as Delhi, Mumbai, Bangalore *etc*, a solution is needed to provide lungs of green space to urban areas or concrete jungles. That's why vertical garden is hottest trend in the world that allows plants to grow on walls and any non-horizontal surfaces. Vertical gardens are especially popular for small- space gardening where ground is at a premium. A vertical garden is also known as green wall or living wall, it is self sufficient vertical garden attached to exterior, interior, freestanding or attached to an existing wall of a building. Vertical gardening functions for urban agriculture, urban gardening and certainly an option to include some greenery in the house/ building. Vertical gardening is more than just aesthetics; it can help to cool and insulate buildings, reducing the need and cost for air conditioning. Growing plants in the building can also help to filter air particulates and improve air quality as well as add some humidity to centrally cooled offices at the same time. It requires little maintenance/trimming and mostly does not use soil. Vertical gardening helps to save water by reducing the need for irrigation and watering. By developing a vertical garden, residents can tremendously improve their well being and also cure certain sicknesses through biophilia and its uses at mental institutions and hospitals and also used as a sound barrier. There's a research on the potential of vertical gardens on air quality which was conducted in United Kingdom near the Edgware Road underground station in recent past and they concluded that air pollution is deposited more easily onto plants than hard surfaces.

**Key words-** Vertical, Garden, Wall, Air, Water, Nature, Building, Ground, Resident, Pollution



### Effect of Pruning on the Yield and Quality of Kinnow Fruit

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Pruning is an important aspect of fruit crop cultivation. Most of the fruit species respond well to pruning activities as it promotes plentiful fruit bud formation thereby increasing the crop load and maximizing the yield. Pruning in citrus is not well documented but some research studies have shown citrus responds to pruning. Mature, healthy and vigorous bearing trees are Pruned on west side and other tree on east side and other from south side and last one from north side. Unpruned healthy plants were treated as control. The perusal of the data generated revealed that pruning of healthy fruit bearing branch on south side produced larger number of fruits with attractive colour and better quality as compared to other pruning trees. Fruit weight and juice percentage were also observed to be superior under the same tree. The study revealed that instead of conventional pruning strategies followed in Kinnow orchards, one can take up lopping of heavy bearing branch on the southern side of the orchard to open the canopy for better light penetration and solarisation of the plant which comprehensively resulted in the increased yield with better quality of fruits.

**Keywords :** Pruning, Kinnow, Lopping

### Seed Germination Enhancement through Breaking Seed Dormancy in Tropical and Temperate Tree Species

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The most important factor for the success of plantation is the readily availability of quality seeds. Seeds of many trees species germinate quickly when subjected to favorable conditions of moisture and temperature whereas; other species possess some degree of seed dormancy. There are various kind of dormancy occur in trees species such as; exogenous dormancy due to hard seed coat, seed coat impermeable to water, presences of chemical; endogenous dormancy due to immaturity of embryo, oxidation and presence of inhibitors; and double dormancy which include both seed coat and embryo dormancy. In most of tropical tree seeds, physical dormancy occurred because of hard seed coat whereas temperate trees seeds mainly have physiological dormancy. Various methods to deal with dormancy include; scarification or physical method, stratification or physiological method and chemical method. Scarification which is done in hard seed coated species such as *Acacia mangium*, *Acacia catechu*, *Acacia nilotica*, *Albizialebeck*, *Cassia spp.*, *Santalum album*, *Terminaliaarjuna* etc. Mechanical scarification and concentrated H<sub>2</sub>SO<sub>4</sub> have been widely used to improve germination of several hard seed species, but degree of seed coat thickness among different species is the cause of differential responses to various pre sowing treatment. Stratification is done to remove physiological and morphological dormancy (endogenous dormancy). Most of the Conifers generally have physiological dormancy, stratification for 0-5°C for 60-70 days is better to overcome this kind of dormancy. Chemical methods include use of growth regulator and chemicals for dormancy breaking. Several growth hormones are associated with seed germination and seedling physiology, but the most important being gibberellins, IAA and Kinetin etc. Among all growth regulators GA3 is most commonly used for germination enhancement @ 100-200 ppm for 1-2 h in most of the species. KNO<sub>3</sub> is important chemical for germination enhancement in many species such as *Acacia nilotica* and *Meliaazedarach*. So, breaking seed dormancy is necessary for seed germination enhancement in nursery.

**Keywords:** Stratification, Scarification, Growth regulators, Chemicals, Seed, Dormancy etc.



## Productivity of Rain Water Harvesting Techniques on Production Efficiency, Leaf Area Index and Moisture Use Rate of Pearlmillet (*Pennisetum glaucum* L.) Under Rainfed Condition

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A field experiment was conducted at Kanpur, Uttar Pradesh during two *Kharif* seasons of 2012 and 2013 to assess the relative productivity and profitability of Pearlmillet (*Pennisetum glaucum* L.) as influenced by different low cost water harvesting techniques. The soil of the experimental field was sandy loam in texture with average fertility. Water harvesting techniques tested in the experiment were compartmental bunding, deep ploughing, raised and sunken bed, inter row water harvesting, inter-paired row water harvesting, scooping and flat sowing as control. The result revealed that different rain water harvesting techniques showed significant response over control in respect to yield, protein and starch. Among different water harvesting techniques, Inter-Paired Row Water Harvesting (IPRWH) produced highest production efficiency of 23.56 and 21.90 q ha<sup>-1</sup> fetching 4.67 and 4.78 Leaf Area Index (LAI) which exhibited maximum Moisture Use Rate (MUR) of 4.36 and 3.63 during 2012 and 2013, respectively.

**Key words:** Rain water harvesting, Consumptive use, Leaf area index, Production efficiency, Moisture Use Rate.

## Studies on phytotoxicity of pesticides in rabi sorghum [*Sorghum bicolor* (L.) Moench]

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Totally 15 pesticides were evaluated consisting of 13 insecticides, 1 acaricide and 1 botanical, along with control at 3 dosages. The pesticides were applied at 20, 60 and 90 days after sowing. Observation on different phytotoxic symptoms was recorded based on visual score (1-10) later per cent phytotoxicity was calculated. Highest mean per cent phytotoxicity index was recorded in the profenophos @ 1.0, 2.0, 4.0 ml/litre treated plots (20.2, 44.1 and 56.1 PPI) at seedling, vegetative and reproductive stage of crop growth, followed by spiromesifen. Others such as malathion, methomyl, chlorophyriphos, cypermethrin, alphamethrin, imidacloprid produced the different phytotoxic symptoms like chlorosis, white blotches and bronzing type of symptoms to a various level. Acephate, fipronil, carbofuran, phorate, chlorantraniliprole, emamectin benzoate and NSKE were found safe to sorghum. Among chemical pesticides evaluated, carbofuran and imidacloprid were found superior in reducing the shoot fly, where as acephate, fipronil, imidacloprid and NSKE were found superior in reducing the sucking pests.

**Key words:** Phytotoxicity, Bio-efficacy, Pesticides, Sorghum

## Demand driven based sustainable nutrient management in rice and wheat under rice-wheat cropping system

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Crop management, soil fertility and crop needs for nutrients can vary greatly among nearby fields and between crop-growing seasons. Existing fertilizer recommendations for rice often consist of one blanket rate of N, P and K for vast areas of rice production. The rates of fertilizer actually used by farmers often vary greatly from such recommendations and have little or no



relationship with the actual amounts and ratios of nutrients required to match the needs of the crop for high profitability and protection of the environment from leakage of excess nutrients. Due to excessive use of fertilizers in imbalanced ratios causing the low nutrient use efficiency and associated environmental problems which has raised the serious concerns about the existing nutrient management practices. Site specific nutrient management is a potent climate smart nutrient management technology which is able to establish synergy with crop-soil nutrient dynamics and is also able to reduce the possible threat to the environment in form of N<sub>2</sub>O emission. Practices that improve crop N uptake can reduce N losses to the environment, thereby increasing fertilizer N use efficiency (NUE). The objective of the study was to evaluate different nutrient management approaches for enhanced nutrient use efficiencies by crop driven nutrient management by preventing the possible N losses. Treatments comprised of six location/site specific nutrient management approaches along with 4 nutrient omission treatments. The investigation results indicated that the treatment Nutrient Expert recommended fertilizer under SSNM (NE-SSNM) is able to mitigate crop driven N demand at the critical stages of crops and also superior in terms of grain yield and profitability. More grain yield with less fertilizer were obtained by using SSNM (Nutrient Expert recommended fertilizer) techniques in comparison to the blanket N application and other nutrient approaches, which is economically viable and environment friendly.

**Keywords:** Nutrient Decision Support Systems (NDSS), Nutrient Use Efficiency (NUE), Site Specific Nutrient Management (SSNM)

### **Development of a quantification method for the analysis of sugars in apple fruit juices using ATR- FTIR coupled with Multivariate regression modeling**

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A simple and reliable method was developed for the direct estimation of sugar content in fruit juices using ATR-FTIR technique coupled with chemometrics. The whole MID-IR (4000cm<sup>-1</sup> to 400cm<sup>-1</sup>) spectral region was analyzed and fingerprint region (1200cm<sup>-1</sup> to 900cm<sup>-1</sup>) based on maximum variability was selected. In the present study, wavenumber regions were selected on the basis of characteristic functional group of each sugar analyzed through OMNIC software, this method excluded the requirement of principle component analysis (PCA) for the selection of variables from the large FTIR data set of sugars. For a better and optimized model development, untransformed spectra (Raw) and Savitzky- Golay transformed spectra (1<sup>st</sup> and 2<sup>nd</sup> derivative) were compared. Total nineteen synthetic sugar mixtures (3 Pure sugar solution, 6 binary mixtures and 10 ternary mixtures) were prepared and scanned through ATR-FTIR in MIR region (4000cm<sup>-1</sup> to 400cm<sup>-1</sup>). PLS-R and PCR regression methods were compared to find out the best optimized model based on lower RMSEC/RMSECV value and higher correlation coefficient values. Sixteen synthetic sugar mixtures, composed of appropriate ratio of each sugar (Fructose, Glucose and Sucrose) were used to develop the calibration model using PLS-R/PCR method. PLS-R method was found more accurate based on various statistical parameters as compared to the PCR, hence used for the prediction of the “Test set”. Out of ten ternary mixtures, three randomly selected ternary mixtures along with six authentic apple cultivars were treated as “Test set” and sugar content was predicted based on the best PLS-R model developed. For Fructose, Glucose, sucrose and total sugar content, raw spectra generated FTIR model obtained the most optimized statistical parameters in terms of R<sup>2</sup> and RMSEC values (R<sup>2</sup>Fructose; 0.9952, R<sup>2</sup> Glucose; 0.9961, R<sup>2</sup> Sucrose; 0.9983, R<sup>2</sup> Total Sugar; 0.9968).

**Keywords:** Sugar quantification, ATR-FTIR Chemometric Model, Fruit Juices, PLS-PCR

### **Detection and quantification of fried oil in mustard oil and coconut oil by ATR-FTIR spectroscopy combined with chemometrics**

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Attenuated total reflection- Fourier transform infrared (ATR-FTIR) spectroscopy along with multivariate regression modelling was utilized to develop the methodology for classification and quantification of Pure Mustard oil (PMO) and Pure



coconut oil (PCO) from its adulterant fried mustard oil (FMO) and fried coconut oil (FCO) in proportions of 0.5 to 50% v/v. Based on spectral data of both oil samples, Principal component analysis (PCA) was applied on selected informative spectral region (3000-2800  $\text{cm}^{-1}$  and 1800-500  $\text{cm}^{-1}$ ) for coconut oil and separate spectral regions 3010-2800  $\text{cm}^{-1}$ , 1800-550  $\text{cm}^{-1}$  and combined region (3010-2800  $\text{cm}^{-1}$  and 1800-550  $\text{cm}^{-1}$ ) for mustard oil respectively. Linear discriminant analysis (LDA) was used on selected wavenumbers obtained from the loading spectra. LDA accurately classified 100% of the initial groups and 90% correctly for coconut oil and 91.7% for mustard oil when cross-validated. For quantification, Principal components regression (PCR) and Partial least squares regression (PLS-R) models were constructed and compared for normal, first and second derivatives to get a robust model. For coconut oil, PLS-R model for normal spectra of combined spectral region showed best results for prediction with the high  $R^2$  value of 0.993 and the root mean square error (RMSE) of 1.332% v/v. Similarly for mustard oil, PLS-R model for 2<sup>nd</sup> derivative spectra of 1800-550  $\text{cm}^{-1}$  spectral region showed best results for prediction with the high  $R^2$  value of 0.998 and RMSE of 0.631% v/v. The lowest limit of detection in both oils was predicted as 0.5% v/v.

**Keywords:** FTIR Spectroscopy; Adulteration; Multivariate regression; Frying; Mustard oil; Coconut oil

### **Assessment of composition and direction of trade in Indian Basmati rice**

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Increasing area under paddy crop is perceived as one of the major causes of ground water depletion in India and one of the alternative options is to grow Basmati rice, which also helps in crop diversification. During 2017-18, India accounted for around 70 per cent of the total world basmati rice exports. This study was taken up to assess the demand of Indian basmati rice in the international market. The study analysed the composition and direction of trade in basmati rice for the period 2007-08 to 2018-19 from secondary data. Export of basmati rice was found to be stagnant for the last five years with more than eighty per cent being exported to the Gulf countries. Markov chain analysis identified that Iraq and Saudi Arabia are the most reliable partner of Indian basmati rice. India's dependence on only a few countries for export is disadvantageous for the exporters. In order to enhance the demand of basmati rice in the domestic as well as international markets government initiative like country branding campaigns and establishment of separate institution on the line of spices board.

**Key words:** Basmati rice, Composition and Markov chain analysis

### **Animal drawn Rotary Transmission System for Agro-Processing**

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In Indian agriculture, draught animals are important source of farm power but are not utilised for more than 100 days in a year. As the draught animals remain idle for most of the time it is becoming an economic burden on the farmers. The animals may be made more useful by utilising their idle time in other agricultural operations. The average output of the turmeric polisher is 80 kg/h with an average power output of 0.36 kW/h. The output capacity of Dal mill, Chilly mill, Vermicelli making machine, Papad making machine and flour grinder varies from 8-9 kg/h, 7.5-9.5 kg/h, 8-8.5 kg/h, 50 nos./h, and 7-7.5 kg/h, respectively. The average output of the grinder is 9 kg/h and average power output over one hour of operation has been worked out 0.174 kW. Animal operated rotary transmission system also includes: Operation of Agro-processing machine (Thresher, Grinder, Winnowing, etc.) by the rotary transmission system. The output capacity of thresher varies from 125 to 226 kg/h with output power of 0.32 to 0.54 kW. The paddy thresher can be operated without fatigue for three hours of continuous work. The capacity of chaff cutter varies from 150-350 kg/h and the output power varies from 0.25 to 0.53 kW. The output capacity of the winnowing varied from 403 to 1245 kg/h and the output power varies from 0.17 to 0.42 kW. The winnowing could be operated without fatigue for three to four





hours of continuous work. The particle size of the grinding material came out in between 200 µm to 300 µm.

**Keywords-** Draught animals, agro-processing, rotary transmission system.

### **Effect of different training spacing and fertigation levels on benefit cost ratio of bell pepper grown under protected conditions in mid hills of Himachal Pradesh**

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An experiment was carried out in a naturally ventilated poly house at experimental farm of department of vegetable Science Dr. Y. S. Parmar University of Horticulture and Forestry Nauni to know the effect of different training spacing and fertigation levels on benefit cost ratio of bell pepper grown under protected conditions in mid hills of Himachal Pradesh. The Variety grown was Orobelle which is F<sub>1</sub> hybrid from Syngenta India Ltd was used in laying out the trial. Fruits of this variety are smooth, yellow in color, mostly lobed and the plant is a prolific bearer. The treatments were given in 12 modules. There were 2 levels of training (T1=2 Stem training system, T2=4 Stem training system) there were 2 levels of spacing (S1=30\*60 cm and S1=30\*90 cm) and 3 levels of fertigation levels (F1=100 Kg/ha, F2=150kg/ha and F3=200kg/ha). Each module was replicated 3 times and in the replication respective treatment of training system, fertigation and spacing were given. The results revealed that comprising of recorded the cost price of Rs 877.45 and recorded the maximum selling price of Rs 1947.60 ,profit of Rs 1017.45 and benefit cost ratio 1.21 was observed in module M8 comprising 4 stem training system grown at spacing of 30x 60 cm and fertigation levels of 150 kg/ha

**Keywords:** Training, spacing, fertigation ,benefit

### **Farm Mechanization in Hills of Jammu and Kashmir (India): A Review**

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Mechanization simply means the substitution of human labour or activities with machines, tools and implements for efficient and effective utilization of inputs in order to increase the productivity of land and labour. Farm mechanization has been defined as the process of development and introduction of mechanized assistance of all forms in order to reduce human drudgery, improve timeliness and efficiency of various farm operations, bring more land under cultivation, preserve the quality of produce, improve living condition and markedly advance the economic growth of the rural sector. For the sustainable development of agriculture mechanization, it is needed to locally fabricate widely used agricultural tools, implements and machinery. Technology and machinery enhanced the ability, quality, accuracy and efficiency of the human being. Jammu and Kashmir, being a hilly state, is blessed with diverse agro-climatic conditions suitable for cultivation of a wide range of agri-horticultural crops with a great potential for development. Farm mechanization in hills requires unique set of machines, which are small in size, light in weight and are capable to do maximum possible operations. Various study related to farm mechanization in J&K revealed that that there is increase in area, production and productivity of major food crops over the years but the rate of increase has been slow. The bottlenecks in mechanization are due to undulated topography and terraced irregular shape fields, non-availability of improved equipment, small and scattered land holding, low investing capacity of the farmers and lack of awareness among farmer. On the whole, it can be concluded that despite various constraints, there is a great potential in Jammu and Kashmir to adopt farm mechanization for increasing agricultural production and productivity. Immediate attention is required to strengthen the extension activities and agricultural engineering cell in J&K to handle the farm mechanization problems.

**Keywords:** Mechanization, Sustainable Development.



## Effect of organic and inorganic manures on leaf yield in Stevia (*Stevia rebaudiana* Bertoni) - An Eco-friendly Approach

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*Stevia rebaudiana* is a valuable plant species widely used as low calorie sweetener besides its use for treating cancer, obesity, hypertension, fatigue, depression and in cosmetics and dental problems. Its leaves consist of two important secondary metabolites (steviol glycoside) namely Stevioside and Rebaudioside A and C which make it 30 times more sweeter than cane sugar surprisingly without any calorie. Stevia has become a potential natural alternative to sugar and artificial sweeteners like saccharin, Aspartame, Asulfam-K with the over 346 million diabetic population across the world. The objective of this investigation was to increase the leaf yield by using organic and inorganic fertilizers. Eight treatments viz. control ( $T_1$ ), Nitrogen (N) @ 60kg/ha ( $T_2$ ), Farm Yard Manure (FYM) @ 12t/ha + *Azotobacter* ( $T_3$ ), Vermicompost (VC) @ 3t/ha + *Azotobacter* ( $T_4$ ), 30kgN ( $1/2T_2$ ) + FYM @ 6t/ha ( $T_5$ ), 30kgN ( $1/2T_2$ ) + VC @ 1.5t/ha ( $T_6$ ), 30kgN ( $1/2T_2$ ) + FYM @ 6t/ha + *Azotobacter* ( $T_7$ ), 30kgN ( $1/2T_2$ ) + VC @ 1.5t/ha + *Azotobacter* ( $T_8$ ) were evaluated to find their effect on growth and leaf yield. Higher values of growth and yield parameters are observed in  $T_8$  (vermicompost @ 1.5 t/ha in combination with 30kg N and *Azotobacter*) and  $T_6$  {30kgN ( $1/2T_2$ ) + VC @ 1.5t/ha} with estimated dry leaf yield of 4.78q ha<sup>-1</sup> and 4.32q ha<sup>-1</sup> respectively. After the harvest of the crop, the available N in soil is increased significantly due to fertilization over control. Application of vermicompost @ 1.5 t/ha along with 30kgN per hectare ( $1/2$  of recommended dose) and *Azotobacter* is beneficial not only to increase the leaf yield but also in maintaining the fertility status of soil.

**Keywords:** Stevia, natural sweetener, fertilizers, manures, stevioside

## Variation in fruit and seed characteristics of Kaphal (*Myricaesculenta*) in Himachal Pradesh

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Variations in nature are responsible for creating provenances, clones, races and ecotypes. Variability studies are a prerequisite for improvement of a species. Among several wild fruits *Myrica* is one that has been valued in Ayurvedic and Unani system of medicine for possessing various properties. It commonly known as Kaphal, belongs to family Myricaceae. Kaphal (*Myricaesculenta*) is a well known tree among local people for its delicious fruit and processed products such as squash, syrup and jam. During April-May local people harvest the fruits and sell it in nearby market or as road side vendors. This study was conducted at different sites of Districts: Sirmour, Solan and Shimla. Fruit and Seed characters of the species were observed. It was found that site Tutu has maximum seed length (9.05 mm) followed by Kiarighat, Seed breadth (6.94 mm) was more in site Kiarighat followed by Tutu. Weight of seed (32.94 gm) was maximum at site Jaunaji followed by Tutu. Fruit weight (64.06 gm) and pulp weight (42.82 gm) was maximum at site Kiarighat. Total soluble solids (TSS) was maximum i.e. 20.95% at site Dabhara followed by Serbharal.

**Keywords:** Variation, Kaphal, Seed, Fruit, TSS



## Molecular characterization of the causal agent of chlorotic leaf spot disease of Arka (*Calotropis gigantea*)

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*Calotropis gigantea* is commonly seen with the symptoms of systemic brilliant chlorotic to yellow spots on the leaves. Based on these symptoms the infection is found to be due to virus. So there was a need to study the effect of disease on active phytochemical constituents in leaves and the molecular characterization of the causal agent. Phytochemical constituents viz. antioxidant activity, quinones, flavonoids, total phenols, ascorbic acid, PPO activity have higher values in infected leaves whereas total chlorophyll and carotenoids had lower values in infected leaves. In case of PPO activity it was found maximum at same time interval for both of the samples. However, PPO activity was found higher in infected sample and lower in healthy sample. Molecular characterization studies revealed the presence of virus particles on the basis of results obtained from Virus Like Particle (VLP) purification and electron microscopy. Some icosahedral, enveloped entities of approximately 50-60 nm were observed which proved the presence of virus. The sequencing results showed similarity to insect infected virus *Nucleopolyhedrosis* (OpMNV) and *Paramecium bursaria chlorella virus* (PBCV) from ocean virome studies which were bacterial in origin. Irrespective of different strategies performed for cloning, ligation and PCR the sequencing results were similar. However, these viruses have not been reported in plants. Thus results are indicative of presence of a novel virus or new DNA which needs to be further investigated.

**Keywords:** Systemic, phytochemical constituents, antioxidant activity, quinones, virus like particle

## Fertility status of fruit growing soils of low hills subtropical zone of Himachal Pradesh

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Soil fertility management plays a key role in sustaining fruit production. Present investigation aimed at determining available nutrient status in fruit growing soils of low hill subtropical zone of Himachal Pradesh. The low hills subtropical zone covers 16.4 per cent of total geographical area and 39.5 per cent of total cultivated area of the State, respectively. Based on the standard GPS based soil sampling methodology, surface soil samples (0-15 cm) from 15 representative sites were collected from soils under fruit trees.

The available N (kg ha<sup>-1</sup>), P (kg ha<sup>-1</sup>), K (kg ha<sup>-1</sup>), Ca {cmol(p+)kg<sup>-1</sup>}, Mg {cmol(p+)kg<sup>-1</sup>}, S (kg ha<sup>-1</sup>), Cu (mg kg<sup>-1</sup>), Fe (mg kg<sup>-1</sup>), Mn (mg kg<sup>-1</sup>) and Zn (mg kg<sup>-1</sup>) in soils under fruit trees varied from 163 to 492, 5.4 to 13.8, 120 to 258, 2.1 to 6.2, 0.6 to 2.4, 10 to 33, 0.16 to 0.40, 4.5 to 14.2, 1.3 to 3.9 and 0.34 to 0.74 with mean values of 340, 8.9, 163, 3.8, 1.2, 21, 0.28, 8.9, 2.4 and 0.56, respectively. On the basis of SNI (Soil Nutrient Index) values, soils were rated as medium (1.80), low (1.33), medium (2.00), high (2.93), high (2.53) and low (1.47) in available N, P, K, Ca, Mg and S, respectively.

Out of 15 soil samples analysed, 20, 67, 53 and 40 per cent soil samples were found deficient in available N, P, S and Zn, respectively. Such a spatial variation in soil fertility may be attributed to natural factors/processes as well as land management practices. Also, majority of farmers applied fertilizers at rates much lower than the recommended ones in the study area. Thus, it may be concluded from the present investigation that soil test based fertilizer application may be one of the important key to sustain soil and fruit productivity in low hill subtropical zone of Himachal Pradesh.

**Keywords:** Fertility status, fruit growing soils, low hill subtropical zone.



## Isolation and characterization of lignin utilizing bacteria from activated sludge of paper mill and its ligninolytic activity assay

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Lignin, a plant component is one of the major pollutant in paper industry effluent emerged during papermaking process such pulping, bleaching and washing. Lignin is major contributor of colour and toxicity to the paper mill effluent. The aim of the present study was to isolate, screen and characterize bacteria with lignin utilizing ability. In order to isolate potential lignin utilizing bacteria from activated sludge, bacteria enriched in the presence of effluent+MSM+lignin+tannic acid+azure B+phenol red for 7 days were isolated. Total 10 lignin degrading (LD) bacteria (LD 1-10) were isolated and tested for their growth in presence of different concentration lignin (0-15000 mg/l). All the bacteria were able to utilize lignin but only 5 bacteria such as LD1, LD5, LD8, LD9 and LD10 showed higher growth at 15000 mg/l lignin were selected for further studies. Azure B dye decolourisation assay for lignin peroxidase (LiP) activity showed that all bacteria have LiP enzyme except LD5. Similarly, oxidation of guaiacol, an indicative of laccase enzyme assay on agar plate showed that all bacteria have laccase enzyme activity except LD9. The selected lignin degrading bacteria LD1, LD5, LD8, LD9 and LD10 were identified as *Bacillus cereus* (LD1), *Bacillus aryabhatai* (LD5), *Serratia liquefaciens* (LD8), *Providencia sp.* (LD9) and *Bacillus licheniformis* (LD10) by 16S rRNA gene sequencing.

**Keywords:** Lignin, Activated sludge, Bacterial growth, Enzyme assay.

## Effect of organic inputs on yield and economics of turmeric (*Curcuma longa* L.)

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A field experiment was carried out at Experimental Farm of Department of Soil Science and Water Management, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan, (HP) during 2016-17 and 2017-18 to investigate the effect of organic inputs on yield and benefit cost ratio of turmeric (*Curcuma longa* L.). The experiment was laid out in a randomized block design with four replications comprising eight treatments viz. T<sub>1</sub> (100% RD N through VC & PM on 50:50 N-equivalence basis), T<sub>2</sub> (90% RD N, through VC & PM on 50:50 N-equivalence basis), T<sub>3</sub> (80% RD N, through VC & PM on 50:50 N-equivalence basis), T<sub>4</sub> (70% RD N, through VC & PM on 50:50 N-equivalence basis), T<sub>5</sub> (60% RD N, through VC & PM on 50:50 N-equivalence basis), T<sub>6</sub> (50% RD N, through VC & PM on 50:50 N-equivalence basis), T<sub>7</sub> (40% RD N, through VC & PM on 50:50 N-equivalence basis) and T<sub>8</sub> control only (FYM). In the present study, it had been observed that application of 90% RD N through VC & PM on 50:50 N-equivalence basis (T<sub>2</sub>) significantly enhanced the rhizome yield (628.8 q ha<sup>-1</sup>) which was statistically at par with T<sub>1</sub> (591.7 q ha<sup>-1</sup>), whereas, the lowest yield was recorded under T<sub>8</sub> (481.5 q ha<sup>-1</sup>). The highest benefit cost ratio (B:C) was also recorded under (T<sub>2</sub>) 90% RD N through VC & PM on 50:50 N-equivalence basis (4.92:1), closely followed by (T<sub>1</sub>) i.e. 100% (4.51:1) while the lowest of (3.94:1) was recorded under T<sub>7</sub> with 40% RD with the differences in benefits related to the higher marketable yield and nutrient availabilities. The study suggests that application of 90% RD N through VC & PM on 50:50 N-equivalence basis in turmeric, can be suggested as a cost effective nutrient module for getting higher yield. Use of organic sources through vermicompost and poultry manure on 50:50 N-equivalence basis not only produced highest and sustainable crop yields but also enhanced the B.C ratio of 4.92.

**Key words:** Organic Matter, FYM, Vermicompost, Poultry Manure, Yield and Benefit cost ratio



## Evaluation of genetic divergence in buckwheat (*Fagopyrum esculentum* Moench) germplasm

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Presence of wide genetic diversity among the germplasm was revealed by Mahalanobis D2 analysis. The genetic divergence was studied among a set of thirty germplasm including four check varieties i.e. Himpriya, VL-7, Shimla-B1 and PRB-1 of buckwheat for ten characters. Among 30 germplasm were group into six different non-overlapping clusters. Cluster I was highest number of 9 germplasm followed by cluster II with 6 germplasm. The maximum inter-cluster genetic distance was observed between cluster I and cluster IV (367.82) followed by cluster I and cluster III (313.09). Cluster mean revealed that Cluster IV having 4 germplasm exhibited highest cluster mean for plant height (112.05 cm), number of primary branches per plant (3.55), number of leaves per plant (27.85), 100-seed weight (1.96 g) and seed yield per plant (3.16 g) these characters can be used for improvement of a large number of seed yield and yield per plant. Characters contributing to total divergence are number of leaves per plant (22.30%), seed yield per plant (20.69%), days to 50% flowering (18.62%), plant height (17.47%), 100-seed weight (8.28%), number of internodes per plant (7.59%), days to maturity (3.45%) and number of secondary branches per plant (1.61%). Based on high inter-cluster distance of cluster I with cluster IV, cluster I with cluster III and cluster II with cluster VI such as IC-13507 × IC-412762, IC-341661 × IC-412762, Shimla-B1 × IC-412762, IC-13507 × IC-412733, IC-341661 × IC-412733, IC-294344 × IC-107988, RSR/SKS-104 × IC-107988, Himpriya × IC-107988 and VL-7 × IC-107988 are recommended for hybrid breeding programmes in mid hills of Uttarakhand.

**Key-words:** Buckwheat, Genetic Divergence, Intra and Inter Cluster Distance, Mahalanobis D2, Seed Yield and Yield Attributes

## Novel insights into the regulatory mechanisms underlying floral induction in mango.

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Alternate bearing is a major concern in mango cv. Dashehari which is characterized by fluctuating flowering and fruiting in alternate years. Vegetative and flower bud formation in tropics and subtropics is variant, and implicates age of shoot and cool inductive temperatures respectively. In order to study the molecular basis of vegetative and flower bud formation under subtropics, transcriptome profiling using RNA-Sequencing technology was performed in floral and vegetative buds of mango cv Dashehari. Two pair-end libraries of mean size 734 and 848 bp for vegetative bud (VBD) and floral bud (FBD) samples were prepared respectively. Differential patterns of gene expressions were recorded in floral and vegetative buds for a vast array of genes indicating role of several pathway genes in vegetative bud formation and floral transition. Based on the significantly upregulated or downregulated genes shortlisted from log 2 fold changes and p-value, about 22 major genes which are involved in floral transition viz., callose synthesis and breakdown, plasmodesmata permeability, endoglucanases, auxin responsive genes, ABA synthesis and transport etc. were identified from both floral (FBD) and vegetative buds (VBD) transcriptome data sets. Genes involved in callose deposition viz., MiCSL2 and MiEMF2 were found to be upregulated in vegetative bud. Genes related to callose wall break down viz., MiEnG3, MiEnG6, MiTTL1, MiXG9 were found to be upregulated in FBD. Flowering related transcription factors especially MiAGL8 and MiAP2 were upregulated in flower bud. Reactive active species (ROS) scavengers like peroxidases or catalases, plasmodesmata permeability genes were found to be upregulated in FBD. Auxins and ABA related genes were found to be upregulated in VBD but contrasting in FBD those genes were downregulated. This information was developed into mechanism of flower and vegetative bud formation model in mango cv. Dashehari, that involves complex network of temporal and spatial regulatory genes. The study gives novel insights in mango floral bud induction, supporting cell to cell floral signal transduction and bud break induction in subtropical conditions.



## Assessment of Physico-chemical and Biological Parameters of Gomti River Water Quality and Rejuvenate the Gomti River at Lucknow City Area

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The Gomti river originates from the Fulhar Jheel near Madho-Tanda village, Pilibhit, UP. After ~240 km it enters the Lucknow city and flows ~15 km before leaving city area. Pure water is essential to all forms of living organisms. It is our prime need to maintain and preserve the suitability of fresh water bodies. Most of the human activities including drinking, bathing, washing, aquaculture and agriculture directly depend on the use of water. In Lucknow city, river receives a huge amount of treated/semi-treated/untreated municipal sewage and agricultural runoff with residues of pesticides, fertilizers, detergents, cattle wading, animal's waste products and other organic pollutants are the major sources of water pollution and causes deterioration of river water quality. Five water sampling locations were selected an interval of ~3-5 km between 2 locations. The study area stretches ~15 km at Lucknow city area from Ghaila Bridge, IIM road (an entry point of Lucknow) to Shaheed Path (the exit point of Lucknow). The average pH of Gomti river water was 7.39 whereas the average of DO, BOD and COD, key indicator parameters of water quality were 5.48, 10.12 and 31.2 mg/l respectively. Mean value of total dissolved solids, total alkalinity and total hardness were 252.68, 204, 144.4 mg/l respectively. The nitrate and phosphate were 1.19 and 1.69 mg/l. PAHs were analyzed by HPLC and OCPs by GC. Ten heavy metals were analyzed by AAS and Hg by DMA. The MPN/100 index ranged from 350 to >1600. The results showed that some indicative parameters were beyond the permissible limit and water quality of Gomti river is moderately polluted. The river has lost its own purification system due to loss of biological life in sediments. Henceforth, we recommend all channels carrying wastewater must be treated before final discharge and rejuvenate the river Gomti.

**Key words:** Physico-chemical, Biological, Parameters, Gomti river

## Poplar based Agroforestry system in Northern States of India – a Review

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Poplar in agroforestry system has been adopted due to its short rotation, clear bole, winter deciduous nature and readily available timber market. It is one of the most adopted tree species on agricultural fields in the northern states of India. Different kharif, rabi and annual crops are successfully grown as intercrops at different stages of poplar plantation. It provides remunerative returns to farmers. The net returns of intercrops are higher during early stages of poplar and it decreases as the plantation gets older mainly due to above and below ground competition. Trees also showed better growth performance with intercropping than without intercropping. Research studies have indicated the best performance of various types of grains, vegetables, spices and fodder crops under poplar based agroforestry system. A number of different factors govern the spacing adopted by farmers for poplar plantations. Mainly it is land holding size, access to market, crop or tree growing priority. Breeders are recommending different clones for different agro-climatic regions. Overall objective is to have maximum productivity of tree plantation. Poplar being long duration crop, it is always recommended to procure the planting material from some authentic government or private source. It has been observed that poplar based agroforestry with proper cultural and management practices provide an average of 100 q of wood/acre/year. The income from such plantations varies with the market price of poplar wood which varied from Rs. 150 to 1100/q wood. In addition, the poplar based agroforestry system plays an important role in maintaining soil health by regulating nutrient cycling and adding organic matter in the form of leaf litter. Although the above ground and below ground competition increases with each passing year but it could be minimized by regular pruning, additional irrigation, fertilization and selection of shade tolerant crops. Over the past few decades, it has been observed that adoption of poplar based agroforestry



system by farmers of North India has improved their socio-economic status by providing continuous employment on farm and also helped in preserving ecological balance.

**Keywords:** Poplar, intercropping, farming, agroforestry

### **Studies on Drying Characteristics of Bael Fruit Pulp**

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Bael or Aeglemarmelosfruit contains many functional and bioactive compounds such as carotenoids, phenolics, alkaloids, coumarins, flavonoids, terpenoids and other antioxidants which may protect against chronic diseases. Drying is the process of removal of most of the moisture present in the food that prevents the growth and reproduction of spoilage microorganisms and slows down the action of enzymes and minimizes many of the physical and chemical reactions. The crude mass containing seed, pulp and fibre was added with water having equal quantity, mixed and heated for 1 min at 80°C. The mixture was passed through 20 mesh sieves to separate out the seeds to obtain pulp for drying purpose. Bael fruit pulp weighing 200 g were dried in tray dryer at three drying temperatures viz. 55, 60 and 65°C and four thickness of pulp on the tray (2, 4, 6 and 8mm). All the data were statistically analysed. Drying took place in falling rate period and constant rate period was absent in drying experiments. Moisture diffusivity varied in the range of  $1.21 \times 10^{-9}$  to  $5.84 \times 10^{-8}$ . Water activity of Bael fruit pulp powder was found in the range of 0.299 to 0.460. Ascorbic acid was found maximum at lowest temperature and highest thickness (12.3 mg/ 100g). Bael fruit powder dried at 60°C with 2mm layer thickness, shown higher colour value  $b^*$  (39.5) and it was optimum with respect to drying time, water activity and ascorbic acid, it was also extremely liked by panellist than the other sample.

### **Effect of different nitrogen sources on the growth of *Botryodiplodia theobromae* causing mango dieback**

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Mango (*Mangifera indica* L.) is one of the most important and esteemed fruit crops of the tropical and sub-tropical world and is grown extensively and indigenously as a commercial fruit crop in India. Among all the diseases of mango, mango dieback and gummosis are the most devastating which causes quick decline of mango. The disease is incited by an association of pathogens but the major causal organism is *Botryodiplodia theobromae* (Pat.) Griffon and Maube (Syn: *Lasiodiplodia theobromae*) with its teleomorphic stage *Botryosphaeria rhodina*. Effects of different nitrogen sources on mycelial growth and sporulation of *B. theobromae* were studied on glucose asparagine medium. The quantities of various nitrogen sources viz. urea, sodium nitrate, ammonium sulphate, ammonium nitrate, ammonium oxalate, and ammonium dihydrogen phosphate were adjusted and substituted in place of proline. The maximum mycelial growth was observed in ammonium dihydrogen phosphate and ammonium oxalate after 20 days of incubation. The maximum pycnidial production was also observed in ammonium dihydrogen phosphate followed by ammonium oxalate. The other nitrogen sources recorded minimal pycnidial production. Poor sporulation was observed in all the nitrogen sources tested and no sporulation was found in the basal media.



### **Waste: A silent contributor to climate change**

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Today the explosive generation of municipal solid waste (MSW) and its mismanagement is a huge concern in almost every city and town of India. The Solan city (HP) is also suffering from similar problem. At present there is no waste management technology adopted in the city and it is directly being dumped on un-sanitary landfill site where it undergoes anaerobic digestion (AD). In AD process biogas is the bio-product. The biogas generally comprises of carbon dioxide (CO<sub>2</sub>), methane (CH<sub>4</sub>), hydrogen sulfide (H<sub>2</sub>S) and other gases. Methane and CO<sub>2</sub> are greenhouse gases (GHG), and in fact CH<sub>4</sub> has approximately 31 more global warming potential (GWP) when compared to CO<sub>2</sub>. Considering the waste generation of HP, an investigation is performed and GWP of MSW is determined. Using Landfill gas emission (LandGEM) inventory software (developed by USEPA), analysis revealed that, in a period of 200-2025 approximately 55 tonnes-CO<sub>2</sub>-equivalent will be emitted by the end of 2025. However, on the other hand, MSW of the Solan city has a potential of 30362 kWh of electricity from MSW by the end of 2050. This study, concludes that proper management of MSW will not only curtail the GHG but also it will generate source of revenue in the state. The study also concludes that, if effective measures will not be taken in the future, due to massive GWP from MSW, the MSW will become a great and silent contributor in the global warming and climate change.

**Keywords:** municipal solid waste; anaerobic digestion; greenhouse gases; landfill gas emission; global warming potential; global warming potential.

### **Effect of soil solarization on Rhizoctonia stem rot of chrysanthemum caused by *Rhizoctoniasolani***

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Rhizoctonia stem rot of chrysanthemum caused by *Rhizoctoniasolani* is a serious problem in chrysanthemum resulting in huge losses. Soil solarization is one of the most effective non-chemical methods of disease management which is widely used against many soilborne pathogens in different crops. Soil solarization with transparent polyethylene mulch (25 µm thick) was found most effective against stem rot pathogen. Soil solarization increased average maximum soil temperature to 44.9 °C with an increase of 7.07 °C at 5 cm soil depth over unsolarized pots. Effect of soil solarization was observed on disease causing capability of the stem rot pathogen. Sclerotia of the stem rot lost the viability by 88.7 per cent in comparison to unsolarized soil in the pots after 40 days of soil solarization at 5 cm depth. Soil solarization for 40 days increased the incubation period of the disease by 20 to 40 days and symptoms of the disease were delayed and disease incidence was reduced by 46.1 per cent in comparison to unsolarized pots. Soil solarization also increased the plant growth parameters and reduced the number of days taken for 1st flowering in comparison to control.





## Comparative study of effect of organic and inorganic nutrient sources on yield and economics of cauliflower - tomato production in mid hills of Northwestern Himalayas

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Cauliflower and tomato are the two important vegetable cash crops of Northwestern Himalayas cultivated mainly in mid hills of Himachal Pradesh. With the objective to assess the effect of organic and inorganic nutrient sources on yield and economic performance of cauliflower-tomato cropping sequence in mid hills of Northwestern Himalayas, the present investigation with different combinations of fertilizers, FYM and vermicompost was carried out under cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. Pusa Snowball K-1 and tomato (*Solanum lycopersicum* L.) cv. Solan Lalima. The experiment was laid out in a randomized block design with three replications comprising eleven treatments viz. T1 (Absolute control), T2 (100% FYM only), T3 (100% VC only), T4 (100% N + 100% FYM), T5 (100% NP + 100% FYM), T6 (100% NPK + 100% FYM), T7 (100% NPK + 100% VC), T8 (100% NPK + 50% FYM + 50% VC), T9 (50% NPK + 100% FYM + 50% Rec. N through FYM & VC on 50:50 N-equivalence basis), T10 (75% NPK + 100% FYM + 25% Rec. N through FYM & VC on 50:50 N-equivalence basis), T11 (125% NPK + 100% FYM). The treatments consisting of FYM either sole or in combination with inorganic fertilizers proved to be comparatively better than vermicompost, in terms of significantly higher yield, net returns and B:C ratio in general. Higher net returns under INM system as compared to sole organics application indicated that organic sources of nutrients are least profitable in spite of having higher market values of organically grown crops. This study lead to the conclusion that sole organic application results in comparatively lower yields, B:C ratio and Net returns as compared to when they are integrated with inorganic sources. So we need to adopt mid way of nutrition to make cauliflower-tomato vegetable production system sustainable and economically viable model for NW Himalayas

**Keywords:** FYM, VC, Cauliflower, Tomato, economics, yield

## Genetic variability and genetic divergence study in strawberry genotypes

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The success of the breeding programme in strawberry is achieved by the effective utilization of the heritability and variability shown by the population. Genetic analysis is recognized as an effective method for cultivar identification or phylogenetic systematics and selection of parents for carrying out hybridization.

The analysis of variance for the various characters of strawberry genotypes showed that the mean sum of square (MSS) due to the treatment was highly significant for all the characters. The phenotypic coefficient of variation was higher than their respective genotypic coefficient of variation for all the traits studied. Existence of high estimates of heritability in broad sense ( $H^2$ ) and moderate to high genetic advance as percentage of mean for most of the traits provides opportunities for fair selection as such traits reflect less influence of environment and ensure true expression of genotype. A positive correlation was reported between yield and other traits except average number of runners per plant. Path analysis revealed that most of the traits had direct positive effect on average yield plant<sup>-1</sup>.

The genetic divergence was estimated by Toucher method which group the genotypes into clusters based on  $D^2$  values. The distribution of genotypes into different clusters was at random and observation of sufficient  $D^2$  values among different cluster suggests that the genetic constitution of the promising lines in one cluster is in close proximity with the promising lines in other clusters of the pair may lead to desirable segregates having broad genetic base through hybridization between genotypes of two distant clusters.

**Keywords:** Coefficient of variations, Clusters, Correlation, Genetic divergence, Heritability, Strawberry.



## Seed Source Studies in Wild Pomegranate (*PunicagranatumL.*) in Himachal Pradesh

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The present investigation entitled “Seed Source Studies in Wild Pomegranate (*PunicagranatumL.*) in Himachal Pradesh” was carried out in the Department of Tree improvement and Genetic Resources, Dr. Y.S. Parmar University of Horticulture and Forestry Nauni, Solan (HP) during 2017-2019 with the aim to evaluate various phenotypic characters of the parent trees, leaf morphological characters, seed traits, selection of the trees based on fruit characteristics and nursery performance of the progeny. The details relating to material used, experimental site and methodology adopted for study are described under following characters: Phenotypic studies (Tree height, Crown spread, Tree Diameter), leaf morphological characters (leaf length, leaf breadth, leaf area, leaf petiole length), floral characteristics (flower size, pollen vectors), Seed traits (Germination percentage, Germination energy, Germination value), Fruit characteristics (Fruit shape, Fruit size, Fresh fruit weight, Fresh seed weight, Rind thickness, Fresh seed weight, 100 fresh seed weight, 100 dry seed weight, Total Soluble Solids, Acidity, Total sugars, Reducing sugars, Non reducing sugars), Nursery studies (Seedling height, Collar diameter, Internodal length, Number of branches, Number of leaves per branch). Present study was conducted by selecting five trees under ten seed sources each namely Narag (S<sub>1</sub>) and Neripul (S<sub>2</sub>) district Sirmour, Wakhnaghat (S<sub>3</sub>) and Sadhupul (S<sub>4</sub>) district Solan, Basantpur (S<sub>5</sub>) district Shimla, Sundernagar (S<sub>6</sub>), Rewalsor (S<sub>7</sub>) and Aut (S<sub>8</sub>) district Mandi, Mohal (S<sub>9</sub>) and Banjar (S<sub>10</sub>) district Kullu. Phenotypic studies reported that Neripul with tree height 8.35 m, diameter 14.72 cm, crown spread 9.8 m among all seed sources had maximum value among remaining seed sources. Leaf morphological and morphometric characteristics were maximum in Sadhupul with higher leaf area 12.66 cm<sup>2</sup> and Mohal with maximum leaf petiole 0.5 cm as compare to other seed sources selected. Seed trait was maximum for Sundernagar having maximum germination percentage of 70.46 % which was maximum among selected seed sources. Fruit characteristics were higher in Banjar for fruit length and breadth with the values 38.83mm and 39.53mm respectively. For nursery performance seedling height was found maximum in Wakhnaghat 56.63cm raised from round shape fruits and 58.63 raised from oval shape fruits among selected seed sources. Important traits like 100 dry seed weight was maximum in Neripul with value of 3.53g which was highest among selected seed sources. High heritability and genetic gain was found in seedling height, leaf petiole length, tree height, crown spread (N-S), leaf length, leaf breadth. These traits are useful and important for further selections and tree breeding programs for wild pomegranate (*Punicagranatum L.*).

## Studies on performance of Strawberry (*Fragaria x ananassaDuch.*) genotypes under shadenet and polytunnel

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The study on performance of twenty strawberry genotypes grown under polytunnel and shade net was conducted at Horticulture Farm, School of Agriculture, Lovely Professional University, Phagwara, Punjab during 2018-2019. The experiment was laid in RBD with 3 replications for different characters. The maximum plant height was recorded in Tioga (6.00cm) under polytunnel and San Andreas (5.31cm) under shadenet during the initial days of planting. But in the later stages maximum plant height was observed in CH-III-52 (28.47cm) and Kalimpong Local (29.03cm) under polytunnel and shade net respectively. Kalimpong Local, Sheet Moster, CH-III-52 and Swiss were found promising varieties for runner production. For the yield related attributes, the cultivars Winter Dawn, Hadar and Camarosahas performed good under both conditions. As per the quality of the fruit, E1-13#32, Hadar and Royal Round were having good amount of Ascorbic acid under both conditions and total sugars were observed maximum in Tioga under polytunnel and under shade net it was maximum in Florida. The sugar/acid ratio and TSS/acid ratio were maximum in Tioga under polytunnel while under shadenet sugar/acid ratio and TSS/acid ratio was maximum in E1-13#32.

**Keywords:** Genotypes, Polyntunnel, Runners, Shade Net, Strawberry, Yield.



## Bioremediation of chromium solutions and chromium containing tannery effluent by a consortium of biofilm forming bacteria

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Partially treated tannery effluents required effective bioremediation to prevent adverse environmental impacts. Four efficient biofilm forming bacterial strains namely IITR004, IITR005, IITR006 and IITR007 were isolated from tannery sludge and investigated for Cr(VI) reduction study. Based on the 16S rRNA gene sequencing the isolated strains IITR004, IITR005, IITR006 and IITR007 were identified as *Bacillus vallismortis*, *Bacillus haynesii*, *Alcaligenes aquatilis* and *Enterococcus faecium*, respectively. A consortium of these isolates was formulated and used to remediate chromium from chromium solutions and chromium containing tannery effluent. The MIC of Cr(VI) for *Bacillus vallismortis*, *Bacillus haynesii*, *Alcaligenes aquatilis* and *Enterococcus faecium* are 600 mg/L, 450 mg/L, and 500 mg/L, respectively. All four isolates (*Bacillus vallismortis*, *Bacillus haynesii*, *Alcaligenes aquatilis* and *Enterococcus faecium*) could completely reduce 100 mg/L of Cr(VI) in both culture media (99.13%, 99.5%, 99.6% and 98.27%, respectively) and effluent (95.4%, 93.48%, 98.6% and 75.84%, respectively) within 24 h Cr(VI). The reduction of chromium was enzyme mediated and enzyme and chromium reduction was observed in different cell components but major chromium was reduced intracellularly. Biofilm forming bacterial consortium adsorb on artificial carrier (scotch brite) exhibited significant COD reduction (79%). Detail tannery effluent bioremediation using studies developed consortium is in progress.

**Keywords:** Tannery effluent, Cr(VI) reduction, Biofilm forming bacteria, consortium, effluent treatment.

## Cold Stress Induced Disruption of Carbohydrate Metabolism Causes Cold-Sensitivity in Chickpea (*Ciceraritenium. L*)

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Cold stress is the major hurdle in increasing productivity of chickpea (*Ciceraritenium L.*) in northern India. Carbohydrates are the important components of plants metabolism, however, role of carbohydrates in cold-sensitivity or cold-tolerance is not well understood in chickpea. In the present study, we evaluated leaves of two genotypes, GPF2 (cold-sensitive).and ICC16349 (cold-tolerant) to assess the impact of cold stress on sugar levels and expression of carbohydrate metabolism genes. In addition to cold stress, sugars and gene expression levels were also studied in plants re-exposed to normal temperature after cold stress. In sensitive GPF2, cold stress did not affect the total and non-reducing sugar contents, however, reducing sugars and starch contents were decreased. In contrast to this, in tolerant ICC16349 under cold stress, total sugar and non-reducing sugar content increased, reducing sugar content decreased, and starch content remained static. The activity of sucrose synthesis enzyme, Sucrose synthase, reduced both in the GPF2 and ICC16349 under cold stress with more decrease in ICC16349. Sucrose synthesizing genes, *UDPG glucose-pyrophosphorylase* and *Sucrose phosphate synthase2*, overexpressed in tolerant genotype under cold stress as evident from acid invertase activity and overexpression of *cell wall invertase*. The activities of starch degrading enzymes increased in GPF2 under cold stress as compared to ICC16349. After re-exposure of cold treated plants to normal temperature, the plants of both the resistant and susceptible genotypes gradually reverted back to original levels of sugars as well as enzyme with few exceptions indicating that chickpea has the phenomenon to recover fast from cold stress. It can be concluded that cold-sensitivity in chickpea results from disturbances in carbohydrate metabolism as evident from sugar and enzyme levels. Furthermore, maintenance of starch levels and enhancement in non-reducing sugar content is crucial for cold tolerance in chickpea.

**Keywords:** Chickpea, Cold-Stress, Carbohydrate Metabolism, Gene-expression, Sugar, Starch



## Processing and Marketing of Makhana In Darbhanga District of Bihar

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Euryale ferox is an important aquatic crop, belonging to family Nymphaeaceae. It is native to South East Asia. It is commonly known as Makhana, Gorgon nut or Foxnut and grown in stagnant perennial water bodies like ponds, Oxbow lakes, and swamps. From the past few years makhana is also being cultivated in field system. It is a cash crop and is marketed in the form of popped makhana commonly known as MakhanaLawa. In Bihar, area under makhana cultivation is about 13,000 hectares and accounts to a total yield of 85 per cent of the total production in India. Major Makhana producing districts in Bihar include Darbhanga, Sitamarhi, Madhubani, Saharsa, Supaul, Araria, Kishanganj, Purnia and Katihar. Fishermen community belonging to the weaker sections of the society is mainly involved in makhana sector.

It is observed that, among the selected farmers 40 per cent were illiterate, 46 per cent were studied up to class Vth, 54 per cent respondents were in age group of above 50 years old, the farmers having family member of 6-10 people were 60 per cent, the farmers having annual income of Rs. 50,000 to 1,00,000 was 32 per cent, the large number of people (62 per cent) were involved in other professions with agriculture and aquaculture for their livelihood. The farmers having 2 earner in the family was 56 per cent. And the farmers having up to 0.5 hectares of land was 68 per cent, the farmers taken pond on lease of up to 2 hectares was 82 per cent.

In pond system, the cultivation of makhana cost accounts Rs. 1,44,075 per hectare. The yield of makhana seed was 2000 kilogram per hectare. The price makhana seed was Rs. 125 per kilogram. The gross return from the makhana was Rs. 2,50,000 per hectare. The net return came to Rs. 1,05,925 per hectare. The share of labour cost was 77.39 per cent which is highest in the cultivation of the makhana. The total operational cost shares 90.5 per cent and total fixed cost shares 9.5 per cent of the total cost incurred in the cost of cultivation of the makhana.

The efficiency of makhana seed processing was 35 per cent which means that 100 kilogram of makhana raw seed yields 35 kilogram of makhana pop. The processing cost of the makhana pop was Rs. 7033 per 100 kilogram makhana pop. The labour cost involved in the processing was 83.39 per cent of the total cost. Fuel involves 8.47 per cent, packaging involves 6.35 per cent and equipments involves 1.78 per cent of the total cost of processing of makhana

Makhana is marketed through two channel but both the channels involves same market intermediaries such as; Producer, Processor, wholesaler, Retailer and Consumer. The difference is that in one channel farmer processes the makhana by processor and pays the charge of processing to the processor and take the makhana pop and sell it to the wholesaler, which was more profitable for the farmer, as in this channel the producer share in consumer price was 57.26 per cent. In the second channel due to lack of financial assistance the farmer sell the makhana seed to the processor and then processor sells the makhana pop to the wholesaler after processing it. In this channel the producer share in consumer rupees was 20.12 per cent which is less than the channel I, so it is less followed. The marketing efficiency of the channel I was 1.33 per cent and that of channel II was 0.25 per cent.

Constraints in production, processing and marketing of the makhana is also studied. The major production constraint were No ownership of pond, Labour intensive cultivation, Lack of improved variety, Lack of credit facility, Lack of scientific knowledge, encroachment of pond by fewer powerful people and water scarcity in ponds. The major processing constraints were lack of processing machinery and equipment, lack of credit facility, dependence on climate and health risk of the processor. The major marketing constraints found were the price fluctuation, lack of transport facility and unorganised and inadequate market.

Tools/implements should be designed for harvesting. Smokeless Chulhas needs to be constructed with chimney and hand gloves should be provided in roasting process. There is need for large scale improvement in processing, value addition, grading, packaging, storage, and market infrastructure. Geographical Indication (GI) registration can be taken up for makhana, for protecting the traditional knowledge of the producers and processors of makhana in the state. Makhana farmers may be linked to a Micro Finance Institution (MFI), which would provide them timely micro credit.



## Effect of Temperature Variations on Earthworms

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The earthworms improve the fertility of soil in different ways and, therefore, they are of utmost importance in agriculture. The burrowing and soil feeding habits of earthworms make the soil permeable which permit both aeration and quick absorption of water. It also permits easy and deep penetration of the plant roots. These are able to store moisture without dispersing. Earthworms are very sensitive to low temperatures and can survive temperatures up to 30°C. It was also noted that although higher temperatures favoured growth, fecundity would be higher at temperatures ranging from 22 to 25°C. It was concluded that earthworms would be a better candidate for vermiculture in regions with a tropical or moderate climate as it a fairly narrow tolerance range for temperature with a high degree of intolerance for temperatures below 16°C. Earthworms are one of the most important soil animals that have the capability to maintain the fertility of the soil and hence are playing a key role in sustainability. They maintain the physicochemical properties of the soil by converting biodegradable materials and organic wastes into nutrient-rich products

**Keywords:** Earthworms, temperature, vermiculture, biodegradable

## Characterization of genetic diversity in *Chrysanthemum morifolium* Ramat through SSR's

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Molecular characterization of chrysanthemum germplasm using 17 simple sequence repeats was carried out with the aim to determine the parental diversity. A total of 30 chrysanthemum genotypes were selected which were maintained as chrysanthemum germplasm at Floricultural Farm of the Department of Floriculture and Landscaping, Punjab Agricultural University, Ludhiana. DNA extraction and further molecular SSR analysis was carried out in Fruit Molecular Biotechnology Lab in School of Agricultural Biotechnology. Genomic DNA was isolated using standard CTAB procedure by Doyle and Doyle with some minor modifications. DNA was quantified using Thermo Scientific NanoDrop™ 1000 Spectrophotometer and quality of DNA was checked by 0.8 % agarose gel electrophoresis. The DNA was amplified through polymerase chain reaction (PCR) with PCR amplification of 11µl reaction mixture. PCR products were stored at 4°C before analysis and PCR-amplified DNA fragments were separated on a 3.5% agarose gel. Out of the 17 SSR markers, all the 17 revealed clear and consistent amplification profile in the entire germplasm set. Out of the 17 SSR markers amplified, 15 markers exhibited polymorphism and showed high levels of allelic diversity while remaining 2 were monomorphic. A total of 47 alleles were amplified by 15 polymorphic SSR loci and the number of alleles ranged from 1 to 6 with an average of 2.76 alleles per locus and percent polymorphism varied from 33.33 to 100% with an average of 81.37%. Coefficient of similarity varied from 0.46-0.90, indicating much genetic variation in chrysanthemums. Clustering was done based on the dissimilarity matrix values through UPGMA method, which grouped 30 chrysanthemum genotypes into two major clusters, Cluster I and Cluster II. Maximum number of genotypes were clustered in Cluster I and on the other hand cluster II comprised only one genotype. Results suggested that SSRs are highly useful for assessing the genetic diversity analysis among the chrysanthemum germplasm as genetic improvement and development of new varieties in chrysanthemum is very difficult due to genome complexity, high level of heterozygosity, occurrence of inbreeding depression, self-incompatibility and high rate of failure of many crosses. As we know for a modern and industrialized floriculture, there is always a demand and necessity for new varieties and therefore it is necessary to characterize and understand the genetic relationships of the various accessions available in the gene bank for the future success to develop an efficient breeding program and thus our study must be beneficial in floriculture improvement programs.

**Key words:** genetic diversity, *Chrysanthemum morifolium*, SSR



## Correlation and Path Coefficient Analysis of Morphological Traits In Wheat

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Globally, wheat is the most important crop that excels all other cereal crops both in area and production, thereby providing about 20 percent of total food calories to the world. Correlation and path correlation for yield and its contributing traits in F<sub>3</sub> generation derived from the cross WH711 / WH542 was assessed. Two hundred thirty-eight progenies along with their parents were studied for correlation and path coefficient analysis of morphological traits in wheat at HAU Agricultural Research Farm during Rabi 2014-15. Generally, the estimates of phenotypic correlation coefficients were higher than the corresponding genotypic correlation coefficients for all the traits combinations. Grain yield per plant had high significant and positive correlation with plant height followed by number of tillers per plant (0.658\*\*), spike length, spike weight, number of grains per spike, number of spikelets per spike, grain length, 1000 grain weight, biological yield per plant (0.651\*\*) and harvest index (0.573\*\*). Thousand grain weight was negatively and significantly correlated with number of grains per spike, whereas biological yield per plant had negative correlation with harvest index. Path coefficient analysis revealed that the magnitude of positive effects on grain yield per plant was highest through harvest index (0.6970) followed by number of tillers per plant (0.0689), number of grains per spike, spike length revealed via biological yield per plant in F<sub>3</sub> generation. The results indicated that these traits may be used as direct selection criteria in any breeding program designed to increase grain yield per plant.

**Keywords:** Wheat, phenotypic correlation, genotypic correlation, grain yield per plant

## TREES: The Better Carbon Sequester's

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Forest trees are the key component of the global carbon cycle and plays a significant role in mitigating climate change. Trees are considered as a mean to reduce CO<sub>2</sub> emissions as well as enhancing carbon sinks. Fast-growing trees provide opportunities for carbon (C) sequestration. The study was designed to quantify individual carbon sequestration potential of tree plantation of hilly areas and the mitigation potential of the degraded sites after reforestation. The results revealed that mean rate of carbon storage has been found higher in trees with maximum of total biomass and reforestation of degraded land categories can definitely help in mitigation of significant amount of carbon emission. Trees likely had a greater capacity to sequester C in the long term because of their diverse configuration with the age of the plantation and the major contribution came from the timber, roots and litter. Due to growth rate and adaptability to a range of environments, in addition to carbon storage rapidly produce biomass for energy and contribute to reduced greenhouse gas emissions. This study will help to estimate levels of atmospheric CO<sub>2</sub> that could be sequestered by trees and the mitigation potential by the degraded sites.

**Keywords:** Carbon sequestration, Trees Biomass, Degraded Sites, Mitigation

## Semiochemicals: recent pest management strategy

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Semio-chemicals are defined as 'substances which transmit messages between living organism, both plant and animals'. Semio-chemicals (GK, Semeon, a signal) are chemicals that mediate interactions between organisms. Semio-chemicals are subdivided in to Allelo-chemicals and pheromone, depending on whether the interactions are interspecific or intraspecific,



respectively. Allelo-chemicals, then, are chemicals that are significant to individuals of a species different from the source species. Allelochemicals are subdivided into several groups depending on whether the response of the receiver is adaptively favourable to the emitter but not to the receiver (Allomnes), is favourable to receiver but not the emitter (Kairomones), is favourable to both emitter and receiver (synomones) Within both allelo-chemicals and pheromones sometimes useful to refer to chemicals as arrestants, attractants, repellents, deterrents, stimulants, or other descriptive terms. These terms can behaviour is involved in the response such as feeding stimulant or flight arrestant semio-chemicals which are emitted by one individual and produce a response in another individual are referred to as pheromones. Pheromones (GK, Pherum, to carry; hormone, to excite or are released by one member of a species to cause a specific interaction with another member of the same species. Pheromones may be further classified on the basis of the interaction mediated, such as alarm, aggregation or sex-pheromones. It is the sex pheromones of insects that are of particular interest for integrated pest management (IPM) practitioners. The application of semio-chemical attractants has been the most extensively practiced and has become an integral part of many IPM programmes. The spatial distribution of allelochemical contents also varies from part to part. The pheromones are useful to insects in alarm, sexual attraction, aggregation or tracking, or specific changes in physiological development e.g sexual determination or maturation. Pheromones have also enjoyed considerable success for direct control of pests, mainly through mating disruption. The technical and biological issues have been more challenging in direct control applications. There remain major knowledge gaps in the amount of pheromone required to achieve disruption, as well as the plume structure and behavioural mechanisms that operate with different types of formulations, blends and delivery systems. There has been a recent upsurge of interest in lure and kill tactic internationally. The challenges associated with direct control by mass trapping, lure and kill or lure and infect tactics need further research.

**Key words:** Semio-chemicals, allelochemicals, IPM.

### **Effect of Fortification on Nutritional and Sensory Quality of Papaya And Guava Fruit Bar**

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Papaya (*Carica papaya* L.) and Guava (*Psidium guajava* L.) are important tropical fruits and claim superiority over other fruits by virtue of their commercial and nutritional values. The present study was conducted at College of Horticulture and research station, Anantharajupeta during 2015-2016 with an objective of enhancing the protein content of papaya-guava fruit bar and increasing its nutritional quality by fortifying with defatted soya flour and skimmed milk powder. Different fortified fruit bars contained TSS ranged from 77.45 to 79.24 ° Brix, moisture content from 14.92 to 15.01 percent, pH from 3.38 to 3.87, titratable acidity from 0.80 to 0.98 per cent, reducing sugars from 36.59 to 48.94 per cent, total sugars from 61.15 to 74.45 per cent, ascorbic acid from 81.70 to 133.70 mg/100g, total carotenoids from 849 to 1340 µg/100g and protein content from 0.69 to 2.10 per cent. However, on the basis of sensory evaluation, the treatment T7 (60% papaya pulp + 40% guava pulp (AS) + 6% skimmed milk powder) found to be the best with maximum score for colour and appearance, flavour, texture, taste and overall acceptability among all treatments at zero as well as 30, 60 days of storage.

**Keywords:** Papaya -Guava Fruit bar, Fortification

### **Use of flower waste into value-added products for generating livelihood opportunities- A review**

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Solid waste disposal is the most crucial problem in the world, and flower waste is an integral part of these significant



concerns. However, like any other natural solid waste floral waste can we technologically improvised on, converting it to value-added. Degradation otherwise is a lengthy process, and it causes a massive hazard to wellbeing of our surroundings, primarily soil and water. Therefore, there is a need for a proper and eco-friendly method for floral waste degradation. Looking into the harmful impact of the improper disposal of wastes on the environment and the slow deterioration of these wastes, emphasis should be given on how we can transform this waste to wealth, by their utilization in diverse sectors, ranging from agriculture to various other industries, creating multiple value-added products that can help generate livelihood as well.

**Keywords:** Flower, Waste, Livelihood, Wealth

### **Edible Flowers- a budding nutraceutical resource**

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Flowers are associated with humans since time immemorial, and their use in cooking dates to various ancient civilizations. Edible flowers are essential in terms of their nutritional content apart from their aesthetic appeal to the consumers. Globally, edible flowers in food, beverage and pharmaceutical industry are in much demand due to their increasing popularity in international cuisines and modern medicine; and with millennial homemakers due to their habit of adding variety to plate. Edible flowers are rich sources of antioxidant, anti-carcinogen, vitamin, and chemical compounds of health benefit and thus may have a vital role in human nutrition. Potential market targeting new food items aimed at satisfying both taste and health can find all its requirements in edible flowers owing to their organoleptic and nutraceutical properties. This review aims to summarize the current knowledge from the various studies to evaluate the nutritional and medicinal benefits of different edible flowers on human health, besides their use in the food industry.

**Key Words:** Food, Nutrition, Medicine, Flavour, Aroma

### **Response of radish (*Raphanussativus* L.) to irrigation scheduling and nitrogen levels on growth and water use efficiency**

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A field experiment on “**Response of radish (*Raphanussativus*L.) to irrigation scheduling and nitrogen levels on growth and water use efficiency**” was carried out in the experimental farm of Department of Soil Science and Water Management, Dr Y S Parmar University of Horticulture and Forstry, Nauni, Solan (HP) during 2016-17 and 2017-18.. Twelve treatment combination comprising four irrigation schedules i.e. I<sub>0</sub> (control), 4 cm irrigation at IW/CPE ratio I<sub>1</sub> (0.8), I<sub>2</sub> (1.0), I<sub>3</sub> (1.2) and three N levels i.e. N<sub>0</sub> (control), N<sub>1</sub> (75 per cent of recommended dose of nitrogen) and N<sub>2</sub> (100 per cent of recommended dose of nitrogen), were replicated thrice in a randomized block design (factorial) in plot size of 3m × 2m and spacing of 15 cm × 10 cm. The study focused on ascertaining the effect of irrigation schedules and N levels on number of leaves, leaf length, root length, root diameter, net root weight, gross root weight and yield of radish. The treatment combination N<sub>2</sub>I<sub>3</sub> was recorded with maximum number of leaves (27.3 and 25.0), leaf length (32.53 cm and 29.44 cm), root length (22.21 cm and 32.91 cm), root diameter (4.58 cm and 5.28 cm) and yield (309.0 q ha<sup>-1</sup> and 288.1 q ha<sup>-1</sup>) during 2016-17 and 2017-18, respectively over the N<sub>0</sub>I<sub>0</sub>. Irrigation schedule I<sub>1</sub> exhibited highest WUE (116.9 kg ha<sup>-1</sup> mm<sup>-1</sup>) with 17.11 cm of total water requirement followed by I<sub>2</sub>. Radish yield under N<sub>2</sub>I<sub>3</sub> and N<sub>2</sub>I<sub>2</sub> these treatment combination in the pooled data do not differ significantly. Hence N<sub>2</sub>I<sub>2</sub> could be considered as most appropriate treatment combination for obtaining higher yield of radish crop.





## Carbon sequestration potential and nutrient dynamics of three major rainfed agroforestry systems of western arid Rajasthan

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Agroforestry is a traditional farming practice in arid regions worldwide as trees not only minimise the risk of crop failure but enhances the productivity and fertility of soil. Additionally, trees on agricultural fields helps in sequestration of carbon in its different components as well as soil. Therefore, the present study was conducted to identify and estimate the carbon sequestration potential and nutrient dynamics of three major agroforestry systems (*Prosopis cineraria*, *Tecomella undulata* and *Hardwickia binata*) of arid western Rajasthan. The total carbon sequestration potential of the various systems ranged between 34.75 Mg C ha<sup>-1</sup> (sole cluster bean) to 120.96 Mg C ha<sup>-1</sup> (sole *P. cineraria*). The difference in sequestration potential in tree biomass was attributed to age of the trees as well as their growth performance. The soil carbon sequestration potential of different systems ranged between 32.90 to 56.09 Mg C ha<sup>-1</sup>. The litterfall of the species ranged between 3.74 Mg ha<sup>-1</sup> yr<sup>-1</sup> (*T. undulata*) to 9.44 Mg ha<sup>-1</sup> yr<sup>-1</sup> (*H. binata*). The decomposition of litter was quicker in *T. undulata* (9 months) as compared to *P. cineraria* (12 months) and *H. binata* (15 months). Nutrient inputs (N, P and K) through litterfall and decomposition rates of litter showed the significant differences among species ( $P < 0.001$ ). The summarization of results shows that *P. cineraria* based systems (sole as well as with crop) had more sequestration potential besides maximum and quicker addition of nutrients through litterfall and litter decomposition.

**Keywords:** arid agroforestry, carbon stock, litterfall, litter decomposition, nutrient inputs

## Paludarium – A Review

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The lack of vegetation in urbanized areas, as a result of human establishments, directly affects the quality of life from the physical and aesthetic point of view. To execute a terrestrial ecosystem in combination with aquatic and air ecosystem within a limited space/ area and to get an aesthetic look there is a solution called “PALUDARIUM”. The construction of paludarium is recommended in the interior of the building. By this technology, a small space can be used for the accommodation of many species of flora and fauna and also naturally occurring elements, obtaining aesthetic valences, benefit for indoor environment and human health. Paludarium is one of the art of landscape design in a container with visualizing terrestrial ecosystem, aquatic ecosystem and air ecosystem in the form of nature in miniature. As a paludarium presents an environment where the combination of land and water is possible, much different variety of species can be kept together it would include some habitats that mimic a sloped beach, river's edge or flooded forest. The aim/ concept is to replicate rain forest, desert, wetland and streams to let hobbyists keep a diverse collection of both terrestrial flora and fauna with aquatic animal and plants and also to develop paludarium as learning media on the subject of an ecosystem. It has a horticultural utility that there is no blend in between soft scape and hardscape elements of the garden but paludarium gives very good aesthetic look by blending with natural elements. It should be an attractive option to a hobbyist who has considering or thinking about keeping amphibians. A lot of background research needs to be done into the individual species that paludarium will hold as particularly with amphibians. Some of them can be quite delicate or have a specific need.

**Keywords:** Paludarium, ecosystem, amphibians and aesthetic



## **Doubling farmers income through Extension Strategies**

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Today is an ICTs era and ICTs play an important role in revolutionizing. It has potential to provide benefits to every section of the strata. ICTs play an important role in empowering rural people. Government has also started various schemes related to empowerment of rural people. There are various digital techniques or ICTs tools as radio, television, mobile phone, internet which plays an important role to empower rural community. At present more than half per cent of India's population is dependent on farming. Past research strategies for development of Agriculture in India has focused on raising Agriculture output and improving food security. In rural areas people are unaware about various technology related to Agriculture. With the use of extension strategies people will aware about the new and innovative technologies related to Agriculture. Extension strategies play an important role to empower farming community. Present paper aims to discuss about the role of extension strategies for doubling farmers income.

**Key words:** doubling, income, extension strategies

## **Use of Plant Extracts and Essential oil In Prevention of Fruit Drop in Kinnow Mandarin**

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The dropping of fruits in Kinnow mandarin cause severe yield losses. In most citrus species, heavy fruit drop are serious problems. This continued drop at various stages of fruit development results in considerable reduction in yield and leads to low profit to citrus growers. The use of plant extracts will be effective for controlling the pathological fruit drop in kinnow. Plant extract shows some fungicidal properties which is very helpful for controlling the pathological fruit drop. The pathological fruit drop occur in mid- September to mid- October. So that this time for spraying these plant extract is best. There are various plant extracts like cinnamon, clove, garlic, onion, heena tree, cardamom etc at different concentration is used to control the pathological fruit drop. Clove bud and leaf oil were also effective against the growth of colletotrichum with concentration equal to or above 0.5%. It is better than chemical fungicide because it don't have any toxic effect and their result is also equal or better than these fungicides.

**Keywords :** Plant extract and oil, Kinnow, Dropping

## **Application of lamb jacket and feeding of selenium-yeast for enhancing resilience against winter stress**

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Exposure to low temperature during winter is a serious problem in lamb rearing as their thermo-regulatory system is not properly developed. A jacket made up of coarse waste wool was used for thermal insulation to protect the lambs from low temperature. Lower temperature in cold leads to oxidative stress in lambs. Selenium is an essential antioxidant having an important role in growth, health and defence system in lambs. Therefore, in another approach, an antioxidant supplement of the



selenium-yeast pellet (SeY) was prepared and supplemented orally (Selenium 0.12mg/Kg diet and  $2.2 \times 10^8$  cfu/ml *Saccharomyces cerevisiae*). Thirty-two postweaning (3 months) lambs were equally divided into four groups; G1: control; G2: lambs provided with jacket; G3: lambs feed SeY (25 g); G4: lambs provided with a jacket and SeY (25 g). All the lambs were provided with ad libitum moong (*Vigna radiate*) straw. Lambs in G1 and G2 were fed with 400 g concentrate mixture, while SeY supplemented lambs (G3 and G4) were given 375 g. All the lambs were kept inside the asbestos-roofed shed during the night. Lambs in G2 and G4 were put on the jacket only during night time. Weekly record of blood biochemical response was similar among the groups except for the indicator for oxidative stress. The total antioxidant activity and oxidative stress index was higher ( $P < 0.01$ ) G3 and G4. The average daily gain was higher in G2, G3, and G4 as compared to G1. Therefore, it may be concluded that lamb jacket and SeY might be beneficial for growing lambs during winter to reduce the effect of winter stress.

**Keywords:** Lamb, winter, selenium, oxidative stress index, antioxidant.

### Feeding of unconventional feed silage during scarcity period in sheep

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*Amaranthus viridis* grows plenty during monsoon in semi-arid region. The mixed-silage involving dry pearl millet straw, which is less palatable to sheep used for balancing appropriate moisture during ensiling as *A. viridis* posed practical problems to wilt during monsoon. Thus, forage mixture involving *A. viridis* 75% and pearl millet 25% was used for silage making. *Moringaoleifera* leaf a good source of natural antioxidants, available almost throughout the year also used for silage making. A 70:30 ratio of *M. oleifera* and dry pearl millet straw found to preserve adequate moisture for making mixed-silage. Forty-four ewes were equally divided into four groups and fed with the silage for two months. The animals were fed either of the two silages alone, viz *A. viridis* (G1), *M. oleifera* (G2) or in combinations, viz 2/3rd *A. viridis* + 1/3rd *M. oleifera* (G3) and 1/3rd *A. viridis* + 2/3rd *M. oleifera* (G4) during the lean season. All the ewes were offered with ad libitum silage and 400 g concentrate. The dry matter (DM) content of the silages was recorded at 30.37% for *A. viridis* and 33.40% for *M. oleifera*. The intake of DM from silages and total DM was significantly ( $P < 0.05$ ) lower in G1, while it was highest in G2. The digestibility showed a reverse trend. The water intake per kg DM intake was significantly ( $P < 0.05$ ) higher in G2 as compared to G1. The result showed both the silages were preferred by the ewes and found palatable and most importantly can be fed during scarcity.

**Keywords:** Silage; moringa, dry matter, digestibility, sheep

### Tectonics during early permian-triassic period

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This geological period is responsible for the major changes in the earth crust, formed the various graben or the rift type structure have been developed in Easter and Central India, along with various rifted valley in Australia, South Africa, and in South America etc. In India the eastern part is occurring in the Damodar valley, Mahanadi, Godavary valley, Umaria- Shabdol, Chhindawara Nagpur, Bhandara, in Satpura regions in Central India, These area are characterized by the presence of Lower Gondwana rocks. The most important fact regarding these Gondwana rocks is its origin. The rift /Graben type valleys has been formed due to Mountain Building activities and other tectonic movement of early Permian time, such for instance as the rejuvenation of the Aravalli mobile belt and Eastern Mobile belt, had their reaction, now in the subsidence of large blocks of the country to the equilibrium plane, between vertical or slightly inclined Normal Faults in the crust, as a result the Graben/ Rift valleys has formed. These tectonic depressions are naturally become the place of deposition of river sediments in the new drainage configuration. The continually increasing load of the sediment that were poured in to basin caused them to be sink



relatively to the surrounding Archean or Vindhyan province from which sediments were derived and thus gave rise to continuation of the same conditions without any interruption for quite a long geological period. The Gondwana faulted depression / basin, correspond to the present disposition of their out crops. It should not be supposed that in every case these out crop imply the original faulted basis. Some of these faults were post Gondwana in age (Triassic) The strike of these faults delimiting Gondwana basin in E-W in Bengal and in Bihar and NW-SE in Mahanadi, Godavary, Umaria, Satpura regions etc. The down throws of the main bounding fault are generally unequal in amount, e.g. on the south side of Damodar Valley basin, the throw is much greater than in the north margin, basin on the Godavary, Mahanadi, Umaria, Satpura region subsided much more on their NE margin than on SW. It is this circumstance that has determined the prevailing dip of the Gondwana strata, to the south in the former area and to the NE in the later. Minor cross or oblique faults are also seen in the basins, which have afforded pathway for the later igneous intrusions in the Lower Gondwanas. It is a sinking of loaded trough among the Archean Crystalline rocks that has tended to preserve with Gondwana rocks. The vertical tectonics did not have disturb the horizontal stratification of these deposit, beyond imparting to the then warping or a slight tilt now in one direction.

**Key words:** Tectonics, early Permian, triassic period

### **Shallow tubewells pouring the rare helium gas wells in saugor division, southern ganga basin region, Bundelkhab region M.P. India.**

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The studies on the Discovery of Helium gas in petroliferous tube wells in Saugor Division, southern Ganga Basin region has been carried out in great detail in 58 shallow Tube wells,. The discovery of the rare gas helium in hydrocarbon rich zone in the shallow tube wells in agricultural field at Pipariya - Bhutoli Garhakota Tahsil and Meerkerhi Jilla and Rahatgarh town, Goghara village, Bharatpur near Banda, Mandi- Bamora in Bina Tahsil, Patneshwar Village and Bannad Village in Sagar Tahsil, of Sagar District and Batiyagarh. Mehalwaraanf Sukhaviillage, Singrampur, Konda, Jabera, Villages in Damoh District of M.P. is a unique finding in rocks of the Vindhyan Super Group, in the history of Earth Science in India. The depth of tube wells are varying in 300 feet to 750 feet. These shallow tube wells provide the ground water only up to the month of November- Decemebr every year and after this they become the dry and start the pouring of the Helium and petroleum gas regularly. The inliers of the Vindhyan rocks exposed within the Deccan trap terrain in the good source of helium gas as it (Deccan Trap act as the cap rock over the Vindhyan rocks, which contain the Helium and petroleum gas. On the basis of geochemical analysis, it is remarkable to note that average values of helium contents varies from 0.34 % to 0.732 % along with the 72% to 99 % of methane and ethane, and minor amount of oxygen, nitrogen and CO<sub>2</sub> gases in the hydrocarbon rich zone are recorded during the geochemical and stable isotope analysis. It has been found in the stable isotope  $\delta C^{13}$  value the values for the methane is -43.6 per mil w. r. t. to -54.9 per mil w.r.t. PDB and for the Ethane gas is -24.9 to -26.4 per mil w. r. t. PDB in the gas samples collected in the saturated sodium chloride solution in the glass bottles at various sites in Sagar & Damoh District. The occurrence of rare helium gas in the Hydrocarbon rich zone is reported first time in Jan, 2007 from the tube wells of Sagar Distt, which were geochemically and stable isotopically analyzed in the labs of KDMIPE Dehradun & NGRI Hyderabad. The gaseous hydrocarbon analysis show the presence of moderate to low concentration of methane (C<sub>1</sub>) 1 to 104 ppb, Ethane (C<sub>2</sub>)-1 to 14 ppb, Propane (C<sub>3</sub>) 1 to 10 ppb, i- Butane (i C<sub>4</sub>) 1 to 9 ppb and n Butane (n C<sub>4</sub>) 1 to 8 ppb in the soil samples collected from different locations. The Result of the adsorbed soil gas and stable isotopic analysis of Ethane gas in these samples  $\delta C^{13}$  value are ranging from -24.9 per mill w.r.t. PDB and -26.9 per mill w.r.t. PDB are indicative that this gas is of thermogenic origin, which must have been formed at very high temperature & pressure condition in the deeper horizon of the Great Vindhyan sedimentary basin of an early Proterozoic (>600m.y.) period.

**Keywords-** Petroliferous, vindhyan rocks, stable isotopically, thermogenic, Deccan trap, sandstone, inlier, proterozoic.



### **Performance of different sugarcane varieties in district Kushinagar, U.P.**

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The comparative performance of different sugarcane varieties were assessed at Krishi Vigyan Kendra (ICAR-IIVR), Sargatia, Seorahi, Kushinagar during 2013-2015. Following sugarcane varieties viz., CoSe-5451, CoSe-96436, UP-5125, Co-86032 and CoSe-1434 have been studied for various agronomic as well as quality traits like yield, plant height, etc. Planting of sugarcane in paired row for the variety Co 86032 gave highest yield (625.35 q/ha) in comparison to rest other varieties. The yield of other varieties respectively is 605.55, 505.25, 525.35 and 515.45 q/ha as UP-5125, CoSe-5451, CoSe-1434 and CoSe-96436. Sowing of sugarcane in paired row save seed, fertilizer, fuels, water and man power and increases the productivity of the crop. The average weight of sugarcane was recorded maximum in the variety Co-86032 (1.30 to 1.38 kg). The plant height, softness, nutrient use efficiency, water use efficiency and average weight of sugarcane was recorded maximum in the variety Co-86032.

**Key words:** Sugarcane, comparative performance and agronomic traits.

### **Role of Mulches in Rainfed Agriculture**

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Rainfed agriculture plays a very important role in Indian economy and rural livelihoods. It is spread over 60% of net cultivated area, contributing more than 40% to the national agricultural production. Water availability in the basic resource which determines the success of rainfed agriculture. Uncertainty in crop production in rainfed areas is due to fluctuations in rainfall and its distribution. Rainfed agriculture which suffers from water shortages, frequent droughts or drought like situations, should imbibe the technologies that conserve the soil and moisture effectively. Mulch means any material applied on soil surface to check the evaporation and improve soil water. About 70% rainfall is lost through evaporation which can be reduced by mulching. Mulches have two distinct types; organic and inorganic. Mulching with both the materials aims to cover soil water evaporation, control weeds, maintain a good soil structure and protect crops from soil contamination.

**Key words:** Rainfed agriculture, Organic mulch, inorganic mulch, soil structure, water

### **Effect of Zinc, Manganese And Sulphur on the Growth, Bulb Yield And Quality of Onion (*Allium Cepa L.*)**

**Cv. Nasik Red**

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The experiment compared of 24 treatment combinations and replicated three times was Randomized Block Design with eight treatment (ZnSO<sub>4</sub> @ 10kg/ha (T<sub>2</sub>), SO<sub>4</sub> @ 10kg/ha (T<sub>3</sub>), MnSO<sub>4</sub> @ 10kg/ha (T<sub>4</sub>), ZnSO<sub>4</sub> @ 10kg/ha + SO<sub>4</sub> (T<sub>5</sub>), ZnSO<sub>4</sub> @ 10kg/ha + MnSO<sub>4</sub> @ 10kg/ha (T<sub>6</sub>), SO<sub>4</sub> @ 10kg/ha + MnSO<sub>4</sub> @ 10kg/ha (T<sub>7</sub>), ZnSO<sub>4</sub> @ 10kg/ha + SO<sub>4</sub> @ 10kg/ha + MnSO<sub>4</sub> @ 10kg/ha (T<sub>8</sub>) and the control (T<sub>1</sub>) were applied in the field. The results have shown that application of ZnSO<sub>4</sub> significantly increased all the growth parameters (Plant height, number of leaves and chlorophyll content in leaves), yield and yield attributes (equatorial diameter of bulb, weight of bulb neck thickness, yield of onion) and quality attributes (TSS, dry matter content, sulphur content in onion bulb). Similarly, application of T<sub>8</sub> (Zn+Mn+S) significantly increased all the growth, yield and yield attributes and quality parameter of onion bulbs. Maximum net returns 58632 of onion was obtained with the application of T<sub>8</sub> (Zn+Mn+S) followed by T<sub>5</sub>, T<sub>6</sub>, T<sub>7</sub>, respectively, being at par with each other. Further, maximum B:C ratio (13.63:1) in onion.

**Keywords:**



## Induced Resistance and Suppression of Virus Multiplication by a Rhizobacterial Isolate

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Efficacy of the rhizobacterial isolate UN1 in induction of systemic resistance was evaluated either through a decrease in the number of local lesions due to sunnhemp rosette virus (SRV) infection on *Cyamopsis tetragonoloba* Taub. (Guar), or through a reduced disease incidence and low tobacco mosaic virus (TMV) titre in its systemic host, *Nicotiana tabacum* cv. White Burley. Lower leaves of the test hosts were treated with an overnight culture of the rhizobacterial isolate UN1 ( $2 \times 10^9$  cfu/mL) and the treated plants were challenge inoculated on all leaves with SRV/TMV, 24h later. A significant decrease in SRV lesion number (80-90%) was recorded on the treated and untreated leaves of *C. tetragonoloba*, when compared to the control plants treated with sterile broth only. Tobacco plants treated with the UN1 isolate showed a delay in the development of typical mosaic symptoms, with a decrease in disease incidence as well as infection severity. The presence/absence of TMV in the control and treated sets was confirmed through SDS-PAGE and dot blot, while the viral load in the infected plants was determined through indirect ELISA. The identity of the isolate UN1 was established as *Pantoea agglomerans* through PCR amplification and sequencing of the 16S rRNA gene, along with its cultural and biochemical characteristics.

**Keyword-** Rhizobacteria, induced resistance, dot blot, ELISA

## In Vitro studies on variability in the growth of twenty isolates of *Fusariumoxysporum*f.sp. *ciceri* causing chickpea wiltin different fungicides

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Field survey was undertaken and Seventy one samples of chickpea wilted plants were collected from twenty two locations in different districts namely Bhopal, Raisen, Rajgarh, SagarSehore and Vidisha of Vindhyan Plateau Zone of Madhya Pradesh. Out of Seventy one isolates, only twenty were found pathogenic to chickpea. These isolates were categorized into six different groups on the basis of colony diameter, growth pattern and number of micro and macro conidia. The physiological studies of the representative isolates of these six groups were made on six different fungicides at 1000 ppm concentration. All the fungicides differed significantly from each other. The minimum mean radial growth (39.68 mm) was recorded in groups 5 of isolates Ri4, Ri5 and V2 and Maximum (41.04 mm) in group one consisting of B2, B3, Se6 and Se8. The maximum mean radial growth (84.46 mm) was obtained on untreated (control) and minimum (15.36 mm) on thiram. These isolates were exhibited three types of growth pattern namely fluffy, partially submerged and submerged. The maximum number of micro conidia was produced on untreated (control) (7.58 million/ml) and Minimum (1.29 million/ml) in thiram. Similarly, the maximum number of macro conidia were produced on untreated (control) (2.67million/ml) and minimum (0.19 million/ml) onthiram.

**Key words:** Chickpea wilt, *Fusarium oxysporum* f.sp. *ciceri*, pathogenic, Macro conidia, Microconidia and Fungicides

## Changes in soil chemical &biochemical properties during transition from conventional to organic farming

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Although conventional farming has played an important role in improving food and fiber productivity to meet human demands but has been largely dependent on intensive inputs of synthetic fertilizers, pesticides and herbicides which leads to many environmental and public health concerns (Horriganet al., 2002). Alternatively, the concept of organic agriculture is receiving increased attention and organic food markets are also expanding rapidly in many countries including India (Willerland Yussefi 2005).India's National Program for Organic Production (NPOP) requires at least a 2-year transition period for annual crops before



the produce may be certified as organically grown. The transition period pose many challenges, because the changes in the chemical, physical and biological properties of the soil take time to reach an ecological balance. The results obtained from the experiment conducted by Tuet *al.* (2006) have shown that compared to the conventional practice significant yield reduction occurred in the organic practice, whereas some of reduced-input strategies (e.g. no-fungicide, no-herbicides, no-synthetic fertilizer) produced similar yields during the transition period. Microbial biomass and activity were very responsive to transition strategies from conventional to organic farming systems. Compared to the conventional control, microbial biomass C and N was significantly higher in all reduced-input transition and organic treatments. Similarly, according to Gopinath *et al.* (2008), there was 23–65% reduction in grain yield of wheat under organic amendments such as composted FYM, vermi-compost and lantana compost compared with mineral fertilizer treatment. Furthermore, improved soil properties in terms of lower bulk density, increase in pH, oxidizable organic C, available K and enzymatic activity in the soil after a 2-year transition period have also been observed. Soil fertility can be problematic during the transition period from conventional to organic farming, when the soil biota may not be able to support the rates of decomposition needed to provide sufficient soil fertility in the early growing season (Scow *et al.*, 1994). Among the different enzymes studied, phosphatase were earliest indicators of changes occurred in soil due to the organic transition (Melero *et al.*, 2008). Finally, composted FYM along with bio-fertilizers can be used for quick stabilization of soil fertility and biological activity, which in turn help in nutrient availability and minimum loss in yield during transition period.

**Keywords:** Conventional farming, transition period, organic farming

### **Analysis of growth of major vegetables and forecast of seedlings demand in Karnataka**

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Vegetables are progressively more accepted as vital for food and nutrition security. Vegetable production provides a promising financial opportunity for reducing rural poverty and unemployment and is a key factor of farm diversification strategies. Today, neither the economic nor nutritional power of vegetables is sufficiently realized. In this regard, the present study attempts to analyze the growth, estimate the area under major vegetable crops (tomato, chilli, brinjal and cabbage) and also to estimate the demand potential of these vegetable seedlings for the agricultural year 2019-20 in the major growing districts and Karnataka state as a whole. To accomplish these objectives, time series data on area under these vegetables were collected from Directorate of Economics and Statistics, Bengaluru from 2010-11 to 2018-19. The study indicated that, existence of annual demand of 161.13 crores of tomato seedlings, 138.53 crores of chilli seedlings, 23.94 crores of brinjal seedlings and 62.57 crores of cabbage seedlings are required for cultivation of estimated area of 65,259.00 hectare area under tomato, 46,754.00 hectare area under chilli, 17,238.00 hectare area of brinjal and 11,263.00 hectare of cabbage in the state of Karnataka for the agricultural year 2019-20. Area under tomato and chilli cultivation in Belagavi and Kolar districts witnessed negative growth rate i.e., -4.13 and -2.36 per cent per annum respectively, even though these districts have enormous area under cultivation. In order to protect and retain the interest of farmers to cultivate these vegetables, attractive policies should be initiated i.e. announcing Minimum Support Price (MSP), providing seedlings and other prime inputs on subsidy basis, linking the farmer producers to processors, establishing Farmer's Producer Organization (FPO) and cold storage units at farm level. Further, price fixation based on cost of cultivation on regular basis would be other important factor motivating farmers to increase area under these vegetables.

**Key words:** area, demand, growth, karnataka, seedling forecast, vegetables



## Fertilizer application in tuberose: A review

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Tuberose is one of the most popular and commercial bulbous flower crop grown in India for its fragrant flowers to mitigate the domestic and export requirements. Tuberose is a heavy feeder of NPK and responds well to the organic and inorganic nutrient application particularly nitrogen fertilizer among the major nutrient required for optimum growth, development and flowering of tuberose nitrogen has greater influence on development of vegetative and reproductive organ. In determining the yield of flower crops phosphorus is one of the major and crucial limiting factors. Potassium enhances the flower production in tuberose. So the fertilizers play a major role on growth and flowering of tuberose. As fertilizer application results in an increased yield of tuberose flowers which increases the profit of farmer many times. So recommend the farmer to apply recommended dose of fertilizer on tuberose crop

**Keywords:** Fertilizer, Profit, Flowers

## Comparison of Antioxidant potential of two edible aroids, Elephant foot yam (Zimmikand) and Giant taro (Gandiali)

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Edible aroids (members of the family Araceae) considered among the world's most ancient food crops that are also known for their medicinal properties. The edible aroids have many medicinal uses like they have anti-bacterial activity, antioxidant activity, gastro-protective activity, analgesic activity, anti-helminthic activity, anti-inflammatory activity, anti-tumor activity, anticonvulsant activity, anti-diarrheal activity. In the present investigation we investigated the antioxidant potential of the two edible aroids viz., *Alocasia* Spp. (Giant taro) and *Amorphophallus* Spp. (Elephant foot yam). The Giant taro was found to be significantly rich in antioxidants than the Elephant foot yam. The giant taro shows the 13.51% higher DPPH radical scavenging activity than the elephant foot yam, the total phenolic content and the total flavonoid content of giant taro was respectively 2.6 and 9.57 times higher than elephant foot yam. Whereas, the ascorbic acid of giant taro was found to be 1.71 times higher than elephant foot yam.

**Keywords:**

## Detection and characterization of multi-drug and multi-metal resistant *Klebsiella pneumoniae* from treated tannery wastewater

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The leather industry is a major source of environmental pollution in India. The wastewater generated by leather industries contains very high pollution parameters due to the presence of a complex mixture of organic and inorganic pollutants. Heavy metal contamination in the environment has become a serious problem due to the increased addition of various toxic metals from natural as well as anthropogenic sources. In present study, enterobacterium was isolated from the treated tannery





wastewater and characterized as lactose fermenting, gram-negative, motile, rods shape. The isolated strain was further streaked successively on HiCrome Klebsiella selective agar plates for several times to get distinct and pure colonies. Further, based on the 16S rRNA gene sequence analysis, the bacterium was identified as Klebsiella pneumonia with accession nos. MH559818, respectively for public domain. In addition, the antibiotic and heavy metal resistant property of the isolated bacterium was also investigated by the disk diffusion method on the Muller-Hinton agar and nutrient agar medium amended with the increasing concentrations of various toxic metal ions, respectively. Results revealed that the strain was sensitive for Gentamicin; Ampicillin; Ciprofloxacin; Levofloxacin; Tetracycline; Vancomycin; Norfloxacin; Streptomycin; Penicillin and Erythromycin. The significant number of multiple drug resistant (MDR) bacteria was observed in both sample. Human infections caused by these bacteria could be difficult to treat with available drugs. The bacterial pathogen also showed the Minimum Inhibitory Concentration (MIC) of Cr (Cr 6+), Cu (Cu2+), Zn (Zn2+), and Ni (Ni2+). These multi-drug and multi-metal resistant organisms can be used as a potential agent for the bioremediation of metal contaminated sites. It indicates that the industrial effluents are organically enriched medium supporting the fast growth and spreading of microbes, which are resistant to multiple antibiotics and metallic ions. The spreading of such microbes in environment is serious threat for the human health.

**Keywords:** Antibiotic, Metal resistant, Klebsiella pneumonia, 16S rRNA gene, Tannery wastewater

### **Efficiency of naturally adopted competent microalgae and their consortia for waste water remediation**

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Pollution load in the aquatic ecosystem are continuously rising in 21st century and therefore assess to clean water has become a global issue. Climate change, urbanization, population growth and high living standard are the major threat of water pollution and have put a massive load on the ecosystem. Therefore, there is a pressing need to find better way to manage the ecosystem in sustainable and cost effective manner.

Algae growing in natural habitat have a lot of potential in the field of remediation and waste treatment. Besides, biomass produced by the algae could further be utilized in pharmaceuticals, nutraceuticals industries as well as production of biofuel. Algae being grown in diverse habitat could effectively remediate the high pollution present in water and waste water without add of input in the form of cost, price, maintenance, and man power. Microalgae *C. vulgaris*, *C. humicola*, *Oscillatoria* sp., *Chlamydomonas* sp. and *Scenedesmus* sp. growing in diverse habitat (sewer line, sewage water, road side, side wall of waste flow etc) in Lucknow and nearby area were collected and isolated. The collected algae were tested under laboratory to assess their bioremediation potential singly as well as in group. In addition, naturally adopted consortia of algae were also examined in term of their growth and biomass productivity for comparative analysis. The details study of the potential of these algae will be discussed in the conference.

**Keyword:** Microalgae, Energy, Bioremediation, Biofuel

### **Antibiotic Resistance In Modern World: A Major Issue**

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Antibiotic resistance occurs when micro-organisms change in response to antibiotics. This problem has emerged to be a major threat to the microbial communities affecting health care globally. Multiple drug resistant microorganisms are developing very fast, causing common infections to become serious health issues which are leading to post antibiotic era. These microbes have developed resistance against antibiotic groups especially, broad spectrum antibiotics which is the major challenge for researchers to tackle this issue. . If the current scenario continues, antibiotics will be of no use to combat this serious issue. Therefore, new strategies must be developed to slowdown or to completely takeover this multiple drug resistance. Factors responsible for development of resistance are mutation, transduction, conjugation, lateral gene transfer, virus mediated gene transfer. Many known antibiotic resistance genes are found on transposons, integrons or plasmids which can be mobilized and



transferred to other bacteria of same species. Areas with high population density especially of humans are known to have antibiotic resistance genes in abundance as compared to those areas which are less populated. Sources and movement of antibiotic resistance genes are nature, medicine, agriculture, physical and biological forces. Right now little is known about antibiotic resistomes of vast majority of environmental bacteria hence more detailed studies of environmental reservoirs of resistance are crucial for our future availability to fight infections.

### **High Throughput Screening of *Mycobacterium Fortuitum* Proteome for Discovery of Novel Drug Targets**

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*Mycobacterium fortuitum* belongs to nontuberculous mycobacterium (NTM) division of the genus *Mycobacterium*. Ubiquitous presence of the species makes its isolation possible from natural and processed water, sewage and dirt. The bacterium causes several clinical complications like osteomyelitis, ocular diseases, joint infections, skin and soft tissue lesions and surgical-site infections. Proteomic investigations help in uncovering the pathways and cellular processes essential for bacterial survival and persistence in the environment. *M. fortuitum* proteome was hence explored to unearth its proteins related to the physiology, metabolism and virulence. Shotgun proteomics was employed to analyze the peptides through LC-MS/MS approach. Total protein content was quantified using Bradford assay. A total of 6337 proteins having 9397 peptides compiled into 2017 protein groups were identified in the analysis. Proteins identified were categorized into those essential for bacterial metabolism, cell division, replication and respiration. All these were directly related to survival of the pathogen. A major fraction of proteins were characteristic of the elements involved in fatty acid biosynthesis, indicating the peculiar trait of mycobacterial species rich in mycolic acids. Data suggested expression of several transcriptional regulatory elements, for coordinated cell multiplication. Another research dimension can investigate probable functions of a large cluster of uncharacterized proteins through bioinformatic studies. Expression of virulent proteins indicates pathogenic nature of the bacterium which might be acting as the causative agents behind human infections. Analysis of such proteins would help in unveiling the molecular mechanism of *M. fortuitum* pathogenesis and host-pathogen interaction. The present study would facilitate discovery of molecular markers that can be targeted for combating mycobacterial infections. It may also provide solutions to the emerging drug resistance in *M. fortuitum* isolates.

**Keywords:** *Mycobacterium fortuitum*, proteome, drug target, drug resistance

### **Eco-friendly Management of Newly emerging insect pests**

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Emerging pest is the pest reported from an area on a particular crop whose population has been increasing to cause economic damage. Newly emerging pests namely Papaya mealybug (*Paracoccus marginatus* Williams and Granara de Willink), cotton mealybug *Phenacoccus solenopsis* (Tinsley), coconut mite (*Aceria guerreronis* Keifer), serpentine leaf miner (*Liriomyza trifolii* Burgess) and tomato leaf miner [*Tuta absoluta* (Meyrick)], Fall army worm [*Spodoptera frugiperda*]. Intensive farming system warranted the use of high doses of chemical fertilizers, herbicides and plant protection chemicals which have damaged the soil health (soil flora and fauna), productivity and also sustainability. Growing public awareness and concern about the adverse effects of pesticides on human health, soil and water resources and development of resistance and resurgence among the insect-pests have necessitated the need to look for eco-friendly, safer and effective methods of pest management. Eco-friendly approaches for sustainable agriculture is a productive unit where human get the free gifts of nature namely, land, light, air, temperature, rain water, humidity and its practices includes Regulatory (Plant Quarantine), Mechanical (Light/Sticky Traps, Plastic Mulching. Banding of Fruit Trees. Fruits Wrapping), Physical (Heat & amp; Cold



Treatment, Physical Barriers, Irradiation), Cultural (Crop Rotation, Trap Cropping, Intercropping, Cover Cropping, Barrier Cropping, Strip Cropping, Mulching, Deep Summer Ploughing, Fallowing, Flooding, Use of Fertilizers & Pest-Free Planting Stock, Sowing Practices and Removal of Infected Plants), Botanical (Green manures, Mulching, Organic Amendments, Sugars and antagonistic Plants), Biological (Biocontrol Agents), Semiochemicals (Allelochemicals, Pheromones), host resistance, integrated methods and novel approaches [biotechnological approaches, biofumigation, variety mixtures, avermectins, bacteriophages, bio-priming of seeds, non-pathogenic strains, plant defense activators, plant growth promoting rhizobacteria (PGPR), soil solarization, strobilurin fungicides, RNA interference (RNAi), pathogenesis-related proteins (PRs), fusion protein-based biopesticides and seed mat technology]. Integrated Pest Management (IPM) is an eco-friendly approach which aims at keeping pest population at below economic threshold levels by employing all available alternate pest control methods. Eco-friendly insect-pest management requires the manipulation of local natural resources for conservation and augmentation of natural enemies.

**Key words:** Eco-friendly, Agriculture, Emerging , Insect pest management, Pesticides

### **Bioreclamation Strategies for Stone Mine Spoil Areas of South- Eastern Rajasthan**

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Rajasthan has the largest geographical area under mining leases (2.31 lakh ha) in the country and considered as a museum of minerals including renowned building stones. Open cast mining of Kota stone results in extensive soil damage, altering soil microbial communities and affecting vegetation leading to destruction of vast amounts of land. Stone mine spoils left to nature may take decades to centuries to develop any vegetation cover. However, carefully planned artificial interventions may helpful to mimic natural processes and time span of establishment. Keeping in view of above facts, the experimental study started in the year 2015 under nursery with 11 tree species viz. *Acacia nilotica*, *Acacia senegal*, *Acacia tortilis*, *Pongamia pinnata*, *Butea monosperma*, *Azadirachta indica*, *Aegle marmelos*, *Cassia siamea*, *Inga dulce*, *syzygium cuminii* and *Ficus racemosawere* raised with different rooting media composition for stress screening and hardening in order to find out suitable tree species. Among the 11 tree species, four best performing tree species viz., *Acacia nilotica*, *Inga dulce*, *Syzygium cuminii* and *Pongammia pinnata* were transplanted in main plot and planting techniques imposed in subplot for field evaluation at Laxmipura stone mines spoil sites of Ramganjmandi in Kota district of Rajasthan. Among the four tree species highest survival rate of plant was recorded with *Karanjat* the end of two and half years of planting. Among the different rooting media treated plot, highest survival rate of *Karanj*(93.3%) and *Jungle jalebi* (66.7%) was recorded with Soil + FYM with gunny bag plot. While, the highest survival rate of *desi babool* (80%) and *Jamun* (28.3%) was recorded with Soil and Soil + FYM treated plots, respectively. Among four tree species, *Desi babool* and *Jungle Jalebi* were performing better in terms of plant height and collar diameter at stone mine spoil site. Planting techniques which involves pit size and rooting media did not showed any clear trend with respect to survival rate and growth performance among the tree species. Based on overall, survival rate and growth parameters it is indicating that *Desi Babool* and *Karanj* performing better than other two species under harsh climatic conditions Therefore, it is suggested that selected tree species could be utilized for effective ecological restoration of stone mine spoil areas of Rajasthan.

**Keyword:** Bioreclamation, Stone mine spoil. Tree species and Planting techniques



## **Influence of different spawn substrates and spawning techniques on production of button mushroom [*Agaricus bisporus* (Lange), Sing]**

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Cultivation of mushroom is being considered as one of the most significant agriculture business that can be started with minimum investment and got maximum profit in less time. Today we have achieved food security by producing about 240 million tonnes of food grains. However, our struggle to achieve nutritional security is still on. Mushroom cultivation are environmental friendly that impart diversification and also help in addressing the problems of quality food, health and environmental sustainability. The present experiment was conducted to determine the best substrate for spawn production of button mushroom (*Agaricus bisporus*) and different spawning techniques for mushroom cultivation. The cereal grains of wheat (*Triticum aestivum*), maize (*Zea mays*) and paddy (*Oriza sativa*) were evaluated as spawn substrate. Three spawning techniques such as top spawning, mixed spawning and layer spawning were also evaluated. Among all grains spawn substrate and spawning techniques wheat spawn was found superior over maize spawn and paddy spawn. Whereas mixed spawning technique is most suitable than layer spawning and top spawning technique. The different combination of grains spawn and spawning technique also influenced the duration of spawn run, pin head formation, numbers of pin head and fruiting bodies. The combination of (wheat spawn and mixed spawning) gave maximum yield (827.39 gm/ box), less time taken for spawn run, highest number of pinhead (199.23/box) and fruiting body (64.39/box) followed by (wheat spawn and layer spawning). Spawn is the mushroom mycelium growing on a given substrate. It serves as the seed in mushroom cultivation. Spawning is the inoculation of the culture into the substrate or compost. For getting higher production with lower cost, it is very necessary for growers to have a good quality of spawn and knowledge about different spawning technique and all aspect of mushroom cultivation.

## **Recent Trends and Growth Performance of Indian Spice Trade: Solution for Doubling Farmer's Income**

**Baljinder Kaur Sidana and M K Sekhon**

India rightly called as the “Spice Hub of the World” its exports touched 10.28 lakh tonnes valued at 2.78 billion US dollars during 2017-18. Chilli occupied the largest share (23.7%), followed by mint products (18%) and spice oils and oleoresins (14.8%) in terms of export value of total spices during 2017-18. This necessitates the importance of processed and value added spices in the country as well as in the international market for doubling farmers income. The present study has examined the growth and instability of Indian spice trade during 1995-96 to 2016-17. Based on National Horticulture Mission, the total study period has been divided into two periods i.e. pre-NHM and post-NHM periods. Compound growth rate and Cuddy-dellavalle indices were employed to determine the growth rate and instability respectively. The results revealed that growth rate was highest in spices compared to agriculture in both exports and imports. The spices share in exports increased from nearly 4 per cent to 8 per cent of total agriculture exports during the span of 22 years. The study also found that chilli is the largest exporting spice and pepper is the largest importing spice in the country. Besides this, compound growth rate of almost all the major spices in India registered positive growth rate in both export and import coupled with higher instability indices in these commodities. Hence, appropriate measures should be taken to augment and stabilise the spices exports from the country and decrease the spices imports to the country. Some of the major exporting countries increased the spices cultivation in order to reap the benefits and now the competition in spice trade has become fierce. There is a need to focus on the growth and instability in export and import of major spices in India in order to know the present position of India and measures need to be taken to compete in the international market.

**Key words:** Compound growth rate, Cuddy-Della Valle index, Export, Import, Spices.

**JEL classification:** C22, F10, O40.



## **Processing of banana pseudo-stem: waste into wealth – A review**

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Maharashtra is the 2nd largest grower of banana in the country with 71072 hectares, out of this, Jalgaon district alone has 55000-60000 hectares of banana plantation each year having the highest banana average productivity of 55-60 MT/hectare. Nearly 300000-325000 people earn their living on banana cultivation, harvesting, handling and transportation of banana. The Banana Growers bring their Banana Pseudo-stems after cutting bunch of Banana to nearest Cottage Industrial Units and gets Rs. 500/- per MT. These Units are operated by the local farmers SHG. The Unit extracts Banana Fibre from Banana Pseudo-stems. The Cottage Industrial Units makes compost at Unit from the Scutcher waste and sell to local farmers. The banana pseudo-stem after harvesting of Banana bunch generating approximately 70-80 MT per hectare is thrown on boundaries and burnt after drying wasted presently by the banana grower. The farmers are having disposal problems with the pseudo-stem and incurring heavy expenditure on the disposal without getting any income. Pseudo-stem contains central core (10-15 %), banana fibre (1.5-2 %) and waste material after fibre extraction (85-90 %). Which are commercially used for manufacturing candy, pickle, soft-drinks, currency note paper, textile industry, paper-dish, files, organic liquid fertilizer, compost, etc. Transportation of bulky banana stem to the production unit is very laborious as well as expensive. To solve this problem, small Cottage Units were established to reduce the distance between farm and production unit. The farmers received outstanding results of Organic Liquid Fertilizer on Banana, Grapes, Pomegranate, Cotton, Onion, Orange and Strawberry. Many farmers from banana growing area of the MH State visited the project and propose to start such project in their areas.

**Key words:** Pseudo-stem, biomass, liquid fertilizer, scutcher, sap, fibre

## **Status of French bean rust in Himachal Pradesh and its eco-friendly management**

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Rust is an important disease of French bean particularly of pencil types in mid hills of Himachal Pradesh. The disease was found to occur in moderate to severe form in major French bean growing areas of Himachal Pradesh with severity ranged from 23.45 to 72.42 per cent. A systematic survey of major French bean growing areas of Solan, Shimla, Kullu, Sirmour, Mandi and Kangra districts of Himachal Pradesh was done during 2016 crop season. Highest rust severity (72.42 %) was recorded in Shilli followed by Kandaghat (70.32 %), Nauni (69.85 %) and Dangheel (65.10 %) in different French bean growing areas of Solan district. For the eco-friendly management different plant origin bio-pesticides were evaluated both under in vitro and field conditions. Under in vitro conditions, Neemajal, Achook and Nimbicidine were found most effective in causing cent percent urediniospore germination inhibition at 5 per cent concentration. Under field conditions Neemajal was found more effective in reducing the rust severity and increasing the green pod yield.

**Keywords:** French bean, rust, Neemajal and severity



## Postharvest quality of guava (*Psidium guajava*) as effected by *Lactobacillus curvatus* dip treatment

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The objective of this study was to preserve the postharvest quality of guava cv Shweta by the application of *Lactobacillus curvatus*. The dip-treatments included control (C), a suspension of  $1 \times 10^8$  cells/ml of the bacteria (T<sub>1</sub>), 2% guar gum plus bacteria (T<sub>2</sub>) and 2% guar gum (T<sub>3</sub>) was applied to green mature guava fruits and stored under ambient conditions (10 °C and 65 % of relative humidity). On the day of harvest the fruits had firmness 12.30 Kg/cm<sup>2</sup>, TSS of 12.5°B, titratable acidity of 0.50 per cent. Bacteria plus 2% guar gum treated fruit displayed significantly ( $p \leq 0.05$ ) lower cumulative physiological weight loss per cent (7.84%) and TSS:Acid ratio (66.90), compared to control cumulative physiological weight loss per cent (10.96 %), and TSS:Acid ratio (69.94) on the 9<sup>th</sup> day of storage. Comparatively higher antioxidant content (6.68mg TE/g FW) and ascorbic acid (125.40 mg/100g) in T<sub>2</sub> supported the measured physico-chemical parameters, than those in other treatments and control 5.91 mg TE/g FW and 101.59 mg/100g. In addition, treated fruit showed retention of greenness thereby enhancing the shelf-life by 9 days compared to control for 6 days.

**Key words:**-*Lactobacillus curvatus*, guava, postharvest, ascorbic acid, antioxidants.

## Application of Attenuated Total Reflectance-Fourier Transform Infrared Spectroscopy Combined with Multivariate Analysis for Detection and Quantification of Cane Sugar in Cow Milk

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Milk consumption is steadily increasing globally due to its high nutritive value and immense health benefits. Adulteration of milk to gain economic benefit is rampant. Cane sugar is added illegitimately in milk to reconstitute its compositional requirement followed by adulteration of extraneous water in milk. The potential application of Fourier transform infrared spectroscopy using Attenuated total reflectance (FTIR-ATR) combined with chemometrics was evaluated for the detection and quantification of cane sugar in milk. Milk samples were adulterated with seven different percentage levels (1-7% w/v) of cane sugar. Spectra of pure milk and milk adulterated with known concentration of cane sugar were acquired in the wavenumber range of 4000-400 cm<sup>-1</sup>. The spectral range of 1070-980 cm<sup>-1</sup> revealed clear differences in absorption values. Principal component analysis (PCA) showed clustering of samples based on levels of cane sugar in milk. Soft Independent Modelling of Class Analogy (SIMCA) approach was applied for the classification of test samples which showed 100% classification efficiency. Partial least squares (PLS) regression model was established to quantify the level of cane sugar in milk using normal spectra, 1st derivative and 2<sup>nd</sup> derivative. PLSR model for normal spectra showed best prediction as compared to 1<sup>st</sup> derivative and 2<sup>nd</sup> derivative with coefficient of determination (R<sup>2</sup>) of 0.996 for calibration and 0.995 for validation. This method is rapid, non-destructible, cheap and has a sensitivity of 1% level of cane sugar adulteration.

## Effect of methyl anthranilate on stomach musculature of *Rattus rattus*

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Methyl anthranilate (MA) is aromatic compound found naturally in grape and citrus. It is a non-lethal, nociceptive primary bird repellent. The objective of this study was to evaluate the effects of 2.5% MA on stomach musculature of *R. rattus* in



order to develop an effective repellent formulation to manage rodents as they cause huge economic losses under both agricultural and commensal situations. Three groups consisting of six *R. rattus* were fed on 2.5% MA treated bait under bi-choice, no-choice and controlled conditions, and daily bait consumption was recorded prior to autopsy. Consumption of treated bait under bi-choice conditions was less in comparison to no-choice conditions. Histomorphological studies done to determine the effect of 2.5% MA treated bait on the thickness of external muscularis layer, submucosa, mucosa and internal muscularis layer of anterior, middle and posterior part of stomach. Results revealed that there was no change in colour of stomach in bi-choice group of rats but it changed in no-choice group of rats. There was non-significant difference in weight of stomach between untreated and bi-choice group of rats, but there was significant reduction in the weight of stomach in no-choice group of rats. Thickness of external muscularis layer, submucosa, mucosa and internal muscularis layer and keratin layer reduced significantly in no-choice group as compared to bi-choice and control rats. Separation of keratin layer from mucosa was also observed in anterior part of stomach under no-choice conditions. Results show that gastric malaise caused by 2.5% MA makes it a potential secondary repellent thus justifying its utilization in grain stores.

**Key words:** methyl anthranilate, stomach musculature, *Rattus rattus*, histomorphological studies, secondary repellent

### **Protective Effects of Tomato and Spinach Extracts Against Sodium Arsenite Induced Thyrotoxicity in Albino Rats**

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Heavy metals are well known environmental pollutants due to their toxicity and persistency. Heavy metals are nondegradable and can bioaccumulate in living organisms, arsenic is ranked among 20 most hazardous heavy metals and is a known endocrine disruptor. Tomato and spinach are best source of natural antioxidants and their components exhibit anti-inflammatory, therapeutic and anti-proliferative properties. The aim of present study was to evaluate the modulatory potential of tomato and spinach extracts sodium arsenite induced thyrotoxicity in rats. Forty albino rats were divided into eight groups. Group I rats were kept as control. Group II rats were administered a single oral dose of 10 mg/kg bw of sodium arsenite and left for 30 days. Group III rats were given an oral dose of 50 mg/kg bw of tomato extract for 30 days. Group IV rats were given an oral dose of 50 mg/kg bw of spinach for 30 days. Group V rats were given an oral dose of tomato extract and spinach extract for 30 days. Group VI rats were treated with arsenic (10mg/kg bw) + tomato extract (50mg/kg bw). Group VII rats were treated with arsenic (10mg/kg bw) + spinach (50 mg/kg bw). Group VIII rats were treated with arsenic (10mg/kg bw) + tomato extract (50mg/kg bw) + spinach (50mg/kgbw). Autopsies were done 30 days post treatment. In rats arsenic exposure resulted in abnormal thyroid hormone function but tomato and spinach supplementation showed quite encouraging effects.

**Keywords:** Heavy metals, Arsenic, Tomato, Spinach, Antioxidants, Thyrotoxicity.

### **Succession of Microfungi on leaf litter of *Anogeissus pendula* in Datia district, Madhya Pradesh, India**

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Litter is an important component and a major source of soil organic matter on the Earth. Decomposition of leaf litter in forest ecosystem is mostly governed by microfungi. Present Study has been carried out to understand the biology and ecology of litter decomposition. After removing litter bag from pit at 15, 30, 45, 60, 75, 90, 120, 150 and 180 days of interval, isolation and identification of fungi was done. For isolation of fungi, serial dilution method was used. A total of sixteen fungal species were isolated from the selected plant. Among the identified fungal species, two species are belonging to the genus *Mucor*, *Penicillium*, and *Trichoderma*; seven species belonging to *Aspergillus* and only one species from each of the genus *Rhizopus*, *Geotrichum*, and *Chaetomium* were isolated and identified during the course of work. The most abundant group was Ascomycetes. The dominant



species on leaf litter of *Anogeissus pendulawere* *Aspergillus flavus*, *Aspergillus niger*, *Aspergillus japonicus*, *Aspergillus nidulans*, *Rhizopus stolonifer*, *Penicillium chrysogenum*, *Trichoderma viride* and *Mucor varians*.

**Key words:** Litter, decomposition, microfungi, colonization

### ***Buchanania lanzan* Spreng: A Promising Nut With An Abating Future**

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*Buchanania lanzan* Spreng (Anarcardiaceae), a native to Indian subcontinent also known as Chironji, Char, Charoli, Achar, was first described by Francis Hamilton in 1798 in Burma. It is a natural wild growth, evergreen moderate-sized tree with a distinct dark grey crocodile bark with red blaze found in dry deciduous forests of India as well as other tropical Asian countries, Australia and Pacific islands. It has a capacity to withstand adverse climatic conditions except water logging which is detrimental to its growth. The main propagule used is seed but the major problem lies with the low germination capability because of the hard seed coat as well as the fungal association with the storage of seeds. According to the traditional indigenous knowledge, all parts of the plant i.e root, leaves, seeds, fruits and gum exhibit medicinal values which are extensively being tapped by the tribal community, Ayurveda and pharmaceutical industries. Due to profiteering and destructive harvesting, Chironji has been included in the Red Data Book published by International Union for Conservation of Nature and Natural Resources (IUCN). Therefore, development of competent measures for the conservation of the species as well as promulgation of proper knowledge and education to the tribal community is imperative.

**Keywords:** *Buchanania lanzan*, Chironji, Seed, Conservation.

### **Water Management Using Automated Single Row and Paired Row Drip Irrigation Systems**

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Drip irrigation, one of the micro irrigation methods, in which water is applied frequently at low rates from a low pressure delivery system comprising of small diameter plastic pipes fitted with outlets, called emitters or drippers, directly to the land surface close to the plant where the roots grow. It was observed that the application of water is less in drip irrigation method, compared to flood irrigation method. Drip irrigation can reduce water use by 30 to 70 % compared to conventional sprinkler irrigation. A few low cost automation systems were developed and evaluated their performance with drip irrigation on different crops. For sweet corn crop in initial stage water was applied in alternative days, from development stage water was applied regularly. With comparison of different irrigation systems, it was observed that the height of the plant, the number of kernel rows per cob, the length of the cob is more in single row drip system compared to paired row drip irrigation method, because based on soil moisture sensor water is applied efficiently to the plant at correct time.

**Key words:** Drip irrigation, Micro irrigation, Flood irrigation, Automation system, Single row drip system, Soil moisture sensor





## Evaluation of feasibility and possibility of transplanted pigeonpea under various dates of planting at Bemetara District in Chhattisgarh

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A field experiment was conducted at College of Agriculture and Research Station, IGKV, Bemetara (Chhattisgarh) to evaluate the feasibility and possibility of transplanted pigeonpea under varying dates of planting during kharif season of 2015. An experiment comprising of seven treatments including one farmers practice of direct seeding on 14<sup>th</sup> July (T<sub>1</sub>) and six dates of transplanting viz., 14<sup>th</sup> July (T<sub>2</sub>), 24<sup>th</sup> July (T<sub>3</sub>), 03<sup>rd</sup> August (T<sub>4</sub>), 13<sup>th</sup> August (T<sub>5</sub>), 23<sup>rd</sup> August (T<sub>6</sub>) and 2<sup>nd</sup> September (T<sub>7</sub>) laid out in randomized complete block design with three replication. Results revealed that all the growth and yield attributes of pigeonpea influenced significantly due to varying dates of planting. Crop planted on 14<sup>th</sup> July resulted in taller plants with a maximum height of 183.07 cm coupled with greater number of branches (33.70 plant<sup>-1</sup>), nodule counts (52.11 plant<sup>-1</sup>) and their dry weight (109.67 mg plant<sup>-1</sup>), dry matter accumulation (158.10 g plant<sup>-1</sup>) and LAI Superior yield attributes such as pods (486.83 plant<sup>-1</sup>), as well as total seeds (849.47 plant<sup>-1</sup>) were also recorded from early transplanted crop i.e. 14<sup>th</sup> July among all the dates of transplanting as well as with direct seeded pigeonpea. The better growth and yield attributes of pigeonpea planted on 14<sup>th</sup> July resulted in highest grain (2268.52 kg ha<sup>-1</sup>) and stover (9754.63 kg ha<sup>-1</sup>) yields, as well as net returns (89187 ha<sup>-1</sup>) and B:C ratio (3.73) from transplanted pigeonpea compared to rest of treatments.

**Keywords:** Transplanted pigeonpea, date of sowing, kharif, growth characters and yield

## Biological management of American fall armyworm *Spodoptera frugiperda*.

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The fall armyworm, *Spodoptera frugiperda*, a moth starting from tropical and subtropical America, has as of late turned into a genuine nuisance India. Natural control offers a monetarily and naturally more secure option in contrast to manufactured chemical sprays that are being utilized for the administration of this pest. Therefore, different natural control choices are being considered, including the presentation of *Telenomus remus*, the principle egg parasitoid of *S. frugiperda* in the Americas, where it is now utilized in augmentative biological control programs. *T. remus* Nixon (Hymenoptera: Scelionidae) can be developed effectively under lab conditions. It is a control specialist because of its ability to attack the entire egg mass. *T. remus* was first introduced in Quite a while in 1963 from New Guinea to control *Achaea janata* (Linnaeus) (Lepidoptera: Noctuidae) and *S. litura*. It was later presented in Israel from India in 1969, trying to control *S. littoralis*. The International Institute of Biological Control (IBCI) in England has given *T. remus* for control of *S. frugiperda* in the United States, the Caribbean and South and Central America. *T. remus* has been effectively settled on eggs of *S. frugiperda* in with parasitism levels changing from 47-90% in Venezuela with parasitism levels of 60-100%. So the present review emphasizes the importance of *T. remus* and its effective utilization in controlling *S. frugiperda* in Integrated pest management programme.



## “Studies on Morphological and Biochemical Characterization of Cucumber (*Cucumis sativus* L.) Germplasm”

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The present investigation was conducted during July-October, 2014 and February-June, 2015, at Vegetable Research Center and NAIP laboratory, Department of Vegetable Science in G. B. Pant University of Agriculture and Technology, Pantnagar, Uttarakhand. The field experiment was laid out in Randomized Block Design having with forty six genotypes along with two checks with 3 meters X 60 cm spacing. Observations were recorded on total 7 growth and 8 yield characters. Data were analyzed statistically for their mean, range, character association, path coefficient analysis, diversity analysis through principal component analysis, non-hierarchical euclidean analysis and protein profiling through SDS-PAGE.

The results revealed significant differences among the genotypes observed for most of characters except number of fruits per plant, fruit weight, fruit length and fruit diameter. Genotypes, namely, PCPGR-7207, PCPGR-7027, PCPGR-4343, PCPGR-748, PCPGR-264, PCPGR-7557 and PCPGR-7176 recorded for maximum yield. Phenotypic coefficient of variation was higher than that of genotypic coefficient of variation for the characters. Heritability in broad sense was found maximum for fruit weight (88.85) and minimum for primary branches per plant (25.31).

Pooled analysis of two season data revealed that Fruit length (52.15) had maximum genetic advance as percentage of mean. Yield quintal per hectare exhibited highly significant and positive phenotypic correlation with number of fruits per plant (0.860\*\*) and fruit weight (0.517\*\*). Path analysis revealed that number of fruits per plant (0.837) followed by fruit weight (0.491), test weight (0.013). So these are the important characters which showed be preferred while making selection for improvement of yield.

Approximately 83.339 and 83.332 per cent of variation was recorded due to first five principle components on various genotypes in first season and second season respectively. The first four principle components recorded a per cent variation of 66.617 among various genotypes in pooled analysis. Protein profiling of genotypes resolved all forty six indigenous germplasm lines into different groups on the basis of presence and absence of fifteen protein bands distributed into A, B and C zone respectively.

**Keywords:** Cucumber (*Cucumis sativus* L.), Correlation, Variability, PCV, GCV, Heritability, Genetic advance

## A review on the scenario of the Nano-biofertilizer its advancement and adoption towards the farmer in India.

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The intervention of the technology at nano scale is generally referred as nano technology in other words, it is the technology which deals with the matter at its molecular level and covers a broad range depending on its utility. Now, there has been a revolutionary development in the field of agriculture with science and engineering as a tool is being implemented.

Agriculture in India is deprived in the adoption of recent advancement whose 15.87 % of GDP of the total is dependent. The rate of population increases with the accelerating rate which seems to result the problematic situation in the coming years with respect to the ecosystem balances, food security and safety, fertilizer toxicity etc. Therefore, various aspects of engineering and science helps in developing various nanobiofertilizers for maintaining the eco-dynamic and achieving the higher



yields at the low cost. Thus, a review is being made on nanobiofertilizer its types, intervention, impacts on the agricultural crops and the process of adoption by the farmers in the recent years.

### **Isolation and Selection of native soil antagonists from bellpepper nurseries of Solan and Sirmaur districts.**

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In the present investigation, eight composite soil samples were collected from healthy and diseased nurseries of bell pepper from different areas of Solan and Sirmaur districts. Repeated isolations were made from soil samples by serial dilution technique. The media used for isolations were Potato dextrose agar (PDA), Nutrient agar (NA) and Starch Casein Agar (SCA) for fungi, bacteria and actinomycetes, respectively. The number of isolates were enumerated by viable count method. A total microbial count of  $9.31 \times 10^4$ ,  $5.88 \times 10^5$ ,  $3.20 \times 10^6$ ,  $3.94 \times 10^7$ ,  $2.54 \times 10^8$  and  $2.57 \times 10^9$  were obtained. Morphologically similar colonies based on cultural characteristics viz. elevation, shape, surface, edge and margin were selected. As a result, 40 microbial isolates (16 fungal, 18 bacterial and 6 actinomycetal) were obtained for further screening.

**Keywords:** microbes, enumeration, isolation.

### **Food and stress management: Combating stress with a balanced nutritional diet**

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Stress is an entangled phenomenon and each person has their own stress endurance level. Exposure to stressors outcomes in a sequence of embedded responses (stress responses) consisting of sequence of reactions in the body system such as behavioural modifications and various hormonal secretions. There is a strong relationship between stress and eating behaviour of individual. Serotonin is known as a happy hormone, although cortisol is named as a stress hormone that influences the function and feelings of our body. Long term stress will trigger different illnesses such as cardiovascular diseases, diabetes and cancer. There are several ways to deal with stress and one intelligent alternative is to eat stress fighting balanced nutritional diet and reducing stress through food. A well balanced diet with correct nutrients has powerful stress reducing benefits that improve functioning of brain, intensify immune function, lower blood pressure, improve circulation and cut back toxins from the body. These nutrients in food (complex carbohydrates, proteins, tryptophan, vitamin C, vitamin B and minerals) play an important role in managing stress. Food and nutrition affects our interactions with family, friends, community and environment. We need to decide about what and how we eat that affect not solely our health and welfare, but the health of those around us and of our planet. So, build the proper changes, read the labels, concentrate on how you feel after eating, drink plenty of water, add more fruit and vegetables to your diet, plan your meals by the day or may be the week. Nutrition/food education is an essential part of improving dietary habits, food choices and plays an excellent role in stress reduction and management.

**Keywords:** Balanced nutritional diet, Dietary habits, Hormones, Nutrients, Stress management, Stressors



## Agro-forestry and land use management

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Agroforestry is a land use management in which trees or shrubs are grown around or among crops or pastureland. This intentional combination of agriculture and forestry has varied benefits, including increased biodiversity and reduced erosion. Agroforestry combines agriculture and forestry technologies to create more integrated, diverse, productive, profitable, healthy and sustainable land use systems. The most important agroforestry practices are windbreaks, riparian forest buffers, alley cropping, silvi-pasture and forest farming. Agroforestry is a social forestry having purpose of sustainable development. Practices are focused on meeting the economic, environmental and social needs of people on their private lands. At the farm level, agroforestry is a set of practices that provide strong economic and conservation incentives for landowner adoption. Incorporated into watersheds and landscapes, agroforestry practices help to attain community/society goals for more diverse, healthy and sustainable land-use systems. Agroforestry provides strong incentives for adoption of conservation practices and alternative land uses, and supports a collaborative watershed analysis approach to management of landscapes containing mixed ownerships, vegetation types and land uses. Other benefits of agro-forestry are increased productivity, decreased weed competition, enhanced biological regulation of major insect problems, increased efficiency in use of solar radiation, increased soil organic matter, increased biodiversity in agricultural landscapes, decreased wind and water erosion, increased uptake and fixation of atmospheric carbon dioxide, increased nutrient retention and improved economic efficiency.

**Key words-** Agro- forestry, Agriculture, Forestry, Land use, Intentional

## Constraints faced by the Sugarcane growers in adopting Bio-fertilizer in Marathwada region

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The present study was conducted mainly with the objective to study knowledge and adoption of bio-fertilizers by the sugarcane growers. For the study, Latur district was selected purposively as from Marathwada region. Three talukas viz., Latur, Ausa and Nilanga were selected from district purposively and four villages from each talukas were selected purposively on the basis of area and production of sugarcane. Thus constituting the total sample size 120 respondents. Ex-post Facto research design was used for the study. The study portrayed that the constraints faced by the sugarcane growers in adopting bio-fertilizers were 70.00 per cent of respondents reported unable to understand the details of bio-fertilizer effect used in sugarcane. While, 65.00 per cent respondents stated their problems regarding lack of subsidy on bio-fertilizer, 62.50 per cent of the respondents stated their problems regarding inadequate water availability, 60.00 per cent of the respondents stated that lack of confidence towards bio-fertilizer practice, 59.17 per cent of the respondents expressed that non-availability of labours at appropriate time, 58.33 per cent of the respondents reported lack of timely finance, followed by 55.83 per cent of respondents expressed that non-availability of bio-fertilizer in time and 50.00 per cent of the respondents expressed the high wages of labour.

**Key words:** Constraints, Bio-fertilizer, Sugarcane growers, Ex-post facto research design



## Variability in flowering behaviour and physico-chemical traits of bael (*Aegle marmelos* Correa.) cultivars under subtropical conditions

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Bael (*Aegle marmelos* Correa.) popularly known as 'Bengal quince' belongs to the family Rutaceae. It is one of the important indigenous fruits of India, having its own nutraceutical significance. It has a reputation in India for being able to grow in places where other trees cannot. However, systematic study on characterization of newly developed bael cultivars has not been still reported especially under North Indian conditions. Hence, the present investigation was conducted with the aim to study the adaptability and performance of bael cultivars under subtropical conditions, so that unproductive wasteland of the region may be used for plantation of a hardy fruit tree like bael, which holds promise for nutrition security and prosperity.

Nine cultivars of bael (*Aegle marmelos* Correa.) were evaluated for variability in morphological characters, flowering behaviour, physico-chemical traits and yield attributes under subtropical conditions for two consecutive years. Results reveal that different cultivars exhibit considerable variability in vegetative characters, flowering behaviour and yield attributes. Maximum terminal leaf length (13.50 cm) and breadth (8.40 cm) was recorded in cv. CISH-B-2 whereas, lateral leaf length (10.38 cm) in cv. CISH-B-2 and lateral leaf breadth (6.54 cm) in cv. NB-5. Flower bud emergence was found to start from 2<sup>nd</sup> week of May to 3<sup>rd</sup> week of May while earliest flower bud emergence took place in cv. NB-5 *i.e.* on April, 30. The flowering period starts from 15<sup>th</sup> May and till 29<sup>th</sup> June with peak flowering from 2<sup>nd</sup> week of June to 3<sup>rd</sup> week of June in most of the cultivars. Morphological characters of bael fruit *i.e.*, fruit weight in cv. NB-17 (1.80 kg), fruit circumference in cv. CISH-B-2 (50.01 cm), fruit length in cv. CISH-B-1 (17.20 cm) was found to be maximum. Minimum number of seeds/fruit were found in cultivar NB-5 (82 seeds/fruit), number of seed sacs in cv. Pant Shivani (11 seed sacs), seed percentage (0.364 %) in NB-17, shell weight in cv. CISH-B-2 (0.548 g), shell percentage (16.63 %) in Pant Aparna and shell thickness in cv. NB-5 (1.5 mm), pulp weight (1.30 kg) in cv. NB-17, pulp percentage (82.39 %) in cv. Pant Aparna was found to be maximum respectively.

**Key words:** Bael, fruit weight, seed per fruit, shell percentage, pulp percentage, yield.

## Studies on Combining Ability and Gene Action for Growth and Quality Characters in Tomato (*Solanum lycopersicum* L.)

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Tomato (*Solanum lycopersicum* L.) is an important solanaceous vegetable crop widely grown in India for its fleshy fruits. The present investigation was undertaken to study the combining ability of the parents and crosses for yield and yield contributing traits in tomato using twenty one hybrids involving seven lines and three testers in line x tester mating design. The genotypes were evaluated in Randomized Block Design with three replications at college of horticulture, SKLTSU, Telangana. The present study revealed that none of the parent was best combiner for all the traits indicating differences in genetic variability for different characters among the parents. Line x Tester effect was found significant for all the characters under the study except for days to first flowering and days to last harvest. Combining ability analysis revealed that magnitude of specific combining ability variance was greater than general combining ability variance suggesting the predominance of non-additive gene action for all the characters studied. The gca effects of the parents revealed that EC 620494, EC 654289 and testers ArkaMeghali, Pusa Ruby were found to be promising general combiners for growth and quality traits. Based on significant sca effects three hybrids *viz.*, LA 3667 x ArkaVikas, EC 631407 x Pusa Ruby and EC 654289 X Pusa Ruby were identified as promising for growth and quality characters.

**Key words:** Tomato, Combining ability, Gene action, Gca, Sca.



### Performance Evaluation of Multi-Crop Plot Thresher

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Plot thresher is very useful for threshing of the multiple crops on experimental plots. In this research a multi-crop plot thresher is developed for threshing on experimental plots. Studies were conducted on Green gram, Black gram, Soybean, Sorghum and Wheat on the effect of different cylinder speed 545, 745, rpm (11.55 m/s, 15.79 m/s), concave clearance (15, 20, 25 mm), moisture content in the range of 13.1% to 16.8% w.b. and type of threshing mechanism on seed quality. Peg tooth type cylinder was used for experiment. Seed quality was evaluated in terms of unthreshed seeds, broken seeds, blower and hopper loss and threshing efficiency. It was found that unthreshed and broken grain percentage increases with increase in pod moisture content. Thus the threshing efficiency was also decreases. The threshing efficiency for Green gram, Black gram, Soybean, Sorghum and Wheat was found maximum i.e. 99.57, 98.97, 97.84, 95.87 and 97.58 % at 745 rpm (15.79 m/s) and 20, 20, 15, 15 mm concave clearance respectively. The germination percentage of these seed was found maximum i.e. 86, 89, 83, 89 and 91 % respectively. The germination decreased with increase in cylinder speed. The concave clearance had only a small effect on germination. The labour requirement for manual threshing of experimental plots was comparatively reduced by using this thresher. Also this thresher is suitable for small to medium land holding farmers.

**Keywords:** Plot thresher, Cylinder, Concave, threshing efficiency, broken seeds.

### Performance Evaluation of Solar Power Fencing System to Protect Farm from Stray or Wild Animals

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Solar power fencing system provides both an economical and practical solution to achieve maximum protection of farm through effective control of stray or wild animals. In present research work the performance of the solar power fencing system was evaluated by studying the performance of a large and a small solar panels and fence wire. It was found that input and output of solar panel were maximum from 12:00 hours to 15:00 hours facing to south. The output energy from large panel and small panel were found 34.53 watts and 6.23 watts respectively. The average values of conversion efficiencies of large panel and small panel varies between 16.97% to 10.48% and 18.24% to 10.30% respectively.

The range of pulsating current through fence wire were found 0.005 to 0.008 Amp. Each pulse in fence wire is for about 0.0003 of seconds and pulses are spaced about 1.0 seconds apart. In normal operating condition the fence wire voltage remains between 6.6 KV and 7.6 KV but the minimum and maximum voltage found were 2 KV and 11 KV. However voltage ranging between 3.5 to 11 KV were found effective and satisfactory. Looking to the above performance, the solar power fencing system was found ideal system for remote and isolated areas for protecting farm from intruder and control stray or wild animals.

**Keywords:** solar farm fencing, SPV system, wild animal, animal control, power fencing.

### Nutritional evaluation of fodder resources available in Spiti valley of Himachal Pradesh

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Spiti, valley of Himachal Pradesh is a typical cold desert with bare mountains; but with a rich fauna and flora. In, Spiti region of HP cattle, yak, churu, sheep and goat are primarily reared by local farmers to meet out their household nutrient demands;



however, a deep scarcity of quality green fodder is faced in this region. Therefore, the present study was carried out to evaluate nutritive value of available fodder resources in Spiti valley of HP during 2016-17. The composite samples of fodder species were collected in the month of July and September 2016 to analyze the different nutritional parameters. The findings of the study revealed that the nutritional attributes of different fodder species varied markedly among different category of samples. The dry matter content was found highest in *Stipajaquemontii* (68.20) and lowest in *Carexartfusca* (24.83%), crude protein content was found highest in *Pisumsativum* (22.90%) and lowest in *Hordeumvulgare* (5.12%), ether extract content was found highest in *Dracocephallumheterophyllum* (5.55%) and lowest in *Hordeumvulgare* (1.08%), crude fibre content was found highest in *Hordeumvulgare* (35.40%) and lowest in *Elymussemicostatus* (14.20%), total ash content was found highest in *Oxytropismicrophyla* (10.97%) and lowest in *Pisumarvense* (5.30%), acid insoluble ash content was found highest in *Rumexnepalensis* (4.56%) and lowest in *Stipajaquemontii* (0.34%). neutral detergent fibre was found highest in *Hordeumvulgare* (57.77%) and lowest in *Cicermicrophyllum* (33.93%). Acid detergent fibre was found to be highest in *Dracocephallumheterophyllum* (39.05%) and lowest in *Lactucamacrorhiza* (20.60%).

**Keywords:** Spiti, fodder resources, Nutritive evaluation

### **Management of fruit flies (*Bactrocera* spp.) in cucumber using insecticides and biopesticides**

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The study was conducted to evaluate the effect of insecticides and biopesticides against *Bactrocera* spp. on cucumber crop (var. K-75) planted at spacing of 180x65 cm at the experimental farm of the Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P.) during 2014 and 2015. Evaluation of insecticides and biopesticides against *Bactrocera* spp. infesting cucumber revealed lambda cyhalothrin (0.008%) as the most effective insecticide, with infestation values of 13.59 and 11.69 per cent, during 2014 and 2015, respectively. It was followed by the same insecticide at lower concentration (0.004%) where, fruit infestation of 19.52 and 16.13 per cent, were recorded during 2014 and 2015, respectively. Spinosad (0.004 and 0.002 %) was next in the order of effectiveness with fruit infestation values of 25.41, 23.69 and 28.45, 25.85 per cent, during 2014 and 2015, respectively and was at par with fruit infestation of 15.48 and 24.15 per cent in deltamethrin (0.0056%). The per cent infestation recorded with azadirachtin (0.001 and 0.002 %) was at par with malathion (0.1 and 0.2%).

**Keywords:** *Bactrocera*, lambda cyhalothrin, spinosad, azadirachtin, malathion, deltamethrin.

### **Assessing efficacy of some plant growth regulators for improving fruit set, yield, and quality in custard apple under hot and humid climate of eastern India**

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Of late, custard apple (*Annonasquamosa* L.) belonging to family Annonaceae, is gaining due importance in Indian horticulture by virtue of its hardy nature, wider adaptability, delicious taste, nutritional and processing values. However, low fruit set caused by protogynous dichogamy, pollination syndrome and natural stress during flowering, is one of the major production constraints for expanding its area under commercial cultivation and realising its cropping potential. Therefore, a field experiment was conducted at ICAR-IIHR- Central Horticultural Experiment Station, Aiginia, Bhubaneswar, Odisha during 2018-19 to study the response of custard apple var. 'Arka Neelachal Vikram', planted at 5m x 5m spacing to foliar application of some plant growth regulators, viz., naphthalene acetic acid (NAA), homobrassinolide (HBR) and gibberellic acid (GA<sub>3</sub>) in terms of fruit set, yield and fruit quality. The experiment was laid out in randomized block design with 10 treatments, viz., NAA (25, 50 and 100 ppm), HBR (0.1, 0.3 and 0.5 ppm), GA<sub>3</sub> (50, 100 and 150 ppm) and control. Each treatment was replicated thrice with four plants in each replication. Treatments were foliar sprayed thrice, during flowering season (April to June) at monthly interval. Results revealed



significant improvement in fruit set ( $12.01 \pm 3.2\%$ ) and crop yield (8.29kg/tree) due to foliar application of 100ppm NAA. Lowest fruit set and yield were recorded in case of untreated plants ( $7.7 \pm 2.24\%$  fruit set and 5.1kg/tree fruit yield). Application of GA<sub>3</sub> (100-150ppm) was found to be very effective in improving various parameters of fruit quality, viz., TSS, TSS acid ratio and pulp content. Fruits harvested from 100ppm GA<sub>3</sub> treated plants recorded the highest values for TSS (23.24°B), TSS acid ratio (63.31) and pulp content (57.86%). Thus, application of NAA @100ppm and GA<sub>3</sub> @150ppm could be useful for improving fruit set, fruit yield and quality of custard apple in humid tropics of Eastern India.

**Key words:** Custard apple, Fruit set, Homobrassinolide, NAA, GA<sub>3</sub>, Yield

### Physiological Studies on Growth of Temperate Fruits

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This study examined the physiological growth of the different temperate fruit crops and what different changes take place in tree. Mainly Apple, Almond and Apricot were studied. In Apple, the growth and dormancy induction in micro-propagated rootstock under controlled environments was studied. It was demonstrated that low temperature ( $>12^{\circ}\text{C}$ ) induces growth. Chilling at 6 or 9 °C for 6 weeks helps in dormancy release and growth resumption, whereas at 12°C was marginally effective, even after 14 weeks. In Almond, the effect of irrigation at a time of harvest was studied. By regression analysis we came to know about the loss in crop yield by 7 kg/tree in response to each 1MPa decrease in stem water potential. Fruiting positions were negatively related to the water stress. In Apricot, the effect of flooded soil on the growth was studied by taking 2 yr potted plant (*Prunus armeniaca* L., cv Bulida) and grafted on two different rootstocks: Pollizo prune (*P. insititia* L.) and Real Fino apricot. We take three treatments in consideration T0 is not flooded (Controlled), T1 flooded for 3 days and T2 flooded for 6 days. As a result of this we can see the apricot plant grafted on Pollizo prune rootstock is better than apricot grafted on Real Fino combination to resist soil flooding.

**Key Words:** Chilling, Growth resumption, Rootstock, Crop Yield, Water stress, Flooding stress, Water relation.

### Encapsulation in chitosan-based nanomatrix as an efficient green technology to boost the antifungal, antiaflatoxic and antioxidant activity of *Levisticum officinale* essential oil.

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The present study was undertaken to investigate the nanoencapsulation of *Levisticum officinale* Koch. essential oil (LOEO) in chitosan-TPP matrix for enhancing antifungal, antiaflatoxic and antioxidant potency. GC-MS analysis of LOEO showed terpineol (24.03 %) as major compound. LOEO loaded chitosan nanoemulsion (LOEO-CsNE) was confirmed by SEM, FTIR and XRD analysis. LOEO-CsNE exhibited antifungal and antiaflatoxic activity at 0.8 and 0.8 µL/mL, respectively. Reduction in membrane ergosterol, enhanced leakage of vital cellular components, disruption of cell membrane and vitality confirmed fungal plasma membrane as a possible target of antifungal action. Further, LOEO-CsNE effectively displayed significantly reduction in methylglyoxal content confirmed their antiaflatoxic mode of action. LOEO-CsNE exhibited high IC<sub>50</sub> value measured through DPPH assay. Moreover, non phytotoxicity on seed germination and negligible mammalian toxicity as represented through high LD<sub>50</sub> value on mice demonstrates its practical application with wide consumer's acceptance.

**Keywords:** *Levisticum officinale* essential oil (LOEO); Aflatoxin B<sub>1</sub>; Nanoencapsulation; Methylglyoxal; Chitosan;





## Soil health management strategies against soil borne plant pathogens

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Soil is part of the dynamic, living, natural terrestrial ecosystem. It consists of four major components: mineral materials, organic matter, water, and air. Soil is essential for all and it gives not only a support for plant roots, but also a reservoir of essential nutrients necessary for the growth of plants. Due to intensive agriculture, however, soil is threatened by erosion, loss of nutrients, pollution, and so forth. All cultural practices are known to directly or indirectly affect populations of soilborne pathogens and the severity of their resultant root diseases. Cultural practices are known to have a strong influence on soil health *viz*; Rotations, Tillage, Organic amendments. Rotating crops with non-host or less susceptible plants may cause a decline in the specific pathogenic populations due to their natural mortality and the antagonistic activities of other microorganisms. Conservation tillage is associated with leaving previous crop residues on the soil surface or partially buried in the soil. This organic matter, with a variable level of decomposition, can enhance the microbial biomass and activity. The utilization of organic amendments for control of soil-borne plant pathogens has often been considered at best variable because of it containing high nitrogen, such as poultry manure, meat and bone meal, and soymeal, significantly reduced populations of a wide spectrum of soil-borne plant pathogens. The incidence and severity of root diseases is an indirect assessment of soil health for soil use.

**Key words:** dynamic, ecosystem, organic, tillage, decomposition, antagonistic

## Monk fruit (*Siraitiagrosvenorii*): An emerging natural low-calorie sugar substitute

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Monk fruit (*Siraitiagrosvenorii*), an herbaceous perennial vine, is native to Southern China and Northern Thailand. It is commonly known as “luohanguo” or “luohankuo” in China, “la han qua” in Vietnamese and “arhat” in Buddha. The fruits of this species are rich in triterpene glycoside which is sweet in taste and have low calorific value. The sweet triterpenoid glycoside derived from mature monk fruit produces mogroside V during its biosynthesis that has a sweetening strength of 250 (relative sweetness of sucrose is one). Therefore, monk fruit can be used as sugar substitute. In addition, minor bioactive compounds present in the vines and leaves of monk fruit include  $\beta$ -amyrin, aloe-emodin, aloe-emodin acetate, p-hydroxyl benzyl, n-hexadecanoic acid, 12-methyltetradecanoic acid,  $\beta$ -sitosterol and daucosterol. These bioactive metabolites exert certain health-promoting activities like antidiabetic, anticarcinogenic, antibacterial, antioxidant and antiallergic. Further, in recent years healthy lifestyle has increased the interest of consumer towards low calorie natural products. Thus *S. grosvenorii* could potentially serve as a novel source of natural non-sugar sweetener for a wide range of food products.

**Keywords:** Monk fruit, Luohanguo, Mogrosides, Health benefits, Natural sweeteners

## Persistence and Dissipation Pattern of Spiromesifen in/on Green peas, Cucumber and Bitter gourd

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Emerging pest is the pest reported from an area on a particular crop whose population has been increasing. Pesticides form



an integral part of the integrated pest management and are valuable for enhancing the crop production to find their entry in global market by providing off season fresh vegetables which otherwise is not possible without their use. However, the generation of data under the centre sector scheme “Monitoring of Pesticide Residues at National Level” has revealed the presence of non-labelled pesticides in vegetables. Also consumers nowadays are very much concerned about the level of pesticide residues in food due to the application of pesticides in crops and soils as we are being exposed to low levels of pesticide residues through our daily diet food consumption. These residues, if present in large quantities are considered unsafe that can lead to severe medical health issues. Spiromesifen [3-(2,4,6-trimethylphenyl)-4-(3,3-dimethylbutyl-carbonyloxy)-5-spirocyclopentyl-3-dihydrofuranon-2] (Oberon®) is one such unique insecticide recommended for the management of various pests and mites on the crops under investigation. Therefore, to safeguard the interests of the consumers the CIBRC has recommended generating Good Agricultural Practices (GAP) data for the fixation of maximum residue limit (MRL) at the national level to safeguard the interest of the consumers. For this supervised field trials at recommended dose @120 g a.i.ha-1 of Spiromesifen (Oberon 240 SC) were laid at Departmental Farm of the University to study the persistence and dissipation pattern of spiromesifen in/on green peas, cucumber and bitter gourd. One kilogram of fruits of peas, cucumber and bitter gourd were drawn at an interval of 0, 1, 3, 5, 7 and 10 days following last spray application and processed following QuEChERS technique. The residues of spiromesifen were estimated on GC MS employing Selected Ion Monitoring (SIM) mode. The selected ions for spiromesifen were 57, 272 and 99 m/z. Efficiency of analytical method was determined by conducting recovery studies in the respective crops under investigation. Recovery of spiromesifen was above 80% in all crops at all the levels of concentration. After the second application of spiromesifen on green peas 0.040 mg kg-1 were detected in the seeds extracted from the 0 day sampled green pea pods. Residues were not detected in the seeds of 1 day sampled green pea pods. Average initial deposits were found to be 0.649 and 0.771 mg kg-1 on cucumber and bitter gourd, respectively. The deposits of spiromesifen dissipated below the limit of determination i.e. 0.05 mg kg-1 on 1st, 5th and 7th day on the respective crops. The half life (RL50) was found to be 1.4 and 1.7 days on cucumber and bitter gourd, respectively.

**Keywords:** spiromesifen; green peas; cucumber; bitter gourd; residue dynamics

## Evaluation of seed treatment and soil amendments with biocontrol agents and bio formulations against *Fusarium* wilt pathogen

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Efficacy of fungal and bacterial biocontrol agents and bioformulations was evaluated under pot house conditions against *Fusarium* sp. causing *Fusarium* wilt of cucumber. Seed and soil treatment with fungal biocontrol agents (*Trichoderma harzianum*, *T. viride* and *T. virens*), bacterial biocontrol agents (*Pseudomonas fluorescens*, *Bacillus* sp.) and bio formulations (Jeevamrit and Beejamrit) was done. Mass multiplied cultures of fungal and bacterial biocontrol agents were used for seed treatment and soil application whereas bioformulations were used fresh in their pure form. The investigation was conducted in completely randomized design with four replications each and a control was maintained without any seed and soil treatment with biocontrol agents and bioformulations. Data in terms of number of wilted plants in each treatment and per cent disease incidence was recorded. Among the different biocontrol agents and bioformulations evaluated against *Fusarium oxysporum*, *T. harzianum* proved most effective with minimum disease incidence of 20.83 per cent and disease control of 48.25 per cent followed by *T. virens* with disease incidence of 22.91 per cent and disease control of 45.42 per cent as compared to control with disease incidence of 62.49 per cent. Among the bacterial bio control agents, *P. fluorescens* exhibited significantly lower disease incidence of 37.49 per cent as compared to *Bacillus* sp. with 45.83 per cent disease incidence. Among the bioformulations, beejamrit was found significantly more effective than jeevamrit with 29.16 per cent disease incidence and 37.57 per cent disease control.



## Forms of sulphur in tea growing soils of Lesser Himalayan region of Himachal Pradesh

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Out of seventeen essential plant nutrients, plants take up only three essential nutrients (carbon, oxygen, and hydrogen) from air and water and remaining from the soils. Sulphur, recognized as fourth important plant nutrient after N, P and K, is also gaining considerable importance in quality crop production in India. There is a wide scope to increase tea production if we can use full potential of tea soils for tea cultivation. However, tea has a particular need for sulphur, over and above its function as a major nutrient for rapid healthy growth and development. Sulphur is important as a soil amendment chemical to generate and maintain a favored low pH for the acid-loving tea bush. It seems strange that the quality of a fine aroma beverage like tea should depend heavily on an unpleasant smelling chemical like sulphur. Introduction of high yielding crop varieties, intensive and multiple cropping, use of high analysis N and P fertilizers and the decreased use of farmyard manures have led to a wide occurrence of S deficiency in soils and diverted the attention of the researchers towards this hitherto neglected element. To study different fractions of sulphur of tea growing soils of Lesser Himalayas, fifteen soil samples were collected from Kangra and Mandi districts of Lesser Himalayas to analyze the different fractions of sulphur (water soluble, exchangeable, available, organic, non-sulphate and total sulphur). The results showed that, different fractions of sulphur viz., water soluble, exchangeable, available, organic, non-sulphate and total sulphur ranged from 4.5 to 9.9, 9.9 to 20.9, 15 to 30.8, 256.6 to 444.6, 17.2 to 46.7 and 288.8 to 513.9 mg kg<sup>-1</sup>, respectively. The fractions of sulphur present in these soils are in the order of total sulphur, organic sulphur, non-sulphate sulphur, available sulphur, exchangeable sulphur and water soluble sulphur. In the present study, it was found that all forms of S present in soils were significantly and positively correlated with each other

**Keywords:** Himachal Pradesh, water soluble S, exchangeable S, available S, non-sulphate S, total S, organic S

## A review on the biodiversity and importance of agricultural important insect fauna in relation to pest potential for selected horticultural crop

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Pollination is often considered to be the most useful activity of insects, for human begins. Herbivorous insects damage 18% of world agricultural production. Despite this damage less than 0.5 percentage of the total number of the known insect species are considered pests. Insect pests are created through the manipulation of habitats by humans, where crops are selected for larger size, higher yields, nutritious value, and are cultivated in monocultures for maximum production. To ensure stable crop yields we need to change the management strategies of agro ecosystems. We need to manage these systems in such a way that insects performing valuable ecosystem services are also incorporated into the system. It is important to recognise how the services that insects provide can improve agricultural ecosystems. Thus it is very important to recognize these beneficial insects, so as to be appreciated and conserved in selected horticultural crops.

**Keywords:** Pollination, Agro ecosystems, Pests



## **Doubling Farmers Income Through The Innovative Strategies**

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In India agriculture is known to be one of the most significant economic activities. The two-third of the Indian population is dependent directly or indirectly on the agriculture sector for their livelihood. Indian agriculture sector accounts for 14 per cent of India's gross domestic product (GDP) and provides employment to 50% of the countries workforce. It is important to point out that what is sought to be doubled is the income of farmers, not output or value added or the GDP of the agriculture sector. If technology, input prices, wages and labour use could result in per-unit cost savings, then farmers' incomes would rise at a much higher rate than the rate of increase output. Another very momentous source of an increase in farmers' income is the relative increase in prices of farm products compared to non-agricultural commodities. There are many innovative strategy through which we can at least try to doubling the incomes of farmers it is little difficult to reach in 2022 as per government stated for doubling the farmer income. Emphasis on irrigation along with end to end solution on creation of resources for 'More crop per drop'. introduction of quality seeds and nutrients according to the soil quality in different area. Investments in warehouses and cold chains to prevent Post-harvest losses. Promotion of value addition through food processing. Implementation of National Agricultural Markets and e-platforms (e-NAM) to eliminate shortcomings of all the 585 centers. To Alleviate the risk, introduce crop insurance scheme at a lower cost. Promotion of allied activities such as Dairy-Animal Husbandry, Poultry, Bee-keeping, Horticulture, and Fisheries, diversified farming, organic farming, FPOs(farmers producer organisation). Agro-forestry system.

**Keywords :** doubling farmer income, e-NAM portal, Post harvest losses, Food processing and Entrepreneurship Development, FPOs, diversified farming, Agro-forestry system.

## **Impacts of organic zero tillage systems on soil quality**

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Adopting zero tillage practices can enhance soil quality in cropping systems and this study was accompanied by collecting the surface soil samples from prominent sorghum-wheat and mung bean-wheat cropping system of Haryana state locating in similar agro-ecological regions under two different tillage systems with the same soil types. The samples were collected from two different depths considered as surface (0-15 cm) and subsurface (15-30 cm) layer. The long-term zero-tillage practices in mung bean-wheat cropping system, resulted, relatively higher soil nitrogen and organic carbon contents, microbial biomass, dehydrogenase, alkaline phosphatase, cellulase and urease activities at the 0-15 cm depth than conventional tillage. The abundance of various microbes viz. bacteria, fungi, actinomycetes, *Azotobacter* and phosphate solubilizing bacteria was relatively higher in zero-tillage surface layer in mung bean-wheat crop-rotation. Soil organic carbon content was positively correlated with most of the soil physico-chemical and microbiological properties and was found to be suitable for sorghum-wheat and mung bean-wheat crop-rotations. These results indicated that the zero-tillage system under sorghum-wheat and mung bean-wheat crop-rotations and soil depth were two important factors affecting soil microbial community and activity. The zero-tillage practices improved physico-chemical as well as microbiological properties of soil that may lead to enhanced crop yield.

**Keywords:** Crop-rotations, Enzyme activities, Organic carbon, Zero tillage



### **“Integrated nutrient management in fodder maize and oats cropping sequence”**

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Burgeoning population is increasing pressure on land and livestock to meet human food requirements. Livestock is a major source of livelihood security for the poor in most of the developing countries. In India, where over 75% farmers are small and marginal holders, livestock is the main source of livelihood for a majority of the rural population. However, the performance of livestock is heavily dependent on the quantity of nutritious forage fed to animals. The total area under cultivated fodder in India is only 8.4 m ha (5.23%) which is not sufficient to meet the requirements of the growing livestock population. Maize is one of the most versatile fodder crops in the world because of its higher production potential, wider adaptability, succulence nature and excellent fodder quality; and is free from toxicants; therefore, it can be safely fed to animals at any stage of crop growth (Kumar et al., 2016). Whereas, oats is the important winter cereal fodder crop grown as multipurpose crop for food, feed and fodder crop. It contains, on dry matter basis 10.0 -11.5 % crude protein, 55-63 % neutral detergent fibre, 30-32 % acid detergent fibre, 22.0-23.5 % cellulose and 17-20 % hemicelluloses when harvested at 50% flowering stage of crop. Both fodder maize and oats crop deplete higher amount of nutrient from soil. Soil nutrients supplied through sole NPK fertilizers in a continuous intensive cropping system may deplete soil fertility, especially micronutrients and organic carbon. However, use of only organic inputs may not be sufficient to meet the nutrient requirements of high yielding cultivars. Hence, the integrated use of organic and inorganic inputs is a better nutrient management option; and this may minimize sole dependence on chemical fertilizers for higher crop production. Many recent studies have advocated the integrated nutrient management system. Inclusion of organic manures has led to a considerable increase in crop yields and improved soil fertility (Bandyopadhyay et al., 2010). In order to reduce dependence on commercial fertilizer, there is much interest to use local available farmyard manure as alternative source. It is the source of energy to the soil microflora and organic carbon content is considered to be an index of the soil health (Chand et al., 2006). The use of plant growth promoting rhizobacteria (PGPR) increased the crop yield in addition to decrease the use of chemical fertilizers (Yasmin et al., 2013). Panchagavya is a biopromoter which contains almost all the major nutrients like N, P, K and micronutrients, hormones required for crop growth as well as the predominance of fermentative microorganisms (Selvaraj, 2003). The combined use of organic wastes, PGPR and chemical fertilizers is beneficial in improving crop yield, soil pH, organic carbon and available N, P and K in sandy loam soil (Rautaray et al., 2003).

**Keywords:** Fodder, Integrated nutrient management, maize, Oats, Quality



## Studies on Assess the Performance of Pollution Tolerant Indoor Plants Under Different Environmental Conditions

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Due to passage of time, continuous increase in human population, transportation, vehicular traffic and industries, which have resulted in increase in the concentration of gaseous and particulate pollutants which effect the human health issues. By Considering these facts, the present study will be conducted on different indoor plants to study the APTI index and their performance indifferent pollution sites. The experimental trail was conducted in the Department of Floriculture and Landscape Architecture, Dr. Y.S. Parmar University of Horticulture and Forestry Nauni, Solan (H.P.). In this experiment fully grown 30 indoor pot plants like *Aeonium arboreum*, *Aglaonema modestum*, *Aspidistra elatior*, *Asparagus densiflorus*, *Aucuba japonica*, *Begonia semperflorens*, *Chlorophytum comosum*, *Cliviaminiata*, *Cordylina compacta*, *Crassula ovata*, *Dracaena deremensis*, *Euphorbia splendens*, *Excoecaria bicolor*, *Ficus benjamina*, *Fuchsia hybrid*, *Hedera helix*, *Hydrangea macrophylla*, *Jacobiniacarnea*, *Kalanchoe blossfeldiana*, *Monstera deliciosa*, *Nephrolepis exaltata*, *Pelargonium hortorum*, *Peperomia caperata*, *Peperomia obtusifolia*, *Rhapis excelsa*, *Ruscus hypoglossum*, *Schefflera arboricola*, *Scindapsus aureus*, *Strobilanthes kunthianus*, *Syngonium podophyllum* were used in the present study. To estimate the air pollution tolerance index (APTI), various biochemical parameters such as total chlorophyll content (mg/g), leaf extract pH, ascorbic acid content (mg/g), relative water content (%) were estimated. APTI value ranged from 8.00 (*Ruscus hypoglossum*) to 9.64 (*Scindapsus aureus*). Among the 30 indoor plants top 5 plants 9.64 (*Scindapsus aureus*), 9.54 (*Chlorophytum comosum*), 9.50 (*Dracaena deremensis*), 9.49 (*Aglaonema modestum*), 9.39 (*Ficus benjamina*) appeared as the most tolerant species among the tested indoor plants which must be included in indoor landscape as a good air purifier while *Ruscus hypoglossum* as bioindicators to sense the pollution in indoor environment.

**Keywords:** Air pollution, indoor plants, Air Pollution Tolerance Index (APTI)

## Phenological variation in trees and shrubs species of family Anacardiaceae in Western Himalaya

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The study of the periodicity of recurring biological events represents the seasonal variation in plants influenced by environmental factors is called phenology. A number of phenophase events such as vegetative, reproductive and fruit/seed phase occur in sub-montane trees and shrubs species belongs to the family anacardiaceae; *Buchanania lanzan*, *Continuoscogygia*, *Lanneacoromandelica*, *Pistacia khinjuk*, *Rhus parviflora*, *Semecarpus anacardium* and *Spondias pinnata* due to variations in seasonal periods induced by a variety of factors like significant rain in winter/summer, decreasing or increasing in temperature, photoperiods etc. in Western Himalaya. The tree and shrubs species were selected and marked for documentation of different phenophase events in relation to temperature and rainfall at monthly interval for two years from January, 2017 to December, 2018. Leaf bud initiation starts from February, with a peak in April and end with May before the monsoon. Young leaves start expanded in April till May and peaks in May whereas leaf senescence start in August and October and ends with November. Flower/flowering bud starts from February to April whereas fruiting starts from April to July and ripe during May to August. The result shows seasonality for all species with environmental factors viz; rainfall and temperature affect the phenophase status under different categories (vegetative, reproductive and fruit phenophase) during year, 2017 and 2018.

**Key words:** Sub-montane forest, Western Himalaya, Phenophase status, Circular statistics.



### **Soil Health Card Scheme (SHC) is benefit to increase farmer's income**

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Soil Health Card Scheme has been introduced in year 2014-15 to assist State Governments to issue soil health cards to all farmers in the country. Soil health card will provide information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. Soil status will be assessed regularly every 2 years so that nutrient deficiencies are identified and amendments applied. Soil Health Card scheme has been approved for implementation during the remaining period of 12th Plan to provide 12 crore SHC to the farmers in the country. It is Nation-wide program to conduct farm level soil analysis.

### **Review on Innovation platforms for Agri value chains**

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Innovation platforms (IPs) have been identified as an effective approach to achieve the development targets set by a group of multiple stakeholders through the participation and empowerment of various beneficiaries at local level. With its roots in innovation systems theory, the Innovation Platform is the real world implementation of the concept. Innovation Platforms have been conceptualized as a group of individuals (who often represent organizations) with different backgrounds and interests: farmers, traders, food processors, researchers, government officials etc. who come together to diagnose problems, identify opportunities and find ways to achieve their goals (ILRI, 2013). The aim of innovation platforms is to enable collaboration and interaction among stakeholders, in order to activate new ways of doing things. These IPs are becoming popular in agriculture value chain development in recent days. Hence a need has emerged to study such innovation platforms and to study the extent of institutionalization of such innovation platforms. In this context a review has been done on studies conducted on innovation platforms in agriculture and allied sectors.

### **Alleviation of drought stress in *Sorghum bicolor* with drought-adaptive and P-solubilizing plant growth promoting microbes**

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There are number factors leading to the food crisis all over the world such as increasing urbanization and industrialization has led to the shrinkage of the land in past few decades. Increasing human population has further added to the world's food security concern and these factors are affecting the climate in a severe way. Drought is one of the major abiotic stresses accepted as the main constraint for loss of the crop yield worldwide. Further, problems are created by nutrient limitations and particularly low phosphorus (P) soil status due to which modern agricultural systems are highly dependent on chemical fertilizers. There are diverse P-solubilizing microbes which make the availability of phosphorus to plants. The drought tolerant microbes attracted the attention of the scientific community due to their ability to promote plant growth and adaptation under the abiotic stress of drought. In the present study, the rhizospheric samples were collected from cereals and pseudo-cereals growing in Baru Sahib, Himachal Pradesh. The microbes were isolated on different growth media such as: Nutrient agar, King's B agar, Tryptic soy agar, Potato Dextrose agar, and Rose Bengal agar, using serial dilution method. A total of 193 isolates were obtained. All 193 isolates were screened for drought tolerance on nutrient agar infused with different concentrations of PEG (5%, 6%, 7%,



8%). 137, 42, 20, 15 could tolerate 5%, 6%, 7%, 8% PEG respectively. Drought tolerant isolates were further screened for P-solubilization. Among 137 isolates, 97 solubilized phosphorus. Further, 97 drought-adaptive and P-solubilizing isolates were screened for plant growth promoting attributes. Finally, the efficient stress adaptive and P-solubilizing strain with multiple plant growth promoting attributes were identified as *Streptomyces laurentii*, *Acinetobacter calcoaceticus*, *Pseudomonas libanensis* by 16S rRNA gene sequencing. The efficient strains were used for alleviation of drought stress in sorghum in a pot experiment under green house conditions. All the strains influenced the growth and physiological parameters differently. The alleviation of drought stress in sorghum was revealed by increase in root length, shoot length, biomass, chlorophyll content, accumulation of proline, glycine betaine, total soluble sugars, and decrease in lipid peroxidation. The drought tolerant P-solubilizing microbes with multifunctional PGP attributes could be valuable in agriculture as bio-inoculants.

**Keywords:** Diversity, Drought, Phosphorus, PGP traits, Plant growth

### **Precision farming: For improving crop production technology**

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'Precision farming' or 'Precision Agriculture' aims at increasing productivity, decreasing production costs and minimizing the environmental impact of farming. The management of in-field variability in soil fertility and crop conditions for improving crop production and minimizing the environmental impact is the crux of precision farming. New technologies, such as Global Positioning Systems (GPS), sensors, satellites or aerial images, and Geographical Information Systems (GIS) are utilized to assess and analyse variations in agricultural production. An information and technology based farm management system to identify, analyze and manage variability within by doing all practices of crop production in right place at right time and in right way for optimum profitability, sustainability and protection of the land resource. Precision Agriculture is a systems approach to farming for maximizing the effectiveness of crop inputs.

### **Line X Tester analysis for estimation of heterosis and combining ability in linseed (*Linum usitatissimum* L.)**

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The present investigation consisted of 6 lines of diverse genotypes of linseed and 3 testers having broad genetic base and wider adaptability, which were crossed as per line x tester analysis (Kempthorne, 1957) in Rabi season to generate 18 crosses. These 18 crosses were evaluated along with 9 parents and 3 checks viz: Neelum, Allahabad Local and T-397 in RBD having three replications. The data were recorded on ten characters to study the heterosis and combining ability. The significant mean sum of squares for all the 10 characters indicated the presence of substantial amount of variability. *Per se* performance for seed yield and its components depicted that cross EC12082 x EC41656 was found to be best. Estimates of heterosis (ha) showed that the highest average heterosis, heterobeltiosis and economic heterosis for seed yield per plant was observed by cross EC12082 x EC41656. Analysis of variance for combining ability showed significant differences for all the characters. The parents EC10077, EC 41528, and EC 41656 were good general combiner for seed yield and most of the traits. Highest positive sca effect for seed yield per plant was depicted by the cross EC12082 x EC41656. It can be concluded from the present study that cross A-238(196) X EC-41528 was found best as it showed positive significant economic heterosis for seed yield per plant along with positive significant economic heterosis for number of capsules per plant, 1000 grain weight and biological yield per plant. The parents A-202(183) and EC-41528 were good general combiner for seed yield and most of the traits. Therefore, these parents either can be used to constitute a composite variety or can be used as parents for development of superior single cross hybrids.

**Key words:** Heterosis, Combining ability, Seed Yield and Linseed (*Linum usitatissimum* L.)





## Chlorophyll *a* fluorescence: A tool for plant's "health check-up"

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In nature, plants are exposed to many adverse factors that interfere with the photosynthetic process, leading to decline in growth, development, and yield. Chlorophyll *a* fluorescence allows valuable information on photochemical properties of leaves to be obtained rapidly. Then physiological state of several photosystem II (PSII) components, electron transport chain components, and the cooperation of light-dependent and light independent biochemical reactions can be evaluated by analysis of chlorophyll fluorescence (ChlF) induction curves. Nowadays, ChlF measurements are a popular method for evaluating the impact of stress factors on photosynthesis.

Application of the chlorophyll fluorescence technique is very promising. I shall be discussing its application in crop plants mainly to identify effects of abiotic stresses like high/low temperature, drought, salinity, nutrient deficiency, UV radiations, environmental pollutants, etc. on crop plants. Scientists from different fields, such as plant physiology, biotechnology, forestry, ecophysiology, and even plant breeders and farmers, are using it to study the structure and function of photosynthetic apparatus. This technique is now being used in vertical walls, checking water purity, space research stations, etc. It is a non-invasive, rapid (1 sec measurement) and reliable method to monitor stress conditions in plants and can be used to do "health check-up" of plants. This 1 sec measurement can give immense information about photosynthetic efficiency of plants which is directly related to overall crop yield. In my talk, I want to introduce the basic principle, usage and applications of this technique with examples from my own research.

**Key words:** Chlorophyll *a* fluorescence, tool, health check-up

## Isolation, Purification and Evaluation of Anxiolytic Principle – Bergenin from *Caesalpinia digyna* Rottler Roots: An Evidence Based Research

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*Caesalpinia digyna* Rottler (Caesalpinaceae) commonly known as Vakerimul (Hindi), Udakiryaka (Sanskrit) or Teri Pods in English, is a large, perennial, prickly shrub or climber grown in Indian states of Andhra Pradesh, Madhya Pradesh and Eastern Ghats. Roots of this plant have been used traditionally as astringent, febrifuge and nerve tonic since the ancient times. Traditional literature also reported that in some regions of Burma, root powder of *C. digyna* mixed with water is used as febrifuge, and is said to have soothing effects on the nerves. Based on the facts of traditional uses, the extracts (Petroleum ether, chloroform, ethanol and water) of *C. digyna* roots were evaluated for anxiolytic activity on Laca mice using Elevated plus maze animal experimentation model. The effective extract (ethanol) exhibited anxiolytic effect and the same was processed for column chromatography using bioactivity guided fractionation approach with the view to isolate anxiolytic constituent. The study resulted with the isolation of anxiolytic crystalline compound – bergenin (Trihydroxybenzoic acid glycosides). The dose of bergenin was optimized using EPM. Bergenin exhibited significant anti-anxiety activity at 80 mg/kg, po, which is comparable to that of diazepam (2 mg/kg, po). Further, the biomarker was quantified in the plant using TLC-densitometric analysis. The content of bergenin in *C. digyna* roots was found as 0.589 % w/w.

**Keywords:** *Caesalpinia digyna*, Ancient knowledge, Bergenin, Anxiolytic, Bioactivity guided fractionation, Quantification.



### Preliminary study of microbial ecology of river Beas in wake of spillage of molasses

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The pollution of riverine water poses a major risk to the human health besides altering the aquatic flora and fauna. This study was conducted to determine the effect of spillage of molasses in river Beas at three different sites namely; Dhilwan (Jalandhar), FattuDhingra (Kapurthala) and Miani (Kapurthala). Bacterial communities were observed at these three sites in the month of December 2018. The changes in microbial dynamics are being periodically observed at these sites of riverine flow during the conservation and restoration process. There is substantial data base available on microbial water quality of underground water being used for potable purposes but very less information is available on the microbial community structure of irrigation waters. Surface water used for irrigation is monitored much less intensively. A limited monitoring is available on occurrence of indicator organisms rather than on occurrence of actual pathogens. Indicator organisms have been selected mainly to indicate the potentially occurring faecal contamination rather than presence or concentration of any specific pathogens. In the present study, both indicator organism and pathogenic bacteria are being monitored by regular sampling at all three selected sites. The isolated pure cultures are being subjected to various pathogenicity tests including blood haemolysis, biofilm formation and antibiotic resistance. Among the three samples collected from different location, sample B (FattuDhingra) was found to have maximum microbial load (23X10<sup>5</sup>), followed by sample A (Dhilwan) and C (Miani). Most probable Number (MPN) index was high (1100) in both sample A and B and was minimum in sample C (460). But faecal coliform is detected in all the samples. Morphological distinct bacterial colonies have been isolated and are being checked for blood haemolysis, biofilm formation and antibiotic resistance.

**Keywords:**-Microbial ecology, Molasses spillage, MPN, pathogenesis, coliforms

### Management of stem rot and wilt of carnation with native *Trichoderma* spp., their mass multiplication and enhancement of shelf life on antioxidant crops

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Carnation production in Himachal Pradesh, India is in a declining phase under the protected environment by the interference of biotic pressure exerted due to some soil borne pathogens such as *Fusarium oxysporum* f.sp. *dianthi* and *Rhizoctonia solani* mainly responsible to deteriorate the plant health and cause losses upto 40 per cent annually. Due to many adverse effect of the chemical method which is widely adopted to control the diseases in general in plants, and more particularly continuous and excessive application of fungicides has affected the environment as well as on human health. An alternative practical and safe approach is needed to reduce its intensity. The native well known *Trichoderma* spp. have been isolated from the carnation rhizosphere from different provinces for testing their antagonistic activity under *in vitro* against the pathogens in order to mass multiply the best strains of *Trichoderma* on different readily available media. Multiplication and shelf life assessment of the native *Trichoderma* species on various solid and liquid substrates such as vermicompost, FYM, cocopeat, wheat straw, cocopeat, mushroom compost, rice straw including PDB and Molasses yeast extract was studied. Wheat straw registered highest colony count followed by vermicompost as agro-based substrates while in liquid substrates; PDB (potato dextrose broth) appeared superior in supporting the growth of the native isolates. Three native species namely *Trichoderma viride* (78.10, 80.87%), *Trichoderma harzianum* (79.03, 79.47%) and *Trichoderma reesei* (71.40, 72.87%) showed highest antagonistic activity against *Fusarium* and *Rhizoctonia* pathogens causing carnation wilt and stem rot diseases by giving maximum per cent mycelia growth inhibition *in vitro*. However, isolates *T. viride* (I-10), *T. harzianum* (I-5) and *T. polysporum* (I-4) also performed better over the rest of isolates by giving mycelia inhibition within the range of 64 to 70.33 per cent. Potential *Trichoderma* spp. were further



grown on best solid medium which revealed the highest population count in wheat straw with 10% wheat flour and 3% jaggery at pH 6.5. Natural antioxidant crops, soybean, maize and brown rice enhanced the shelf life of *Trichoderma* spp. under storage period of four months in solid medium. In all four native species *T. harzianum*, *T. viride* and *T. hamatum* and *T. viride*(1-10) performed better and can be used in the management of devastating diseases of carnation.

**Key words:** carnation, mass multiplication, antioxidant crops, substrates, *Trichoderma* spp. wilt, stem rot disease

### Effect of GA<sub>3</sub> and growing media on seed germination of jamun (*Syzygiumcumini*L.)cv. Local

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The present investigation was conducted at Fruit Research Station Lalbaug, Department of Horticulture, College of Agriculture, JAU, Junagadh during 2019. The treatments comprised of different concentrations of GA<sub>3</sub> (G<sub>1</sub>: Water soaked, G<sub>2</sub>: GA<sub>3</sub> 300 ppm, G<sub>3</sub>: GA<sub>3</sub> 400 ppm and G<sub>4</sub>: GA<sub>3</sub> 500 ppm) and different growing media [M<sub>1</sub>: Soil+ Cocopeat+ FYM (1:1:1), M<sub>2</sub>: Soil+ Cocopeat+ FYM (2:1:1), M<sub>3</sub>: Soil+ Cocopeat+ Vermicompost (1:1:1), M<sub>4</sub>: Soil+ Cocopeat+ Vermicompost (2:1:1)]. The treatment G<sub>4</sub>: GA<sub>3</sub> 500 ppm had significant influence on different seed germination traits like minimum days required for seed germination (9.25 days), maximum germination percentage (91.98%) and survival percentage (78.66%) of jamun seedling. The media M<sub>3</sub>: Soil+ Cocopeat+ Vermicompost (1:1:1) had also significant influence on different seed germination traits like minimum days required to seed germination (13.17 days), maximum germination percentage (78.41%) and maximum survival percentage (75.99%) of jamun seedling. Among the interaction effect G<sub>4</sub>M<sub>3</sub> was found to be better with respect to minimum days required to germination (7.67 days), the maximum germination percentage (93.90%) and maximum survival percentage (84.44%) of jamun cv. Local. The polyembryony percentage was found non-significant among the different treatment of GA<sub>3</sub> and media, as well as their interaction. From the observation, it can be concluded that seed germination of jamun cv. Local, can be enhanced by the seed treatment with GA<sub>3</sub> @ 500 ppm for 24 hours followed by showing the seed in media composed Soil+ Cocopeat+ Vermicompost (1:1:1) alone or in combination.

**Keywords:** Jamun, Media, Gibberellic acid, cocopeat, Vermicompost, Farm Yard Manure (FYM), Germination.

### Biopesticides: Emerging Prospects

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Due to unrestricted use of chemical pesticides, on one hand there has been an increase in crop production on the other hand there has emerged a bundle of new problems including pest resistance, development of new pests, accumulation of toxins of pesticides in food, poisoning of water bodies, environmental pollution, genetic modification of crops etc. A safer alternative to pesticides for crop protection, which has emerged are these biopesticides. These are the naturally occurring substances that biologically control harmful pests. The biopesticides can be living organisms (bacteria, virus, and algae), their products (biochemicals produced by them) and also plant products. These are ecofriendly, used in minimal amounts, target specific and also biodegradable. Chemical pesticides kill all beneficial organisms also which are helpful for crops like earthworms etc. in addition to the target pests. In India market for biopesticides is continuously increasing as the consumer is also now aware about what they are consuming is coming from organic source and not exposed to chemicals. Biopesticides are an important component of integrated pest management (IPM) for sustainable agriculture. Neem based pesticides, *Bacillus thuringiensis*, NPV and *Trichoderma* are the major biopesticides produced and used in India.

**Key words:** Biopesticides, ecofriendly, crop protection, sustainable agriculture



## A comparative study on the effects of chemical and bio-fertilizers on growth and yield of okra (*Abelmoschus esculentus* (L.) Moench)

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The present study entitled “Effect of Chemical and Bio-fertilizers on growth and yield of Okra [*Abelmoschus esculentus* (L.) Moench]” was conducted at the experimental farm, Department of Agricultural Sciences, DAV University, Jalandhar in summer season of 2019. Field experiment was laid out in Randomized Block Design with three replication and ten treatments, comprising of chemical and bio-fertilizers viz. T (RDF), T (RDF of *Azospirillum*+50% N+100% P and K), T (50% *Azospirillum*+75% N+100% P and K), T (RDF of *Azotobacter*+50% N+100% P and K), T (50% *Azotobacter*+75% N+100% P and K), T (50% PSB+50% P+100% N and K), T (RDF of PSB+75% P+ 100% N and K), T (50% PSB+50% *Azotobacter*+50% P+100% N and K), T (50% PSB+50% *Azospirillum*+100% N, P and K), T (50% *Azospirillum*+50% PSB+50% N, P and K). The result of experiment indicated that the treatment T ((50% PSB+50% *Azotobacter*+50% P+100% N and K) was found significant with reference to the minimum days to 50% germination, maximum plant height, number of leaves, number of branches per plant, number of fruit per plant, average fruit weight, fruit length, fruit diameter, fruit yield per plant, fruit yield per plot and fruit yield per hectare.

## Pollution and Management

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Earth is the sustenance of 'nature' that is a key to the development of future of mankind. The increasing levels of global warming, the depletion levels of the ozone layer, serious loss of biodiversity have made everyone aware of the growing environmental concerns. Environmental health comprises those aspects of human health, including the quality of life, that are determined by the physical, chemical, biological, social and psychological factors. UNICEF and every country are talking about sustainable development. Industries; indispensable meter of growth, were perceived as localized problems of air, water and land pollution. From an ecological perspective degradable and non-degradable pollutants destruct atmosphere- features that have relevance to environmental problems. Undesirable solid or gaseous particles in the air by humans and nature like volcanoes which release ash, dust, sulphur and other gases, forest fires cause air pollution, water pollution occurs when the quality or composition of water changes as a result of man's activities such that it becomes unfit for any purpose. Marine pollution adversely affects human, obstructs marine activities and lowers the quality of sea water. The discharge of warm water into a river is known as thermal pollution. When sound exceeds 125 decibels level, makes noise pollution which deteriorates human health and environmental quality. The soil is a thin covering over the land consisting of a mixture of minerals, organic materials, living organisms, air and water that together support the growth of plant life and formation of soil from the parent material. Soil erosion makes a soil less fertile and reduces water-holding capacity. Nuclear power is being used to day as a reliable source of electricity. Radiation helps in disease diagnosis. Several serious accidents have caused world wide concern about safety and disposal of radioactive wastes. Radiation can cause mutations, menas changes in genetic make up, ultimately leads to abnormal offspring and cancer. Adopting following remedial steps we can create a clean planet.

- ❖ Putting a greater emphasis on pollution prevention rather than control.
- ❖ Reducing the use of fossil fuels.
- ❖ Improving the quality of vehicular fuel.
- ❖ Increasing the use of renewable energy.



- ❖ Limiting our consumption of material goods.
- ❖ Recycling glass, plastic, paper, cardboard, aluminum and metals.
- ❖ Reducing paper consumption.
- ❖ Planting trees and reforestation efforts will increase biodiversity, stop soil erosion, reduce carbon monoxide build up and will add aesthetic value to the area.
- ❖ Avoiding use of chemical fertilizers and pesticides.
- ❖ Not disposing the chemical fertilizers and pesticides.
- ❖ Not disposing the household chemical, fat, oil, grease, cleaning agents down the sink or toilet.
- ❖ Avoiding garbage disposal. Keeping solid waste solid and making a compost pill from vegetable scraps.
- ❖ Using only phosphate free soaps and detergent.
- ❖ Keeping mind before disposal, nuclear wastes needs to be solid from resistant to leaching.
- ❖ Shielding of high activity waste.

**Keywords:** Sustenance, biodiversity, Atmosphere, Soil-erosion, Fossil, Radiation.

## **Phycosynthesis and application of Silver Nanoparticles synthesized by Cell-Free Extract of green alga**

### ***Chlorella vulgaris***

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In the present study silver nanoparticles were synthesized by using the cell free extract of green alga *Chlorella vulgaris* which offers a sustainable way of silver nanoparticle synthesis. The biotransformation of silver were characterized by UV-Vis spectroscopy, SEM, TEM and FTIR. The colour change in algal extract from light green to dark brown and the SPR peak at 430 nm showed the formation of AgNPs. The SEM and TEM analysis showed that AgNPs synthesized by *C. vulgaris* are well scattered, highly stable, spherical in shape and were in the range of 9-14 nm size. The biomolecules involved in reduction of silver were identified by using FTIR which showed that proteins and peptides, are mainly responsible for the formation of AgNPs. Furthermore, the algal synthesized AgNPs exhibited high antibacterial activity against *Escherichia coli*, *Klebsiella pneumonia* and *Salmonella typhi* and antifungal activity against *Fusarium solani*, *F. moniliforme*, *Aspergillus luchuensis*, *Trichoderma* sp. and *Penicillium* sp. The maximum zone of inhibition was observed in *S. typhi* (2.4 cm) followed by *K. pneumonia* (1.9 cm) and *E. coli* (1.7 cm). The fungal growth was most affected in *Penicillium* sp. followed by *Fusarium* sps. but the growth of *A. luchuensis* and *Trichoderma* sp. was not affected by the *C. vulgaris* synthesized AgNPs. Use of such a microalgal system provides a simple, cost-effective alternative pattern for the biosynthesis of silver nanoparticles in a large scale that could be of immense use for biomedical applications.

**Keywords:** Algae, nanoparticle, nanotechnology, phycosynthesis, silver

## **Knowledge of Rural Women Regarding Health and Nutrition Practices in Bikaner District of Rajasthan, India**

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The present study was conducted in Bikaner district. There are six panchayatsamitis out of which Bikaner



panchayatsamiti was selected. Out of thirty one Gram panchayat in Bikaner panchayatsamiti four Gram panchayat were selected namely KilchooDeodan, Ridmalsarpurohitan, Palana and Nalbari. One village from each selected Gram panchayat was selected on the basis of random sampling technique. Thus, four villages were selected for the present investigation (Surdhanachauhanan, Raisar, Palana, Nalbari). A sample of one twenty rural women in the age group 15-45 years (30 rural women from each village). Interview Schedule was developed to collect the data regarding health and nutrition knowledge of rural women.

The major findings of the present study revealed that in general information majority of the respondents belonged to middle age group, educated up to primary, belonged to 4001-6000/- monthly income group, nuclear family system, other backward caste, involved in agriculture occupation, had above 2.1-5 hectare of land holding, no membership of social organization, no participated in training programme and medium level of mass media contact, urban contact and extension contact.

The overall knowledge of the rural women was medium. Out of eight aspects of health and nutrition the knowledge about the aspect of 'Basics of foods and nutrition' and 'Environmental hygiene' were ranked first with overall mean per cent score. On the basis of these findings it could be concluded that health and nutrition knowledge of rural women was medium.

**Key words:-** Health, Nutrition, Knowledge, Hygiene, Environment,

## **Sustainable Water Management and Agricultural Development in India with Special Reference to Himachal Pradesh**

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India is a developing country where more than 60 % people depend on agriculture. It remains the backbone of Indian economy. However, Indian agriculture depends on rainfall and the productivity is not equal every year and place. Though there are several reasons due to which agriculture is still not sustainable, but water is considered as one of the most critical resources for sustainable agricultural development throughout the world. And therefore, management of water resource has very important role in agricultural development. Irrigated areas should be increased, while fresh water supplies should be diverted from agriculture to meet the increasing demand of domestic and industrial use. Furthermore, the efficiency of irrigation is very low, since less than 65 % of the applied water is actually used by the crops. The sustainable use of irrigation water is a priority for agriculture in arid areas. So, under scarcity conditions and climatic change considerable effort should be done to introduce policies aiming to increase water efficiency based on the assertion that more can be achieved with less water through better management. Better management usually refers to improvement of water allocation or irrigation water efficiency. Agricultural practices, such as soil management, irrigation and fertilizer application and disease and pest control are related with the sustainable water management in agriculture and protection of the environment. Socio-economic pressures and climate change impose restrictions to water allocated to agriculture. The adoption of sustainable water management in Mediterranean is not only a technological problem but involves many other considerations relative to social behavior of rural communities, the economic constraints, or the legal and institutional framework that may favor the adoption of some measures and not others. Sustainable water management in agriculture has a multi-functional role like improvements in irrigation application, soil and plant practices, water pricing, reuse of treated wastewater, farmers' participation in water management and capacity building. Under this presentation, an attempt has been made to illustrate the effect, need and method of water resource management for sustainable agricultural development in India with reference to Himachal Pradesh.

**Keywords:** Sustainable agriculture, Water management; Climate Change, Irrigation.



## Gene Action and Combining Ability Study for Yield and Other Quantitative Traits in Brinjal (*Solanum melongena* L.) Under Coastal Region of Andhra Pradesh, India

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A field experiment was carried out at Horticultural College and Research Station, Venkataramannagudem, West Godavari District, Andhra Pradesh, India. The experimental material consists of seven lines and three testers and Line x Tester mating design was followed in this study. The Line x Tester analysis of combining ability is the most commonly used method to find out the general and specific combiners and study the nature of gene action governing the inheritance of different characters. Study of combining ability is important for selecting parents for hybridization. Combining ability and gene action were studied in line x tester mating design using seven homozygous lines namely, IC 090053, IC 285140, IC 421194, IC 545893, IC 90806, SM 9 and SM 10 and testers viz., Bhagyamathi, Gulabi and Shyamala. General combining ability studies revealed that SM9 and SM10 were best combiners for major yield and yield contributing characters viz., number of primary branches, fruit length, fruit girth and average fruit weight number of fruits per plant yield per plant and low fruit borer infestation. However, the estimates of specific combining ability showed the highest desirable *sca* effects in cross SM9 x Gulabi for fruit girth, number of fruits per plant and yield per plant. Gene action analysis revealed preponderance of additive genes for plant height, days to 50% flowering, number of fruits/plant, total phenols and fruit borer infestation, while non-additive genes for number of primary branches, fruit length, fruit girth, average fruit weight, yield/plant.

**Key words:** Brinjal, Combining Ability, Gene action.

## Effect of *Pseudomonas fluorescens* and *Azotobacter chroococcum* on growth, yield and nutrient uptake in tomato (*Lycopersicon esculentum* Mill)

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Out of 21 soil samples, six strains of *Pseudomonas fluorescens*, were identified and studied for their morphological and biochemical characteristics. Field experiment was conducted during *rabi*, 2016-17, in a randomized block design with three replications and nine treatments. *Pseudomonas fluorescens* isolate (Pf4S) was found efficient under pot culture technique, were evaluated and applied singly and dually along with *Azotobacter chroococcum* in combination with graded levels of nitrogen.

Results of the field experiment revealed that, the plots dually inoculated with *P. fluorescens* + *A. chroococcum*, with 100% N dose had highest germination percentage (80.50%), the tallest plants (54.98 cm), highest number of main branches (8.30) with dry plant weight (68.89g plant<sup>-1</sup>). Treatment had highest number of fruits (34.21 fruits plant<sup>-1</sup>), highest average fruit weight (62.30g fruit<sup>-1</sup>), highest fruit yield (679.10q ha<sup>-1</sup>), highest dry matter weight (135.60 g plant<sup>-1</sup>), highest uptake of nitrogen and phosphorus (42.30kg ha<sup>-1</sup> and 15.15kg ha<sup>-1</sup>, respectively). However above treatment result dose did not differ significantly from those recorded with *P. fluorescens* + *A. chroococcum* with 75% N and 50% of N. Thus, these three treatments had analogous effect in improving plant growth, yield and nutrient uptake in tomato.

**Key words:** *Pseudomonas fluorescens*, *Azotobacter chroococcum*, nutrient uptake, tomato



## High-Throughput Amplicon Sequencing Revealed Distinct Microbial Communities Within Rhizosphere and Root Interior Region in Two Chemotypes of *Chrysopogon Zizanioides*

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The effect of chemical composition of the essential oils on the structure microbial community associated with the roots of different chemotypes of vetiver crop is not explored. Microbial communities associated with two chemotypes of vetiver, CIM-Khusinolika (CK) and CIM-Vridhi (CV), having very distinct chemical composition of essential oils present in their roots, was analyzed by high-throughput amplicon sequencing method. This study showed that bacterial community present in the rhizosphere of two chemotypes was diverse, Chlorofexi being the most dominant. Contrarily, endophytic bacterial diversity within the roots of both chemotypes was less diverse than that of rhizosphere community, and showed predominance of Proteobacteria. The bacterial communities within roots of CK and CV were dominated by plant growth promoting *Pseudomonas* and *Rhizobium* species, respectively. To our best knowledge, this study is first description of fungal community associated with the roots of two distinct vetiver chemotypes. Among fungi, Zygomycota dominated the rhizosphere but Ascomycota dominated root interior of both chemotypes. Detection of volatile compound producing *Phoma* and *Alternaria* species in root interior region reflect the role of fungi in generation of essential oil complexity. The existence of distinct microbial community in the rhizosphere and root interior region, and dominance of plant beneficial microorganisms within root interior region suggests that vetiver chemotypes affect composition of root associated microbial communities, promote niche specialization and recruit specific groups of microorganisms.

**Keywords** *Chrysopogon zizanioides*; Chemotype; Rhizosphere; Root interior; Microbial community, Amplicon sequencing;

## Rural Industrialization in the Development of Nations and Gender

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In rural society, it is commonly accepted that the female employment occurs due to their abilities acquired at home, such as housekeeping, culinary knowledge, and dexterity at sewing, which together open the door to canaries and workshops that make shoes, clothes, toys, and other consumer goods of high nature. As these abilities are taken to be 'natural', employers treat them as 'unskilled' jobs to which a low value may be assigned relative to the manufacturing tasks learned by men. This 'cheapening' of female labor also arises from viewing the work of women in terms of 'feminine' attributes as being careful, attentive, fine, delicate, and sensitive. These qualities are seen as part of the innate character of woman, rather than as part of the skill set associated with paid labor and priced in the market. Another factor identified to be the cause of this low wage rate was their responsibility for reproductive tasks and other domestic work. This limits the possibilities for women to approach work as a career developed over the long term. In this study we review the effective adaptation of the rural market for manufacturing labor to the situation of rural women. It also looks into the instability of the rhythms of production, a key entrepreneurial element in cheapening the cost of manual labor, is manipulated as a mechanism to achieve labor 'flexibility,' which in turn emanates from and is adapted to the needs of female workers. The major finding was that rural manufacturing has been able to maintain and recreate the precarious conditions of the labor market such that they are viewed as a concession on the part of employers to women's domestic responsibilities. However, it's important to note that though social disqualification of female labor might diminish over time, the process is slowed by another deeply rooted social fact: gender differences within the family.

**Keywords:** Rural, Sociology, Women, Cheapening, Flexibility, Gender Differences.





### **Screening of maize landraces from north eastern Himalayan region for improved root traits and leaf chlorophyll content under waterlogging condition**

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Waterlogging condition is one of the most challenging abiotic stresses unfavourable for maize production as the crop is highly susceptible to excess moisture condition, especially at seedling stage. One microcosm experiment (control and treatment) was conducted using 11 landraces of maize which are subjected to artificial flooding (4-5 cm water level above soil surface) at 6-7 leaves stage for 15 days. Waterlogging Tolerance Coefficient (WTC) was calculated for each parameter to screen and identify the genotypes tolerant to waterlogging at seedling stage. Genotype RCM-4-19 was found promising with highest WTC for root adaptive traits viz. root surface area (5.36), root volume (6.92), number of crosses (7.70), number of forks (7.95), number of tips (5.65) and total root length (4.19) whereas for average root diameter, genotype RCM-9-19 showed the highest WTC value of 1.35. Moreover, genotype RCM-11-19 have exhibited the highest value of WTC for leaf chlorophyll content index (0.90) followed by RCM-8-19 (0.89).

**Keywords:** Maize, Seedling stage, Waterlogging Tolerance Coefficient, root traits, chlorophyll content

### **Formulation of instant soup mix using *Moringaoleifera* (Leaf powder) for value addition**

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*Moringaoleifera* Lam (Moringaceae) is a highly valued multipurpose herbal plant. It contains essential amino acids, protein, fibre, ash and minerals but its utilization in foods has remained unrealized and unexploited. The present research work was carried out aiming in preparation of ready to reconstitute instant soup mixture marking and other ingredients to get acceptable soup mix of desired health benefits. Instant soup mix is a popular energetic snack, consumed and liked by everyone. Instant soup prepared with more than 24% taste moringa leaf powder along with other ingredients was found acceptable in terms of all sensory parameters. The results indicated that supplementation with moringa leaf powder significantly enhanced the nutritional characteristics and had a reasonable amount of required nutrients. Instant soup mixes packed in aluminum foil was found to be successfully stored for 90 days at room temperature without any major changes. In physico-chemical, microbial and organoleptic parameters. The developed soup is formed high in protein 13.51%, ash 9.76%, fibre 2.60% and low in fat 2.60% and energy value which make the developed soup as an appropriate choice for the fulfillment of nutritional demand of people. Therefore the value added instant soup mix can also play a great role in attaining the nutritional security in the country.

### **Economics of Supply Chain Management of Tomato in Akola District**

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A supply chain is a network of facilities and distribution options that performs the functions of procurement of materials, transformation of these materials into intermediate and finished products to customers. Supply chain management has prime importance in case of agriculture produce especially fruits and vegetables. For estimation of modern supply chain for tomatoes



the data of modern retailing center were not available in Akola district because of this the data of modern retailing center were collected from Reliance fresh, Nashik. The functionaries involved in tomatoes procurement chain such as producer, wholesaler and retailer were selected for collecting information by personal interview method for the year 2008-2009. The efficiency of supply chain was estimated for traditional as well as modern supply chains. (Total quantity procured in the chain - Total quantity lost in the chain)/ Quantity procured in the chain. In case of Traditional supply chains involves a) Producer → Whole seller → retailer → consumer and b) Producer → Whole seller → hawker → consumer. Regarding the modern supply chain includes *i.e.* Producer → Modern retailing center → consumer

In modern supply chain of tomato price received by producer was higher *i.e.* Rs. 599.83 as compare to traditional supply chain of tomato and price paid by consumer was less in modern supply chain *i.e.* Rs. 703.80 as compare to traditional supply chain of tomato. The highest efficiency was observed in modern supply chain *i.e.* 0.80 while, the efficiency in traditional was (0.73) and (0.76). Losses of tomato in modern supply chain was observed less *i.e.* 20.33 kg per quintal as compared to retailer (27.18) and hawker (23.67) chain respectively.

**Key words :** Price spread, Supply chain of tomato and procurement of tomato.

### **Shelf Life Studies Of Different Formulations Of *Trichoderma Harzianum***

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Trichoderma is used as bio-agent and reported to be quite effective, inexpensive and eco-friendly and can be used as seed treatment, applied direct to the soil before planting & added in organic fertilizers. Trichoderma controls the pathogenic organism by competition, mycoparasitism, and antagonism. It excretes the enzymes like viridin, and gleotoxin thereby enhancing the root growth. Hence it has got significant importance in ecofriendly disease management. The first step in the bio-control study is the identification of promising bio-control agent. Once the bio-control agent is identified and is proven effective against plant pathogens over several reproducible results, the method of mass production, formulation and application should be taken into consideration to stabilize the product during storage and to facilitate its delivery to the plant. The major bottleneck of bio-pesticides is the shelf life and inconsistent performance. Therefore, the present study “Shelf life studies of different formulations of *Trichoderma harzianum*” was undertaken at biological control lab, NIPHM with the objectives viz., Evaluation of solid and liquid substrates for mass production of *T. harzianum* and Shelf life studies of different formulations of *T. harzianum*. From the study it was found that all the prepared formulations retained optimum viability. Capsule and sachet based formulations gave higher shelf life of *Trichoderma* as compared to wettable formulations. Application of Capsule and sachet based formulations would be more convenient for application, storage and handling to control diseases in orchards and in the field and would help the farmer get better yield.

**Key words:** Trichoderma, bio-pesticide, Shelf life, formulations, mycoparasitism, antagonism.

### **Studies on sex modification with silver nitrate in Kakrol (*Momordica dioica* Roxb)**

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The present investigation was carried out during kharif season of 2011 to study the effect of different concentrations of silver nitrate on sex modification in Kakrol (*Momordica dioica* Roxb) at College of Horticulture, Venkataramannagudem, A.P. The soil of the experimental plot was medium in available N, low in available phosphorus and fairly high in available potassium. The field experiment was laid out in randomized block design with seven treatments replicated thrice. The treatments comprised of 100, 200, 300, 400 500, 600 ppm silver nitrate and control. Silver nitrate was sprayed on female plants at pre floral stage. Results revealed that spraying of silver nitrate resulted in development of hermaphrodite flowers at 20 to 25 days after spraying.



Spraying of silver nitrate at the rate of 600 ppm significantly affected the stamen length and stigma length over other treatments. The lowest stamen and stigma length were recorded with 100 ppm silver nitrate. The yield characters like fruit diameter, fruit stalk length, individual fruit weight, number of seeds per fruit and fruit yield were found to be significant at 500 ppm silver nitrate application.

**Key words:** silver nitrate, kakrol, sex modification, yield

### Dissipation kinetics of profenophos in/on brinjal, tomato and okra

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Profenophos is a organo phosphate insecticide used in large scale for agricultural applications to control many insect pests of fruit and vegetable crops. The present investigate efforts were made to study the persistence of profenophos (Profex 50 EC) @500 g a.i. ha<sup>-1</sup> in the fruits of brinjal (*Solanum melongena*), tomato (*Solanum lycopersicum*) and okra (*Abelmoschus esculentus*) for the fixation of maximum residue limit (MRL) at the national level to safe guard the interest of consumers. Fruits of these vegetables (1kg) were sampled at an interval of 0, 1, 3, 5, 7 and 10 days after application, processed by QuEChERS technique and the residues were quantified using SHIMADZU GC 2010 equipped with FPD and capillary column (DB-5, 30m long, 0.25mm ID. and 0.25µm film thickness). To evaluate the efficiency of the method, the profenophos was spiked at different levels viz., 0.05, 0.1, 0.25, 0.50 and 1.0 mg kg<sup>-1</sup> in the fruits and recovery was recorded. The initial deposits of profenophos on brinjal fruits were 1.971 mg kg<sup>-1</sup> that dissipated to 0.954, 0.421, 0.195 and 0.072 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively. In case of tomato the initial deposits were 1.379 mg kg<sup>-1</sup> at the application rate of 500 g a.i. ha<sup>-1</sup>. The deposits further dissipated to 0.894, 0.427, 0.193 and 0.072 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively. The initial deposits of profenophos on okra were 1.418 mg kg<sup>-1</sup> followed by 0.819, 0.269, 0.136 and 0.064 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying. Half life value (RL<sub>50</sub>) was calculated to be 1.5 days for brinjal and tomato. In case of okra half life value was 1.8 days.

**Keywords:** Profenophos, Brinjal, Tomato, Okra

### Persistence Pattern of Profenofos in/on Cabbage and Cauliflower

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It is well recognized that there are risks attached to the consumption of pesticides treated crops because of the presence of residues on them. Therefore, CIBRC recommended generating Good Agricultural Practices (GAP) data to evaluate the persistence of profenofos in/on cabbage and cauliflower at the recommended dose and double the recommended dose @ 500 and 1000 g a.i. ha<sup>-1</sup> for the fixation of maximum residue limit (MRL) at the national level. Supervised field trials at recommended and double the recommended dose were laid at Departmental Farm of the University to study the residue dynamics of profenofos on the above said vegetables. Vegetable sample were drawn at regular interval and processed following QuEChERS technique. In order to evaluate the efficiency of analytical method, the profenofos was spiked at five different levels viz., 0.05, 0.10, 0.25, 0.50 and 1.00 mg kg<sup>-1</sup> in cabbage and cauliflower heads and recovery were in the range of 81.20 to 94.33 per cent and 85.67 to 96.27 per cent, respectively. Following last foliar application of profenofos at recommended dose the average initial deposits were found to be 2.637 and 2.609 mg kg<sup>-1</sup> and at double the recommended dose were 4.254 and 5.232 mg kg<sup>-1</sup> in cabbage and cauliflower, respectively. The deposits of profenofos dissipated below the limit of determination i.e. 0.05 mg kg<sup>-1</sup> in 10<sup>th</sup> day and 15<sup>th</sup> day at recommended and double the recommended dose on both crops. The half-life (RL<sub>50</sub>) was found to be 1.3 and 1.8 in cabbage and 1.3 and 1.5 in cauliflower at recommended and double the recommended dose, respectively.

**Keywords:** Persistence, Profenofos, Cabbage, Cauliflower,



### Effect of climate change on tritrophic interactions

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Changes in atmospheric CO<sub>2</sub> levels increase in temperatures and shifts in precipitation levels can adversely affect natural enemies of insects. Plants react to raised concentration of CO<sub>2</sub> with higher biomass. As a result there would be a dilution effect on nitrogen levels and those chemical constituents that require nitrogen. Lower nutritional benefits of plants unfavorably impacts insects that feed on them directly and furthermore their parasitoids and predators in an indirect way. Temperature greatly influences the survival, development and abundance of insects and the effect is direct. Expanded temperature range can modify both plant and herbivore phenology by affecting synchronization between the two trophic levels impacting the movement of natural enemies and the adequacy of their natural control. Each insect species and even each population might have different optimum temperatures for survival and reproduction. Insects inhabiting the colder climates with marked seasons have better tolerance to thermal extremes. The interaction among CO<sub>2</sub>, temperature, moisture, plants and their natural enemies complex and cannot be easily predicted. Adaption of conservation agriculture practices such as increasing crop diversity on farms, reduced tillage, use of mulches, increasing vegetation diversity both on farms and landscapes are likely to have a positive effect on parasitoid and predator abundance and interactions resulting in best natural control.

**Key Words:** Climate change, CO<sub>2</sub>, trirophic interaction, temperature

### Impact of NRM technology in Cooch Behar District of West Bengal

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Agriculture is extremely vulnerable to climate change issues. Rise in temperature as well as changes in precipitation pattern increase the likelihood of short-run crop failure and long-run production decline. NICRA (National Innovations on Climate Resilient Agriculture) project start in Cooch Behar District since 2010-11. The major object of the project were to enhance the resilience of Indian agriculture to climatic variability and climate change through strategic research on adaptation and mitigation, to validate and demonstrate climate resilient technologies on farmers' fields, to strengthen the capacity of scientists and other stakeholders in climate resilient agriculture and to draw policy guidelines for wider scale adoption of resilience-enhancing technologies and options. Khagribari village of Cooch Behar District selected purposively for implementation of the NICRA project. Several activities were done from 2010-11 to 2017-18. The major objective of this study was to find out the Impact of Natural Resource Management (NRM) technology of NICRA project in Cooch Behar District of West Bengal. The study was conducted from April, 2017 to December, 2018. It was found from the study that the potato and wheat yield were increase due to timely irrigation. It was also exposed from the study that live saving irrigation was given during Rabi season after increased the pond depth from 5.5 - 7.0 ft. up to 10.5 - 11 ft.

**Keywords:** Climate, Precipitation, NICRA, Resilience, Management, Irrigation, Ponds.



## Phytochemical screening and Antioxidant Activity of *Withania Somnifera* and *Calotropis Gigantea*

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Literature sources have shown that the plants were used for medicinal purposes from ancient time. In the coming years, it is likely to see the continuation of the emergence of new products containing natural oils and herbs in the market. Nowadays, consumers preferentially look for products derived from plants and other natural sources. In this study, we tested commonly available medicinal plants namely *Withania somnifera* and *Calotropis gigantea*, for their phytochemical screening and antioxidant activity. The plant extract were screened for antioxidant activity using DPPH free radical scavenging assay. Also Total phenolic content of extract were determined by folin-ciocalteu reagent method and tannin content by vanillin assay. In study it was found that Antioxidant activity of 1mg/ml solution of *W. somnifera* leaves exhibited 87.2% inhibition and *C. procera* leaves exhibited 37.9% inhibition. In case of *C. procera* seeds had 1.42% inhibition while *W. somnifera* seeds exhibited 88.9% inhibition. Total phenolic content of *W. somnifera* leaves had 36.02mg/g GAE phenolic content while *C. procera* leaves had phenolic content 5mg/g GAE. It was found that *W. somnifera* seeds and *C. procera* seeds extract had almost same amount of phenolic content that 35.04 mg/g GAE. *C. procera* seeds had more tannin content (0.053mg/g) than *W. somnifera* seeds (0.021mg/g) while *C. procera* leaves (0.019 mg/g) extract had less tannin content as comparison to *W. somnifera* leaves extract (0.024mg/g).

**Keywords:** Phytochemical screening, Antioxidant Activity, Total Phenolic acid, Total tannin content

## Development and application of a novel RT-LAMP assay to detect *Potato spindle tuber viroid* in potato

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Potato spindle tuber viroid (PSTVd) is a quarantine pathogen of potato infecting leaves, tubers as well as true potato seeds. They comes under the genus *Pospiviroid* in the family *Pospiviroidae* which is largely known to infects wide members of *Solanum* spp. PSTVd is having 359-nucleotides circular RNA structure with the absence of typical initiation codons, which replicates in the nucleus and are assumed to have a rod-shaped secondary structure in their native state. Due to absence of protein coding ability, the detection of PSTVd is done with RNA based assay. In this study the investigations were carried out to develop a novel fluorescent reverse transcriptase loop mediated isothermal amplification (RT-LAMP) assay for detection of PSTVd. The optimization of RT-LAMP reaction conditions and reagents concentrations were carried out with time, temperature, MgSO<sub>4</sub>, dNTPs and *WarmStart Bst* DNA polymerase. The target specificity of primers was assessed with restriction digestion and sequence analysis. Limit of detection was determined by 10 fold serial dilutions of PSTVd samples. Detection of the RT-LAMP assay was assessed in potato leaf samples and compared with real time PCR and RT-PCR methods. The method was carried out with optimized reaction conditions included reagent mix, incubated at 65°C for 50 min. The predicted size of amplicon was observed in RT-PCR and also sequence analysis reveal higher similarity with genomic region of PSTVd isolates. We were able to detect PSTVd upto 0.2pg/μl concentration using the newly developed RT-LAMP primers. Further, the samples with positive reaction developed a characteristic fluorescent green color. The RT-LAMP assay was further evaluated in leaf samples, with RT-LAMP and real time PCR. The RT-LAMP assay developed in this study has a potential to be a beneficial tool in detection of PSTVd in a low cost laboratory due to its simplicity, rapidness and application in large samples.

## Effects of ploidy on reproductive efficiency of *Artemisia glauca* Pall. exWilld.

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The genus *Artemisia* is one of the largest of the Asteraceae family, with more than 500 species distributed across the Northern Hemisphere, with few representatives reaching the Southern Hemisphere. Polyploidy widely prevalent in this genus



and is considered as the contributing factor for its wide distribution. The same has been used successfully by genus *Artemisia* of family Asteraceae for its extension and diversification. The process of whole genome duplication (WGD) in land plants has been proposed to act as a major source of evolutionary genomic variability and plasticity, thus acting as a main mechanism driving diversification and speciation (De Storme and Mason, 2014). It is a genus with high economic value, being used medicinally throughout the world.

Present study has its focus on genetic system of a species of *Artemisia* namely *Artemisia glauca* Pall. ex Willd. Used as a spice, flavouring for salads and in manufacture of tarragon vinegar, this species has more than 60 oil components consisting of 99.0 - 99.7% of the total volatile components. Populations of this species sprawling on the lower reaches of PirPanjal mountain ranges and Kishtwar Himalayas, J&K, India. It has been analysed for their breeding and meiotic system. Two of these populations namely [Poonch (1580 masl) and Rajouri (1047 masl)] are diploids with  $2n=18$ , other two [Kishtwar (1750masl) and Rajouri (1047masl)] are tetraploids with  $2n=4x=36$  populations. Presentation will elaborate on the details of these cytotypes and effects of ploidy on reproductive output of the species.

**Keywords:** *Artemisia*, whole genome duplication, genetic system, dracumculus, diploid, tetraploid

### **Inhabitant Pathogenic Bacterial Strains to Reduce the Reproductive Potential and Dengue Vector Competence**

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*Aedes aegypti* is a primary vector of dengue virus and the causative agent of dengue is an emerging globally as the most important arboviral diseases currently threatening human populations. At present, no effective control measures are available for dengue vectors. Therefore, vector control is currently the primary intervention method and is population reduction, in which natural *A. aegypti* populations would be reduced with inhabitant bacterial strains that are unable to transmit dengue virus. The effective bacterial strains were isolated from different soil samples and infected insect species in the range of grizzled squirrel wildlife sanctuary, Srivilliputtur, Tamilnadu. Based on the pathogenicity of strains, a total of 45 isolates were further screened against early third instar larvae of *A. aegypti* and only four isolates effectively extend the larval durations as well as reduce the reproductive potential. The 16S rRNA gene sequences revealed that potential isolates were *Bacillus firmus* (MK791255), *Bacillus paramycooides* (MK788268), *Bacillus siamensis* (MK788212), and *Bacillus licheniformis* (MK791256). The phylogeny depicted those four distinct groups with homology amid the intimately related *Bacillus* spp. After 48 hours exposure, the *B. licheniformis* strain (cell mass of  $2.2 \times 10^7$  CFU/ml) showed the potent larvicidal activity with  $LD_{50}$  of 16.22  $\mu$ g/ml and  $LD_{90}$  of 19.89  $\mu$ g/ml and the *B. paramycooides* strain inhibits the larval and pupal development and observed intermittent stages and causes abscess in the gut and siphon regions. Therefore these studies demonstrate the challenge for dengue vector in reducing developmental and reproduction competence.

**Keywords:** 16S rRNA sequencing, Phylogeny, Pathogenicity, *A. aegypti* and Larval duration.

### **Response of different nutrient management practices on growth development and yield behaviour of spring maize**

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A field experiment was conducted during spring season to study the response of different nutrient management practices on growth development and yield behaviour of spring maize (*Zea mays* L.). The experiment comprising of four organic manures



(pressmud @ 7.5 t ha<sup>-1</sup>, vermicompost @ 7.5 t ha<sup>-1</sup>, FYM @ 15 t ha<sup>-1</sup> and no organic manure) in main plot and six fertilizers levels (135 kg N ha<sup>-1</sup>, 180 kg N ha<sup>-1</sup>, 135 kg N ha<sup>-1</sup> + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, 180 kg N ha<sup>-1</sup> + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup>, 75% RDF and 100% RDF) in sub plots with three replications in split plot design during 2016 and 2017. Results revealed that the highest growth parameters of maize viz. plant height (cm), leaf area index and dry matter accumulation (g/m<sup>2</sup>) were recorded with pressmud @ 7.5 t ha<sup>-1</sup> being at par with vermicompost @ 7.5 t ha<sup>-1</sup> at all the crop growth stages except, 20 DAS. Significantly highest values of yield attributes and yield viz. ear height, cob length, cob girth, number of grains/cob, test weight, grain and straw yields were recorded under pressmud @ 7.5 t ha<sup>-1</sup> which was being at par with vermicompost @ 7.5 t ha<sup>-1</sup> over no organic manure during both the years. Application of 100% RDF being at par with 75% RDF and 180 kg N ha<sup>-1</sup> + 30 kg P<sub>2</sub>O<sub>5</sub> ha<sup>-1</sup> recorded highest growth, yield attributes and yield over 135 N during both the years.

**Key words:** *Zea mays*, Organic manures, Fertilizers, Growth, Yield attributes, Yield

### **Morphological and Molecular Characterization of *Marssonina coronaria* (Ellis & J.J. Davis) J.J. Davis Causing Premature Leaf Fall**

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Apple blotch is a major apple disease caused by *Marssonina coronaria* (Ellis & J.J. Davis) J.J. Davis that causes critical economical losses in apple orchards in Himachal Pradesh. Surveys were conducted in Rohru, Jubbal and Shimla areas of Himachal Pradesh and infected leaf samples were collected. Isolation of the pathogen was done from the infected leaves on Peptone-PDA medium. Three isolates of *Marssonina coronaria* were obtained and evaluated for the morphological and molecular characters. All three isolates were morphologically similar and were having same cultural characteristics. The colonies of all isolates were dark brown to black with wrinkled surface without aerial mycelia and ranged from 3-5 mm in diameter. Conidia were single septate, hyaline, ampule shaped and constricted at the septum. However, not much difference was obtained in colony diameter and size of conidia. The ITS region of rDNA of three isolates was amplified using ITS1/ITS4 primers which resulted in amplification product of 572-600 base pair. The sequences obtained after rDNA sequencing of the isolates were analysed using BLASTn analysis and showed highest homologies (97-100%) with *Marssonina coronaria*. Phylogenetic tree illustrated that the isolates were closely related with isolates of Shimla (India), Kullu (India), South Korea and China with accession numbers Shimla1, Shimla4, KM873725, AB494963 and HM368521. The present study indicates the genetic relationship among different isolates of *Marssonina coronaria* and depict that ITS rDNA sequence is prospectively useful in taxonomic species determination.

### **Studies on floral, vegetative and fruit characteristics of some elite mango (*Mangifera indica* L) germplasm in two mid hill districts of Nepal**

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A survey of indigenous seedling mango germplasm growing in Kavre and Sindhupalchok districts of Nepal was carried out during the period of 2016 to 2017. The Survey is based on the data collected from the local sources among the farmers and orchard caretakers. More than 100 mango elite seedlings growing at farmer fields/institutes, road sides and orchards were surveyed. Among from these best ten promising mango germplasm were selected and assessed in terms floral, vegetative and fruit characteristics. The Tree, leaf, foliage, flowering, fruit, stone and seed characters showed a lot of variation among the germplasm. The chance for the selection of elite genotypes are high due to wide genetic diversity in the germplasm and there is



tremendous possibility of such material to act as a source for the selection of superior genotypes for conservation, evaluation utilization and a source for crop improvement in future breeding program.

**Keywords:** *Mangifera indica*, germplasm, floral, vegetative and fruit characteristics. Variability.

### Advanced Seed Germination in Cucumber

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Profitable cultivation of vegetables can only be practiced if all the vegetative growth phases occur uninterrupted and precociously. Cucumber, one of the succulent vegetable crop, is quite remunerative for the farmers. So any process that enhances the rate of germination is beneficial for reaping early and sizeable harvest. Normal seed germination of cucumber takes place within 10-12 days at a temperature of 25°C to 30°C. Any shortening of the germination duration will eventually lessen the time to harvest and increase the crop index. A new method for early germination of cucumber seedlings has been tried in kitchen gardening and can be successfully applied for commercial production of cucumber plant. Under this method, seed are sown in black polythene bag which is covered by transparent polythene sheet. The polythene sheet is fixed on all sides of the polybag so that it covers the entire internal area of the polybag. The polythene sheet replicates the polyhouse effect and increases the temperature inside the polybag which leads to early germination of seed much earlier than at normal temperatures. It is specifically suitable for early sowing of the seeds in cooler areas where there are issues regarding seed germination due to lower temperatures. It is low cost technique and very helpful in timely production of vegetables. It can also help to stabilize the price of vegetable crop in the market early in the season.

**Key words:** Cucumber, germination, polybag, polyhouse, seed.

### Pharmacological properties of *Achras Zapota*

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Seeds of Chiko (*Achras Zapota* Linn.) are known to be aperient and diuretic. It is also used as mild laxative and antipyretic. The infusion of the crushed seeds, prepared with sweetened water and the filtrate, is claimed to promote diuresis. On the other hand, the bark is used to check and regulate blood flow and give tone to the muscles. Aside from that, it is reputed to be tonic and febrifuge. The fruit soaked in melted butter overnight is prescribed to prevent fever and bile and liver abscess. In Cambodia, the bark is a component of concoction to cure diarrhoea and fever. In Java, the flowers of the plant is used as a certain ingredient pounded together to make a powder rubbed over the body of a woman after childbirth. In West Indies, the seeds are known to be aperient and diuretic and the bark reputed to be tonic and febrifuge. The bark contains much saponin, saponin, and tannin than the other parts of the tree yielding 11.8 percent equally. The leaves contain a bitter principle alkaloid, saponin and fixed oil, with 0.076 and 1.45 percent respectively. The seeds yield the saponin; saponin, achrassaponin; an alkaloid; fixed oil 16-23 percent; a bitter saponin 0.80 percent. The gum chicle, the principal substance derived from the milky juice of the bark, contains resin 75 percent, gum (arabin) 10 percent, calcium oxalate, sugar, etc. The fruit- flesh yields saccharose 7 percent, dextrose 3.7 percent, and levulose 3.4 percent. It contains 0.013 percent saponin. The unripe fruit is full of tannins and is therefore astringent. The ripe fruit gives an energy yield of 60 kcal per 100 g. They contain about 15% total sugars and the vitamin C content is 10-20 mg per 100 g.

**Key words:** Sapota, Vitamins, fruits, sugar





## Influence of Integrated Nutrient Management on Sapota cv. Kalipatti under Semi-Arid Eco-system of Rajasthan

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Sapota (*Manilkara achras*), popularly known as *chiku*, is one of the important tropical fruit crop of India. The fruit is a fleshy berry and it is a good source of digestible sugar (12-18%) and an appreciable source of protein, fat, fibre and minerals (Ca, P and Fe). The area under cultivation of Sapota is increasing due to high productivity and very less susceptibility to the pests and diseases. Integrated nutrient management in Sapota is one of the most important aspects for higher fruit yield, better quality fruit and improving soil health. A study was carried out in 8 years old Sapota (cv. Kalipatti) orchard during 2012-14 at ICAR-IISWC, Research Centre, Kota-Rajasthan. The experiment was laid out with seventeen treatment combinations of organic, inorganic and bio-fertilizers. The experimental study revealed that almost all treatments with combined application of organic and inorganic sources of nutrients had significant difference in fruit yield of sapota, soil microbial biomass and NPK content of leaf over control *i.e.* 1000:500:500g NPK /plant denoted as T<sub>1</sub>. Among different treatments, application of 2/3 of T<sub>1</sub> + 50 kg FYM + 250g *Azospirillum* + 250g *Azotobacter*/plant (T<sub>11</sub>) significantly increased the number of fruits/ plant (327.88), yield/ plant (29.03 kg ) and yield/ha (4.52t) on pooled data basis. The soil microbial count of fungi (8.895 cfu g<sup>-1</sup> soil), bacteria (11.186 cfu g<sup>-1</sup> soil) and actinomycetes (5.606 cfu g<sup>-1</sup> soil) was higher in treatment T<sub>15</sub>(2/3 of T<sub>1</sub> + 10 kg vermicompost + 250g *Azospirillum* + 250g *Azotobacter*/plant) at fruit harvest stage. The leaf N content (2.029%) was higher in T<sub>15</sub> while P (0.280%) and K (1.797%) content were higher in T<sub>11</sub>. From this investigation, it is concluded that 32% higher yield could be harvested with application of treatment (T<sub>11</sub>) in Sapota Cv. Kalipatti under semi-arid region of Rajasthan.

**Key words:** Sapota Cv. Kalipatti, Integrated Nutrient Management, Biofertilizers, Fruit yield, Soil Microbial Biomass and Leaf nutrients.

## Response of mango (*Mangifera indica* L.) cultivars to agro-chemicals with respect to yield parameters under Southern region of Rajasthan

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Due to wide adaptability, high nutritive value, richness in variety, delicious taste, pleasant flavour, attractive appearance, mango enjoys the unique popularity among the masses and classes. Fruits are rich in vitamin A and C. Application of agro-chemicals alter the behavior of trees for the economic benefit of the fruit growers. In this regard an experiment was conducted at Agriculture Research Station, Banswara district of Rajasthan to find out the response of different agro-chemicals. The experiment consisted of thirteen treatments along with control and replicated thrice in a Randomized Block Design. 15 year old mango orchard was selected for experiment which have Dashehari, Langra and Kesar. Plants were planted with square system of planting and 10 x 10 m spacing. Agro-chemicals used Calcium chloride, Potassium nitrate, Paclbutrazol and Sorbitol. The following treatment combinations were applied control-water spray, Calcium chloride (0.3, 0.6 & 0.9%), Potassium nitrate (1, 2 & 3%), Paclbutrazol (500, 1000 & 1500 ppm) and Sorbitol (1.5, 2.0 & 2.5%). Application of different agro-chemicals were applied at different stages and time. Maximum fruit weight (204.87g), polar diameter (9.60 cm) and equatorial diameter (5.26 cm) were found in Kesar, Dashehari and Langra respectively. Yield per tree and estimated yield per hectare were significantly higher under Langra as compared to Dashehari and Kesar. Among alternate bearing mango cultivars (Dashehari, Langra and Kesar), cultivar Langra recorded higher yield (85.92 kg tree<sup>-1</sup> and 8.66 t ha<sup>-1</sup> estimated) over Dashehari and Kesar. Various agro-chemicals were also found to affect the yield per tree and estimated yield per hectare significantly and recorded maximum yield kg tree<sup>-1</sup> and estimated yield per hectare were found under treatment PBZ 1500 ppm, 86.61 kg tree<sup>-1</sup> and 8.66 t ha<sup>-1</sup>, respectively.

**Keywords:** Mango, Calcium chloride, Potassium nitrate, Paclbutrazol, Sorbitol and agro-chemicals



## **Horticultural processing waste: A potential resource for bioactive compounds**

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India is the second largest producer of fruits and vegetables in the world and horticultural crops are extensively processed to manufacture a wide range of value added products. This generates a large amount of waste (by-products) such as stalks, peels, seeds etc., which causes serious environmental issues like disposal problems due to soil and water pollution as well as green house gas emission. Out of the total fruit and vegetable production in India, 17-40 per cent is discarded as waste due to various reasons. Industrial processing produces mainly juices, cider, canned and dried processed products which generates by-products in the million tons per year. For instance, the fraction of discarded materials in the majority of fruit and vegetable processing industries is highly dependent on the location and method of harvest as apple (12-47%), mango (30-50%), citrus (30-50%), pomegranate (40-50%), banana (20%), peach (11-40%), pear (12-46%), apricot (8-25%), grapes (15-20%), pineapple (50%), tomato (5-25%), peas (6-79%), potato (5%), sweet potato (15%), carrot (18%), cabbage (5-25%), cauliflower (67%), garlic (25-30%), beet root (15-43%) and pumpkin (18-21%). These different kind of processing waste are potential source of bioactive compounds such as polyphenols, proteins, polysaccharides, dietary fibres, flavour compounds, pigments (anthocyanins, carotenoids, betalains etc.), edible oils and phytochemicals which hold tremendous potential applications to be used in development of functional foods, food additives, prebiotics, antioxidants and also in pharmaceutical and cosmetic industries as health supplements due to their possible health benefits. The development of various extraction techniques for efficient recovery of bioactive components will not only add value to the food waste but also useful in reducing the cost of formulated products and decreasing the use of synthetic chemicals in such formulations at the same time contributing to an efficient waste reduction management.

**Keywords:** Fruits, vegetables, waste, bioactive compounds, extraction, health benefits

## **Enhancing farmers income through self help group approach**

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Self Help Groups (SHGs) are novel and innovative organization setup for rural people and their social upliftment and welfare. SHGs have inculcated great confidence in the minds of rural women to succeed in their day to day life. Empowering is not just for their economic needs but also through more holistic social development. The study was conducted with the objective to know the impact of self help groups participated in Kisan Mela after being involved themselves into a group. The leaders of fifteen SHGs were personally interviewed for the fulfillment of the objective. The data collected with the help of frequencies and percentages. The findings revealed that a large majority (93.33%) took technical advice from the Punjab Agricultural University and were involved in the entrepreneurship of honey, spices, pickles, mushroom, Jaggery, multigrain flour, bags as a result of which most of the respondents (60%) increased their income in the range of 1-10 lakhs annually while 26.67 per cent of the respondents earned income in the range of 11-20 lakhs annually from the group. It was noticed that about 73.33 % of the groups are followed the collective marketing of their products i.e. all members are collectively participated for marketing of their produce while 26.67 % of groups individually market their products. It is recommended that self group approach is beneficial in enhancing the income of farmers in current scenario for livelihood security

**Keywords:** self help group, enterprises, income, empowerment



### **Effect of plant growth regulators on growth, quality and yield of papaya**

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The use of plant growth regulators has assumed an integral part of modern fruit production to improve the quality and production of fruits and it has resulted in outstanding achievements in a number of fruit crops with regard to improvements in yield and quality. Because of its diverse effect, it is possible to use certain growth regulating chemicals at particular stage of fruit growth and development to exhibit maximum effect. In recent years, attention has been mainly given to use of growth regulators in modification of growth, flowering, fruiting, fruit quality and yield of different fruit crops. There are various types of growth regulators are used like NAA, IAA, GA<sub>3</sub> at certain concentrations for improving the growth and quality attributes in papaya. NAA plays an important role in increasing the fruit size and also control the pre-fruit drop in papaya. Gibberellic acid helps in the fruit set, fruit weight, increase in length, girth. IAA plays a important role in plant development and growth including cell elongation and division, lateral root elongation and fruit development.

### **Effect of heat treatments on bacterial counts,viscosity and IgG concentration in colostrum of jersey cow**

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The aim of present investigation was to determine the effect of different time temperature treatment on IgG concentration, microbial count and viscosity of bovine colostrum. First three days colostrum samples were collected from kangra, chamba, shimla district of himachalpradesh. Pooled colostrum samples were subjected to three different heat (60, 63 & 65°C) treatments for 60 minute. Samples were analyzed for viscosity, IgG concentration, standard plate, coliform, *Staphylococcus aureus* and *Salmonella spp.* counts. Significantly reduction in bacterial counts was observed in all the heat treated samples as compared to untreated colostrum samples. Except for standard plate count, the above mentioned pathogens were undetectable in all the samples subjected to heat treatment. Colostrum samples heated at 60°C for 60 min had significantly (P<0.01) higher levels of IgG than the other two temperature treatments. Viscosity was unaffected after heating colostrum at 60°C for 60 min whereas significant (P<0.01) increase was observed at 63 and 65°C. In this study, heat treatment of colostrum at 60°C for 60 min significantly (p<0.001) reduced bacterial count, slightly reduced IgG concentration, and did not affect viscosity.

### **Climate changes and Alternation in Phenological events in Apple (*Malus pumila*)**

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The climate changes and rotation in phenological occasions in Apple fruit crop. Apple (*Malus pumila*) is commercially the most important temperate fruit and is fourth among the most widely produced fruits in the world after banana, orange and grape. China is the largest apple producing country in the world. The worldwide environmental change and expanded atmosphere changeability are as of late thought to be a gigantic concern worldwide because of normal inside procedure and outside driving of the air like Ozone harming substances (CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O). the impact of CO<sub>2</sub> enhancement at various development phase of natural product or vegetative development, quality in fruits. the atmosphere changes parameter direct effect on the harvest physiological, biotic pressure and came about to the decrease of yield and quality blooming and fruiting. CO<sub>2</sub> level is increment and atmosphere changes may likewise affect on yield through impact of bug and maladies.. Deficient chilling enormously impacts blossom initiation and organic product colouration alongside crumble in fruit taste and surface. Time of tree budburst and blooming is dictated by day length. Climate changes is impact on changes fertilization in fruit crop.

**Keyword:** climate changes, Fruit quality, Phenology, Pollination.



## Expression of Buffalo Recombinant Lysozyme in *Pichia pastoris*

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Lysozyme is a 130 amino acid residues enzyme, which catalyzes hydrolysis of 1, 4-beta-linkages between N-acetylmuramic acid and N-acetyl-D-glucosamine residues in peptidoglycan layer. It is an important hydrolyzing enzyme involved in the animal defense, digestive functions, functional foods and dairy industries. In the present investigation, we have successfully expressed buLyz gene in *Pichia pastoris*. Further, Genomic DNA was isolated from the transformed clones of buLyz in *Pichia pastoris*. With insert size of lysozyme gene (429 bp), the PCR product was found to be 662 bp (429 bp insert + 233 vector sequence). SDS-PAGE was performed to check the expression of the buLyz protein. Expression of recombinant buLyz was observed at expected molecular weight on SDS-PAGE (14.4 kDa). Recombinant lysozyme was produced at small scale and IL fermenter level. On the induction with methanol, buffalo milk lysozyme was expressed in *Pichia pastoris*. Two methods were used to analyze the catalytic activity of recombinant buLyz and compared the activity of recombinant buLyz with commercial Hen egg white lysozyme in lysoplate assay using *Micrococcus lysodeikticus* suspension in PBS and incubated at 37°C and it was observed that buLyz catalytic activity against *Micrococcus lysodeikticus*. The turbidometric assay for lysozyme activity was carried out to know the expression of buffalo lysozyme gene. Expression was detected by lysozyme activity assay in culture supernatant. Lysozyme shows the catalytic activity against a *Micrococcus lysodeikticus*. O.D. was measured at 450 nm as a function of time at an interval of 200 seconds.

A drop in O.D. with time suggested the Lysis of cells by lysozyme. Shorter time taken to reach a given O.D. value suggested a higher activity of the lysozyme. To generate biomass for secreted expression of protein, recombinant clones were grown in BMGY media containing glycerol. After biomass production, transferred to BMMY media containing methanol. The expression was detected after 24 hours of induction with methanol.

## Quercusleucotrichophora A Camus(Ban oak): Evaluation of Holocellulose and Lignin content from provenances in Himachal Pradesh

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Chemical composition is one of the most important parameters which and to determine suitability of wood as raw material for pulp and paper industry and other applications. The principal chemical constituents of wood are cellulose (40-50 %), hemicelluloses (15-25 %), lignin (15-35 %) and minor amount of other substances called extractives (4-10 %) which interacts in such a way so as to form a natural composite. The amount of extractives in wood varies from less than 3 to over 30 per cent of the wood oven dry weight. These properties of the wood can vary from site to site, within site, among different and same species. Ban oak is the most common broadleaf tree of family Fagaceae in the mid-elevations of the Central Himalayas in India. It is also found in Myanmar, Pakistan, Nepal, Thailand and Vietman. It is best adapted to the regions with a mild and moist climate. Oaks (*Quercus* spp.) are the dominant, climax tree species of the moist temperate forests of the Indian Himalayan region where about 35 species of *Quercus* are extensively distributed between 1000-3500 m. The present study aimed at evaluating the content of holocellulose and lignin in the wood of banoak (*Quercusleucotrichophora*) among twenty two provenances from Himachal Pradesh. The average holocellulose content ranged from 65.31 % to 71.30 %. The maximum and minimum holocellulose content was found in Barog (71.30 %) and Banikhet (65.31 %) provenance, respectively. The average lignin content was ranged from 20.48 % to 28.46 %. The maximum and minimum lignin content was observed in Dhami (28.46 %) and Jibhi (20.48 %) provenance, respectively.

**Keywords:** cellulose, hemicelluloses, lignin, banoak, provenance



### **Effect of harvesting time on ripening of mango cv. Dusheri**

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The ripening quality of mango cv. Dusheri was investigated when harvested on different time under sub-tropics of northwestern India. Fruits were harvested at 101, 106 and 111 days after fruit set (DAFS) and kept at 25°C in temperature controlled chamber for ripening. Fruits were analyzed periodically for physico-chemical characteristics at the time of harvest (0 h) and after 72, 96 and 120 h of ripening period. With an advancement in ripening period, an increase in physiological loss in weight, soluble solids content (SSC), sensory quality rating, b-carotene and pulp colour development of mango fruits were recorded. While a decline in fruit firmness and titratable acidity (TA) was observed with ripening period. Fruits picked at 111 DAFS recorded highest SSC (8.01%), sensory rating (4.67), b-carotene (0.427 mg/100 g) vis-a-vis lowest fruit firmness (15.3 lb) and TA content (1.56%). The luminosity of fruit pulp decreased with the storage period. The redness and yellowness of the fruit pulp represented by a\* and b\* values, respectively increased with delay in harvesting period. The rate of ripening was rapid in late harvested fruits as compared to early harvested fruits. After 96 h of ripening period, fruits harvested at 111 DAFS showed very much desirable quality whereas fruits harvested at 101 DAFS showed moderately desirable quality. Results showed that harvesting of mango fruits can be extended to 111 days and such fruits attained optimum ripening quality after 96 h at 25°C.

**Keywords :-** Mango, mangifera indica, harvesting time, ripening, physico-chemical character

### **Organic farming for soil health management and conservation of soil fertility in sodic soils**

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In arid and semi-arid regions, land degradation due to sodic soil is commonly observed in India. The sodicity of soil adversely affects the crop productivity. The soils characteristics are adversely affected by the upward movement of salts due to changes in the rainfall pattern and evapotranspiration rates. In India states of Gujarat, Uttar Pradesh, Maharashtra, West Bengal and Rajasthan consist of saline and sodic soil. There is a need for reclamation the sodic soils to improve the crop productivity and soil fertility. Due to the increased sodium content (Na<sup>+</sup>), nutrient availability to crop is affected and osmotic stress occurs that reduces productivity. Reclamation of soil requires a practice system that sustainably improves the soil health and thereby crop growth. Organic farming practices improve sodic soil by binding the small soil particles to large water stable aggregates and improves soil structure. The present study is an observation of efficiency of different organic manure sources in reducing sodicity and improving the nutrient content of soil. Application of different organic amendments enriches the rhizosphere with nutrient supply that could improve the microbial population of soil. This in turn can facilitate the biogeochemical cycling and help to replenish the soil fertility. Improving the enzymatic activity of soil help to improve soil quality. Practice of agroforestry with trees that can sustain salt stress can be a solution to the sodic soil and thereby conversion of fertile lands to arable forms.

**Key words:** Organic farming, soil health management, sodic soils

### **Use of indigenous medicinal plants by tribal women for treatment of fever, cough & cold**

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Nanded district of Maharashtra state has the major forest area in the district is in Kinwat taluka (i.e.) about 57,800



hectares. This taluka is also a part of area popularly known as Gondwan. Approximately more than three out of every ten persons in taluka are tribals (32 per cent). Among tribals, Rajgond (47 per cent), Andh (36 per cent), Pardhan (9 per cent) and Bhil (5 per cent) are the main tribals. The tribal area is spread over 1146 square kilometers (Census, 1991). Most of the tribal women working in the farming activities and they take care of health of all family members. They are most of the time used medicinal plants and parts to cure health problems. From kinwat taluka six villages were selected and twenty villagers from each village were randomly selected for the study. Thus, from each village 20 respondents making the total sample size 120 were selected. For this study statistical tools were used as frequency, percentage, correlational analysis, multiple regressions. To collect data regarding use of indigenous medicinal plants for Fever, cough & cold by them interview schedule was prepared with help of information regarding diseases name, plant name, medicinal plants used in the form of seed, root stem, bark, leaves, flowers, rhizome, bulb. Plants are one of the most important sources of medicine. The application of plants as medicines dates back to prehistoric period.

**Keywords:** Treatment, Fever, Cough, cold, medicinal plants, sources of medicine etc.

### **Agrometeorological Yield Forecast Modelling for Apple crop in Himachal Pradesh, India**

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Apple is one of the most important temperate horticulture cash crop of Himachal Pradesh and presently facing the problems like poor post-harvest management, storage, transport as well as marketing practices in the state. However, the agrometeorological models for crop yield forecasting are helpful in strategic planning, prior estimates of crops yield to facilitate in decision making & policy planning for storage and transportation & marketing of produce. Therefore, in the present investigation productivity of apple crop was regressed with monthly as well as annual weather parameters viz. rainfall, maximum temperature and minimum temperature for last 31 years (1988-2018) of Kullu and Shimla district and for last 25 years (1994-2018) of Kinnaur district. Stepwise multiple regression technique was applied with yield as dependent variable and weather parameters as independent variables. Weather based crop yield forecast model equations were developed and crop yield was predicted with maximum accuracy for Kinnaur ( $R^2=0.80$ ) followed by Kullu ( $R^2=0.71$ ) and Shimla ( $R^2=0.66$ ). The model equations were validated using root mean square error (RMSE) which were 1.25, 3.63 and 0.22 tones/ha for Kullu, Shimla and Kinnaur, respectively. The standard error of estimates for model equations were, 1.29, 2.33 and 0.63 for Kullu, Shimla and Kinnaur, respectively.

**Keywords:** Apple, Agrometeorological, Yield forecast, Modelling

### **Amendment application on resource conservation and crop productivity in semi arid region of South Eastern Rajasthan**

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Soil degradation process includes loss in soil productivity, soil erosion, loss of soil cover etc. are serious issues in India putting food security and income of farmers at risk. Degradation process like surface runoff and erosion are responsible for extensive losses of topsoil and reduction in agricultural productivity. Amendments like gypsum FYM and crop mulches maintain high concentration of electrolytes in the soil solution and cover the soil surface from direct impact of raindrops. With this background an experiment was conducted with combinations of treatments like T1: Control; T2: Recommended Dose of Fertilizer (RDF) (Soybean); T3: RDF + FYM (10t/ha); T4: RDF + Mulches (mustard mulch 3t/ha); T5: RDF + Gypsum; T6: RDF + Gypsum + FYM; T7: RDF + Gypsum + Mulches; T8: RDF + Gypsum + Mulches + FYM. Results showed that gypsum application significantly reduced (20%) soil loss and runoff in all the treated plots thereby increasing water infiltration. Runoff



percentage varied from 4.8 to 9.9 % of rainfall. High soil loss was observed in control (3.2t/ha) whereas soil loss was lowest (1.4t/ha) in plots where gypsum+ mulch+FYM (T6) was applied to soil. Among the various treatments, T8: RDF+ Gypsum + Mulches + FYM followed by T6: RDF+ Gypsum + Mulches showed least runoff and soil loss. The highest runoff, soil and nutrient loss was observed in control plots with no application of amendments. Among various nutrients available Sulfur status improved from 4 ppm to 6ppm where gypsum was applied as amendment. High grain yield was observed in treatment where RDF+gypsum+ mulch was applied followed by T8 treatment. Thus application of these amendments are economically viable options for farmers in resource conservation especially in degraded lands of semi arid regions.

**Keywords:** Runoff, soil loss, gypsum, FYM, soybean

### **Entomopathogenic nematodes and their symbiotic bacteria as a biocontrol agent – Recent trends.**

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Entomopathogenic nematodes (EPNs) have been utilized in classical, conservation, and augmentative biological control programs. The Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan -173230 (Himachal Pradesh) India, on their potential as inundatively applied augmentative biological control agents. Extensive search over the past three decades has demonstrated both their successes and failures for control of insect pests of horticulture crop pest. We present highlights of their development for control of insect pests above and below ground. The target insects include those from foliar, soil surface, cryptic and subterranean habitats. Advances in mass-production and formulation technology of EPNs, the discovery of numerous efficacious isolates/strains, and the desirability of reducing pesticide usage have resulted in a surge of commercial use and development of EPNs. Commercially produced EPNs are currently in use for control of lepidopteran and coleopteran and other insect pest. However, demonstrated successful control of several other insects, often has not led to capture of a significant share of the pesticide market for these pests. Our focus in this mechanism and pathogenicity of nematode, phylogeny of nematode for *Steinernematidae* and *Heterorhabditidae*. *Steinernematidae* is represented by the genera *Steinernema* and *Neosteinernema* and *Heterorhabditidae* is represented by the genus *Heterorhabditis*. They are associated with mutualistic bacteria in the genus *Xenorhabdus* for *Steinernema* and *Photorhabdus* for *Heterorhabditis*. Thus, it is a nematode bacterium complex that works together as a biological control unit to kill an insect host by penetrating the host through natural opening and there by releasing the bacterial symbiont which spread and multiply in the haemolymph of the insect pest and kill them by septicemia. In developing biocontrol programs using EPNs, one mechanism to increase the chance of success is to screen novel nematode species or strains for potential efficacy against particular target pests.

**Key words:** Entomopathogenic nematodes (EPNs), Bacteria, Insect pest, biological control

### **Water resource conservation practices in hills of Uttarakhand: women's perspective**

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Women, the pillar of hill economy in Uttarakhand has a significant contribution in the development of hill agriculture. The male force is generally out of home/state for the sake of earning livelihood. In those cases, it is the women, who have to take the whole sole responsibility of her home, her farm as well as her children. By this way, she is the only person who has to take care of her agricultural farms as well as natural resources like water which is to be used for farming activities. The water resource naturally appears in the hills through streams/springs is slowly and slowly moving toward scarcity which would have negative



impact on hill agriculture and as a result on the survival of the hilly people. The natural water resources have been termed as lifeline of mountainous ecosystem. This lifeline is to be restored/ rejuvenated for environment and economic sustainability in the hilly areas. So, in this research work, role of women in water resource management was assessed. The study was conducted in the Jaunsar region of Kalsi block, Dehradun in Uttarakhand. Total 200 respondents were selected for interview session. The results indicated that majority of the women (91%) were doing afforestation activities followed by digging of *kachcha* pond to harvest rain water.

**Key words:** Management, Scarcity, Springs, Water resource

### **Effect of Chelating Agents Application in Soil With Excess Zinc on Growth And Biochemical Constituents of *Trigonella*.**

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A clay pot experiment was conducted on remediation of contaminated soil with applications of chelating agents (EDTA and Citric acid) individually and in combination to overcome its toxicity effects on growing *Trigonella* plants. The soil was alluvial (sandy loam, mild calcareous, low organic matter <0.3%), amended with ZnSO<sub>4</sub> (300 mg kg<sup>-1</sup> of soil). *Trigonella foenum-graecum* L. plants were sown in Zn- contaminated soil and supplied with EDTA (10 μM) and Citric acid (10 μM), singly or in combination, once in a month. At interval of 30, 50 and 70 days of sowing plants were observed for growth parameters (shoot length and dry weight) and at day 50 some biochemical constituents such as pigments (chlorophyll a, chlorophyll b, total chlorophyll and carotenoids contents), activities of catalase and peroxidase enzymes, proline and protein contents determined. The application of chelants EDTA and Citric acid in combination inhibited pigments, protein and proline contents. The single application of EDTA enhanced increased protein, proline contents and activity of catalase and peroxidase in *Trigonella foenum-graecum* leaves. The increased activity of antioxidants (carotenoids, proline and protein contents and activity of catalase and peroxidase indicated more Zn uptake in *T. foenum-graecum* in response to application of the EDTA in Zn- contaminated soil.

**Keywords:** Zinc- contaminated soil, chelants, *Trigonella foenum-graecum*, EDTA, Citric acid, antioxidant.

### **Vegetative Growth of Marigold (*Tagetes erecta* L.) under Shade net house as Influenced by Rooting Media**

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Marigold is one of the easiest annual flowers to cultivate, having wide adaptability. Flowers are attractive and having good keeping quality. They produce marketable flowers in a short time and are used widely for religious and social functions as well as grown in gardens and pots for display purpose. Marigolds are sold as loose flowers, as cut flowers. In fact, marigolds rank next only to jasmine in popularity in south india. African marigold (*Tagetes erecta* L.) are tall, vigorous growing plants (up to 90 cm). A higher number of roots were seen in terminal cuttings of marigold than in case of seed propagation of marigold. Similarly, increased number of branches, leaves per plant, plant height, size of bloom than those plants propagated sexually. An experiment was carried out at College of Horticulture, Venkataramannagudem, in factorial concept with two factors *i.e.*, varieties at two levels and rooting media at eight levels thus making 16 combinations which were replicated twice. The effect of varieties, rooting media and their interactions were found to be significant on different vegetative parameters under study.

**Keywords:** wide adaptability, tall, loose flowers, vegetative.





## Phytoremediation – A Review

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In modern era, increasing population and deficiency in basic resources leads human towards the more destruction and contamination of environment. While the green revolution resulted in the development of new cultivars of crops suited to high input of fertilizer and water, many regions of the world rely on contaminated soils utilized for food production. To minimize the gap between available resources and needed resources some preventive steps are much needed. Nowadays people are more concern about soil, water, air or any other natural resource. As we all know that India is basically dependent on farmers and farming. Due to heavy use of chemical molecules: it may be fertilizers, pesticides, weedicides or genetically modified plants agricultural soils are contaminated with heavy metals. Furthermore, increasing amounts of urban and industrial wastes which may contain also significant quantities of toxic metals are being disposed on the agricultural lands. Heavy metal contaminated soil causes many human diseases as well as deforms the environmental structure. Severe toxic metal contamination of soil may cause a variety of problems, including the reduction of crop yield, serious damage of plants and intoxication of animals and humans. Pollutant clean-up using conventional methods are often hampered by high cost and ineffective pollutant removal. Phytoremediation is a sustainable, cheap and eco- friendly approach to lower the contamination of soil and reclaim its natural fertility and productivity. Phytoremediation consists in the use of the green plants to remove the pollutants from the environment or to reduce their toxicity. Plants through several natural, biophysical and biochemical processes, such as adsorption, transport and translocation, hyper-accumulation or transformation and mineralization, can remediate pollutants.

**Keyword:** Soil contamination, Phytoremediation, heavy metal.

## Precision phenotyping of contrasting potato (*Solanum tuberosum* L.) varieties in a novel aeroponics system for improving nitrogen use efficiency: in search of key traits and genes

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With increasing population, degrading soil health, limited arable land area, and high cost of nitrogen (N) fertilizers, improving nitrogen use efficiency (NUE) of potato is an inevitable approach to save the environment and achieve sufficient tuber yields with less N fertilizer supply. Recently, we have developed an aeroponics system to study NUE in potato applying integrated genomics, physiology, and breeding approaches. This study aims on precision phenotyping of plants of two distinct potato varieties (Kufri Gaurav, N efficient; Kufri Jyoti, N inefficient) in the novel aeroponics system. Plants were grown in aeroponics under controlled conditions with low N (0.75 mmol L<sup>-1</sup> NO<sub>3</sub><sup>-</sup>) and high N (7.5 mmol L<sup>-1</sup> NO<sub>3</sub><sup>-</sup>) levels. Plant biomass, root traits, total chlorophyll content, and plant N were increased with increasing N supply, whereas higher NUE parameters namely NUE, agronomic NUE (AgNUE), N uptake efficiency (NUpE), harvest index (HI), and N harvest index (NHI) were observed at low N. An NUE efficient cv. Kufri Gaurav showed higher tuber dry weight, fresh tuber yield, tuber number per plant, early start of tuber harvesting, root traits, stolon traits, NUE parameters, and higher amino acids (aspartic acid and asparagine) content at low N supply. Higher expression of nitrate reductase (NR), nitrite reductase (NIR), and asparagine synthetase (AS) genes was observed in the leaf tissues of Kufri Gaurav at high N. Thus, aeroponics-based precision phenotyping enables identification of NUE efficient genotypes based on key traits and genes involved in improving NUE in potato. Further, this study suggests that the potential of aeroponics can be utilized to investigate N biology in potato under different N regimes.

**Key words:** Precision, phenotyping, aeroponics



## Efficacy of Integrated Nutrient Sources on macronutrient status of soil under Cauliflower

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The present investigation was carried out with cauliflower (*Brassica oleracea* var. *botrytis* L.) cv. Pusa Snowball K-1 at the Experimental Farm of Department of Soil Science and Water Management, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2014-15 and 2015-16. The experiment was laid out in a randomized complete block design with three replications comprising seven treatments viz. T<sub>1</sub> (100% NPK + FYM), T<sub>2</sub> (100% NPK + FYM + PGPR), T<sub>3</sub> (100% NPK + 50% FYM and 50% VC on N equivalence basis + PGPR), T<sub>4</sub> (75% NPK + 50% FYM and 50% VC on N equivalence basis), T<sub>5</sub> (75% NPK + 50% FYM and 50% VC on N equivalence basis + PGPR), T<sub>6</sub> (50% NPK + 50% FYM and 50% VC on N equivalence basis) and T<sub>7</sub> (50% NPK + 50% FYM and 50% VC on N equivalence basis + PGPR). Pooled analysis of data showed that effect of different inorganic and organic treatments was significant and the pattern was similar to both the years of study. There were significant variations in the available N, P and K status of soil after crop harvest among different treatments. Maximum available N, P and K content in soil was recorded under the treatment T<sub>3</sub> (100% NPK + 50% FYM + 50% VC on N equivalence basis + PGPR) which indicated that available N, P and K increased by 33.99%, 42.88% and 30.54% over the values recorded before execution of experiment, respectively. Effect of different organic and inorganic nutrients with bacterial inoculation on exchangeable Ca, Mg and SO<sub>4</sub><sup>2-</sup> S were noted to be significant and highest exchangeable Ca, Mg and SO<sub>4</sub><sup>2-</sup> S status was recorded under T<sub>3</sub> which was found statistically at par with treatment T<sub>5</sub>.

**Keywords:** Organic and inorganic nutrient sources, macro nutrients, cauliflower

## Comparison of Antioxidant potential of two edible aroids, Elephant foot yam (Zimmikand) and Giant taro (Gandiali)

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Edible aroids (members of the family *Araceae*) considered among the world's most ancient food crops that are also known for their medicinal properties. The edible aroids have many medicinal uses like they have anti-bacterial activity, antioxidant activity, gastro-protective activity, analgesic activity, anti-helminthic activity, anti-inflammatory activity, anti-tumor activity, anticonvulsant activity, anti-diarrheal activity. In the present investigation we investigated the antioxidant potential of the two edible aroids viz., *Alocasia* Spp. (Giant taro) and *Amorphophallus* Spp. (Elephant foot yam). The Giant taro was found to be significantly rich in antioxidants than the Elephant foot yam. The giant taro shows the 13.51% higher DPPH radical scavenging activity than the elephant foot yam, the total phenolic content and the total flavonoid content of giant taro was respectively 2.6 and 9.57 times higher than elephant foot yam. Whereas, the ascorbic acid of giant taro was found to be 1.71 times higher than elephant foot yam.

## Changes in soil biological activities with application of green manure and bioinoculants in kharif maize

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Soil serves as a dynamic, non-renewable resource that directly influences production ability and environmental balance. The intensive agricultural practices had negatively affected soil in terms of quality, structure and biological equilibrium. To



diminish these harmful ecological impacts, organic farming can serve as an alternate approach which is based on the concept of sustainable agricultural productivity while improving farmer's profitability as well as soil health to the possible extent. So, the present investigation was carried out for two years to evaluate the changes in soil biological properties of maize rhizosphere with application of different combinations of green manure, cellulose degrading bioinoculant and inorganic nitrogen. The soil samples were collected from various treatments to enumerate microbial flora and soil enzymatic activities at different growth stages of the maize crop. The data analysis showed that total bacteria, fungi and diazotrophs increased significantly with combined application of cellulose degrading bioinoculant, green manure and 100% nitrogen as compared to treatments having sole application of inorganic nitrogen. However, application of sole inorganic fertilizer supported the growth of slow growing actinomycetes population towards the harvest of the crop. Application of cellulose degrading bioinoculant + green manure + 100% nitrogen increased dehydrogenase, alkaline phosphatase and urease activity over the treatment having 100% recommended nitrogen. The different microbial populations (except actinomycetes) were found in positive correlation with soil enzymatic activities, indicating beneficial impact of increased microbial number on activities of enzymes involved in nutrient transformation reactions. It was concluded that continuous application of cellulose degrading bioinoculant along with green manure and inorganic nitrogen could improve the soil biological health and fertility in sustainable manner.

**Keywords:** Bioinoculant, Correlation, Green manure, kharif, Maize, Soil enzymatic activities

### **An overview of antioxidant properties of citrus fruits**

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Citrus is manifested for its nutrition and health build-up characters. In recent years, the performance of antioxidants in the prevention and treatment of numerous human chronic and degenerative diseases have attracted much attention towards citrus fruits because they are proposed to be a great source of dietary antioxidants. Phenolic acids show strong antioxidant properties through the dehydrogenation of hydroxyl groups and the effect of ortho-substitution on a benzene ring. The total content of citrus phenolic acids ranged from 180 mg/g DW in flesh of grapefruits to 5060 mg/g DW in peel of Ponkan mandarins. Limonoids are a group of highly oxygenated, tetracyclic triterpene secondary metabolite derivatives which range from 0 to 95.46 mg/100 g DW in citrus fruits. Flavonoids have a direct role in scavenging reactive oxygen species, which can counteract lipid oxidation *in vitro* and improve the body's antioxidant enzyme activity, and decrease peroxide formation *in vivo*. They are ranging from 0.19 mg/g FW (in mandarins) to 2.4 mg/g FW (in oranges). Pectin, is chemically a polysaccharide, consisting of a linear chain of linked galacturonic acid. Pectin can decrease the blood lipid level and peroxidative status and shows antioxidant activities in kidney toxicity induced by octylphenol. In Citrus fruits, pomelo and lemon usually have a higher pectin content, and their total pectin contents range from 36.0 mg/g DW to 86.4 mg/g DW in the peels. Carotenoids act as modulators of the physical properties of lipid membranes participate in photoprotection and in the light-harvesting complex of the photosynthetic apparatus and play important roles as photoprotectives and scavengers of free radicals and ranging from 0.06 mg/L to 10.02 mg/L in citrus fruits. Generally, mandarin fruits had much higher content of total carotenoid than sweet oranges, lemon, grapefruit, and pummelos.

**Keywords:** citrus; phenolic acids; limonoids; flavonoids; pectin; carotenoids.

### **Residue Dynamics of Imidaclopridin Cabbage and Cauliflower**

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Monitoring of pesticide residues in food for the evaluation of food quality is a prior objective of pesticide research so as



to avoid possible risk to human health. Thus, it is very important to determine the judicious use of pesticides and compliance with the pre harvest interval and maximum residue limit (MRL's). Therefore, CIBRC recommended generating Good Agricultural Practices (GAP) data to evaluate the residue dynamics of a recommended and commonly used insecticide, imidacloprid on cabbage and cauliflower. A supervised field trial was conducted at the experimental farm of the department of Entomology, Dr Y S Parmar, UHF Nauni, Solan (H.P.) following two foliar applications of imidacloprid (Confidor 17.8 SL) @ 25 g.a.i./ha for the fixation of MRL at the national level to safe guard the interest of consumers. Cabbage head and cauliflower curd (1Kg) each were sampled at an interval of 0, 1, 3, 5, 7 and 10 days after second spray application, processed by QuEChERS technique and the imidacloprid residues were estimated on Liquid chromatograph SHIMADZU LC-20AT. Efficiency of the analytical method used was evaluated by conducting recovery studies in the respective crops under investigation by spiking imidacloprid at 0.05, 0.10, 0.25, 0.50 and 1.00 mg kg<sup>-1</sup> in the respective fruits. Recovery of imidacloprid was above 80% in all crops at all the levels of concentration and was in the acceptable range of 70 to 110 per cent. Persistence pattern of the insecticide showed that the average initial deposits of imidacloprid were 0.392 mg kg<sup>-1</sup> in cabbage heads that dissipated to 0.254 and 0.106 mg kg<sup>-1</sup> after 1, and 3 days of spraying, respectively. The residues were found below the limit of determination after 5 days of spraying. In cauliflower curds the initial deposits of imidacloprid were 0.488 mg kg<sup>-1</sup> at the application rate of 25 g a.i. ha<sup>-1</sup> that dissipated to 0.398, 0.296, 0.192 and 0.102 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively. Residues were below the limit of determination (0.05 mg kg<sup>-1</sup>) after 10 days of spray application. The half life period (RL<sub>50</sub>) was found to be 1.6 and 3.2 days, in the respective crops under investigation. Dissipation of this neonicotinoid insecticide followed concentration dependent first order kinetics.

**Keywords:** Imidacloprid; cabbage; cauliflower; residues; persistence studies

### **Paramparagat krishi vikas yojana is programme of new India**

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Paramparagat Krishi Vikas Yojana (PKVY) is one of the schemes under National Mission for Sustainable Agriculture (NMSA) to promote certified organic cultivation in 2 lakh ha covering 10,000 clusters. Financial assistance of Rs 50,000 per ha per farmer is provided in 3 years to develop the organic cluster of 20 ha each and to cover certified area by 2 lakh ha during 2015-16 and 2017-18.

**Keywords:** Paramparagat, krishi, vikas, yojana

### **Agriculture crop residues in management of soil fertility and agriculturally beneficial microbes**

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In India, about 500 million tons (Mt) of agricultural CRs are generated every year. Furthermore, it is assumed that to feed India's future projected population of 1.35 billion in 2025, agricultural production, especially that of rice and wheat (major staple foods), would have to certainly increase by about 25%. In India, the rice-wheat (RW) cropping pattern of the Indo-Gangetic Plains has contributed significantly in the food security. However, viability and sustainability of this unique cropping pattern is at risk due to the decline of soil fertility, over exploitation of natural resources and emerging adverse impacts of climate change. At the same time, high yields of the irrigated RW system have resulted in production of huge quantities of CRs. As a result the practice of rice straw burning at field sites is common in north-western parts of India causing soil nutrient losses and serious air quality problems. Burning of paddy straw emits huge amount of trace gases like carbon dioxide, sulphur oxide, methane, carbon monoxide, nitrogen oxide and large amount of particulate matters, which creates severe human health and environmental problems. In recent years, the magnitude of stubble burning was so high that it received international attention. The National Aeronautics and Space Administration (NASA) released a satellite image showing large number of fires across millions of



hectares of agriculture fields in various major paddy producing states of India i.e., Punjab, Haryana, Uttar Pradesh, etc. Management of rice straw, rather than wheat straw is a serious problem, because there is very little turn-around time between rice harvest and wheat sowing and due to the lack of proper technology for recycling. Among options available to farmers for the crop residue management (including burning), important are baling/removal for use as feed and bedding for animals, in situ incorporation in the soil with tillage, and complete/partial retention on the surface as mulch using zero or reduced tillage systems. Therefore, possible efficient management of CRs, produced every year in huge amount should be addressed on priority basis in major agricultural waste (CRs) producing countries including India. The changes in soil microbial diversity/biomass levels due to soil disturbances may also adversely affect the soil physico-chemical properties, fertility and agro-ecosystem stability. Therefore, it is urgently required to explore the possibility of CRs utilization in benefits of soil/agriculture and environmental sustainability.

**Key words:** Agro-environmental sustainability, ecosystem services, beneficial microbial agents

### **Studies on Germination Performance of *Albizia procera* (Roxb.) Under Nursery Condition**

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The experiment entitled “Studies on germination performance of *Albizia procera* (Roxb.) under nursery condition” was conducted in nursery of the Department of Silviculture and Agroforestry, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan-173230 (HP) during 2017-2018. The seeds were treated with five different presowing treatments, eight different growing medium and three different container type. The experiment was conducted in complete randomized design with three replications. Germination parameters viz., germination value and energy period in *Albizia procera* were significantly influenced by different presowing treatments, growing medium and container type. The best germination value (24.74) and energy period (3.00 days) were recorded in T<sub>1</sub>C<sub>1</sub>M<sub>8</sub> treatment combination (seeds soaked in normal water for 24 hours, raised in polybags of size 23 cm×13 cm and growing medium consisting of soil + vermicompost (1:1)) and least germination value (4.00) and energy period (24.00 days) were recorded in T<sub>5</sub>C<sub>2</sub>M<sub>2</sub> treatment combination (controlled treatment, raised in root trainer of size 150cc and growing medium consisting of sand + soil + vermicompost (1:2:1)).

**Key words:** pre sowing treatments, container type, growing medium, *Albizia procera*

### **Structural similarity searching approach for identifying potent phytochemicals to speed up drug discovery process**

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Natural products are the vast reservoir of chemical structures and important biological functions which are largely unexplored. The drug discovery process is majorly dependent on the identification of new drug entities from diverse pool of natural molecules. For identification of novel scaffolds of natural origin, computer aided drug designing (CADD) strategies play a very important role. We have used structural similarity searching approach (following hypothesis that similar structures possess similar biological activities) to elucidate structure-activity relationship of less explored phytochemical and their unknown pharmacophore. The results from in silico analysis were further validated by *in vitro* and *in vivo* studies. The phytochemicals we study were found to be structurally similar with some common molecules like Fenchone with Camphor (similarity index (SI): 100%), Sabinene with (+)-3-carene, and Protodioscin with lanosteroletc. and were also found to possess many important biological activities like anti-oxidant, anti-microbial and anti-cancer etc. The phytomolecules like p-coumaric acid, naringenin and alpha-lipoic acid were found to possess antidiabetic properties by animal studies. Further molecular docking studies elucidate the potential binding of many of these phytochemicals with different histone deacetylases thus identifying the molecular mechanism for their therapeutic significance. To best of our knowledge such type of studies facilitate the target fishing as well as making the roadmap in drug design and discovery process for identification of novel therapeutics.



## Livestock Management and Its Impact on the Farming Systems of the Mid Hills in Nepal

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Upper Astam (1475 meter elevation) and Bherabari (900 meter elevation) of Dhital VDC, Kaski have similar traditional livestock management system but the population of large livestock used in farming is fairly high in Bherabari (livestock per 0.18 hectare) than in Upper Astam (1 livestock per 0.34 hectare). However the number of small livestock is higher in Upper Astam (1 small livestock per 0.35 hectare) than in Bherabari (1 small livestock per 1.02 hectare). Fluke diseases (Chiso/Mate) and Foot & Mouth disease (khoriyat) are the predominant diseases of live stock in Bherabari whereas Fluke disease, Foot and Mouth disease, Impaction (Bhuri-dhadine) and Babesiosis (Lahumute) diseases badly affect the health of the livestock in Upper Astam. The farm households in Upper Astam derive comparatively less benefit from the use of livestock in its farming system than that in Bherabari. Most of the farm households in both locations are involved in livestock rearing and agricultural practices.

**Key words:** Livestock Management, Impact, Farming System

## Evaluation of apricot cultivars in temperate regions of the north western Himalayas

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Apricot (*Prunus armeniaca* L.) belongs to family Rosaceae mainly grown in the temperate & sub-temperate regions of the world i.e. north western Himalayas, western Tibet, western & central Asia and Europe etc. In India, it is mostly grown in Jammu and Kashmir, Ladakh, Himachal Pradesh, parts of Uttarakhand and North-Eastern hilly regions etc. Apricot varieties with white flesh and sweet kernel are grown up to 3000 m.s.l. while varieties with yellow flesh and bitter kernel requires warm climate and well suited to 1000-1500 m.s.l. Its cultivation requires well drained deep soil with pH 6-8, up to 100 cm annual rainfall, long winter with frost free conditions and warm springs best for fruits set. For Apricot propagation, wild apricot seedlings have been found as good rootstock with smooth union and vigorous scion growth. Wild Peach and Myrobalan plum are also found to be suitable rootstock for dry & high moisture soil conditions respectively. The early cultivars mature within 75 days from full bloom, while the late cultivars require 100-120 days for proper harvest maturity. The study was conducted at horticulture research farm, Dhanda of ICAR-IARI, regional station Shimla-4, Himachal Pradesh during 2016-2019. This study includes evaluation of 20 cultivars viz. EC 233228, New Castle, Suffaida Oblonga, Nari Kinnaur, Moorpark, Charmagaz, Harcot, Apricot 24 (Shimla), St. Ambraise, Nugget, Batti, Kaisha, Cneff-A, CITH Collection, Apricot Seedling (Local), EC 168342, Local Special, CITH-1, Karsog Selection & Himri Selection of apricot. The horticultural traits studied to evaluate these varieties with average values of fresh fruit weight 32.75g & range 9.55-80.25g, fruit length 36.80mm & range 24.00-54.50mm, fruit width 34.67mm & range 21.50-50.00mm, T.S.S 8.91-degree brix & range 13.75-22.45-degree brix and acidity 2.5g/100ml with acid sugar ratio 7.56:1 sugar/acid ratio. The value addition of apricot products will bring a good return to the orchardist. There is ample need of further research & monitoring to achieve the quality apricot productions.

**Keywords:** Temperate; Cultivars; Rootstock; Horticultural traits; Acid Sugar ratio.

## Isolation, Purification and Evaluation of Anxiolytic Principle – Bergenin from *Caesalpinia digyna* Rottler

Roots: An Evidence Based Research

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*Caesalpinia digyna* Rottler (Caesalpinaceae) commonly known as Vakerimul (Hindi), Udakiryaka (Sanskrit) or Teri Pods in English, is a large, perennial, prickly shrub or climber grown in Indian states of Andhra Pradesh, Madhya Pradesh and



Eastern Ghats. Roots of this plant have been used traditionally as astringent, febrifuge and nervine tonic since the ancient times. Traditional literature also reported that in some regions of Burma, root powder of *C. digyna* mixed with water is used as febrifuge, and is said to have soothing effects on the nerves. Based on the facts of traditional uses, the extracts (Petroleum ether, chloroform, ethanol and water) of *C. digyna* roots were evaluated for anxiolytic activity on Laca mice using Elevated plus maze animal experimentation model. The effective extract (ethanol) exhibited anxiolytic effect and the same was processed for column chromatography using bioactivity guided fractionation approach with the view to isolate anxiolytic constituent. The study resulted with the isolation of anxiolytic crystalline compound – bergenin (Trihydroxybenzoic acid glycosides). The dose of bergenin was optimized using EPM. Bergenin exhibited significant anti-anxiety activity at 80 mg/kg, po, which is comparable to that of diazepam (2 mg/kg, po). Further, the biomarker was quantified in the plant using TLC-densitometric analysis. The content of bergenin in *C. digyna* roots was found as 0.589 % w/w.

**Keywords:** *Caesalpinia digyna*, Ancient knowledge, Bergenin, Anxiolytic, Bioactivity guided fractionation, Quantification.

### **Adsorption of methyl isocyanate on pristine, vacancy and $M_4$ ( $M= Fe, Ni$ and $Cu$ ) decorated graphene: A DFT-D study**

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Methyl isocyanate (MIC) is a toxic gas responsible for the Bhopal gas tragedy in 1984. It is used in the manufacture of plastic, polyurethane foam and carbamate pesticides. In this work, DFT studies have been performed to study different modes of adsorption of MIC on graphene, vacancy graphene and  $M_4$  ( $M= Fe, Ni$  and  $Cu$ ) decorated graphene. It has been found that physisorption occurs in case of pristine and vacancy graphene, whereas chemisorption occurs on  $M_4$ -decorated graphene. Strong adsorption on  $M_4$ -graphene and  $M_4$ -vacancy graphene has been proved by the high negative adsorption energy and large charge transfer. Adsorption of MIC is strongest on  $Fe_4$ -decorated graphene. Electron density difference plots of  $M_4$ -graphene/vacancy graphene after adsorption have also been studied. Density of states (DOS) / partial density of states (PDOS) plots before and after adsorption, along with band gap, have also been reported.

**Key words:** Adsorption, methyl isocyanate, pristine, vacancy

### **Biocontrol and root colonization potential of fungal root endophytes against white root rot of apple**

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White root rot caused by *Dematophoranecatrix* Hartig is the most devastating soil borne diseases attacking apple plants worldwide. The disease is prevalent both under nursery and orchard conditions resulted significant yield losses. In Himachal Pradesh alone, the disease results in the losses to the tune of \$1.6 million dollars and may be expected much more in the coming years. The apple seedlings are killed within 3 weeks, whereas adult plants may survive 2 to 3 seasons after infection. Although spectacular progress has been made towards chemical and many others management aspect but they fails to provide complete control of disease. The use of root endophytic microbes in management of soil borne pathogens particularly against root rot of apple is still a new subject and may prove a high priority research for ecofriendly management of this pathogen. Seed treatment followed by soil application with M8 isolate was highly effective exhibited 93.55 per cent disease control. The treatment M1 was next best in order provided 89.25 per cent control of disease. Similarly, under field conditions, the overall maximum per cent disease control was exhibited by M8 (84.95%). The treatment M1 was the next best in order, and provided 81.72 per cent disease control. These six most promising root endophytes were identified by ITS gene sequencing. To test the ability of root endophytes to colonize, interact, and established in the inner environment of host plant, root colonization assay was performed with six most promising fungal root endophytes which revealed maximum colonizing behaviour of successful colonization. In case of



seedlings treated with fungal root endophytes, maximum endosphere and rhizosphere count was recorded with *Crinipellistabtim* strain M8. Additionally, confocal microscopic images of transverse sections of root cells colonized by promising fungal root endophytes varied to a greater extent. Thus, abundant tissue colonization by root endophytes as compared to untreated control suggested the establishment and persistence of inoculated strains in endosphere of apple seedlings. These findings are the first documentation of non-targeted colonization of apple roots by fungal root endophytes and suggested them as an alternative approach against most devastating white root rot pathogen.

### **Isolation, Screening and Characterization of Methanotrophs from rhizosphere of paddy crop**

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Methanotrophs are bacteria that are capable of utilizing methane as their sole source of carbon and energy. These bacteria are subsets of methylotrophs and are also known as methane oxidizing bacteria. The flooding water condition in rice crop creates an ideal environment for methanogens, which produce methane gas. Regulation of this methane gas in rice crop is necessary as methane being green house gas affects environment in negative way. Methanotrophic bacteria are promising solution to mitigate the emissions of methane from flooded rice fields. These bacteria utilize methane gas before its release to atmosphere. A total of twenty methanotrophic bacteria were isolated from rhizospheric soil of paddy crop. Biochemical characterization of these isolates revealed that all the isolates were oxidase and catalase positive; and most of them were able to solubilize starch. All the isolates were able to fix atmospheric nitrogen and were also able to produce plant growth hormone i.e. Indole Acetic Acid. Out of twenty isolates, seventeen isolates were able to solubilize phosphorous, five were able to tolerate 60°C temperature, nine were able to utilize cellulose and five were able to solubilize zinc. The presence of plant growth promoting traits in these methanotrophic bacteria in addition to their ability to oxidize methane shows the importance of these bacteria for their use as microbial inoculants. Among the twenty isolates, three best methanotrophic bacteria (based on their functional activities) were evaluated for their biofertilizer potential using rice as host. The application of methanotrophic bacteria as bio-inoculant resulted in improved soil biological and physico-chemical properties along with the promotion of plant growth. The identification of these bacteria using 16s rDNA technique reveals the presence of *Oceanobacillusjeddahense*, *Arthrobacter sp.*, *Pseudomonas tolaasii*, *Stenotrophomonasmaltophilia*, *Serratiamarcescens*, *Bacillus pumilus*, *Paracoccusacridae*, *Uncultured bacterium*, *Pseudomonas savastanoii* and *Prolinoborusfasiculus*.

**Keywords:** Biofertilizers, Functional characterization, Methanotrophs, Rice crop

### **A comparative analysis of phytochemical profile of stem, bark and pods of *Moringa oleifera*.**

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*Moringaoleifera* also known as drumstick tree, Mother's best friend, Miracle vegetable, swanjana, etc., is a tree which can grow in any climate. Each and every part of the plant possesses several beneficial compounds like phenols, flavonoids, glucosinolates, isothiocyanates, simple sugars, antioxidants, etc. Due to the presence of these compounds, this plant shows various biological activities but it is yet to draw the attention for its use in agriculture. Keeping all these in mind it was thought of interest to investigate stem, bark and pods of *Moringaoleifera* for determination of its bioactive components as well as their efficacy for antifungal activity and nutritional potential. From the study, it was found that stem of *Moringaoleifera* contains four compounds namely cholest-5-en-3-ol, stigmaterol, gamma-sitosterol, and tricosanoic acid while its bark contains three compounds namely, 2,11-dihydroxy-12-methoxylactone, xylitol and beta-sitosterol. Pods of *Moringaoleifera* were found to contain five compounds, viz, 22-tritetracontanone, 1-octacosanol, Methyl tetratriacontanoate, Hexadecane and  $\beta$ -sitosterol. Total phenolics content was found to be maximum in acetone fraction while flavonoids content was found to be maximum in ethyl acetate fraction.





Antioxidant activity was found to be maximum in acetone fraction whereas antifungal activity was found to be higher against *Rhizoctoniasolani* than *Fusarium*.

### **Different Techniques of Weather Forecasting-A Theoretical Study**

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Weather plays an important role in agricultural production. It has a profound influence on the growth, development and yields of a crop, incidence of pests and diseases, water needs and fertilizer requirements in terms of differences in nutrient mobilization due to water stresses and timeliness and effectiveness of prophylactic and cultural operations on crops. The quality of crop produce during movement from field to storage and transport to market depends on weather. Bad weather may affect the quality of produce during transport and viability and vigour of seeds and planting material during storage. Weather forecasting is defined as prediction of the state of the atmosphere for a given location by technology. Weather forecasts are important because they are issued to protect life and property, to save crops and to tell us what to expect in our atmospheric environment. Occurrences of erratic weather are beyond human control. However, it is possible to adapt to or mitigate the effects of adverse weather if a forecast of the expected weather can be had in time. In the case of weather forecasts which relate to water usage in agriculture, forecasts of both precipitation amount (P) and evapotranspiration (E) are relevant, the latter being dependent upon forecasts of air temperature, humidity, surface solar radiation intensity and wind speed. The predictability of weather conditions varies with time; skilful weather forecasts at daily resolution are possible 10-14 days ahead, depending upon the type of atmospheric circulation regime. Modern-day skilful weather forecasts are based on the numerical weather prediction approach, involving computer-based modelling from a set of initial atmospheric and environmental conditions. These initial conditions are generally determined through an assimilation process which combines both real-time meteorological measurements (in-situ and remotely sensed).

**Key words :** Weather Forecast, Technology, Computer ,Environment

### **Production and Optimization of Enzyme Xylanase from *Aspergillusniger* Isolated from Decaying Litter of Orchha Forest, M.P., India.**

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Litters are the dead organic remains of plants and animals present in natural habitats. Litters are attacked by soil micro-organisms and convert complex organic matter into simple organic and inorganic compounds. Present study has been undertaken with a view to understand the biochemistry involved in the decomposition process occurring in the Orchha forest range of Madhya Pradesh. For this degrading samples have been collected from the forest range and in all 16 fungal genera have been isolated from collected samples. All the identified strains have been subjected to test xylanolytic activity. Fungus *Aspergillusniger* has been found to have xylanolytic activity. Then after the growth parameters such as incubation period, temperature, pH, carbon and nitrogen sources have been optimized for optimum growth condition for maximum enzyme production under liquid state fermentation (LSF). In the present study, two substrates wheat bran and corn cobs (Powdered) have been used. Maximum xylanase production was observed 168 hrs & 216 hrs of incubation, 4 mg/ml & 20 mg/ml of substrate, 0.3 mg/ml & 0.5 mg/ml of peptone, 0.8 mg/ml & 0.9 mg/ml of yeast extract for wheat bran and corn cobs respectively. The optimum temperature and pH for each substrate was 30°C and 5.5. Enzyme activity was also optimized for certain parameters such as incubation period, temperature, pH and substrate (Oat spelt xylan) concentration.

**Keywords:** *Aspergillusniger*, Optimization, Litter, Liquid state fermentation.



## Improving Soil Health for Sustainable Crop production

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Soil is a critically important component of the earth's biosphere, functioning not only in the production of food and fiber but also in the maintenance of worldwide environmental quality. But Soil health is degrading day by day due to intensive agriculture practices and overexploitation. This reduction in soil health is due to the diversion of land and water to infrastructural activities (industry, urbanization) and ever increasing population forced us to produce more and more from shrinking natural resources. Also as a result of increasing demand for quality food production, natural land covers particularly tropical forests is being converted to cropland at an alarming rate which in turn deteriorate the soil quality. This decline in soil environment quality threatens the food production and decline in yield has been observed in many cropping systems in many parts of the country. Major factors leading to yield decline are due to soil erosion, imbalanced nutrient use, soil structure deterioration and suboptimal addition of inorganic fertilizers to soil etc. Thus, it is now a need of the hour to make Indian farmer's aware of the soil health. The terms soil health/ soil quality are interchangeable. The concept of soil quality emerged in the literature in the early 1990's and centers on the capacity of a specific kind of soil to function within natural ecosystem boundaries to sustain plant and animal productivity, maintain water and air quality and support human health and habitation. It also provides us understanding of how soils respond to agricultural practices over time. Several schemes have been started such as soil health card to make farmer know the nutritional status of the soil. Other practices contributing to soil health improvement are use of cover crops, carbon sequestration, crop diversification, STRC approach, conservation agriculture and integrated nutrient management system. Hence soil resources are truly living bodies with biological, chemical, physical properties and processes performing essential ecosystem services and these must be conserved and improved by adopting appropriate technologies.

**Keywords:** Soil Health, Intensive Agriculture, Production, Cover crops, Carbon Sequestration, Conservation Agriculture.

## Molecular characterization of the virus causing severe leaf curl and stunting in Punjab

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Chilli (*Capsicum annum* L.) is one of the economically important spice and vegetable crops grown in India. This crop suffers a great loss due to the infection of viruses. Begomoviruses are major constraint in the production of chilli in Indian subcontinent. The objective of this study is to identify the begomovirus species causing severe leaf curl and stunting of chilli in Punjab. During surveys conducted near Jalandhar region of Punjab, these symptoms were observed in major chilli growing fields. In most cases the whole field was found to be infected leading to very low productivity. Infected leaf samples showing curling and retarded growth were collected and analyzed for begomovirus infection using begomovirus specific primers (PAL1v1978 & PAR1c496; Rojas et. al. 1993) through polymerase chain reaction (PCR). This primer pair gives approximately 1.3kb amplicon of DNA-A of bipartite begomoviruses or the single component of monopartite begomoviruses. Expected sized amplification was obtained in PCR. Amplified product was purified using Wizard SV Gel and PCR Clean-Up System (Promega, USA). The purified product was directly sequenced using ABI PRISM<sup>®</sup> 3130xl Genetic Analyzer (Applied Biosystems, USA). The obtained sequence was analyzed using nucleotide BLAST. It shared maximum identity of 89.66% with pepper leaf curl virus isolate Mirzapur (GenBank accession no. JN201335.1). Latest demarcation threshold for different begomovirus species after genome-wide pairwise identity is 91 % (Brown et. al. 2015). The obtained results suggest that the present begomovirus might be a distinct species. Cloning of complete genome of the virus and its sequencing is in progress.

**Keywords:** -*Begomovirus*, PCR, Monopartite, Bipartite, Sequencing, distinct species



### Threats of Abiotic stresses on Cereal crops

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Abiotic stress is the negative impact of non living factors on the living organism in a specific environment. The main abiotic stresses affecting the major cereal crops are temperature, moisture and salinity. Abiotic stresses which causes more than 60% losses in crop productivity are the major concern for food and nutritional security of additional 0.4 billion Indians by 2050. These Abiotic stresses causes more than 40% losses in cereal crops in India. These stresses cause germplasm extinction, frost injury, insect-pest attack, degrading food quality in crop cultivation. High temperature affects vegetative growth, flowering, crop yield and causes metabolism imbalance in plants. Moisture stress have an adverse effect on the growth, photosynthesis, carbohydrate and nitrogen metabolism. Due to moisture stress at the reproductive stage there is 60-70% reduction in yield in maize crop and 40-80% reduction in yield in rice crop. Both drought and waterlogging are water stresses which results in lower production. Thus, thorough understanding of adverse influence of abiotic stresses on different crop species is imperative for devising innovative agronomic practices for overcoming the adverse impacts. Timely intervention with appropriate adaptation strategies would help in realizing sustainable yields. Practices such as irrigation at critical stages, mulching, selection of variety tolerant to stress conditions, use of growth regulators, anti transpirants, amendments and nutrient management are required to alleviate the adverse effects. The advanced irrigation like micro-irrigation, partial root zone drying (PRD) are another option under limited water conditions. The inclusion of stress tolerant crops or varieties and adoption of desirable genes in the crop plant would further enable the farmers to overcome adverse effects of abiotic stresses. Integration of all the available adoption options would be the most effective approach in sustaining the production and productivity of cereal crops under abiotic stress conditions.

**Keywords:** Cereal Crops, Abiotic Stress, Metabolism, Partial Root Zone Drying, Management

### Diversity and distribution pattern of tree communities in different forests of Hamirpur district, Himachal Pradesh, North Western Himalaya

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Shivalik hills of the Himachal Pradesh is bestowed with divine floral and faunal wealth. Forests of these hills provide life support not only to the people of Himachal Pradesh but also to those in the plains. Present study has been conducted in the Hamirpur district of Himachal Pradesh to evaluate the diversity and distribution of vegetation in different forest types. Twenty seven sites were sampled and surveyed between 472-1016m asml in different habitats, vegetation type, geo coordinates, aspect and slope. Survey was done between 2015-2017. Standard ecological methods were followed for data compilation and evaluation. Tree communities were identified based on IVI (Important value Index). Maximum sites were represented by *Pinus roxburghii* community followed by *Acacia catechu* community. Species richness was found maximum in *Pinus roxburghii* community followed by *Acacia catechu* community. Total tree density varies from 350.00-1090 Ind/ha. Shrub density ranged from 1240 Ind/ha-2245.00 Ind/ha. Herb density varies from 7.77- 124.583 Ind/m<sup>2</sup>. Species diversity (H') ranged from 0.36-1.33. Concentration of dominance (Cd) ranged from 0.345- 0.80. There is a plethora of biological invasions across the Shivalik hills due to which forest ecosystems here is highly degraded. Risk is not only restricted to biodiversity loss, as invasive alien species also threaten the environment, economies, and human welfare. Underground vegetation is replaced by invasive species at greater extend. *Lantana camara*, *Bidens pilosa*, *Parthenium haustorium*, *Eupatorium odoratum* etc. are some of the



highly reported invasive species which replaced the native flora. Continuing resource degradation in the mountains has led to a demand of growing concern and a sense of urgency in the context of seeking strategies, which can ensure the sustainability management and conservation of forests. Sites with and without invasion species need to be monitored continuously to suggest suitable management plans.

**Keywords:** Shivalik, Invasive, IVI, Monitoring, Management, Density, TBA,

### **Sesame Phyllody Disease: Its Symptomatology, Etiology, And transmission in Madhya Pradesh (India)**

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Phyllody is a serious disease of sesame in India. In the present study investigations were carried out on the symptomatology, etiology, and transmission of this disease. Roving survey conducted during *khari* 2018 at Tikamgarh and Chhatarpur district, indicated that phyllody incidence ranging from 2.64 per cent in Tikamgarh district to maximum of 9.02 per cent in Chhatarpur district. The average maximum per cent disease incidence of 6.16 per cent was recorded in Chhatarpur district and minimum incidence of 5.12 per cent disease was recorded in Tikamgarh district. During the survey the major symptoms of the disease are phyllody, witch's broom, floral virescence, thickening of veins, twisting of stem, deformation of capsule, severe reduction in leaf size, early drying of the plant were noticed. Under severe condition cracking of seed capsule, germination of seeds within capsule, and floral malformation like abnormal green structures in place of normal flowers were also noticed. The phytoplasma successfully transmitted through side grafting from donor sesame to healthy sesame and produced typical phyllody symptoms within 35-40 days. Sesame phyllody was successfully transmitted from sesame to sesame by grafting. The phytoplasma causing the sesame phyllody disease had a limited host range and it was transmitted to sesame by leaf hopper and to periwinkle by grafting. The phytoplasma produced phyllody on sesame and floral virescence and little leaf on periwinkle. Transmission of phytoplasmas from naturally infected plant host species using the parasitic plant *Cuscuta* spp. (dodder) The sesame phyllody phytoplasma was also successfully transmitted by dodder.

**Key words:** *Sesamum indicum*, phyllody, symptomatology, etiology, transmission, India

### **Screening of sesame germplasm against the root and stem rot (*Macrophomina phaseolina*) infection under natural condition**

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Sesame (*Sesamum indicum* L.) is an ancient oilseed crops cultivated in semi-arid Tropics and sub tropics regions in India. It play an important role in the oilseed economy throughout the world. The fungal disease root and stem rot caused by *M. phaseolina* (Tassi) Goid is the most important disease and is widely, distributed in sesame growing region. The pathogen attacks plant at all growth stages. Due to soil borne nature practically no effective field control and no source of resistant is available. Screening of 200 sesame germplasm lines during the year *khari* 2017 at research farm of PC unit., JNKVV, Jabalpur under natural condition against root and stem rot disease incidence. It is revealed that eight germplasm lines viz; ES-62, SI-2116, EC-310421, S-0335, S-0448, KIS-375-1, IC-131448 were found resistant (disease scale 1), one hundred and Thirteen germplasm lines viz IS-665, SI-1679, EC-334995, IS-722, KIS-398, IS-728, SI-49, NIC-905, EC-334995, IS-722-2-84, IS-461-1-84-1, NIC-163-83, S-0308, GRT-83135, IC-14093, S-0434, MT-67-61, IS-309, KMS-322-1, NIC-9839-1, ES-48, NIC-10622, ES-249, NIC-16347, NIC-16324, were found moderately resistant (disease scale 2) Sixty five germplasm lines showed moderately susceptible; (disease scale 3) nine germplasm were susceptible IS-321, ES-334997, S-0439, IS-649, S-0130, NIC-16129, S-0579,



IS-653, S-0430 (disease scale 4) and five germplasm lines were highly susceptible ES-75-2-84, ES-33497, MIC-8526, NIC-7913, TS-261 (disease scale 5).

### **Triple Layer Storage Bags for Control of Aflatoxin Accumulation in Dry Chillies**

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With respect to aflatoxin accumulation, the initial aflatoxin content recorded was 0 ppb. Among different types of storage bags, there is no aflatoxin accumulation was recorded in triple layer plastic bag (0 ppb) and jute bag treated with fungicide (0 ppb). The maximum aflatoxin accumulation was recorded in jute bag (4 ppb). Triple layer plastic bag (0 ppb) and jute bag treated with fungicide (0 ppb) were at par and recorded no aflatoxin accumulation. Among different set of storage periods such as 2, 4 and 6 months, the minimum aflatoxin accumulation was recorded in the 2 months storage period (1.25 ppb) followed by the 4 months storage period (1.75 ppb). The maximum aflatoxin accumulation was recorded in 6 months storage period (2.25 ppb). All the storage periods were significantly different ( $P < 0.001$ ) with each other. Aflatoxin accumulation observed in triple layer plastic bag and jute bag treated with fungicide was nil compared to other bags in the study. This could be due to increased levels of CO<sub>2</sub>, reduced levels of O<sub>2</sub> and less fungus activity inside the bags which are detrimental to the fungal growth and aflatoxin production. But considerable amounts of aflatoxin content were observed in chillies stored in jute bag (4.0 ppb) and polythene bag (3.0 ppb). This clearly indicates that the free circulation of air, moisture content along with relative humidity and temperature plays an important role in molds fungi growth and aflatoxin production in chilli storage. These results are similar with investigations conducted on maize by Udohet *et al.*, (2000), Nesciet *et al.*, (2011), Williams *et al.*, (2014) and Waliyaret *et al.*, (2015).

### **Meeting Nutrient Energy Needs Through Green Manures In Rice Farming Systems**

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Green manures were used as effective sources of plant nutrients in subsistence farming before the chemical era, and considerable advances have been made in recent years in our understanding of various aspects of green manuring. Though green manure is an important component of low input sustainable agriculture, its use has declined even in areas where it was traditionally practiced with pulse crops. Time of incorporation of green manure also determines its effectivity. Nutrient releasing pattern of sesbania indicated that rapid – N present in leaves liberates within two days where as slow-N existed in shoots released later. Non availability of standard seed and its high cost restricted farmer to adopt green manuring in their fields. In future, attention should be paid to identify the niches for green manures on the basis of hydrology, topography and landscape ecology. Screening should be done to evolve multipurpose green manure crops that provide food, forage, fuel and industrial uses.

**Keywords:** Green manures, Rice, Nutrient energy, Sesbania

### **Recent trends in agriculture: vertical farming and organic farming**

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Advancements in the field of science and technology along with the global urbanization are the major factors driving the



course and evolution of agricultural research. Rise in per capita income in developing nations, occupational changes and global linkages have changed the food preferences. These trends along with the increase in population pose a challenge to agriculture for producing more & better food. Increase in the productivity of agriculture by employing techniques of conventional (20th century) agriculture is posing a limitation. The threat to environment, due to dependence on chemical fertilizers and pesticides for increasing productivity and pest management respectively is major constraint affecting the global food production. These trends suggest that new innovations in agriculture are inevitably needed and these innovations should be integrated with the main stream agriculture (the big agriculture as we may call). Vertical farming and organic farming are the research areas to fight these constraints. Vertical farming employs vertical stacking of the farms therefore small land can be utilized for more production. In addition, this technique is well suited for the rapidly growing global urban population as the demands of food supply can be met from within the cities and thus reducing the transportation cost and environment deterioration caused by fuels in the process. Organic farming on the other hand is based on the principles of minimization of the chemical inputs in the agriculture and hence is environment friendly. Thus, these techniques can be utilized for increasing the production and productivity to meet the growing food demands.

**Keywords:** agricultural trends, urban agriculture, vertical farming, organic farming, sustainability, climate change

### **Qualitative Traits Assessment In Chilli (*Capsicum annum L.*) Genotypes Under Southern Telangana Conditions**

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Assessment of qualitative traits for plant breeding programs and conservation reserves are critical to the application of inheritance in chilli. A field experiment was conducted in *Kharif*, 2018 at P.G. research farm, College of Horticulture, Rajendranagar, Hyderabad in randomized block design with three replications using forty genotypes of chilli for 9 characters. Genotypes were sown on rows with the length and spacing 45cm and 60 cm, respectively. Morphological characteristics were evaluated based on NBPGR descriptors. Results revealed that there was high variability amongst genotypes. Purple stem colour and leaf colour was recorded in ST 13874, purple coloured fruits were recorded in ST 13874 and white coloured fruits in ST 13837, 4 genotypes have erect fruits (ST 13874, EC 378688, ST 13837, ST 13875) and one of them has semi pendent fruits (PBC 80). Three genotypes ST 13837, ST 13874 and ST 13875 can be exploited as ornamentals because of their beautiful foliage and fruits characters. Genotypes with desirable characteristics can be identified and used in breeding program for further improvement in traits.

**Key words:** Chilli, Genotypes and Qualitative trait.

### **Bioresources and technologies used for biofuel production**

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Today we greatly relies on Fossil fuels. Today's energy model is based on the extensive utilization of fossil fuels, is affected by economic and environmental problems. So, a new energy model is needed based on greener and renewable energy resources, and cleaner as well as more sustainable fuel technology. Three generation of biofuels, biogas, Syngas, Vegetable oil blend this are first generation biofuels. Second generation biofuels includes bioethanol and biodiesel and third generation biofuel includes micro-



algae based biodiesel production. So as a short term response to the consequences of greenhouse gas emissions and the sustainability of the fossil fuel based energy model, the industry has developed ready to use substitutes for traditional fossil fuels, delivered generally under the commercial 'bio' denomination. In addition, the production techniques rely on high energy inputs, both in feedstock production and in the biofuel synthesis. A great variety of domestic, agricultural and industrial residues, from lignocelluloses forestry and agriculture waste to fatty acid rich waste waters, generated by the dairy, poultry or vegetable oil refinery industries, as well as the sludges from urban waste waters, can be used as precursors of biofuels. Application of these concepts requires a series of technical and biotechnological improvements, such as the optimization of lipids and sugars extraction, feedstock pretreatment processes, biofuels production plant design, alcohol dehydrogenases or hydrolases to increase their activity and reusability, genetic engineering of microbes to facilitate both the pre-treatment of precursors, and the synthesis and purification of the biofuels. Key words : Fossil fuels, Biofuel, Renewable resources, Sustainable fuel technolog

### **Resilience of Avishaan sheep in hot semi-arid tropics under limiting nutritional condition**

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Shortage of feed and fodder is a major constraint in sheep rearing during summer and winter in hot semi-arid tropics of India. However, a prolific sheep, Avishaan (12.5% Garole, 37.5% Malpura, 50% Patanwadi) has been developed in the hot semi-arid region by introgression of fecundity gene (Fec B) originated from the hot-humid region into native adapted sheep of the hot-semi-arid region to increase the farmer's income. Sixteen native adapted (Malpura) and sixteen Avishaan rams were selected and equally divided into four groups viz native control (M), native nutritional stress (MS), Avishaan control (A) and Avishaan nutritional stress (AS). The rams of M and A group were offered with their maintenance requirements as per ICAR (2013) recommendation. The rams of MS and AS were offered with 30% less than their maintenance requirements to mimic the nutritional scarcity. The bodyweight of AS decreased significantly ( $P < 0.05$ ). The plasma glucose, thyroxine, and cortisol level reduced significantly ( $P < 0.05$ ) under nutritional shortage in both the breeds. The dearth of nutrition significantly ( $P < 0.05$ ) reduced sperm motility and viability in AS rams within the acceptable limit. The negligible variation in blood biochemical's and satisfactory semen quality attributes of the experimental rams reflected that the Avishaan is resilient to hot semi-arid tropics under limited nutritional availability and can be an important contributor of livelihood security in this region.

**Keywords:** Adaptation, Avishaan, nutrition, stress, semi-arid.

### **Effect of Sb additive on electrical properties of Se-Te glassy alloys**

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The present paper reports the dc conductivity measurements up to 100V for pellets of  $\text{Te}_{15}(\text{Se}_{100-x}\text{Sb}_x)_{85}$  ( $x=0, 1, 2, 3, 4$  at.%) glassy alloys, prepared by melt quenching technique, at room temperature and higher temperature range (298-338K). The samples obey Ohm's law in the lower (0-25V) voltage range whereas the behaviour in the higher (25-100V) voltage range is non-ohmic. The dc conductivity is calculated from the I-V characteristics curves of the pellets of bulk samples. The increase in dc conductivity is probably due to increase in Se-Sb bond concentration in the Se-Te-Sb glassy alloys on Sb addition. The plots of  $\ln(I/V)$  versus  $V$  are straight lines for all the samples at all the temperatures suggesting space charge limited conduction, SCLC, mechanism in the samples. DOS has been calculated using SCLC. The calculated values of DOS are found to increase with Sb addition. Sb, being less electronegative (2.05) than Se (2.4), increases the concentration of positively charged defects which further increases the DOS.

**Key words:** Chalcogenide glasses, Space Charge Limited Conduction, localized states, Density of States



## Macrofungi as nanoparticle factories: oyster mushroom-derived nanoparticles and their possible applications

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Research and innovation in nanoparticles (NPs) synthesis protocols has led to their production at industrial scale in environmentally-prudent and economically feasible manner. Macro-fungi including diverse mushroom species such as *Agaricus bisporus*, *Pleurotus* spp., *Lentinus*, *Ganoderma* spp., are known to possess high nutritional, immune-modulatory, anti-microbial (anti-bacterial, anti-fungal, and anti-viral), besides anti-oxidant and anti-cancerous properties. These properties of the mushroom extracts can be further improved through biosynthesis of nanoparticles from culture or culture-free extracts of the macro-fungi. Several *Pleurotus* species such as *P. florida*, *P. pulmonaris*, *P. cornucopiae*, *P. ostreatus*, *P. eryngii* have been used for NPs synthesis. These myco-derived NPs can be utilized to enhance the efficiency of drugs to target the effective cells, particularly for the treatment of gastrointestinal and prostate cancer across the globe including Asia (China, Japan) and North America (USA). The *Pleurotus* synthesized metal NPs can inhibit the growth of numerous foodborne bacteria; gram-positive (*Staphylococcus aureus*, *Bacillus cereus*,) and negative bacteria (*Escherichia coli*, *Salmonella typhi*, *Vibrio parahaemolyticus*, *Citrobacter koseri*, *Enterobacter aerogenes*, *Pseudomonas putida*), and fungi (*Candida albicans*, *Colletotrichum gloeosporioides*, *Erythricium salmonicolor*). Similarly, against many cancer cell lines, *Pleurotus florida* gold NPs exhibited high anti-cancer activity. Further, no toxic effect on the application of myco-synthesized NPs was detected in Vero (African green monkey kidney normal cell) cell lines. Thus, biosynthesized NPs obtained from *Pleurotus* can be a sustainable source for the effective treatment of a variety of diseases caused by human pathogens and other chronic disorders.

**Keywords:** *Pleurotus*, Oyster mushroom, Nanoparticles, Antibacterial, Anticancer, Antioxidant

## Food fraud: A world wide food safety crisis

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Food fraud or economically motivated adulteration means deliberate and intentional substitution, addition, tampering, or misrepresentation of food, food ingredients, or food packaging; or false/ misleading statements made about a product, for economic gain. It is illegal duplicity for money-making and emerging ocean of crime directly or indirectly related to our health and ethical values. Food fraud has been conducted since classical times evident by Roman seals on amphorae containing fraudulent olive oil and wine. It is a white-collar crime that is emanating risk both in developed and developing countries. Actors in food fraud can be inside a supply chain, or an external party who uses the original packaging to pack and sell an inferior product to cause a public health risk, and the most common types of food frauds include adulteration, tempering, over-run, theft, diversion, simulation and counterfeit. The various food items which are highly susceptible to food fraud involve oils, milk, and meat products, infant formula, honey, juices, spices, etc. Making milk the second most commonly adulterated food ingredient after olive oil. Enormous incidences are attracting limelight over years and alarming us about frauds in the food sector like melamine contamination in 64 tonnes of raw dairy materials in China, horse meat scandal in Europe, incorporation of animal depot fats and cheaper vegetable fats in Ghee, in India, etc. To mitigate food fraud, recently, a scheme FOSTAC is launched by FSSAI in India which recommends that all licensed food businesses must have at least one trained and certified Food Safety Supervisor. Likewise, FDA, ISO, GFSI, BRC, USDA, etc are also mitigating food frauds globally. Food fraud is a planetary problem so not only government but individually also we need to combat it hand in hand as the food holds the key to a sustainable future.

**Keywords:** Food Fraud, health risk, illegal duplicity, Milk, olive oil, Safety





## Isolation of Mycorrhizal spores from in and around Babina forest, Jhansi (U.P.) India.

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Soil is a habitat of large number of micro-organisms viz bacteria, fungi, actinomycetes, algae and protozoa etc. constituting biotic environment of soil micro-ecosystems. These micro-organisms play important role in numerous physiological activities including biogeochemical cycle for this microbial community forms association with other organisms such as saprophytic, parasitic and symbiotic associations. Some of the soil inhabiting rhizospheric fungi have been found as growth promoting while some are pathogenic. Several soil fungi have been found to have symbiotic association with roots of higher plants which are called as mycorrhizal associations. Mycorrhizal associations in plants are of two types ectomycorrhiza or extra matrical spore and endomycorrhiza. Extra matrical spores of mycorrhiza are quite common and can survive in environment of low fertility, drought, disease and temperature extremes where alone they fail to survive. Present work has been carried out to isolate and identify mycorrhizal spores growing symbiotically with roots of trees in Babina forest range of Jhansi district of Uttar Pradesh. For this surveys have been carried and soil samples have been collected. Using wet sieving method spores have been isolated and identified on the basis of shape, size and colour. Spores belongs to genera are *Acaulospora*, *Glomus*, *Entrophospora*, *Gigaspora* and *Scutellospora* out in different seasons such as winter summer and rainy from December 2017 to November 2018.

## Standardization of Growth And Astaxanthin Content by Continuous Cultivation of The Microalgae *Haematococcus Pluvialis*

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*Haematococcuspluvialis* seems to accumulate the highest level of astaxanthin and is currently the primary industrial source for natural astaxanthin production. Astaxanthin is known as the “king of carotenoids”. The carotenoid pigment astaxanthin is fat-soluble and considered to be one of the most valuable super antioxidant with a wide range of applications in the food colouring agent, feed additives for the poultry and aquaculture industries, cosmetics, pharmaceuticals and nutraceuticals industries and production was estimated at 280 metric tons in 2014. It is a supreme free radical scavenger and restores balance to gene expression and critical nutrient for mitochondria health which potential for promoting human health span because of that it is use for anti-cancer and anti-inflammatory substance that can reduce ageing symptom. Astaxanthin market potential is estimated and production demand shall be increase to 11% to 15% per year globally. With extraordinary potency, cost and increase in demand, astaxanthin is one of the high-value microalgal products of the future globally. In the present study we have standardized various physio-chemical parameters for the large-scale production of astaxanthin by using *H. pluvialis*. Four different media Bold basal media (BBM), Modified bold basal media (MBBM), CFTIR and Fog's media were used to preoptimize conditions to grow *H. pluvialis* to test the production of astaxanthin at different flask level, the maximum culture filtrate yielded 2µg astaxanthin per 1g biomass (dry cell weight) in MBBM at 1 liter's scale at 23°C, pH 6.8, 2000 lux of light intensity and 18:6 (light/dark) period for growth of culture quantify by HPLC analysis. Further, characterization was done by using TLC, UV-Vis spectroscopy and FTIR analysis. The present study showed that the *H. pluvialis* has high potential for industrial production of astaxanthin.

**Keywords:** *Haematococcus pluvialis*; Astaxanthin; Biomass; HPLC; FTIR



## Molecular farming : the new generation of biotechnology

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"Molecular farming" is the production of proteins or other metabolites valuable to medicine or industry in plants traditionally used in an agricultural setting. It harnesses heterologous protein expression systems, such as plants, for the large-scale production of recombinant proteins that are therapeutically valuable. Molecular farming is the production of pharmaceutically important and commercially valuable proteins in plants. This demonstrates the use of transgenic plants as bioreactors for the molecular farming of recombinant therapeutics. Molecular farming has been hailed as the "third wave" of genetically-modified organisms produced through biotechnology for the bio-based economy of the future. Unlike products of the first wave, such as herbicide resistant crop plants, which were perceived to benefit only the farmers who used them and the agrochemical companies who developed them, products of molecular farming are designed specifically for the benefit of the consumer. Such products could be purified from food or non-food organisms for a range of applications in industry, as well as animal and human health other expression systems. Several efficient plant-based expression systems have emerged, and >100 recombinant proteins have now been produced in a range of different species. Cell cultures of transgenic plants, physical containment, dedicated land, plastid transformation, biological confinement, male sterility, gene use restriction technologies (GURTs), expression from or in roots, expression in edible parts and seeds, post-harvest inducible expression, and temporal confinement have been suggested as additional solutions to minimize the risks of Plant Molecular Farming.

**Key words:** Molecular farming, new generation, biotechnology

## Integrated management of plant parasitic nematodes using plant formulations, oil cakes and nematicides affecting Tomato and Capsicum crop in Solan district of Himachal Pradesh

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The mid-hill region of Himachal Pradesh is known for cultivation of tomato and capsicum. Among these, the former one is highly susceptible to *M. incognita*, one of the most commonly occurring nematode species with the widest host range. Capsicum is also infected by this nematode. Both these vegetables are the economic mainstay of the farmers of the mid hill region as the crops cultivated during June to November in this area are marketed as off season vegetable crops in the northern plains and fetch high remuneration to the farmers of the region. Thus, keeping in mind the environmental issues of chemical nematicides, integrated nematode management using plant formulations and organic amendments and confining the use of inorganic molecules to nursery was justifiably tried in these two most commercial crops viz., tomato and capsicum grown in the region. Among the nursery treatments tried against *M. incognita*, all the disinfectants viz. dazomet, formalin, carbofuran barring STTC and seed treatment with formulation of *Pseudomonas fluorescens* were found to be effective as evident from the healthy, ungalled roots and optimum aerial growth. Seedlings from dazomet treated nursery when root dipped in plant formulations (MaxRaze and Max Canon) prior to their transplantation in plots amended with neem or groundnut cake yielded best results in forms of plant growth parameters, fruit yield and reduction in nematode population and galling.

**Keywords:** Dazomet, formalin, *Pseudomonas fluorescens*, STTC, carbofuran, *Meloidogyne incognita*



## Role of vermicompost in the crop production :A review

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Organic compost in general are beneficial to soil fertility when applied to soil at regular interval. Through the vermicomposting many kind of organic waste can be converted into vermicompost. Studies revealed that application of vermicompost in different crops led to an increase in the quantitative characters like yield/ha and size of the fruit etc and qualitative characters like colour, TSS, and carotenoids. Vermicompost also improved the soil structure by improving the amount of NPK in the soil as well as increased the benefit cost ratio because of higher yield and better quality.

**Key words :** Quality, Yield, Vermicompost, Organic

## Biology of Mealy Bug, *Maconellicoccus hirsutus* (Green) on Custard Apple

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Biology of pink mealy bug, *Maconellicoccus hirsutus* (Green) was studied in the Biocontrol Research laboratory, Department of Agricultural Entomology, M. P. K. V., Rahuri, during summer 2019. The results revealed that female had three nymphal instars without any pupal stage, while male had three nymphal instars besides, pre-pupal and pupal stages. The average incubation period, nymphal period and adult longevity for female was 4.1, 20.8 and 8.9 days and for male 3.8, 20.3 and 2.6 days, respectively and thus accounted 33.8 and 26.7 days for total life span of mealy bug. Female showed dynamic patterns of fecundity with the range from 179 to 387, with an average fecundity of 278 eggs. Study also revealed that female showed sexual as well as asexual reproduction whereas, the more number of females emerged than males.

**Keywords:** *Maconellicoccus hirsutus*, biology, adult longevity

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**Keywords:** *Maconellicoccus hirsutus*, biology, adult longevity

## Generating the doubling income of farmers through global gap

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India is the second largest producer of the fruits and vegetables in the world after China. Nothing good this for us! because our export share in the global market is less than 1%; much lesser than small countries, like Thailand and Chile. Why?



Reasons for low export share are lack of confidence in the safety of our fruits and vegetables due to: (1) Unhygienic conditions in the farms. (2) Poor agricultural practices. (3) High pesticides and other chemical residues. (4) Micro-biological contamination. (5) Comparatively poor and inconsistent quality in the produce. (6) Short shelf life. Yet our farmers have no knowledge about how can we produce worldwide quality produce? The world people want qualitative and safely produce. GLOBALGAP (formerly known as EUREPGAP) is a private sector body that sets voluntary certification standards and procedures for good agricultural practices. It was originally created by a group of European supermarket chains. GLOBALGAP aims to increase the consumers' confidence in food safety by developing good agricultural practices which must be adopted by producers. The focus of GLOBALGAP is on food safety and traceability.

GAP approach applies recommendations and available knowledge to addressing environmental, economic and social sustainability for on-farm production and post harvest process resulting in safe and healthy food. The use of Good Agricultural Practices in the production of fresh fruit and vegetables is essential to prevent pathogen contamination. GAP provides simple steps that fruit and vegetable growers can implement to greatly reduce the potential for contamination on the farm. Growers who are able to provide assurances that their products are safe will have a marketing advantage. GAP programme is one way to help maintain the trust that currently exists between local growers, markets and the consumer. GLOBALGAP is a pre-farm-gate standard, which means that the certificate covers the process of certified product from farm inputs and all the farming activities until the product leaves the farm. GLOBAL GAP is a leading global certification programme whose mission is to bring farmers and retailers together to produce and market safe food to protect scarce resources and build a sustainable future.

**Key words:** GLOBALGAP, Global Market, Doubling Income, Safety and quality, EUREPGAP, Social sustainability.

### **Doubling the income of farmer through post harvest management and value addition of horticultural produces**

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India is the second largest producer of the fruits and vegetables in the world after China. Nothing good this for us! because there is 25 to 40% post harvest loss of our total horticulture produces due to lack of post harvest facilities. Not more than 2% processing is done of our total horticulture commodities. Our horticulture export share in the global market is less than 1%; much lesser than small countries. Due to these, our farmers facing problems for generation of income. But there is one hope ray for enhancing the more than doubling income of farmers through post harvest management and value addition of horticulture produces. Post harvest technology and processing have potentiality to create rural industries. We can minimize the post harvest loss and increase the shelf life of fresh as well as processed products of horticulture through post harvest management and value addition. Operations after harvesting like trimming, curing, sorting, washing, grading, chemical treatment, packaging, storage, transportation and marketing are very useful for enhancing quality of fresh as well as canned products. We can prepare and preserve so many value added products like jam, jelly, candy, preserve, squash, syrup, cordial, RTS, ketch-up, sauce, chutney, nectar, pickle, marmalade etc. through canning, bottling, freezing, dehydration, drying and ionization methods. There is no limit for enhancing the income through post harvest management and value addition in horticultural industries. Today we know that there is no need of more production, but there is a need of value addition of our farm produce. At present the price of one kg lime is Rs.5.00 only. but we can earn Rs. 500 from one kg lime by making different value added product like lime syrup (from lime juice-Rs150), lime pickle or chutney from lime fruit peel after extraction of juice (Rs. 100), lime seedlings from lime seed 30-40 (Rs. 300-400). There are so many examples of this type of value addition of horticultural as well as other farm produce. So there is no need for waiting five years for doubling the income, we can earn more than doubling income in one season or in one year through post harvest management, processing and preservation of different value added products from fresh horticultural produces.

**Key words:** Doubling Income, Post Harvest Management, processing, value added product



## The Knowledge and Practice Gap of Different Nutritional Habits of the Farm Women

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Farm women are the major player to improve the nutritional status because they are user of the most of the farm product, selection of rich nutritional food is most important. Knowledge of farm women on nutrition is help to select food for nutrition. And the application of the knowledge is play major role for nutrition. Therefore the study was undertaken to determine the gap on knowledge and practice of nutrition. The sample of 100 farm women respondent were interviewed taking fifty from each village Dhalaguri and Dhanghinguri of Cooch Behar-II block under Cooch Behar district in West Bengal. Purposively, multi-stage sampling procedures were followed in the present study. The district Cooch Behar and block Cooch Behar-II was purposively selected due to the availability of active farming women involved in agriculture and allied sectors. Out of the thirteen Gram Panchayats of Cooch Behar-II block, two villages were randomly selected namely Dhalaguri and Dhanghinguri for the study.

**key word ;** nutrition knowledge , knowledge gap, Nutrition, women, balance diet.

## Enhanced efficacy of zingerone loaded niosomes against virulence phenotypes and biofilm formation by *Pseudomonas aeruginosa*: An *in-vitro* and *ex-vivo* study

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Zingerone, has enormous pharmacological properties and thus can be used as promising candidate against various infections. However, sparingly aqueous solubility limit its full potential as therapeutic agent. The present study was designed to enhance its polar nature in the form of niosomal formulation and to investigate its potential in treating *Pseudomonasaeruginosa* infections. Zingerone loaded niosomes (Z-Niosomes) were prepared and characterized in terms of size, polydispersity index (PDI), zeta potential, *in vitro* drug release and encapsulation efficiency. Effect of prepared formulation was evaluated in attenuation of virulence factors and biofilm formation by *P. aeruginosa*. Z-Niosomes were found to possess uniform size of 564.8nm, PDI of 0.377 with -4.68 mV zeta potential and encapsulation efficiency of 52%. Selected niosomal preparation significantly reduced virulence factors and biofilm formation by *P. aeruginosa*. The attenuation effect of Z-Niosomes against *P. aeruginosa* was also confirmed by its increased susceptibility to phagocytic uptake and killing. The results of the present study suggests that Z-Niosomes can be employed as therapeutic option in various *P. aeruginosa* infections.

**Keywords:** Zingerone, Niosomes, *Pseudomonas aeruginosa*, Biofilms, Phagocytosis.

## A study of happiness in relation to self-esteem of adolescents

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Happiness is the degree to which people evaluate their overall quality of present life-as-a-whole positively. Happiness is a mental or emotional state of well- being characterized by positive or pleasant emotions ranging from contextual to intense joy. When we appraise how much we appreciate the life we live, we seem to use two sources of information: affectively, we estimate how well we feel generally and at the cognitive level we compare life as it is with perceived standards of 'how life should be'. Self-



esteem continues to be one of the most commonly research concept in social psychology (Baumeister, 1993). The present study was undertaken in Bhiwani district of Haryana state. Two senior secondary schools of Bhiwani city and two senior secondary schools of village Kitlana and Chappar of Bhiwani district were selected as per demand of the study. A sample of 100 rural and 100 urban adolescents of 14-20 year age were taken, thus making a total sample of 200 adolescents. Happiness scale by Hills, P., and Argyle, M. (2002), was used to assess happiness among adolescents. Self Esteem Scale Rosenberg (1965) used to assess self-esteem among adolescents. The findings revealed non-significant differences in happiness ( $Z=0.76$ ), ( $Z=0.96$ ), and Self-esteem level ( $Z=0.98$ ), ( $Z=0.62$ ) of rural/urban and girls/boys respectively.

Key words :- Happiness, Mental, Emotions, Self-Esteem

## A STUDY OF ENVIRONMENTAL POLLUTION AND ITS CAUSES

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Man is causing all round damage to atmosphere, water, land, to the various elements of environment and to the ecosystem itself. There is so much man-made pollution and environmental degradation that the nightmare ahead is enough jittery to shake us all. Taking a synoptic view of the general scenario a few trends are underway. Our atmosphere on global as well as regional scale is heavily polluted. The protective ozone shield in the heavily populated latitudes of the northern hemisphere is thinning twice fast as scientists thought a few years ago. The buildup of green house gases will lead to significant changes in the weather patterns in the near future leading to global warming. The destruction of ozone layer and the further warming of the earth surface threaten catastrophic consequences such as eruption of cancerous and tropical diseases, disruption of oceans food chain, rising of sea levels, submersion of many islands, melting of small land-based glaciers, flooding in many low lying coastal areas and harvest loss etc. The most striking reason of the environmental degradation and hence global environmental crisis is the fact of deteriorating relationship between man and environment because of rapid rate of exploitation of natural resources, technological development and industrial expansion. The rate of environmental change and resultant environmental degradation caused by human activities has been so fast and widespread. The process of development itself also leads to damage of the environment, if not properly managed. Associated with the rapid economic growth, the extravagant affluence consumes far more resources and put far greater pressure on natural resources.

Key words : Environment, Cause, Consequences, Pollution

### Antimicrobial potential of *Delphinium denudatum* (Wall Ex Hook & Thom)

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Plants produce a diverse array of secondary metabolites, many of which are known to possess antimicrobial potential. The present study was carried out with an objective to investigate the antimicrobial potential of different plant parts of *Delphinium denudatum*. Antimicrobial potential of *D.denudatum* plant parts (stem, root, leaf) extracts were tested against three groups of



microorganisms, bacteria (Gram positive and Gram negative bacteria), actinobacteria and fungi. Plant extracts were prepared in seven different solvents (methanol, ethanol, ethyl acetate, acetone, hexane, chloroform and water) according to their polarity. The qualitative estimation of antimicrobial activity was performed following plate assays through disk diffusion method while the quantitative estimations were based on minimum inhibitory concentration (MIC). All the plant parts showed antibacterial activity, maximum being in case of stem. Among different solvents, ethanolic stem extract showed highest antibacterial activity ( $15.33 \pm 0.11$  mm) against *S. marcescens* and aqueous leaf extract showed highest antiactinobacterial activity ( $21.0 \pm 0.07$  mm) against *Nocardia tenrefensis*. Antifungal activity, that was tested against 5 fungal species, was absent in all the plant parts extracts. Values obtained for MIC varied with respect to different solvents. This is a preliminary study showing the antibacterial potential of *D. denudatum* with respect to the importance of solvent selection in harvesting antimicrobial metabolites.

**Key words:** *Delphinium denudatum*, antibacterial, antiactinobacterial, antifungal, MIC

### Refinement and standardization of preservation technique for diseased plant samples

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Most of the farmers are not able to identify crop diseases which are new or occurring less frequently. Furthermore, agricultural students also get confused to identify the symptoms of particular disease in dried or bleached plant samples preserved in formalin. Hence, a study has been conducted in the year 2017-18 and 2018-19 to refine and standardize existing technique for the preservation of diseased plant samples for longer duration without bleaching and damaging them least. Five samples of diseased plant from various crops were collected, washed in tap water and finally three were selected for each disease subjected for further treatments. Selected triplicate samples were soaked in 3 - 6 per cent concentrations of copper sulphate solution for 4 - 6 hours depending upon type of sample followed by six to eight serial washing (first three for half an hour followed by one hour for each wash) in tap water. In final step, the treated samples were stored in formaldehyde and acid solution of different concentrations. Observations were recorded related to symptom deviation from initial stage, and bleaching of sample at two weeks interval. Most of the samples in formalin get damaged and bleached as compare those which are kept in acid solution. The pre-treatment with copper sulphate varied with type of sample where succulent sample of leaves require 4 hour soaking time in 4 per cent concentration and hardy samples require 5-6 hours soaking in 5 percent solution of the chemical. Serial washing for different durations was more effective than washing in running tap water which leads to wastage of water too. The sulfuric acid solution of 0.5 per cent kept the succulent samples of diseased leaves in good condition for 6 - 12 months with least or without bleaching whereas 1.0 per cent concentration of this acidic solution was effective to preserve the hardy diseased leaves and stem samples for 6 - 12 months. So this technique is comparatively easy and safe which keeps preserve the diseased plant sample for longer duration without loss of its actual appearance.

**Key words:** Bleaching, Copper sulphate, Diseased samples, Preservation, Plant

### Biological management of corm rot of saffron

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Saffron (*Crocus sativus* L.) is considered as one of the most expensive spices because of its therapeutic and aromatic value. In the present study, corm rot was recorded as a major biotic stress, in all the surveyed saffron growing areas of Kishtwar district of Jammu province. Maximum disease incidence of 59.33 per cent and severity 35.00 per cent was recorded from Lower Poochal. Different myco-pathogens viz., *Fusarium oxysporum* f.sp. *gladioli*, *Fusarium oxysporum*, *Rhizoctonia* sp., *Aspergillus* sp., *Penicillium* sp. and *Macrophomina* sp. were isolated from the diseased corms of saffron, having per cent occurrence of



34.67, 20.33, 15.67, 15.00, 11.67 and 2.67, respectively.

Under *in vitro* conditions, using dual culture assay on potato dextrose agar, *Trichoderma viride* and *T. harzianum* significantly reduced the mycelial growth of the *Fusarium oxysporum* f.sp. *Gladioli*, with the inhibition of 77.60 and 76.60 per cent, respectively, as compared to control. Under field conditions, dipping of saffron corm in carbendazim @ 50% WP @ 0.2 %, exhibited maximum reduction (70.33%) in the disease incidence, which was followed by corm treatment with *T. viride* and *T. harzianum* ( $1 \times 10^7$  cfu/ml) and soil solarization, resulting in the reduction in the corm rot incidence by 61.55, 57.15, 59.90 per cent, respectively, over control. Population density of *F. oxysporum* f.sp. *gladioli* was significantly reduced (72.50%) by soil solarisation treatment after 90 days of sowing of saffron, as compared to its population before planting of corms.

In case of growth promotion traits *viz.*, emergence of sprouting, flowering and number of flowers in saffron, corm treatment with *Bacillus subtilis* @  $1 \times 10^9$  cfu/ml significantly reduced the number of days of sprouting and flower emergence and also increased the number of flowers (23 & 74 DAS and 3, respectively) as compared to control (31 & 86 DAS and 1, respectively).

**Keywords:** bio-control, corm rot, pathogens, saffron, PGPR

### Heavy metal accumulation by plant species at fly ash dumpsites: Thermal power plant, Gandhinagar, Gujarat

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Naturally growing wild plant species were identified for accumulation of heavy metals at fly ash different disposal sites of Thermal Power Plant Gandhinagar. Cd, Fe, Zn, Cu, Ni, Pb and Cr metals were selected for studying accumulation by indigenous plants. Nine major weed species growing dominantly at fly ash dumpsite were identified i.e. *Prosopis juliflora*, *Ipomea carnea*, *Calotropis procana*, *Nerium indicum*, *Abutilon indicum*, *Tephrosia purpurea*, *Cassia tora*, *Parthenium hysterphorus*, *Jatropha gossypifolia*. Results showed significant accumulation of fly ash heavy metals by indigenous identified plants positive pattern of accumulation differed significantly in different weed species. Roots showed higher accumulation of heavy metals as compared with shoot in most of the plants but in some shoots also showed more accumulation compared to roots. Both translocation factor and bioaccumulation factor was calculated to determine metal translocation from site to roots and from root to shoot. Current results suggest that these plants species can effectively survive in harsh environment and can be used for eco-restoration purpose and also they can be used as potential phytoremediation species.

**Keywords:** Fly ash, Heavy metals, Weed species, Phytoremediation and Eco-restoration.

### Isolation and optimization of cultural conditions for Glucoamylase production.

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Glucoamylase, a digestive amylolytic enzyme and Generally Regarded As Safe accredited hydrolyzes 1,4-glycosidic bonds from the non-reducing ends of starch and 1,6-glycosidic linkages in polysaccharides yielding glucose as the end-product, which in turn serves as a feedstock for various biological fermentations. It is a fungal enzyme generally produced by *Aspergillus* and *Rhizopus* species. Glucoamylase is used in the production of high fructose corn syrup, glucose syrup, alcohol fermentation, retardation of staling, digestive aid, biofuel production, waste water treatment etc. In our study, soil samples were serially diluted to establish pure cultures. Isolate producing highest glucoamylase activity was selected and its production parameters were optimized under Solid State Fermentation in potato dextrose agar medium. During screening it was found that Starch broth as a growth medium was more productive. Optimized production and reaction parameters were obtained by varying various parameters.  $210 \times 10^4$  spores/ml inoculum showed maximum activity (4.28 U/mg) and starch as carbon supplement gave activity of 5.05 U/mg. Peptone acted as a good organic nitrogen supplement with 5.12 U/mg activity while sodium nitrate as inorganic nitrogen supplement gave





an activity of 5.3U/mg. Maximum activity of glucoamylase was recorded at pH 2.5 and temperature 25°C with 6.23U/mg and 7U/mg, respectively. Enzyme production was highest at 72 hours with 7.24U/mg activity. Citrate buffer with pH 5.5 and molarity of 0.05 proved best with 8.2U/mg and 8.4U/mg activities. 1.4% substrate concentration showed maximum activity of 9U/mg. Incubation time of 15 minutes at 30°C showed maximum activity of 13.45 U/mg and 14.33 U/mg.

**Keywords:** Glucoamylase, enzyme, optimization.

### Evaluation of different accessions of Shatavar (*Asparagus racemosus* Willd) for growth and yield parameters under Jammu Sub-tropics

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*Asparagus racemosus* (Shatavar) is mainly known for its phyto-estrogenic properties and is an important medicinal plant of tropical and subtropical India. Medicinal usage of tubers has been reported in the Indian and British Pharmacopoeias and in traditional systems of medicine such as Ayurveda, Unani and Siddha. It has been used in Ayurveda as a galactagogue, aphrodisiac, anodyne, diuretic, antispasmodic and nervine tonic since time immemorial. The plant finds use in about 64 ayurvedic formulations. Due to its multiple uses, the demand for *Asparagus racemosus* is constantly on the rise; however, the supply is rather erratic and inadequate. Destructive harvesting, combined with habitat destruction in the form of deforestation has aggravated the problem. The plant is now considered 'endangered' in its natural habitat. Therefore, the need for conservation and production of this plant is crucial. The present study was undertaken to evaluate 20 accessions procured from NBPGR, New Delhi to identify superior genotypes. Observation on growth and yield parameters viz. shoot length (longest), number of shoots, number of tubers, length of longest tuber finger, fresh weight of tubers and dry weight of tubers were recorded. The average dry weight of tubers per plant in different accessions ranged from 130.88 g-397.60 g. Maximum dry weight of tubers per plant (397.60 g) was observed in accession IC471923 whereas, it was statistically at par with accessions IC471922 (387.52 g), IC471911 (384.55 g) and IC471909 (349.51 g). Wide range of variability is observed in number of tubers per plant, fresh and dry tuber yield parameters, which can be exploited for crop improvement.

**Key words:** *Asparagus racemosus*, galactagogue, accessions, tubers, variability

### Eco-friendly Management of Pokkah Boeng Disease of Sugarcane

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Sugarcane is a huge biomass generating crop and cultivated almost all the states of country. The crop requires ten to twelve months for maturity. During its cropping season, the crop is attacked by number of insect-pests and diseases. More than 200 sugarcane diseases are reported and out of 55 diseases is economic importance worldwide. These sugarcane diseases are caused by diverse group of pathogenic microbes. Fungal diseases have great economic importance in sugarcane crop. Major fungal diseases are red rot, wilt and smut. Besides these fungal diseases, emerging new fungal disease in sugarcane is *Pokkah Boeng*. *Pokkahboeng*, a Javanese term means malformed or distorted top. The disease was first recorded in Java on sugarcane variety POJ 2878 by Walker and Went in 1896. During 1930s, first time in India it was recorded as minor disease with 1-2% incidence but recently in subtropical region of India, disease appeared in serious presence on sugarcane varieties viz., CoS 8436 and Co 0238 (15 – 35% disease incidence). Presently the disease is being managed by adopting resistant sugarcane varieties and two to three foliar spraying of fungicides like 0.1% Bavistin, 0.2% Blitox – 50 and 0.2% Copper oxychloride with an interval of 15 days during pre-monsoon period. The application of chemicals for its management is not eco-friendly approach. So fungal and bacterial culture, plant extracts and natural products have been screened and found effective for its management under *in vitro*



and field conditions. In different treatments, sett treatment along with foliar application of *Trichoderma harzianum* not only reduces 89 percentage disease incidences but also improves sugarcane germination percentage, cane yield and juice quality parameters.

**Key words:** Eco-friendly Management, Pokkah Boeng Disease, Sugarcane

## Effect of sowing dates and varieties on growth, development and yield of Indian mustard (*Brassica juncea* (L))

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The present study entitled, “Effect of sowing dates and varieties on growth, development and yield of Indian mustard (*Brassica juncea* (L))” was conducted at Research Farm, Department of Agriculture, Swami Vivekananda University, Sagar (MP) during rabi season 2017-18. The experiment was laid out in split plot design with three replications. The main plot treatments consisted of three sowing dates viz., October 20, November 4 and November 19. The sub-plot treatments consisted of three varieties viz., Pusa Agrani, Pusa Bold and Varuna. The objectives of the experiment were to study the influence of sowing dates and varieties on phenology, growth, development and yield of Indian mustard (*Brassica juncea* (L)). October 20 sowing took maximum days to maturity followed by November 4 and November 19. Duration of reproductive phase was longer in October 20 sown crop followed by November 4 and November 19 sown crops. The crop sown on October 20 exhibited significantly higher plant height and LAI at all growth stages followed by November 4 and November 19 sowing dates. Similarly, October 20 sowing also resulted into higher total plant biomass as well as its allocated to different plant parts at all growth stages as compared to November 4 and November 19 sown crops. October 20 sown crop exhibited significantly higher number of primary and secondary branches (plant<sup>-1</sup>) at fully ripened seeds (maturity) stage followed by November 4 and November 19 sown crops. October 20 sowing produced significantly more number of siliqua (plant<sup>-1</sup>), 1000-seeds weight (g), seed yield (g plant<sup>-1</sup>), seed yield (kg ha<sup>-1</sup>), biological yield (kg ha<sup>-1</sup>), stover yield (kg ha<sup>-1</sup>), harvest index and oil content (%) followed by November 4 and November 19 sowings. Sowing dates were failed to show significant differences in the number of seeds (siliqua<sup>-1</sup>) among varieties, Varuna took maximum days to maturity followed by cvs. Pusa Bold and Pusa Agrani. Duration of vegetative phase was longer in cv. Varuna followed by cvs. Pusa Bold and Pusa Agrani. Duration of reproductive phase was not differed significantly among varieties. Cultivar Varuna exhibited significantly higher plant height maturity followed by cvs. Pusa Agrani and Pusa Bold. Cultivar Pusa Bold exhibited significantly higher LAI followed by cvs. Varuna and Pusa Agrani at all growth stages. Pusa Bold also led to record higher total biomass and its allocation to different plant parts viz., leaves, stem and siliquae followed by cvs. Varuna and Pusa Agrani at all growth stages. Cultivar Pusa Bold produced significantly more number of siliqua (plant<sup>-1</sup>), number of seeds (siliqua<sup>-1</sup>), 1000-seeds weight (g), seed yield (g plant<sup>-1</sup>), seed yield (kg ha<sup>-1</sup>) and HI followed by cvs. Varuna and Pusa Agrani. Cultivar Varuna exhibited significantly higher oil content (%) followed by cvs. Pusa Bold and Pusa Agrani. Interaction effects were found non-significant for each and every characters. The seed yield (kg ha<sup>-1</sup>) was significantly and positively correlated with plant height, LAI, total biomass at all growth stages as well as with number of siliquae, number of seeds and test weight, biological yield and harvest index. The results of one year field study concluded that sowing of mustard on 20 October under the agro-climatic condition Sagar the optimum to achieve higher productivity of mustard. Similarly, cv. Pusa Bold was found to be most suitable for agro-climatic condition of Sagar (M.P.).

**Key words:** Mustard, Sowing dates and Varieties



## **Doubling farmers' income an important on: Crop diversification**

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In the past five decades or so, increasing agricultural production and ensuring food security was the main concern for agricultural development. To the great satisfaction, Indian farmers with the help of agricultural scientists and policy makers could achieve that by bringing 'Green Revolution' and 'Rainbow Revolution'. These strategies involved an increase in productivity through intervention of better crop production technologies and varieties, among few others. Agricultural crop diversification is an important stressrelieving option for economic growth of the farming community. Diversification of agriculture in the first Green Revolution areas such as Punjab, Haryana and Western Uttar Pradesh seems need of the hour. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from valueadded crops with complementary marketing opportunities. Persistent low level of farmers' income can cause serious adverse effect on the future of agriculture in the country. To secure future of agriculture and to improve livelihood of half of India's population, adequate attention needs to be given to improve the welfare of farmers and raise agricultural income. Crop diversification refers to the addition of new crops or cropping systems to agricultural production on a particular farm taking into account the different returns from valueadded crops with complementary marketing opportunities. Crop diversification provides better conditions for food security and enables farmers to grow surplus products for sale at market and thus help to obtain increased income to meet other needs related to household well-being. Crop diversification and inclusion of the new varieties can be one of the important technologies in increasing the farmers' income to a certain extent, if not double. Diversification can also manage price risk, on the assumption that not all products will suffer low market prices at the same time and increase the profitability of the farming community.

**Keywords:-** Diversification , Crop , Income , Agriculture , Farmers, Production

## **Recent advance in horticulture and allied science**

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Horticulture crops perform a vital role in the Indian economy by generating employment, providing raw material to various food processing industries, and higher farm profitability due to higher production and export earnings from foreign exchange. Diverse agro-climatic conditions in India ensure the production of all types of fresh fruits, vegetables and medicinal plants in different parts of the country. The horticultural industry offers a variety of jobs, both directly and indirectly. Many jobs require knowledge and training in horticulture. The level of training could be vocational or at the college level. The nature of work may be indoor or outdoor. Intense manual labour or paperwork in office may be involved. The following are the identified categories of jobs that require varying degrees of familiarity with horticulture. Horticultural products need to be transported from the areas of production to nearby and distant markets, and ultimately, to consumers. Because of their highly perishable nature and in order to retain their quality for a long duration, horticultural products require special care and handling in transportation. Which deals with the study of cultivation of vegetable crops? The term vegetable is applied to edible herbaceous plants or parts, commonly used for culinary purposes. It may be grains as in maize cobs (sweet corn, baby corn), peas, bulbs, corms, rhizomes, roots and tubers, leaves, pods, fruits or curds, mushroom, etc. There has been an increase in irrigation facilities but there are crops, which even with little



watering, can survive. One only needs to ensure adequate water management. Some dry land horticultural crops, like jamun, ber, tamarind, wood apple, custard apple, ramphal, etc., can be grown on rainfed land also. Compared to other countries, agricultural labour and other agricultural inputs are far cheaper and easily. This leads to the use of intensive methods and improved technology in the production of horticultural crops.

**Keywords:-** Horticulture, Cultivation, Production, Industry, Categories, Crop.

### **Ninjacart: Solving Supply Chain Woes for Fresh Fruits and Vegetables**

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Supply chain is basically the combined set of people, resources, knowledge and activities which help in transporting the products from one place to the other. It consists of activities related to conversion of raw materials into finished products useful for the end users. Supply chain in India suffers from both demand side challenges and supply side challenges. Ninjacart is India's leading agri marketing platform, **solving one of the toughest supply chain problems of our country through technology**. Currently, ninjacart connect vegetables and fruit growing farmers directly with businesses. At one end, they help farmers get better prices and ensure consistent demand and on other end, they help retailer's source fresh vegetables at competitive prices directly from farmers. They do this effectively at lower cost, better speed and larger scale using integrated supply chain powered by technology, data science, infrastructure and logistics network. Every day, around 500 tonnes of vegetables and fruits are delivered to thousands of shops and retail stores across multiple cities in India in just two and a half hours. And this is done by agritech startup Ninjacart with a delivery accuracy rate of 99.88 percent all year-round, without a single day off. Ninjacart also maps the best routes for drivers to reach their destinations with clearly identified points.

**Key words:** Ninjacart, supply chain, marketing, farmers, retailers, fruits and vegetables.

### **Status of small millets under organic farming framework in mid hills of Uttarakhand, India**

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Among rainfed crops, small millets as a group figure prominently. India is the largest producer of small millets which are often referred to as coarse cereals. In India, these crops are grown in diverse soils, varying rainfall regimes and in area widely differing in thermo- and photo-periods. In state Uttarakhand, these crops are being grown by poor and tribal farmers since time immemorial. The resilience exhibited by these crops is helpful in their adjustment to different kinds of ecological niches and have made them quite indispensable to rainfed, tribal and hill agriculture where crop substitution is difficult. Although, Small millets are known to cope up with biotic and abiotic stresses, nevertheless, under vulnerable conditions some of the diseases cause heavy losses and can damage entire crop. Among the seven small millets that are grown in India, finger millet and barnyard millet are grown extensively in Uttarakhand at present whereas foxtail millet and proso millet are grown in some patches as catch crop. Based on the study conducted during 2012-2018, *Cercospora* leaf spot (*Cercosporaeleusinis*) and blast (*Pyriculariagrisea*) of finger millet, grain smut (*Ustilagopanici-frumentacea*), sheath blight (*Rhizoctoniasolani*) and leaf blight (*Helminthosporiummonoceros*) of barnyard millet, blast (*Pyriculariasetariae*) and leaf blight (*Cochliobolussetariae*) of foxtail millet, leaf spot or blight (*Bipolaris-panici-miliacei*) of proso millet have been recorded as major biotic constraints in reducing



the production and productivity of these crops in state Uttarakhand.

These crops are cultivated under organic farming framework in marginal and degraded soils with little cash inputs and chemical fertilizers and pesticides are generally not adopted by small and marginal farmers in hills of Uttarakhand. Therefore the present investigation was planned with an objective to ascertain the status of economically important major prevailing diseases associated with small millets and also to record the outbreak of any new emerging diseases with time along with to determine the available sources for the biomanagement of any biotic problem interfering small millets production.

**Key words:** Small millets, finger millet, barnyard millet, biotic stresses, pesticides and biomanagement

**Bio-management of biotic stresses in barnyard millet (*Echinochloafrumentacea*L.) and improving growth and yield attributes with a particular reference by using *Trichoderma* isolates through seed bio-priming and value added FYM**

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An attempt was made to apply putative *Trichoderma* spp. possessing multifarious plant growth promoting (PGP) traits with a view to promote growth, yield and induce resistance against biotic stresses in vital but underestimated crop viz., barnyard millet (*Echinochloafrumentacea* L.). Physiological and biochemical parameters were also studied under greenhouse conditions to explore the mechanism underlying plant biotic stress resilience in response to *Trichoderma* inoculation.

The isolates of *Trichoderma* spp. were used through seed bio-priming technique along with value added FYM. The treatment T3 (Seed bio-priming with *Trichoderma* isolate Th-14+ FYM pre-colonized by Th-14) was found significantly superior over all the treatments with respect to all the studied traits related to growth, yield and yield contributing attributes at the same time reducing sheath blight and leaf blight diseases caused by *Rhizoctoniasolani* and *Helminthosporiummonoceros* respectively followed by the treatment T5 (Seed bio-priming with *Trichoderma* isolate Th-21 + FYM pre-colonized by Th-21) and T4 (Seed bio-priming with *Trichoderma* isolate Th-19+ FYM pre-colonized by Th-19) which were statistically at par. The study also revealed that the bio-control strains showed significant potential when used along with FYM. However, the treatment T3 proved to be most effective in improving the growth and yield attributes and also helped in suppressing incidence of sheath blight and leaf blight diseases in barnyard millet.

In comparison with the untreated plants, characterization of *Trichoderma* treated plants confirmed that they had reinforced contents of proline along with relatively higher levels of chlorophyll content, SPAD value, total phenols and membrane stability index while lower accumulation of malonaldehyde content in comparison to untreated plants under the present materials and environmental conditions. The research merits attention and could additionally open the avenue for the use of putative bio-control agents in enhancing growth and yield parameters and suppressing the most destructive diseases of barnyard millet in the mid hill regions of Uttarakhand.

**Key words:** Barnyard millet, Seed bio-priming, Sheath blight, Leaf blight, *Trichoderma*, Proline, Phenols and Malonaldehyde

**Preliminary study of microbial ecology of river Beas in wake of spillage of molasses**

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The pollution of river in water poses a major risk to the human health besides altering the aquatic flora and fauna. This



study was conducted to determine the effect on spillage of molasses in river Beas at three different sites namely; Dhilwan (Jalandhar), FattuDhingra (Kapurthala) and Miani (Kapurthala). Bacterial communities were observed at these three sites in the month of December, 2018. The changes in microbial dynamics are being periodically observed at these sites of river in flow during the conservation and restoration process. There is substantial data base available on microbial water quality of underground water being used for potable purposes but very less information is available on the microbial community structure of irrigation waters. Surface water used for irrigation is monitored much less intensively. A limited monitoring is available on occurrence of indicator organisms rather than on occurrence of actual pathogens. Indicator organisms have been selected mainly to indicate the potentially occurring faecal contamination rather than presence or concentration of any specific pathogens. In the present study, both indicator organism and pathogenic bacteria are being monitored by regular sampling at all three selected sites. The isolated pure cultures are being subjected to various pathogenicity tests including blood haemolysis, biofilm formation and antibiotic resistance. Among the three samples collected from different location, sample B (FattuDhingra) was found to have maximum microbial load ( $23 \times 10^5$ ), followed by sample A (Dhilwan) and C (Miani). Most probable Number (MPN) index was high (1100) in both sample A and B and was minimum in sample C (460). But faecal coliform is detected in all the samples. Morphological distinct bacterial colonies have been isolated and are being checked for blood haemolysis, biofilm formation and antibiotic resistance.

**Keywords:** Coliforms; Microbial ecology; Molasses spillage; MPN and Pathogenesis

#### Effect of different vitamins on regeneration of taro (*Colocasia esculenta* Schott.) *in vitro*

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In this present study, we have attempted to derive a one-step protocol for shoot proliferation and root induction from cormel tip cultures of taro using MS, MS Nitsch and MS B5 vitamins incorporated with various concentrations of plant growth regulators such as BAP, KIN and ADS. The medium containing MSN+BAP (0.5 and 1.5 mgL<sup>-1</sup>) and MS+BAP (1.0, 1.5 and 2.0 mgL<sup>-1</sup>) exhibited early bud break (3.0±0 days) while compared with MS and MSB5 medium. Higher doses of MSB5+BAP (2.0 mgL<sup>-1</sup>) registered higher number of shoots (4.60±0.89) followed by MSB5+BAP (1.5 mgL<sup>-1</sup>, 3.20±0.84) whereas lower doses of MSN+ADS (0.5 mgL<sup>-1</sup>) exhibited higher number of shoots (3.40±0.89) at 28 DAI. Overall shoot length was higher in MSN followed by MSB5 and MS. Amongst the cytokinins, BAP at 1.0-1.5 mgL<sup>-1</sup> was induced higher shoot length in comparison to KIN and ADS. MSN+ADS (1.0-1.5 mgL<sup>-1</sup>) induces better leaves in cormel tip cultures of taro *in vitro*. MSN+ADS (0.5 mgL<sup>-1</sup>) observed to be induced better for root induction from cormel tip cultures of taro *in vitro*. ADS (0.5-1.0 mgL<sup>-1</sup>) in association with MSN vitamins produced more proliferated shoots with easy differentiation into well derived plantlets with better root system hence, this protocol may be used as one-step medium for shoot proliferation and root induction from cormel tip culture of taro *in vitro*.

**Key words:** *in vitro*, taro, SEM, MSN, MSB5

#### Innovative Farming System Strategies towards Doubling Farmer's Income in Uttar Pradesh

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India is predominated by small farm agriculture where 85% farms are in marginal and small categories of less than 2 ha. The total number of operational holdings in the country is 138.35 million with an average size of 1.15 ha. These small farms, though operating only 48.16% of net irrigated area and 44% of land under cultivation, are the main providers of food and nutritional security to the nation. These households are also having mean family size of 4 to 5 indicating availability of at least 900 man days per year for the farm work. Taking in to consideration of all these opportunities, ICAR-Indian Institute of Farming Systems



Research, Modipuram have developed 5 Integrated Farming Systems (IFS) models through AICRP on Integrated Farming Systems for Uttar Pradesh and evaluated these modules on selected farmers field in Central Plain, Eastern Plain and Western Plain zones of the state. Under Central Plain zone of the state, crops + livestock was recorded as the prominent farming system where crops + dairy + orchard + vermicompost+ boundary plantation was found most profitable venture with 109% higher net annual income over the net income received from existing farming scenario. Dairy component with one cow and one buffalo registered the largest share (38.7%) to the total net income of the households whereas, cropping systems components with various compositions including fodder crop stood second with 30.1% contribution to the total net income. Results of farming systems evaluated at Varanasi (on-station), Faizabad (on-station) and Ambedkarnagar (on-farm) under Eastern Plain revealed that 142% higher net income could be possible with improved farming systems having cropping systems + dairy + orchard + poultry+fishery+ mushroom + vermicompost + boundary plantation as important components over the existing crop+livestock farming system. About half (47.7%) of the total net income fetched by the dairy component with rearing of Jersey & HF cross bred cows triplet in number at Varanasi whereas at Faizabad, cropping systems with five combinations such as rice-wheat-maize + cowpea, rice-potato-green gram, deshichari-mustard-blackgram, rice-lentil-sudanchari and rice-berseem-green gram cultivated at 62% of total model area yielded 55.3% net income to the total. With improved farming system i.e. Cropping systems + dairy + Agro-horti system + fishery +mushroom + vermicompost + boundary plantation + kitchen garden under Western Plain region of the state registered 162% higher income over the existing farming system with only two component i.e. crop+livestock. With the developed prototype IFS model on 0.70 ha at Modipuram (Meerut), sorghum-oat-green manure, sorghum-chickpea-green manure, rice-mustard-moong and maize+redgram-wheat+mustard-green manure grown on 50% of the total area gave 48.3% contribution to total net income but in case of large model size (1.5 ha), the contribution of crop components was decreased (42%) and share of the dairy was increased from 18% to 22% to the total net income of the model. Diversification of marginal and small farms with other activities results in additional employment to the family at all the location with various number (mandays/ha) of additional employment such as 108,240, and 325 mandays/ha at Central Plain, Eastern Plain and Western Plain respectively.

**Key words:** Integrated Farming System, Cropping Systems, Net Income, Mandays, Doubling farmers income

### **Short term of UV-B (285-325nm) induced initial damages of the *Rattus norvegicus* ear and paw edema cells**

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Ultraviolet radiation-induced sunburn cells characterised by pigmentation, colouration, wrinkles and red spots on the outer surface of skin. UVB radiation has detrimental effects to initially induce sunburn cells in the soft tissues. In the present study, an attempt was made to study the photodermatology of skin under UVB irradiation using a biological model rat (*Rattus norvegicus*). The experiment included nine male rats were grouped into three classes based on the treatment procedure and irradiated time for 5 minutes. The first group contained animals without any treatment (A), second group mild dose of UVB irradiated skin (B) and third group heavy dose of UVB irradiation 4 weeks/3 times. The damage of tissue layer induced red-inflammation on blood veins in the ear and paw edema damages were categorised to base on the dosage of UVB irradiation. Only the higher dose of UVB has significantly ( $P > 0.5$ ) increased red spots or wrinkle and cutaneous damages of the soft tissues of ear and paw edema



## Developing Wheat Lines for Biotic Stress Resistance through *Imperata cylindrica* Mediated Chromosome Elimination Doubled Haploidy Technique

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Conventional breeding has led to the development of number of varieties, but, with the changing climatic conditions accompanied with fast growing population there is an urgent need to fasten the breeding methods. Hence, use of biotechnological tool like Doubled Haploidy becomes important. The production of haploid plants from hybrids, followed by chromosome doubling will provide wheat breeder with a mean to accelerate the development of true breeding lines. Spontaneous development of haploid plants was first described by Blakeslee *et al.* in *Datura stramonium*. But, depending on spontaneous haploid production was not the solution (due to very low frequency) for its commercial application. With the achievement of *in-vitro* culture of *Datura* anther by Guha and Maheshwari the potential of haploid for plant breeding arose. The DH produced by anther culture technique has stronger genotypic specificity whereby, wide hybridization comes up with a solution. Several inter-specific/ inter-generic hybridization methods are used for haploid production in wheat. These methods include wheat x maize, wheat x pearl millet, wheat x *tripsacum*, wheat x *teosinte*, wheat x barley and wheat x job's tears. All these methods include embryo rescue technique and haploids are formed due to chromosomes elimination of the pollen parent during embryo development. Chaudhary *et al.* has identified system of wide hybridization which performs superior over maize- mediated technique. This system uses *I. cylindrica* (cogon grass- a wild grass) as a pollen source and has been found to be more efficient alternative pollen source for doubled haploid production in wheat. *I. cylindrica* is a winter season plant and coincides well for flowering with that of wheat and triticale under natural conditions. *I. cylindrica* is genotype nonspecific for hybridization with any variety of wheat, triticale or their derivatives and its pollen is readily available in abundance during the wheat hybridization period. This wild weedy perennial grass doesn't require repeated sowings and is available under natural conditions in almost all parts of the world. It is genotypic non specific and lacks somaclonal variation and albino plants development along with having higher regeneration rate coupled with lower cost. Cytological studies of *I. cylindrica*- mediated system has inferred that endosperm is not formed in wheat x *I. cylindrica* hybrid and all the chromosomes of this grass are eliminated in the first zygotic division during the process of seed development, thereby allowing the production of embryo carrying pseudoseeds. Thus, integration of *I. cylindrica* mediated Doubled haploidy system with conventional breeding will be instrumental for future wheat breeding programmes.

Breeding wheat using doubled haploid technique is of great interest to geneticists and breeders because of complete homozygosity and the short duration of their production cycle and the need for smaller population sizes. Selection also becomes more efficient, since the testing of homozygotic lines in the field experiments gives a more realistic picture of agronomic performance. Doubled haploid (DH) populations have lot of applications in plant breeding like cultivar and germplasm development, transferring traits from wild types, studying components of quantitative genetics and whole genome mapping. This paper will reveal the innovative protocol which can actually increase the DH production efficiency and open new vistas globally for speed breeding in wheat and development of yellow rust resistant wheat lines.

## Genetic analysis of seed yield traits in Chickpea

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The genetic value of an individual genotype is important parameter to any crop improvement programme. Correlation and Path analysis is used to identify quantitative character. Yield is a complex trait; governed by many genes having small and additive





effects. In this regard a study was carried out chickpea genotypes in Rabi 2014-15 at Pulses Improvement Project, Mahatma Phule Krishi Vidhyapeeth, Rahuri, Maharashtra, India. Experiment was conducted on sixty chickpea genotypes with Randomized Block Design in two replications. Each plot consisted of single row of 4 meter length with a spacing of 45 × 10 cm. The negative association was recorded between days to fifty percent flowering and number of seeds per plant, while significant positive association was observed in number of pods per plant, plant height, number of secondary branches per plant, plant spread, 100 seed weight, and number of primary branches per plant with dependent character seed yield per plant. By analysis Path coefficient data it was observed that number of pods per plant had highest direct effect on seed yield per plant followed by 100 seed weight, plant height and days to maturity while the traits number of seeds per pod and days to 50 per cent flowering revealed negative effect on seed yield. This evaluation indicated that in chickpea yield improvement breeding we have to emphasize on positively correlated yield associated character. It is also suggested to select traits with strong positive direct as well as indirect effects via some other traits.

**Keywords:** Chickpea, genotypes, path coefficient analysis, correlation analysis, seed yield

### **Direct and indirect effects of extrafloral nectaries on plant fitness and reproductive output of the two species of *Luffa*(L.)**

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Extrafloral nectaries are nectar secreting glands that are present outside the flower on vegetative (leaves, bracts and bracteoles) and non-reproductive floral parts like sepals. Weber and Keeler (2013) have reported extrafloral nectaries in a total of 3941 species distributed across 745 genera and 108 families of angiosperms. The nectar secreted by the EFNs is a valuable carbohydrate rich food resource that attracts aggressive ants and various other insects (Boudouris and Queenborough, 2013). In the present communication, we have tried to assess the impact of extrafloral nectaries on plant fitness and reproductive efficiency of two species of cucurbits namely *Luffa cylindrica*(L.). Roem. and *Luffa acutangula*(L.) Roxb.

**Keywords:** Extrafloral nectaries, herbivory, plant fitness, reproductive efficiency

### **Nutraceutical properties of *Carrissa carandus* biomolecules**

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*Carrissa carandus* (Apocynaceae) plant is native and common throughout much of India, Burma and Malaya and dry areas of Ceylon and commonly known as Karaunda in some parts of India and Malaya. In present scenario plant-derived materials have become of great importance in the protection of cell membrane fluidity, protein denaturation, lipid peroxidation and oxidative DNA damage caused by free radicals. The different parts of *C. carandus* were dried and powdered to estimate the contents of carotenoids, vitamin C, total phenolics, protein and carbohydrate as well as in vitro estimation of antioxidant and DNA damage protection against UV rays and hydroxyl ion in the plant sample were also estimated. Results showed that the vitamin C, carotenoid (in fresh weight), total phenolic content and carbohydrate (dry weight) content was significantly present in highest amount in leaf and the values are 80.32 mg/g, 13.11 µg/g, 84.48 mg/g of GAE and 87.78 mg/g, respectively where as ripened fruit have shown highest protein content 247.59 mg/g of dry weight. The results obtained from these experiments showed that the plant parts having high protein and carbohydrate content showed high total phenolic content which can be mainly responsible to scavenge the free radicals. The high ascorbic acid and carotenoids content showed that the plant may be potential source of natural antioxidant.

**Keywords:** *Carrissa carandus*, Carotenoids, Ripened fruit, Ascorbic acid, Natural antioxidant



## Studies on growth rate parameters of cabbage aphid, *Brevicoryne brassicae* (L.) on cauliflower (Megha cultivar)

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Cauliflower is an important Cole crop grown throughout the world for the table purpose. The crop has great nutritional value in the human diet for which large acreage of this crop is grown. In hilly regions of India especially in Himachal Pradesh, the crop is grown as an off-season vegetable crop. The crop is attacked by a large number of insect pests of which the cabbage aphid, *Brevicoryne brassicae* is an important pest which not only deteriorates the quality of the crop but also reduces the yield to a considerable extent. Mostly the new leaves and the growing point of the leaves are affected to a greater extent. Besides the cabbage aphid also feeds on the underside of the leaves and flowers. The aphid has also been reported to be the vector of 20 virus disease in a large number of plants. Various types of management practices are used to manage the population of this pest including the use of synthetic insecticides; the excessive use of which often has led to the development of many side effects. So for the development of different methods of protection, it is imperative to know the complete record of the growth rate statistics on a particular hybrid/cultivars. Studying these parameters would help in understanding and formulating the management strategies on a particular hybrid/cultivar in a better way.

The studies on the growth rate parameters of the cabbage aphid were carried out on cauliflower (Megha hybrid) under laboratory conditions at room temperature (7-26.5°C). For this purpose, the observations for the developmental period (from birth to adult emergence), reproductive period, longevity (from birth to death) and life time fecundity at different temperatures were used to construct age-specific life tables for the cabbage aphid. The growth rate parameters were calculated as per the methods given by Birch (1948) and Carey (2001). On the basis of these data, the net reproductive rate, the intrinsic rate of natural increase ( $r_m$ ), mean generation time (T), the true generation time, the finite rate of increase, weekly multiplication rate and doubling time parameters were calculated.

Growth rate studies of *B. brassicae* on Megha hybrid of cauliflower at room temperature reveal that the on the first day of the pivotal age, the survival was 100% and this trend was recorded upto third day of the pivotal age. However, on the fourth day of pivotal age, there was 80% survival which persisted up to 6<sup>th</sup> day. The survival from 7<sup>th</sup> to 19<sup>th</sup> day of the pivotal age was 70%. It was observed that with the increase in the pivotal age, the survival rate was decreased. Nymph laying was started on 11<sup>th</sup> day of the pivotal age (2.14 nymphs/female). Maximum nymphs were laid on the 14<sup>th</sup> day (3.71 nymphs/female) while minimum numbers of nymphs were laid on the 21<sup>st</sup> day of the pivotal age (1.00 nymphs female). On the 22<sup>nd</sup> day of the pivotal age, only two nymphs were laid after which the laying of the nymphs was completely stopped on 23<sup>rd</sup> day of the pivotal age. On the basis of these data, the growth rate parameters were calculated which reveal that the gross reproductive rate (GRR) was 28.13 nymphs/female while the net reproductive rate (Ro) was 18.0 nymphs/female. The approximate generation time was 15.32 days. The innate capacity for natural increase (rc) was found to be 0.18 on the basis of which, the true intrinsic rate of increase ( $r_m$ ) was calculated which was found to be 0.199. Further, the true generation time (T) was calculated which was found to be 14.52 days. On Megha hybrid, the finite rate of natural increase was 1.58 while the doubling time (DT) was found to be 3.46 days. The weekly multiplication of population (WM) was found to be 4.0 days.

The overall studies thus reveal that the on Megha hybrid, the cabbage aphid is able to multiply at faster rate and the population would double in 3.46 days.

## Standardization of seed drying method by chemical desiccants for cowpea cv. KashiKanchan

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Freshly harvested seeds of cowpea are highly prone to bruchids infestation and fast deterioration if the moisture content of seed is more than 12%. One of the best methods to manage the bruchids infestation and control deterioration during seed



storage is reduction of seed moisture. Bringing down the seed moisture to safer level by sun drying is an inexpensive method in tropical countries. But sun drying is difficult where high humidity and high temperature is frequently fluctuating one with another. Use of seed dryer also a best alternative to bring down the moisture content. But it may affect the viability due to temperature fluctuation at the time of seed drying. Zeolite beads (aluminum silicate) and silica gel are desiccants, which can be utilized for drying and ultra-drying of seeds. Sometimes ultra-drying of pulse seeds may induce secondary dormancy. By considering the above points, to standardize the drying method, vegetable cowpea cv. Kashi Kanchan seeds were mixed with Zeolite beads and Silica gel, separately, in the ratio of 1:0.5, 1:1, 1:2 and 1:3 (seed: desiccant, by weight) in an air tight container and kept at room temperature. Initial moisture content of seeds (12.4%) was estimated by hot air oven method. Seeds were separated from desiccant and weighed after 24h, 48h, 72h, 96h and 120h of drying. Weight of desiccants were also noted down at every 24h interval. At the end of the experiment final moisture content of dried seeds were estimated. It was observed that seed drying with zeolite beads was faster than silica gel. Significantly higher moisture content was removed from seeds (2.5 %) within first 24h by zeolite beads in 1:3 ratio. Final moisture content of seeds dried with zeolite beads reached 7.21% in 1:3 ratio and 9.6% in 1:0.5 ratio of drying condition after 120h of drying. In all the treatments, maximum moisture content from seeds was removed within first 24h of drying. Gradual increase in weight of desiccants indicate continuous removal of moisture from the seeds during drying period. Seed germination test concluded that seed drying with zeolite beads reduced the moisture content without affecting viability of seeds. Further work is necessary to know the storability of seeds dried with desiccants under air tight condition.

**Key words:** Seed drying, desiccants, moisture content, cowpea and germination

### Assessment of genetic purity in hybrid and validation studies in F<sub>2</sub> generation for the specific trait of interest using SSR markers in cucumber (*Cucumis sativus* L.)

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The molecular marker of Simple Sequence Repeat (SSR) was used to evaluate seed genetic purity of a hybrid and validation studies of F<sub>2</sub> population in cucumber. Experiment was carried out at the Experimental Research Farm of the Department of Vegetable Science, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh during the years 2015 and 2016. The experimental material for the study comprised of Khira-75 is a commercial variety grown in low and mid hills of the state (HP) but late in flowering and genotype PI-618860 is an inbred line collected from North Central Regional Plant Introduction Station, USA is early in flowering and having resistance to various biotic stresses. For confirmation of true hybridity and validation for traits of interest the parents Khira-75 and PI-618860 were crossed and F<sub>1</sub> and F<sub>2</sub> population of cross were raised. Hybrid purity studies revealed that one primer CSN 160 produced both the bands in parents as well as in F<sub>1</sub> population. Validation of molecular markers was confirmed with SSR00262, SSR17922, SSR10018 and SSR01331 for earliness, peduncle length and horticulturally important traits respectively.

**Keywords:** SSR marker; hybrid seed purity; cucumber; *Cucumis sativus* L. and validation.

### Ethnomedicinal plants of Shikari Devi Sanctuary area of Seraj Valley District Mandi Himachal Pradesh

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Nestling in the foothill of Himalaya, Shikari Devi Sanctuary area is a rich source of ethnomedicinal plants. This is one of the floristically rich zone. Due to favourable environmental conditions this zone is blessed with plentiful ethnomedicinal plant wealth. This area is located in Seraj Valley of Tehsil Thunag District Mandi at an altitude of about 2485 -3350 m above sea level. Total area is about 72 sq km. Shikari Devi area is covered by rich green pastures and with dense forest covered with *Abies pindrow*, *Syzygium cumini*, *Quercus leucotrichophora*, *Taxus wallichiana*, *Cedrus deodara* and rich in medicinal flora. Since



time immemorial medicinal plants have been greatly used by the local communities for their health care system. People living in the Himalayan regions are greatly dependent on the resources which they get from the forest. Though the communities have varying level of dependency i.e. medicine, edible, fodder, timber, fuel etc. Some of the most preferred species for medicine used in this area are *Bergenia ciliata*, *Trillium govanianum*, *Angelica glauca*, *Allium ursinum*, *Seseli indicum*, *Allium wallichi*, *Thymus linearis* etc. They are used for their varied medicinal values. Few species are continuously exploited for their own consumption and for trade indicate high pressure on these species. Their conservation is needed to restore the biodiversity.

**Key words:** Shikari Devi Sanctuary, Medicinal Plants, Diversity, Indigenous uses, Conservation

### Non-chemical disinfestation methods against *Oryzaephilus mercator* (Fauvel) infesting walnut kernel

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Walnuts (*Juglans regia*) are enriched with nutritional and health promoting attributes and have good export potential and long shelf life. However, insect-pests are constraints in their storage and marketing. Of the nine pests reported from India to affect walnut during storage, merchant grain beetle, *Oryzaephilus mercator* (Fauvel) (Coleoptera: Silvanidae) is the most important. Though not associated with direct weight loss in store, its infestation can lead to substantial contamination, resulting in quality deterioration, which may affect walnut export. Present investigations on ecofriendly disinfestation treatments viz., high temperatures (50°C, 60°C), low temperatures (1°C, -15°C), modified atmospheres (MA): MA<sub>1</sub> (40% CO<sub>2</sub>+60% N<sub>2</sub>), MA<sub>2</sub> (50% CO<sub>2</sub>+50% N<sub>2</sub>), MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) and combination treatments were undertaken to study their efficacy against *O. mercator* and stages thereof infesting walnut. At a temperature of 50°C and 60°C, pupal stage was most tolerant when treated in kernel with LT<sub>99</sub> (time to kill 99% of insects) values of 96.69 min and 45.13 min respectively. At low temperature of 1°C, 99% of the most tolerant stage (late larva) may be controlled by 5.2 days of exposure and at -15°C, 99% of the most tolerant stage (adult) may be controlled by 0.88 h of exposure period when treated in kernel. Of the MA treatments tested, MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) was most effective. The lethal times required for 50%, 90% and 99% kill of most tolerant stage at 28°C were 6.19, 10.88 and 16.53 h, respectively and 4.71, 7.68 and 11.98 h respectively at 35°C. Thus effective disinfestation treatments were: low temperature treatment at -15°C giving 99% disinfestation of walnut kernel within 0.88 h and combination treatment of MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) at temperature of 35°C giving 99% disinfestation within 11.98 h with no adverse effect on sensory attributes of walnut. This has great potential for use as phytosanitary treatment during export.

**Key words:** *Oryzaephilus mercator* (Fauvel), Walnut, Disinfestation, Thermal treatment, Modified atmospheres.

### Important Insect visitors of Litchi Bloom and Effect of Bee Pollination on yield of Litchi

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Insect pollination is crucial in the production of many commercially important crops. The dominant visitors observed on litchi bloom were mainly of two orders namely Hymenoptera and Diptera, consisting *Apismellifera* L., *Apis dorsata* Fab., *Apis florea* Fab., *Xylocopasp.*, *Polistes hebraeus* Fab., *Formica* sp., and *Scaevapyrastril.*, one unidentified Dipteran species was also recorded. These were further categorised into three different categories on the basis of visits namely, most frequent visitors, frequent visitors and less frequent visitors. The habitat of *Apismellifera* L. was the bee hives, *Apis dorsata* Fab. combs were found on water tank towers as well as on the trees *Apis florea* Fab. were present in bushes while *Xylocopasp.* were found on bamboo stems. The comb of *Polistes* F. were found on the buildings, *Formicasp.* was found residing in the soil while *Scaevapyrastril.* was of arboreal nature. Enhancing the amount or quality of insect pollination can lead to increase in crop value by decreasing the time to crop maturity and also by increasing its uniformity, quantity and quality. The yield was maximum in open pollination (120.3



kg/tree), followed by bee pollination (118.4 kg/tree) and lowest in pollination exclusion (92.1 kg/tree). The visit of pollinators increased the yield of crop in significant manner in spite having no significant difference in number of flowers per panicle in open pollination, bee pollination and pollination exclusion.

**Keywords:** Pollination, Litchi, Honey bee, Crop Production.

### **Geo-spatial Technology for Plant Diseases and Pests**

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Food security is our prime goal and losses in crops production hamper it. Various biotic and abiotic factors affect agriculture productivity and production. Among them poor soil, water scarcity, adverse temperature and insect pests, diseases and weeds are the causes that reduce the productivity of agricultural crops. Only plant diseases, insect pests and weeds cause 36 per cent loss in production. The losses may be reduced by the Nobel application of geospatial technology in study of outbreaks and management of insect pests and plant diseases. Geospatial technology includes Geographic Information System (GIS), Remote Sensing (RS) and Global Navigation Satellite System (GNSS). These systems have been used in collecting, mapping, analysing the distribution and predicting the scenario of insect pests and diseases. The technology has been used from the very beginning surveying the status of crop in respect of insect pests and diseases until forecasting to be occurred. However, the Geospatial technology has certainly playing a crucial role to decision makers in forming strategies for management of insect pests and diseases of agriculture crops and thus productivity and production.

### **Nutritional and antinutritional properties of biofortified wheat genotypes after phytase treatment**

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Phytate (*myo*-inositol-1,2,3,4,5,6-hexakisphosphate) is the major storage form of phosphate in plant seeds. It acts as a chelating agent for divalent cations such as Fe<sup>2+</sup>, Zn<sup>2+</sup>, Ca<sup>2+</sup>, Mg<sup>2+</sup>, Mn<sup>2+</sup> and makes complexes with these minerals which are insoluble and unavailable for their intestinal absorption in monogastric animals including humans. In this study, various biofortified wheat genotypes were evaluated for content of minerals (Fe and Zn), inorganic phosphate, phytic acid and tannin with a comparative analysis of same in parental wheat varieties as control. Another experiment was conducted to evaluate the effect of exogenous phytase supplementation and treatment in wheat flour of the experimental wheat derivatives as well as varieties on various nutritional and anti-nutritional parameters as above. Phytase supplementation led to improved dialyzability of minerals, soluble protein content and inorganic phosphate, respectively. Based on the mentioned outcomes, potential application of phytase is suggested in processing of foods for human consumption.

**Key words:** Phytase; Phytic acid; Tannin; Inorganic phosphate; Micronutrient dialyzability.

### **Medicinal crops for crop diversification in mango orchards for livelihood and food security under Jammu subtropics**

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Crop diversification is a farming practice which offers an extensive choice in the cultivation of various crops within a certain



limited area in order to extend production related activities on various crops and also to minimize the risk involved in the production of specialized food grain crops. In the fruit tree-based systems, agricultural crops are normally grown in the interspaces of fruit trees planted at a spacing of 5-7 m apart. The fruit trees are managed for 30-35 years and they give regular income and the intercrops, mostly annual crops, provide seasonal returns. The present investigation was done to screen out the best intercrop out of the four crops viz. ginger, turmeric, kalmegh and stevia that can be grown in old grown mango orchards. The experiment was laid out in Udheywala farm of SKUAST- Jammu. Mango orchard selected for the study had a very dense canopy and thus the interception of light was only 30-40 percent than that in the open. Crops allocated maximum assimilates towards leaf and branch growth both in open and under shade and the distribution was more pronounced under tree cover. There was almost 1.5 to 2 times higher distribution towards above ground biomass in case of intercrops compared to sole crop. It implied that these crops can be successfully introduced into mango based system. In comparison to sole crops, all the intercrops had 40%-50% reduction in yield except ginger which had a survival rate of 13.21% in the open conditions. Maximum yield (85.72 q ha<sup>-1</sup>) was recorded in turmeric followed by ginger (53.86 q ha<sup>-1</sup>), kalmegh (22.63 q ha<sup>-1</sup>) and minimum (0.14 q ha<sup>-1</sup>) in stevia under mango. The land equivalent ratios (LER), the measure of yield performance revealed that the monoculture equivalents were less than one for turmeric, stevia and kalmegh in all the treatments, indicating that production in such a system reduced the yield of each crop relative to what had been produced in a similar sized monoculture plot i.e sole crop. The maximum LER (13.48) was recorded for Mango + ginger followed by Mango + turmeric (1.57), Mango + kalmegh (1.53) and the least was in Mango + stevia (1.01). Thus it was concluded that under the subtropical conditions of Jammu region, ginger (*Zingiberofficinialis*), turmeric (*Curcuma longa*) and kalmegh (*Andrographispaniculata*) can be grown successfully as intercrops, however, stevia (*Stevia rebaudiana*) cannot be integrated. The most remunerative crop among the four was turmeric followed by ginger and kalmegh.

**Keywords:** Mango, Growth parameters, Stevia, Ginger, Agroforestry, Turmeric, Kalmegh

### Standardization of irrigation schedule for higher growth, yield and water use efficiency in *Asparagus racemosus*

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*Asparagus racemosus* (commonly known as Shatavar, Shatavari and Satmuli) belonging to family Liliaceae is a perennial climber found in the tropical and subtropical parts of India upto an altitude of 1500m a.m.s.l. Its tubers are used both in traditional and modern therapies. The major active constituents of *Asparagus racemosus* are steroidal saponins (Shatavarins I-IV) present in the tubers. It has been used in Ayurveda as a galactagogue, aphrodisiac, anodyne, diuretic, antispasmodic and nervine tonic since time immemorial and is mainly known for its phytoestrogenic properties. Due to destructive harvesting for tubers, its natural population is decreasing day by day. To make the cultivation of shatavar economical and viable it is imperative to increase the yield of its official part i.e. tuber. Biomass production in plant species depends directly on the availability and abundance of water due to seasonal fluctuations. In this context, the present study was conducted to standardize the irrigation schedules based on irrigation water depth and cumulative pan evaporation. The experiment was conducted under Randomized Block Design with ten treatments and three replications. In the present study, 3 irrigation water depths i.e., 40mm, 50mm and 60mm were used to achieve IW and CPE ratio of 0.75, 1.0 and 1.25 in each depth. Pan evaporation and rainfall were recorded daily. The maximum average dry weight of tubers per plant of 329.86 g was observed in treatment IW<sub>60mm</sub>/CPE<sub>60mm</sub>=1 followed by 3.21 g in IW<sub>60mm</sub>/CPE<sub>48mm</sub>=0.75 and 3.10 g in IW<sub>60mm</sub>/CPE<sub>80mm</sub>=1.25 but all were found statistically at par. Minimum average dry weight of tubers per plant (162.73 g) was found under rainfed condition. Rainfed treatment recorded water use efficiency (WUE) of 0.058 kg/m<sup>3</sup> which was at par with WUEs of 40 mm and 50 mm depth irrigations at all the three ratios. Based on low and non-significant difference in WUE in different irrigation schedules, the crop can be grown as rainfed.

**Keywords:** *Asparagus racemosus*, Shatavar, irrigation, water use efficiency, Shatavarin



## Development of high throughput protocol for in vitro estimation of glycemic index in Potato (*Solanumtuberosum*) tuber

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Potato is a root vegetable growing underground and an important staple food next to cereals. Potato starch is hydrolyzed by various enzymes in the human gut. Consuming starchy food like potato, which has a high glycemic index (GI) is likely to lead to the development of serious diseases such as type-2 diabetes, obesity and cancer especially in people with a sedentary lifestyle. We developed an inexpensive and precise high throughput in vitro method for estimation of GI of potato tubers. Among the six varieties, Kufri Chipsona-3 exhibited the highest GI (83.08) whereas KufriJyoti had the lowest value (72.87); the resistant starch (RS) content being 1.08% (low) and 2.18% (high) respectively. Our study showed a strong significant negative correlation ( $R = -0.889$ ) between GI and RS whereas a negative correlation ( $R = -0.523$ ) was found between GI and amylose content (AC). However, RS and amylose content (AC) were positively correlated ( $R = 0.383$ ). The newly developed protocol for estimation of in vitro GI of potato is a simple, rapid and precise method which would be helpful to screen a large number of potato and its product. This will also have an impact on plant breeders to select low GI potato lines which will ultimately benefit the general consumer in general and diabetic person in particular.

## Role Of Plant Growth Substances on Sex Expression and Yield of Cucurbitaceous Crops

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Cucurbits group is considered as the largest group of vegetable among eleven groups of vegetables, having tremendous commercial importance. Cucurbits exhibit a wide spectrum of sex form and diversity of sex expression, which is a serious problem for increasing fruit set and yield of crops. Most of cucurbits are monoecious and flower pattern is characterized by successive development of solitary staminate or pistillate flowers at node along either the male flowers is considerably more in number than female flowers. It can be inferred that it is possible to obtain lower sex ratio (M:F), higher number of fruits per plant and higher yield of cucurbitaceous crops with the application of various plant growth substances. The most effective concentration of Ethrel 50-150 ppm (Bottle gourd, Ridge gourd), 250 ppm (Sponge gourd) and 500 ppm (Water melon), 100-500 ppm (Cucumber), 200 ppm (Pumpkin), MH 50-150 ppm (Bottle gourd, Bitter gourd), PBZ 25-100 ppm (Bottle gourd, Bitter gourd), GA3 20 ppm (Bitter gourd) TIBA 150 ppm (Water melon) and Cycocel 200 ppm (Bottle gourd), were proved outstanding in the respect of sex expression and yield improvement in cucurbitaceous crops.

**Key words:-** Cycocel, Ethrel, GA<sub>3</sub>, Cucurbits, Sex expression etc

## Eco Friendly Management of Insect And Pest

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Plant diseases need to be controlled to maintain the quality and abundance of food, feed, and fiber produced by growers around the world. Bio-pesticides are ecofriendly pesticides which are obtained from naturally occurring substances (biochemicals), microbes and plants. Some are chemical pesticides if they act on nervous system of the pest. Through the use of



biopesticides in a wider way, agriculture and health programmes can be beneficially affected. There are many disadvantages associated with the use of chemical pesticides like genetic variations in plant populations, reduction of beneficial species, damage to the environment or water bodies, poisoning of food and health problems such as cancer which makes biopesticides to come into picture. India has a vast potential for biopesticides. Some biopesticides currently being developed may be excellent alternatives to chemical pesticides. Biopesticides being target pest specific are presumed to be relatively safe to non-target organism including humans. However, in India, some of the biopesticides like BT, NPV, neem based pesticides, Trichoderma etc. have already been registered and are being practiced. Different approaches may be used to prevent, mitigate or control plant diseases. Beyond good agronomic and horticultural practices, growers often rely heavily on chemical fertilizers and pesticides. Such inputs to agriculture have contributed significantly to the spectacular improvements in crop productivity and quality over the past 100 years. Additionally, the spread of plant diseases in natural ecosystems may preclude successful application of chemicals, because of the scale to which such applications might have to be applied. Consequently, some pest management researchers have focused their efforts on developing alternative inputs to synthetic chemicals for controlling pests and diseases.

**Key Words:** Bio pesticides, plant disease, pest, insect.

### **Enhancement of growth and biochemical yield of wheat plants, grown in sodic soil by integrated application of $\text{CaSO}_4$ , $\text{ZnSO}_4$ and FYM.**

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Soil salinity and sodicity are major abiotic factors which negatively affects plant growth and crop yield. These sodic soil specially have high content of insoluble salts like carbonates and bicarbonates of sodium and calcium along with high proportion of clay, responsible for its shrink-swell properties. The current study was conducted to observe the effect of integrated application of  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  (@ 100mg/Kg soil),  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  (@ 25mg/kg soil) and FYM (@10g /Kg soil) in sodic as well as non-sodic soil. A clay pot experiment was designed where the wheat (*Triticumaestivum* L. var. HD 3086) plants were grown in three set of soil filled pots (with 6kg soil capacity and lined with polythene), in one set only sodic soil (negative controlled) was filled, in second set sodic soil treated with fertilizers was filled and in third set normal soil treated with same dozes of fertilizers (positive controlled) was filled as that of sodic treated. In all three set of pots basal doses of N: P: K were applied (60: 30:30 mg/kg respectively) and each set was in triplicates. The treatments in second and third set of pots were as  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$  @ 100mg/kg,  $\text{ZnSO}_4 \cdot 7\text{H}_2\text{O}$  @25 mg/kg and FYM @ 10 g/kg soil were added 10 days prior to sowing and irrigated with water. Wheat seeds were soaked overnight in water after washing thrice. The water shocked seeds were sown as five seeds per pot at the depth of about 2 cm. The observations of growth parameters were made on regular basis and after 40 days of sowing biochemical parameters like pigments, protein, proline, catalase and peroxidase activity were estimated following standard methods. Soil sodicity has negative effects on plant growth even at germination stage and time of seedling emergence and number of seeds germinated varied according to medium of growth and treatments. The maximum growth was observed in normal treated soil followed by sodic treated and sodic non treated soil grown plants.

**Keywords:** Sodicity,  $\text{CaSO}_4 \cdot 2\text{H}_2\text{O}$ , growth, biochemical, treatments.





### **Effect of Integrated Nutrient Management on papaya**

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Integrated nutrient management includes the combine use of organics (i.e. manure, compost, bio fertilizers, green manure, crop residues, etc) and inorganic fertilizers to increase crop yield and farmers profits, improve crop quality and minimize nutrient losses to environment. Nutrient management is one of the key factor and most important cultivation practices to improve the productivity of papaya and account for 30% of total cost of cultivation. The productivity of papaya is adversely affected if the crop is not fed properly. The complementary use of chemical fertilizers, organic manures, biofertilizers is important to maintain and sustainability issues gaining importance. The complementary use of chemical fertilizer, organic manures, biofertilizers and other organic is important to maintain and sustain a higher level of soil fertility and crop productivity.

**Keywords:** INM, Papaya, Chemicals

### **Organic Farming for Sustainable Agriculture and Soil Fertility Management**

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Soil fertility is the backbone of agricultural systems and plays a key role in determining food quantity and quality. In recent decades, soil fertility has decreased due to indiscriminate use of agrochemicals, and nations around the globe are now facing the challenge of increasing food production while sustainably maintaining soil fertility. Organic farming is the best option to maintain the soil quality in which we utilise compost and vermicompost in place of chemical fertilizers. The objective of present study was to develop compost and vermicompost from the wastes like vegetable and fruit waste, food waste and biodegradable municipal solid waste, and assess their physicochemical, nutrient, microbial analysis and their toxicity assessment on seed germination percentage of pea plants. For this we made five different treatments (T<sub>1</sub>-T<sub>5</sub>) of the different organic waste in various ratio (co-composting). T<sub>5</sub> contains earthworms for the vermicompost development. At every 15 days we observed physicochemical parameters (pH, electrical conductivity, moisture content, pore space volume, percentage pore space, bulk density, particle density, organic carbon, organic matter and sulphur), Nutrients (Macro-N, P, and K. Micro- Zn, Fe, Mn and Cu) and at every month we isolated bacterial strain from the developing compost and vermicompost up to the 90 days. After 90 days the toxicity of final material was assessed on seed germination percentage of pea plants. The results from the study showed that the Material prepared from the different organic wastes exhibited positive impact on germination of pea plants. From this study it could be concluded that utilisation of compost and vermicompost besides chemical fertilizers is very beneficial, cost effective, sustainable and environment friendly.

**Key words:** Organic waste, Compost, Earthworms, Vermicompost, Pea plant

### **Effect of different levels of potassium on performance of Kharif maize (*Zea mays* L.)**

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The present experiment entitled “**Effect of different levels of potassium on performance of Kharif maize (*Zea mays* L.)**” was carried out at the Crop Research Centre of Tirhut College of Agriculture, Dholi under Dr. Rajendra Prasad Central Agricultural University, Pusa, Samastipur, Bihar during *Kharif* 2017. The experiment was laid out in randomized block design with four replication taking variety 'Pioneer-3377' as a test crop. The soil of the experimental field was sandy loam in texture,



calcareous in nature with pH 8.2 and low in organic carbon (0.44%). The soil contained 210, 16.32 and 122 kg ha<sup>-1</sup> available N, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O, respectively. The treatment comprised of nine treatments viz., RD of N and P + no K (T<sub>1</sub>), RD of N and P + 30 kg K ha<sup>-1</sup> (T<sub>2</sub>), RD of N and P + 60 kg K ha<sup>-1</sup> (T<sub>3</sub>), RD of N and P + 90 kg K ha<sup>-1</sup> (T<sub>4</sub>), RD of N and P + 120 kg K ha<sup>-1</sup> (T<sub>5</sub>), RD of N and P + 150 kg K ha<sup>-1</sup> (T<sub>6</sub>), T<sub>2</sub> + 5 t FYM ha<sup>-1</sup> (T<sub>7</sub>), T<sub>3</sub> + 5 t FYM ha<sup>-1</sup> (T<sub>8</sub>), T<sub>4</sub> + 5 t FYM ha<sup>-1</sup> (T<sub>9</sub>). Different treatments had significant influence on growth, yield and yield attributes of maize.

Plant height, number of leaves, dry matter accumulation, yield and yield attributes i.e., number of cobs plant<sup>-1</sup>, length of cobs, girth of cobs, number of grains cob<sup>-1</sup> and test weight were significantly influenced by different treatments. The plant population recorded at different stages of growth was found to be non significant due to different treatments. Experimental results indicated that treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>) produced higher plant population at all the stages of growth which were responsible for higher yield. Treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>) recorded higher plant height, number of leaves, dry matter accumulation at all the growth stages. There was no significant difference on 50% tasseling and silking. Similarly, there was no marked effect of different treatments on number of cobs plant<sup>-1</sup>, length of cobs, girth of cobs and test weight. However, number of grains cob<sup>-1</sup> was found significantly higher in treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>). Grain yield, stover yield and stone yield were significantly influenced by different treatments. The maximum grain yield (63.19 q ha<sup>-1</sup>), stover yield (101.61 q ha<sup>-1</sup>) and stone yield (14.61 q ha<sup>-1</sup>) were recorded under treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>). N and P content of grain and stover were non-significant due to different treatments. However, significantly higher K content of grain and stover was recorded with treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>). Significantly higher N, P & K uptake of grain and stover were recorded under T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>) as compared to other treatments. Economics of different treatments clearly indicated that by virtue of higher grain yield, treatment T<sub>9</sub> (T<sub>4</sub> + 5 t FYM ha<sup>-1</sup>) exhibited a gross returns, net returns and B: C ratio of ₹ 90,046 ha<sup>-1</sup>, ₹ 47,987 ha<sup>-1</sup> and 1.14, respectively.

### Response of Different Nitrogenous Fertilizers on Fruit Quality and Plant Growth.

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The present investigation was carried out with apricot (*Prunus armeniaca* L.) at the Experimental Farm of Department of Soil Science and Water Management, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2014-15 and 2015-16. The experiment was laid out in a randomized complete block design with three replications comprising eleven treatments viz. T<sub>1</sub>- urea 0% + Ca(NO<sub>3</sub>)<sub>2</sub> 100%, T<sub>2</sub>- urea 20% + Ca(NO<sub>3</sub>)<sub>2</sub> 80%, T<sub>3</sub>- urea 40% + Ca(NO<sub>3</sub>)<sub>2</sub> 60%, T<sub>4</sub>- urea 60% + Ca(NO<sub>3</sub>)<sub>2</sub> 40%, T<sub>5</sub>- urea 80% + Ca(NO<sub>3</sub>)<sub>2</sub> 20%, T<sub>6</sub>- urea 100% + Ca(NO<sub>3</sub>)<sub>2</sub> 0%, T<sub>7</sub>- urea 100% + Lime (708 g/tree), T<sub>8</sub>- urea enriched compost 25% + Ca(NO<sub>3</sub>)<sub>2</sub> 75%, T<sub>9</sub>- urea enriched compost 50% + Ca(NO<sub>3</sub>)<sub>2</sub> 50%, T<sub>10</sub>- urea enriched compost 75% + Ca(NO<sub>3</sub>)<sub>2</sub> 25%, T<sub>11</sub>- urea enriched compost 100% + Ca(NO<sub>3</sub>)<sub>2</sub> 0%. Pooled analysis of data showed that response of different treatments was significant and the pattern was similar to both the years of study. TSS contents of apricot fruit were markedly influenced by various nitrogenous fertilizers. Highest TSS (15.60 °Brix) and the lowest acidity (0.94%) was recorded under treatment T<sub>7</sub> (urea 100% + lime 708 g/tree). Annual shoot extension and tree spread (NS and EW) varied significantly among different treatments and ranged from 16.3 to 29.8 cm and 6.41 to 7.01 m, respectively and maximum being under treatment T<sub>7</sub> (urea 100% + lime 708 g/tree).

**Keywords:** urea, calcium nitrate and urea enriched compost.

### Studies on floral, vegetative and fruit characteristics of some elite mango (*Mangifera indica* L) germplasm in two mid hill districts of Nepal

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A survey of indigenous seedling mango germplasm growing in Kavre and Sindhupalchok districts of Nepal was carried out during the period of 2016 to 2017. The Survey is based on the data collected from the local sources among the farmers and orchard



caretakers. More than 100 mango elite seedlings growing at farmer fields/institutes, road sides and orchards were surveyed. Among from these best ten promising mango germplasm were selected and assessed in terms floral, vegetative and fruit characteristics. The Tree, leaf, foliage, flowering, fruit, stone and seed characters showed a lot of variation among the germplasm. The chance for the selection of elite genotypes are high due to wide genetic diversity in the germplasm and there is tremendous possibility of such material to act as a source for the selection of superior genotypes for conservation, evaluation utilization and a source for crop improvement in future breeding program.

**Keywords:** *Mangifera indica*, germplasm, floral, vegetative and fruit characteristics. Variability.

### **Effect of different growing media and shade levels on pot plant production *Aglaonema modestum*.**

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An experiment was conducted to study the effect of different growing media and a shade level on pot plant production of *Aglaonema modestum*. The experimental trial was carried out at the experimental farm of Department of Floriculture and Landscape Architecture, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (Himachal Pradesh). In this experiment different growing media viz. Soil + Sand+ FYM(1:1:1), Soil+ Cocopeat + FYM (1:2:2), Soil+ Cocopeat + Vermicompost(1:2:1), Forest Soil were used with 50%, 75% and 90% shade levels. Different shade levels will be attained by using 50%, 75% and 90% shade nets. In this study it was observed that maximum plant height (34.8cm) was recorded in Soil + Cocopeat + FYM(1:2:2) with 90% shade, number of leaves(18.00) was recorded in Forest Soil with 90% shade and plant spread(35.7cm N-S , 31.93cm E-W) was recorded in Soil + Cocopeat + FYM (1:2:2) with 50% shade after 180 DAP.

### **Contribution of Plant Protection Measures and extension Efforts in Doubling the Farmer's Income**

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Although India has doubled its per hectare yield in the past decades since green revolution time beyond the farmers in India continue face the challenges like lack of irrigation facilities, depleting water table levels, fragmentation of land, lack of scientific knowledge in farming, etc. However, one of the critical problems faced by farmers is low level of income. There are several factors that have dented the farmer's income which includes small land holdings, lack of availability of irrigation facilities and over dependence on monsoon, low consumption of pesticides and scanty crop yield. Plant protection is the practice of managing weather, weeds, pests and diseases that damage or inhibit the growth of fruit, vegetable and other horticultural crops. Proper crop protection is important to produce higher quality crops with minimal wastage. The crop protection encompasses: Pesticide-based approaches such as herbicides, insecticides and fungicides. Farmers lose a significant part of their income as their crop and produce are attacked by pests and weeds; hence it is essential to protect not only the crop but also the produce as on an average 25% of the yield is destroyed during storage and transportation. Pesticides help conserve the environment. Crop protection measures also covered the practices which farmers used to defend their crops against weeds, insects, and disease. Farmers around the world make multiple decisions each day regarding how best they can protect their crops. The enable farmers to produce more crops per unit area with less tillage, thus reducing deforestation, conserving natural resources and curbing soil erosion. Pesticides are also critical for the control of invasive species and noxious weeds. In present time it is high time to exploit the integrated plant protection measures through digital extension & communication system to increase the adoption rate of plant protect technologies among farmers, to save crop losses since sowing to harvesting and storage as well, which is directly correlated factor to enhance the income of farmers.

**Keywords:** Plant protection measures, Digital extension, Farmers, Doubling income.



### **Survey for assessing the disease severity of early blight of tomato caused by *Alternariasolanii* major growing parts of southern Karnataka**

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Early blight is one of the most important diseases of tomato (*Solanumlycopersicum* L.) worldwide and catastrophic. The disease was prevalent in all the tomato growing areas of southern karnatakaviz; Kolar, Chikkaballapur, Ramanagara and Tumakur districts were roving survey during *khari*f2017. And Per cent Disease Index (PDI) was recorded ranged from 28.75 to 57.50 per cent. The maximum PDI was observed in Chowdadenahalli village in Kolar district with 57.50 per cent and minimum PDI in Janapanahalli village in Tumkur district with 28.75 per cent.

Among the districts surveyed, the maximum disease severity was recorded in Kolar (50.43%), which may be due to susceptibility of cultivars, favourable environmental conditions *viz.*, optimum temperature and relative humidity, moisture conditions that must have favoured to build up of inoculum and subsequently showing increase in disease severity, whereas in Tumakuru district the disease was less (31.75%) compared to other districts. This may be due to unfavourable environmental condition which might reduce the build-up of inoculum and thus reduced the severity.

### **Effect of Gibberellic acid and different drying conditions on drying kinetics of grapes**

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In India, raisins are mainly produced in Maharashtra and 72.5 per cent of grape produced is used for table purpose, nearly 25.5 per cent is dried for raisin production. Application of high doses of Gibberellic acid by growers not only affects the eating quality of raisins but also causes delay in drying of grapes. Another problem which is effecting raisin production since last few years is untimely rains during grape drying season resulting in inferior quality of raisin.

Keeping in view the above problems experiments were conducted by ICAR –National Research Centre for Grapes, Pune where different doses of Gibberellic acid was given at pre bloom, flowering and fruit set stage. It was observed that application of Gibberellic acid increases the skin thickness which resulted in delay in ripening of grapes as compared to non treated grapes. In another experiment drying chambers having different drying conditions were fabricated at ICAR-NRCG. Grape drying was done in these modified drying chambers. Drying kinetics of grapes in these chambers indicated that the drying time was reduced by 50% in chamber having 40°C & 25% RH as compared to chamber with ambient conditions.

**Key Words:** Raisin, Gibberellic acid, drying time, temperature and humidity

### **Role of Nanotechnology in Horticulture**

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Nanotechnology has been defined as relating to materials, systems and processes which operate at a scale of 100 nm or less. Nanotechnology has many applications in all stages of production, processing, storing, packaging and transport of agricultural products. It has great potential to make agricultural more efficient by using nano-sensors and nano-agricultural chemicals. Nanotechnology is also used in Horticulture. The nanotechnology has its use in horticulture. Nowadays nanotechnology is used in many agricultural sciences such as horticulture. Nanotechnology is used in horticulture for increasing the shelf life of the product by controlling the growth of micro organisms, introducing a new generation of packaging coverage's (Films) and controlling



influence of gases and the harmful rays (UV), increasing strength, quality and packaging beauty, and using the multiple chips (Nanobiosensors) for labeling products that considered as fundamental step to automated control of storages. In this review

**Key words:-** Nano, Horticulture Packaging etc

### **Using Perl's blue method to detect the Iron Uptake in cowpea roots Treated with Iron Fertilizer**

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The aim of this soil pot experiment was to detect iron uptake in roots of cowpea (*Vigna unguiculata* L.) var. Rituraj, plants treated with ferrous sulphate  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  (10 ppm) at presowing using Perl's stain, which trace ferric ( $\text{Fe}^{3+}$ ) and ferrous ( $\text{Fe}^{2+}$ ) form of iron. Sections of cowpea root (of approximately 35 days of plant growth) were analyzed for detection of ferric and ferrous form of iron in Fe treated and control (untreated) plant. Ferric form produced as an insoluble blue compound after Perl's blue method. Ferrous ions do not produce a coloured reaction product, thus are excluded from the visualisation. Results showed that control plant showed more ferric ions in root as compared to Fe treated plant, indicating that applied Fe was taken up by treated roots. *In vitro* analysis shows that Perl's stain is helpful to understand Fe homeostasis in uptake mechanism under Fe deficient and sufficient conditions.

**Keywords:** iron; ferric; ferrous; cowpea; Perl's stain

### **Genome Wide Identification of TIR-NBS-LRR Gene Family in Potato and Their Expression Profiles in Response to Early Blight Disease Caused by *Alternaria solani***

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Potato is the most important non-cereal food crop, with worldwide production yielding approximately 388 million tonnes in 2017. The potato is prone to more than a hundred diseases caused either by bacteria, fungi, viruses and mycoplasmas. However, early blight or *Alternaria* blight caused by *Alternaria solani* is worldwide in distribution and one of the most destructive foliar disease in areas of epidemics with favorable weather conditions. To identify the resistance source against this pathogen, different strategies are being applied worldwide. TNLs are subset of gene family NBS-LRR that is responsible for approximately 80% of resistance genes identified till date in plant system against different pathogens. A total of 44 TIR-NBS-LRR genes were identified in potato genome through highly stringent computational method. These TNLs were characterized on the basis of conserved protein motifs, chromosomal locations, phylogenetic relationships and gene expression analysis. Expression pattern of selected genes was studied in two moderately resistant (Kufri Jyoti, Kufri Pukhraj) and one susceptible (Kufri Chandramukhi) genotypes of potato at different time points after early blight infection using real-time quantitative PCR. A total of 24 genes have been selected and among these genes, the majority of the NBS-LRR genes showed differential expression in response to early blight infection. Among these 24 genes, most of the selected TNL genes showed differential expression after inoculation in both resistant and susceptible genotypes which indicates the involvement of these genes in early blight infection. Taken together, our study will provide a new insight of TIR-NBS-LRR genes in response to early blight infection.

**Keywords:** *Alternaria solani*, Early blight, Potato, Genotypes, Real time PCR, TIR-NBS-LRR genes



## Apple-Marigold intercropping based Integrated Farming System in temperate Bhandarwah region of District Doda: A case study

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The present case study analyses apple-marigold intercropping based Integrated Farming System (IFS) model in village Gajotha of Tehsil Bhalla of temperate Bhandarwah region of District Doda of Jammu and Kashmir. A 54 years old farmer Hind Bhushan of the village has successfully adopted this system under the guidance of KVK Doda at his 3.2 hectares of farm of which 2.8 is under cultivation. Of the total land under cultivation, 0.8 hectares is irrigated and 2.0 hectares is rain fed. Percent-wise area under different enterprises are; horticulture (53.57%), field crops including fodder (28.57%), vegetables (10.72%), fishery (3.58%), cattle and sheep (0.45%), poultry (0.18%), and nursery raising (0.18%). With the integration of different enterprises, this model has been very successful in the area. Besides, two poly-lined water harvesting structures and a vermi-composting unit have also been established at the farm. Fruit orchard having 300 apple and 120 grafted walnut trees in an area of 1.5 hectares in which intercropping of marigold is followed is the major component of the system and represents the judicious use of the inter-space in fruit orchard for marigold cultivation. Net farm income from the model has been found to be Rs 3.40 lac per annum per hectares during the year 2018-19. The IFS model however needs enterprises optimization for more judicious resource utilization and profit maximization.

**Keywords:** Intercropping, farm income, integrated farming system, enterprise, apple, marigold

## Visual detection of phorate pesticides in water and food sample using silver nanoparticles as colorimetric probe

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Silver nanoparticles based colorimetric probe has received a great interest in the assaying of trace analytes in environmental samples. The present study is based on silver nanoparticles for the detection of highly toxic and widely used phorate pesticides. The proposed system is simple, rapid and provides a platform for on-site monitoring of phorate without using any costly instruments. The detection system is based on localized surface plasmon resonance (LSPR), the chemical interaction between the phorate and silver nanoparticles leads to a change in color of silver nanoparticles (Bright yellow to Brownish red), allowing the visual detection of phorate pesticides. Further, the detection mechanisms have been verified via FT-IR, UV-vis spectra, Zeta Potential, TEM and DLS. The prepared nanoparticles are spherical and have 22 nm size. The developed sensor is sensitive and has a limit of detection 0.5 ppm by naked eyes and 0.1 ppm by using UV-visible spectrophotometer. Furthermore, the proposed method was successfully applied for detection of phorate residues in water and food samples.

**Keywords:** Silver Nanoparticles, Organophosphate, phorate, etc.

## Comparison of Different Empirical models used for Estimation of Evapotranspiration for Mustard crop.

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Evapotranspiration is the combined water loss from plant and soil surface. Evapotranspiration is a necessary evil as it



devoid plants of water but it also help maintain temperature of the crops and avoid heat stress. In present study, potential evapotranspiration (PET) was calculated for mustard crop under seven empirical models and pan evaporation. Models used for the study were: Modified Penman model, Hargreaves model, Thornthwaite model, BlaneyCriddle model, Turc model, Christiansen model and FAO Penman Monteith model. Input required for conducting the study was: Maximum and Minimum Temperature, Maximum and Minimum Relative Humidity, Bright sunshine hour, Evaporation and Wind speed. Actual Evapotranspiration (AET) was derived from the PET with the help of Crop Coefficient value (Kc). Later, all the models were compared with measured value to see the respective performance of the models. Models were ranked based on their performance and later validated the performance by R<sup>2</sup>, RMSE, CVRMSE, NRMSE and MBE method. Another method of validation was by comparison of R<sup>2</sup> value of Leaf Area Index (LAI) and Shoot Biomass (SB) with cumulative PET and AET. Result came out to be that Hargreaves model performed best for the crop with highest ranking and validation under RMSE and other validation methods. Overall Turc model performed weakest of all the models.

**Keyword:** Mustard, Potential Evapotranspiration (PET), Actual Evapotranspiration (AET), LAI, Shoot Biomass (SB).

### **Bio-efficacy of *Heterorhabditisbacteriophora* against lepidopteran insect pests of tomato**

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The persistence use of chemical pesticides against insect pests has resulted in development of resistancy along with degradation of soil & human health. To overcome this problem the present study was planned to test the bio efficacy of indigenous entomopathogenic nematodes (EPNs) against the lepidopteran insect pests of tomato using petri plate bioassay in laboratory. The target pest were collected from farmer's field near Eternal University and reared on natural as well as artificial diet in the Zoology laboratory of the University under optimum conditions. The already isolated EPNs were mass multiplied on bait insect *Corcyra cephalonica* & *Galleria mellonella* and tested for efficacy against *Helicoverpaarmigera*, *Spodopteralitura* and *Agrotissegetum*. *In vivo* culturing of *H. bacteriophora* was also done on *C. cephalonica* & *G. mellonella* and yielded approximately 10,000-11000 IJs/ larva of rice moth. The effect of *H. bacteriophora* on *Helicoverpaarmigera* larvae in different exposure time showed that highest mortality 96% at dose 200 IJs/10 larvae was recorded in 3<sup>rd</sup> instar larvae after 120 hours, whereas the lowest mortality 4% was recorded at dose 50 IJs/10 larvae after 24 hours. In case of 4<sup>th</sup> instar larvae highest 100% mortality was recorded at dose 200 IJs/10 larvae after 120 hours and least 6% was at 50 IJs/10 larvae after 24 hours. The pathogenicity of *H. bacteriophora* against 3<sup>rd</sup> instar larvae of *S. litura* at different exposure time showed that highest mortality 98% at dose 200 IJs/10 larvae was recorded after 120 hours, whereas the least mortality 5% was recorded at dose 50 IJs/10 larvae after 24 hours. In 4<sup>th</sup> instar larvae highest 100% mortality was recorded at dose 200 IJs/10 larvae after 120 hours and least 6% was at 50 IJs/10 larvae after 24 hours. The pathogenic effect of *H. bacteriophora* against the 3<sup>rd</sup> instar larvae of *A. segetum* at highest tested dose of 200 IJs/10 larvae caused progressive increase in mortality after 120 hours the mortality caused up to 98%. The lowest mortality 8% was recorded at dose 50 IJs/10 larvae after 24 hours. In case of 4<sup>th</sup> instar larvae highest 94% mortality was recorded at dose 200 IJs/10 larvae after 120 hours and least 10% was at 50 IJs/10 larvae after 24 hours. Fourth instar larvae were found to be more effective to indigenous EPNs strain (*H. bacteriophora*) as compared to third instar larvae. The results revealed that maximum mortality was recorded 96-98% at inoculation 200 IJs/10 larvae after 120 hours and was significantly different from the mortality recorded in other inoculations, whereas lowest mortality was recorded at inoculation 50 IJs/10 larvae. The result showed that with the increase in time exposure, rate of mortality also increased up to 100%. It is concluded that native species of EPNs show high virulence against the local pest in laboratory studies.

**Keywords:** *Heterorhabditisbacteriophora*, *Helicoverpaarmigera*, *Agrotissegetum*, *Spodopteralitura*, Bioefficacy, Pathogenicity



## Fruit and vegetable mandi waste for microbial production of animal feed enzyme

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### Abstract

Use of microbial enzymes as feed additives is a well-established practice and the majority of feeds for poultry and swine in intensive farming contain feed enzymes. In particular, the application of phytase has been widely adopted, but many other enzyme classes can significantly improve the utilization of feed such as cellulases, pectinases, amylases and proteases. The feed enzymes market has been projected to reach about US\$1,280 million by 2019 from US\$900 million in 2014. However, the huge cost of feed enzymes due to the rise in the cost of raw materials is acting as a key restraint hindering the growth of this market. The objective of current study was using low cost substrate mainly fruit and vegetable mandi waste viz. mix fruit pomace, cauliflower stem and reject, banana pseudo stem, bael, cabbage, sugar beet waste, aonla pomace, kinnow peel, mosambi peel, mango peel & stone and guava waste for animal feed enzyme production using microbes *Lactobacillus curvatus* and *Saccharomyces cerevisiae* having probiotic value and incubated under the anaerobic condition at  $35 \pm 5^\circ\text{C}$  for 7 days. After that the filtrate was used as liquid crude enzyme extract while the residue was mixed with wheat straw in 2:1 ratio, air dried and packed. Since enzymes are proteins with a highly complex three-dimensional molecular structure and are heat sensitive, enzyme activity was observed in liquid crude enzyme extract at different time intervals during storage at room temperature. Highest phytase activity was observed in crude enzyme extract of mixed fruit pomace ( $103 \mu\text{mol/ml/min}$ ) followed by bael waste and aonla pomace ( $100$  and  $99 \mu\text{mol/ml/min}$ , respectively). Highest pectinase activity was observed in crude enzyme extract of kinnow peel ( $3.887 \mu\text{mol/ml/min}$ ) followed by bael waste ( $1.0883 \mu\text{mol/ml/min}$ ). Highest cellulase activity was observed in crude enzyme extract of kinnow peel ( $1.406 \mu\text{mol/ml/min}$ ) followed by bael waste ( $0.978 \text{ U } \mu\text{mol/ml/min}$ ). Highest amylase activity was observed in crude enzyme extract of kinnow peel ( $3.121 \mu\text{mol/ml/min}$ ) followed by bael waste ( $1.150 \mu\text{mol/ml/min}$ ). Since, enzymes are heat sensitive, the activity decreased during storage at room temperature. Higher protein value and probiotic microbial load was observed in solid residues left after crude enzyme extraction. The study indicates that kinnow peel, bael waste and aonla pomace can be suitably used for production of animal feed enzymes.

**Key words:** Fruit and vegetable, mandi waste, microbial production, animal feed, enzyme

## Mango leaf composting using microbial consortium

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Mango leaves are rich source of calcium, magnesium, nitrogen, phosphorus and some other trace elements. Therefore, leaf litter accumulation in mango orchard is a potential source of soil nutrients and organic matter, but farmers recognize it as waste material that needs to be discarded from the system. The common management practices in dealing with such problem is burning of leaves which causes environmental pollution as well as reduce soil fertility. Composting of mango leaves is a beneficial proposition from environmental as well as soil fertility point of view. However, it takes 120 to 150 days for composting of leaves. The present study was conducted to reduce composting period. A microbial consortium of 20 bacterial and 12 fungal isolates, from degrading organic substrates and having high degradative enzyme activities, was used for composting of mango leaves. It took one month for complete composting. Metagenomic analysis at species level of the mango leaf compost indicated that 3% of OTUs (Operational Taxonomic Unit) were assigned to unassigned species with in chitinophagaceae family. The study indicates that in addition to added microbial consortium, some microbes are also coming from the environment that is helping in composting processing.

**Keywords:** Mango leaf, composting, microbial consortium





## Effect of long-term application of fertilizers and amendments on soil health in an acid Alfisol

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Maintaining soil in optimum health is a prerequisite to support necessary food grain production and sustain ecological services. Increasing food production sustainably to meet future food and nutritional needs while maintaining a healthy soil resource is complex. Thus, to study the effect of continuous cropping and fertilization on soil health, an experiment was conducted in ongoing long-term fertilizer experiment. This experiment was initiated during 1972 at experimental farm of Department of Soil Science, College of Agriculture, CSK HPKV, Palampur in randomized block design with eleven treatments which were replicated three times. The soil of the experimental area was silt loam and classified taxonomically as “*TypicHapludalf*”. Soil samples were collected from surface (0 - 0.15 m) and subsurface (0.15 - 0.30 m) layers after the harvest of wheat (*rabi*, 2016-17). Samples were analyzed for various physical, chemical and biological soil health parameters using standard methods of analysis. Balanced fertilization along with FYM improved the soil physical condition, maintained soil nutrient status and enhanced biological activity of soil thus improved overall soil health. Use of lime along with balanced fertilization improved soil health as compared to imbalanced fertilization. The soil was rendered almost barren with the sole use of N because of the deleterious effect of continuous use of urea on soil health. Therefore, it can be concluded that integrated nutrient management helps in maintaining soil health over a long period of continuous cultivation.

## Studies on quality characteristics of squeezed honey of hive and wild honeybees

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The present investigation entitled “**Studies on quality characteristics of squeezed honey of hive and wild honeybees**” was conducted during the year 2018 to 2019 in Apiculture Laboratory, Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The squeezed honey of hive bees viz., *Apis mellifera* and *Apis cerana* was collected from the university apiary, whereas, the squeezed honey of wild honeybees viz., *Apis dorsata* and *Apis florea* was obtained from beekeepers of Nalagarh. The samples were analyzed for various physico-chemical characteristics under laboratory conditions. Pollen density (92000 pollen grains per 10g), sucrose (8.90 %), Ca (61.20 mg/kg), Mg (17.60 mg/kg), P (63.10 mg/kg) and Na (89.33 mg/kg) were statistically highest for *A. cerana* squeezed honey, whereas, pH (6.25), moisture (17.20 %) and F:G ratio (1.98) was statistically highest in squeezed honey of *A. dorsata*. Squeezed honey of *A. mellifera* had statistically highest EC (0.61 mS/cm) and Vit.C content (25.56 mg/100g), whereas, squeezed honey of *A. florea* had statistically highest acidity (83.56 meq/kg) and phenol content (86.37 mg/100g). The amount of pH and F:G ratio for squeezed honey of *Apis dorsata* (6.25 and 1.98) and acidity for squeezed honey of *A. florea* (83.56 meq/kg) was above the permissible level of FSSAI Standards for honey (2018). Significant positive correlation was recorded between EC and pH; moisture and pH; amino acid and acidity of squeezed honey of *A. mellifera* and between EC and pH; acidity and fructose of squeezed honey of *A. cerana*. Significant positive correlation was recorded between colour and pollen density; amino acid and acidity; Vit.C and acidity of squeezed honey of *A. dorsata* and between EC and pH; amino acid and acidity of squeezed honey of *A. florea*. However, the honey of hive and wild honeybees analyzed from different areas of Himachal Pradesh was safe for consumption and suitable for Indian market and export purpose.

**Keywords:** Honey, hive bee honey, wild bee honey, HMF, squeezed honey and honey sugars



## Physico-chemical characteristics of *Apis cerana* F. honey from different agroclimatic zones of Himachal Pradesh

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The present investigation entitled “Physico-chemical characteristics of *Apis cerana* F. honey from different agroclimatic zones of Himachal Pradesh” was conducted during the year 2018 to 2019 in Apiculture Laboratory, Department of Entomology, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh. The honey of indigenous hive bee i.e. *Apis cerana* F. was sampled from four agroclimatic zones of Himachal Pradesh and information on floral sources was also recorded at the time of sampling. The samples were analyzed for various quality parameters following standard estimation procedures and compared with the standard quality parameters given by FSSAI Standard for honey (2018). The *A. cerana* honey of Zone 2 (Mid hills, sub-humid zone) had statistically highest pollen density (88888 pollen grains per 10g), sucrose (7.16 %), Ca (86.59 mg/kg), P (70.30 mg/kg) and Na (167.08 mg/kg), whereas, moisture (17.61 %), glucose (34.42 %), acidity (46.16 meq/kg), amino acid (113.39 mg/100g), diastase (16.99 DN) and phenol (80.73 mg/100g) were statistically highest in Zone 1 (Sub-mountain and sub-tropical, low hills zone). The honey of Zone 4 (High hills, temperate dry zone) had statistically highest fructose (36.84 %), F:G (1.40) and Vit.C (26.48 mg/100g), whereas, pH (5.51), EC (0.35 mS/cm) and HMF (65.89 mg/kg) were statistically highest in Zone 3 (High hills, temperate wet zone). The quality parameter for honey from Zone 2 (regions of Mandi) indicated that the vegetation and honey flow sources are natural and wild in origin. No specific trend in physico-chemical characteristics was observed with respect to altitude. Thus, the honey of *A. cerana* from different locations of four agroclimatic zones of Himachal Pradesh was well within the limit of FSSAI, safe for consumption and suitable for Indian market and export purpose.

**Keywords:** *Apis cerana*, HMF, indigenous honeybee, hive bees, honey sugars and honey quality

## Arbuscular mycorrhizal symbiosis in sustainable maintenance of soil fertility for improving nutrient acquisition and growth of Poplar

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Mycorrhizal symbiosis represents a specialized plant-fungal interface through which nutrients are transported from soil to the host. Arbuscular mycorrhizal (AM) hyphae not only transport nutrients but also contribute to soil nutrient cycling by developing cooperative interactions with microbes of plant rhizosphere. In this aspect, a pot experiment was conducted to assess the synergistic effect of AM fungi and inorganic fertilizers on nutrient acquisition and growth of Poplar (Clone PL5). A total of twelve treatments were made using different combinations of AM fungi (as culture AM<sub>1</sub> and AM<sub>2</sub>) and variable doses of inorganic fertilizers (75% and 100% of recommended dose of N and P fertilizer). AM symbiosis in terms of percent root colonization of Poplar was observed, which revealed higher root colonization with AM<sub>1</sub> inoculation as compared to AM<sub>2</sub>, at 60 and 180 days after plantation (DAP). The AM inoculated treatments were observed with significantly higher soil nutrient availability as compared to uninoculated controls as highest organic carbon (0.34 %), available N (157.1 kg ha<sup>-1</sup>) and available P (17.0 kg ha<sup>-1</sup>) content was observed with application of AM<sub>1</sub> + N<sub>100</sub>P<sub>75</sub>, whereas highest available K (135.5 kg ha<sup>-1</sup>) content was recorded in treatment with application of AM<sub>1</sub> + N<sub>75</sub>P<sub>75</sub>. Nutrient uptake as N (0.70 g/plant), P (0.15 g/plant) and K (0.54 g/plant) was recorded highest in mycorrhizal treated plants (under AM<sub>1</sub> inoculation) than the non-mycorrhizal controls. Plant growth attributes viz. leaf number per plant, collar diameter, root-shoot biomass and length improved significantly with AM<sub>1</sub> inoculation along with recommended dose of fertilizers. Moreover, plantations engaged in mycorrhizal symbiosis but receiving reduced doses of inorganic fertilizer were observed with highest percentage (100 %) of survival and sprouting. It was concluded that AM inoculation improved the



growth of Poplar and efficiently substituted for the reduced dose of inorganic fertilizers through increased soil fertility and nutrient uptake. Therefore, AM as bio-inoculant can be accepted as standard practice in developing a nutrient efficient system for obtaining quality nursery stock of Poplar.

**Keywords:** Arbuscular mycorrhizae, Bio-inoculant, Poplar, Stocks, Nutrient acquisition.

## Recent Trends in Entrepreneurial Activities in Floriculture

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Floriculture is 'the art of growing flowers to perfection' being a branch of horticulture, it deals with the cultivation of flowers and ornamental crops from the time of planting to the time of harvesting. In India and worldwide floriculture has emerged as a profitable agribusiness. Market of floriculture is unscientific and unorganised still some specific market like K R market (Karnataka), Dadar market (Maharashtra) gives better platform for floral marketing in India. Recent advances in genetic transformation enable the production of desirable and novel flower colors in some important floricultural plants. The main pigment targeted for flower color modification are anthocyanins that contribute to a variety of colors such as red, pink and blue. India is the largest exporter of dry flowers as dry flower products can efficiently add value to flowers. Different dry flower products like wall hanging, greeting card, pot pourri etc. can be prepared. Dry flower industry is available business for both at household and at industry level. It provides scope for employment generation. As unknowingly we are exposed to toxins and harmful pollutants even when we are indoors. There are certain plants, which are excellent purifiers in this scenario like areca palm, bamboo palm, aloe vera, boston fern, money plants, syngonium plants, snake plant, peace lily, spider plant and dracaena. The green building concept (i.e. a structure which is environmentally responsible and resource efficient throughout its life cycle) is gaining importance in various countries. It creates healthy indoor environment with minimum pollutants.

**Keywords:** Floriculture, genetic engineering, flower pigment, dry flower, indoor plants, green building.

## Integrated Approaches in Crop Protection

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The objective of this paper is to explore the extent to which the integrated approaches in crop protection has helped in striving towards a sustainable agriculture, food security, and providing nutritious food to the people across the globe. Plant pest and disease can wipe out farmers' hard work and cause significant loss to yield and income posing a major threat to food security and sustainable agriculture. Integrated crop protection represents an approach to the control of pest that places emphasis on the crop and cropping system rather than individual pest disciplines because there is no single product that can bear the crop protection burden alone. The integrated system of protection focuses on the following: Crop protection innovation, weed management, insect management, plant disease management, eco-friendly crop protection measures and knowledge on pest diversity. The order of priorities is on (i) increasing yield (ii) crop protection (iii) human health (iv) environmental and social aspects. This sequential approach results in solving many problems related to sustainability of agriculture like increasing soil erosion, secondary salinization, water logging, soil nutrients depletion, health hazards and environmental pollution.

**Keywords:** Integrated crop protection, Monsanto, food security, sustainable agriculture, Integrated Pest Management



## Field screening of cucumber parents and hybrids for tolerance against downy mildew and powdery mildew diseases

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Cucumber production is threatened by heavy incidence of downy mildew and powdery mildew diseases which inflict economic loss. Identifying and deploying tolerant genotype are required for cucumber geneticists to develop promising hybrid/variety against these diseases. An experiment has been conducted at Horticulture Research Station/KVK, Dr. YSPUH&F, Kandaghat, Solan, Himachal Pradesh during *Pre-Kharif* season 2017 in field condition to probe the tolerance among cucumber genotypes (parent and hybrids) against downy mildew and powdery mildew diseases and yield component traits. The occurrence and severity of downy mildew and powdery mildew diseases was recorded periodically under natural conditions. Fifteen leaves were randomly selected from different levels of height (from top to bottom) from five vines of each genotype/hybrid and disease severity for downy mildew and powdery mildew was recorded by adopting the 0-4 scale and 0-5 scale, respectively. The classification of genotypes (parent and hybrids) into resistant and susceptible groups was classified into five categories [0-10% : resistant (R); 11-20%: moderately resistant (MR); 21-30% : moderately susceptible (MS); 31- 40%: susceptible (S); > 40%: highly susceptible (HS)] on the basis of percent disease index (PDI). In this present study, PDI (Per cent disease Index) was calculated and it was ranged from 11.38% to 56.38% and 11.00% to 66.67% for downy mildew and powdery mildew diseases, respectively. Among the genotypes (parent and hybrids), cross 2870 G × K-90 recorded maximum yield (4.90 kg/plant) and least PDI of 11.38 (19.72) % followed by 2870 G × Kohinoor Local with yield (4.90 kg/plant) and least 12.36 (20.58) % PDI categorized under moderately resistant group. Therefore, hybrids 2870 G × K-90 and 2870 G × Kohinoor Local were identified as downy mildew and powdery mildew disease tolerance hybrid in field condition and these hybrids also better for fruit yield and yield component traits.

Keywords: Cucumber, Downy mildew, Powdery mildew, Yield component.

## Climate change, its impact on agriculture and mitigation strategies

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Population growth and climate change are the challenges of the 21st Century. Climate change is mainly caused by anthropogenic emissions of greenhouse gases (GHG: CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFC, PFC and SF<sub>6</sub>), which accumulate in the earth's atmosphere and trap heat. It is a known fact that global temperature levels will rise anywhere between 2 - 5° over the next century. In developing countries like India, climate change could represent an additional stress on ecological and socio-economic systems that are already facing tremendous pressures due to rapid urbanization, industrialization and economic development. Climate change has had an effect on the monsoons too. India is heavily dependent on the monsoon to meet its agricultural and water needs, and also for protecting and propagating its rich biodiversity. Most of the simulation studies have shown a decrease in the duration and yield of crops as temperature increased in different parts of the India. Yields of both *kharif* and *rabi* crops decreased as temperature increased by 2°C; and increase resulted in 15-17 percent decrease in the grain yield of both crops, but beyond that the decrease was very high in wheat. The nutritional quality of cereals and pulses may also be moderately affected which in turn will have consequences for our nutritional security. The loss in farm level net revenue may range between 9 per cent and 25 per cent for a temperature rise of 2-3.5°C climate change. The potential of organic agriculture in mitigating climate change depends on its ability to reduce emissions of GHGs, nitrous oxide and methane, increase soil carbon sequestration, and enhance effects of organic farming practices which favor the above two processes. Reduction of greenhouse gas emissions recent experiments results suggested that organic agriculture can significantly reduce GHG emissions. Both conventional and organic agriculture



relies on solar and fossil energy for food production. Carbon sequestration in soils and plants is the only strategy that can remove carbon from the atmosphere and, over time, reduce atmospheric concentration of CO<sub>2</sub>. This approach allows the enforcement of adopting new and improved farming practices aim at mitigating climate change. In addition, organic agriculture is highly adaptable to climate change and is also provides a high degree of diversity in the ecosystem.

**Key words:** Climate change, impact, mitigation, strategies

### **Effect of different organic and inorganic manures on growth and yield of Kapoor tulsī (*Ocimum kilimandscharicum* Guerke) under mid-hill condition of Himachal Pradesh.**

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The present study was achieved on Kapoor tulsī (*Ocimum kilimandscharicum* Guerke) during the two seasons 2017-18 and 2018-19 at the experimental farm of Department of Forest Products, Dr. Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh (India). In this experiment ten treatments viz., Control, FYM (15t/ha), NPK (120:60:60 kg/ha), FYM+NPK (15 t/ha + 120:60:60 kg/ha), Jeevamrutha-desi cow (125 l/ha), Jeevamrutha-jersey cow (125 l/ha), Panchagavya-desi cow (50 l/ha), Panchagavya-Jersey cow (50 l/ha), Vermicompost (3t/ha) and Vermicompost + NPK (3 t/ha + 120:60:60 kg/ha) were evaluated in RBD design with three replications on growth and yield of Kapoor tulsī. Pooled results revealed that the combined application of vermicompost and NPK (3 t/ha + 120:60:60 kg/ha) produced highest growth viz. plant height (107.58 cm), number of branches per plant (35.00), number of leaves per plant (383.17) and yield viz. fresh herb yield (94.05 q/ha), essential oil content (0.431 %), essential oil yield (26.67 l/ha) as compared to control and sole application.

**Keywords:** Manure, tulsī, herbage, essential oil, growth and yield.

### **Comparative studies on the persistence of Triazophos in some summer vegetables**

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In an effort to compare the persistence of triazophos, applied @ 500 (X-dose) and 1000 (2X-dose) g.a.i ha<sup>-1</sup> in the fruits of capsicum, brinjal and tomato crops, the present study has been made. The study indicated that the dissipation of this insecticide irrespective of fruits followed concentration dependent first order kinetics. Half-life value (RL<sub>50</sub>) was calculated to be 1.5, 1.6 and 1.5 days for capsicum, brinjal and tomato, respectively at X-dose. Moreover, the persistence of this insecticide when compared between different fruits, it is highest in capsicum followed by brinjal and least in tomato. Initial deposits of triazophos at X-dose on capsicum fruits were 1.874 mg kg<sup>-1</sup> dissipated to 0.947, 0.461, 0.195 and 0.068 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively. In case of brinjal initial deposits were 1.104 mg kg<sup>-1</sup> dissipated to 0.788, 0.390, 0.187 and 0.062 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively and in tomato fruits at X-dose initial deposits of triazophos were 1.073 mg kg<sup>-1</sup>, dissipated to 0.779, 0.298, 0.134 and 0.059 mg kg<sup>-1</sup> after 1, 3, 5 and 7 days of spraying, respectively. Triazophos residues dissipated below the limit of quantification (LOQ) of 0.05 mg kg<sup>-1</sup> after 10 and 15 days, respectively, at single and double the application dosages in all the three vegetable crops.

**Keywords:** Triazophos, Capsicum, Brinjal, Tomato



**Organic tomatoes: Heterosis studies for fruit yield and its components in bacterial resistant tomato (*Solanum lycopersicum* L.) under Mid Himalayan conditions**

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Tomato (*Solanum lycopersicum* L.) cultivation in commercial growing pockets of Himachal Pradesh is severely affected due to bacterial wilt disease (caused by *Ralstonia solanacearum*). Being soil borne only the genetic resistance in the cultivars/hybrids is of practical significance especially in organic farming condition where chemical fertilizer is a limiting factor. Being safe and better in quality, the demand for organic tomatoes is increasing day by day, for which high yielding organic input responsive varieties/hybrids with more pest tolerance/resistance are required. Keeping these points in view, the present investigation was undertaken to estimate the extent of *per se* performance and heterosis, under organic farming system. Eight diverse genotypes and their 28 cross combinations developed in half diallel mating design were evaluated along with standard check Avtar (7711) in bacterial wilt sick plots in RBD with three replications under organic farming system. The analyses of variances indicated significant differences among genotypes (G) for marketable yield and other component traits in all the environments. Most of the hybrids and parents showed 100 per cent plant survival. On the basis of *per se* performance and heterosis for marketable fruit yield and component traits, the cross combinations *viz.*, 12-1 × BWR-5, Palam Pride × BWR-5, Palam Pride × 12-1 and Hawaii 7998 × 12-1 were the most promising and surpassed the standard check (Avtar). Development of these superior F<sub>1</sub> hybrids and/or true breeding lines suitable for cultivation under organic condition has the potential to boost tomato production in bacterial wilt infested areas.

**Key words:** *Solanum lycopersicum*, organic, heterosis, better parent

**Cooking effect on ascorbic acid, protein and phenol content of potato**

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Potato plays an important role in health of humans as it contains many health beneficial components such as ascorbic acid, phenols, proteins, carotenoids and carbohydrates. Cooking methods such as boiling and microwaving alter potato composition significantly. Thus, the present study was conducted to evaluate the effect of different cooking methods (Boiling, Microwaving, Frying) on ascorbic acid, total phenols and total protein of potato varieties *viz.* Kufri Chipsona 1 (processing variety), Kufri Jyoti and Kufri Bahar (table varieties). Boiling had most deleterious effect on ascorbic acid content with 26% reduction followed by microwave cooking (16%) on average. Total protein content (FW) on boiling and microwaving reduced by 53% and 83%, respectively. Total phenols decreased by both processing methods with maximum decrease after boiling (83%) followed by microwaving (52%). Decrease of 33% and 17% for ascorbic acid; 63% and 54% for total protein; 65% and 28% for total phenols were observed in chips and french fries, respectively. Hence, it can be concluded that both cooking methods cause reduction in potato health promoting compounds but microwaving can be considered as better cooking treatment with minimal effect on these health promoting compounds.

**Keywords:** Potato, Ascorbic acid, Protein, Phenol, Boiling, Microwaving



## Diversity of click beetles belonging to subfamily Agrypninae (Coleoptera, Elateridae) in India

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The Elateridae (commonly known as click-beetles and larvae are known as wireworms) with 10000 described species are among the richest families in Coleoptera. Elaterids are found worldwide in a range of habitats such as grasslands and forests, and their larvae, commonly called wireworms, dwell in soil, litter, or dead wood, where they feed on plants, animals, or decaying organic matter. Wireworms are important pests of a wide variety of crops such as potato, cereals, carrot, onions, beans, peas, cabbage, radish, sugar beet, sugarcane and soft fruits. They are also predaceous on numerous species of wood boring cerambycid and scarabaeid grubs.

So far seven subfamilies are reported from India. Subfamily Agrypninae is one of the largest in Elateridae and represents a cosmopolitan group. Members of this subfamily inhabit the tropical regions of the old and new world. The earliest record of Agrypninae Elateridae from India was published by Fabricius in "Systema Entomologiae" who described *Elater fuscipes* from South India, which was transferred later to the genus *Lanelater*. Candeze, Schwarz, Fleutiaux and Ohira and Becker are the authors who contributed to the Indian Agrypninae. Vats and Kashyap studied the Elaterids from North western India and described forty new species of the genus *Agrypnus*. Chakraborty and Chakraborty published a check list of this subfamily from India. But since then many taxonomic changes and new taxa have been added to the Indian Agrypninae fauna. So in the present study all those changes have been taken in to consideration.

The geographical distribution for all the species has been compiled mainly based on literature and survey. A total of 225 valid species names belonging to 24 genera are reported from India distributed in to five tribes viz., Agrypnini, Drilini, Hemirhipini, Oophorini, and Pseudomelanactini. Among the tribes, the most diverse one is Agrypnini with 143 species. Within this tribe the most speciose genera is *Agrypnus* followed by *Adelocera*. The next diverse tribe is Oophorini with 42 numbers of species followed by Pseudomelanactini. The least diverse tribe is Drilini represented by single genus *Selasia* with a single species.

The species of this subfamily is distributed throughout India but maximum diversity reported from northern parts of the country. So the present exhaustive listing of Subfamily Agrypninae provides a holistic view about diversity and distribution and it also helps in exploring Agrypninae diversity in unexplored areas.

## Exploitation of Somaclonal Variations in Vegetable Crop Improvement

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Somaclonal variations are genetic or epigenetic changes induced in plant cell and tissue culture. Induction of somaclonal variation, is an alternate approach to conventional breeding and transgenic approaches to introduce desirable genetic variability in the gene pool. Tissue culture based *in vitro* selection has emerged as a feasible and cost-effective tool for developing stress-tolerant plants. Somaclonal variation is manifested as cytological abnormalities, frequent qualitative and quantitative phenotypic mutation, sequence change, and gene activation and silencing. The selection of somaclonal variations appearing in the regenerated plants may be genetically stable and useful in crop improvement. It occurs in rather high frequencies, which is a great advantage over conventional mutagenesis. Use of somaclonal variation may reduce the time required for the release of new variety as compared to mutation breeding. The ease of tissue culture propagation has revitalized certain ornamental industries and facilitated the rapid introduction of new cultivars. Several strategies have been followed to ascertain the genetic fidelity of the *in vitro* raised progenies comprising morpho-physiological, biochemical, cytological and DNA-based molecular markers approaches. Somaclonal variations can pose a serious problem in any micropropagation program, where it is highly desirable to produce true-to-type plant material. On the other hand, somaclonal variation has provided a new and alternative tool to the breeders for obtaining genetic variability relatively rapidly and without sophisticated technology in horticultural crops, which are



either difficult to breed or have narrow genetic base. This method of somaclonal variation selection has been successful in enhancing disease resistance in several crops and it is an accepted biotechnological approach with tremendous potential for crop improvement.

**Keywords:** Somaclonal variations, biotechnology, crop improvement, *in vitro* selection, molecular markers, disease resistance.

### **Henna Genetic Resources for Enhancing Productivity in Hot Arid and Semi Arid Region of Rajasthan**

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Mehndi or Henna (*Lawsonia inermis* L.) is a perennial shrub which is growing in a commercial scale in arid and semi-arid regions of Rajasthan. This hardy shrub belongs to the family Lythraceae and is cultivated as a commercial crop possess natural orange-red colour dyeing properties in arid and semi-arid region of Rajasthan. It occupies about 40,000 ha area in India out of which 35,000 ha alone in Pali district (Sojat and adjoining tehsils). Around 90 percent of total production of henna dry leaves is produced in Pali district of Rajasthan and Sojat is only center for its processing and trading in India. Cultivation of henna is profitable under low rainfall as well as poor soil condition and it is an important source of income of farmers in the drought prone arid and semi-arid regions of Rajasthan. There are no released varieties of henna at present and only populations raised from seeds are existing at farmers field in India. Hence considerable scope exists for germplasm selection for high yield and lawsone content. Research studies were initiated in Central Arid Zone Research Institute (CAZRI), Regional Research station, Pali, to identify and generate elite type of henna through clonal origin for increasing the quality leaf production. So, the survey has been made in Sojat area and CAZRI, Jodhpur for identification of elite henna genetic resources. Eighteen superior henna plants were collected based on morphological characters viz., plant height, plant circumferences, number of branches, leaf length, leaf width, internodal length and crown spread and Lawsone content. The plant height ranged between 112 cm to 211 cm. The leaf length and width ranged from 1.59 to 3.8 cm and 0.8 to 1.53 cm respectively. The cuttings were collected from selected superior henna plants and multiplied for further field evaluation.

**Keywords:** Henna, Hardy shrub, Variability, Arid and Semi-arid region, Leaf production

### **Impact of Climate Change on Shifting of *Pinus wallichiana* in the High Altitude of Pangri valley, Himachal Pradesh, North Western Himalaya**

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#### **Abstract**

Climate change is one of the biggest challenges to the world in the 21<sup>st</sup> century. Climate is changing from the last glacial maxima (LGM) but after industrialization the rate of climate change is rapidly increasing. The CO<sub>2</sub> level has increased from 280 ppm (1960) to 495 ppm (IPCC, 2019). The global average surface temperature rose 0.6 to 0.9 degrees Celsius (1.1 to 1.6° F) between 1906 and 2005, and the rate of temperature increase has nearly doubled in the last 50 years and the global average surface temperature rose 1.5 degrees Celsius after industrialization. Alpine climates also have experienced even greater increases in temperature. With an increase in anthropogenic activities determining the global climate, and in particular, altitudinal distribution of plant communities are likely to change and a subsequent reaction of climate sensitive species and ecosystems are expected to shift towards high altitude. The present study is an attempt to assess the shifting of *Pinus wallichiana* due to climate change at high altitude of Pangri valley, District Chamba of Himachal Pradesh. Shifting of vegetation was assessed on the basis of class size distribution of plants with respect to





altitudinal range. Seedling of *Pinuswallichiana* shows maximum positive significant correlation with altitudinal range ( $r= 0.320$ ), indicating thereby, with increase in altitude the seedling density also increasing. Sapling of *Pinuswallichiana* also showing maximum positive significant correlation with altitudinal range ( $r= 0.300$ ), indicating thereby, with increase in altitude the sapling density also increasing. Both seedling and sapling increase with altitude showing shift of *Pinuswallichiana* with altitude. Trees density in size class  $>200\text{cm}$  of *Pinuswallichiana* showing maximum negative significant correlation with altitudinal range ( $r= -0.370$ ), indicating thereby, with increase in altitude the density of trees with diameter  $>200\text{cm}$  is decreasing. Total tree density of *Pinuswallichiana* showing maximum negative significant correlation with altitudinal range ( $r= -0.164$ ), indicating thereby, with increase in altitude the total tree density is decreasing. So there is need to regular monitoring of the alpine vegetation to check the impact of climate change on vegetation.

**Keywords:** Climate change, Density, Size Class, Altitudinal Range, Shifting of Vegetation

### Effect of Plant Extracts on Sciarid flies in Oyster Mushroom

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Oyster mushrooms are prone to the insects belonging to order diptera among which the most prevalent are the sciarid and phorid flies. Neem seed kernel extract, *Meliaazedarach*, *Ricinuscommunis* and Neemkavach were used against *Bradysiatritici*(Coquillett) in *Pleurotussajorcaju*. Dichlorvos (0.01%) was used as a standard check, untreated insect inoculated bags as control I and untreated insect free bags as control II. The maggots of the test insect were released at 40 individuals per bag. The formulations were sprayed each at 1.0, 2.0 and 5.0 per cent at spawning. Observations regarding per cent mycelial growth at pin head initiation, per cent mycelial depletion at second flush, total sporophore yield, per cent infestation of sporocarps by *B. tritici*, multiplication potential of the test insect on *P. sajorcaju* and visual symptoms were documented. NSKE (5 %) and castor leaf extract (2%) were most effective concerning to mycelial growth and depletion, insect multiplication, flush pattern and total sporophore production. All the treatments were found to be effective in reducing sporocarp infestation with respect to insect inoculated control and all the bags represented improved yields with respect to insect inoculated control. The only treatment which was not found to be effective was castor leaf extract (5%) which did not allowed optimum mycelial impregnation resulting into negligible sporophore production possibly due to high concentrations of ricin and ricinine.

**Keywords:** NSKE, *Meliaazedarach*, *Ricinuscommunis*, *Bradysiatritici*, ricin, ricinine

### Carbon storage potential of traditional agriculture-based agroforestry system along the altitudinal gradient in Solan district of Himachal Pradesh

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Climate change is the result of global warming, which is mainly due to an increase in the concentration of greenhouse gases especially CO<sub>2</sub>. The largest proportion of CO<sub>2</sub> in the atmosphere is a result of burning of fossil fuels and conversion of tropical forests to agricultural lands. One of the strategies to manage CO<sub>2</sub> is through carbon sequestration. Agroforestry systems provide a huge potential for terrestrial carbon sequestration and can play an effective role both in mitigating and adapting climate change. Keeping this in view, the present investigation was carried out in Solan district of Himachal Pradesh to study the carbon storage potential of different traditional agriculture-based agroforestry systems viz., agri silviculture (AS), agri horticulture (AH), agri silvi horticulture (ASH), agri horti silviculture (AHS) along the elevation. Total carbon stock in vegetation among different agro forestry systems varied from 25.38 tC ha<sup>-1</sup> to 33.97 tC ha<sup>-1</sup> and it followed the precedence as ASH>AHS>AS>AH. There was increase in total carbon stock of vegetation along altitudinal gradient in all the agroforestry systems. Soil carbon



density among different systems varied from 57.41 t C ha<sup>-1</sup> to 59.03 t C ha<sup>-1</sup>. The maximum soil carbon density was recorded in ASH followed by AS, AHS and least in AH. Along the altitudinal gradient soil carbon density increased along the elevation up to E<sub>4</sub> and then decreased. Thus, this study could provide information on carbon sequestration potential of these traditional agroforestry systems and can also predict the effect of climate change on these potentials. These systems could be promoted in area for long term economical as well as ecological benefits.

**Keywords:** Agroforestry, carbon sequestration, carbon stock, climate change.

### **Evolution of suitable genotype(S) of Strawberry under open field and polyhouse condition of Southern Rajasthan**

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A study was conducted under naturally ventilated greenhouse and open field conditions of Southern Rajasthan to evaluate genotypes of strawberry (*Fragaria x ananassa* Duch.) at Horticulture Farm, Department of Horticulture, Rajasthan College of Agriculture, Maharana Pratap University of Agriculture and Technology, Udaipur (Rajasthan), India during the years 2011-13. Performance of strawberry genotypes viz. Camarosa, Winter Down, Ofra, Sweet Charlie, Seascape, Nabila and Rania under both environmental conditions revealed that the cultivars Seascape followed by Winter Dawn were best with respect to the plant height and spread. The cultivars Winter Dawn and Ofra were earliest to flower and the duration of flowering was longest in Winter Dawn and Camarosa. The cultivars Winter Dawn and Camarosa stand promising with respect to fruit yield and fruit size. The TSS, Vitamin-C and total sugar contents were highest in Sweet Charlie, whereas acidity was highest in Nabila.

**Keywords:** Strawberry, genotypes, open field, polyhouse and Southern Rajasthan

### **GAP along with market linkages enhance farmers income: a case study of Malihabad, Uttar Pradesh**

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Mall-Malihabad fruit belt of Lucknow district is well known for production of world famous Dashehari mango. The farming community in this fruit belt is facing with the issues of high cost of insect pest management under changing pest dynamics, high post-harvest losses and wastages due to inappropriate harvesting and post harvest practices and low produce price due to dependency on intermediaries. Therefore, horticultural interventions viz; judicious use of pesticide, good harvesting and post harvest practices and innovative marketing was carried out in selected orchards to augmenting mango grower's income under Farmer FIRST project in Nabipanaha villages of Malihabad mango belt during year 2017 and 2018. Good Agricultural Practices (GAP) during production, harvesting and post harvest handling were followed in orchards of selected farmers and further linkages were developed with local and distant markets. The income of GAP adopters were compared with non GAP adopters. The numbers of pesticide sprays were reduced to four in GAP adopted orchards compared to average 7.27 sprays in conventional management practices. The cost incurred in pest and disease management was reduced to 19.69 per cent as compared to traditional practice. Losses due to cracking and bruising during harvesting operation were reduced to 2.28 per cent in GAP adopted orchards while 8.67 per cent harvesting losses were reported in conventional harvesting practices. The highest net price per kg mango (Rs. 58.4) was achieved in distant marketing followed by direct marketing to local consumer (Rs. 32.43) in urban area whereas lowest net price per kg mango (Rs. 20.96) was obtained in traditional marketing. GAP adoption and market linkages led to 93.08 per cent enhancement in farmer's income compared to traditional production, harvesting, post harvest practices and marketing. Higher benefit cost ratio (2.91) was also calculated for GAP and market linkages system compared to traditional system.

**Keywords:** Mango growers, income, marketing linkages, good horticultural practices.



## Hi-tech approach for Strawberry (*Fragaria* × *annanasa*Duchesne) cultivation

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Strawberry, *Fragaria* × *annanasa* Duchesne, is octaploidspecies and the grown commercially temperate and subtropical climatic regions of the world. It is a high value crop and requires application of standardized practices for secured output. Technological advancement has enabled the hi-tech cultivation of strawberry. Hi-tech approaches like plug tray propagation, robotics, plasticulture, Variable rate technologies (VRTs), nutrient film technique and hydroponics are being used for effective input management, quality planting material production and disease-free strawberry production. Fruit of strawberry is spoiled early when it comes in contact of soil and it also reduces its quality so use of soilless growing media like hydroponics is the best method to solve this kind of problem. In hydroponics, in place of soil, different substrates like cocopeat, vermiculite and perlites in combination with water and nutrients are used for the cultivation of strawberry. The substrate-based hydroponics system is more stable and is suitable for the long production cycle of strawberry. Among various hydroponic methods nutrient film technique (NFT) is the best method for the cultivation of strawberry however, due to lack of buffering capacity it is risky and is associated with problem of crown rot. Thus, use of soilless substrate or media under hydroponic system is commercially most viable for quality production of strawberry.

**Keywords:** Hi-technology, Hydroponics, Nutrient Film Technique (NFT), Soilless, Strawberry.

## Alteration of Anti-Oxidative Enzyme Activity in Mustard Plant under Cadmium Stress

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Cadmium (Cd) is ecologically hazardous and non essential heavy metal, which causes oxidative stress in plants. Elevated concentration of Cd in water and soil affect adversely on plants, animals, and human health through food chain. In order to explore deleterious effect of oxidative stress of Cd toxicity under glass house condition, a soil pot culture experiment was implemented with mustard (*Brassica juncea*) a hybrid variety (TMMD-2901) under different Cd concentration 1(T1), 5(T2), 10(T3) and 25(T4) mg Cd kg<sup>-1</sup> soil. The results showed that the growth parameters such as germination percentage, plant height, fresh & dry weight (leaf, stem, and root) and photosynthetic pigments of hybrid variety (TMMD-2901) of mustard was reduced at higher concentration of cadmium (25 mg Cd kg<sup>-1</sup>soil). A concentration dependent increase was observed in anti-oxidative enzymes and lipid peroxidation. This increase in antioxidant enzymes activity depicted the high tolerance of mustard plant towards heavy metal stress by increasing activity of SOD (superoxide dismutase), CAT (catalase), POD (peroxidase) and APX (ascorbate peroxidase).

**Key words:** Cadmium, Antioxidant Enzymes, Oxidative Stress, Photosynthesis Pigments and Mustard.

## Pest Management in Different Farming Systems

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The side-effects of the modern agricultural chemicals and machines raise serious interrogations about the overall benefits of the new technology in Conventional farming system. Agricultural chemicals, including hormones and antibiotics leave residue in food that may cause cancer or genetic damage. This farming system has more popular in farmers, although highest debt for input



requirements. This situation has been leading to a new thought of looking at other natural farming systems like organic farming and zero budget natural farming. The alternative technologies return to traditional, eco-friendly practices; organic farming is one among them. The three main tactics dealing with pest problems in organic agriculture are the use of botanical pesticides, biological control agents and cultural (management) techniques. Organic farming is holistic food production management system, which promotes and enhances agro-ecosystem health, including biodiversity, biological cycles and soil biological activity. Another alternative, to overcome the rising problems of synthetic insecticide is Zero Budget Natural Farming (ZBNF). The word 'budget' refers to credit and expenses, thus the phrase 'Zero Budget' means without using any credit, and without spending any money on purchased inputs. 'Natural farming' means farming with Nature and without chemicals. Subhash Palekar, the discoverer of ZBNF, gave many theories, principles and methods of ZBNF. The principal methods of ZBNF include crop rotation, green manures and compost, biological pest control. For the management of pests, biopesticide are supernumerary to minimize harsh effects of synthetic insecticides. Three new biopesticides viz., Brahmastra, Agniastra and Neemastra, extract from different natural occurring plants with cow urine and cow dung are effective against major pest of economic crops. These organic and zero budget natural farming systems not only reduce the dependence on the insecticides for pest management but also help in sustainability in production with minimizing the cost of raising crop.

**Key Words:** Agniastra, Brahmastra, Conventional Farming, Neemastra, Organic Farming, Zero Budget Natural Farming

### **Studies on the effect of cocopeat based growing media for pot plant production of China aster (*Callistephus chinensis* (L.) Nees)**

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China aster is a most popular annual flowering plant grown throughout the world and belongs to the family Asteraceae. In India, it is grown traditionally for loose and cut flowers, floral decorations, garlands and venis, bouquets, buttonholes, making mixed herbaceous border etc. In addition, it is sold as a popular pot plant. The present investigation was carried out at the Research Farm of the Department of Floriculture and Landscape Architecture, Dr Yashwant Singh Parmar University of Horticulture and Forestry, Nauni, Solan (HP) during 2018-19. The experiment was laid out in a Completely Randomized Design (Factorial) using four growing medium i.e. (i) sand + soil + FYM (1:1:1, v/v), (ii) sand + soil + FYM + cocopeat (1:1:1:1, v/v), (iii) [sand + soil + FYM (1:1:1, v/v)] + cocopeat (1:1, v/v), (iv) [sand + soil + FYM (1:1:1, v/v)] + cocopeat (1:3, v/v) and five cultivars viz., 'Arka Aadhya', 'Arka Archana', 'Arka Kamini', 'Local White' and 'Local Pink'. The observations were recorded on various growth and flowering parameters. It was documented that cultivar 'Local White' exhibited maximum plant spread of 27.86 cm when grown in [sand + soil + FYM (1:1:1, v/v)] + cocopeat (1:1, v/v). Earliest visible bud formation was noticed in cv. 'Arka Kamini' (72.17 days) when grown in mixture comprising of sand + soil + FYM + cocopeat (1:1:1:1, v/v). Likewise, duration of flowering was noted maximum (43.67 days) in cv. 'Arka Archana' when grown media containing [sand + soil + FYM (1:1:1, v/v)] + Cocopeat (1:1, v/v). As far as flower diameter is concerned cv. 'Arka Archana' (6.10 cm) was found to have maximum flower diameter when grown in sand + soil + FYM + cocopeat (1:1:1:1, v/v). Based upon the present study, it can be concluded that all five cultivars can be grow successfully in pots.

**Key words:** China aster, pot plant, cocopeat, plant spread, visible bud formation, flower duration



## Economics of Cotton Carding Enterprise in Punjab -A Study of an Agro Based Industry

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The present study was carried out with the objective to analyze the economics of cotton carding (*Penja*) an agro based industry in Punjab. The primary data were collected from 40 villages of Fatehgarh Sahib District during the year 2015-16. A total number of 12 enterprises were found running cotton carding units. The proportion of landless, marginal, small, semi medium, medium entrepreneurs were 58.33 percent, 16.66 percent, 8.33 percent, 16.60 percent, and 16.66 percent respectively and none of the entrepreneur had large farms. The entrepreneurs were adding value to the cotton and filling it in a stitched cloth for making of quilts used in winters and were found charging for their value addition. The net returns were to the tune of Rs 21378 per annum. The payback period was 6.71 years. The major problem as reported by the entrepreneurs was of seasonality of the work and availability of raw material. Uninterrupted power supply and all time availability of raw material may help in promoting the agro based village industry in the state.

**Keywords:** Agro based, Enterprises, Cotton carding, Payback Period, Gross Returns, Net Returns

## Diversification of mountain agricultural area and income in relation to farm size and other Socio economic Characteristics: A case study of Himachal Pradesh.

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Diversification with commercial crops is now a key strategy to increase agricultural income and minimize risk and to further help in poverty alleviation, employment generation and environmental conservation. The present investigation was an attempt to identify the empirical relationship within a static framework, between crop diversification and selected socio-economic variables; and these relationships are sensitive to different diversification measures used. The study is based on primary data which was collected from the selected respondents with the help of multistage random sampling technique. Diversification was measured by using Herfindahl index, Entropy index and index of maximum proportion. For determining the effect of different factors on diversification, a censored tobit regression model was used. The results show that distance from market (Km), experience (years), cropping intensity, crop yield index, literacy rate, literacy index, farm size and dependency ratio w.r.t. family size were significantly affecting the diversification index. It is the present need to motivate the farmers to diversify the farming through providing facilities such as price policy, proper market and disseminating market information at appropriate time and providing low cost agricultural technology etc. in order to get benefited by diversifying the farm. The study suggests region specific policies for provisions of acreage and income generating diversification activities for smooth economic transformation.

**Keywords:** Diversification, Risk Management Strategy, Tobit Model, Dependency Ratio, Crop Yield Index.



## Recent advancements in the predictive systems for detection and management of plant diseases.

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The predictive systems have been in use in agriculture since the early 20<sup>th</sup> century when people discovered a high correlation between disease spread and severity with the environmental variables. The introduction of computers various computer simulation models were developed like EPIDEM (against early blight of tomato and potato in 1969). Various new technologies have emerged in recent years like remote sensing, which are the breakthrough in the detection, forecasting, and management of plant diseases. The remote sensing technology uses powerful sensors to detect light reflected from the surface of plants as well as soil. This is a non-invasive method that can be used for the detection of plant diseases over a large area in a short period of time. The satellite-based remote sensing system as well as sensors mounted on unmanned aerial vehicles (UAVs) or drones can be used for obtained aerial images in a specific spectrum of light. Remote sensing combined with geographic information system can be used for mapping the severity of infection of specific plant pathogen in a given area. The sensors can be mounted on machines (like tractors and sprayers) or in field for near field remote sensing. The sensors used in remote sensing usually detect a small portion of the spectrum of light reflected by plants and soil at a given time which limits the spectral resolution. However the hyperspectral sensors can detect radiation in wider range of the spectrum which provides a wider area for investigation. The image processing and data mining system can be used to process and classify the images of diseased samples such as leaves taken from mobile devices for automatic and accurate detection of plant diseases. Web-based predictive models such as SISALERT has been developed which uses computer simulation models combined with real-time weather data acquisition for disease forecast.

**Key Words-** Predictive system, Remote sensing, Web-based models, Image processing and data mining.

## Marketing Costs and margins in the Marketing of Groundnut in Punjab

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The present study was undertaken to examine the production, consumption and marketed surplus of groundnut on different size categories of farms in Hoshiarpur district, to estimate the marketing costs and margins of various intermediaries in the marketing of groundnut and to analyse the constraints associated with the marketing of groundnut in the study area. Primary data for the year 2017-18 were collected from 60 farmers comprised of 34 small, 14 medium and 14 large farmers from three villages of Bhunga block of Hoshiarpur district. To study the marketing aspects data were collected from various intermediaries in Hoshiarpur market. It was observed that the average size of holding in case of small, medium and large farmers was 4.73, 15.18 and 33.57 acres respectively. The area under groundnut on said categories of farmers was 3.48, 12.63 and 25.39 acres respectively. The marketed surplus in groundnut was found highest on large farms (99.53%) as compared to medium farms (98.89%) and small farms (95.61%). Only one marketing channel i.e., Producer-Commission Agent-Wholesaler-Roaster-Cum-Retailer-Consumer was identified in the study area for marketing of the produce. Price spread was estimated to be Rs.5027.00 in the prevailing channel. Producer's share in consumer's rupee was found to be 41.21 per cent. In marketing of the produce major problems faced by the farmers were output price fluctuation, transportation of produce to the market, dependence on commission agent for sale and delayed payment etc.. Farmers should be encouraged to organize themselves into cooperatives which will help them improve the bargaining power and also generate scale economies in acquisition of inputs, services, and information. Better marketing facilities, standardization of minimum support price are generally required to make groundnut production a remunerative enterprise in the study area. Govt. price policy should ensure better minimum support price to groundnut growers for their produce with a view to encourage the increase in area and production.

**Keywords:** Constraints, Groundnut, Marketed surplus, Marketing costs, Margins



## Storage stability and quality assessment of stabilized Rice bran and wheat bran and their utilization in Development of instant noodles

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Despite the nutritional value, the use of cereal bran in food products is restricted due to presence of lipid degrading enzymes, which causes rancidity and as a result, the shelf life is very low. An attempt was made to stabilize wheat bran and rice bran and then add them to instant fried noodles. The optimum stabilization process included steaming at 100°C for 5 minutes and further drying at 70°C for about 1 hour. The process resulted in decreased lipase activity in both wheat bran and rice bran to a satisfactory level. The free fatty acids % in steamed wheat bran did not increase significantly during 60 days of storage. However, the treatment was not effective in case of rice bran though the free fatty acid formation was less compared to raw bran samples. Instant noodles were produced with varying compositions of bran i.e. 0%, 10% raw bran, 15% raw bran and 10% stabilized bran. The addition of bran in noodles increased the total dietary fibre content of noodles from 3.78% up to 6.82%. The storage stability of the noodle samples were checked at 62.8°C by sensory evaluation. The noodle samples containing stabilized bran were found to be more stable than the samples containing raw bran. Hence stabilization of bran can be a good option to include it in food products without compromising the stability of the product. For future study, the method of noodle production may be shifted towards air drying to overcome oil uptake problem.

**Keywords:** lipid degrading enzymes, stabilization, free fatty acids, instant noodles, storage stability.

## Different Species of *Salix* in Kashmir Valley

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The genus *Salix* spp. belongs to family Salicaceae, comprising of trees and shrubs. It has around 400 species, divided into 32 series of which only a few include tree-sized species. They are found growing primarily on the moist soils in cold and temperate regions of the Northern Hemisphere. Its centre of abundance is in China, having about 270 species, and in the former Soviet Union, with 120 species. About 103 species occur in North America and 65 species in Europe. In India, 27 known native willows have been recorded. Willows are cheap, provide a sustainable source of material for a variety of uses, are easy to establish from cuttings, and require no fertilizer inputs. Besides having medicinal properties, willow is used in the manufacture of boxes, brooms, cricket bats, cradleboards, chairs, and toys, etc. In addition, tannin, fibre, paper, rope, and string can be produced from the willow wood. The multipurpose tree of Kashmir, *Salix*, is planted everywhere in the valley and is found growing wild in the forests and along Nallahs even in high altitude areas of Ladakh and Kishen Ganga drainage in the form of a bush or shrub is known as 'Veer' in Kashmiri. A good number of species of *Salix* are indigenous in Kashmir including *Salix tetrasperma*, *Salix wallichiana*, *S. dephnoides*, *S. caesia*, *S. denticulate*, *S. elegans*, *S. himalaynsi*, *S. acmophylla*, *S. flabellaris*, *S. fragilis*, *S. phenotachya* and *S. pseudowallichiana* (Masoodi *et al.*, 2004). *Salix fragilis*, *S. caprea*, *S. babylonica*, and *S. maatsudana* are the other species of tree willow introduced in Kashmir.

**Keywords:** Salix, Willow, Kashmir, Uses, Species



## Enhancement of Learning Environment through Metacognitive Strategies

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The present day era is marked by globalization and advancement in technology which are the main driving forces of change and challenges in the socio-economic, environmental and technological landscapes. To meet the challenges of 21<sup>st</sup> century 'Metacognition' has been recognized as a critical skill to thrive and help students to succeed in their classroom and beyond. At its core, metacognition is a basic survival strategy, since it involves self-reflection on one's current position, future goals, potential actions and strategies. Thus, metacognition plays an important role in learning and achievement. It helps students in optimizing their problem-solving experience by being aware of how one is engaging with the process of learning, interpreting the task at hand as well as what strategies are being selected and employed in achieving learning goals. With this thought of pursuit in mind the present study was conducted to investigate the relationship between the 'Metacognition and Learning Environment' among adolescents. The sample for the study was collected from the adolescents (aged 16-18 years) studying in the randomly selected Government Senior Secondary schools of Ludhiana and Moga districts of Punjab. **Metacognitive Awareness Inventory (MAI)** developed by **Schraw and Dennison (1994)** was used to investigate 'Metacognition' among adolescents along with its components and sub-components. Whereas, **Dundee Ready Education Environment Measure (DREEM)** developed by **Roffet al (1997)** was adapted for the purpose of assessing the student perceptions of their 'Learning Environment'. The findings of the study revealed that the 'Regulation of Cognition' component of metacognition and the overall metacognition were significantly and positively correlated with the 'student perceptions of learning' as well as 'student perceptions of atmosphere' dimensions of the Learning Environment. However, 'Knowledge of Cognition' component of metacognition and the overall metacognition were significantly and positively correlated with the 'student academic self-perceptions' dimension of Learning Environment. Thus, the results suggested that it was important to develop metacognitive skillfulness among students through intentional methods for enhancing their learning experiences and elevating students to a level of thinking beyond their current capabilities.

**Keywords:** Metacognition, Learning Environment, Knowledge of Cognition and Regulation of Cognition

## Integrated management of weed

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Integrated weed management (IWM) is a strategy for weed control that considers the use of all available weed control techniques, including preventative measures, monitoring, crop rotations, tillage, crop competition, herbicide rotation, herbicide mixtures, biological controls, nutrition, irrigation, burning, etc. IWM does not solely rely upon herbicides for weed control. It is necessary because weeds negatively impact crop yields, interfere with many crop production practices, and weed seeds can contaminate grain. To prevent weed growth preventing measures like biological, mechanical, cultural and chemical controls are there. In biological control a less common IWM strategy is the use of living organisms, including livestock, insects, nematodes, fungi, and bacteria, to target weeds. Many biological agents target specific weed species, while livestock are typically more generalist in the weeds they consume. For mechanical control common mechanical tools to disrupt weed growth and survival include cultivation, tillage, burning, and handweeding. In cultural method crop management decisions that make crop more competitive against weeds and help optimize the effectiveness of herbicide applications. Common examples include timely scouting, row spacing,





crop rotation, crop variety selection, timing of planting, and cover crops. Chemical herbicides are a key part of IWM in conventional and some organic systems. In conventional crops, using multiple effective herbicide modes of action (MOA) is essential for effective control of resistant weeds.

**KEYWORDS-** IWM, Chemical, Biological, Cultural, Mechanical

### **Storage Stability and Quality Assessment of Stabilized Rice Bran and Wheat Bran and their Utilization in Development of Instant Noodles**

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Despite the nutritional value, the use of cereal bran in food products is restricted due to presence of lipid degrading enzymes, which causes rancidity and as a result, the shelf life is very low. An attempt was made to stabilize wheat bran and rice bran and then add them to instant fried noodles. The optimum stabilization process included steaming at 100°C for 5 minutes and further drying at 70°C for about 1 hour. The process resulted in decreased lipase activity in both wheat bran and rice bran to a satisfactory level. The free fatty acids % in steamed wheat bran did not increase significantly during 60 days of storage. However, the treatment was not effective in case of rice bran though the free fatty acid formation was less compared to raw bran samples. Instant noodles were produced with varying compositions of bran i.e. 0%, 10% raw bran, 15% raw bran and 10% stabilized bran. The addition of bran in noodles increased the total dietary fibre content of noodles from 3.78% up to 6.82%. The storage stability of the noodle samples were checked at 62.8°C by sensory evaluation. The noodle samples containing stabilized bran were found to be more stable than the samples containing raw bran. Hence stabilization of bran can be a good option to include it in food products without compromising the stability of the product. For future study, the method of noodle production may be shifted towards air drying to overcome oil uptake problem. **Keywords:** lipid degrading enzymes, stabilization, free fatty acids, instant noodles, storage stability.

### **Environment of Antarctica**

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Larsemann Hills is an ice-free coastal oasis in east Antarctica with exposed rock and low rolling hills and contains hundreds of freshwater lakes of varying sizes, depth and biodiversity. An environmental study was being conducted at Larsemann Hills to evaluate the Ambient air quality, Lake and Sea water quality, soil and sediment characteristics, Noise level, solid waste generation, handling and disposal practices, etc. Geographically, the core study area (Bharti Island) is situated on Latitude 69° 24' 00.0" S and 76° 10' 00.0" E on southern part of the Earth. Air, water, soil and sediment samples were collected from various locations of different Islands/Peninsulas like Bharti Island, Fisher Island, McLeod Island, Broknes peninsula and Stornes peninsula. This assessment and monitoring work was carried out to formulate the strategy for the conservation of natural resources of Antarctica continent.

The aim of this study is to assess the general characteristics, metal content, pesticide, radiation contamination and bacteriological



analysis of water, soil and sediment. The air quality of different islands was also conducted to assess the level of particulate matter, oxides of nitrogen, sulphur dioxide, carbon monoxide and volatile compounds in air. The present work is aimed towards developing base line data for the local environmental settings and to evaluate the impacts of various activities on the environmental components during the construction work of third Indian station, 'Bharti' in east Antarctica.

**Key words:** Antarctica, environmental monitoring, water quality, environmental components

### **“Evaluation of different crops for quality fodder production”**

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The field experiment was conducted during *Khari* of 2017 at Research farm of Agronomy Section, ICAR-National Dairy Research Institute, Karnal. The experiment was laid out in randomized complete block design (RCBD) with eight treatments and three replications. Among eight treatments two perennial forage crops (Napier bajra hybrid, guinea grass) and four seasonal fodder crops (cowpea, sorghum, baby corn and maize) were tested. Experimental results revealed that biometric parameter of different fodder crops were performed according to their genetic structured and varietal performance at balancing dose of RDF. The highest biomass yield and dry matter yield were observed in NBH + cowpea intercropping (63.7 & 11.9 t/ha) respectively (at two harvest cutting of NBH), which were at par with sole NBH and guinea grass + cowpea treatments. Quality parameters like protein yield, ether extract yield and total ash yield of different fodder crops were estimated and significantly highest recorded in NBH + cowpea intercropping treatment, while the lower quality parameters were recorded with baby corn fodder. It is negatively correlated with the total quality fraction of the fodder crops. The ADF content which is undesirable, was noticed the highest in the sorghum sole (41.6%) followed by guinea sole (40.1%) while, the lowest ADF content was noticed in sole maize (35.3%) and it was statistically significant from sole sorghum and guinea forage crops. Nitrogen uptake was estimated significantly higher in the combination of NBH + cowpea intercropping (231 kg/ha) over to other fodder crops however, the lower N uptake was observed in sorghum (127 kg/ha). As worked out the economics of cultivation baby corn was recorded high profit and generated revenue around Rs. 2470 per day (Rs./ha) with net income (1.60 lakh/ha) and B: C ratio (5.2) which was significantly higher as compared to other fodder crops. Based on this experiment it could be concluded that for higher biomass and quality fodder production cultivation of NBH + cowpea intercropping (2:3) row ratio was the best combination for getting higher fodder productivity, good quality fodder and maintain the soil health. Baby corn cultivation recommended mainly for generation of higher revenue along with good tonnage of biomass yield within short time duration.

**Keywords:** Biomass, Baby corn, Cowpea, Guinea grass, Napier Bajra hybrid, Quality Sorghum

### **Glutamate can be used as an indicator of potato flavour**

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Flavour plays a major role in selection of a food item and monosodium glutamate is generally used as an additive in most of the processed products to enhance the taste. Glutamate also known as flavouring umami amino acid is present in free form in majority of food products and potato is no exception to that. Potato tubers are consumed in several ways and extent of flavour may vary due to production environment and cooking methods. In the present study, effect of processing (raw, boiled, microwaved) and cultivation method (inorganic and organic) on glutamate content and its correlation with taste was investigated. Results revealed that processing increased glutamate content significantly, particularly with microwaving showing the highest glutamate concentration under both cultivation practices. Raw tubers of ten indigenous potato varieties contained 4 (Kufri Jyoti) to 24



mg/100g FW (Kufri Garima) glutamate that increased to 17 (Kufri Girdhari) to 41mg/100g FW (Kufri Pukhraj) after boiling and 25 (Kufri Pukhraj) to 98mg/100g FW (Kufri Himsona) after microwaving. On an average, boiling increased its content to 79%, while microwaving increased content to 250%. In both organically and inorganically grown potatoes, boiling showed non-significant effect on glutamate content, whereas microwaving has increased the glutamate content to maximum concentration. In inorganic potatoes, glutamate was high by 11% in raw and 5% in boiled tubers as compared to organic potatoes, whereas, microwaving improved its concentration by 2% in organic potatoes over the inorganic one. The results suggested that method of cooking and varietal character is more dominant for higher level of flavouring compounds than the cultivation method. Glutamate content showed high positive correlation (0.73) with organoleptic score, which makes this compound a good indicator of potato flavour and glutamate content can be a reliable marker for screening the potato samples for flavour.

**Key words:** Potato, Flavour, Glutamate, Processing method, Cultivation method,

### Biological Synthesis of Copper Nanoparticles and itsin-vitro Anti-obesity Applications

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The present study was undertaken to investigate thebiologicalsynthesis of copper nanoparticlesby reduction with plant extracts (*Bauhinia variegata*and *Saussurealappa*). The study included the synthesis, optimization, characterization, antimicrobial activity and in-vitro anti-obesity applications of plants synthesized copper nanoparticles. The plant samples were obtained from the high altitude region of Kinnaur, Himachal Pradesh. The optimization of copper nanoparticles was based on the UV-Visible spectra and average particle size using Dynamic light scattering. The characterization of plant synthesized copper nanoparticles was confirmed by Fourier Transform Infrared (FTIR) spectrum. Furthermore, the morphological characterization of copper nanoparticles was confirmed by Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDS) and Powder X-ray Diffraction (PXRD). The anti-microbial activity of plants synthesized copper nanoparticles was checked against the bacterial strains *Staphylococcus aureus*, *Escherichia coli*, *Klebsiella pneumonia* and *Pseudomonas aeruginosa* with varyingzone of inhibition for *Bauhinia variegata* (17 mm, 18 mm, 19 mm and 18mm)and *Saussurealappa* (17 mm, 19mm, 18 mm and 18 mm) respectively. The anti-obesity and anti-diabetic activities of plants synthesized copper nanoparticles were confirmed by lipase inhibition assay and Amylase inhibition assay. The eco-friendly synthesis of copper nanoparticles exhibited innovativeapplications and can be used as afood additive, packaging material and in the detection of number of adulterants and pesticides present in the food.

**Keywords:** Copper nanoparticles, *Bauhinia variegata*, *Saussurealappa*, FTIR; DLS; SEM

### Development of serological based assay by production of polyclonal antibodies against the recombinantcoat protein of Indian isolate of *Apple stem grooving virus*

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*Apple stem grooving virus* (ASGV) belonging to the genus *Capillovirus*under family *Betaflexiviridae*is one of the widely distributed latent viruses mainly on pome fruit trees. It infects apple causing considerable economic losses that is a threat to the apple industry. To study the occurrence and incidence of ASGV disease, sensitive antisera based diagnostic tool has been developed, which would be helpful in large scale indexing, certification and quarantine programmes. Coat protein gene of ASGV



was cloned into pET-32a(+) and pHIS-Parallel expression vectors. Expression characteristics of the proteins expressed from both the systems were compared and taken for raising the antisera. Sensitivity and specificity of the antiserum against virus infection was compared by Double Antibody Sandwich (DAS-ELISA). Some of the samples which tested negative with the reference (commercial) kit were positive with indigenously raised antisera [in pHIS-Parallel and pET-32a(+)] and gave strong intense reactions with pHIS-Parallel raised antisera. It was observed that the antisera raised from the protein expressed from pHIS-Parallel expression system (smaller ~3 kDa His tag) was more sensitive as compared to the antisera raised from the protein expressed from pET-32a(+) expression system (~18kDa His tag) and the commercially available antisera. The antisera could also be successfully used for western blotting of infected samples and in DAS-ELISA and Indirect ELISA. To the best of our knowledge this is the first report on production of polyclonal antiserum against recombinant coat protein of ASGV from India, for reliable detection of the virus.

**Keywords:** ASGV; DAS-ELISA; Indirect ELISA; pET-32a(+); pHIS-Parallel; Polyclonal antibody

### **Chitosan: A novel approach for eco-friendly plant disease management**

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Extensive use of chemical pesticides during the last few decades for plant disease management resulted in negative impacts on the environment as well as to the consumer's health. In recent years, eco-friendly approaches have been developed for managing plant diseases as alternative to chemical pesticides, including the use of natural compounds such as chitosan. Chitosan is a deacetylated derivative of chitin. Chitin is naturally present in the fungal cell wall as the important constituent and in crustacean shells from which it can be easily extracted. Chitosan has multiple advantages as it is safe, inexpensive and can be easily associated with other compounds to achieve better performance. Dual properties of Chitosan can be used in plant disease management: antimicrobial property and host defence inducing property. It controls pathogenic microorganisms by inhibiting growth, sporulation, spore viability, germination and by disrupting cells. These molecules are reported to be active against fungi, viruses, bacteria and other pests. During the plant-pathogen interaction it behaves as a resistance elicitor inducing both local and systemic plant defence responses, including the lignin synthesis, callose formation, accumulation of phytoalexins, pathogenesis related (PR) proteins and proteinase inhibitors. Chitosan is also effective against seed borne pathogens, as it can form physical barriers (film) around the seed surface, and also vehicular other compounds that could be added to the seed treatments. Chitosan shows the positive effect on biodiversity enrichment in the rhizosphere, and shown to give many benefits to different plant species by reducing the pathogen attack and infection, when used as soil amendment. Concluding that the chitosan is an active molecule and will become a popular plant protectant for achieving the goal of sustainable agriculture.

**Keywords:** chitin; chitosan; phytoalexins; pathogenesis related (PR) proteins; elicitor; systemic plant defense;

### **Extraction and comparative analysis of curcumin present in mid-stage and harvesting-stage turmeric rhizome samples (*Curcuma longa*)**

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Curcumin, the main bioactive compound found in turmeric rhizomes has a wide variety of applications in clinical field and that is why it attracts researchers from all over the world. While there are various studies on curcumin extraction and quantification, comparison of curcumin content according to soil profile and cultivation period has not been performed yet. This study includes research over testing soil from where turmeric rhizome samples has been taken, easy extraction method of curcumin and comparison of curcumin content of turmeric rhizome samples of different regions and at mid-stage and harvesting



stage. For the extraction of curcumin from turmeric rhizome samples, UPLC-MS technique was employed as validated method with modified conditions. According to this study, soil profile affects the content of curcumin in the turmeric rhizomes. Out of three regions chosen for testing, Hamirpur showed high curcumin content (95%) in mid-stage which decreased during the harvesting stage (32.5%). Una region also showed the same pattern as Hamirpur, mid-stage curcumin content (85%) decreased during harvesting stage (72.5%). However, the turmeric rhizome samples taken from Kangra showed lowest curcumin content (65%) during mid-stage which increased during harvesting stage (84%). According to the results obtained during this study, the amount of curcumin present in all the three samples varies at two stages (i.e. mid-stage and harvesting stage). In future, this type of study can guide farmers for turmeric cultivation with modern methodology (organic farming and soil testing before cultivation) to increase their crop yield as well as quality of product.

**Keywords:** UPLC-MS, Soil- Profile, Bioactive, Una, Hamirpur, Kangra

### **Evaluation of botanical extracts, animal wastes, organic and inorganic salts, micronutrients and bio-agents against *Sclerotinia sclerotiorum* (Lib) de Bary cause of Sclerotinia rot of rapeseed-mustard under field conditions**

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Rapeseed-mustard crop occupies a premier position among oilseed crops with 25 per cent of total oil seed production. Among all the diseases affecting this crop, sclerotinia stem rot is emerging as very serious constraint in the production and productivity of rapeseed-mustard across the country. Due to increasing concern for environment and health, need for the replacement of fungicides with safe and eco-friendly management approaches has been arisen. So the present experiment was carried out for the evaluation of botanical extracts, animal wastes products, organic and inorganic salts, micronutrients and bio-agents against sclerotinia rot under field conditions. Botanical extract (garlic bulb, onion bulb) and animal waste products (cow urine, cow dung) were evaluated at 5 and 10 % concentration, organic and inorganic salts eg. sodium bicarbonate, oxalic acid, calcium carbonate and calcium sulphate at 1 and 2% concentration, micronutrients eg. borax, sulphur, zinc oxide and their combinations at 0.5 % concentration, bio agent eg. *Trichoderma*, *Pseudomonas* and their combinations at 0.5 % concentration in different formulations as spore suspension, culture filtrate and dust were tested against artificially inoculated pathogen in field. Among all the treatments garlic bulb extract and cow urine depicted maximum reduction in disease incidence (65.9 and 66%) at 5 percent concentration and (66.0 and 66.3%) at 10 percent concentration respectively followed by sodium bicarbonate (55.5% disease reduction) and calcium carbonate (43.9% disease reduction) 2 percent concentration. However, rest of the treatments were not found much effective against the disease with disease reduction ranging between 32.7 to 10.4 percent. Hence, natural or eco-friendly products such as cow urine and garlic bulb extracts can further be utilized to develop Integrated Disease Management (IDM) module for chemical free, safe, eco friendly and affordable management of sclerotinia rot disease in future.

**Key words:** Rapeseed-mustard, Sclerotinia rot, percent disease reduction, management.

### **Evaluation and characterization of host differentials for identification of resistant sources against white rust disease of rapeseed/mustard caused by *Albugo candida***

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Rapeseed-mustard crop occupies a premier position accounting for 25 per cent of total oil seed production of India. Among various diseases affecting this crop, white rust/ blister of rapeseed-mustard caused by *Albugo candida* is one of the important diseases in India with a significant yield loss. Among various management practices breeding for resistant genotypes / varieties



considered as most eco-friendly, economic and effective method for managing plant diseases. But emergence and attack of new virulent races of the pathogen is breaking down the already existing resistance in the cultivars. By keeping in view the diversity of rapeseed-mustard growing regions and Present investigation was undertaken by cross inoculating different Brassica genotypes/cultivar (30 no.) with different *A. candida* isolates (20 no.) collected from different geographical locations for the identification of host differentials as well resistant sources. On the basis of more or less similar phenotypic disease reaction different Brassica genotypes can be grouped as under and could be used as host differentials: **Group 1:** Varuna, RH-30, Kranti; Pusa Bold; **Group 2:** EC 399313, EC 399301, **Group 3:** Bioysr, **Group 4:** PT303, Bhawani; **Group 5:** Torch, Tobin; **Group 6:** Candle; **Group 7:** GSL1, Wester; **Group 8:** *Sinapis alba*, **Group 9:** Ragini; **Group 10:** DLSC-1, Kiran; **Group 11:** *Eureca sativa*, **Group 12:** Sangam; **Group 13:** Donskaja; **Group 14:** Cutlass; **Group 15:** Pusa Kalyani, BSH-1; **Group 16:** NRC DR-515; **Group 17:** Heera; **Group 18:** TL15, **Group 19:** *Raphanus sativus*; **Group 20:** *Brassica oleracea*. These host differentials of *Brassica* genotypes/ Variety could be used for further study on for the identification of new possible pathogenic race of *A. candida* pathogen as well as resistant sources against the white rust disease.

**Key words:** White rust, rapeseed-mustard, host differential, resistance

### Ornamental trees to mitigate 'POLLUTION'

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With the advancement of science and technology, we human beings are succeeded in the living standards filled with comfort and luxury. The side effect of this advancement which could not be neglected now is environmental pollution. Atmosphere is one of the most polluted spheres on the earth as per the report of WHO. Outdoor air pollution is believed to cause an estimated 1.3 million annual deaths worldwide. Environmental pollution has reached to such a stage that biological species are struggling for its existence. The rapid urbanization and industrialization in the world during the last decades led to increasing levels of air pollution dwindling urban air quality. The air is being continuously polluted in urban areas through heavy traffic, industry, domestic fuel combustion, stone quarries, coalmines and various agricultural activities from the adjoining areas. These particulates are dangerous to human health and environment causing various diseases to plants and animals, damage to properties including our cultural heritage, national monuments, archives etc. Ornamental plants play an important role in monitoring and maintaining the ecological balance by their involvement in the cycling of nutrients and gases like carbon dioxide and oxygen. Public attitudes towards plants usage for air filtration from the environmental pollutants and the evidence of phytoremediation efficacy exhibited by some plants have prompted new investigations into the use of ornamental plants as a green technology in phytoremediation for air contamination and noise pollution reduction. The tree species like *Terminalia arjuna*, *Tabebuia argentea*, *Eucalyptus globulus*, *Muntingia calabura*, *Ficus bengalensis*, *Mangifera indica*, *Psidium guajava* are identified as best trees for dust polluted area. Ornamental trees not only enhance the aesthetic beauty of the area but also serves the functional properties like reduction of air, noise, dust pollution, urban heat island effect and carbon sequestration.

**Key words:** Environmental Pollution, Ornamental trees, Shrubs, Phytoremediation

### Climate change and mitigation strategies for Agriculture

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Climate is an important factor of Agricultural production. Climate change is any change in climate, whether arising naturally or from human causes. It is nothing but heating of surface atmosphere due to emission of GHGs, thereby increasing global



temperature and that is cause impact on rainfall patterns and temperature for along period of time. The recent drought and floods affect seriously the live hood of billions of people and global economy adversely affect too. Climate variability affects dramatically productivity of crops with severe impact on food security. It affects the crop physiology, crop biochemistry, floral biology, biotic stress like disease-pest incidence. The major GHGs are Co<sub>2</sub>, CFCs, HFCs, NH<sub>4</sub> and N<sub>2</sub>O. Agriculture increases 20% of emission of GHGs. The sources of NH<sub>4</sub> are nitrogen fertilizers, flooded paddy fields, biomass burning and livestock production. The strategies for mitigations are management of crops and farming system by improve residue management e.g. avoid biomass burning and include N fixing plant into crop rotation. Fertilizer and biomass management by reduce the use of synthetic fertilizers, avoid leaching of N fertilizers, use slow releasing fertilizer, N inhibitors and biogas production (methane capture). Soil management by use of organic fertilizer, cover crops, inter cropping and biochar. Afforestation, Carbon sequestration and carbon credit. Carbon credit are key component of national and international to mitigate the growth in conc. of GHGs. A credit can be sold in international market. At present price of 1 carbon credit is 10.5\$.

Key words- GHGs, mitigation, carbon credit, reduction, management.

### **Influence of Weather Parameters on Major Rice Insect-Pest Infestation in Terai Region of West Bengal**

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Insect pest infestation, one of the key factors for rice yield decline, relies highly on the variability of different weather parameters, other than biotic mortality factors. Hence, an investigation was carried out in order to assess the influence of various weather parameters on infestation of brown planthopper, green leafhopper, yellow stem borer and gundhi bug during the boro seasons of 2014-16 at the farm of Uttar Banga Krishi Viswavidyalaya, Pundibari, West Bengal, India (26.52° N, 89.11° E). As the dependant variable was count in nature, negative binomial regression and Poisson regression models were employed to reveal the underlying functional relationships. Standardized regression co-efficients were also computed with a view to compare the influences of various weather parameters. Results emanated from the study revealed that negative binomial regression model fitted best for brown planthopper, green leafhopper and yellow stem borer with lesser AIC (60.96, 7.59 and 14.19, respectively) and BIC (71.62, 8.51 and 17.12, respectively) values. However, in case of gundhi bug, Poisson regression model fitted best with least AIC (1.67) and BIC (2.61) value. Among the several weather parameters, minimum relative humidity was found to be the most influential with respect to the occurrence of major rice insect-pests.

**Key words:** Count data modelling, Negative binomial regression, Poisson regression, Rice insect-pests, Weather influence.

### **Effect of seed priming with various plant defense activators on quality and health of radish seed**

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Seeds of radish cv. Japanese white were primed with various concentrations of four different plant defense activators which included twelve different treatments viz. T<sub>1</sub>: Salicylic acid @ 25ppm, T<sub>2</sub>: Salicylic acid @ 50ppm, T<sub>3</sub>: Salicylic acid @ 75ppm, T<sub>4</sub>: Jasmonic acid @ 55 ppm, T<sub>5</sub>: Jasmonic acid @ 110 ppm, T<sub>6</sub>: Jasmonic acid @ 165 ppm, T<sub>7</sub>: Butyric acid @ 250ppm, T<sub>8</sub>: Butyric



acid @ 500ppm, T<sub>9</sub>; Butyric acid @ 750ppm, T<sub>10</sub>; Potassium nitrate @ 1%, T<sub>11</sub>; Potassium nitrate @ 2% and T<sub>12</sub>; Potassium nitrate @ 3% and its effect on various seed quality and health parameters was observed following paper towel method and blotter methods as per the standard procedures given by ISTA. The results of the experiment revealed significantly higher values for various seed quality parameters like germination (95.50%), seedling length (23.22 cm), seedling dry weight (13.07 mg), seed vigour index– Length (2217.10), seed vigour index– Mass (1248.37), speed of germination (87.17) with blotter method and seedling emergence (78.25%), speed of emergence (30.97), normal seedlings (78%) with Potassium nitrate @ 2% (T<sub>11</sub>) as compared to other treatments. This treatment i.e. Potassium nitrate @ 2% also showed minimum values for parameters such as dead seeds (3%) with paper towel method, ungerminated seeds (21.75%) with grow out test. It can be concluded from the experiment that seed priming with potassium nitrate @ 2% increase seed quality and health in radish.

### Effect of Global Climate Change on Water Resources

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Effects of global climate change that have important implications for water resources include increased evaporation rates, a higher proportion of precipitation received as rain, rather than snow, earlier and shorter runoff seasons, increased water temperatures and decreased water quality in both inland and coastal area. These changes will have a substantial destabilizing effect on the hydrological cycle, resulting in greater variability in precipitation and stream flows and increasing intensity of extreme hydrological events. Glacier melt may yield more runoff in the short term but less in the medium and long terms. Potential climate impacts in India are severe: sea level rise, changes in the monsoon, increased severe storms and flooding, more drought and severe water stress. All of these impacts set back general socio-economic development. The diversity and extremes of India's climate and geography are characteristic of its society as well. Global climate change has considerable implications on water resources and agriculture and hence on our food security and farmers livelihood. We need to urgently take steps to increase our adaptive capacity. A wide variety of adaptive actions may be taken to lessen or overcome adverse effects of climate change on water and agriculture. At the level of farms, adjustments may include the introduction of new crop varieties or species, switching cropping sequences, sowing earlier, adjusting timing of field operations, conserving soil moisture through appropriate methods and improving water use efficiency.

**Key words:** Climate change, Carbon dioxide, Hydrologic cycle, Runoff, Temperature, Water resources, Water management,

### Field efficacy of novel insecticides against Diamondback Moth, *Plutellaxylostella* and Cabbage caterpillar, *Pierisbrassicae* in cabbage

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Novel insecticide molecules with green chemistries offer great scope in the management of insect pests of vegetable crops. They maintain a high level of efficacy to target pests along with low toxicity to non-target organisms and are not persistent like a conventional group of insecticides. An experiment was conducted to evaluate the efficacy of different novel insecticides against diamondback moth and cabbage caterpillar in cabbage cv. Golden Acre in field conditions. The field experiment was carried out at Regional Research Station farm, Sargatia, Kushinagar in a Randomised Block Design (RBD) with nine treatments including untreated control each replicated thrice. The percentage reduction of the pest population over control was calculated by





using the formula given by Henderson and Tilton (1955). The average larval population of diamondback moth *Plutellaxylostella* varied from 7.87 to 10.27 before insecticide application. The larval population was significantly decreased in all the treated plots after insecticide application in comparison to untreated control. Chlorantraniliprole 18.5 SC, indoxacarb 14.5 SC and emamectin benzoate 5 SG were found to be the most effective against diamondback moth giving 92.12, 84.97 and 79.00 % reduction whereas quinalphos 25 EC, novaluron 10 EC and fenvalerate 20 EC were observed as least effective giving 67.41; 65.18 and 51.76% reduction over the untreated control, respectively. The average larval population of cabbage caterpillar *Pieris brassicae* was observed in the range of 7.13-9.53 before insecticide application and it was significantly reduced after the insecticide application in all the treatments except untreated control. Indoxacarb 14.5 SC, spinosad 45 SC and chlorantraniliprole 18.5 SC were found the most effective giving 89.91, 86.72 and 78.54% reduction over the untreated control. However, fenvalerate 20 EC, novaluron 10 EC and quinalphos 25 EC were found least effective giving 59.93, 59.33 and 56.82 % reduction over the untreated control. Thus, chlorantraniliprole 18.5 SC and indoxacarb 14.5 SC can be effectively used for the management of the diamondback moth and cabbage caterpillar.

**Keywords:** novel insecticides, cabbage, diamondback moth, cabbage caterpillar

### Standardization of integrated weed management practices in chrysanthemum

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Chrysanthemum (*Dendranthema grandiflora* T.), belonging to the family Asteraceae, is one of the most widely cultivated herbaceous perennial plant. Weeds cause heavy damage to this crop by competing with main plants for water, nutrients, light and space besides acting as alternate hosts to a number of pathogens and pests. Therefore, the present experiment was conducted in the experimental field area of Division of Floriculture and Landscaping, ICAR-IARI, New Delhi during 2016-17 and 2017-18 to standardize integrated weed management practices and its effect on weed population, vegetative and floral parameters of chrysanthemum cv. Haldighati. Ten different treatments with three replications were compared in terms of weed population, growth and flowering parameters. The results of experiment showed that Pendimethalin pre-emergence after transplanting @ 1kg/ha + hand weeding twice (30 & 60 DAT) was found to be the effective for controlling both monocot and dicot weed population. Maximum plant height and plant spread (NS and EW) was observed with Pendimethalin @ 1kg/ha + imazethapyr 0.1kg/ha pre-emergence after transplanting + residue @ 5t/ha. Earliest flowering was also observed with Pendimethalin @ 1kg/ha + imazethapyr 0.1kg/ha pre-emergence after transplanting + residue @ 5t/ha. Maximum number of branches, number of flowers/plant, fresh weight of ten flowers and flower longevity was observed with Pendimethalin pre-emergence after transplanting @ 1kg/ha + hand weeding twice (30 & 60 DAT).

**Key words:** integrated weed management, chrysanthemum

### Screening of Chrysanthemum morifolium varieties for salinity tolerance

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A pot experiment was carried out to screen chrysanthemum (*Chrysanthemum morifolium* Ramat.) germplasms for salt tolerance during 2016 and 2017 at Floriculture Research farm, IARI, New Delhi. The screening focuses on the response of forty chrysanthemum varieties subjected to four salinity levels (0mM, 45mM, 70mM and 135mM of NaCl) viz., Ajay, Pusa Anmol, Pusa Centenary, T. Q. Pink, Himanshu, Shyamla, Anemone Red, White Queen, Malika Yellow, White Anemone Tall, Garden Beauty,



Red Stone, Basanti, Mayur 5, Yellow Reflex, Geetanjali, Maghi White, Jaya, Dolly Orange, Jayanti, Haldighati, Atom Jaya, Birbal Sahni, Ajay Orange, Pusa Kesari, Sukla, PusaChitraksha, PusaAditya, Johan Beber, StarYellow, PusaSona, Neelima, Sadwin Yellow, Vasantika, Pusa Centenary, Red Spoon, ThaiChen Queen Pink, Thai Chen Queen and Lalit. Maximum reduction in plant height was recorded in Jaya under 135 Mm NaCl compared to control. Flower opening was delayed under stress condition but Atom Jaya took minimum days for flower opening under NaCl stress. Reduction in chlorophyll fraction was observed in 135 mM NaCl compared to control. Leaf chlorophyll content was highest in Pusa Anmol. Low Na: K level which is a desirable trait for salt tolerance was recorded in Pusa Anmol and Neelima. Among the forty chrysanthemum germplasm, Pusa Anmol was found most tolerant due to enhanced photosynthetic pigments, proline content and low Na:K ratio.

**Key Words :** Chrysanthemum , Flowering, Growth, Salinity, Chlorophyll Content

### **Gamma radiation induced mutation in papaya (*Carica papaya* L.)**

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Gamma rays are the most commonly used mutagen in plants as it causes a high frequency of induced mutations. It can be used to overcome the difficulties in papaya breeding to get true to type plantlets especially in dioecious varieties. An optimum dose is highly desired to produce the high frequency of mutations with minimum killing of treated individuals. Therefore, the present investigation was undertaken to determine the LD<sub>50</sub> of gamma rays and effect of different dosages of gamma rays on morphological, physio-chemical, biochemical parameters of papaya. In the preliminary dosimetry study, seeds from two papaya varieties, Ranchi Local and Arka Surya were irradiated in a gamma chamber at Bhabha Atomic Research Centre (BARC), Mumbai with 7 different radiation doses ranging from 10 Gy to 70 Gy at every interval of 10 Gy. Prior to irradiation in one experiment, seeds were soaked overnight in water and surface-dried and in another experiment, seeds were immersed in water while irradiation. Radio sensitivity test of germinated seeds showed that LD<sub>50</sub> was 31.99 Gy for pre-soaked seeds and 24.3 Gy for seeds immersed in water. From the analysis of GR<sub>50</sub> and GR<sub>30</sub> for both the irradiated conditions, it was found that 34 Gy and 28 Gy was the most effective dose with maximum possibility of desirable mutation. 30 Gy (for pre soaked seeds) and 20 Gy (seeds immersed in water) significantly influenced % of germination (55.14), vigour index (12.85), survival percentage (78). In M<sub>2</sub> population, minimum plant height (117.8 cm), bearing height (72.8cm), days to 1<sup>st</sup> flower (115 days), maximum stem dia (11.65 cm), no of fruits on trunk at 1<sup>st</sup> harvest (29), fruit weight (978g), pulp thickness (33.80 cm), cavity index (23.46), TSS (10.35<sup>o</sup> B), Ascorbic acid (62.97mg/100g) were observed in 30 Gy as compared to control. 32 selected mutant lines were grown in M<sub>3</sub> generation for confirmation by molecular markers (ISSR, SSR). Hence, moderate doses of mutagen could be utilized to create genetic variability for making effective selections for yield and quality traits in papaya.

**Key words:** Papaya, Gamma rays, LD<sub>50</sub>, breeding, quality, molecular marker



## Role of Intercropping on Growth, Yield, Population Dynamics of Major Insect Pests And Economic Impacts In Brinjal

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Small farmers constitute 79.4% of our farming community and their cultivated lands (0.05-2.49 acres) are shrinking day by day. Intercropping offers the possibility of yield advantage relative to sole cropping through yield stability and improved yield in tropical and sub tropical areas. Field experiments were carried out with 7 treatments [T<sub>1</sub> (Sole Brinjal), T<sub>2</sub> (Brinjal + Cowpea), T<sub>3</sub> (Brinjal + Garlic), T<sub>4</sub> (Brinjal + Fenugreek), T<sub>5</sub> (Brinjal + Onion), T<sub>6</sub> (Brinjal + Coriander), T<sub>8</sub> (Brinjal + French bean)] in randomized blocked design in autumn-winter 2016-17 at "C" Block Farm of BCKV, Kalyani, Nadia, West Bengal. Considering the facts, the present investigation was planned to find out suitable intercrop with brinjal for obtaining maximum economic return through increasing the productivity of the crop under intercropping system and determine the effect of intercrops on damage potential of major insect pest of brinjal. The results indicated that most of the growth and yield attributes were significantly influenced due to intercropping. Intercropping of brinjal with french bean recorded significantly maximum values for most of the growth characters like plant height (121.00 cm), number of leaves per plant (188.50), primary branches per plant (5.00), root weight (29.47 g), root length (23.85 cm), root volume (47.70 cc) and shoot to root ratio (30.23). However, a minimum day to first flowering was found in brinjal with cow pea intercropping system (36.67 days). Brinjal + french bean combination recorded maximum yield (36.59 t/ha) which was statistically *at par* with brinjal + cowpea (34.89 t/ha). Significant reduction of FSB and leaf hopper infestations was observed in brinjal + garlic intercropping system. Maximum production efficiency was observed in brinjal + fenugreek (227.69 kg/ha/day). Intercropping of brinjal with french bean was found promising for better utilization of biological resources as it recorded maximum values for LER (2.36), competitive ratio (0.70) and desirable lower values of aggressivity (0.50). However, Brinjal + garlic was found maximum for RCC (4.93) and brinjal + onion recorded maximum for monetary advantage index (314.05). Economic analysis revealed that brinjal + french bean intercropping system was found most remunerative as it recorded highest net return and B:C ratio (Rs. 231076.43 and 3.02, respectively). Based on the performance of brinjal under different intercropping combinations, growing of brinjal with french bean was adjudged as the best treatment combination to maximize the growth, yield and quality of brinjal under the Gangetic alluvial zone of West Bengal.

**Keywords:** Brinjal, Intercrop, Fruit and shoot borer, Competitive function, Economics.

## Assessment of Host Plant Resistance in certain French bean (*Phaseolus vulgaris* L.) genotypes against Leaf miner (*Chromatomyia horticola* Gaur.), Aphid (*Aphis craccivora* Koch.) and Pod Borer (*Helicoverpa armigera* Hub.)

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Various genotypes of French bean obtained from Indian Institute of Pulses Research, Kanpur were sown at Agricultural Research Farm of Banaras Hindu University during the Rabi season of 2017-18 for assessing the effects of resistance to leaf miner, aphid and pod borer. Genotype VL 63 showed resistance reaction to aphid (7.83 aphids/plant) compared to all other varieties whereas genotypes 405 (56.83 aphids/plant) and RE 15-1 (51.11 aphids/plant) showed susceptible reaction. Genotype RE 15-1 showed resistance reaction to leafminer damage on leaves (13.27%), whereas genotypes HUR 15 (27.04%) and 180 (24.87%) showed susceptible reaction with higher leaf damage. Pod damage due to pod borer (*Helicoverpa armigera*) was severe on genotype VL



63(3.67 %) and least severe on genotype HUR 76 (0.33 %). Genotype HUR 76 produced highest yield as compared to other genotypes (12.00 q ha<sup>-1</sup>), while genotype 214 and 96 (6.67 q ha<sup>-1</sup>) produced lowest yield.

**Key words:** *Phaseolus vulgaris*, *Chromatomyia hortícola*, *Aphis craccivora*, *Helicoverpa armigera*, screening.

## Macrofungi as Nanoparticle Factories: Oyster Mushroom-Derived Nanoparticles And Their Possible Applications

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Research and innovation in nanoparticles (NPs) synthesis protocols has led to their production at industrial scale in environmentally-prudent and economically feasible manner. Macro-fungi including diverse mushroom species such as *Agaricus bisporus*, *Pleurotus* spp., *Lentinus*, *Ganoderma* spp., are known to possess high nutritional, immune-modulatory, anti-microbial (anti-bacterial, anti-fungal, and anti-viral), besides anti-oxidant and anti-cancerous properties. These properties of the mushroom extracts can be further improved through biosynthesis of nanoparticles from culture or culture-free extracts of the macro-fungi. Several *Pleurotus* species such as *P. florida*, *P. pulmonaris*, *P. cornucopiae*, *P. ostreatus*, *P. eryngii* have been used for NPs synthesis. These myco-derived NPs can be utilized to enhance the efficiency of drugs to target the effective cells, particularly for the treatment of gastrointestinal and prostate cancer across the globe including Asia (China, Japan) and North America (USA). The *Pleurotus* synthesized metal NPs can inhibit the growth of numerous foodborne bacteria; gram-positive (*Staphylococcus aureus*, *Bacillus cereus*,) and negative bacteria (*Escherichia coli*, *Salmonella typhi*, *Vibrio parahaemolyticus*, *Citrobacter koseri*, *Enterobacter aerogenes*, *Pseudomonas putida*), and fungi (*Candida albicans*, *Colletotrichum gloeosporioides*, *Erythricium salmonicolor*). Similarly, against many cancer cell lines, *Pleurotus florida* gold NPs exhibited high anti-cancer activity. Further, no toxic effect on the application of myco-synthesized NPs was detected in Vero (African green monkey kidney normal cell) cell lines. Thus, biosynthesized NPs obtained from *Pleurotus* can be a sustainable source for the effective treatment of a variety of diseases caused by human pathogens and other chronic disorders.

**Keywords:** *Pleurotus*, Oyster mushroom, Nanoparticles, Antibacterial, Anticancer, Antioxidant

## Screening of tannase-producing bacteria from the Termite gut.

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Termite gut harbors a complex composition of microbiota essential for symbiotic digestion. Termites and their gut microbiota play a prominent role in degradation of lignocelluloses, cellulose and other secondary metabolites along with nitrogen metabolism. Lower termites show unique lineages of cellulolytic flagellates while bacteria and archaea are major symbionts in higher termites. Tannin acyl hydrolase (commonly known as tannase) is an industrially important enzyme that catalyzes the ester bonds present in hydrolysable tannins, having a wide range of applications in pharmaceutical, food, chemical and beverages industry. In this study, we have isolated tannase-producing bacteria from termite gut using various enrichment methods utilizing nutrient agar supplemented with 0.3% tannic acid at 37°C for 24h. The zone of hydrolysis was observed for the presence of tannase activity that was further confirmed using tannase assay. It was observed that maximum tannase activity by bacterial culture was found to be 8U/ml at 37°C after 24h of incubation. Various isolated bacterial cultures were characterized via biochemical and molecular characterization using different biochemical methods and 16sRNA amplification respectively. Further, parametric optimization of SmF and SSF conditions using cheaply available agrowaste residues such as jamun, keekar, tamarind, behera, harad etc. will be done for optimal production of tannase followed by characterization of tannase activity.



## Effect of Birds on Agriculture

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Agricultural bird species have larger habitat and food revelation than forest species. Based on a global data base, bird congregations in tropical agro-forest ecosystems were composed of suspiciously more frugivorous and nectarivorous, but fewer insectivorous bird species compared with forest. Similarly, insect predators of plant-feeding arthropods were more diverse in Ecuadorian agro-forest and forest compared with rice and pasture. Bee diversity was also higher in forested habitats. Hence, diversity of insectivorous birds and insect predators as well as bee pollinators declined with agricultural transformation. In contrast, with increasing agricultural amplification, avian pollinators and seed dispersers initially increase then decrease in proportion. It is well established that the proximity of agricultural habitats to forests has a strong influence on the functional diversity of agro-ecosystems. The reduction of insect pests by birds in agriculture may provide an incentive for farming practices that enhance the conservation value of farms for birds and other wildlife. Bird species associated with greater habitat heterogeneity and more pasture, winter grain, farmstead and other non-crop habitats (hedgerow, woodland) to sites with few bird species associated with larger fields, more rowcrop and spring grain, more passes and tilling, and use of herbicides and chemical fertilizers. The importance of non-crop habitats, more permanent crop cover, and less intensive management practices to the conservation of avian biodiversity on farmland should be reemphasized.

**Keywords :** Agroforest , agroecosystems, frugivorous , nectarivorous , conservation.

## Dye decolourization by partially purified laccases from *Pseudomonas aeruginosa* and *Pseudomonas fluorescens*

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Laccases (E C 1.10.3.2; benzenedioil: oxygen oxidoreductase) are the family of multi-copper oxidases that require oxygen to oxidize organic compounds. In the environment they are involved in the biodegradation of lignin and humic acids. The enzyme exhibits broad substrate specificity. *Pseudomonas aeruginosa* and *Pseudomonas fluorescens* screened for laccase assay showed positive result. *Pseudomonas aeruginosa* shows optimum laccase production at 40°C at pH 7 for 72 h of incubation with 2% glucose as carbon source and 2% peptone as nitrogen source whereas, *Pseudomonas fluorescens* required an optimum temperature of 40°C at pH 7 for 72 h of incubation with 2% glucose as carbon source and 2% sodium nitrate as nitrogen source for production. The crude laccase obtained from *Pseudomonas aeruginosa* and *Pseudomonas fluorescens* showed enzyme activity 0.059 U/ml and 0.063 U/ml and the protein content 0.82 mg/ml and 0.67 mg/ml respectively. The partially purified laccase showed enzyme activity 0.028 U/ml and 0.032 U/ml and the protein content 0.55 mg/ml and 0.38 mg/ml respectively. The partially purified laccase enzyme produced from *Pseudomonas aeruginosa* and *Pseudomonas fluorescens* was able to decolorize congo red dye at room temperature. Therefore, it can be suggested to optimize the enzyme production at pilot plant scale for the industrial application and biodegradation. Laccase produced from *Pseudomonas aeruginosa* and *Pseudomonas fluorescens* can be used for degradation and detoxification of industrial dyes. Laccase oxidizes phenolic compound as well as highly recalcitrant environmental pollutants, which are useful for their applications to several biotechnological applications.

**Keywords:** Laccase, *Pseudomonas aeruginosa*, *Pseudomonas fluorescens* and dye decolourization.



## **Agricultural Developmental Programmes And Their Strategies**

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India is an agricultural country with 144 million hectares of land is under cultivation which is highest in the world. It is second largest populated country in the world and its more than half of population depends on agriculture sector. So, it is necessary to achieve rapid increase in the level of agriculture production through concentrate on different agricultural development programs. There are many agricultural development programs are launched after independence to make Indian farming system self-sufficient. Intensive Agriculture Development Program (IADP) 1960 by which loan, seeds, fertilizer tools, etc. are provided to the farmers at lower price to reduce input cost. It was launched as pilot basis in one district of 7 states at that time and after few year of its launching production of wheat as well rice increased in that state rapidly as compare to other state. India produced 23.5 Lakh tones of wheat in 1964-65 compared to 17 Lakh tons in 1961. Soil Health Card (2015) which provide information to farmers on nutrient status of their soil along with recommendation on appropriate dosage of nutrients to be applied for improving soil health and its fertility. Neem Coated Urea (NCU) this scheme is initiated to regulate use of urea, enhance availability of nitrogen to the crop and reduce cost of fertilizer application. Pradhan Mantri Krishi Sinchai Yojana (2015), which has the motto of 'Har Khet Ko Paani' for providing in irrigation supply chain, viz. water sources, distribution network and farm level applications. National Agriculture Market (e-NAM), which provides e-marketing platform for ensuring better price discovery. It brings in transparency and competition to enable farmers to get improved remuneration for their produce moving towards 'One Nation One Market'. Micro Irrigation Fund created by NABARD for encouraging public and private investments in Micro irrigation. By this agricultural development programs farmers become aware to adopt new technologies and cultivation practices for improving their farming.

## **Enam: The Entrepreneurial and Profit Making Venture**

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With nearly 60-70 per cent of the population depending upon agriculture sector for their livelihood, the unification of markets both at State and National level is essential. Thus, National Agriculture Market portal (eNAM) launched by Government on April 15, 2016 is an Indian electronic trading portal which networks the existing APMC mandis to create a unified national market for agricultural commodities. It provides inter connectivity of e-mandis (Electronic Portal) of many states with removal of inter-state barriers and makes platform for farmers to sell their marketable surplus for better fair prices. This will help in reducing marketing channels and provide the farmers more options to sale out their produce and increase the accessibility of market to farmers through warehouse based sale and obviates the need to transport the produce to the mandis. For local traders e-NAM would provide an opportunity to access the National Market while for bulk and big traders it would provide an opportunity to directly participate in local Mandis and will reduce the intermediation cost. With amendment of the State Agricultural Produce Marketing Committee Act (APMC Act), Start up India, Skill India and fine logistics support help out the farmers which would enable them to move their crops, joint venture in agriculture marketing, proper procurement of produce through storage, enhancing supply chain management by reducing out intermediaries, agriculture start ups, procurement of surplus produce, better fair prices, enhancing entrepreneurial venture through new agriculture technologies. Thus e-NAM has increased opportunities of increasing entrepreneurial development in agriculture sector and strengthen the rural economy by transforming Indian agriculture from traditional to an entrepreneurial and a profit making venture.

**Keywords-** eNAM, Surplus and APMC.



## Mycorrhizal application leads to Salt Stress mitigation in Sorghum crops

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Arbuscular mycorrhizal fungi have been reported to promote the plant growth and salinity tolerance by many researchers. They promote salinity tolerance by employing various mechanisms, such as enhancing nutrient acquisition. They can influence the concentration of the nutrients such as nitrogen, phosphorus, potassium in plants by mobilizing them and facilitating the uptake of these nutrients. They supply nutrients to the root system and increased transportation of minerals through absorption and/or translocation. To validate the potential role of mycorrhiza in mitigating salt stress, a study was planned to check the effect of mycorrhiza on the growth of fodder sorghum grown in saline and sodic soils and a pot experiment was carried out in a using three types of soil viz., normal, saline ( $EC_e \sim 8 \text{ dS m}^{-1}$ ) and sodic ( $pH_s \sim 9.0$ ) soil. Results showed that all the mycorrhizal inoculated plants showed better growth in comparison to the control. Enhancement in P-uptake was also found. To verify the mycorrhizal colonization in the roots of sorghum, roots were studied under microscope. For the microscopic study the roots were stained with 0.02% of trypan blue and results revealed mycorrhizal colonization on the root surface as well as in the cortical region of roots. The preliminary results showed salinity and sodicity stress mitigating effect of mycorrhiza on sorghum growth.

**Keywords:** P-uptake, Mycorrhiza, salt stress, mycorrhizal colonization

## Eco-friendly management of conventional and newly emerging insect pests

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One of the major challenges to humankind is threat to agricultural biodiversity, human and animal health due to emerging and invasive pests. Incidence of invasive insect pests such as *Eriosomalnigerum*, *Quadraspidotus perniciosus*, *Orthezia insignis*, *Icerya purchasi*, *Phthorimaea operculella*, *Plutellaxystostella*, *Pineuspini*, *Heteropsyllacubana*, *Liriomyza trifolii*, *Hypothenemus hampei*, *Aleurodicus disperses*, *Bemisia argentifolii*, *Leptocybe invasa*, *Aceria gurreronis*, *Paracoccus marginatus*, *Phenacoccus solenopsis*, *Quadrastichus erythrinae*, *Tuta absoluta*, *Spodoptera frugiperda*, *Paraleyrodes bondari* has been noticed. The invasion of the pests leads to the outbreak of the native and non-native pest due to competitive interaction for biotic and abiotic resources. Hence, habitat manipulation is an emerging technology to enhance biological control by use of cultural practices to effect the habitat manipulation. It includes enhancement of plant biodiversity, provision of adequate refugia for the natural enemies in agro-ecosystem which focuses on reducing mortality rate, providing the supplementary resources and manipulation of the host plant attributes and altering the cropping system for the benefit of natural enemies. Many adult parasitoids and predators benefit from sources of nectar and protection is provided by refuges such as hedgerows, cover crops, and weedy borders. Mixed planting and intercropping increase the diversity of habitats and provide more effective shelter and alternative food source to predators and parasites. Intercropping of chickpea with coriander increases the activity of *Campoletis chloridae* and decreases the population *Helicoverpa armigera*. Strips harvesting in Lucerne enhance predator or parasitoid population. Periodical trainings are necessary to minimize the gap between extension workers and farmers, for the success of incorporating conservation and manipulation techniques in farming.

**Keywords:** Habitat manipulation, Invasion of insect-pest, Biological control, Natural enemies



### Differential changes in enzyme activities caused by temperature stress in manganese deficient wheat plants.

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In order to better understand the role of cold acclimation with manganese, a pot experiment was conducted under controlled glass house condition. Seeds of wheat plants (*Triticumaestivum*L.) variety PBW-502 were grown in pot with silica and daily irrigated with hoagland nutrient solution. Manganese was supplied at two levels- manganese deficient level (MnD-0.5  $\mu$ M) and manganese sufficient (MnS-10 $\mu$ M) in the form of MnSO<sub>4</sub>·H<sub>2</sub>O. Prior to sowing seeds were acclimated and then maintained at glass house temperature. After 45 days of exposure, the plants were harvested, and growth and metabolites of antioxidative metabolism were determined. Proline which is a low molecular weight osmolyte is crucial in sustaining cellular function under chilling stress was increased in MnD acclimated level than the MnS non-acclimated treated as control. Cold acclimation decreased the H<sub>2</sub>O<sub>2</sub> content in MnD plants than the non-acclimated MnS plants. Glutathione reductase (GR) and ascorbate, MDA concentration were significantly decreased in MnD acclimated plants than the control. Activities of antioxidative enzymes like peroxidase (POX), catalase (CAT), superoxide dismutase (SOD) were also higher in cold acclimated MnD than the MnS plants.

**Key words:** ascorbate, peroxidase, catalase, superoxide dismutase, malondialdehyde (MDA) *Triticumaestivum*.

### Agro-advisory: A tool to reduce agricultural production risk at farm level

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There is an important role of weather in exhibiting dangers to the crop. Different important weather parameters like temperature, rainfall, wind speed and direction along with the cloud cover determines the dangers that affect various stages of the crop and also determines the productivity losses that would occur. The prediction and verification of these weather parameters if done in advance can ensure the reduced losses to the farmers. Similarly a new technique in order to inform the farmers at the ground level is being used by India Meteorological Department where it provides the weather forecast for five days which is value added at the district level and then by the Agromet Advisory Services, a group of subject experts an Agromet Advisory Bulletin is formulated which provides for the various crop management practices. These bulletins are now being prepared by the various SAUs which provide these bulletins online as well as through Short Message Service to the farmers who can take action accordingly. These bulletins consist of the various actions to be taken by the farmers in accordance with weather conditions existing in the district.

**Keywords:** Agromet Advisory Services, Agromet Advisory bulletins, weather prediction and verification





## Effect of Planting Dates, Mulching and Application of GA<sub>3</sub> on Seed Yield and Quality of Marigold (*Tagetes Erecta*L.) cv. 'PusaNarangiGainda'

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Marigold is one of the most popular flowers in our country on account of its easy culture, wider adaptability and lucrative returns. The demand for marigold flowers has shown a steady increase exponentially in the recent years. African marigold cv. 'PusaNarangiGainda' assumes greater significance as their flowers are more in demand. The demand for marigold seeds is increasing in our country owing to reasons that its cultivation is being taken up in large area, annually. So, to cope up the seed demands in terms of the quantity and quality, the technology for improving the yield and quality of marigold seeds needs to be standardized. Hence, present study had been planned to investigate the influence of planting time, application of mulches and GA<sub>3</sub> on growth, flowering and seed production of marigold. In the said study, marigold seedlings of cv. 'PusaNarangiGainda' were planted on (1<sup>st</sup> week of July, 3<sup>rd</sup> week of July & 1<sup>st</sup> week of August) in two consecutive years i.e. 2015-16 and 2016-17 and mulched with Black plastic mulch, Silver-black plastic mulch & Crop residue mulch along with control. The spray of GA<sub>3</sub> @ 0, 50, 100 & 150 ppm were given after 45 days of transplanting in both the years. 1<sup>st</sup> week of July along with application of silver-black mulch and GA<sub>3</sub> @ 150 ppm gives better results in term of yield and quality traits like number of seeds per head, seed yield per plant (g), seed yield plot (g), 1000 seed weight (g), germination percentage, SVI-L and SVI-M.

**Keywords:** GA<sub>3</sub>, Mulch, marigold, planting Dates.

## Effect of different carbon and nitrogen sources on *Ganoderma* species

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*Ganoderma* species (W. Curt: Fr.) P. Karst is one of the most popular mushrooms in oriental medicine. *Ganoderma lucidum* is a species of the class Basidiomycetes, which belongs to the family Polyporaceae/Ganodermataceae of the order Aphyllophorales. The study was carried out to investigate favorable mycelial growth conditions of *Ganoderma* species under sources such as carbon and nitrogen. In the present investigation the chosen four strains i.e. DMRO-44 (*Ganoderma lucidum*), DMRO-45 (*Ganoderma lingzhi*), DMRO-90 (*Ganoderma resinateum*) and DMRO-207 (*Ganoderma lucidum*) of *Ganoderma* species were developed on five distinctive carbon and six distinctive nitrogen sources to check their steadiness. Irrespective of strains used, glucose was found to be the most suitable carbon source for raising the cultures of *Ganoderma* species. Starch was found to be the non-preferable carbon source with the minimum radial growth rate. All the selected strains of *Ganoderma* species were grown on six different nitrogen sources selected for the present study. Irrespective of strains used, leucine was found to be the most suitable nitrogen source for raising the cultures of *Ganoderma* species. Whereas, ammonium sulphate was found to be the non-preferable nitrogen source with the minimum radial growth rate.

**Key words:** *Ganoderma* species, Carbon, Nitrogen and different strains



### Evaluation of promising genotypes of ber (*Zizyphus mauritiana* Lamark) against its pest complex.

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The investigation on evaluation of promising genotypes of ber against its pest's complex were carried out at AICRP, Arid Fruit Zone Project, Department of Horticulture, MPKV, Rahuri, Dist. Ahmednagar, Maharashtra during 2016. Among the twenty genotypes screened against pest complex, the genotype Chandegaon Sel., and Chalisgaon were found significantly superior in registering least damage due to leaf eating caterpillar and fruit damage due to fruit borer and stone weevil. Moreover, these genotype were visually found free from powdery mildew disease which could be used as best source of resistance in future. The data on pest infestation due to leaf eating caterpillar, leaf webber, fruit borer and stone weevil amongst twenty genotype showed the non-significant correlation with periodically observations with meteorological data.

**Keywords-** ber, *Zizyphus mauritiana* Lamk, fruit borer, stone weevil, leaf webber

### Bioefficacy of new insecticide molecules against lepidopteran pests of soybean

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Soybean (*Glycine max* (L.) is the premier pulse and oil seed crop in India. The low productivity of soybean is attributed to abiotic and biotic stresses like weeds, insect pests and diseases. The crop is infested by more than 275 insect pests on different plant parts of soybean and about a dozen of them have been reported causing serious damage from sowing to harvesting (Ramesh Babu, 2010). An Experiment comprising six treatment and including control was laid out variety JS-93-05 to manage lepidopteran pests (*Helicoverpa armigera*, *Chrysodeixis acuta* and *Spodopteralitura*) through five new insecticides *i.e.* Brofanilide 30% SC @ 6.6 g a.i./ha, Brofanilide 30% SC @ 12.6 g a.i./ha, Brofanilide 30% SC @ 18.6 g a.i./ha, Emamectin benzoate 5% SG @ 11 g a.i./ha and Flubendiamide 39.35% M/M SC @ 48 g a.i./ha. The observation of lepidopteran pests were recorded as number of larvae recorded from ten randomly selected plants at weekly interval. To calculate the efficacy of each treatment, the per cent reduction of insect pest's population was calculated by using **Henderson and Tilton formula**. Effect of new insecticide molecules on spider was observed on 1, 3, 5, 7 and 10 days after application of insecticides. The highest mean per cent reduction in the larval populations of *Helicoverpa armigera*, *Chrysodeixis acuta* and *Spodopteralitura* were observed in the plot treated with Brofanilide 30% SC @ 12.6 g a.i./ha followed by plot treated with Brofanilide 30% SC @ 18.6 g a.i./ha having no significant difference between them. The lowest per cent reduction of 23.59 per cent was recorded in control plot. Lowest spider population (0.71 spider/plant) was recorded in Emamectin benzoate 5% SG @ 11 g a.i./ha and which was on par with other remaining treatments. However, highest spider population (1.55/plant) was recorded in control.

**Keywords:** Soybeans, *H. armigera*, *Chrysodeixis acuta*, *S. litura*, Novel Insecticides, Efficacy.

### Eco-friendly management of conventional and newly emerging plant disease and insect pests

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In this era of continuously emerging new pathogens it is inevitable to measure the loss in food grain production due to insect-pests and in this condition the only technique which goes with sustainability as an integral part is Integrated Disease Management. An experiment was carried out in order to check the efficacy of seed treatment in preventing the root rot disease (caused by *Rhizoctonia solani*) in chill (*Capsicum annum*). In treatment where the biological agent was applied as seed coatings, these were grown on 0.1 per cent malt- extract medium in Petri-dishes. After the development of profuse sclerotia in these



cultures, the mycelium and sclerotia were collected with the help of a fine brush and suspended in 10 ml sterile water, to get a mycelial concentration of  $2 \times 10^6$  cfu/ml. 10 g seeds of chilli were coated separately with antagonist using 1ml of mycelial suspension. The seed were kept in moist chamber for a day and then sown. Observations on plant mortality were recorded at 60 and 90 days after sowing. On the basis of pooled data, that minimum Plant mortality (10.75 and 15.50 per cent) was found in SAAF + Neem cake + *T. viride* at 60 and 90 DAS during the year 2015 and 2016 which is most effective treatment among all the treatments respectively. Farmers are advised to use this combination of treatment in order to prevent disease development.

**Keywords:** chilli, root rot, seed treatment

### **Efficacy of Different Botanicals Against Pulse Beetle (*Callosobruchus chinensis* Linnaeus) in Stored Cowpea**

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Pulses (grain legumes) are the second most important group of crops worldwide. *The pulse beetle, Callosobruchus chinensis* (L.) (Coleoptera: Bruchidae), is a worldwide insect pest that infests pulses in the fields and in storage. Seven vegetable oils namely neem oil, mustard oil, groundnut oil, sunflower oil, clove oil and rhizome powder in combination with oils were tested as grain protectants of cowpea against pulse beetles. Groundnut oil at 0.75 ml/100g seed was found to be the best effective for successful protection of cowpea seeds against pulse beetle up to four months of storage. Neem oil at 1.0 ml/100g seed was found to be the next best effective treatment.

**Keywords:** Per cent seed damage, Per cent weight loss, Botanicals, *Callosobruchus chinensis* (L.), Cowpea

### **Detection and quantification of fried oil in mustard oil and coconut oil by ATR-FTIR spectroscopy combined with chemometrics**

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Attenuated total reflection- Fourier transform infrared (ATR-FTIR) spectroscopy along with multivariate regression modelling was utilized to develop the methodology for classification and quantification of Pure Mustard oil (PMO) and Pure coconut oil (PCO) from its adulterant fried mustard oil (FMO) and fried coconut oil (FCO) in proportions of 0.5 to 50% v/v. Based on spectral data of both oil samples, Principal component analysis (PCA) was applied on selected informative spectral region ( $3000-2800 \text{ cm}^{-1}$  and  $1800-500 \text{ cm}^{-1}$ ) for coconut oil and separate spectral regions  $3010-2800 \text{ cm}^{-1}$ ,  $1800-550 \text{ cm}^{-1}$  and combined region ( $3010-2800 \text{ cm}^{-1}$  and  $1800-550 \text{ cm}^{-1}$ ) for mustard oil respectively. Linear discriminant analysis (LDA) was used on selected wavenumbers obtained from the loading spectra. LDA accurately classified 100% of the initial groups and 90% correctly for coconut oil and 91.7% for mustard oil when cross-validated. For quantification, Principal components regression (PCR) and Partial least squares regression (PLS-R) models were constructed and compared for normal, first and second derivatives to get a robust model. For coconut oil, PLS-R model for normal spectra of combined spectral region showed best results for prediction with the high  $R^2$  value of 0.993 and the root mean square error (RMSE) of 1.332% v/v. Similarly for mustard oil, PLS-R model for 2<sup>nd</sup> derivative spectra of  $1800-550 \text{ cm}^{-1}$  spectral region showed best results for prediction with the high  $R^2$  value of 0.998 and RMSE of 0.631% v/v. The lowest limit of detection in both oils was predicted as 0.5% v/v.

**Keywords:** FTIR Spectroscopy; Adulteration; Multivariate regression; Frying; Mustard oil; Coconut oil



### Optimization of Genomic DNA Isolation Protocol in Polysaccharide Rich Plant Okra (*Abelmoschus esculentus* L. Moench)

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Plant molecular biologists find it difficult to isolate high quality plant genomic DNA from the plant tissues containing polysaccharides or mucilage and the polyphenols through conventional methods. Since isolation of genomic DNA is a preliminary step in many genetic interventions in plants, the availability of an efficient plant genomic DNA protocol for such plant is highly desired. Further, these polysaccharides interfere with the activity of *Taq* DNA polymerase and also obstruct other polymerases, ligases and restriction endonucleases. Therefore, not only the isolation of high quality of genomic DNA is trivial but also the downstream applications are affected.

Okra (*Abelmoschus esculentus* L.) is an important vegetable crop cultivated in tropical, subtropical and warm temperate region around the world. Okra is said to be useful against genito-urinary disorders, spermatorrhoea and chronic dysentery. Daily consumption of 100gm of okra provides 20% of calcium, 15% iron and 50% of vitamin C of human dietary requirements. However, both the leaves and the fruits of this plant are rich in polysaccharides and polyphenols. In a study conducted at Department of Agricultural Sciences, DAV University, it was found that the standard CTAB method of DNA isolation by Doyle & Doyle, (1987) was not efficient in yielding the genomic DNA of high quality in all genotypes (18 in numbers) of okra. therefore, we tried some modifications in the conventional method. To overcome the problem of polysaccharide rich mucilage and polyphenols, the modifications in standard CTAB method were made with regard to the amount of leaf sample, concentration of salt in the extraction buffer, use of PCI & PVP and the use of sodium iodide with silica dioxide. It was found that the use of lesser amount of leaf tissue (100 mg), high concentration of salt (5M) and use of PCI (50:48:2) & PVP (4%) and purification using sodium iodide (4M to 8M) and silicon dioxide with sodium hydroxide or potassium hydroxide (3:1 to 9:1) are the desired modification in the standard method for the isolation of high quality genomic DNA. The isolated DNA using the modified method was intact and was of good quality DNA as shown by  $A_{260nm}/A_{280nm}$  (1.7-1.9) ratio and in the agarose gel (0.8%). Further, the DNA isolated by the modified method was also found suitable for the downstream applications like PCR and SSR analysis.

### Natural Resource Management Technologies– An Analysis for Wheat Crop in Punjab

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Punjab state led the country's Green Revolution of the 1960s and earned for itself the distinction of becoming 'Granary of India' but this has been achieved at a great cost in terms of degradation of agricultural ecology and exhaustion of scarce natural resources. For the present study, a sample of 1100 farmers (50 from each district) of Punjab state was taken to analyse the adoption of existing resource conservation technologies (RCTs) along with their economic benefits, motivational factors, reasons for adoption/non-adoption/discontinuation for use of these RCTs for wheat crop. The results revealed that about 70 per cent farmers had adopted laser leveling of fields. About 12 per cent farmers green manured their field, 11 per cent were using zero till drill, 10 per cent opted for green manuring, and 4 per cent were applying bio-fertilizers while only one per cent had opted for bed planting of wheat. As far as area is concerned it was observed that about 54 per cent of the wheat area was laser leveled, 8 per cent was under zero till drill, 5 per cent green manured, 2 per cent sown with happy seeder and at 2 per cent bio-fertilisers were applied and merely 0.12 per cent was bed planted. Almost all the respondents had laser leveled fields in Moga and Bathinda followed by Faridkot and Sri Muktsar Sahib (98% each). In Sangrur about 17 per cent farmers had adopted happy seeder followed by Moga (14%). About 40 per cent farmers of Gurdaspur district sown wheat using zero tillage drill followed by Moga (26%). Bed planting was adopted by about 6 per cent respondents in Patiala and Sangrur. About 32 per cent respondents in Sri Muktsar Sahib followed green manuring followed by Bathinda (28%). The maximum 20 per cent respondent farmers of Tarn Taran used bio-fertilisers. However, the major constraints for adoption of the RCTs were timely availability of inputs (43.8%), finance (43.71%), technological reasons (42.20%) and general issues (40.43%). Therefore, extension workers must advocate and encourage the farmers to adopt RCTs



through awareness generation trainings/demonstrations. The government should establish custom hiring centres through Self Help Groups for unemployed youth by providing subsidy and simultaneously provide solutions to constraints in adoption of these technologies.

**Key words:** Resource conservation, adoption, constraints, happy seeder, laser leveller, green manuring, bed planting, zero tillage

### **Effect of Solid Media on growth of *Ceratocystis fimbriata* the incitant of Pomegranate Wilt**

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The investigations were aimed at to study the effect of five Non-synthetic/ Semi Synthetic Media and three Synthetic Media on Colony growth and perithecium production of *C. fimbriata* which is the incitant of pomegranate wilt. For the physiological studies *C. fimbriata* cultures were grown in different medium in sterilized Petri plates which were incubated for 15 days at  $25 \pm 2^\circ\text{C}$  and inoculated with 7 days old 5 mm culture disc of the test pathogen under aseptic conditions. The fungus was allowed to grow and diametric growth was recorded after 24, 48, 72, 96 and 120 hours. An average value of 3 replications in a treatment was worked out and used as quantitative measure for comparing growth under different treatments. Results were analyzed statistically and compared. The results point out to the conclusion that both radial colony diameter and production of perithecium of *C. fimbriata* revealed notable variation when grown on different media. When mean diametric growth of *C. fimbriata* was calculated among the eight media after 120 hours of inoculation, Potato Dextrose Agar (15.86 mm) and Oat Meal Agar (15 mm) were statistically at par and were superior to aid the colony growth followed by Richard's Agar (14.86 mm). Corn Meal Agar was the next best medium supporting the colony growth (13.80 mm) and was followed by Czapek's (dox) Agar (10.53 mm). Next best medium was Malt extract Agar (9.66 mm) which was closely followed Sabouraud's Agar (8.80 mm) in terms of supporting Radial growth of *C. fimbriata* and lowest growth was observed in case of Host leaf extract (2.60 mm). The production of Perithecium on PDA was faster than other media and also perithecium was produced in Malt Extract agar, Richard's Agar and Oat meal Agar.

**Keywords:** *Ceratocystis fimbriata*, Pomegranate Wilt.

### **Development of eco friendly mulch mats**

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A major constraint in crop production is heavy infestation of weeds. Weeds compete with the crop for water, sunlight and nutrients. Application of mulch in the field facilitates in curbing weed growth. It is also used to conserve moisture, improve the fertility and health of the soil as well as to enhance the visual appeal of the field. In Punjab, paddy straw management is a burning issue. Looking into the problems of weed growth and paddy straw management, three variants of mulch mats using paddy straw were developed in the Department of Apparel and Textile Science, PAU, Ludhiana. These three variants were T1- paddy/ paddy (woven), T2- paddy/ cotton (woven) and T3 – paddy (non-woven). These variants were tested under control conditions for papaya crop. All the three treatments were reported to be effective in controlling diverse weed flora for a long period of time. Further, it was observed that mulch mat developed from paddy straw and cotton waste remained intact even after one year. These eco friendly mulch mats will help the farmer to reduce weed growth as well as the burden of straw management.

**Key words:** crop, mulch mat, paddy, straw management, weed.



### Effects of Fly ash on growth of *Vigna mungo* L.

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Parichha Thermal Power Plant is situated in district Jhansi, which uses bituminous coal. This coal from coal mines are subjected to crusher where it is powdered with particle size less than 20 mm. This raw coal is transported to boiler through coal-pipes by high pressure hot air. Burnt coal comes out from the chimneys get mixed with air also then precipitated in surrounding area and some ash is fall in the bottom boiler called as bottom ash or coal ash. Present work has been taken to work out the effect of different concentrations of fly ash on growth and yield of *Vigna mungo* L. Var. T-9 obtained from certified seed centre. Seeds of *Vigna mungo* have been examined for different concentrations of fly ash and different plant parameters such as percent germination, plant height in terms of shoot and root length, fresh weight, dry weight and chlorophyll content have been analyzed. Maximum germination percent of 94% have been recorded for the sample mixed with 25% fly ash and 75% field soil. For other vegetative parameters it has been found that sample 2.5% fly ash and 75% soil is highly supportive of plant growth. This has been supported by the leaf samples analyzed for chlorophyll content. In the fresh leaves, where maximum amount of chlorophyll content have been recorded.

### Application of Buttermilk concentrate for the Encapsulation of Omega-3 Oil

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Omega-3 (ω-3) fatty acids, owing to their reported health benefits, have initiated interest in research in the area. Exposure of these poly-unsaturated fatty acids to light, oxygen and metals results in oxidation, which limits their shelf-life. The current project was aimed to develop a suitable ω-3 delivery system for vegetarians using buttermilk. It was envisaged that the milk fat globule membrane (MFGM)-rich buttermilk may prove a suitable encapsulating medium for encapsulating ω-3 oil. Flaxseed oil was loaded @ 12% in concentrated buttermilk. This ω-3 oil emulsion was stable for 21 days and thermally stable for 30 min at 60°C, which suggested its suitability for processing such as concentration and drying. The emulsion was dried in a spray drier using three different inlet air temperatures, 170°C, 180°C and 190°C. Based on responses such as peroxide value, moisture content, water activity, flowability and L\*, a\* and b\* values, the inlet air temperature of 190 °C was selected. Confocal laser scanning microscopy and scanning electron microscopy established that the encapsulation efficiency was good. The study indicated that buttermilk, by virtue of its phospholipids-rich fragment - MFGM-, can stabilise and prevent the oxidation of ω-3 rich oil. Buttermilk can serve as a matrix for the encapsulation of ω-3-rich oil, which will not only result in a stable emulsion, but can also solve the problem of disposing the buttermilk in the dairy industry.

**Keywords:** Emulsion, flaxseed, omega-3, phospholipids, buttermilk, spray drying.

### Screening of ligninolytic bacteria with lignin peroxidase activity for degradation of lignin and azo dye

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The effluent discharge from pulp and paper industry is highly polluted and become a serious concern for environmental and public health. The effluent generally is alkaline in nature and has high COD and BOD, pH, organic content, and brown color and contains lignin and its derivatives which are recalcitrant in nature. Discharge of partially treated effluent poses serious threat to the environment, which includes terrestrial and aquatic life and cause toxicity in living organism. The aim of my study is to isolate highly potential ligninolytic bacteria capable of growing in presence of lignin at high concentration (500- 1000 mg/l)



from activated sludge of pulp and paper mill. Enrichment of ligninolytic bacteria was done by growing bacteria in presence of lignin for 7 days 35°C at 120 rpm. Enriched samples were also used as a source for isolation of lignin degraders. As a result of screening (primary and secondary), total 4 bacterial strains were isolated and tested for growth and degradation for lignin and azure B dye. Out of 4 isolates, a bacterium named as B2 showing LiP activity along with degradation of lignin was selected for further studies. The selected bacterium B2 was identified as *Serratia liquefaciens* by 16SrRNA gene sequencing. The lignin and azo dye degradation studies with *S. liquefaciens* indicated its potential for use in the applications for lignin and azo dyes degradation. Purification of LiP enzyme produced during degradation by B2 isolate is in progress.

**Keywords:** pulp and paper, azo dye, activated sludge, Kraft lignin, lignin peroxidase, Lip activity

### **Plasticulture: The future of farming**

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India supports nearly 16 per cent of world's population with 2.4 per cent land resource and 4 per cent water resource and lately the dwindling quality and the vagaries of the availability of these resources are raising serious questions on the sustainability of the agricultural practice. To counter the problem, efforts need to be redirected to improve the productivity of the land, efficiency of the supply chain while reducing the carbon footprint, by efficient usage of fertilizers, as a result of agricultural practice. Plasticulture, which is use of plastic in agricultural practice, is an answer to this rallying cry. Plasticulture is a scientific way of carrying out agriculture, which not only improves the productivity, but optimizes the input resources as well, thereby reducing the cost. Use of plastic material in agricultural practices is referred to as Plasticulture. Plasticulture includes all kinds of plant or soil coverings ranging from mulch films, row coverings, poly tunnels to greenhouses. The benefits of Plasticulture are reduced water loss, UV stabilization to cool soil and prevent insects & prevention of weed growth. Polyethylene plastic film is used majorly for Plasticulture, by growers, because of its flexibility, easy manufacturing and affordability.

All these factors make use of plastics in agriculture an interesting proposition, as there are substantial benefits of employing the Plasticulture techniques to improve the productivity while saving the water consumption and minimizing the post-harvest wastages. Compared to world average of polymer utilization in agriculture which stands at 8 per cent, India has polymer utilization of just 2 per cent. Hence there is a lot of potential of plastic application in agriculture. The greater use of plastic in agriculture can also help to a great extent to achieve up to fifty per cent of the intended targets in Agriculture. The wider use of Plasticulture can reduce the loss of harvest and can increase the efficiency thus contributing more to the GDP. It is estimated that the agriculture output can be increased by INR 68,000 Crore by using proper plasticulture applications like drip irrigation, mulching etc. Also, using innovative plastic packaging and handling techniques can promote proper harvest management which will in turn contribute towards the Agriculture GDP.

**Keywords:** Plasticulture, utilization, plastic material, plastic application

### ***Rhizoctonia* AG-E causing root rot of *Cedrus Deodara* (Roxb.) G. Don**

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*Cedrus deodara* is the state tree of Himachal Pradesh is one of the most important conifer in the Himalayan moist temperate forests. Root rot is a serious disease of *Cedrus Deodara* caused by Binucleate *Rhizoctonia* AG-E that causes critical economical losses in Himachal Pradesh. We conducted experiment to test the *in vitro* efficacy of rhizospheric fungal and bacterial antagonists against the Binucleate *Rhizoctonia* AG-E pathogen. Antagonistic activities of the native fungal and bacterial microorganisms were determined against root rot pathogen (Binucleate *Rhizoctonia* AG-E) so that the most effective antagonists



could be evaluated under pot conditions for the management of the disease. We evaluated four fungal antagonists and two bacterial antagonists, out of four species of fungal antagonists *Trichoderma viride* was found to be most effective and showed significant superiority amongst all the antagonists tested that resulted in 75.02 per cent inhibition of the mycelial growth of pathogen followed by *T. harzianum* with 70.41 per cent inhibition. Out of two bacterial antagonists, *Bacillus subtilis* was found better than *Pseudomonas fluorescens* which inhibited the mycelial growth up to 66.11 per cent as compared to *P. fluorescens* with 40.75 per cent mycelial inhibition. The present study indicates that biological control agents, fungal antagonists and bacterial antagonists are effective against root rot disease of *Cedrus Deodara* caused by Binucleate *Rhizoctonia* AG-E.

### ***In vitro* Evaluation of biological control agents against the Binucleate *Rhizoctonia* AG-E causing root rot of *Cedrus Deodara* (Roxb.) G. Don**

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*Cedrus deodara* is the state tree of Himachal Pradesh is one of the most important conifer in the Himalayan moist temperate forests. Root rot is a serious disease of *Cedrus Deodara* caused by Binucleate *Rhizoctonia* AG-E that causes critical economical losses in Himachal Pradesh. We conducted experiment to test the *in vitro* efficacy of rhizospheric fungal and bacterial antagonists against the Binucleate *Rhizoctonia* AG-E pathogen. Antagonistic activities of the native fungal and bacterial microorganisms were determined against root rot pathogen (Binucleate *Rhizoctonia* AG-E) so that the most effective antagonists could be evaluated under pot conditions for the management of the disease. We evaluated four fungal antagonists and two bacterial antagonists, out of four species of fungal antagonists *Trichoderma viride* was found to be most effective and showed significant superiority amongst all the antagonists tested that resulted in 75.02 per cent inhibition of the mycelial growth of pathogen followed by *T. harzianum* with 70.41 per cent inhibition. Out of two bacterial antagonists, *Bacillus subtilis* was found better than *Pseudomonas fluorescens* which inhibited the mycelial growth up to 66.11 per cent as compared to *P. fluorescens* with 40.75 per cent mycelial inhibition. The present study indicates that biological control agents, fungal antagonists and bacterial antagonists are effective against root rot disease of *Cedrus Deodara* caused by Binucleate *Rhizoctonia* AG-E.

### **Studies on diversity of *Fusariumoxysporum* f. sp. *cubense* in Eastern part of Bihar and their sustainable management**

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In current situation banana production is facing numerous challenges by several biotic and abiotic factors. Among these factors the Fusarium wilt disease caused by *Fusariumoxysporum* f. sp. *cubense* (*Foc*) represents huge losses of banana yield. In this study a progression of experiments were planned and did to find the morphological diversity. And also to access efficacy of various fungicides, oilcakes and bio-agents against *Foc* *in vitro* as well as in pot condition. Four isolates of the pathogen were collected from different district of Bihar (Katihar, Purnea, Khagaria and Bhagalpur). Great variability was recorded in size of conidia, growth rate, colony color and sporulation of the isolates. The results of present study *in vitro* efficacy of fungicides evaluated through food poison techniques revealed that greatest inhibition percent in all the three concentrations of tebuconazole+trifloxystrobin against KFoc-1 (87.54 %), PFoc-2 (94.06 %) and KhFoc-3 (93.97 %) but in case of BFoc-4 (85.39 %) the growth of pathogen is most inhibition in all concentration of carbendazim. The outcome demonstrated that mahua cake extract (15%) recorded the greatest inhibition of mycelial growth of KFoc-1 (43.66 %), PFoc-2 (55.49%), KhFoc-3 (72.99 %) and BFoc-4 (53.37 %) over control followed by neem cake extract (15%), KFoc-1 (38.27%), PFoc-2 (50.56%), KhFoc-3 (55.02%) and BFoc-4 (43.71%). Among two antagonists of *Trichoderma* spp., one antagonist of *Pseudomonas fluorescens* (Biomonas) was tested and was found the *Trichoderma viride* (Boomerma) showed strong antagonistic activity against all Focisolates followed





by *Trichodermaasperellum* (Thg-1) and *Pseudomonas fluorescens* (Biomonas). In the pot culture experiments the plants showed disease severity ranged from 0.00% (No disease) in T4 and T12 to 66.00% in T14 saw at 180 DAP. The *Trichoderma* (Boomerma) and tebuconazole+trifloxystrobin were found highly effective for the management of panama wilt of banana in both *in vitro* and under pot condition.

**Keyword:** *Fusariumoxysporum* f. sp. *cubense*, Banana, Fungicides, Bioagents, Sustainable.

### **Effect of Different Control Practices on Population Density of Various Fungi At Pre-Sowing And Post-Harvesting Stag In Nursery of Tomato**

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Tomato is the most popular vegetable in the world because of its taste, colour and high nutritive value and also for its diversified use. There are many factors involved in low yield of tomato; among them are infestations by fungi, bacteria, nematodes or viruses and the competing weeds are predominant. The most urgent need is to develop bio-control agents and varieties of tomato that can resist the ravage of important fungal diseases caused by *Alternaria* sp, *Aspergillus* sp, *Penicillium* sp *Helimentosporium* sp. The present study was carried out to study the effect of various fungicide on population density of various fungi at pre-sowing and post-harvesting stag of tomato. The detail treatment wise application of some major fungicide and its effect on fungus is discussed below.

### **Analysis of The Mitochondrial Coi Gene Fragment And Its Informative Potential For Phylogenetic Analysis In Family Pentatomidae (Hemiptera: Hetroptera)**

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Pentatomidae is a widely diverse family represented by 4,722 species belonging to 896 genera. It is considered as one of the largest family within suborder Heteroptera. In the present study, partial mitochondrial COI gene fragment of approximately 600bp from seven species of family Pentatomidae collected from different localities of Northern India has been analysed. The data divulged an A+T content of 65.8% and an R value of 1.39. The COI sequences were added directly to Genbank NCBI. The database analysis shows mean K2P divergence of 0.7% at intraspecific level and 13.5% at interspecific level, indicating a hierarchal increase in K2P mean divergence across different taxonomic levels.

**Keywords:** Pentatomidae, mitochondrial gene, COI.

### **DNA Barcoding in Pentatomid Bugs for Identification and Phylogenetic Analysis**

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Pentatomids are generally known as the “Shield Bugs”, due to the shield shaped body with more or less triangular scutellum covering more than half of the abdomen or “Stink Bugs”, because of the emission of disagreeable pungent odour from a pair of scent glands that open in the region of the metapleura. Most pentatomids are plant feeders and thus cause extensive damage to food crops and fruit trees. They are considered as one of the major agricultural pests of economically important crops throughout the world that include legumes (soyabeans), cereals (rice, wheat) and tree crops. Mitochondrial DNA (mtDNA) has been considered as more elucidative and easy to work with, as it is more abundant (i.e. 500-1000 copies per cell). Further it has relatively fast mutation rate, lacks introns and shows no recombination. Thus, mtDNA suits as the best device to trace phylogeny.



Morphology based identification is not considered sufficient for phylogenetic studies. So, molecular identification is better option because the DNA molecule is a great source of information. Partial DNA sequences of the mitochondrial COI gene has been used to identify and discover new species, a process referred to as DNA Barcoding. A 648 bp fragment of COI can be used as a DNA barcode to identify and distinguish between animal species. This fragment size of COI has been shown to provide sufficient resolution to identify cryptic species, thereby increasing taxonomy based biodiversity estimates. So, the present research has been undertaken for the identification and phylogenetic analysis of economically important Indian species of family Pentatomidae (Hemiptera) on the basis of COI gene fragments of mt DNA. The final aligned data pertained to 60 sequences of 623 bp using COI gene. Sequence of *Aeschyntelus notatus* belonging to family Rhopalidae was taken as out group. The overall aligned data showed 331(61.1%) conserved and 201(32.2%) parsimony informative sites for COI gene sequences across family Pentatomidae.

Pairwise comparisons were made between sequences on three different taxonomic levels i.e., within the same species, between species of same genus and between pairs of genera representing the same family using COI gene sequences. The percentage divergence values revealed a clear pattern of increased nucleotide diversity across hierarchical levels. Phylogenetic analysis was done using Maximum Likelihood (ML), Minimum Evolution (ME) and Neighbour Joining (NJ) methods in MEGA6 software. Various sequences were taken from Genbank from different parts of the world to construct the phylogenetic tree relevant to the present sequences (comparison of the present sequences obtained for various species with the sequences obtained for them in other parts of the world). All the species studied revealed a similar pattern with high bootstrap value forming well separated clades. It can be concluded that COI is an excellent marker for the identification and phylogenetic analysis of Pentatomidae species of Indian origin.

**Keywords:** Pentatomid bugs, Mitochondrial DNA, Barcoding, COI, Phylogenetic tree, MEGA

## **Impact of UV-B Radiation on Photosynthetic Performance and Lipid Production Efficiency of Green Algae *Chlorococcumhumicola* and *Chlorella vulgaris***

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Micro-algae are known as the largest contributor to biomass production due to photosynthesis on the Earth. They can convert atmospheric carbon dioxide to potential biofuels, foods, feeds and high-value bioactive substances. Gradual depletion of the stratospheric ozone layer due to industrialization has enhanced incidence of UV-B radiation imparts deleterious effects on both flora and fauna. This increase in UV-B radiation affects photosynthetic efficiency of micro-algae too. In the living system, imposition of oxidative stresses by UV-B exposure leads to the production of reactive oxygen species in micro-algal cells too. A general rise in the activities of various antioxidative enzymes, such as Superoxide dismutase, Peroxidase, Catalase and Glutathione reductase, and non-enzymatic components such as reduced glutathione, ascorbic acid, -tocopherol, -carotene, etc. to counteract the effect of radicals. The micro-algae with its high biomass production rate and radiation tolerant nature offers a range of biotechnological opportunities to produce high-value added commercial products such as biofuels, lipid contents and other valuable bioactive compounds. In present investigation, micro-algae *C. humicola* and *C. vulgaris* were exposed to UV-B radiation for different time period to assess its growth, biochemical responses, lipid production efficiency and physiological changes viz., photosynthetic performance, non-photochemical quenching, etc. The chlorophyll fluorescence parameters indicated that the maximal photochemical efficiency of PSII (Fv/Fm), the actual photochemical efficiency of PSII in the light and the NPQ displayed minimal changes at 2h of exposure but significantly decreased at 4h as compared with the control set. Moreover, UV-B stress decreases the light energy utilization of photosystem-II and thus damages the photosynthetic capacity in light reaction in algae. The algae used in this study showed remarkable alteration in growth and tolerance behaviour which was more pronounced in the case of *C. humicola* than *C. vulgaris*. The effect of UV-B on biochemical, physiological and lipid production efficiency is explained.

**Key words:** UV-B; Algae; Lipid



## Phytoremediation: Assisted by Plant Growth Regulators and Plant Growth Promoting Rhizobacteria for Degradation of Pesticide and Heavy Metals

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Phytoremediation technique is used for treatment of pollutants or waste present in contaminated soil or ground water by green plants that remove, degrade or stabilize undesirable substances. Heavy metal and pesticide pollution of soil is a significant environmental problem and has an adverse effect on human health and agriculture. Plant growth regulator (PGR) and plant growth promoting bacteria (PGPR) facilitate phytoremediation technique. PGR has been investigated as a suitable method for improving efficacy of phytoremediation. Effective PGR to improve phytoremediation include auxin, cytokinin and gibberellins. PGR increases biomass of plant, reduces negative effect of contaminants and improve growth of plants under stress conditions. PGPR are capable of degrading toxicants through phytoremediation. Studies have reported that microorganism are colonizing rhizosphere area and are involving in mechanisms for plant resistance towards toxicant by various secretions and production of several important compounds such as siderophores, phytohormones and metal binding proteins. Rhizobacteria plays a major role in phytoremediation of pesticide and heavy metal polluted soil, by reducing toxicants and promoting growth of plants by different mechanism or by using chelating agents, acidification and phosphate solubilizing agents. Current review is based on the application of PGR and PGPR in degradation of heavy metal and pesticides.

## Assessment of growing medium and containers on out planting of *Emblica officinalis* Gaertn. seedlings

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The evaluation of growing medium and container type on Aonla was examined in nursery area where the experiment was laid out, while out planting performance were assessed in the plantation area during 2014. The study involved nursery and out planting experiments, which was laid out in randomized block design (factorial), replicated thrice. The study reveals that the seedlings raised in growing medium M<sub>3</sub> consisting of soil + sand + mushroom compost (1:1:2) recorded significantly highest out planting survival per cent (83.33) in the seedlings. The growing medium M<sub>3</sub> also recorded the significantly maximum height growth (54.17cm) and collar diameter (6.92mm) for the out planted seedlings. Moreover, the seedlings raised in polybag (C<sub>2</sub>) having size 9"x4.5" with eight side + eight bottom perforations, recorded significantly maximum survival per cent (82.78), height growth (53.84cm) and collar diameter (6.77mm) of the seedlings. Similarly, the interaction effect of growing media and container type displayed significant influence on the out planting survival, height (cm) and collar diameter (mm) growth of *Emblica officinalis* seedlings. The seedlings raised in polybags C<sub>2</sub> of size 9"x4.5" with eight side + eight bottom perforations, filled with growing medium M<sub>3</sub> consisting of soil + sand + mushroom compost (1:1:2) registered significantly maximum values for survival per cent (93.33), height growth (63.13cm) and collar diameter growth (7.62mm) of the seedlings. The reason for good seedling growth could be attributed to the superior performance of compost based growing media and variation in container size. Higher percentage of organic matter in growing medium could have provided good moisture and aeration for the seedlings in combination with container size has a significant role in carrying capacity of potting mixture, nutrient availability, favourable pH and EC. Higher container volume resulted in vigorously growing seedling stock, which ultimately resulted in better outplanting performance.

**Key words:** Growing medium, container type, Polybag



## Significance of medicinal and aromatic plants in the Pharmaceutical sector

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Medicinal plants have been the origin and basis of pharmacology and therapeutics. Plants have been one of the important sources of medicines even since the dawn of human civilization. Ayurveda is around 5000 years old holistic healing system and remained one of the India's traditional Health care systems. Approximately one third of all pharmaceuticals are of plant origin. Some of the bio active constituents like Alkaloids, Glycosides, Steroides, Phenols, Tannins, Anti-oxidants and other compounds are found in plants. It is beneficial against Human diseases like malaria, dysenteric, etc. Latex, Essential oils, Dyes and Vegetable Oils which are derived from Medicinal plants are also used for medicines. Many of the medicines are produced with the help of living cell which are not completely useful to plants like protoplasm. Nowadays in current scenario many pharmaceutical companies are using chemical compounds claiming for economical and availability reason for drug production which has cut down the use of medicinal and aromatic plants. Atropine Drug is extracted from *Atropa belladonna* (Hyosciamine compound), Morphine, Codeine, Nicotine drug is extracted from *Papaversomniferum* (Morphine compound), Colchicine drug is extracted from *Colchicum autumnale* (Colchicine compound) and many more. Recent research in China on Medicinal Plants shows about 140 new drugs have been developed. Example: Anisodamine gives good effects for the treatment of morphine addiction which is derived from seeds of celery. Most of the population in Developing countries still use Plant as primary remedies.

**Keywords:** Medicinal Plants, Ayurveda, Bio active constituents, Living cell, Chemical Compounds, Research Interest

## Effect of micronutrients and sea weed sap on fruit set, yield and quality of mango (*Mangifera indica* L.) cv. Dashehari

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The present investigation was carried out at GBPUA&T, Pantnagar, U.S. Nagar, Uttarakhand to study the effect of micronutrients and sea weed sap in mango cv. Dashehari. The investigation has shown that the application of RDF + foliar spray of ZnSO<sub>4</sub> @ 0.4 % + CuSO<sub>4</sub> @ 0.2 % + Boric acid @ 0.2% (2 sprays at just before flowering and marble stage) was found to be most effective for increasing number of fruits per panicle at pea and marble stage (9.67 and 4.58, respectively), yield plant<sup>-1</sup> (271.51 kg), yield ha<sup>-1</sup> (27151 kg), per cent increase in yield (56.40 %), TSS (18.51 °B), total sugar (12.88 %), reducing sugar (3.56 %), non-reducing sugar (8.85 %) with reduced acidity (0.149 %). The higher fruit weight (221.98 g), fruit length (10.87 cm) and fruit width (6.54 cm) were observed with the application of RDF + 10 % sea weed sap (2 sprays at panicle emergence and marble stage) + ZnSO<sub>4</sub> @ 200 g + CuSO<sub>4</sub> @ 100 g + Boric acid @ 100 g (soil application). Thus, it is concluded that the basal application of recommended dose of fertilizer (RDF) with foliar spray of micronutrients may be helpful in upliftment of yield and quality of mango cv. Dashehari.

**Keywords:** Mango, micronutrients, sea weed sap, fruit set, yield and quality.



## Assessment of Soil Quality Under Prevalent Cropping Systems In Mid Hill Condition of Himachal Pradesh

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Himachal Pradesh, is a mountainous region spread over an area of 55,673 km<sup>2</sup> with elevation ranging from 350 meters to 6,500 meters above mean sea level noticeably increasing from west to east and south to north. For agricultural planning, development and the sustainable use of natural resources. Himachal Pradesh has been categorized into four agro-climatic situations viz. low hills, mid hills sub humid, high hills temperate and high hills dry temperate.

The zone-II extends from 651 meters to 1,800 meters above mean sea level. This zone occupies about 8 % of the total geographical area and about 37% of the cultivated area of the state mainly having brown soils. Soil quality has been defined as “the capacity of specific kind of soil to function within ecosystem and land use boundaries to sustain biological productivity, maintain environmental quality and sustain plant, animal and human health” (Doran and Parkin, 1994). To assess the soil quality we have to consider various physical, chemical and biological attributes referred to as indicators. These indicators may directly monitor the soil or monitor the outcomes that are affected by the soil. The present investigation entitled “Assessment of soil quality under prevalent cropping systems in different agro-climatic zones of mid hill conditions of Himachal Pradesh” was carried out with a view to ascertain the physical, chemical and biological properties of soils under prevalent cropping systems viz., maize- wheat, rice- wheat and vegetable based in different agro climatic zones of Himachal Pradesh. On the basis of detailed survey and random sampling, representative 45 soil samples from two depths i.e. 0-0.15 m and 0.15-0.30 m were collected. Soil samples were analyzed for their physical, chemical and biological properties and key indicators were identified using multivariate statistical analysis for computing the soil quality index. Wide variations in the soil health indicators were observed among different sites. The soil texture under various sites selected in the present study varied from sandy loam to sandy clay loam, however sandy loam was observed as the most dominant texture both under cereal and vegetable based cropping systems. Soil reaction across various sites under present study was slightly acidic to neutral in reaction. Higher salt accumulation (EC) was observed under vegetable based cropping systems as compared to those of cereal based. Organic carbon was medium to high and available N, P and K contents were in low to medium category. Organic carbon and available and total N P and K contents were higher under the vegetable based cropping systems than cereal based. DTPA Fe, Mn, Zn and Cu were observed sufficient, whereas total Fe, Mn, Zn and Cu were recorded higher in cereal and vegetable based cropping system. Microbial biomass carbon, microbial biomass nitrogen, potentially mineralizable nitrogen and soil respiration were higher. Overall higher soil quality index was observed under vegetable based cropping system as compared to the cereal based cropping systems.

**Keywords:** Mid hills, Cropping systems, Soil Quality

## Shelf Life Studies of Different Formulations of *Trichoderma Harzianum*

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*Trichoderma* is used as bio-agent and reported to be quite effective, inexpensive and eco-friendly. *Trichoderma* species can be used as seed treatment, applied direct to the soil before planting & added in organic fertilizers. *Trichoderma* is used as bio-control agent because it controls the pathogenic organism by the mechanism like competition, mycoparasitism, and antagonism. It excretes the enzymes like viridin, and gleotoxin thereby enhancing the root growth. Hence it has got significant importance in ecofriendly disease management as a bio-pesticide. The first step in the bio-control study is the identification of promising bio-control agent. Once the bio-control agent is identified and is proven effective against plant pathogens over several reproducible results, the method of mass production, formulation and application should be taken into consideration to stabilize the product during storage and to facilitate its delivery to the plant. The major bottleneck of bio-pesticides is the shelf life and inconsistent performance. In order to overcome this problem, the present study “Shelf life studies of different formulations of *Trichoderma*



*harzianum*” was undertaken at biological control lab, NIPHM with the objectives viz., Evaluation of solid and liquid substrates for mass production of *T. harzianum* and Shelf life studies of different formulations of *T. harzianum*. From the study it was found that all the prepared formulations retained optimum viability. Capsule and sachet based formulations gave higher shelf life of *Trichoderma as* compared to wettable formulations. Application of Capsule and sachet based formulations would be more convenient for application, storage and handling to control diseases in orchards and in the field and would help the farmer get better yield.

**Key words:** *Trichoderma harzianum*, bio-pesticide, bio-control agent, Shelf life, formulations, mycoparasitism, antagonism.

### Development of hybrids based on cytoplasmic male sterility (CMS) and double haploids (DH) in cole crops

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Cole crops are an important group of cool season vegetables. Initially, these crops were confined to Europe and other temperate regions but after the Second World War the cultivation of cole crops has also spread to tropics and sub tropics regions of the world. All the members of this group have a common ancestry and that is the reason they are fully cross compatible with each other. In general, these are highly cross pollinated crops and show preponderance of non-additive gene action for most of the economic traits. Hence, heterosis breeding has turned out to be of more relevance. Cytoplasmic male sterility among *Brassica oleracea* was broadly investigated to implement it as a low-cost, efficient and reliable system for the production of F<sub>1</sub> hybrids that could be easily utilized by breeders. In India, the hybrids of cabbage developed in public sector through the use of CMS are KTCBH-84 and H-64. CMS is therefore considered as an alternative approach overcoming the problems experienced while using sporophytic self incompatibility system. Self-incompatibility is not always stable, and may be suppressed by high temperature or drought and CMS (Cytoplasmic male sterile) lines are stable over the range of environments. Several CMS genes have been identified by molecular genetic studies, including Ogura CMS from Japanese radish, which is the most extensively studied and most widely used. Three Ogura based improved cytoplasmic male sterile (CMS) lines of cauliflower (*Brassica oleracea* var. *botrytis* L.) viz., Ogu1A, Ogu2A and Ogu3A were developed following seven generations of backcrossing with Snowball group. Due to lack of a reliable and rapid method of producing inbred lines, as conventional breeding techniques is labour demanding and is time consuming. The feasibility of using double haploids (DH) as an alternative and faster method of producing inbred lines. Double haploids are being produced are comparable to inbred line produced by many generation of self pollination and commercially used by private companies in F<sub>1</sub> seed production.

**Keywords:** Cole crops, F<sub>1</sub> hybrids, CMS and double haploids

### CRISPR-based Genome editing: A targeted gene modification system for the sustainable agricultural insect pest management

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Genome editing technologies are useful for understanding the functions of target genes in diverse organisms. Before the CRISPR/Cas9 system was discovered, zinc finger nucleases (ZFNs) and transcription activator-like effector nucleases (TALENs) technologies were used for genome modification; ZFNs and TALENs, however, require the use of a variety of nucleases, and the off-target effects of nucleases can lead to cellular toxicity. In addition, methods using ZFNs and TALENs are complex and labor-intensive. These two genome-editing systems have been recently replaced by the CRISPR/Cas9 system, which is far more convenient and effective than ZFNs and TALENs. CRISPR/Cas9 generates changes at the genomic level that are stable and heritable, and the mutant gene can be transmitted to the next generation, CRISPR loci are typically composed of a clustered set of CRISPR-associated (Cas) genes and a signature CRISPR array, which includes a series of repeat and spacer



sequences. The Cas9 nuclease-induced double-strand break (DSB) can be repaired via two major approaches, non-homologous end-joining (NHEJ) and homology-directed repair (HDR), and these distinct DSB repair mechanisms can be further subdivided depending on the nature of the generated DNA ends (NHEJ will give rise to insertion or deletion (Indel) mutations that disrupt the open reading frame (ORF) of target genes, by this way, we can knockout of target DNA sequence and HDR can be used to introduce specific mutations or insert sequences of interest in accordance with the invading DNA template by homologous recombination (HR), in this way, we can knock-in of specific gene.

**Keyword:** Genome editing, CRISPR/Cas9 system, ZFNs and TALENs etc.

### Effect of drip irrigation on soil water content under protected conditions

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Availability of irrigation water is the major constraint to crop production in many parts of the world. The advantage of drip irrigation is a significant technological improvement in irrigation system, which helps to combat water scarcity in agriculture. In recent years, the adoption of drip irrigation has gained momentum owing to its positive impact on water saving, productivity and quality of produces in many crops. The study aimed at evaluating the effect of drip irrigation levels and different NK fertigation levels on soil water behaviour. The treatments comprised of (a) Three drip irrigation levels,  $DI_{0.6}$  (Daily drip irrigation at 60 per cent of open pan evaporation),  $DI_{0.8}$  (Daily drip irrigation at 80 per cent of open pan evaporation) and  $DI_{1.0}$  (Daily drip irrigation at 100 per cent of open pan evaporation) (b) Three NK fertigation levels viz.,  $NK_{50}$  (50% of RDF of which 25% applied as basal and rest 75 % through fertigation at weekly interval),  $NK_{75}$  (75% of RDF of which 25% applied as basal and rest 75 % through fertigation at weekly interval) and  $NK_{100}$  (100% of RDF of which 25% applied as basal and rest 75 % through fertigation at weekly interval) and (c) Control (C)-100% RDF applied through conventional method (1/2 N and full PK as basal and remaining 1/2 N in equal split at monthly intervals) with drip irrigation at 1.0 PE. Ten treatment combinations  $\{(3 \times 3 = 9) + 1\}$  were repeated, thrice in a completely randomized design.

The soil water content ( ) determined at regular interval throughout the growth period of strawberry indicated that ' ' values were higher in  $DI_{1.0}$  as compared to  $DI_{0.8}$  and  $DI_{0.6}$  at 65, 95, 125, 155 and 185 days after transplanting (DAT). The soil moisture content at 0-0.075 m and 0.075-0.15 m soil depths was higher in  $DI_{1.0}$  and  $DI_{0.8}$  respectively. The soil moisture content at 0.15-0.30 m soil depth was higher in  $DI_{0.8}$  and  $DI_{1.0}$ . Thus, it may be concluded from the present investigation that the soil moisture content increased from  $DI_{0.6}$  to  $DI_{1.0}$  by 13 % in 0-0.075, negligible in 0.075-0.15 and about 6% in 0.15-0.30 m soil depths.

**Keywords:** Drip irrigation, soil water content, protected conditions.

### In vitro cytotoxicity evaluation of saponins from North-western Himalayan region

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The present study aimed to evaluate the *in vitro* cytotoxicity of saponins isolated from different parts of the plants [*Asparagus adscendens* Roxb. (AA) (fruits), *Silene inflata* Sm. (SI) (whole plant), *Sapindus mukorossi* Gaertn. (SM) (pericarp of fruit) and *Chlorophytum borivillianum* (CB) (leaves)] collected from Northern-western Himalayan region. The total crude saponin-rich fraction yields were  $20.0 \pm 2.845\%$  (SM),  $9.8 \pm 1.439\%$  (CB),  $8.0 \pm 2.564\%$  (AA) and  $4.0 \pm 1.486\%$  (SI) by methanolic extraction protocol. The qualitative saponin estimation was done using foam test and thin-layer chromatography (TLC). The TLC chromatograms of the saponin-enriched fractions of AA, SI, SM and CB revealed clear white spots against a pink to red background and greenish-black spots on aluminium plates coated with silica gel 60. The spectrophotometry analysis of the



fractions confirmed presence of saponins at the concentration of  $820 \pm 1.846 \mu\text{g/ml}$  (SM),  $560 \pm 2.426 \mu\text{g/ml}$  (AA),  $240 \pm 0.536 \mu\text{g/ml}$  (SI), and  $110 \pm 1.664 \mu\text{g/ml}$  (CB). The  $HD_{50}$  values for AA, SI, SM and CB were  $301.01 \pm 1.634$ ,  $736.7 \pm 2.824$ ,  $18.0 \pm 1.894$  and  $170.70 \pm 2.783 \mu\text{g/ml}$  using 0.5% sheep red blood cell suspensions, respectively. However, the  $HD_{50}$  value of QuilA (QA, commercial, standard plant saponin) was  $17.15 \pm 2.127 \mu\text{g/ml}$ . The sulforhodamine B cell cytotoxicity assay revealed that QA was more toxic to Vero cells (IC<sub>50</sub> value was  $60 \mu\text{g/ml}$ ) than AA, SI, SM and CB (IC<sub>50</sub> value was  $>200$ ,  $>200$ ,  $150.8$  and  $137.1 \mu\text{g/ml}$ , respectively). On the basis of the results of all the assays, the saponin-enriched fractions from the fruits of *A. adscendens* were found to be the least cytotoxic compared to the saponins from the other three plants. Thus, the saponins-enriched fraction from fruits of *A. adscendens* Roxb. could be further explored for establishing their safety *in vivo* models before usage in different formulation of drugs.

**Key words:** *In vitro*, cytotoxicity, saponins, North-western Himalayan region

### **Doubling Farmers Income By Modern Apiculture Practices**

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In India, adoption of modern apiculture as allied agricultural practice especially by the small and marginal farmers can play important role to double their income. At present, it is estimated that India has about ten lakhs indigenous bee (*Apis cerana*) colonies and two lakhs imported European bee (*Apis mellifera*) colonies. Besides decreasing the risk of crop failure by proper pollination apiculture have potential to generate valuable secondary products and hence directly increase farmer's income. Horticulturally important crops such as apple, strawberry, several medicinal plants, floriculture crops and vegetable crops are mainly cross pollinated and highly dependent upon pollinators for good fruit set, fruit quality and yield. The hive products also have industrial importance which can create livelihoods for several sectors within a society. Honeybee products like honey, beeswax, propolis, pollen, royal jelly and bee venom are highly valued for their rich medicinal, aromatic and cosmetic properties and thus they are used since ancient times mostly in their pure form. In order to increase their market value, bee products can be easily mixed with other ingredients, so that one can get maximum profit by adding minimum resources. This also raise the scope of apiculture as an entrepreneurial activity for honey based ready to serve drinks, natural wax candles, honeybee pollen capsules, etc. Besides all these practices, commercial queen rearing and migrational bee keeping is also a beneficial ventures to enhance the income of farmers. For the commercialization of apiculture at farmer level we need proper farmer trainings and proper marketing channels for beehive products. Backyard apiaries at home and village level will be the most vital part of the modern practice to enhance the apiculture and also to save the endangered bee species.

**Keywords:** Apiculture, Hive products, Farmers income, Migrational beekeeping, Pollination.

### **Emerging Crop Cultivation Technologies for Doubling Farmers' Income**

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In India, the focus in agriculture till recent past was on achieving food security through expansion of area under irrigation and increased use of external inputs like chemical fertilisers and pesticides along with increased area under high yielding varieties. The indiscriminate use, or rather misuse, of water for irrigation and nitrogen especially under rice-wheat cropping system, has led to the groundwater pollution as well as depletion of ground water resources. The other major issue of concern was the intensive tillage which involved substantial costs and energy. The intensive tillage depleted the soil organic carbon status which adversely affected the soil health and reduced the factor productivity. If we continue to misuse inputs especially nitrogen and exploit the natural soil and water resources at the current level, productivity and sustainability are bound to suffer. Therefore, to achieve sustainable higher productivity as well as profitability, efforts must be focused on reversing the trend in natural resource degradation by adopting efficient resource conservation and input management technologies.





Under the conventional practices being followed by the farmers, the fields are generally not properly leveled leading to poor performance of the crops. It is due to the fact that part of area suffers due to water stress and part due to excess of water leading to reduced productivity. Precision land leveling is a precursor technology for resource optimization. It increased inputs use efficiencies coupled with more area under the crop due to reduced area under bunds and channels leading to higher productivity. Hence, adoption of laser land leveling will help produce more crop per drop. Conservation Agriculture is much more than just reducing the mechanical tillage. In addition to saving on cost involved in intensive tillage, the surface residue retention has multifarious benefits. It protects the soil from the physical impact of rain and wind, stabilizes soil moisture and temperature in the surface layers, provides favourable habitat for a number of organisms, from larger insects down to soil borne fungi and bacteria and helps improve the organic carbon status of soil. Moreover, proper fertiliser application, especially top dressing urea just before irrigation helps improve the yield by 4-6% over the conventional top dressing of urea 2-5 days after irrigation. Use of NDVI sensor for need based nitrogen application saves 15-20% nitrogen without any reduction in productivity of wheat as well as rice crops. The water applied at each irrigation was marginally lower in zero tillage whereas water saving was substantial in furrow irrigated bed planting system (FIRBS). The total water saving compared to conventional was about 2.5 per cent in zero tillage and about 20 per cent in FIRB system. Leaving crop residues at soil surface *i.e.* conservation agriculture can help save one irrigation which would be more than 15% water saving. The micro-irrigation practices (sprinkler and drip) can save more than 25-30% water compared to conventional flood irrigation practice. The evolution of multiple herbicide resistance in *Phalaris minor* and development of herbicide resistance in other weeds like *Rumex dentatus*, *Polypogon* and *Avenaludoviciana* is another serious threat to wheat production and to tackle these issues effective weed management practices is a must. All these practices adopted systematically can significantly increase the farm productivity and profitability which can contribute substantially in doubling the farmers' income.

### Study One effects of Fire-Retardant Treatments on Plywood Performance

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The present investigation was carried out to study the effects of different fire-retardant treatments on plywood performance. Plywood samples were treated with different fire-retardant composition which was a mixture of borax, boric acid, ammonium sulphate and phosphoric acid. Different preservative treatment methods such as normal dipping, pressure treatment and microwave treatment followed by dipping were used. The treated plywood samples were also tested against different fire tests such as flame penetration test and flammability test. The average retention of preservative & time taken for burning of sample in flame penetration test was recorded highest under microwave+dipping method *i.e.* **29.54kg/m<sup>3</sup>** and **34.30 min** respectively. In flammability test average retention and time taken were again highest under microwave+dipping method *i.e.* **28.75kg/m<sup>3</sup>** and **43.32min** respectively. Study suggests that formulations viz: borax, boric acid, ammonium sulphate and phosphoric acid imparted resistance against fire. It was found that out of three treatments more retention and time taken for burning of plywood sample was obtained highest in microwave treatment followed by dipping which gives more resistance to plywood against fire as compared to other preservative treatments.

**Keyword:** Fire-retardant, Pyrolysis, Flammability, Borax, Boric-acid, Plywood.

### Organic nutrient management on productivity of rajmash (*Phaseolus vulgaris* L) in high hills of Jammu.

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Bhaderwah Rajmash is famous for its unique taste and flavour. It is known for its good cooking qualities, sweetness, easy



digestibility and colour, and is in high demand in market. *Rajmash* of other regions are sold in the market on the tag name of Bhabarwah *Rajmash*. Bhabarwah *Rajmash* is a local pole type trailing variety of the *Phaseolus vulgaris* L. Bhabarwah *Rajmash* is an herbaceous annual plant grown for its edible dry bean. Keeping in view these points a field experiment was conducted for three years at research farm of Regional Horticultural Research Sub-station Bhabarwah, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu during *Kharif*, 2014, 2015 and 2016 on *rajmash* to evaluate different organic sources of nutrients in term of yield under sub alpine conditions of Bhabarwah". The experiment was laid out in Randomized Block Design consists of nine different combinations of organic sources of nutrients including FYM, vermicompost, neem cake, rice straw and pine needles and three replications. After 3<sup>rd</sup> year study it has been observed maximum yield attributes w.r.t **Pod Length (cm), No. of pods/plant, Number of grains/pod, Test weight(g)** and grain yield of *rajmash* were realized with the application of organic sources like 1.25 t/ha FYM + 1.25 t/ha Vermicompost + 1.25 t/ha Neem Cake + 1.25 t/ha pine needles to maize crop then followed by the application of 1.25 t/ha FYM + 1.25 t/ha Vermicompost + 1.25 t/ha Neem Cake + 1.25 t/ha pine needles with seed treatment through trichoderma (4 g/kg of seed) with foliar spray of neem oil (3%) after one month and repeated at 15 days interval and organics applied with trichoderma and foliar spray cow urine (5%) after one month repeated at 15 days interval.

**Keywords:** *Rajmash*, FYM, Vermicompost, Pine Needles, Neem Cake and Trichoderma

### Optimization of the recipe for ready to serve drink and squash from carrot

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Carrot (*Daucus carota* L.) is one of the most important root vegetable of winter season. It belongs to the family Apiaceae and is well known for its remarkable nutritional and health benefits. It is rich in vitamin A, B, C and E and is also a good source of potassium, folate, manganese, phosphorous, magnesium, copper, folic acid, thiamine, magnesium, iron and zinc. Since it is a seasonal vegetable, available in bulk during its harvest season and suffer huge post-harvest losses without the adequate cold storage facilities especially in the developing countries; the preparation of value added products could be beneficial not only in reducing its post-harvest losses but will also ensure year around availability of its products. Therefore, during the present study, the four different recipes of ready to serve (RTS) drink and squash were prepared with variation in pulp concentration (%) and total soluble solids (°B) and further evaluated for chemical analysis to estimate total soluble solids (TSS), acidity, pH, total sugars, reducing and non-reducing and sensory evaluation at fresh and at 30 days interval during the storage period of 90 days. There was a slight increase in pH, total soluble solids and total sugars a considerable rise in reducing sugars, whereas there was a slight decrease in acidity and also a considerable decrease in non-reducing sugars was noticed in both the products during storage. The product prepared with was subjected to organoleptic evaluation during storage period to assess the quality attributes viz. appearance, aroma and flavour, taste and overall acceptability according to 5- point hedonic. According to organoleptic evaluation the best recipe of RTS drink was found to be the one containing 15% pulp with 15°Brix (TSS) whereas the best recipe for squash was found to be the one containing 30% pulp and 45°Brix (TSS).

### Detection of pesticide residues from vegetable market samples by using RP-HPLC

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Cabbage, cauliflower and tomato are the most widely grown vegetables grown under Indian conditions. Off-season production of cole crops and tomato is widely accepted by the farmers in Manipur for higher returns because of the ideal soil and climatic conditions for cultivation of vegetable. Being succulent in nature, the crops are seriously affected by various insect pests (Sarwar, 2014). Among the insect pests, cabbage butterflies, diamond back moth, Spodoptera, cabbage aphid, tomato fruit borer, etc. are the most prominent pests in Meghalaya, Manipur, Mizoram and Sikkim. Different types of pesticides are using for increasing the crop production in north eastern states. A market survey for vegetable samples was conducted during 2018-2019



from major markets of Manipur. The vegetables like cabbage, cauliflower and tomato samples which were grown by the farmers of Manipur were sampled on a monthly basis. The samples were extracted and clean-up by using modified Quechers methodology and analyzed in RP-HPLC equipped with UV-VIS detector. Out of forty cabbage market samples, twentyseven samples were detected the residues of chlorantraniliprole, malathion, dichlorvos and chloropyrifos insecticides above MRL (FSSAI). Similarly, the cauliflower samples (40 nos.) collected from market, the insecticides like chlorantraniliprole, malathion, fipronil, chloropyrifos, deltamethrin and dichlorvos residues were found above MRL from 29 samples. Out of forty tomato market samples, thirtyone samples were found to be detected the residues of thiamethoxam, flubendiamide, chloropyrifos, fipronil, carbofuran, monocrotophos and dichlorvos above MRL (FSSAI).

**Key words:** cabbage, cauliflower, tomato, pesticide, residues, MRL

### **Effect of Biostimulants and Micronutrients Grade on Yield and Quality of Rose Cv. Top Secret under Protected condition**

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The present investigation was carried out at Hi-tech Horticulture Park, JAU, Junagadh during 2018-19. The experiment laid out in Factorial Completely Randomized Design (FCRD), consisting two factors with three replication and nine treatment combinations. The treatment comprised of three different levels of Biostimulants (B) viz., B<sub>1</sub>: Banana enrich sap 1%, B<sub>2</sub>: Panchgavya 3%, B<sub>3</sub>: Humic acid 0.2% and three different levels of Grade of Micronutrient IV (M) viz., M<sub>1</sub>: 0.5%, M<sub>2</sub>: 1% and M<sub>3</sub>: 1.5%. The treatments Biostimulants and Micronutrients grade IV formulation applied twice (first spray at 15 days after pruning and second spray at 30 days after first spray). The result indicated that the treatment B<sub>2</sub> comprised of Panchgavya 3% recorded significantly maximum number of cut flowers per plant (14.83), number of cut flowers per m<sup>2</sup> (58.83) and yield of flowers per ha (5.83 Lakh/ha). The treatment M<sub>3</sub> (1.5% grade-IV micronutrient formulation) was recorded significantly maximum number of cut flowers per plant (15.03), number of cut flowers per m<sup>2</sup> (59.93) and yield of flowers per ha (5.93 Lakh/ha). The treatment B<sub>2</sub> (Panchgavya 3%) recorded significantly maximum length of bud (2.22cm), diameter of bud (1.63cm), diameter of flower (6.27 cm), vase life of cut flower (8.52 days), *in situ* longevity of flower (8.73 days), fresh weight of flower (11.08g), dry weight of flower (3.57 g) and pedicle length of flower (24.77cm). The treatment M<sub>3</sub> (1.5% grade-IV micronutrient formulation) was also recorded significantly maximum length of bud (2.25cm), diameter of bud (1.61 cm), diameter of flower (6.53 cm), vase life of cut flower (8.59 days), *in situ* longevity of flower (8.86 days), fresh weight of flower (11.06 g), dry weight of flower (3.53 g) and pedicle length of flower (25.13cm). Interaction effect of biostimulants and micronutrient grade on yield parameters was observed significant. While the interaction effect of biostimulants and micronutrient grade on quality parameters was observed non significant in rose Cv. Top Secret under protected condition.

**Key words:** Rose, Top Secret, Biostimulants, Micronutrient grade IV, Yield, Quality, Panchgavya.

### **Effect of Biostimulants and Micronutrients Grade on Growth and Flowering of Rose cv. Top Secret under Protected Condition**

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The present investigation was carried out at Hi-tech Horticulture Park, JAU, Junagadh during 2018-19. The experiment laid out in Factorial Completely Randomized Design (FCRD), consisting two factors with three replication and nine treatment combinations. The treatment comprised of three different levels of Biostimulants (B) viz., B<sub>1</sub>: Banana enrich sap 1%, B<sub>2</sub>: Panchgavya 3%, B<sub>3</sub>: Humic acid 0.2% and three different levels of Grade of Micronutrient IV (M) viz., M<sub>1</sub>: 0.5%, M<sub>2</sub>: 1% and M<sub>3</sub>: 1.5%. The treatments Biostimulants and Micronutrients grade IV formulation applied twice (first spray at 15 days after pruning and second spray at 30 days after first spray). The application of Panchgavya 3% recorded higher vegetative growth viz., plant



height(61.12 cm), plant spread (22.71 cm) in N-S and E-W (38.00 cm) direction, number of branches per plant (5.29) and stem diameter(1.02 cm). The treatment B<sub>2</sub> (Panchgavya 3%) also recorded significantly the minimum days required to first flower bud emergence (17.61 days) and days to first flower opening (25.83 days), maximum number of petals per flower (52.62) in rose cv. Top Secret. The treatment M<sub>3</sub> (1.5% grade-IV micronutrient formulation) recorded significantly maximum plant height (62.27 cm), plant spread in N-S (22.89 cm) and E-W (38.50 cm), number of branches per plant (5.28) and stem diameter (1.02 cm). The treatment M<sub>3</sub> (1.5% grade-IV micronutrient formulation) was also recorded significantly the minimum days required to first flower bud emergence (17.94 days), days to first flower opening (26.14 days), maximum number of petals per flower (52.63). Interaction effect was observed non significant. Hence in protected condition the plant growth and flowering parameters can be enhanced by the application of Panchgavya 3% with 1.5% grade IV micronutrient.

**Key words:** Rose, Top Secret, Biostimulants, Micronutrient grade IV, Growth, Flowering.

### **Callus mediated organogenesis in *Lilium polyphyllum* D. Don a critically endangered Astavarga plant in North Western, Indian Himalaya**

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*Lilium polyphyllum* D. Don (Liliaceae) is a critically endangered herbaceous perennial, commonly known as snow lily or Ksheerkakoli. Bulbs of the plant are of immense medicinal use and have astringent and anti-inflammatory properties. Due to the overexploitation of the species from the wild and degradation of habitats are posing threats to its existence. The present study aims to develop a propagation protocol and mass multiplication of the species from bulb scales of *L. polyphyllum*. From the bulb scales callus was induced in basal MS medium containing 2, 4-D (0.5, 1, 1.5, 2 and 3mg/l) and BAP (0.5, 1, 1.5 and 2mg/l), NAA + BAP (0.5+2mg/l), where maximum effect (97.25%) was recorded. Maximum shooting (98.75%) was observed in the calluses when they shifted to MS medium supplemented with BAP (1 and 2mg/l), NAA (0.5mg/l), with an average of 1-2cm shoot length per culture. The well developed *in-vitro* regenerated shoots were transferred to the rooting medium and 100% rooting was achieved in half-strength MS basal medium supplemented with IBA and IAA (1 and 2mg/l). The *in-vitro* regenerated plantlets were shifted to a glasshouse in the sterilized soil and vermiculite mixture for acclimatization. After survival of the plantlets were finally transferred to the open environment with 90% success.

**Keywords:** Callus, *Lilium polyphyllum*, propagation, *in-vitro*.

### **Potassium solubilizing microbes from cereal crop growing in Divine Valley of Baru Sahib and agricultural applications for crop improvement**

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Potassium is one of the most important essential nutrients and required in large quantity for the proper functioning and growth of all plants, animal, and humans. It is 7<sup>th</sup> most abundant elements in Earth's crust. Potassium is available in the form of insoluble form of potassium which is not easily utilized by the plants. As potassium is not available for plant use so it may cause plant's growth retardation. Plant growth promoting microorganisms are helpful in increasing yield in addition to convention plant protection. The efficient potassium solubilizing microbes (KSM) could be applied for the solubilization potassium available in the soil. The soluble form of K are easily available and taken up by the plants for plants growth and developments. In the present study, rhizospheric soil sample were collected from different cereals growing in Baru sahib region, Himachal Pradesh, India and total isolates were obtained 425 on used of Aleksandrovar medium. All the isolates were screened for potassium



solubilization on Aleksandrov agar plates. Among all the bacterial isolates are 102 produced potassium solubilizing activities. Selected KSB isolates were characterized for other plant growth promoting (PGP) attributes such as solubilization of phosphorus and zinc, production of siderophores and IAA, ACC deaminase activity. On the bases of biochemical and molecular technique the selected seven K solubilizing bacterial strains were identified as *Pantoea agglomerans*, *Pseudomonas*, *Proteus* sp., *Acinetobacter* sp., *Klebsiella* sp., *Klebsiella* sp., and *Bacillus* sp. The potassium solubilizing microbes were evaluated on barley in natural conditions and were found to increase root length, shoot length, biomass of the plants when compared to control. K-solubilizing PGP bacteria may have exploited as agricultural agent for wheat crop under different stresses condition, critical diseases and may have also used in the amelioration of K-deficient soils.

**Keywords:** Crop improvement, Diversity, PGP traits, Plant growth, Potassium

### Sustainable Tourism

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Sustainable Tourism is defined as tourism that respects both local people and traveller, cultural heritage and the environment. It seeks to provide people with an exciting and educational holiday that is also of benefit to the people of the host country. It is that tourism that full account of its current and future economic, social and environmental impacts, addressing the needs of visitors, the industry, the environment and host communities. Sustainable tourism development destinations, including mass tourism and the various niche tourism segments. Sustainable tourism was the theme of World Biodiversity Day 2017. India and Sustainable Tourism; 1) Ministry of Tourism has launched the implementations of the Sustainable Tourism Criteria for India (STCI) in association with Ecotourism Society of India (ESOI). 2) STCI had been developed for the accommodation, tour operators and beaches, back waters and lakes sector of the tourism industry. 3) STCI follow the guidelines set by the Global Sustainable Tourism Criteria (GSTC) that has been evolved under the guidance of United Nations agencies like UNEP and UNWTO. Ecotourism can be defined as, responsible travel to natural areas that conserve the environment, sustains the well-being of the local people and involves interpretation and education. There is an immediate need of Ecotourism Trusts in order to make the environment more and more eco-friendly like Mangalajodi Ecotourism Trust in India which has recently won the United Nations World Tourism Organisation (UNWTO) Awards for Innovation in Tourism Enterprise. Mangalajodi is a village located on the northern banks of Chika Lake in Odisha (Vision IAS 2018). Due to coordinated efforts by the community, the number of migratory birds in the region has been restored since 2000 Ministry of Environment, Forest Conservation and Climate Change (MoEFCCC). It provides livelihood opportunities for the local communities, educate visitors and enhances their understandings of nature. The Government of India is strongly committed to the 2030 Agenda for Sustainable Development. So if we want to check the environmental crisis, we will have to transform our thinking and attitude, that in turn would lead to a better environment and better future.

**Key Words:-** Sustainable tourism, Ecotourism, Local communities, Environmental Crisis.

### Microbial Contamination of Fast Foods and its Impact on Mice (*Mus musculus*)

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Fast food refers to food that can be prepared and served quickly. The fast foods enriched with highly proteinaceous oil and cereals considered as high risk substrates for fungi and bacteria and thus, for mycotoxin contamination. There may be adverse effects on human health when mycotoxin in contaminated fast foods are consumed. In the present investigation five finished fast foods viz., Vegetable Chowmin, Vegetable Pizza, Vegetable Burger, Bread Vegetable Roll and Egg Roll and its ingredients are routinely tested three times in a year (summer, rainy and winter) for the incidence of fungi and bacteria, mycotoxicological abilities of these fungi, and pathological test of mycotoxin contaminated fast foods on mice. The most frequently isolated fungi were species of *Aspergillus*, *Mucor* and *Rhizopus*. *Aspergillus* spp., were isolated from almost all raw materials tested with the



highest incidence (55%) on noodles. On synthetic media, 105 strains of *A. flavus*, 11 of *A. parasiticus*, 22 of *A. ochraceus* and 19 of *Fusarium oxysporum* were screened for the production of mycotoxins. In these tests, 56% of *A. flavus*, 11% of *A. parasiticus*, 36% of *A. parasiticus* and 47% of *F. oxysporum* isolates produced aflatoxins, citrinin, ochratoxin A and zearalenone, respectively. Natural mycotoxin contamination was detected in 99% of fast foods and 43% of the ingredients used in the preparation of these fast foods. Aflatoxin<sub>B</sub><sub>1</sub> was the most frequent mycotoxin recorded in almost all the samples well beyond the tolerance level (20µg/g) fixed by the World Health Organization. Consumption of mycotoxin contaminated fast foods by human or animal results in its accumulation and exerts a wide range of adverse effects on different vital organs like liver, kidney, lungs, heart, reproductive organs, blood composition, etc. Therefore, there is an urgent need to prevent the entrance of such contaminated raw samples into commercial fast foods; for this there is need for the relevant local authorities to ensure that the food sold to consumers in fast foods restaurants is safe, wholesome and fit for human consumption in order to prevent outbreaks of food-borne illnesses. We should be able to define and take advantage of modern storage practices that improve quality and decrease the probability of mycotoxin contamination.

**Key words:** Microbial contamination, mycotoxins, fast foods

### **Synthesis and characterization of thiamine loaded chitosan Nanoparticles and their growth promoting effect on *Cicer arietinum***

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Nanotechnology is emerging as a rapidly growing field with application in science and technology for the purpose of manufacturing new materials at the nanoscale level. In recent years, chitosan nanoparticles have gained in popularity due to their potential use in organic and sustainable agriculture. In the present work, for the first time, we are synthesizing thiamine loaded chitosan nanoparticles (TCNPs) and it was characterized by using UV-Vis spectroscopy, FTIR, DLS, XRD, TEM and SEM. The formation of nanoparticles showed an absorbance at 267 nm on UV-visible spectroscopy. TEM images showed well dispersed spherical shape nanoparticles and size in 10-60nm. The X-Ray diffraction showed no peak it indicates amorphous structure. We assessed that seed treatment with TCNPs at (0.1%, w/v) concentration shows enhanced growth promotory effect on chickpea seed germination, seed vigour index and growth parameters on (root length, shoot length, No of secondary roots, fresh weight and dry weight) compare to control plants.

**Key words:** Synthesis, characterization, chitosan, Nanoparticles, growth promoting effect

### **Increasing of pigeonpea farmer's income by soybean and greengram intercropping**

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India has the largest population of small and marginal farmers prevailing under *rainfed* condition. Doubling or increasing of income of this population is of prime concern with limited resources. Additive series of intercropping seems appropriate since it reflects the actual cropping system; a fixed density of main crop grown with various densities of intercrop. A field experiment was conducted at NARP farm, Bharuch with two densities of greengram and soybean in two different row spacing of pigeonpea with the view of testing both increasing pulse production and increasing farmer's income. The data revealed that in all the three years of experimentation and pooled results, significantly higher pigeonpea equivalent yield (PEY) was obtained in pigeonpea (120 cm) intercropped with soybean in the ratio of 1:2. However, the data pertaining to monetary returns revealed that maximum net returns and B:C ratio were obtained in pigeonpea (120 cm) intercropped with soybean in the ratio of 1:2 followed by pigeonpea (120 cm) + greengram (1:2) and sole pigeon pea sole 120 cm.



**Keywords:** Intercropping, Pigeonpea, Soybean, Greengram, Additive Series.

### **Effect of mineral supplementation on serum and phosphorous level in marathawadi buffaloes**

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The present investigation was carried out to study the effect of mineral supplementation on serum calcium and phosphorus, 7 days before and after parturition in 14 Marathwadi advance pregnant (10 m) buffaloes maintained by farmers in the rural area around Parbhani. Group-I (n=7, treatment group) those animal shown Ca and P level below normal range and Group-II (n=7, control group) include those animals shown serum Ca and P level within normal range. Group-I were given orally mineral supplement (Avion powder) 250 gms before and after 7 day of parturition.

The average blood serum calcium levels before seven days of parturition, at the time of parturition and after seven days of parturition was (8.86±0.27, 10.15± 0.64), (10.92±0.38, 8.06±0.60) and (11.40±1.85, 9.59±0.51)mg/dl in group I and II respectively. This result was statistically highly significant. However, similar average blood serum phosphorus was (4.60±0.27, 5.80±0.80) (5.50±0.17, 7.90±0.27) and (5.90±0.14, 5.70±0.23) mg/dl in group I and II respectively. So it can be concluded that there was significantly increased in the serum calcium and phosphorus level after parturition in the treatment Group observed due to pre-partum mineral supplementation.

**Key words:** Effect, mineral supplementation, serum, phosphorous level, marathawadi buffaloes

### **Influence of various date of sowing with varieties on garden pea (*Pisum sativum* L.)**

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A field experiment was conducted during the winter season of 2016, 2017 and 2018 at the experimental farm of College of Horticulture, SDAU, Jagudan Distt. Mehsana (Gujarat) 384 460. The experiment was laid out in split plot design with treatment comprising three dates of sowing, viz. 3<sup>rd</sup> week of October, 4<sup>th</sup> week of October and 2<sup>nd</sup> week of November in main plots and 14 different pea cultivar, viz. Bonnevillie, Arkel, Pusa Pragati, Azad P 1, Kashi Nandini, Kashi Udai, Kashi Shakti, Arka Karthik, Lincoln, Early Giant, Azad P 3, Kashi Mukti, VRPMR 9 and GDFP 1. Significant results were observed for minimum days (76.75) taken to first picking which showed earliness in treatment D<sub>3</sub> (2<sup>nd</sup> week of November) whereas, in second and third year non significant results were observed. In pooled analysis significantly minimum days (73.48) was noticed in treatment D<sub>3</sub> (2<sup>nd</sup> week of November). However, in pooled data minimum days (91.49) was recorded in D<sub>3</sub> (2<sup>nd</sup> week of November) and was at par with treatment D<sub>2</sub> (4<sup>th</sup> week of October) but both were superior to early sown D<sub>1</sub> (3<sup>rd</sup> week of October). As far as variety is concern minimum days (67.89) taken for first picking was recorded in variety Kashi Nandini (VRP-5). Minimum days taken for last picking (79.44) were recorded with variety Kashi Nandini (VRP-5). Maximum number of picking (3.44) with variety VRPMR 9, maximum length of pod (9.44 cm) with variety Arka Karthik, number (33.75) of pods/ plant in variety GDFP 1 (V14), number of seeds per pod (7.56) were recorded with variety Kashi Shakti (VRP -7) and Arka Karthik. Though the maximum weight of pods/plant (58.46 g), yield of green pod/ha (135.54 q) and shelling percentage (60.40%) were observed in Bonnevillie. However, maximum protein content was reported in Pusa Pragati.

**Key words:** Growth, garden pea, sowing time, pod, yield, *Pisum sativum* etc.



## Estimation of biochemical characteristics of maize genotypes against maydis leaf blight (*Bipolaris maydis*) as source of resistance

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Maydis leaf blight disease has been reported from all the continents of the world, affects most of the cereal crops. Maydis leafblight of maize incited by foliar pathogen, *Bipolaris maydis* has become a major constraint in the successful cultivation of this crop. Development of resistant varieties is the most appropriate approach to control the disease and the concept is now developing to explore the built-in plant defense mechanism in relation to pathogen attack. In the present study, an attempt was made to identify biochemical characteristics imparting resistance against maydis leafblight in maize genotypes. The resistant genotypes had higher total chlorophyll, total phenols, total soluble sugars, total proteins, flavonoids and ascorbic acid than the susceptible genotypes. The chlorophyll content was found to be lesser in the infected leaves than the healthy ones. The reduction in total phenols, total soluble sugars, total proteins, flavonoids and ascorbic acid was at a higher rate in susceptible ones than the resistant genotypes. These biochemical characteristics might be responsible for imparting resistance against maydis leaf blight in maize genotypes.

**Key words:** Maydis leaf blight, Biochemical, Maize, Resistance

## Inter species relation of nesting in Black Kite and House Crow

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Birds adopt a range of strategies for maximum breeding success. Ideal nesting site play a very crucial role in breeding success but low tree density in an area could be a major reason for low breeding success. Using the abandoned nesting platform of other bird species is an adaptation acquired by some birds to adapt in urban areas having low tree density. Black Kite and House Crow have adapted themselves according to urban landscape. Breeding biology of Black Kite (*Milvus migrans*) and House Crow (*Corvus splendens*) was studied for four breeding seasons in last nine years i.e. 2010-11, 2013-14, 2016-17 and 2018-19 in Punjab Agricultural University, Ludhiana. The interspecies relation between Black Kite and House Crow was studied for their nesting and breeding. It was recorded that the breeding season of Black Kite starts in December-January and the egg laying occurs by January end. The eggs hatch in 28-32 days and juveniles leave the nest by May end to mid June. The nesting of House Crow starts in May-June. It was observed that House Crow occupied the abandoned nesting platform of Black Kite. In the four breeding seasons 15.36% nests of Black Kite were occupied by House Crow. The secondary nesting tendency of House Crow increases with decrease in tree density in the area. It was observed that the tree density decreases after 2013-14 in the study area and the secondary nesting tendency of House crow increase upto 23.81% but when tree density again increased in 2018-19 the secondary nesting tendency decreases to 13.04%. It can be concluded that if the tree density of the area is inversely linked with the tendency of House Crow to use the abandoned nesting platforms of Black Kite.

**Key words:** Abandon Nesting Platform, Black Kite, House Crow, Secondary nesting, Tree density

## Vegetative Propagation of *Berberis Lycium* Royle: An Important Shrub Species of Himachal Pradesh

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The experiment entitled “Vegetative propagation of *Berberis lycium* Royle: an important species of Himachal Pradesh” was conducted in nursery of the Department of Silviculture and Agroforestry, Dr Y S Parmar University of Horticulture and Forestry, Nauni, Solan-173230 (HP) during 2017-2018. The cuttings were treated with seven different concentration of auxins viz., control (T<sub>1</sub>), 1.00% captan + 1.00% sucrose-talc (T<sub>2</sub>), 0.20% IBA + 1.00% captan + 1.00% sucrose-talc (T<sub>3</sub>), 0.40% IBA +





1.00% captan + 1.00% sucrose-talc ( $T_4$ ), 0.60% IBA + 1.00% captan + 1.00% sucrose-talc ( $T_5$ ), 0.80% IBA + 1.00% captan + 1.00% sucrose-talc ( $T_6$ ), 1.00% IBA + 1.00% captan + 1.00% sucrose-talc ( $T_7$ ). The experiment was conducted in randomized block design with three replications. Growth parameters viz. sprouting percent, rooting percent, shoot length, root length and main shoot diameter in *Berberis lycium* were significantly influenced by different concentration of auxins. The maximum sprouting percent (36.66%) and rooting percent (30.33%) were recorded in  $T_5$  (0.6% IBA+1% captan+2% sucrose-talc) and minimum sprouting percent (10.00%) and rooting percent (3.33%) was recorded in  $T_1$  (control).

**Key words:** auxins, IBA, sucrose, captan, *Berberis lycium*

### **Participatory action research for doubling the income of tribal farm women of Odisha through small mango orchards**

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Mango is emerging as a profitable fruit crop on account of huge consumer demand. Its cultivation is increasing in recent past, however, on account of its long juvenile period, the growers do not get any profit during initial years of orchard establishment. With the objective to double the income from small mango orchards with active participation of farm women, participatory action research was conducted in Baskitala village of Mayurbhanj district of Odisha by ICAR-Central Institute for Women in Agriculture, in which various intercrops were grown in interspaces of widely spaced juvenile mango orchards involving 50 farm families. With the intervention of intercropping, the income from small orchards were enhanced by ? 0.35 lakh to ? 2.8 lakh/acre. Among the various intercrops, the highest gross return of ? 2.8 lakh and ? 1.68 lakh per acre of orchard was obtained from pineapple (cv. Queen) and tomato (cv. Arka Rakshak) respectively, while lowest return (? 0.35 lakh/ acre) was obtained from chilli and leafy vegetables inter cropping. Inter cropping with pineapple and cucurbitaceous vegetables was highly preferred by the women farmers of the region (92.7 % and 83.0 % respectively) on account of limited management and short duration nature of the crops. The vegetable crops viz. tomato, chilli, okra, dolichos bean, garden pea, radish, amaranthus, spinach were moderately preferred. Crops like brinjal (41.2 %), onion (46.1 %) and yam (37.6) were least preferred on account of huge pest infestation, poor crop performance and difficulty in harvesting respectively. Intercropping was preferred as a viable option to double the income from mango orchards by the farm women.

**Key words:** mango, orchard, intercrops, farm women

### **Formulation of Guava-Jamun based low-calorie health drink**

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The study was conducted to evaluate the suitability of utilizing guava and *jamun* fruits for preparing reduced calorie health beverages by blending guava pulp with *jamun* pulp in different proportions and replacing sugar sweetness with the sweetness of non-nutritive sweetener viz. stevioside. Out of various combinations tried, the blended drink prepared by using 60 per cent guava pulp + 40 per cent *jamun* pulp with 15 per cent fruit part and 15°B TSS was found the best on the basis of physico-chemical, nutritional and sensory characteristics. Among non-nutritive sweetener, use of stevioside at 75 per cent level of sucrose substitution was optimized to prepare guava-*jamun* based low-calorie health drink. The optimized beverages were analyzed for various physico-chemical, nutritional and sensory attributes. Though, the beverages experienced marginal changes in various physico-chemical and sensory attributes, yet remained shelf stable during storage period for six months at ambient temperature. The *Aloe vera* for fortified low-calorie guava-*jamun* blended health drink having 75 per cent stevioside contained 15.90 Kcal/100g energy value and as such brought about 72.37 per cent reduction in calories over 100 per cent sucrose (sugar) sweetened drink, respectively. Overall, it was concluded that, guava and *jamun* can successfully be utilized for the development of low-calorie functional/health beverages with substantial reduction in calories by way of blending and/or fortification with *Aloe vera* and



replacing sucrose sweetness with stevio side (75%). Further, the developed products had better taste, palatability, medicinal and nutritive value beside reduced energy value; hence their availability in the market will definitely benefit the health conscious people.

**Keywords:** Guava, Jamun, low-calorie, stevio side, health drink

## Genetic Diversity Of Salix For Different Growth Parameters

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Crop diversification from rice-wheat rotation has attracted the attention of government and farmers of Punjab due to continuous decrease in ground water table and deterioration of soil and water quality due to high use of agro-chemicals. *Salix* is one such species, which can tolerate stagnating water, therefore a study has been proposed to identify suitable clones under stagnating water and saline soil conditions. The present investigations comprising different clones of *Salix* was conducted at two different sites with the objectives to diversify the tree base in agroforestry system, which otherwise is dominated by poplar and eucalyptus. Twenty-two willow clones were planted in randomized block design with three replications at two sites (University Seed Farm, Ladhawal, Ludhiana and Alamwala forest, Range Malout, Division Muktsar) to study the genetic diversity among different clones for their growth parameters. The data for plant height, collar diameter, number of branches per plant, canopy spread and diameter at breast height were recorded. All the characters under study at both the locations exhibited significant differences among different clones. On the basis of plant height and collar diameter, clones UHFS-1, UHFS-3 and UHFS-13 were found best at Ludhiana with submerged condition and clones UHFS-1 and UHFS-19 were best at Alamwala. Clones UHFS-1 and UHFS-19 showed wider adaptability at both the sites.

**Keywords:** Willow, Genetic diversity, Growth characteristics, submerged conditions, clone

## Reduction of browning in aonla juice with anti-browning agents during storage at room temperature

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Though aonla (*Emblicaeofficinalis* Gaertn.) is a rich source of antioxidant phytochemicals like polyphenols and ascorbic acid, its juice suffers from browning during storage. The present study was undertaken to find out suitable anti-browning agent for reducing browning during storage of aonla juice (cv. Chakaiya) at room temperature (25–42 C) up to 8 months (February – September). The role of individual phenolic compounds and organic acids in browning was also studied. Ascorbic acid, citric acid, oxalic acid and L-cysteine were tried as anti-browning agents. Individual phenolic compounds and organic acids in juice samples were identified and quantified by high performance liquid chromatography (HPLC). Eight month storage study of juice at room temperature revealed the maximum retention of vitamin C (539 mg/100 ml) was achieved with L-cysteine and that of polyphenols (2.33%) with ascorbic acid, while the lowest NEB (0.153 OD) was recorded with oxalic acid. HPLC analysis of different phenolic compounds confirmed the role of gallic acid in browning of aonla juice as it increased significantly during storage period. Minimum increase of gallic acid was noticed in juice containing L-cysteine as anti-browning agent. Citric acid was the major organic acid detected in aonla juice, but organic acids did not play any role in browning of juice. Oxalic acid and L-cysteine could be used to check browning in aonla juice during storage.

**Keywords:** Aonla, juice, storage, browning, anti-browning agents



### **Diversity of aquatic insects in the selected ponds of Mansa district, Punjab (india).**

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Aquatic insects play major role in different aquatic ecosystem such as Ponds, Lakes, Streams, Rivers etc. and functions as ecosystem equilibrium, pond productivity, food for fishes and are also act as the water quality indicators. The study of aquatic insect has great importance as the ecological factors exert a profound impact on the aquatic organisms such as fishes, water birds and planktons. Present study was conducted on aquatic insect communities in six selected ponds of Mansa district, Punjab (north latitude 29°32' to 30°12' and east longitude 75°10' to 75°46'). The present study was carried out in different seasons are pre-monsoon (Mar-May), monsoon (June-Aug), post-monsoon (Sept-Nov) and winter (Dec-Feb) seasons during the period of June 2017 to May 2019 in two selected ponds. The fauna of aquatic insects was collected by enclosing one square meter of area with square-meshed cloth (Size). Aquatic insects were sorted, brush-picked and preserved in 70% alcohol. Morphological studies of aquatic insects was done under different magnifications of stereozoom microscope with the help of relevant literature. Abundance and diversity of aquatic insects inhabiting the ponds were studied. Four orders, Twenty five species belonging to fourteen families of aquatic insects have been recorded. The abundance or dominance of orders as follow:-Hemiptera>Coleoptera>Diptera>Odonata.

**Keywords:** Aquatic insects, ponds, diversity

### **Development of 'Ogura' CMS fertility-restored hybrids by introgressing fertility restorer gene (Rfo) into Brassica oleracea through inter-specific hybridization**

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In order to identify the source/donor lines of fertility restorer gene (*Rfo*), eight genotypes of *Brassica napus* L. and 16 genotypes of *Brassica carinata* L. were screened with the help of three *Rfo* gene specific markers using PCR thermal cycler machine during, 2017. Out of 24 genotypes screened, *Rfo* gene was confirmed in three genotypes viz. Teri Garima, Shyamali and Phaguni. During summer season of 2018, interspecific crosses between 12 (six inbred lines and six 'Ogura' based CMS lines) lines of cabbage and cauliflower with three source/donor lines of *Rfo* gene were attempted in Line × tester design. Out of 36 different cross combinations, only three interspecific crosses resulted in successful fertilization and ovule formation. The embryo rescue of ovules was done at different stages i.e., 15 DAP (days after pollination), 20 DAP, 25 DAP, 30 DAP and 35 DAP. Experimental results revealed that highest success rate of embryo rescue was obtained when ovules were cultured at 30 DAP in all three hybrids, but number of ovules/embryos rescued at this stage were found lower (4) than at 25 DAP (10). On the other hand, all the ovules failed to germinate when rescue was done either 15 DAP or 35 DAP. Hence, maximum efficiency of embryo rescue for interspecific crosses between CC (*Brassica oleracea*) and AACC (*Brassica napus*) genome can be obtained by ovule/embryo culture at 25 days after pollination. Further, 19 F<sub>1</sub> plants so obtained were screened with the help of three *Rfo* gene specific primers. Out of three primer pairs, only two primers amplified PCR product and confirmed the presence of *Rfo* gene in 15 F<sub>1</sub> plants under screening. The phenotype of these plants was intermediate to that of their respective parents and all of them were found to have very poor fertility due to their triploid nature.

**Keywords:** *Brassica oleracea*, fertility restorer gene, *Rfo* markers, embryo rescue, interspecific hybridization



## Evaluation of CMS based hybrids of cauliflower (*Brassica oleracea* var. *botrytis* L.) for yield and its contributing traits

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During summer season of 2018, 10 *Ogura* based cytoplasmic male sterile (CMS) lines were crossed with five testers in Line  $\times$  Tester design to develop 50 CMS based F<sub>1</sub> hybrids of cauliflower. The hybrids so developed were evaluated along with two standard check cultivars (*Pusa Snowball Hybrid-1* and *Casper Rz*) for yield and its contributing traits during winter season of 2018-19. Experimental results revealed wide variation among the hybrids for different horticultural traits under study. Among all the hybrids under study, maximum marketable curd weight and marketable yield was recorded in the hybrid combination KTCF-51A<sub>1</sub>  $\times$  KTCF-4 (814 g and 361.77 q/ha) which was followed by KTCF-54A<sub>1</sub>  $\times$  KTCF-1 (808 g and 359.11 q/ha), KTCF-62A<sub>1</sub>  $\times$  KTCF-30 (786 g and 349.33 q/h), KTCF-58A<sub>2</sub>  $\times$  KTCF-30 (754 g and 335.11 q/h) and KTCF-51A<sub>2</sub>  $\times$  KTCF-4 (749 g and 332.89 q/h). These cross combinations exhibited self-blanching white to snow white compact curds. Besides this, above mentioned hybrids were also found superior than both the check cultivars with the heterosis range of 8.08-17.46 and 0.54-9.26 per cent over *Pusa Snowball Hybrid-1* (PSBH-1) and *Casper RZ*, respectively. These promising hybrids need to be tested at multilocations for stability analysis.

**Keywords:** *Cauliflower, cytoplasmic male sterility, compact curd, CMS based hybrids and marketable yield*

## Precision Farming: In Crop Production

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Precision farming concept is spreading rapidly in developed countries as a tool to find the challenge of agricultural sustainability. Precision farming is an approach where inputs are utilised in precise amounts to get increased average yields compared to traditional cultivation techniques. Hence it is a comprehensive system designed to optimize production by using a key elements of information, technology, and management, so as to increase production efficiency, improve product quality, improve the efficiency of crop chemical use, conserve energy and protect environment. Thus, precision farming is an appealing concept and its principles quite naturally lead to the expectation that farming inputs can be used more effectively, with subsequent improvements in profits and environmentally less burdensome production. The precision farming developments of today can provide the technology for the environment friendly agriculture of tomorrow.

## Functional characterization of regulatory elements associated with NAC members involved in development and stress responses from *Brassica* species

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Cis-acting regulatory elements, that bind and interact with trans-acting factors such as transcription factors are responsible for the accurate spatio-temporal expression and functioning of various genes. Among the various class of cis-elements (enhancer, repressor and promoters), promoters are considered the most important class of cis-regulatory element; owing to its critical role in regulation of transcription, thorough sequence and functional characterization of promoters are necessitated.

Plant transcription factors have been classified into 84 families. NAC transcription factor family is amongst one of the largest plant transcription factor families and members are characterized by a NAC domain at N-terminal which has motifs for DNA-protein and protein-protein interactions (Ooka et al. 2003; Ernst et al. 2004). Analysis of *Arabidopsis thaliana* identifies



105 members of this family. Transcription factor proteins coded by the members of NAC family play important role in various developmental pathways, stress responses, cell signaling and secondary metabolic activities. *CUC2*, *NAC1* and *ORE1* are three members of NAC family, that are under post-transcriptional regulation by micro RNA-164. Although the role of NAC, ORE1 and CUC2 in regulating development and stress has been well characterized in Arabidopsis [(shoot apical meristem formation (CUC-miR164), gynoecium development (CUC-miR164), leaf serration (CUC-miR164), root development (NAC1-miR164) and leaf senescence(ORE1-miR164)], their characterization from crop species such as Brassicas are incomplete. We report here sequence characterization of members of NAC1, CUC2 and ORE1 from Brassicaceae, and functional characterization of promoter element associated with NAC1 from *Brassica juncea* using promoter::reporter transcriptional fusions. Sequence analysis allowed us to identify conserved motifs which may have functional importance; functional analysis of promoters under different conditions reveals regulation through various hormones (NAA, GA, ABA); when subjected to heat and cold stress, differential promoter activity was observed as a function of time.

**Keywords:** Transcription factor, Promoter, NAC1, CUC2, ORE1, stress response, hormonal regulation

### **Economics of Production and Marketing of Capsicum (*Capsicum annuum*) in Solan District of Himachal Pradesh**

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Capsicum is an important off-season vegetable of western Himalayas and offers potential for boosting economy of farmers of hilly regions. In Himachal Pradesh, it is extensively grown as cash crop (April-October) in agro climatic zones-I, II and III in an open environment. Solan district of Himachal Pradesh ranks first in capsicum production with a total production of 34850 tonnes in 1217 hectare, followed by Sirmaur (11874 tonnes in 711 hectare), Kangra (5612 tonnes in 385 hectare), Mandi (5296 tonnes in 372 hectare) and Shimla ( 5035 tonnes in 342 hectare). Solan and Kandaghat developmental blocks of Solan district contribute most of the capsicum production in state. The major varieties of capsicum grown in Solan are California Wonder, Yolo Wonder, Solan Bharpur, Dollar and Bharat. For this study a representative sample of 80 farmers having 40 farmers from each block. The results revealed that the area production and productivity of capsicum in H.P and Solan has shown significant increase over the years. The average family size at an overall level comprised of 5.07 persons and literacy rate was 93.55 per cent. 87.35 per cent of the work force practice farming followed by service (7.91 %) and business sector (4.74 %). Average income from vegetables including capsicum was Rs. 205313.17 per farm which was 63.59 per cent of the total income of the sampled households. The per hectare cost of cultivation of capsicum was Rs. 134896. Cost of capsicum production was Rs. 776.81 per quintal. The input output ratio was 2.39. The Cobb-Douglas production function revealed that FYM was significant at 1 per cent level and human labour and fertilizer were significant at 5 per cent level. The MVP to factor price ratio observed that planting material, FYM, fertilizers and plant protection chemicals were underutilized and human labour was over utilized in the study area. The marketable surplus at an overall level was 28.21 quintal and marketed surplus was 28.09 quintal.

**Keywords:** Capsicum, income, cost, production

### **Lead acetate induced biochemical changes in the blood of a freshwater fish *Heteropneustes fossilis* (Bloch.)**

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Environmental pollutants such as metals, pesticides and other chemicals pose serious risks to many aquatic organisms. Accordingly a great deal of previous research has characterized physiological mechanisms of toxicity in animals exposed to contaminants. Lead is a non essential highly toxic metal widely distributed in environment. It is also discharged with water from lead mines, lead refining storage battery as well as plants for manufacture of tetra ethyl lead. The LC 50 value of lead acetate were calculated. The fish *Heteropneustes fossilis* were exposed for acute (24h, 48h, 72h and 96h), short (15, 30 and 45 days) and long



(60, 75 and 90 days) terms to  $1/5^{\text{th}}$  of LC50 values of lead acetate. After completion of experiment the caudal peduncle was cut off with a sharp razor blade and free flowing blood was collected for the biochemical study. Different biochemical parameters viz., bilirubin, SGOT and SGPT were estimated. A significant increasing tendency has been observed in bilirubin, SGOT and SGPT of the lead acetate at different time intervals. The statistical significance between the treated and control groups was calculated by the t-test.

**Key words:** Lead acetate, Biochemical levels, Blood.

### Mitigation of Climate Change in Agriculture

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In the age of the so-called "energy-climate era," a new development strategy is required to replace the conventional growth strategy which is faced with many limitations. In preparing for the future, low-carbon green growth has become the main stream as an inevitable core task to be performed home and abroad, and it is anticipated that there will be a lot of discussions in relation to the preparation of a green growth strategy to cope with global warming for a considerable period of time. As the agricultural sector takes up a very low portion of the total amount of domestic greenhouse gas emissions, with approximately 3%, there is a possibility that proper attention may not be paid to the administration of greenhouse gas reduction activities in the agricultural sector. The agricultural sector has a significant potential to contribute not only to the administration of national greenhouse gas reduction but also to the national development of green industries in the future.

### Surgical strike on cancer with herbs and spices

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Cancer has become a huge menace in today's society. With advancement of the modern era the problem of cancer have gradually increased and is projected to reach over 13 million cases in 2030, globally. Ironically, most of the new cases will be in the low-income countries where tackling this menace will be a big challenge. Cancer is the most common human genetic disease. The transition from a normal cell to a malignant cancer is driven by changes to a cell's DNA. Nutrition may play an important role in prevention, treatment and coping with cancer. Growing evidence points to certain dietary habits increasing or decreasing cancer risk. Processed foods that are high in sugar and low in fiber and nutrients have been linked to a higher cancer risk. Diet rich in fruit, vegetables, and whole grains are considered to be helpful in reducing cancer risk. Also, regular use of ginger, turmeric, cinnamon, cumin, clove and garlic in food is useful. As surgical strike is intended to damage only a legitimate military target, with no or minimal collateral damage to surrounding structures, likewise one can prevent and treat cancer without much side effects with certain indigenous plants like: *Ocimum sanctum*, *Azadirachta indica*, *Embellica officinalis*, *Semecarpus anacardium*, *Tinospora cordifolia*, *Curcuma longa* etc. Several research studies both *in vitro* and *in vivo* has supported the anti-cancer properties of these indigenous plants. Many chemotherapeutic drugs have plant origin. The glaring example include vincristine from the periwinkle plant, and taxanes from the bark of the Pacific yew tree.

**Key words:** cancer, herbs and spices



## Impact of Drought Stress on Relative Water Content (RWC) of Seven Ground Nut (*Arachis hypogea* L.) Genotypes at Different Stages of Crop Growth

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An experiment has been carried out to evaluate the varietal performance of seven ground nut genotypes (TAG 24, TG 37A, TG 39, Dh 256, GNH 804, ICGV 07041 and CSMG 2010-28) under drought stress conditions at the adjacent farm of College of Agriculture, Bidhan Chandra Krishi Viswavidyalaya (Bankura Extended Campus), Chhatna, Susunia, Bankura that included under the red and lateritic zone of West Bengal. Relative Water Content of leaf in all the seven ground nut genotypes have been measured under both irrigated and drought stress conditions during different growth stages at 30, 60, 90 DAS and at harvest and observed that there was a significant difference in the average value of RWC that reduced with the progression of rapid water deficit stress. The RWC progressively increase with the advancement of leaf growth upto 90 DAS and thereby decrease. During 30 DAS, highest RWC was obtained in all the genotypes. Significantly extreme differences in relative water content in all genotypes under water stress became more and more protruding from 60 DAS onwards. During 30 DAS, the highest RWC was observed in GNH-804 (87.74) followed by TG 37A (87.26) and TAG 24 (86.53) under zero stress or irrigated condition whereas under stress TG 37A (49.15) showed maximum RWC followed by TAG 24 (48.20) and GNH-804 (46.68). The lowest RWC was found in genotype CSMG-2010-28 [78.33 in zero stress and 35.65 in stress] that was significantly lowest as compared to all the genotypes. During 60 DAS, the maximum RWC was detected in TAG 24 (88.46) followed by GNH-804 (88.04) and TG 37A (88.0) under zero stress or irrigated condition whereas under stress TG 37A (44.55) showed maximum RWC followed by TAG 24 (43.0) and GNH-804 (42.68). During 90 DAS, the highest RWC was observed in GNH-804 (89.06) followed by TAG 24 (88.32) and TG 37A (88.03) under zero stress or irrigated condition whereas under stress TG 37A (39.55) showed maximum RWC followed by TAG 24 (38.0) and GNH-804 (37.68). During harvest, the highest RWC was observed in TG 37A (76.26) followed by TAG 24 (74.12) and Dh 256 (72.83) under zero stress or irrigated condition whereas under stress TG 37A (33.55) showed maximum RWC followed by TAG 24 (32.90) and Dh 256 (32.68). The lowest RWC was also found in genotype ICGV 07041 [68.80 in zero stress and 29.68 in stress] during harvest. Among the all genotypes, TG 37A showed maximum content of RWC in both zero and stress conditions followed by TAG 24 and hereby exhibited high yield whereas CSMG-2010-28 found least content of RWC and less in yield in both the situations.

From the overall experiments, it was observed that those ground nut plants relish with no stress or zero stressed condition exhibits higher maintenance of RWC (%) throughout the growth period comparatively than mild to sturdy stressed and severe stressed conditions. Some of the genotypes like TG 37A and TAG 24 showed higher maintenance RWC by confirming better hydration and more favourable intracellular water relations that might be due to higher water potential as well as better capability of drought tolerance whereas, CSMG-2010-28 followed by ICGV 07041 and TG 39 are more susceptible to drought.

**Key words:** Groundnut, Relative Water Content (%), Genotypic Variation & Drought Tolerance.

## Eco-friendly Management for Sheath blight Disease of Rice

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Rice is grown as an important cereal crop across the world, but extensively grown in South East Asian countries. Sheath blight disease incited by *Rhizoctonia solani* Kuhn is gaining importance due to wide distribution in almost all rice growing areas of the world. Yield losses in rice due to sheath blight disease in India have been reported up to 54.3% (Chahal *et al.* 2003). This disease is considered as one of the most important factors for stagnated productivity of the rice crop in the country. *R. solani* being a soil borne pathogen and having wide host range, often infects vegetables, pulses, flowers, several field crops, turf grasses, perennial ornamentals, shrubs, and trees (Agrios, 2006). Initially the symptoms appear as water soaked chlorotic patches on leaf sheaths at culms just above the water level which are ellipsoid or ovoid about 10 mm long, somewhat irregular and greenish grey, they enlarge in size and reach 1-3 cm long with irregular margin. The centre of the spots becomes greyish white with brown and purplish margins.



At present, most of the promising varieties have been found susceptible to this disease. No resistant cultivar of rice is available for practical use and intensive rice cultivation practices offer a favourable condition for disease development. Therefore, until the resistant cultivars are evolved, it is considered imperative that the disease should be kept under control with minimum possible loss through effective control measures. Although, several fungal and bacterial antagonists have been found effective against *R. solani* under *in vitro* condition, but a viable technology for their field application is yet to be refined. Of late, the use of organic soil amendments and botanical pesticides has emerged as an alternative disease management tactic against soil-borne plant pathogens. This management practice is very essential and demanding in modern agriculture to curtail the hazards resulting from intensive use of toxic chemicals.

Organic soil amendments and botanical pesticides have been found most effective against sheath blight of rice when it was compared against control under the pot experiment. *Neem* cake amended with *Trichoderma viride* @10 g/kg of soil has resulted in minimum relative lesion height (11.12%) with maximum disease reduction (82.75%) and was most effective than rest of treatments. Besides minimum relative lesion height and maximum reduction in disease, this treatment has resulted in minimum infected tillers (18.01%) also. FYM amended with *Trichoderma viride* @10 g/kg of soil was next best treatment with 17.95% relative lesion height, 72.16 % disease reduction and 20.28% in infected tiller. Sayyad *et al.* (2015) has also studied the effect of botanical pesticides against sheath blight disease of rice and found that the *neem* cake shows maximum disease control and significantly higher seed germination. The efficacy of *Pseudomonas fluorescens* @ 2%, *T. harzianum* @ 2%, *neem* oil @ 5% and *neem* leaf extract @ 5% was found to be the effective treatment and recorded minimum disease incidence (19.4%) and better yield (Babul *et al.*, 2016). Minimum radial growth (10.69 mm) with maximum per cent inhibition (71.71 %) has been observed by *datura* followed by *ashok* with radial growth (14.93 mm) and per cent inhibition (60.49 %) after 24 hours of incubation at 5 % concentration. Pot experiments conducted under artificial inoculation conditions revealed that 10 % extract of *datura* shows minimum relative lesion height (23.71 %) and maximum per cent reduction (67.19 %) followed by *ashok* which shows 30.23 % RLH and 58.17 % reduction over control. However maximum RLH (57.63 %) with least disease reduction (20.26%) has been found in case of chlorodendron. This research article bears BAU communication no.718/2019.

### Persistence Studies of Lambda cyhalothrin in summer vegetables

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Lambda cyhalothrin is a broad spectrum synthetic pyrethroid. It has contact and stomach action on the target pests. It is an agricultural and public health insecticide, controlling a wide range spectrum of lepidopteran and coleopteran insects and mites at all developmental stages, on a wide range of crops. Bitter gourd, capsicum, cucumber and okra are some of the important summer vegetables which are attacked by number of insect pests and mites. Data generated by the central sector scheme “Monitoring of Pesticide Residues at National Level” revealed the presence of non-approved pesticide like lambda cyhalothrin in all these vegetables. To safeguard the interest of consumers, CIBRC recommended to generate Good Agricultural Practices (GAP) data for the fixation of MRL. Therefore, field trials were conducted at Departmental Farm of the University to establish the fate of residues of lambda cyhalothrin on bitter gourd, capsicum, cucumber and okra following last foliar application of Reeva 5EC at recommended dose (X-dose) @ 15 g.a.i./ha. Samples (1Kg) of fruits of all the vegetables were drawn at an interval of 0, 1, 3, 5, 7 10 and 15 days after application, processed following QuEChERS technique. Lambda cyhalothrin residues were estimated by SHIMADZU GC 2010 equipped with ECD and capillary column (DB-1, 30 m long, 0.25 mm ID. and 0.25 µm film thickness). Temperature of injection port and detector was kept at 280°C and 300°C, respectively. Oven temperature was initially kept at 170°C for 5 min then raised to 220°C at the rate of 30°C/min with a hold time of 10 min. and finally raised to 280°C for 7 minutes @4 °C/min. The average initial deposits of lambda cyhalothrin on bitter gourd, capsicum, cucumber and okra were 0.196, 0.233, 0.132 and 0.303 mg kg<sup>-1</sup>, respectively. The RL<sub>50</sub> was found to be 3.2, 2.5, 2.8 and 3.5 days respectively for lambda cyhalothrin in bitter gourd, capsicum, cucumber and okra.

**Keywords:** Persistence, Lambda cyhalothrin, Summer vegetables, Initial deposits





## Nano-technology: A boon – A review

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Providing clean and affordable water to meet human needs is a grand challenge of the 21st century. Worldwide, water supply struggles to keep up with the fast growing demand, which is exacerbated by population growth, global climate change, and water quality deterioration. Industrialization and excessive use of pesticides for boosting agricultural production have adversely affected the ecosystem, polluting natural water reserves. Remediation of contaminated water has been an area of concern with numerous techniques being applied to improve the quality of naturally available water to the level suitable for human consumption. The need for technological innovation to enable integrated water management cannot be overstated. Nano-technology holds great potential in advancing water and wastewater treatment to improve treatment efficiency as well as to augment water supply through safe use of unconventional water sources. Here we review recent development in nano-technology for water and wastewater treatment. The discussion covers candidate nano-materials, properties and mechanisms that enable the applications, advantages and limitations as compared to existing processes, and barriers and research needs for commercialization. By tracing these technological advances to the physicochemical properties of nano-materials, the present review outlines the opportunities and limitations to further capitalize on these unique properties for sustainable water management.

**Key words:** Nano-materials, deterioration

## Development of Composite Wood Made from Waste Material of *Acacia Catechu*

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*The main goal of this study was to evaluate the suitability of kattha extracted wood of Acacia Catechu (Khair) for particle boards. Boards were prepared by using 10% and 12% resin content at two different pressures of 17.5 kg/cm<sup>2</sup> and 21 kg/cm<sup>2</sup>. The physical properties i.e. moisture content, density, water absorption, general swelling and thickness swelling and mechanical properties i.e. Modulus of Rupture, Modulus of Elasticity, Internal Bonding, Screw withdrawal strength were tested. The density of the particle boards ranged from 0.69 to 0.76 g/cm<sup>3</sup>. Particle board made from Acacia catechu (Khair) using 10% resin content at 21 kg/cm<sup>2</sup> pressure showed the highest physical and mechanical properties. Some of the physical properties which are not meeting the requirement of Indian standard can be improved by suitable treatments.*

*Results indicated that suitable particle boards with high strength and dimensional properties can be manufactured using the kattha extracted wood of **Acacia catechu**. Additional treatments might be needed such as coating surface with melamine-impregnated paper or chemical modification of particles to improve the panel quality especially their dimensional stability. Future research work on utilization of kattha extracted waste wood of **Acacia catechu** is needed.*

**Keywords:** swelling, shrinkage, resin, bonding, melamine, Acacia catechu, density



### Niche modelling of *Taxuscontorta* Griff. in Shimla District of Himachal Pradesh

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Species distribution modelling (SDM) helps to evaluate the distribution of species by using occurrence data and environmental variables, which is an important tool for investigating distribution range of rare and endangered species. *Taxuscontorta* Griff. is categorized as an endangered species by IUCN. Using MaxEnt a statistical tool for SDM we recognized the distribution range of species in Shimla district for current and future scenarios. The present study models the potential current and future distribution ranges of *Taxuscontorta* based on its suitable climatic envelope developed under a baseline scenario (1960–1990) and climate change scenarios centred on representative concentration pathways (RCPs) for the year 2070, as provided in the Fifth Assessment Report (AR5) of the UN's Intergovernmental Panel on Climate Change (IPCC). In this study, we used the area under the curve (AUC) of the receiver operator characteristics as an indicator of Max Ent performance. The AUC value for our model exceeded the minimum standard. The approach could be promising in predicting the potential distribution of plant species and thus, can be an effective tool in species restoration and conservation planning.

**Keywords:** Species distribution modelling, Max Ent, *Taxuscontorta*, Shimla, Endangered species

### Role Of Banker Plants For Management Of Insect Pests Of Greenhouse Crops

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Banker plants are compact and mobile habitat placed throughout the greenhouse and provide reliable, long-term reproduction and dispersal of natural enemies released for control of target pests. As a biological control strategy, banker plants offer a novel non-chemical approach to manage commonly encountered pests in the greenhouse. When the natural enemies are released into the crop then the banker plants promote their survival, longevity, and reproduction by providing them with essential resources such as food or shelter. The goal of banker plant system is to sustain a reproducing population of natural enemies within a crop that will provide long term pest suppression. The target pest is deliberately introduced prior to an infestation and acts as alternative prey for the natural enemy. Variations in banker plant systems can be used to control pests such as thrips, white flies, aphids, spider mites, and leafminers. The dispersal of natural enemies from banker plant systems is affected by the choice made between the banker plant system and crop-pest system. The main function of the banker plant is the reproduction of natural enemies by the provision of alternative food on banker plants. Hence, use of banker plant systems in greenhouse crops is eco-friendly, less expensive, avoid multiple release of natural enemies and is an alternative to chemical pesticides and can be used in an IPM programme for management of greenhouse insect-pests. Overall, banker plants reduce environmental concerns and provide the grower an opportunity to advertise earth-friendly, low-impact pest management.

**Keywords:** Banker plants, Biological control, Greenhouse crops, Natural pest control.



## Comparative field bioefficacy of newer insecticides against the major sucking insect pests of Mung bean, (*Vigna radiata* L. Wilczek) in Varanasi region

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A field study was conducted at the Agricultural Research Farm, Banaras Hindu University, Varanasi (U.P.) during *Kharif* 2018 for the evaluation of "Comparative field bioefficacy of newer insecticides against major sucking insect pests of mung bean, *Vigna radiata*(L.) Wilczek. in Varanasi region". Major sucking insect pests of mung bean are whitefly (*Bemisia tabaci*), jassids (*Empoasca kerri*) and thrips (*Caliothrips indicus*). Eight newer insecticides viz., seed treatment with Imidacloprid 600 SL @ 5ml/kg seed, Spiromesifen 240 SC @ 120.0 g a.i./ha, Diafenthiuron 50 WP 312.50 g a.i./ha, Pyriproxyfen @ 10 EC @ 100.0 g a.i./ha, Flonicamid 50 WP @ 75.0 g a.i./ha, Fipronil 5 SC @ 50.0 g a.i./ha, Clothianidin 50 WDG @ 25.0 g a.i./ha, Thiamethoxam 25 WG @ 25.0 g a.i./ha were evaluated in a field experiment against the major sucking insect pests of mung bean. The result and observations showed that two sprayings of different newer insecticides in different experimental plots at 40 DAS and 55 DAS were found to be effective in population control of sucking insect pests. Diafenthiuron 50 WP @ 312.50 g a.i./ha, was proved to be the most effective treatment followed by other treatments for suppressing the population of whitefly, jassids and thrips from 7.67 to 1.37/cage, 5.07 to 1.16/cage and 4.87 to 0.33/10 flowers after first spray and 5.47 to 1.11/cage, 3.40 to 0.78/cage and 3.00 to 0.62/10 flowers after second spray respectively. Diafenthiuron 50 WP @ 312.50 g a.i./ha was effective in the per cent reduction population of sucking insect pests over control followed by Flonicamid 50 WP @ 75.0 g a.i./ha and Fipronil 5 SC @ 50 g a.i./ha. Highest yield was observed in plot treated with Diafenthiuron 50 WP @ 312.50 g a.i./ha followed by Flonicamid 50 WP @ 75.0 g a.i./ha and Fipronil 5 SC @ 50 g a.i./ha i.e., 10.11 q/ha, 9.10q/ha and 8.76 q/ha respectively over control yield i.e., 5.17 q/ha.

**Keywords :** Bioefficacy, sucking insectpests, mung bean, newer insecticides.

## Environmental Toxicity and Management Strategies of Electronic Waste

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E-waste is a popular, informal name for electronic products nearing the end of their "useful life." Computers, televisions, VCRs, stereos, copiers, and fax machines are common electronic products. Many of these products can be reused, refurbished, or recycled. The rapid revolution in technology affected our lifestyle drastically and led us to believe that our lives have changed for better. Now communication with our distant friends or relatives, buying branded products or goods on the go and conducting business meeting I possible with just a single click. But on the other side it also has major negative effects on our life-Elevated Exasperation, Deteriorated Patience, Declining Writing Skill, and Lack of Physical Interactivity. The worst negative side effect of rapidly developing electronics is Electronic or e-waste. It may be defined as discarded computers, office electronic equipment, entertainment device electronics, mobile phones, television sets, and refrigerators. This includes used electronics which are destined for reuse, resale, salvage, recycling, or disposal. Others are reusables (working and repairable electronics) and secondary scrap (copper, steel, plastic, etc.) to be "commodities", and reserve the term "waste" for residue or material which is dumped by the buyer rather than recycled, including residue from reuse and recycling operations. Because loads of surplus electronics and frequently commingled (good, recyclable, and non-recyclable), several public policy advocates apply the term "e-waste" broadly to all surplus electronics. An estimated 50 million tons of e-waste are produced each year. The USA discards 30 million computers each year and 100 million phones are disposed of in Europe each year. The Environmental Protection Agency estimates that only 15-20% of e-waste is recycled, the rest of these electronics go directly to landfills and incinerators. According to a report – the amount of e-waste being produced including mobile phones and computers cold rise by as much as 500 percent over the next decade in some countries, such as India.

**Keywords:** Environment, Electronics, Elements, E-Wastes, Health hazards



### **Saccharification of *Eichhorniacrassipes* biomass by *Trichodermareesei***

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Increasing demand of energy world wide and limited source of resources forced scientists to look for an alternative source of energy. This work has been undertaken with an objective for biomass based fuel technology. *Eichhorniacrassipes* is an aquatic weed which is dangerous to aquatic flora and fauna. In this paper an attempt has been made for the eradication of the weed through its utilization.

The sample (*Eichhorniacrassipes*) was collected from Laxmitalab of Jhansi district. Strain of *Trichodermareesei* was isolated from the leaf and stem of the weed on PDA at 30°C and pH 6.0 substrate was pre-heated and detoxified for saccharification. Ligin (0.22 mg/g), hemicellulose (0.16 mg/g) and cellulose (0.31 mg/g) content was determined. Various growth parameters were optimized and it was found that *Trichodermareesei* has the potential to release sugar at 7 day incubation, 6.5 pH, 35°C and require 3.0g of substrate. Sugar yield was estimated upto 28% after 6 hours of reflux.

**Keywords:** Saccharification, biomass, weed, *Eichhorniacrassipes*, *Trichodermareesei*

### **Does zero-tillage and irrigation practice can influence yield and water productivity of maize-wheat cropping system**

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A decline in land and water productivity, increase in the cost of cultivation, and labor-intensive practices are affecting the productivity of cereal-based systems. Conservation agriculture (CA) has been reported to be sustainable agricultural production technologies. Therefore, to found the impact of tillage and irrigation practices on productivity, profitability and water productivity in maize-wheat cropping system, an experiment was conducted during 2017-18 at research farm of ICAR-IARI, New Delhi. The experiment was conducted in split-plot design with three replications. The main plots consisted of three tillage treatments: (i) conventional-tillage (CT) (ii) zero-tillage + crop residue at 2 t/ha (ZT) and (iii) ZT+ crop residue at 4 t/ha and three irrigation strategies (i) assured irrigation (ii) 50% and (iii) 25% of available moisture depletion (ASMD) in sub-plots. The highest maize equivalent yield (MEY) (5.74 t ha<sup>-1</sup>) and system productivity (11.24 t ha<sup>-1</sup>) was recorded with ZT+ crop residue at 4 t/ha followed by ZT + crop residue at 2 t/ha and CT. Likewise, ZT + crop residue at 4 t/ha recorded the highest input water productivity in maize (5.30 g kg<sup>-1</sup>) and wheat (5.21 g kg<sup>-1</sup>) compared to ZT + crop residue at 2 t/ha (5.16 g kg<sup>-1</sup> in maize and 4.29 g kg<sup>-1</sup> in wheat) and CT (5.02 g kg<sup>-1</sup> in maize and 3.21 g kg<sup>-1</sup> in wheat). In maize, irrigation water productivity enhanced with ZT + crop residue at 4 t/ha by 19.31% over CT (5.80 g kg<sup>-1</sup>). Similarly, in wheat, ZT + crop residue registered an increase of 10.87 and 40.93%, respectively than ZT+ crop residue at 2 t/ha (5.20 g kg<sup>-1</sup>) and CT (4.69 g kg<sup>-1</sup>). Application of assured irrigation and 25% of available moisture depletion (ASMD) recorded at par values of MEY and system productivity followed by 50% ASMD. The highest input water productivity and irrigation water productivity recorded with 25% ASMD followed by assured irrigation and 50% ASMD. In maize, input water productivity and irrigation water productivity increased by 8.92 and 5.43%, respectively over assured irrigation (5.49 g kg<sup>-1</sup> and 6.82 g kg<sup>-1</sup>, respectively). Likewise, in wheat, input water productivity and irrigation water productivity increased by 4.68 and 9.50%, respectively over assured irrigation (4.70 g kg<sup>-1</sup> and 5.58 g kg<sup>-1</sup>, respectively). Overall, it may be concluded that in zero tillage with crop residue at 4 t/ha with 25% ASMD can enhance the productivity and saving of water in maize-wheat cropping system in sandy loam soils of India.



### **Impact of flood on Kaziranga National Park Assam**

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Kaziranga National Park is one of the most famous and important forest area of the North East India. It is situated between Galaghat and Naglon district of Assam, India. It is a world heritage site and famous for the world's largest population of one horned rhinoceroses. It has the highest density of tigers in the world as well. Moreover, it is also the biggest habitat of wild buffalos. A large number of elephants, swamp deer and Haag deer etc. reside in Kaziranga. Kaziranga is situated nearby the flood region of Brahmaputra and its tributaries. Once in every 3-4 years, a large area of Kaziranga National Park is flooded by Brahmaputra. It either causes huge loss to conserved animals or animals die due to hunger because of lack of food. Also, a large number of animals are either killed due to road accidents on highways or killed by illegal poachers. Hunters or poachers also make targets of animals migrating to other places that are safe from floods. The present study is based on the deadly floods of Brahmaputra that caused huge damage to Kaziranga in the year 2019. Due to these floods, more than 200 wild animals including 20 rhinoceros were died. This study deals with the effect of floods on Kaziranga National Park and providing suggestions for diminishing the effect of floods in Kaziranga.

**Key words:** Kaziranga, Flood, Brahmaputra, one horned rhinoceros.

### **Integrated management of weed**

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Integrated weed management (IWM) is a strategy for weed control that considers the use of all available weed control techniques, including preventative measures, monitoring, crop rotations, tillage, crop competition, herbicide rotation, herbicide mixtures, biological controls, nutrition, irrigation, burning, etc. IWM does not solely rely upon herbicides for weed control. It is necessary because weeds negatively impact crop yields, interfere with many crop production practices, and weed seeds can contaminate grain. To prevent weed growth preventing measures like biological, mechanical, cultural and chemical controls are there. In biological control a less common IWM strategy is the use of living organisms, including livestock, insects, nematodes, fungi, and bacteria, to target weeds. Many biological agents target specific weed species, while livestock are typically more generalist in the weeds they consume. For mechanical control common mechanical tools to disrupt weed growth and survival include cultivation, tillage, burning, and handweeding. In cultural method crop management decisions that make crop more competitive against weeds and help optimize the effectiveness of herbicide applications. Common examples include timely scouting, row spacing, crop rotation, crop variety selection, timing of planting, and cover crops. Chemical herbicides are a key part of IWM in conventional and some organic systems. In conventional crops, using multiple effective herbicide modes of action (MOA) is essential for effective control of resistant weeds.

**Keywords-** IWM, Chemical, Biological, Cultural, Mechanical



### **Organic vs. conventional soil management practices impact on soil ecology in wheat rhizosphere.**

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A foremost indicator of soil quality in agriculture is soil ecology, which was significantly influenced by land/soil management systems. To study the terms of soil ecology under different tillage systems, soil was sampled at different crop growth stages (60, 90 DAS, 125 DAS and harvest) from wheat rhizosphere (0-15 cm) under organically grown basmati rice-wheat cropping system at student's research farm, Punjab agricultural university, Ludhiana. Treatments under study comprise of seven, out of which six were organic encompass three types of tillage systems (ZT, CT and DT) with and without paddy straw mulch (6t/ha) and a conventional control with recommended agrochemicals (CT-R). As it was a short-term study (2 year), much difference wasn't discovered, but treatments were statistically significant. Soil physico-chemical parameters (pH, E.C., texture, available potassium and phosphorous) didn't differ among treatments. Biological (total viable count, azotobacter count, and phosphate solubilizing microbial count) and phosphatases (acid and alkaline phosphatases) were pronounced in zero tillage with and without mulch at 90 and 125 DAS. With concatenation of first to second year CT+R and DT+R also performed better. Carbon sequestration (SOC) recorded notably increase of 14 – 15% was revealed in case of ZT+R, ZT-R, CT+R and DT+R treatments whereas CT-R, DT-R SOC of 7-8% was measured. Nevertheless control though having higher viable count but SOC was depleted at the end of second year. Zero tillage systems maintained a stable SOC compared to conventional and deep tillage systems. This indicated that conservative systems were better than conventional in current scenario. Management of long-term conservative practices and cereal-pulse cropping system would be a best amalgamation to regain the lost soil fertility.

**Key Words:** Conservation agriculture, carbon sequestration, soil quality, tillage added with organic amendments and zero tillage and conventional tillage

### **Effect of Foliar Application of Auxin on Growth and Development of Pear**

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Auxins have shown promising results in the modification of flowering through different types of action such as altering earliness, induction or delay in flowering and altering flowering by morphological modifications. We reviewed the effect of auxin spray on flowering, fruit set and fruit growth of Pear. Most commonly used auxins in pear are Na-NAA, NAA, Ethephon, 6-Benzyladenine (BA) and 2, 4, 5-T. Much of these studies are based on spray and droplet techniques. Even though these studies provide a general overview of foliar penetration, they provide limited information about the nature of the penetration process. NAA is widely used in researches and experiments and in commercial agriculture, there is a lack of knowledge on its mechanism of penetration into leaf tissue.

**Key Words:** Auxin, Pear, Leaf Tissue, NAA, Flower regulation, Fruit regulation.



## Nutritional quality and Sensory acceptability of *mathri* prepared from Non-conventional millets of Himachal Pradesh

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### Abstract

**Background:** The non-conventional crops are also known by other terms such as underutilized, underexploited, new, promising, neglected or local crops. These crops include minor millets which are rich in nutrients and resistant to adverse climate conditions. These millets are grown in the remote areas of Himachal Pradesh and losing their popularity although they are rich in nutrients. So the present study was undertaken to prepare a value-added *mathri* from these millets because value addition can help to promote these crops for future use.

**Materials & Methods:** Non-conventional millets were procured from local farmers of district Sirmour of Himachal Pradesh. The *mathri* was prepared by using refined wheat flour and millet flour in different formulations.

**Results:** *Mathri* prepared by using *Panicummiliaceum* flour was most acceptable as compare to others its acceptability index was 82.89 per cent. Controlled *mathri* contained 4.82, 3.25, 24.96, 10.46, 1.76 and 54.71 per cent moisture, ash, fat, crude protein, crude fibre and carbohydrate content, respectively whereas, moisture, ash, fat, crude protein, crude fibre and carbohydrate content of value added *mathri* prepared from millets ranged from 5.16 – 6.52, 3.32 – 4.12, 19.79 – 26.21, 11.02 – 12.23, 1.71 – 3.03 and 49.59 – 55.79, respectively.

**Conclusion:** The data concerning the nutritional evaluation of *mathri* revealed that supplementation of millets increased the nutritional value whereas, the results for sensory evaluation revealed that the sensory scores decreased as compared to the control samples, but all the samples were found to be within the acceptable range. Development of value added products from these millets can enhance the post harvest utilization of these non-conventional millets at household level as well as commercial products.

## Identification of Imidazole based novel antifungal agents by QSAR and Molecular Docking Experiments

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Thirty-four imidazole-based compounds designed by rational approaches in medicinal chemistry and were evaluated for their potential antifungal and antibacterial activities against several fungal and bacterial strains in-silico. All the compounds belonging to particular nucleus were rationally divided in 10 groups of 200 compounds each out of these 10 groups 2 were selected. Out of these two groups one group showed the activity against both the antifungal and antibacterial cells. The other group of 100 compounds was selective for antifungal and remaining 100 showed activities against the bacteria. Interestingly, compounds IA- 2, 3, 10 and 17 showed the excellent activity. These compounds were selected based on their docking scores by Schodinger and Autodock Software's. These identified leads showed the promising activity against fungal as well as bacterial cells as compared to standard molecules.

**Key words:** Imidazole, novel antifungal, QSAR



## Identification of Novel steroidal Sulphatase inhibitors against the Environmental Indicators

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Antibiotic resistance is one of the main public health concerns of this century. This resistance is also associated with oxidative stress, which could contribute to the selection of resistant bacterial strains. Active compounds showed selectivity against the studied Gram-positive bacteria compared to Gram-negative bacteria. 5,7-Dihydroxy-3-phenylcoumarin (compound 8) displayed the best antibacterial activity against *Staphylococcus aureus* and *Bacillus cereus* in-silico and by *Staphylococcus aureus* (MRSA strain) and *Listeria monocytogenes* with higher docking scores. Moreover, molecular docking studies performed on the most active compounds against *Staphylococcus aureus* tyrosyl-tRNA synthetase and topoisomerase II DNA gyrase revealed the potential binding mode of the ligands to the site of the appropriate targets. Preliminary structure-activity relationship studies showed that the antibacterial activity can be modulated by the presence of the 3-phenyl ring and by the position of the hydroxyl groups at the coumarin scaffold.

**Key words:** Novel, steroidal, Sulphatase inhibitors

## Induced Resistance and Suppression of Virus Multiplication by a Rhizobacterial Isolate

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Efficacy of the rhizobacterial isolate UN1 in induction of systemic resistance was evaluated either through a decrease in the number of local lesions due to sunn hemp rosette virus (SRV) infection on *Cyamopsis tetragonoloba* Taub. (Guar), or through a reduced disease incidence and low tobacco mosaic virus (TMV) titre in its systemic host, *Nicotiana tabacum* cv. White Burley. Lower leaves of the test hosts were treated with an overnight culture of the rhizobacterial isolate UN1 ( $2 \times 10^9$  cfu/mL) and the treated plants were challenge inoculated on all leaves with SRV/TMV, 24h later. A significant decrease in SRV lesion number (80-90%) was recorded on the treated and untreated leaves of *C. tetragonoloba*, when compared to the control plants treated with sterile broth only. Tobacco plants treated with the UN1 isolate showed a delay in the development of typical mosaic symptoms, with a decrease in disease incidence as well as infection severity. The presence/absence of TMV in the control and treated sets was confirmed through SDS-PAGE and dot blot, while the viral load in the infected plants was determined through indirect ELISA. The identity of the isolate UN1 was established as *Pantoea agglomerans* through PCR amplification and sequencing of the 16S rRNA gene, along with its cultural and biochemical characteristics.

**Keyword-** Rhizobacteria, induced resistance, dot blot, ELISA

## PCR based methods for early and rapid detection of fungal pathogen *Fusarium oxysporum* sp. *ciceri* in chickpea

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Chickpea, also called Bengal gram ( $2n = 2x = 16$ ) belongs to the family *leguminosae*. It is the second largest cultivated legume crop rich in protein, fiber, complex carbohydrates, vitamins and minerals. India is the largest producer as well as consumer of chickpea and accounts for 68.47% of total global production from 8.11 million hectare area. The production of chickpea is severely affected by wilt causing pathogenic fungi *Fusarium oxysporum* which results in economic losses ranging from 10-40% worldwide. In India, it is estimated to cause 10-15% yield losses annually, but can result in 100% losses under favorable conditions. The general symptoms of wilt and root rot diseases are similar in field and are often visually undistinguishable. In the





present study, PCR based rapid, reliable and easy detection techniques were developed for diagnosis of these fungal pathogens. Loop-mediated isothermal amplification (LAMP) PCR technique was used which clearly detected thirty-five different isolates of *Fusarium oxysporum* sp. *ciceri* collected from different regions of north India. LAMP primers were also able to differentiate these fungal isolates from *Ustilago tritici* and *Puccinia striiformis* f. sp. *tritici*. Further, qRT (quantitative real time) PCR conferred that approximately 3000 genome copies of *Fusarium oxysporum* can be detected by the LAMP primer. It was thus concluded that LAMP, and qRT-PCR are highly sensitive, less time-consuming, and rapid diagnostic assays which could be developed for early detection of prevalent pathogens.

**Keywords:-** LAMP, qRT-PCR, *Fusarium oxysporum*, early detection etc.

### **Delineation of soil nutrient constraints of cashew orchards in India and management alternatives**

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Cashew growing soils are generally deficient in plant nutrients mainly due to the landscape settings in which it is traditionally grown. The yield gap analysis revealed that the optimum production potential of cashew is yet to be tapped. Poor nutrition is likely to be one of the major factors contributing to low nut yield and quality. Optimization of cashew productivity and quality requires an understanding of the nutrient requirements of the tree, the factors that influence nutrient availability and the methods used to diagnose and correct deficiencies. For this detailed survey cashew growing areas is required. Timely management interventions are necessary to stop the depletion of soil nutrient reserves and to realize maximum yield from cashew. This study was undertaken to assess the soil nutrients limiting the productivity of cashew in India and to suggest management alternatives. Regional surveys were carried out in cashew plantations of Puttur, Vengurla, Bhubaneswar, Bapatla, Pilicode and Vridachalam. Soil and leaf samples were collected from 70 orchards in each location. Cashew orchards sampled were acidic and non saline. Organic carbon content of cashew growing areas was on the higher side except for Bhubaneswar, Bapatla and Vridachalam. These soils were deficient in available N, P and low to medium in K. Among the DTPA extractable micronutrients, soils were deficient in Zn and Cu. Soil fertility and nutrient supply is one of the important factor deciding yield and quality of the produce. At field and orchard level, the nutrition aspect is not properly taken care of, causing continuous nutrient mining and deterioration of soil health, apart from yield decline. Various soil fertility management options are discussed in the paper. Management options for soil acidity, major and micronutrients and nutrient management under organic farming systems are discussed.

**Key words:** Cashew, organic farming, foliar nutrition, liming, integrated nutrient management, tropical soil.

### **Niche modelling of *Taxus contorta* Griff. in Shimla District of Himachal Pradesh**

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Species distribution modelling (SDM) helps to evaluate the distribution of species by using occurrence data and environmental variables, which is an important tool for investigating distribution range of rare and endangered species. *Taxus contorta* Griff. is categorized as an endangered species by IUCN. Using MaxEnt a statistical tool for SDM we recognized the distribution range of species in Shimla district for current and future scenarios. The present study models the potential current and future distribution ranges of *Taxus contorta* based on its suitable climatic envelope developed under a baseline scenario (1960–1990) and climate change scenarios centred on representative concentration pathways (RCPs) for the year 2070, as provided in the Fifth Assessment Report (AR5) of the UN's Intergovernmental Panel on Climate Change (IPCC). In this study, we used the area under the curve (AUC) of the receiver operator characteristics as an indicator of MaxEnt performance. The AUC value for our model exceeded the minimum standard. The approach could be promising in predicting the potential distribution of plant species and thus, can be an effective tool in species restoration and conservation planning.



**Keywords:** Species distribution modelling, MaxEnt, *Taxuscontorta*, Shimla, Endangered species

### **An Efficient Synthesis of Pyrazole derivatives in WERSA.**

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Pyrazole derivatives are one of the important five membered heterocyclic, nitrogen containing compounds that has attracted huge interest in recent years due to widespread application in pharmaceuticals, synthetic scaffolds in combinatorial and medicinal chemistry, photographic couplers, chelating agents in coordination chemistry and agrochemical products. In view of above tremendous efforts have been made for the synthesis of pyrazole and its derivatives. Pyrazolin-5-ones and chalcone are the most widely accepted substrates for the synthesis of various pyrazole and pyrazolone derivatives. The methods reported so far involves use of expensive metals as catalyst, which are even time consuming.

Herein, we developed a robust, an efficient, simple and inexpensive route to synthesize the pyrazole derivatives without the use of catalyst in excellent yield.

### **Water Footprint as A Crisis Assessment tool With Special Reference to Water Distress**

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Water is a critical input into agriculture in nearly all its aspects having a determining effect on the eventual yield. Good seeds and fertilizers fail to achieve their full potential if plants are not optimally watered. India accounts for about 17% of the world's population but only 4% of the world's fresh water resources. Surveys conducted by the Tata Institute of Social Sciences (TISS) showed most of urban cities are water deficient. Nearly 40% of water demand in urban India is met by ground water. The government outlined a National Water Policy in 2012 articulating key principles relating to demand management, usage efficiencies, infrastructure and pricing aspects of water. Major challenges include estimation of ground water resources, agricultural crop pricing and water intensive crops and energy subsidies and ground water extraction. The water footprint of a product is an empirical indicator of how much water is consumed, when and where, measured over the whole supply chain of the product. The water footprint of an individual, community or business is the total volume of freshwater that is used to produce the goods and services consumed by the individual or community or produced by the business. Moreover, a WF normally considers green and grey water and blue water as the components. In many parts of the world, consumers and companies are becoming increasingly concerned with issues of sustainability and natural resource use. In this context, and as noted above, water scarcity is rising up the public agenda and water footprints of specific products have been developed to aid understanding of potential direct and indirect impacts. The connections between WF assessments, water policy and policy on related issues such as trade, economic development and agriculture have been the subject of discussions at major conferences in recent years. The Water Footprint Network has also begun to consider the policy implications of WF more systematically.

A WF analysis is not a silver bullet and there are many water policy and water resources management tasks which are beyond its scope. No single stakeholder can solve the complex issues facing the agriculture sector today. Partnerships among stakeholders in the water, agriculture and climate-related sectors are necessary to tackle the challenges of food security under climate change and growing water scarcity.

**Keywords :** Water Footprint, Scarcity, Energy subsidies, supply chain, Natural resource, Assessment.



### Expression analysis of stem gall resistance genes in Coriander (*Coriandrum sativum*).

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Stem gall disease caused by *Protomyces macrosporus* Unger was first reported in Bihar (India). The infections of disease take place at an early stage of seed germination but the symptoms appear much later. It is the most distractive and versatile disease and reduces crop yield and it is prevalent in all coriander-growing areas in India and considered as a limiting factor for successful cultivation. This disease completely effects on coriander leaves, petioles, stem, and fruits. The *genetics of resistance/ susceptible plants and the interaction between the coriander and pathogen remain unclear. In this experiment, we have performed RNS seq of resistance (ACr-1) and susceptible (CS-6) coriander cultivar leaf samples using Illumina NextSeq500 platform.*

Gene expression is the process by which information from a gene is used in the synthesis of a functional gene product. These products are often proteins, but in non-protein coding genes such as transfer RNA (tRNA) or small nuclear RNA (snRNA) genes, the product is a functional RNA. Gene expression profiling simultaneously compares the expression levels of multiple genes between two or more samples. This analysis can help scientists identify the molecular basis of phenotypic differences and select gene expression targets for in-depth study. Gene expression profiling provides valuable insight into the role of differential gene expression in normal biological and disease processes. Today, many of the techniques for quantification of RNA are deprecated because other new techniques provide more information. Currently the most widely used techniques are qPCR, expression microarrays, and RNAseq for the transcriptome analysis. We have used transcriptome to analysis the genes related to resistance in coriander against stem gall disease. Various transcription factors such as AREB/ABF, AP2/ERF, bZIP, DREB1/CBF, HB, MYB, HSF, MYC, NAC and WRKY were shown to influence stress response in plants. In our study found one of the transcript WRKY33 which is very well characterized in response to pathogen response another was ERF6 transcription factor known to involve in pathogen response in plants. Nevertheless, higher differential expression in resistant over susceptible was noted for the WRKY transcripts (>4 fold change) followed by each transcript for ERF (>5 fold change). Coriander transcriptome found WRKY 33 transcription factor is induced in response to pathogen infection. Secondary metabolite pathway transcripts expressed differentially and belonged major to Phenylpropanoid biosynthesis pathway a stress induced metabolic pathway and the enzymes associated with this pathway included trans-cinnamate 4-monooxygenase known to involve in development and environmental stress tolerance, coniferyl-aldehyde dehydrogenase, cinnamyl-alcohol dehydrogenase and peroxidase involved in the lignin biosynthesis pathways and involved in disease resistance in plants were highly expressed in the resistant genotype.

**Key words:** coriander, Stem gall, WRKY33 and transcription

### Water management of Upper Ganga Canal Command Area using Genetic Algorithm

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Upper Ganga Canal (UGC) Project is the oldest irrigation system of India. The canal system irrigates nearly 9,000 km<sup>2</sup> of fertile agricultural land in ten districts of Uttar Pradesh and Uttarakhand. The existing cropping pattern may not utilize the available resources due to poor economic efficiency that result in less water discharge in main stream river Ganga. Therefore, Genetic algorithm is used to optimize the available land and water resources to maximize the net benefit. In the optimal cropping pattern, 1.2% increment is obtained in net profit with the consumption of 26% less water.



### Soil quality under different tillage management practices in lower Shivalik region

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A field experiment was carried out from 2009-10, to study the effect of different tillage management practices in a sandy loam soil, under maize (*Zea mays* L.) - wheat (*Triticum aestivum* L.) cropping sequence, at research farm of ICAR-Indian Institute of Soil and Water Conservation, Research Centre, Chandigarh. The tillage management practices were compared for their effect on selected soil quality indicators, viz. soil aggregation, soil available nitrogen and soil moisture. The treatments were T1: Conventional tillage (CT); T2: Conventional tillage with brown manuring in maize + cowpea (1:2) and wheat + pea (4:1) ratio (CT-BM); T3: Conservation tillage (CST) and T4: Conservation tillage with brown manuring (CST-BM). The macro aggregate % varied from 28 to 46.5%. The highest percentage of macroaggregate was recorded under CST-BM system, followed by CT, CT-BM and lowest in DT. Mean soil available nitrogen varied from 180 to 333 Kg/ha, and the brown manuring systems significantly increased soil available nitrogen due to incorporation of leguminous plant residues. Soil moisture varied from 2.1 to 7.6%, highest being under treatments with residue addition i.e. T4, T5 and T6. Thus, the study suggests that Conservation Tillage in conjunction with brown manuring could be a promising practice for improving soil aggregation, available nitrogen and soil moisture in light textured soil of Shivalik region.

**Key Words:** Brown Manuring, Tillage, Maize-wheat, Soil aggregation, Soil moisture, Soil nitrogen

### Land use changes: A key ecological driver affecting the soil methanotrophs community composition in dry tropical region

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The upland soil plays a significant role in the methane (CH<sub>4</sub>) consumption on higher rate. The CH<sub>4</sub> oxidation in soils is exclusively mediated by methanotrophs. Due to anthropogenic activity the natural forests are gradually being converted into agricultural lands. The land-use changes may strongly affect the methanotrophs activity in such disturbed soils. However, the information regarding the impact of land use changes on soil methanotrophs community composition in dry tropical region is in initial state. Therefore, differences in methanotrophs population density across different land-uses i.e. natural forest, mixed forest, savanna, and agriculture ecosystems in dry tropical soils situated in Vindhyan region were investigated. The abundance of the soil methanotrophs at agriculture site reduced considerably with increasing soil NH<sub>4</sub><sup>+</sup> concentrations and decreasing soil water contents due to soil disturbances. The results suggested that land use practices are responsible for alterations in soil properties, and therefore, led to reduction in soil methanotrophs abundance at disturbed sites (savanna and agriculture land) compared to natural and mixed forest sites. The decreasing order of methanotrophs density across study ecosystems was natural forest > mixed forest > savanna > agricultural land. The outcome of the investigation suggests that land use changes significantly affect the soil methanotrophs abundance and community composition in dry tropical region.

**Keywords:** Agricultural land, ecosystems, forest, land-use changes, methanotrophs, savanna

### Non-chemical disinfestation methods against *Oryzaephilus mercator* (Fauvel) infesting walnut kernel

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Walnuts (*Juglans regia*) are enriched with nutritional and health promoting attributes and have good export potential and long shelf life. However, insect-pests are constraints in their storage and marketing. Of the nine pests reported from India to affect



walnut during storage, merchant grain beetle, *Oryzaephilus mercator* (Fauvel) (Coleoptera: Silvanidae) is the most important. Though not associated with direct weight loss in store, its infestation can lead to substantial contamination, resulting in quality deterioration, which may affect walnut export. Present investigations on ecofriendly disinfestation treatments viz., high temperatures (50°C, 60°C), low temperatures (1°C, -15°C), modified atmospheres (MA): MA<sub>1</sub> (40% CO<sub>2</sub>+60% N<sub>2</sub>), MA<sub>2</sub> (50% CO<sub>2</sub>+50% N<sub>2</sub>), MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) and combination treatments were undertaken to study their efficacy against *O. mercator* and stages thereof infesting walnut. At a temperature of 50°C and 60°C, pupal stage was most tolerant when treated in kernel with LT<sub>99</sub> (time to kill 99% of insects) values of 96.69 min and 45.13 min respectively. At low temperature of 1°C, 99% of the most tolerant stage (late larva) may be controlled by 5.2 days of exposure and at -15°C, 99% of the most tolerant stage (adult) may be controlled by 0.88 h of exposure period when treated in kernel. Of the MA treatments tested, MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) was most effective. The lethal times required for 50%, 90% and 99% kill of most tolerant stage at 28°C were 6.19, 10.88 and 16.53 h, respectively and 4.71, 7.68 and 11.98 h respectively at 35°C. Thus effective disinfestation treatments were: low temperature treatment at -15°C giving 99% disinfestation of walnut kernel within 0.88 h and combination treatment of MA<sub>3</sub> (60% CO<sub>2</sub>+40% N<sub>2</sub>) at temperature of 35°C giving 99% disinfestation within 11.98 h with no adverse effect on sensory attributes of walnut. This has great potential for use as phytosanitary treatment during export.

**Key words:** *Oryzaephilus mercator* (Fauvel), Walnut, Disinfestation, Thermal treatment, Modified atmospheres

### **Effect of postharvest polyamines treatment on quality and storability of jamun (*Syzygium cumini* Skeels) fruit**

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Jamun (*Syzygium cumini* L. Skeels) is an underutilized subtropical fruit native to Indian subcontinent. The fruit is a natural storehouse of several bioactive compounds having immense medicinal and therapeutic properties, especially in curing diabetes. However, Jamun is highly perishable in nature and can be stored for only a couple of days at ambient conditions. Very limited attempts have been made so far for extending shelf life of Jamun. In this study, the effect of postharvest polyamines treatment on preserving physico-chemical and sensory attributes of Jamun have been investigated during storage at ambient conditions. Polyamines are low molecular weight aliphatic amines and are ubiquitous in nature. Fully ripe Jamun fruits after harvest were treated with putrescine (0.5 mM, 1.0 mM) or spermine (0.5 mM, 1.0 mM) by immersion method for 5 minutes and stored at ambient conditions (27 ± 3°C, 75% RH). The control fruits were treated with distilled water for the same duration. The results revealed that putrescine 1.0 mM was highly effective in reducing weight loss and decay loss compared to control and other treatments. This treatment also retained higher bioactive compounds like ascorbic acid, total phenolics, flavonoids and exhibited maximum antioxidant capacity compared to control. The loss of anthocyanin pigments was also recorded minimum in 1.0 mM putrescine treated fruits. The findings of the study revealed that pre-storage treatment of Jamun with putrescine 1.0 mM is highly effective in preserving quality and enhancing storability of fruit during storage under ambient conditions.

**Key Words:** Jamun · Polyamines · Shelf life.

### **To characterize major viruses in apple nurseries on the basis of serological studies**

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Surveys conducted during 2018-2019 in apple nurseries of Solan district of Himachal Pradesh revealed incidence of viral diseases. Leaf samples from the marked plants exhibiting typical viral symptoms were collected and were further serologically detected for the presence or absence of apple viruses by using both DAC (direct antigen coating) and DAS (double antibody sandwich) forms of ELISA. The results of DAC-ELISA revealed the presence all the four genera namely Ilarvirus (apple mosaic virus, prunus necrotic ring spot virus); Foveavirus (apple stem pitting virus); Capillovirus (apple stem grooving virus) and Trichovirus (apple chlorotic leaf spot virus) associated with the apple nurseries. For more accurate and specific detection of apple



viruses namely ACLSV, ASPV, ASGV, ApMV and PNRSV representing the previously mentioned genera, DAS-ELISA based serological characterization was carried out. The findings clearly indicated the presence of mixed infection of ApMV, ASPV, ASGV and ACLSV. However, ACLSV was found to be the most predominant among all viruses.

**Keywords:** apple nurseries, serology, viruses, DAC-ELISA, DAS-ELISA.

### Does the dynamics of carbon storage in *Quercus oblongata* D. Don. along its elevation range follow the carbon limited hypothesis or the growth limited hypothesis?

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Elevation is one of the most important environmental factors that help us to understand the role of climate change on plant growth and its physiology due to variation in abiotic and biotic characteristics along the gradient. The non-structural carbohydrates (NSC) storage in plants may help them rely on carbon reserves to survive in carbon limiting stress, and NSC allocation is related to species related stress tolerance. To test whether *Quercus oblongata* D. Don in western Himalaya, Kangra, Himachal Pradesh is growth limited or carbon limited along the gradient of elevation and hence increasing low temperature stress, NSC concentration of leaves of *Quercus oblongata* D. Don. were analysed along its species range (1000 masl-2500 masl). The NSC concentration in the leaves were found to decrease along the gradient thereby supporting the carbon limitation hypothesis. Further studies would be required in different plant tissues that shall provide an eco-physiological explanation for the mechanism. Such an understanding would help in predicting the response of the species to climate change in terms of a shift in the elevational range of its distribution.

**Keywords:** Carbon limitation, Growth limitation, Non-Structural Carbohydrates, Elevational gradient, *Quercus oblongata* D. Don

### Effect of Different levels of Nitrogen, Potassium and PSB on Growth and Yield of *Zaid* Greengram (*Vignaradiata*L.)

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A field experiment was conducted at Crop Research Farm (CRF), SHUATS, Allahabad, during the *zaid* season of 2018 with 9 treatments replicated thrice in randomized block design, to determine the effect of different levels of Nitrogen, Potassium and PSB on growth and yield of *Zaid* Green gram (*Vignaradiata* L.). The results revealed that application of 20&35 DAS (0.2% foliar spray) of boron + 5.0 kg ha<sup>-1</sup> of zinc was found to be best treatment for obtaining maximum Plant height (cm) (64.16), Number of branches plant<sup>-1</sup> (7.80), Number of Nodules plant<sup>-1</sup> (20.60), Dry weight (g) (8.48g), Crop growth rate (g m<sup>-2</sup> day<sup>-1</sup>) (0.16 g m<sup>-2</sup> day<sup>-1</sup>), Relative growth rate (mg g<sup>-1</sup> day<sup>-1</sup>) (0.0305 mg g<sup>-1</sup> day<sup>-1</sup>), Number of Pod plant<sup>-1</sup> (23.86), Number of grain Pod<sup>-1</sup> (12.40), Test weight (g) (34.14g), Grain yield (t ha<sup>-1</sup>) (2.18 t ha<sup>-1</sup>), Stover yield (t ha<sup>-1</sup>) (2.96 t ha<sup>-1</sup>), Harvest index (%) (45.14%), Protein content (%) (24.56%), whereas the lowest values were Plant height (cm) (53.84 cm), Number of branches plant<sup>-1</sup> (6.73), Number of Nodules plant<sup>-1</sup> (14.86), Dry weight (g) (6.16g), Crop growth rate (g m<sup>-2</sup> day<sup>-1</sup>) (0.07 g m<sup>-2</sup> day<sup>-1</sup>), Relative growth rate (mg g<sup>-1</sup> day<sup>-1</sup>) (0.0107 g m<sup>-2</sup> day<sup>-1</sup>), Number of Pod plant<sup>-1</sup> (17.80), Number of grain Pod<sup>-1</sup> (11.66), Test weight (g) (30.14g), Grain yield (t ha<sup>-1</sup>) (1.46 t ha<sup>-1</sup>), Stover yield (t ha<sup>-1</sup>) (1.83 t ha<sup>-1</sup>), Harvest index (%) (40.19%) and Protein content (%) (20.26%) were found in treatment T<sub>1</sub>, i.e., Control + 0 kg ha<sup>-1</sup>. The highest gross return (115630 ha<sup>-1</sup>), net return (73933.66 ha<sup>-1</sup>) and benefit cost ratio (2.69) were registered in treatment T<sub>12</sub>, i.e., 20&35 DAS (0.2% foliar spray) of boron + 5.0 kg ha<sup>-1</sup> of zinc whereas the lowest values gross return (60230 ha<sup>-1</sup>), net return (20543.4 ha<sup>-1</sup>) and benefit cost ratio (1.51) were registered respectively in treatment T<sub>1</sub>, i.e., Control + 0 kg ha<sup>-1</sup>.

**Key words:** Green gram, growth and yield, Boron and Zinc.



## Turnip mosaic virus- An emerging threat to *Brassica* oilseed and crucifer vegetable crops in India

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Field surveys conducted at 85 locations in North Indian states of Himachal Pradesh, Punjab, Chandigarh, Rajasthan, Jammu and Kashmir and Meghalaya in North-Eastern India in oilseed brassica and crucifer vegetable crops including cauliflower, cabbage, radish, turnip, broccoli, kale, knol khol, bak choy, brussels sprout, Chinese sarson and Chinese cabbage to record the incidence of turnip mosaic virus (TuMV). Symptomatic plants were collected and maintained in the glasshouse for further biological, serological and molecular detection. Indian isolates of TuMV collected from radish were mechanically sap transmitted to mustard variety Tender Green, *Chenopodium quinoa*, *Chenopodium amaranticolor*, *Nicotiana tabacum* variety White Burley, *Nicandra physalodes* and *Datura metel*. The virus isolates were successfully transmitted to mustard variety Tender Green systemically and locally to *Chenopodium quinoa*.

Alkaline phosphatase (ALP) based DAS-ELISA commercial kit from BIOREBA AG, Switzerland; direct antigen coating (DAC) ELISA kit against poty group from BIOREBA AG, Switzerland and EMA 67 monoclonal antibodies provided by Dr. John Walsh, University of Warwick, UK were used for serological detection of TuMV in different isolates of brassica oilseed crops and crucifer vegetables. Serological studies confirmed the presence of TuMV in three different radish isolates collected from Himachal Pradesh with high optical density (OD) values at A<sub>405</sub> nm. The virus was detected from radish as well as inoculated plants of mustard variety Tender Green and *Chenopodium quinoa*. In molecular studies, primers against CP (coat protein) and NIB (nuclear inclusion bodies) genes of TuMV were designed for molecular identification of the virus isolates. cDNA synthesis and PCR conditions have been standardized for TuMV isolates. A desired amplicon of ~450bp of CP gene was obtained which confirmed the exact identity of the virus as TuMV.

**Keywords:** TuMV, *Brassica*, Tender Green, ELISA, RT-PCR

## Application of Database Derived Genic Simple Sequence Repeat Markers for Genetic Relationship Analysis in Tomato Germplasm

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In this study 20 genic SSRs derived from 4200 expressed sequence tag (EST) sequences were used to carry out genetic relationship studies in tomato germplasm. Genomic DNA was assessed using PCR protocol using 20 primers, which produced a total of 62 bands with 60 being polymorphic representing 96.77% polymorphism. Further NTSys pc Version 2.02 was used for data analysis which represented similarity value range of 0.10 to 0.87 indicating a broad genetic base of germplasm. Dendrogram analysis divided the germplasm in two main clusters with further sub-clustering. The maximum similarity of 87% was found between EC-521059 and EC-501074, while minimum similarity of 10% was observed between EC-12699 and EC-6486. It was found that 'SolanVajr' which is a commercial variety, was present on the top of cluster, separating it from rest of the germplasm. This study demonstrated the potential of genic SSRs in genetic relationship analysis further facilitating the use of studied germplasm in breeding programs. These markers can further be used to conduct various molecular analysis like QTL and marker assisted selection studies.

**Keywords:** Genetic, Germplasm, Marker, Polymorphism, Sequence, Similarity



### **Pollen viability influencing fruit set in high temperature condition in brinjal**

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Brinjal is a day neutral vegetable crop and therefore can be grown throughout the year in different parts of India. However, the fruitset is highly reduced in summer season in the plains, particularly when the temperature goes beyond 35°C, thus adversely affecting the yield. Pollen viability has been found to be an important factor influencing the fruitset. Thirty six brinjal genotypes comprising of varieties, breeding lines as well as indigenous and exotic collections were grown during summer season of 2015-16 at the Vegetable Research Farm of Bihar Agricultural University, Sabour. Pollen viability was noted from the time of 50% flowering, which occurred from first week of May at an interval of 10 days. The earliest fruitsetting was observed in Pusa Purple Long at 51.00 days after transplanting (DAT) followed by IHR-562 (53.67 DAT), BRBL-04 (54.33), BRBL-01, Punjab Brinjal-67 and Pusa Purple Cluster (56.67 DAT each) which occurred in the month of May itself when the monthly average day/night temperature was 36.1 °C/24.2 °C and the average pollen viability of these genotypes for month of May were 70.54%, 71.26%, 77.27%, 61.11%, 58.15% and 59.17%, respectively. Pollen viability was found to be a limiting factor for fruitset in brinjal. It was noticed that pollen viability below 50% did not set fruits. Pollen viability increased in all genotypes from second fortnight of June when temperatures dropped to below 32°C/24°C day/night temperature and fruitset occurred henceforth. Thus, pollen viability could be identified as one of the major factors restricting fruitset in brinjal, 50% pollen viability being the minimum threshold level. The genotypes that produced fruits at high temperatures above 36 °C could be further used in breeding programmes for developing heat tolerant lines.

**Keywords:** Eggplant, pollen viability, heat stress, fruit setting

### **Floral waste management for environmental sustainability– A review**

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Solid waste disposal is major problem in the world. However, in India, floral waste is one of the major problem. People are habituated to offer flowers and garlandsto the deities in the temples as they are considered a symbol as devotion and reverence. In India, 80, 00,000 tons of temple flower waste are dumped into the rivers and oceans, which has bad impact on the water quality as well as on the living organisms present in the water. These floral waste can be utilized in different ways to produce a valuable products and help to save environment from pollution caused due to improper disposal of flower waste. There are different techniques like composting, vermicomposting, dye extraction, bio fuel, poultry feeding, incense stick, pulp and paper industry *etc.* which can be used for managing and value addition of flower waste. Overall these waste management approach will lead to environmental management through waste reduction and reutilization. It will also provide value added material for economic gain and employment generation in rural areas. Thus, it can be promoted as potential mechanism to maintain the environmental sustainability at wider scale.

**Keywords:** Flower waste, Dye extraction, Poultry feeding, Pulp and paper industry.





## Survey, Evaluation Of Germplasm Screening And Effect of Seed Treatment on Cercospora Leaf Spot of Marigold

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Marigold is one of the commercially exploited flower crop in India for multiple uses and ranks third in number after roses and chrysanthemum. *Cercospora* leaf spot is caused by *Cercosporatageticola* Ellis & Everhart which causes heavy losses to marigold worldwide as well as in Himachal Pradesh. Therefore present detailed investigation were undertaken with the objectives to study survey and surveillance, germplasm screening and effect of seed treatment with fungicides, bioresources and biocontrol agents on seed health parameters and seed infection in marigold. The incidence and severity of *Cercospora* leaf spot of marigold recorded during the surveys in years 2017-2018 in two districts (Solan and Sirmaur) of Himachal Pradesh. The disease incidence and severity was highest at Nauni (62.4% and 70.4%) and Rajgarh (46.7% and 52.6%) in Solan and Sirmaur district, respectively. Four available varieties of marigold were screened against *Cercosporatageticola* Under natural epiphytotic conditions out of which UHF 786 was found to be moderately resistant to *Cercosporatageticola* as compare to other three varieties that gave moderately susceptible to highly susceptible reaction towards the pathogens. Since *Cercosporatageticola* is a seed borne pathogen, seed health testing studies were conducted by following standard method prescribed by International Seed Testing Association with desired amount of best fungicides, botanicals and bioresources to test their efficacy on different seed health parameters and seed infection due to seed borne nature of the pathogen, three treatments, Folicure 25% EC (tebuconazole), Score 25% EC (difenoconazole) and *Trichoderma harzianum* were found to be most effective by improving high germination percentage from 63.33 to 76.00 in comparison to other treatments, respectively.

**Keywords:** *Cercosporatageticola*, survey, surveillance, germplasm screening and seed treatment.

## Isolation of Potential Mercury Resistant Bacteria (MRB) from Panipat Thermal Power Station (PTPS) dumpsite

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Mercury is a major environmental pollutant, classified among those bio-accumulative toxins that persist in the environment for long periods. When discharged into the environment, it gets deposited in soil and water, making its way into the food chain. Worldwide many areas contaminated with mercury poses threat to people and environment causing neurological disorders, results from the poisoning of methyl-mercury which leads to Minamata disease. Bioremediation is the most promising approach for mercury removal from the wastewater and mercury dumpsite. The present study is an attempt to isolate and identify mercury resistant bacteria (MRB) from Assan Kalan Village pond and soil samples from Panipat Thermal Power Station (PTPS) dumpsite, Panipat, Haryana. Different physico-chemical properties of water and soil samples were determined. Initially, six strains of MRB were isolated using flask enrichment method. Isolated strains were differentiated by different antibiotic and biochemical tests. On the basis of growth kinetics of all, two strains were selected which were showing significant growth upto 10 ppm. The isolates were identified preliminarily by ERIC-PCR and further confirmed by 16S rDNA sequencing analysis. Strain SDS10 has shown 16S rDNA sequence similarity of maximum 99% with *Kocuria marina* and SDS20 has shown similarity of maximum 100% with *Jeotgalicoccus marinus*. Through the present study, for the first time it has been found that these strains are potential mercury resistant bacteria (MRB).

**Keywords:** Mercury; Bioremediation; Mercury resistant bacteria; 16S rDNA; ERIC-PCR

## Colonization of Microfungi during Degradation of *Saccharum officinarum* L.

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Decomposition is a central process in every ecosystem. Decomposers which decompose organic litter are bacteria,



actinomycetes and fungi. In the present study only microfungi associated with decomposition of sugarcane (*Saccharum officinarum* L.) litter in agricultural fields have been investigated with a view to understand their ecology and biology during degradation of leaf litter. For this leaf litter have been collected from agricultural field and put into the pits for degradation, in nylon mesh bags. These bags have been removed from the pits at regular time intervals of 15, 30, 45, 60, 75, 90, 120, 150, 180, 210, 240, 300 days. Spore suspensions were streaked over PDA and appeared fungi were identified. In all 47 fungal species with 26 genera have been identified and recorded. Identified genera have been classified according to their classes. Two genera belongs to class zygomycetes e.g. *Mucor* and *Rhizopus*, nine genera i.e. *Chaetomium*, *Ceratocystis*, *Cochliobolus*, *Emericella*, *Emericillopsis*, *Eurotium*, *Neosartorya*, *Sordaria* and *Corynascus* are belongs to class ascomycetes, two genera i.e. *Rhodotorula* and *Trichosporon* belongs to class basidiomycetes and remaining thirteen genera e.g. *Aspergillus*, *Acremonium*, *Alternaria*, *Candida*, *Colletotrichum*, *Curvularia*, *Cladosporium*, *Fusarium*, *Myrothecium*, *Paecilomyces*, *Penicillium*, *Phoma*, and *Trichoderma* are members of class deuteromycetes.

## Second Generation Bioethanol Production Using Stirred Tank Bioreactor and Utilization of Leftover Waste for Production of Mushroom

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Apple pomace a main by-product of food processing industry of Himachal Pradesh, apple harvesting technology treats pomace as waste because its disposal creates environmental problems. However, apple pomace is an interesting raw material and has attracted considerable attention as a potential sugar, cellulose, xylan and lignin content it can be efficiently utilized as a substrate for second generation biofuel production. In the present study, Bioethanol production from enzymatically hydrolysed apple pomace using co-culture of yeast cells i.e. *Saccharomyces cerevisiae* and *Pichia stipites* was carried out in a stirred tank bioreactor. A 7.5L bioreactor was operated at standardized aeration and agitation rate of 0.1 vvm and 100 rpm respectively for 72h. An enhanced bioethanol yield with fermentation efficiency of 72.36% was obtained under separate hydrolysis and fermentation mode after 36h with controlled temperature of 35°C. The GC-MS analysis of fermentation broth indicated an ethanol yield of 40.37g/l within the medium. The left over waste obtained after enzymatic hydrolysis was collected, dried and mixed in varied ratio with the wheat bran and found that the best yield of mushroom was obtained by mixing 0.50 kg of apple pomace with 1.50 kg of apple pomace maximum fruiting body i.e. 28 were observed with approximate weight of 110gm with highest biological efficiency of 54.23% which is higher than the yield obtained using wheat straw recommending it blending with horticultural waste.

**Keywords:** Apple pomace, Bioethanol, Fermentation, *P.ostreatus*, Reducing sugar, Stirred tank bioreactor.

## Impact of Prescription Based Fertilizer Applications on Soil Properties, Yield And Economics In Turmeric Cv. "Palamlalima" In An Acid Alfisol

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The field experiment entitled "Impact of prescription based fertilizer applications on soil properties, yield and economics in turmeric cv. "Palamlalima" in an acid Alfisol was conducted in a randomized block design with eight treatments comprising control, farmer's practice, general fertilizer dose, soil test based fertilizer application and fertilizer application based on STCR approach with FYM for yield targets of 10, 20, 30 and 40 t ha<sup>-1</sup>. The investigation was carried out during *khariif* season on turmeric crop at the experimental farm of Department of Soil Science, College of Agriculture, CSK HPKV, Palampur, Himachal Pradesh. The significant differences were observed among the various treatments. Supplementation of fertilizers along with FYM in target yield of 30 t ha<sup>-1</sup> resulted in turmeric rhizome (228.5 q ha<sup>-1</sup>) and straw yield (16 q ha<sup>-1</sup>) which was significantly higher over



the treatment comprising of 20 t ha<sup>-1</sup> target. Treatment comprising of general recommended dose gave significantly higher rhizome and straw yield as compared to soil test based and farmer's practice. Moreover, fertilizer application based on target yield of 30 t ha<sup>-1</sup> significantly enhanced the yield as well as nutrients uptake as compared to soil test based and general recommended dose treatment. The status of available N, available P and available K nutrients in soil was improved in target yield of 40 t ha<sup>-1</sup> as compared to target yield of 30 t ha<sup>-1</sup>. Highest content of organic carbon (9.03 g kg<sup>-1</sup>) in soil was found under treatment for target yield of 40 t ha<sup>-1</sup>. The highest net returns (₹ 3,08,278 ha<sup>-1</sup>) were obtained in treatment of target yield of 30 t ha<sup>-1</sup> followed by target yield of 40 t ha<sup>-1</sup> (₹ 2,82,875 ha<sup>-1</sup>) and the least control treatment (₹ 60510 ha<sup>-1</sup>). Treatment having target yield of 20 t ha<sup>-1</sup> excelled all other treatments in terms of benefit: cost ratio (3.15) followed by soil test based treatment (3.04) and least was recorded in control (1.97).

**Keywords :** nutrients, management, Alfisol, turmeric, STCR, fertilizers, economics

### High-Tech Horticulture for Income Promotion

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With shrinking land for agri-horticultural activity, the sensible option before the nation is to increase further the production levels per unit area. Intensive cultivation in hi-tech protected environment with hi-tech production inputs will ensure higher productivity levels. This would call for use of hi-tech horticultural technologies. These are modern technologies which are environment dependent, capital intensive and have capacity to improve productivity and quality. These will include use of genetically modified crop varieties, micro-propagation, integrated nutrient and water management, integrated pest management, protected cultivation, organic farming, use of modern immune-diagnostic techniques for quick detection of viral diseases and hi-tech post harvest technologies, including cold chain. Although these techniques are very capital intensive and require proper education knowledge of machinery but these techniques ultimately fulfill the increasing demands of agri-horti commodities of booming population from the limited areas of land. Such comprehensive, holistic approach towards integration of all technology leads to sustainable horticulture and also ensures income promotion of the nation. Adopting such kind of hi-tech horticultural technologies not only fulfill the increasing demands for food commodities but also improve the living standards of farmers. Ultimately owing such hi-tech horticultural techniques results into high foreign exchange and less dependent on importing various high valued horticultural commodities. So, we conclude that hi-tech horticultural techniques are very crucial in income promotions and to optimize the production from the limited area of land.

**Keywords:** hi-tech horticultural, micro-propagation and protected cultivation

### Standardization of recipe, storage stability and organoleptic evaluation of bitter gourd nectar

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Bitter gourd (*Momordica charantia* L.) belongs to the family Cucurbitaceae. It is well known for its nutritional value and therapeutic properties. The consumption of bitter gourd is limited owing to its bitter taste. Hence, an attempt was made to develop a value added product to increase its level of consumption. In the current study, recipes of bitter gourd nectar with 10 and 15 per cent pulp, 10 and 15° brix total soluble solids and 0.3 per cent acidity were prepared and subjected to physico-chemical analysis and organoleptic evaluation at 0, 30, 60 and 90 days of storage. The physico-chemical parameters such as pH, total soluble solids, total sugars and reducing sugars exhibited an increasing trend while acidity, non-reducing sugars and ascorbic acid showed decreasing trend during storage period of 90 days. Recipe of nectar prepared with 10 per cent pulp, 15° brix total soluble solids and 0.3 per cent acidity was rated superior for overall acceptability at the end of storage period.



**Key words:** Bitter gourd, nectar, physico-chemical, organoleptic, storage

### **Genetic Evaluation of Different Genotypes of Sesamum spp. and their intra and interspecific crosses under mid hill conditions of Himachal Pradesh**

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Twelve parents and twenty three hybrids of sesame (*Sesamum indicum*, *S. mulayanum* and *S. radiatum*) were evaluated for twelve physiological and yield component characters viz., days to flower initiation, days to 50 % flowering, days to 75% maturity, plant height (cm), inter node length (cm), branches / plant, number of capsules /plant, seeds / capsule, 1000 seed weight (g), seed yield/ plant, biological yield/ plant (g) and harvest index (%) at the Experimental Farm area of the Department of Crop Improvement during kharif, 2013. The analysis of variance revealed the presence of sufficient genetic variability for all the characters under study. Based on the mean performance, crosses viz., IC-557261 x LTK-4, IC-557265 x LTK-4 and IC-557174 x TKG-371 significantly out yielded the standard check (LTK-4) for seed yield per plant. While IC-557247 x IC-557175, IC-557261 x IC-557265 and IC-557265 x LTK-4 were found to be significantly superior to the check for biological yield per plant. One cross combination i.e IC-557261 x LTK-4 was found to be significantly superior for seed per capsules. IC-557261 x IC-557247, IC-557265 x IC-557261 and Punjab Til No.1 x IC-557273 were found to be the best three cross combinations (significantly superior than check on the basis of per se performance) for number of capsules per plant. Many other promising cross combinations also appeared in present investigation which could be used in further breeding programme for sesame improvement.

**Key words:** *Sesamum indicum*, *S. mulayanum*, *S. radiatum*, per se performance, seed yield

### **Bioremediation: A Tool to Manage Environment**

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The air water soil, human beings, animals and plants etc. exists in a mutually interacting and interdependent manner forming environment. Environment is also an element of 'Nature' which directly or indirectly; knowingly or unknowingly we the human being consume and which affects our physical, spiritual and mental consciousness. Environment may be of three types-Physical, Biological and Cultural environment. Holistic environment consists of terrestrial, aquatic, edaphic, minerals, plants, animals, microorganism and human being etc. All the five maha-bhoota of nature Prithvi, Jal, Pawak, Gagan and Samir together forms physical and biological environments of Earth. In Vedas these five maha-bhoots are called as Deities with special powers. Even in Vedas human being has been instructed not to disturb nature with unnecessarily and unethically, because any disbalance in the nature will certainly be harmful for the existence of whole universe.

Today, where everyman needs fast and high manifold times. It is a boon for better world on its one side but on the other side it is a huge contribution for pollution of environment. Due to industrialisation many toxic things are discharged in Mother Nature and thus to attain sustainable future, clean and pure environment is biggest challenge today worldwide.

Although there are many conventional methods to make environment clean like – Landfills, Solidification and Stabilization, Soil vapour extraction, Pump and Treat, Chemical oxidation, thermal desorption etc. But all these processes are very costly, labour intensive and time taking. So, the best way to make environment clean is Bioremediation, which means purification of environment with the help of biological agents which may be in form of microorganisms and plants. Bioremediation by plants is called as phytoremediation. Removal of toxic chemicals or xenobiotics with the help of microorganisms is called as bioremediation. It is preferred to any of conventional technologies due to its benefits like – (a) Less expensive (b) Less time taking (c) More environment friendly (d) No waste accumulation after excavation (e) Applicable in all phases of nature. Depending upon the toxic chemicals, their quantity and source of discharge, different microorganisms are used



to simplify different toxic chemicals like *Pseudomonas* is widely used microorganism to degrade aliphatic and aromatic hydrocarbons but *Xanthomonas* is used to degrade polycyclic hydrocarbons. Action of different microorganisms is observed on different xenobiotics.

Bioremediation is carried out by two methods: I. In-situ bioremediation II. Ex-situ bioremediation. When the toxic chemicals are treated at the same place where they are discharged the process is in-situ and when the toxic chemicals are first shifted to other place or containers for degradation its ex-situ bioremediation. Ex-situ bioremediation gives better results because it can be more effective as it is conditions controlled technology microorganisms have better interaction with chemicals but still in-situ is mostly followed because ex-situ is complex and tedious job (Labour intensive) to be carried out. To enhance bioremediation some more technologies are followed like bio-venting, bio-augmentation or bio-stimulation in which, according to requirements oxygen or microorganisms or nutrients can be supplied to the undergoing bioremediation process. Sometimes consortium of microbes is more efficient for bioremediation because synergetic effect of microorganisms is observed. Better results are recorded when sequential (Aerobic Anaerobic) processes are performed for bioremediation to get maximum bioremediation and to overcome many limitations, bioremediation is done by genetically modified microorganisms. As it is proved that genes of microorganisms are responsible for degrading certain toxic chemicals if those genes be increased or multiplied in the plasmid, it is more effective like *Pseudomonas* 'Superbug' and many more genetically modified microorganisms are known.

### **Monitoring of bacterial population in roadside soil from selected region along NH 8A, Gujarat**

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Soil-dwelling microbes play a crucial role in many fundamental nutrient cycling processes, soil structure dynamics, pollution degradation and regulation of different plant communities. Roadside soils often show a high degree of contamination that can be attributed to motor vehicles. Vehicular discharge of numerous gaseous and trace metal contaminants due to incomplete combustion of petroleum fuel adversely affects the microbial population and their activities in soil. In the present study, roadside soil samples from various sites on NH 8A were collected and observed for the bacterial population. Serial dilution and spread plate techniques were performed for the bacterial isolation from the collected soil samples. The identification and molecular characterization were performed by 16S rRNA techniques. The 16S-rRNA sequencing studies identified bacterial species as, *Bacillus drentensis* (MK217088), *Bacillus safensis* (MK774729), *Bacillus haynesii* (MK192808), *Bacillus subtilis* (MK217089), *Bacillus cereus* (MK801278). A phylogenetic tree was constructed by using Clustal W by aligning the 16S rRNA sequences of isolated bacterial colonies. Soil microorganisms are the driving factors and soil microbial properties are recognized as sensitive indicators of soil health and quality. Microbes are also responsible for soil aeration and soil fertility which are among the crucial aspects of soil function.

**Key words:** Microbial Diversity; pollution degradation; Phylogenetic tree; 16S-rRNA Sequencing.

### **Growth and flowering of carnation as influenced by conjoint application of bacterial endophytes and chemical fertilizers under protected conditions**

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Carnation (*Dianthus caryophyllus* L.) the most popular commercial cut flower of the world, holds second rank in commercial importance next only to rose. Carnation cultivation is well adapted to regions having mild climatic conditions and provide good remunerations to the growers. Himachal Pradesh offers a great scope for its cultivation throughout the year. Though fertilizer application influences the production and quality of flowers greatly, their recommendation rate is very high which



directly affects the cost of production. Further, use of chemical fertilizers causes ecological imbalance with potential hazard to flora and fauna. To overcome these issues, use of microbes represent an environment friendly, low-cost input in integrated nutrient management systems. An experiment was conducted to study the effect of bacterial endophytes alone and in combination with different doses of chemical fertilizers on growth characteristics of carnation under protected conditions in mid-hills of Himachal Pradesh. The applications were created as, T<sub>1</sub>: Absolute Control, T<sub>2</sub>: 100% RDF (Recommended doses of fertilizers), T<sub>3</sub>: 75% RDF+Endophyte1, T<sub>4</sub>: 75% RDF+Endophyte2, T<sub>5</sub>: 50% RDF+Endophyte1, T<sub>6</sub>: 50% RDF+Endophyte2, T<sub>7</sub>: Endophyte1 and T<sub>8</sub>: Endophyte2. Various plant growth parameters viz. plant height, days taken to flowering, flower size, duration of flowering, vase life, number of side shoots, number of flowers and number of cut flowers per plant were evaluated in the experiment. A significant increase in plant height (85.27cm) was recorded with treatment T<sub>3</sub> that also induced early flowering and took the least number of days (136.89) for flowering. Treatment T<sub>4</sub> recorded maximum flower size (7.40 cm), duration of flowering (81 days), vase life (19.33cm), number of side shoots (6.56), number of flowers (6.46) and number of cut flowers (6.00). Thus, the application of these endophytes as biofertilizers/biostimulants has the potential to curtail the cost of care in production of high quality carnation plants besides reducing the use of chemical fertilizer in its cultivation.

**Keywords:** Biofertilizer, Biostimulant, Endophytes, Mid-hills, RDF

### ***Rheum austral* D. Don., An Endangered Medicinal Plant: Traditional Uses and Conservative Perspective in Chota Bhangal, Himachal Pradesh**

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*Rheum australe* D. Don., an endangered, robust perennial herb, commonly known as Chukri in ChotaBhangal region of Himachal Pradesh has extensive usage in Indian system of medicine. This species is traditionally used to treat digestive disorders, cuts & wounds, as tonic and as an anti-inflammatory drug in the study area along with its usage as food. The remedying properties of this plant is due to the presence of various bioactive principles such as chrysophanic acid, emodin, starch, rhein, essential oil, calcium oxalate besides oxalic acid in leaves. *R. australe* has been collected extensively from wild for its herbal usage, which place this herb under endangered category. Thus, there is an urgent need for the development of cultivation techniques for this plant in large scale. The present communication gives an insight of therapeutic potential of *R. australe* based on traditional usage of this plant in ChotaBhangal, which provides way for further pharmaceutical research. Further, this study provides preliminary information for future studies to conserve & sustainably use this potent herb at commercial scale.

**Keywords:** *Rheum australe* D. Don., ChotaBhangal, Traditional, Medicinal, endangered, Conservation

### **Floristic diversity and community structure of tree species at Mewar Campus in Rajasthan, India**

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The present study aimed was described the floristic composition and distribution pattern of plant communities at mewarcampus in Rajasthan. A total 56 individual tree species were recorded in the study which belonged to thirty-six families. In the present study an attempt has been to ascertain the current status of plant species which provide major forest products and minor forest product also. The study site was categorized in five plant communities' viz., Timber tree species, Ornamental tree species, Fruit yielding tree species, shrub species and medicinal plants. Highly diversity of plant community was timber tree species (96.99%) which followed by medicinal plants (90.37%). The dominant tree species was *Bauhinia variegata* which belonged to Fabaceae family. During the study, maximum tree species were belonged to Fabaceae (52.36%), Apocynaceae (52.72%), Rutaceae (19.63%) and Myrtaceae, Arecaceae (13.09% each) and minimum tree species which occurred under following families Meliaceae, Rubiaceae, Moringaceae, Moraceae and Proteaceae (6.54% each) respectively.



**Keywords:** Tree species, Family, Community, Diversity

### **Nutrient status of compost and vermicompost produced by different organic wastes**

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Epigeic earthworms play an important role in biodegradation and recycling of organic wastes so as to produce quality vermicompost with high nutrient status. The present work was undertaken to check the quality of compost (without worms) and vermicompost (with *Perionyx excavatus*) produced out of different organic wastes [Cattle manure (CM), Copper Pod Waste (CPW), Parthenium Waste (PW) and Lawn Grass Waste (LGW)]. The produced compost and vermicompost were analysed for different physico-chemical parameters such as pH, EC, % Organic Carbon (OC) and available macro nutrients (N, P, K) through standard prescribed methods. The % organic carbon (OC) was comparatively more (69- 76%) in compost as compared to vermicompost(42-70%) whereas other physico-chemical parameters such as pH, EC were more in vermicompost (7.39-7.98;  $2.0 \times 10^2$ -  $3.5 \times 10^2$ ) as that of compost(7.10-7.65;  $2.0 \times 10^2$ -  $3.4 \times 10^2$ S/m), likewise other macro nutrients such as N,P,K were almost more in vermicomposts (395.75-435.90;16.0-19.20 & 317.61-370.51kg/hect) than that of composts (240.89-401.89;13.60-17.40 & 309.51-321.52kg/hect) of all organic wastes. Results of the present study revealed that the vermicompost produced from different organic wastes by the action of epigeic earthworm, *Perionyx excavatus* have all the essential physico-chemical parameters necessary for sustainable agriculture practices. Further, the quality of both compost and vermicompost primarily depends upon the nature of raw waste material used in the composting and vermicomposting process and the potentiality of the earthworm species used, role of saprophytic microorganisms in biodegradation and mineralization process and prevailing environmental conditions.

**Key words:** Nutrient status, Compost, Vermicompost, Organic wastes and Epigeic earthworm- *Perionyx excavatus*

### **Waste Utilisation in Horticultural Crops: A SteptowardsProduct Diversification and Sustainable Development**

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Driven by increasing world population, economic development and income growth in developing countries the demand, production and processing of horticultural crops, especially fruits and vegetables, have increased very significantly. However, noteworthy losses due to lack of adequate handling operations, and waste in the fresh and processing industries are becoming a serious nutritional, economical and immense environmental problem, as they decompose in landfills and emit harmful greenhouse gases. This waste is composed mainly of skin, seed, rind and pomace of citrus, apples, peaches, pears, banana, pomegranate, berries, mango, onion, potato, tomato and sugar beet etc, containing good sources of potentially valuable bioactive compounds, such as carotenoids, polyphenols, dietary fibers, vitamins, enzymes and oils among others. Tomato seeds, banana peel, rambutan and mango seed kernel, passionfruit seed, black currant, date pits are good sources of edible oil rich in polyunsaturated fatty acids. Many fruit and vegetable wastes are used as a substrate for the production of organic acids (citric, lactic and ferulic acids), single cell protein, essential oils, exogenous enzymes, bio-ethanol/methanol, bio-pesticides, bio-sorbants, bio-degradable plastic, bio-fertilizers and bio-preservatives. Hence, there is a need to utilize novel techniques with respect to the waste materials to achieve higher retrieval rates of phytochemicals and bioactive compounds, which can be utilized in various industries including the food industry, for the development of functional or enriched foods, the health industry for medicines and pharmaceuticals, cosmetic, chemical industries and the textile industry. Apart from these, the use of post-production waste for energetic purposes by producing bio-fuel allows not only for the minimization of the quantity of waste, but



can also reduce the overall cost of running business, that too in a sustainable way.

**Keywords:** Fruits, Vegetables, Waste utilisation, Bio-active compounds, Phytochemicals, Sustainability

## **Knowledge of Rural Women Regarding Health and Nutrition Practices in Bikaner District of Rajasthan, India**

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The present study was conducted in Bikaner district. There are six panchayatsamitis out of which Bikaner panchayatsamiti was selected. Out of thirty one Gram panchayat in Bikaner panchayatsamiti four Gram panchayat were selected namely KilchooDeodan, Ridmalsarpurohitan, Palana and Nalbari. One village from each selected Gram panchayat was selected on the basis of random sampling technique. Thus, four villages were selected for the present investigation (Surdhanachauhanan, Raisar, Palana, Nalbari). A sample of one twenty rural women in the age group 15-45 years (30 rural women from each village). Interview Schedule was developed to collect the data regarding health and nutrition knowledge of rural women.

The major findings of the present study revealed that in general information majority of the respondents belonged to middle age group, educated up to primary, belonged to 4001-6000/- monthly income group, nuclear family system, other backward caste, involved in agriculture occupation, had above 2.1-5 hectare of land holding, no membership of social organization, no participated in training programme and medium level of mass media contact, urban contact and extension contact.

The overall knowledge of the rural women was medium. Out of eight aspects of health and nutrition the knowledge about the aspect of 'Basics of foods and nutrition' and 'Environmental hygiene' were ranked first with overall mean per cent score. On the basis of these findings it could be concluded that health and nutrition knowledge of rural women was medium.

**Key words:-** Health, Nutrition, Knowledge, Hygiene, Environment

## **Evaluating the efficacy of brassinosteroid on physio-biochemical responses of apple plants to water stress**

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Apple (*Malus × domestica* Borkh) is one of the most important fruit crop commercially cultivated in temperate regions of the world and some tropical areas with high altitude. In India, cultivation of apple is largely done in Jammu and Kashmir, Himachal Pradesh, and Utrakhnad; however, it is also cultivated in Arunachal Pradesh, Nagaland, and Meghalaya. In Himachal Pradesh apple is mainly grown under rained conditions. There is very less or no rain during critical periods of growth and development leads to developing stress conditions. In this study one-year-old potted "Super Chief and Red Chief" plants were subjected to various treatments of water stress with brassinosteroid. Both varieties were pre-treated by foliar application of brassinosteroid 0.05 and 0.10 ppm, three days before subjecting to stress. Physiological and biochemical characteristics viz., photosynthesis, chlorophyll fluorescence, water use efficiency, total free amino acids, total proline, and catalase activity showed significantly increased whereas soil moisture reduction under water stress. The maximum increase in physio-biochemical characteristics was recorded by plants subjected to 30 of water stress as compared to 15 days of water stress. Brassinosteroids involved in the stress response and appear to trigger stress resistance mechanism. However, brassinosteroid at both concentrations could help in maintaining vital growth and biochemical processes under water stress conditions. The foliar spray of brassinosteroid (0.05 ppm) prior to the imposition of stress can pave the way to minimize the deleterious effects of water stress on apple plants.

**Keywords:** Apple, brassinosteroid, physio-biochemical, treatments, soil moisture, water stress





## Characterization of Bacteriophage with Special Reference to Different Bacterial Hosts

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Ever since Felix D. Herelle identified the bacteriophage in 1921 to treat variety of bacterial ailments, bacteriophage therapy has gained considerable interest, more so due to growing antibiotic resistance. Since their first use, phage research has transformed fundamental and translational biosciences. In environment, phages are crucial in establishing the balance of bacterial population. From glaciers to ocean bed, phages are present everywhere. They are very specific to their host bacteria, usually target single bacterial species.

This work describes efficient isolation of bacteriophage virus from sewage water using double agar assay. In this method phages in sewage water were amplified by host bacteria and later this suspension was syringe filtered. After that molten agar along with this active phage suspension and active culture of host bacteria in 2:1 ratio were poured onto nutrient agar petridishes. These plates were kept for incubation for 24 hours and later observed for plaque formation. The lysogenic as well as the lytic phages were isolated using this method. Five different bacterial species (i.e. *Escherichia coli*, *Salmonella typhi*, *Pseudomonas aeruginosa*, *Proteus vulgaris* and *Proteus mirabilis*) were used as host for isolation of phages. After overnight culture, the plates were counted for plaques and calculated for pfu (plaque forming units). It was found that for *E. coli*, three different plaques were present in 10<sup>6</sup> dilution. This represents presence of three different strains of bacteriophages. (different plaque sizes represent different strains of phages). Like *E. coli*, *Proteus vulgaris* also gave a bacteriophage titre range from 5 x 10<sup>6</sup> PFU/ml to 10<sup>8</sup> PFU/ml, with both clear and turbid plaques. Since clear zone of plaque indicates DNA genome or tailed phages with lytic activity, whereas the turbid zone of inhibition indicates the presence of the temperate phage; both lytic as well as lysogenic phages were obtained in *Proteus vulgaris*. In *Salmonella typhi*, 10<sup>7</sup> PFU/ml bacteriophage titre was observed in culture, *Pseudomonas aeruginosa* provided a titre of 3 x 10<sup>6</sup> PFU/ml whereas in *Proteus mirabilis*, the titre of phage obtained was 10<sup>6</sup> PFU/ml of bacteriophages. All different plaques were isolated and stored for further testing. We are working on to stabilize PFU of phages in different pH as well temperature without disturbing their titres, so that an optimum value of PFU can be obtained for further phage therapy. Later these phages will be sent for sequencing and TEM (transmission electron microscopy) analysis.

**Keywords:** Bacteriophage, Phage therapy, Double agar assay, PFU, *Proteus vulgaris*, *Proteus mirabilis*

## Salt Tolerant Plant Growth Promoting Rhizobacteria Induces Maize (*Zea Maize*) Seed Growth Under Saline Environment

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Soil salinity is a brutal environmental factor that hindered the growth of crops in saline agricultural field, by the mid twenty first century 50% of cultivable land would be affected through salinity. Agricultural productivity is severely affected by soil salinity because high salt levels that checks the ability and essential elements/ factors. Those are necessary needs for plants growth. Researchers have drawn their attention to improve the growth of crop plants in saline soils eco-friendly with the help of salt tolerant plant growth promoting rhizobacteria. In the present study, different varieties of maize cultivars were observed for their seed viability at different level of salinity (w/v; NaCl) in 0.8% agar plate. Among of all seed cultivars, local variety of maize seed (NV<sub>1</sub>) showed more percent seed viability and growth at 1.0 % NaCl (w/v) after 120 hours and its shoot length, root length and weight 1.6 cm, 2.78 cm and 0.33gm respectively. When observed Salt tolerant plant growth promoting rhizobacteria were isolated from rhizosphere of saline infested zone of maize plant by using nutrient agar plate followed by screened for their salinity tolerance NaCl (w/v) on agar plate i.e. with 6% NaCl (w/v). Screened salinity tolerant rhizobacteria were further examined for their PGP traits, and three salt tolerant rhizobacteria (SP12, SP20, and SP14) were able to produce maximum amount of IAA at 4% of NaCl (v/v) concentration in N.B. broth. All these salt tolerant rhizobacteria were able to induce the seed viability and



growth of maize seed (NV<sub>1</sub>), while SP12 induced more shoot, root length and weight as compared to maize seed (NV1) without treated SP12 at 1% NaCl (w/v). Thus this salt tolerant plant growth promoting rhizobacteria could be effective and eco-friendly tools for mitigation of salinity in saline agriculture field and sustain sustainable agriculture.

**Keywords:** Soil salinity, PGP traits, Rhizobacteria, Maize seed and NaCl

### Isolation and characterization of micro flora associated with different fermented foods

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Fermented foods are an integral part of our food. These have made important contribution to human diets. In our present study, samples of different traditional fermented food were taken from different regions of Himachal Pradesh. These included curd, idli, jalebi, bhaturu and pickles. These samples from these foods were isolated on nutrient agar plates for growth of bacteria incubated at 37°C for 48 hours. The pure cultures of different bacterial strains on agar plates were obtained by streak plate method. The isolates were checked for their colony morphology i.e. forms, elevation, margins and gram staining was done to test their gram reaction. Further, bacteriocin production test was performed to check the antimicrobial activity of isolated pure culture bacteria. Bacteriocins are peptides and proteins with low molecular mass that are produced via bacteria ribosomal synthesis. Also, biochemical tests for all the selected isolates were performed i.e. urease test, carbohydrate utilization test, catalase test, citrate utilization test, indole test, MRVP test. The study done has the potential for further research in microbiology of different food samples and also for the preparation of probiotics.

**Keywords:** Fermentation, Broth, Bacteriocin, Probiotics.

### Significance of ponds for breeding success of water dependent bird species in agricultural landscapes

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Ponds are common landscape elements harbouring rich biodiversity, but are disappearing throughout the countryside. The present study was carried out at four natural ponds and one man-made pond during March 2019 to July 2019 at three locations falling in three agro climatic zones. Three selected ponds in village Jhamat, village Malakpur and Punjab Agricultural University (PAU) campus named as pond A, B and C respectively at location I (Ludhiana). In villages Mukrabpur and Vaa, ponds selected were named as D and E at location II (Ropar) and location III (Ferozpur) respectively. At Pond A, Spot-billed Duck was observed in the month of May with small chicks swimming along the floating weed Morning glory. Nesting and chicks of Indian Moorhen were observed during the month of April to June on both wild vegetation as well as Kikar (*Acacia nilotica*) near the ponds A, B and D. White-breasted Waterhen was observed collecting nesting material and formed cup shaped nest in the month of July at Pond A. Black-winged Stilt was observed nesting on the submerged wall partition at pond C and E in the month of April. Female incubating the eggs and small chicks were observed in the month of June and July respectively. At Pond D, nesting of Indian Pond Heron and Cattle Egret was observed on Date Palm and Tun tree respectively. At pond E, courtship behaviour of Lesser-whistling Duck by diving and raising in water and chicks were observed from May to July. Presence of water vegetation weeds, shrubby plants and undisturbed habitat are important for sustenance of nesting sites, population and diversity of water dependent bird species. The present study provides baseline information on water dependent bird species and their successful breeding in ponds for future monitoring and conservation planning to develop them as biodiversity hotspots.



## Effect of intercropping on population of leafhopper, *Amrascabi guttulabiguttulain* cotton, *Gossypium spp.*

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Cultivating cotton as a sole crop is usually found to be risky and less remunerative. Intercropping in cotton is of significance because of higher profit and stabilized yield advantage, especially under adverse weather conditions. Some intercrops may act as barrier crops, some intercrops deter or others may attract insect pests of cotton and some intercrops attract natural enemies of insect pests. There is increasing awareness about the ill effects of pesticide, particularly in terms of pest resurgence, environmental pollution and toxic residue in food. Hence, efforts are being made to encourage those pest management practices (*i.e.* intercropping) which are eco-friendly. **Cotton variety, HD-432 was sown on 14<sup>th</sup> May and 11<sup>th</sup> May during 2016 and 2017, respectively, in the experimental area of Department of Entomology, CCS HAU, Hisar. Four intercrops were taken *i.e.* Sesame, Pigeonpea, Sorghum and Bajra. All intercrops were sown in the 2<sup>nd</sup> fortnight of July in both the years. There were nine treatments (Cotton+Sesame 1:1, Cotton+Sesame 2:1, Cotton+Sesame 3:1, Cotton+Pigeonpea 1:1, Cotton+Pigeonpea 2:1, Cotton+Pigeonpea 3:1, Cotton+Sorghum as border crop, Cotton+Bajra as border crop and Sole Cotton) and three replications in each treatment and the experiments were laid out in a randomized block design.** The population of leafhopper nymphs were recorded from three leaves, each one from top, middle and bottom canopies on five randomly selected plants per plot. The population were recorded on the lower side of leaves by gently turning the leaf in the morning hours. Observations were recorded at 10 days intervals starting from 10 days after sowing of crop. The results showed that minimum population of leafhopper nymphs was in cotton intercropped with *bajra* as border crop (2.47 nymphs/leaf) which was at par with cotton intercropped with sorghum as border crop (2.49 nymphs/leaf) and maximum population was in sole cotton (3.54 nymphs/ leaf). Among the intercrops, lowest population of leafhopper was recorded in cotton intercropped with *bajra* as border crop (2.47 nymphs/leaf) followed by cotton intercropped with sorghum as border crop (2.49 nymphs/leaf), cotton-pigeonpea 1:1 (2.85 nymphs/leaf), cotton-pigeonpea 2:1 (2.87 nymphs/leaf), cotton-sesame 1:1 (2.96 nymphs/leaf), cotton-sesame 2:1 (2.97 nymphs/leaf), cotton-pigeonpea 3:1 (3.02 nymphs/leaf) and cotton-sesame 3:1 (3.10 nymphs/leaf).

Keywords:- Leafhopper, population dynamics, intercropping, cotton

## Assessment of Combining Ability Effects for Several Yield and Quality Traits of different Strawberry cultivars (*Fragaria × ananassa* Duch.)

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The lines 'Chandler' and 'Sweet Charlie' and the tester 'Torrey' exhibited good general combining ability for various vegetative and fruit characters. The cross combination 'Douglas' x 'Fern' (2.74) due to its significant SCA effect was found to be best specific combiner for plant height and 'Gorella' x 'Fern' (3.02) for plant spread. The cross combination 'Sweet Charlie' x 'Fern' (4.27) has highest SCA for leaf number and area. Maximum positive SCA effect for fruit length were exhibited by the cross combinations 'Chandler' x 'Selva' (2.33) and for fruit breadth 'Douglas' x 'Fern' (3.14). The cross combination 'Confectura' x 'Selva' (2.01) had significant positive SCA effect for the trait fruit weight. For the trait number of fruits per plant the entire cross combinations exhibited non-significant SCA effects and were designated as average specific cross combinations. Estimates of 2SCA were higher in magnitude as compared to 2GCA and variance ratio was found less than one for the traits for the traits plant spread, leaf number per plant, leaf area, fruit length, fruit weight and number of fruits per plant, thereby indicated the predominant role of non-additive gene action whereas in the parameters plant height, fruit breadth and TSS 2GCA were higher in magnitude as compared to 2SCA and variance ratio was greater than one thereby showing additive gene action.

**Key words:** Lines, testers, specific combining ability, general combining ability, gene action



## Effect of Starlight wax emulsion coating on postharvest life and quality of persimmon fruit (*Diospyros kaki* L.)

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*Diospyros* fruit means “the fruit of God”. It is an edible fruit of ebony woody family (Ebenaceae), and is commonly known as persimmon, Oriental persimmon, Japanese persimmon, Kaki, etc. The fruit is very perishable in nature and has a double sigmoidal growth curve. Being a climacteric fruit, inhibiting ethylene biosynthesis or its action may play an important role in slowing the ripening process and enhancing the storage life of persimmon fruits. Among available technologies the use of edible coating material to retain the storage quality of the fruits has been widely used. Edible coatings are very effective against microorganism and have been successfully used to increase the shelf life of fruits. Starlight as a surface coatings can also improve the postharvest quality of fruits and vegetables by reducing transpiration losses. The present study was conducted during 2016-17 in Postharvest Physiology Laboratory, Department of Food Science and Technology, UHF, Nauni. The fruits were coated with edible wax emulsion available in the market i.e. Starlight as T1: 30%, T2: 40% and T3: 50% concentration. The coated fruits were packed in brown paper bags and stored under ambient as well as refrigerated ( $2\pm 1^\circ\text{C}$ ) storage conditions during which physico-chemical analysis of fruits was carried out at an interval of 10 days under ambient conditions and one month under refrigerated storage. From the trial it can be concluded that the persimmon fruits coated with 50 per cent of Starlight wax emulsion have been used to increase the shelf life upto 20 days at ambient and five month in refrigerated storage conditions.

**Keywords:** Persimmon, Starlight wax, edible coating, storage, postharvest life

## Assessment of Sub – alpine Forests in Inderkila National Park of Kullu District Himachal Pradesh, North Western Himalaya

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The present study was conducted in Inderkila National Park of Kullu district, Himachal Pradesh for the assessment of sub-alpine forest vegetation. Total seven trees communities namely, *Betula utilis*, *Quercus semecarpifolia*, *Acer acuminatum* - *Betula utilis* mixed, *Abies pindrow* - *Betula utilis* mixed, *Abies pindrow* - *Acer acuminatum* mixed, *Betula utilis* - *Corylus jacquemontii*, *Picea smithiana*-*Abies Pindrow* mixed were identified based on Importance Value Index (IVI). Among the communities, total density of trees, shrubs and herbs was ranged from 150 - 305 Ind ha<sup>-1</sup>, 249 - 610 Ind ha<sup>-1</sup> and 8.7 -35.5 Ind/m<sup>2</sup>, respectively. Total basal area was ranged from 5.8 -54.2 m<sup>2</sup> ha<sup>-1</sup>, total species richness 151 and Species diversity for trees was ranged from 0.5 – 3.5, shrubs, 0.0 – 3.1 and herbs, 1.5 – 2.9. The density and regeneration (i.e., seedlings & saplings) of *Acer acuminatum*, *Betula utilis* and *Quercus semecarpifolia* in most of the populations revealed that this species would continue to grow in the area. However, the continued anthropogenic activities, climate change and other natural factors may cause *Betula utilis* population depletion in the area. Therefore, frequent monitoring of the *B. utilis* populations is suggested for understanding the dynamics of vegetation and impact of anthropogenic activities and climate change.

**Keywords:** Assessment, Communities, Density, Total Basal Area, Species richness, Species Diversity, Inderkila National Park,



## Exploring the impact of $\alpha$ -terpineol, an essential oil component, in attenuation of quorum sensing regulated virulence factors and biofilm formation by *Pseudomonas aeruginosa*

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Cell to cell signalling system, quorum sensing (QS), in *Pseudomonas aeruginosa* is responsible for regulation of virulence factors and biofilm formation. Three QS regulatory circuits Las, Rhl and Pqs are closely related to its pathogenicity and establishment of chronic infections in *P. aeruginosa*. Therefore, QS may serve as an important target to attenuate its virulence. The present study was aimed to investigate the effect of sub-minimum inhibitory concentration (MIC) of  $\alpha$ -terpineol on QS regulated virulence phenotypes, biofilm formation and its synergistic interaction with ciprofloxacin (CIP) against *P. aeruginosa*. The MIC of  $\alpha$ -terpineol was found to be 6  $\mu$ L/ml and showed synergistic interaction with CIP (FICI < 0.5). The  $\alpha$ -terpineol showed significant anti-QS activity by marked attenuation effect on QS regulated virulence factors including pyocyanin, protease, elastase, and hemolysin alone and in combination with CIP. It also reduced swimming, swarming motilities and biofilm formation which was confirmed by scanning electron microscopy. The key QS genes (*lasI*, *lasR*, *rhlI* and *rhlR*) were successfully down regulated (2-6 fold reduction) in treated cells as evidenced by qPCR analysis. Furthermore, the molecular docking analysis revealed that  $\alpha$ -terpineol can act as strong antagonist of QS receptors, LasR, RhlR and Pqs. This is the first report to explore effect of  $\alpha$ -terpineol in controlling virulence and biofilm formation against *P. aeruginosa*. The findings of present study revealed that  $\alpha$ -terpineol can serve as potential anti-virulence agent in modulating *P. aeruginosa* infections.

**Keywords:** Quorum sensing, *Pseudomonas aeruginosa*, Anti-biofilm,  $\alpha$ -terpineol, Anti-virulence.

## Bio-pesticides- a new era for controlling Spider Mite (*Tetranychus urticae* Koch) infesting eggplant (*Solanum melongena*) and environmental Sustainability

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Egg plant or brinjal (*Solanum melongena* L.) crop is susceptible to various insect and mite pests of which red spider mite, *Tetranychus urticae* (Tetranychidae: Acarina) is the most predominant. *Tetranychus urticae* was most active during May i.e., 22-24 Standard Meteorological Week (SMW) and September-October i.e., 40-43 SMW. Highest mite population (22.87/leaf) was recorded on 42<sup>nd</sup> SMW (first week of October). Sudden fall of population was found in last week of June because of heavy rains. The mite population always recorded higher on the upper canopy (52.75% population) of the plant as compared with the middle (30.64% population) and lower canopy (16.61% population). This result implies that mites were most densely populated in the young and new leaves of eggplant. The mite population had significantly positive correlation with temperature, minimum and average relative humidity where as non-significant positive correlation with maximum relative humidity and weekly total rainfall. Among the seven treatments evaluated microbial toxin- avermectin resulted in the best suppression of mite population (87.10 % suppression), closely followed by chemical insecticide, fenazaquin and mixed formulation of botanical pesticide, azadirachtin with botanical extract, *Spilanthes* (79.24 % and 70.66% suppression). Spectrophotometric scanning of crude methanolic extract of *Spilanthes* flower showed strong absorbance wave length between 645-675 nm. Considering the level of peaks of wave length the flower extract contain some important chemicals of which polysulphide compounds are important and responsible of pest control. azadirachtin and botanical extract individually did not produce good results (moderate mite suppression) but when azadirachtin is used as a mixture with botanical extracts provided better results recording more than 65 % suppression. Microbial toxin, plant extracts and botanical insecticide are biopesticides having less or no hazardous effects on human health and the environment, and therefore, they can be incorporated in IPM programmes and organic farming.

**Keywords:** Seasonal fluctuation, bio-pesticides, vegetable IPM, organic farming, sustainability



## **Alternaria leaf spot of brinjal caused by *Alternariaalternata*(Fr.) Keissler – A new host record from Himachal Pradesh**

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### **Abstract**

Brinjal (*Solanum melongena*L.) also called eggplant or aubergine is one of the most important warm-season vegetables grown in different districts of Himachal Pradesh. During 2018 cropping season, a serious leaf spot disease of brinjal was observed in Himachal Pradesh and causing yield losses as high as 30-40 per cent during the cropping season. The characteristic symptoms of the disease appeared on leaves as small dark brown to black spot which later enlarged by forming concentric rings surrounded by yellow halo in the initial stages of disease progression. The disease resulted in severe blighting of leaves during warm climate coupled with high humid conditions. Isolation made from the diseased leaves on Potato Dextrose Agar revealed olive green to greenish black colour colonies with smooth whitish margins and regular zonations. The mycelium strands were hyaline in colour, septate and irregularly branched which turned to brownish-black when grew older. Conidia were obclavate to pyriform in shape with slender unbranched beak, golden brown to black in colour, born in a chain at the apex of conidiophores. On the basis of morphological and cultural characters the pathogen was identified as *Alternariaalternata*(Fr.) Keissler. Pathogenicity studies revealed the initial symptoms as small sunken isolated yellow to brown spots on the potted plant after 120 hours of inoculation. On detached leaves, the initial symptoms appeared as small yellow fleck after 62 hours of inoculation, while the symptoms on detached fruit appeared as small concentric, dull brown sunken spots after 75 hours of inoculation. Although there are few reports of occurrence of this disease in other states of India, yet this seems to be the first report from Himachal Pradesh regarding the occurrence of *Alternaria* leaf spot of brinjal Caused by *Alternariaalternata*(Fr.) Keissler.

**Keywords-** Brinjal, *Alternaria*, severe, localities, inoculation, detached.

## **Exploitation of Male Sterility in hybrid seed production of Vegetable Crops**

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Vegetable crops are the most extensively utilized for the exploitation of heterosis through hybrid seed production. Male sterility is one of the mechanisms utilized for hybrid seed production in vegetables. Male sterility is the failure of plants to produce functional anthers, pollen, or male gametes in a bisexual flower. This term was introduced by Darwin who was the first to propose that the loss of the male function could play an important role in plant adaptation and evolution. Both the public sector and the private seed sector has successfully utilized male sterility system in several vegetable crops on a global scale to produce hybrid vegetable seeds on a commercial scale. On the other side the public sector in India have bred several vegetables (e.g. tomato, brinjal, chilli, okra, bottle gourd, melons, cole crops etc.) although genetic emasculation through male sterility has been underutilized. Consequently, cost of hybrid seeds is comparatively higher, which is one of the major constraints in achieving more rapid adoption of vegetable hybrid technology. Nevertheless, crops like muskmelon and chilli present very successful examples of utilization of male sterility system in India. In Cauliflower CMS based lines in early and mid-maturity group were observed to be better as compared to conventional hybrid varieties for marketable curd weight and earliness. Male sterility are broadly classified into Genetic Male Sterility (GMS), Cytoplasmic male sterility (CMS) and Cytoplasmic Genetic male sterility (CGMS) systems. On a global level, CMS and CGMS are the most widely utilized in the majority of vegetables. However the achievement of complete male-sterility in the female-parent and the restored-fertility in F1-hybrids are the major bottlenecks in the commercial hybrid seed production. Identification of male sterile mutants in plants eliminate the cumbersome operations of emasculation and reduces cost of cultivation in hybrid seed production. Genetic male sterile mutant DKC 2363, with purple, shrivelled, squeezed anthers without pollen grains and pungent drooping fruits in chilli was reported by researchers in Himachal



Pradesh. Further development of practically feasible molecular markers may provide appropriate cost effective selection strategy to discard 50% male fertile sister plants at seedling stage, which may open the way to exploit monogenic recessive male sterile lines in several vegetables.

**Key words :** Male sterility, Hybrid seeds, Cauliflower, CMS, GMS, Chilli

### **Role of nitric oxide and reactive oxygen species in static magnetic field induced tolerance in soybean against ambient UV-b stress**

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The experiments were conducted to evaluate the impact of static magnetic field (SMF of 200 mT for 1 h) treatment on soybean under ambient UV-B stress. The SMF pre-treated and untreated seeds were grown under iron cages wrapped with polyester filters that cut off UV-A+B (< 400 nm) and UV-B (< 300 nm) radiations, polythene filter control (FC) that transmitted all the UV (280-400 nm) or ambient controls (OC) were without filters. Our results indicated that specific leaf weight, efficiency of PS II, activity of carbonic anhydrase (CA) and nitrogenase (NRA), DNA, RNA and protein content, nitric oxide (NO) and yield were significantly decreased in plants emerged from untreated seeds under ambient UV-B stress. SMF pre-treatment to the seeds mitigates the adverse effect of ambient UV-B and significantly enhanced the above measured parameters as compared to the plants emerged from untreated seeds under OC/ FC conditions. Polyphasic chlorophyll *a* fluorescence (OJIP) transients from SMF treated and UV excluded plants offered a higher fluorescence yield at the I-P phase as compared to the plants grown in ambient UV-B stress. Reduction in the level of superoxide (O<sub>2</sub><sup>-</sup>), hydrogen peroxide (H<sub>2</sub>O<sub>2</sub>), malonyldialdehyde content (MDA) and proline content with a remarkable increase in DNA, RNA, protein and NO content, and increased photosynthetic efficiency and nitrogen fixation in the leaves of soybean suggested the ameliorating effect of SMF pre-treatment against UV-B induced damage. This additional fixation of carbon and nitrogen by SMF pre-treatment and exclusion of solar UV was directed towards the improvement in crop yield. An evaluation of consequences of SMF treated seeds under ambient UV-B stress and growing plants of UT seeds under solar UV exclusion indicated a parallelism among the two effects. UV sensitivity index (SI) also showed that soybean plants that emerged from SMF pretreated seeds were UV-tolerant; SI was higher (3.36 and 3.37) for SMF and lowest (2.12 and 2.24) for UT seeds respectively under OC/FC conditions.

**Key Words:** Growth, nitric oxide, photosynthetic efficiency, reactive oxygen species, yield.

### **Hydrogel: Future's Boon For Horticultural Crop's**

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**Hydrogels** are water swollen polymer chain, having capacity to imbibe water when placed in aqueous environment. This ability to swell, under biological conditions, makes it an ideal material for use in drug delivery and immobilization of proteins, peptides, and other biological compounds. Due to the inimitable physical and chemical distinctiveness of hydrogels, such as hydrophilicity, Swellability and modifiability, there is increasing explore interest in the development and application of novel hydrogels in horticultural crops. Hydrogels have exhibited superior performance in the adsorptive removal of a wide range of aqueous pollutants including heavy metals, nutrients, and toxic dyes. Major challenge pertaining to adsorption kinetics, operational pH range, interference, and hydrogel recovery are examined. Hydrogel retains water in ground soil, reduces the frequency of required watering, and enhances the healthy growth of trees and plants. Hydrogel is beneficial for practically all forms of agriculture, horticulture and gardening, from fields, orchards and vineyards, to lawns, grass sports fields, parks, gardens, flower beds, and plant pots and boxes. Because the major requirement of the horticulture is water and if we use the hydrogel it increase water use efficiency as well. These hydrogels have the ability to sense changes of pH, temperature, or the concentration of metabolite and release their load as result of such a change. Day by water is decline phase due to which quality water is less



present on the earth So the solution for this save water as well use of these kind of material for sustainable agriculture

**Keywords:** Hydrogels; Horticultural Crops, pollutants

### **Sustainable Water Management and Agricultural Development in India with Special Reference to Himachal Pradesh**

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India is a developing country where more than 60 % people depend on agriculture. It remains the backbone of Indian economy. However, Indian agriculture depends on rainfall and the productivity is not equal every year and place. Though there are several reasons due to which agriculture is still not sustainable, but water is considered as one of the most critical resources for sustainable agricultural development throughout the world. And therefore, management of water resource has very important role in agricultural development. Irrigated areas should be increased, while fresh water supplies should be diverted from agriculture to meet the increasing demand of domestic and industrial use. Furthermore, the efficiency of irrigation is very low, since less than 65 % of the applied water is actually used by the crops. The sustainable use of irrigation water is a priority for agriculture in arid areas. So, under scarcity conditions and climatic change considerable effort should be done to introduce policies aiming to increase water efficiency based on the assertion that more can be achieved with less water through better management. Better management usually refers to improvement of water allocation or irrigation water efficiency. Agricultural practices, such as soil management, irrigation and fertilizer application and disease and pest control are related with the sustainable water management in agriculture and protection of the environment. Socio-economic pressures and climate change impose restrictions to water allocated to agriculture. The adoption of sustainable water management in Mediterranean is not only a technological problem but involves many other considerations relative to social behavior of rural communities, the economic constraints, or the legal and institutional framework that may favor the adoption of some measures and not others. Sustainable water management in agriculture has a multi-functional role like improvements in irrigation application, soil and plant practices, water pricing, reuse of treated wastewater, farmers' participation in water management and capacity building. Under this presentation, an attempt has been made to illustrate the effect, need and method of water resource management for sustainable agricultural development in India with reference to Himachal Pradesh.

**Keywords:** Sustainable agriculture, Water management; Climate Change, Irrigation.

### **Metagenomic analysis of biodynamic preparations for microbial community variation**

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Biodynamic agriculture revolves around the use of biodynamic preparations (BD 500–507). These preparations are effective in improvement of soil fertility and management of insect pest in various crop production. The process for preparation of these biodynamic preparations is different for each one. Though, a number of research reports are available on the role of Biodynamic preparations (BD) in improving the yield and quality of crops. Yet, the principle behind their bio enhancing power has still not been much worked out. Our earlier studies report the role of culturable microbes having high enzymatic activity. However, because of the fact that most microorganisms cannot be grown readily in pure culture, metagenomic approach was followed. The results indicated the highest number (16657) of unassigned bacteria were observed in Sample BD506 followed by BD 502 (7395 no.). Bacteria belonging to phylum OD1 and class ZB2 were unidentified at order, family, genus and species level and were present in maximum number in BD 504 (10003no.) followed by BD 506 (7629). Highest total bacterial number was observed in BD 506 followed by BD 501 and then 504. The study explains the effectiveness of BD preparations under field conditions owing to the presence of diverse group of bacteria. Similar Rich diversity was observed in fungal metagenomic analysis as well.





**Keywords:** Biodynamic preparations, metagenomics

### **Heavy Metalstress in Mustard(*Brassica Juncea*) And Its Influence on the Glycine Betaine and Proline Metabolism**

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Several species from the *Brassica* genus are very important agricultural crops in different parts of the world and are also known to be heavy metal accumulators. There have been a large number of studies regarding the tolerance, uptake and defense mechanism in several of these species, notably *Brassica juncea* and *B. napus*, against the stress induced by heavy metals. Numerous studies have also been published about the capacity of these species to be used for phytoremediation purposes but with mixed results. This review will focus on the latest developments in the study of the uptake capacity, oxidative damage and biochemical and physiological tolerance and defense mechanisms to heavy metal toxicity on six economically important species: *B. juncea*, *B. napus*, *B. oleracea*, *B. carinata*, *B. rapa* and *B. nigra*. The genus *Brassica* (Brassicaceae) includes more than 30 species. Due to much more natural and anthropogenic activities, heavy amount of heavy metals have been added into the soil as well as into the water. These cause great disturbances in plants as well in human beings. So, there is a wide interest in the field of scientific research against heavy metals toxicity role in plants. In this way, Osmolytes such as proline is organic substance which normally regulates plant growth and nourishment of plants, grown widely in the areas. Hence, by applying proline or/ by inserting of gene(s) boost up the activity of different enzymes and metabolic pathways are very effective to cope with heavy metals toxicity.

**KEYWORDS:** Accumulators, Phytoremediation, Osmolytes, heavy metal toxicity, proline, Physiological tolerance

### **Comparative Studies of Carrot Pomace Drying by Mechanical Tray Dryer and Microwave Dryer**

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Utilization of pomace in food applications is important from nutritional point of view as they possess good amount of tocopherols, phytosterols, carotenoids and antioxidant activity. Carrots were procured from the local market of Udaipur district of Rajasthan. The pomace was separated out after extraction of juice and blanching was done and then pomace weighing 250g were dried in mechanical tray dryer at air temperature of 50, 65 and 80°C at fixed air velocity of 1m/s and in microwave dryer at power level of 420, 560 and 700W. All the data were statistically analysed. Drying took place in falling rate period and constant rate period was absent in both drying experiments. The moisture diffusivity varied in the range of  $4.54 \times 10^{-9}$  m<sup>2</sup>/s to  $1.45 \times 10^{-8}$  m<sup>2</sup>/s during drying in mechanical tray dryer and varied in the range of  $1.29 \times 10^{-8}$  m<sup>2</sup>/s to  $4.28 \times 10^{-8}$  m<sup>2</sup>/s in microwave dryer. -carotene range was found between 1.10 mg/100g and 5.25 mg/100g in mechanical tray dryer and between 1.02 mg/100g and 3.36 mg/100g in microwave dryer. Ascorbic acid range was found between 1.5 mg/100g and 2.1 mg/100g in mechanical tray dryer and between 0.75 mg/100g and 1.425 mg/100g in microwave dryer. Maximum redness was found in sample dried at 420W microwave power level in microwave dryer.

### **Soil Quality Assessment in Mountainous Agro-Ecosystem using Geospatial Approach**

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A decline in the land quality due to land degradation has become the major issue in the mountainous ecosystem of the Himalayan region. Sustainable use and management of fragile land resources of mountainous ecosystem is vital for maintaining soil quality. Farming on sloping lands, deforestation of hillsides and mountains coupled with increasing soil tillage has led to



increased land degradation, soil erosion, and in some cases, landslides. Improper land management can lead to land degradation and a significant reduction in the productive and service functions of watersheds and landscapes. The present study was aimed to assess soil quality in Maniyar river watershed of mountainous ecosystem located in TehriGarhwal district of Uttarakhand, India. The study involves characterization of soil and terrain parameters and estimation of Soil Quality Index (SQI) by selecting minimum soil dataset. Soil Quality Index is a function of summation of weight multiplied by score for each parameter. Digital elevation model - CartoDEM was used in automated delineation of landforms based on Topographic Position Index (TPI) algorithm using Arc-GIS. Total 103 soil samples (0-20 cm and 20-50 cm) from 45 sites were collected from various landforms and analyzed for physico-chemical properties of the soil. Principal Component Analysis (PCA) was used to reduce the data redundancy and identifying of suitable indicators of soil quality. These indicators were assigned with weight and score to compute Soil Quality Index (SQI). Weight assignment was done following Analytical Hierarchy Process (AHP) and scoring was done by scaling method. SQI of each landform types in the watershed were estimated. SQI in the valley area was estimated highest (0.72) followed by lower hillslope (0.68), middle hillslope (0.67) and upper hillslope (0.65). Soil quality evaluation at hillslope scale will serve as an important mean to prepare effective land use and management plan in the watershed.

**Key words:** Soil quality, hillslope, Geospatial, Himalayan region,

### **Green synthesis of Silver nanoparticles using *Brachystelma ciliatum* bulb extract and its biological activities**

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Nanomaterials offer several benefits for environment and compatibility for biomedical applications such as biosensors, drug, gene delivery, diagnostic tools and cancer treatment which have extensively studied throughout the past decade, like engineering as catalyst and optics. Currently, silver nanoparticles (AgNPs) gained importance, owing to its advantages and versatile potentials such as antioxidant, antimicrobial, pharmaceuticals, anti-angiogenic, wound healing, anti-inflammatory activity and anticancer activity. AgNPs produced by the biological method has a considerable significance owing to the natural abundance of renewable, cost-effective, those by implementing the green chemistry principles. A number of studies have been proved the antimicrobial activity of AgNPs against pathogenic and multidrug-resistant microorganisms. The plant mediated synthesis of AgNPs has become increasingly recognized as a mean to produce cytotoxic agents to fight various cancer cell lines. In the present study, synthesis and characterization of silver nanoparticles and biological activities such as antimicrobial, anti oxidant and *in vitro* Cytotoxicity against breast cancer cell line MCF-7 were tested.

Confirmation and characterization of synthesized nanoparticles by UV-vis spectroscopy, FTIR, DLS, XRD, EDX and TEM. For the assessment of anti microbial activity gram positive and gram negative bacterial pathogens *S. aureus*, *B. subtilis*, *V. cholerae*, *E. coli* and fungal pathogens *A. niger* and *C. albicans* were used. *In vitro* anti oxidant activities DPPH, FRAP, Metal chelating and Phosphomolybdenum was studied. *In vitro* Cytotoxic effect of *B. ciliatum* extract and AgNPs were tested against breast cancer cell line MCF-7.

**Keywords:** Nanoparticles, Antioxidant, Cancer, Cytotoxicity, Breast cancer

### **Effect of different nutrient sources on quality of fodder cowpea**

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Livestock production is an important component of Indian agriculture, contributing 4% to national GDP and a source of employment, as also livelihood, for 70% population in rural areas. India is the highest producer of milk in the world (producing more than 175 million tons per annum) but the milk production per animal is low. Imbalanced feeding and nutrient deficiency are the major issues for low productivity. Inadequate availability of forage resources, both quantitatively and qualitatively has



adversely affected the growth, health, reproduction and production potential of animals. For making the availability of quality green fodder, agronomical intervention like nutrient management plays an important role. However, application of different nutrient combination increase the quantity as well as quality of fodder. Results from a field experiment carried out during *kharif*, 2017 at Research Farm of Agronomy Section, ICAR- National Dairy Research Institute revealed that application of 66.67% RDF + Rhizobium + PSB + KSB + ZnSB significantly improved the quality parameters viz., crude protein (18.30%) and nitrogen concentration (2.93%) of fodder cowpea. However, lower content of total carbohydrate (70%), Nutrient detergent insoluble crude protein (6.84%) and Acid detergent insoluble crude protein (2.40%) on dry matter basis which shows the good quality of fodder were obtained by employing the above treatment than the other treatments.

Keywords: Fodder cowpea, Quality, organic, inorganic nutrient sources

### Characterization Of Late Blight Disease From Major Tomato Growing Areas of Himachal Pradesh And Development Of Integrated Management Strategy

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Tomato (*Solanum Lycopersicon* L) is one of the most widely grown vegetable crop in the world, second to potato. Tomato is the most important solanaceous crop grown worldwide under both open field and protected cultivation. In Himachal Pradesh, it is grown on about 9,930 hectares with an annual production of more than 4,13,709 metric tonnes and major varieties grown in State are Himsona, Solanlalima and Arakshita. Himachal is off season tomato producing state in India where tomato is grown during *kharif* season whereas in plains it is generally grown during *rabi* season giving distinct comparative advantage to the farmers. The area under tomato cultivation has increased but the production has not increased proportionally and the productivity is quite low in comparison to advanced tomato growing countries of the world. The reason for low productivity could be many but one of the reasons is the damage caused by insect pests and number of fungal, bacterial and viral diseases during its growth period. Of them, fungal diseases are of most economic importance and are responsible for huge losses to the growers. Among them, the Oomycete *Phytophthora* represents one of the most serious threats to production. Of the biotic factors responsible for losses to tomato crop, late blight plays an important role. The disease is highly destructive if timely control measures are not taken and almost all varieties of tomato are susceptible to this disease. So our present study to find out resistance sources for the disease and development of effective integrated management strategy through fungicides, botanicals and biocontrol.

### Ecosystem Services Approach for Sustainable Development and Biodiversity Conservation

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The concept of Ecosystem Services and its framework has been important in understanding the way in which it benefits the people and their surroundings. This has led to a number of approaches that are being used increasingly to support the sustainable development and management of biodiversity and ecosystems. However, the utility of the ecosystem services framework and associated tools for supporting biodiversity conservation are the subject of ongoing debates among conservationists. In the present study the various frameworks and the concepts that are needed to assess the ecosystem services in order to find out a suitable strategy for conserving various ecosystems like the Forest, Marine, Terrestrial and Agro-ecosystems with particular focus on Agriculture sector has been discussed. The study highlights on the several general ways in which



ecosystem services approaches support biodiversity conservation, which may not have been possible otherwise. The various new opportunities that ecosystem service approach provide for the conservation of biodiversity include opportunities to add or create new value to protected areas, the opportunities to manage ecosystems sustainably outside of protected areas as well as the development of broader constituencies for conservation and expanded possibilities to influence decision-making. Extensive literatures have been reviewed on the relationship between the socio-economic systems and the ecosystems that become functional with the help of certain drivers of change. Along with it we found out the levels and extent of services provided by each ecosystem and its limitations thereof. Understanding the benefits and limitations of using ecosystem services approaches for achieving biodiversity conservation will help ensure that the finite resources available for biodiversity conservation and sustainable development are used as strategically and effectively as possible to maintain the multiple components of biodiversity and to support human well-being and ecological balance at large.

**Keywords:** Ecosystem Services, Approaches, Biodiversity, Sustainable Development, Agriculture, Ecological.

### **Assessment of Farmer Vulnerability and Adaptation to Climate Change: A Case Study in Shivalik foothill Eco System**

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Social vulnerability of a community has emerged as the least known element in the changing climatic scenario. Among all the sectors, Agriculture sector is more vulnerable to climate change and since the farm lands in Haryana Shivaliks are generally rainfed which are more exposed to climate hence more vulnerable. There is lack of research data on the easurement of social vulnerability with respect to soil and water conservation technologies. The study was conducted in Shivalik Foothill villages in Northern Himalayas in Panchkula district of Haryana to assess the level of vulnerability of farming community and their capability and strategy for adaptation to climate change. Considering the various dimensions of individual (attitudinal, knowledge and skills), social (interconnectedness and cohesiveness), availability of physical resources and other livelihood support systems; social vulnerability index was calculated to measure vulnerability of sample respondents. Majority of the respondents (about 49 per cent) were in highly vulnerable group followed by about 29 per cent in vulnerable group, while about 21 per cent were in moderately vulnerable group. The farmers in the area largely having marginal land holding, having lack of knowledge and skill about adaptation technology and having very high training needs in various areas of adaptation technology could be the factors for their vulnerability.

**Key words:** Farmer, Vulnerability, Adaptation, Climate Change

### **Carbon trading to save future**

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Global climate change is becoming an alarming problem of the 21st century with global warming as the biggest challenge. Man-made activities have added significant quantities of greenhouse gases (GHG) to the atmosphere ever since the Industrial Revolution. According to the Intergovernmental Panel on Climate Change (2001), the atmospheric concentration of CO<sub>2</sub>, CH<sub>4</sub> and N<sub>2</sub>O has risen by about 31%, 151% and 17%, respectively between 1750 and 2000. This International concern about climate change led to the Kyoto Protocol in 1997, which consists of legally binding emission target for industrialized countries to be achieved during the Kyoto commitment period i.e. 2008-2012. The Protocol provides various flexibility mechanisms to mitigate the climate change. This includes International Emission Trading (IET), Joint Implementation (JI) and Clean Development Mechanism (CDM). Carbon credits are a key component of National and International emission trading schemes. These are certificates awarded to the countries that are successful in reducing emission of GHGs. They serve the dual purpose of



protection of nature as well as source of revenue generation for the developing and underdeveloped countries. It encourages reducing GHG emission by capping total annual emission and letting the market assign a monetary value to any shortfall through carbon trading. For trading purpose, one carbon credit is equivalent to one tonne of CO<sub>2</sub> emitted. These credits can be exchanged between businesses or bought and sold in international market at the prevailing market price. In India, carbon is traded on India's Multi-Commodity Exchange. It is the first exchange in Asia to trade carbon credits. Agriculture is the backbone of Indian economy and agricultural emissions account for about 14 % of total greenhouse gas emissions. Furthermore, agriculture is the largest source of non-CO<sub>2</sub> GHG emissions, generating 52% and 84% of total methane and nitrous oxide emissions, respectively. Agriculture practices account for about 20% of India's total emission, hence cost-effective reduction from this sector could significantly reduce India's total emission. India is a developing country hence it has no restrictions to be followed in case of carbon emission. CDM is gaining momentum in our country. Wide spectrum of projects can be started because India is having vast technical human resource and strong industrial base. One of the areas in which CDM projects can be initiated is the biomass projects. The Government of Punjab and Haryana are providing subsidies to farmers for establishing biomass projects. In case farms are of small size such that not enough residues are generated to feed the biomass project then CDM provides the option to bundle up several such small projects and seek carbon credit collectively. Apart from reducing GHG emission, Agriculture CDM projects offer a profitable option for revenue collection through carbon credits for farmers.

**Key words:** Carbon Credit, Carbon Trading, Kyoto Protocol, CDM, GHG emission.

### **Alternative utilization of food residues for fermentative production of bioethanol**

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*Agro-industrial wastes and food residues are often dumped in the open which may pose serious environmental issues. Recycling or various other techniques of utilization of these wastes are already available, which may reduce this waste worldwide. Traditionally reduction of these waste residues using chemical or enzymatic treatment is done and is a well-known practice. This study aims at utilizing a few of the food residues that are generated locally and dumped on the streets without any utilization of numerous nutritional components. Analysis shows that these wastes can be extracted, under specific conditions, for basic nutritional component needed for growth of *Saccharomyces cerevisiae*, one of the commonly used ethanol fermenting yeasts. In this study, optimization of fermentation conditions was achieved to improve ethanol yield. Among the three available substrate selected, the 30 minute extract of Bagasse gives the maximum reducing sugar content and on estimation for alcohol it also gives the best result (0.202% w/v) than Spent Tea Extract and Hydrolyzed Potato Wash Water. These wastes used possess potential for utilization in ethanol production, which forms one of the industrially important products.*

**Keywords:** Food waste, Fermentation, *Saccharomyces*, Alcohol.

### **Assessment of Genetic Divergence Using Mahalanobis D<sup>2</sup> In Tomato Genotypes (*Solanum Lycopersicum L.*) under Southern Telangana Conditions**

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Collection and evaluation of genotypes of any crop is a pre requisite for any programme, which provides a greater scope for exploiting genetic diversity. The genetic divergence was studied among a set of twenty three genotypes of tomato (*Solanum lycopersicum L.*) for twenty four characters in *Kharif*, 2018. The lines/varieties differed significantly for all the characters. By using D<sup>2</sup> analysis, the twenty three strains were grouped into nine clusters. The intra cluster D<sup>2</sup> values ranged from 0.00 to 1795.01. Cluster IV had the maximum D<sup>2</sup> value (1795.01). Highest inter cluster generalized distance (20323.09) was observed between cluster IX and cluster V. Hence, the crossing between the types of these two clusters may result in the development of useful



progenies. The characters, which are contributing maximum towards divergence, were average fruit weight contributed maximum (3873.52 %) towards divergence by 98 times followed by total soluble solids (1857.71 %) by 48 times whereas, membrane stability, number of flowers per cluster, root length, number of fruits per cluster did not contribute towards divergence.

**KEY WORDS:** Divergence, Tomato, Varieties and Cluster.

### Studies on rooting behaviour of *in vitro* grown plantlets of *Citrus jambhiri* Lush.

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An extensive study on root induction from different explants under various concentrations of plant growth regulators (PGRs) was carried out. Multiple shoot proliferation from nodal explants, shoot tip cultures and root explants in *C. jambhiri* Lush. have been standardized. Rooting was induced under NAA, IAA, IBA and ADS. MSN+ADS (1.0 mg/L) induces shoots and roots (3-4 weeks) from *in vitro* shoot tip cultures. The root initiation has been observed in ½ MSN as early as 7 DAI with higher no. of roots (4.3). However, auxins (NAA) induced thick and hairy roots with callus like structures at 2-3 DAI. Apart from being cytokinins, ADS plays an important role in root induction in *C. jambhiri*. Internal and external root structure was examined through scanning electron microscope (SEM). ½MSN and MSN+ADS (1.0 mg/L) without auxin imposed better root proliferation at 1-2 weeks of culture. Plantlets derived from MSN+ADS (1.0 mg/L) showed higher survivability (80-90%) while acclimatization and hardening. Growth response factors were highly expressed under ADS while compared with other PGRs. It has been concluded that, ADS in association with MSN vitamin resulted in shoot and root proliferation with better survivability of *in vitro* plantlets.

**Key words:** *in vitro*, Kachai lemon, root induction, SEM, MSN, ADS

### Insecticide Resistance Management (IRM) Strategy with special reference to Brinjal Shoot and Fruit Borer

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Resistance can be defined as a genetically change in the sensitivity of a pest population that is reflected in the repeated failure of a product (insecticides) to achieve the expected level of control when used according to the label recommendation for that pest species. The annual losses resulting from the resistance of pests to insecticides is more than \$1.5 billion (Hua *et al.*, 2014). Resistance to pesticides is a setback that is escalating. It is approximated that more than 1000 pest species have resistance to at least one pesticide. Among the arthropods, the greatest resistance occurs in the order Diptera, followed by Lepidoptera, Coleoptera, Hemiptera and mites (Ugurlu, 2012). A total of 25 modes of action currently in the classification of IRAC (Insecticide Resistance Action Committee), 85% of these modes of action come from insecticides that act on the nervous and muscular systems. Of these, the group of neonicotinoids is the most representative on the market (27%), while the organophosphates, carbamates and pyrethroids together represent 31%. On the other hand, insecticides that modify growth and development, as well as those that alter the production of energy (respiration), are 13%. At least 325 insecticides already have technical reports of resistance by one or more species (Sparks and Nauen, 2015). Different levels of resistance have been found in the different classes of insecticides. DDT, organochlorines, carbamates, organophosphates, pyrethroids and pyrethrins are the chemical groups that present a higher level of resistance, largely due to their diversity of chemical compounds, and for the long time of use in the market; however, in other insecticides considered as a new generation, resistance reports also have been found.

The first influential strategy was to apply two or more insecticides alternating in turn, that is rotation. The basic idea of rotation is simple: Relax the selection pressure of a single toxin by applying a different toxin for some period of time. Several



field and laboratory experiments have confirmed the effectiveness of rotation and it still plays an important role in resistance management (Cloyd, 2010). However, mixture of toxins is another important strategy both for conventional insecticide applications and for Bt crop management. Although a mixture of multiple toxins has conventionally been used to enhance pest control, empirical and theoretical work suggests that it is also effective to delay or prevent insecticide resistance. Considering above background information, the present study was conducted against brinjal shoot and fruit borer, *Leucinodes orbonalis* with different IRM (Insecticide Resistance Management) strategies viz. sequential strategy, rotational strategy and mixture strategy. After three years of experimentation, it was revealed that rotational strategy (Rynaxipyr 20 SC @ 0.4 ml/l followed by Emamectin benzoate 5 SG @ 0.5 g/l, spinosad 2.5 SC @ 1.5 ml/l, chlorpyrifos 20 EC @ 2 ml/l, cypermethrin 25 EC @ 0.5 ml/l) was found significantly superior in reduction of shoot as well as fruit damage (6.84% and 8.47%) and obtained highest (360 q/ha) yield as compared to others. It was followed sequential strategy (T1 – Rynaxipyr 20 SC @ 0.4 ml/l, T2 – Emamectin Benzoate 5 SG @ 0.5 g/l).

**Key words:** IRM, Brinjal Shoot, Fruit Borer

## Customization of Food through Food Printing

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Currently, a concept of food printing is catching the eyes of consumers, industries and researchers. Food printing opens the channel for on-demand customization of the product which is impossible to achieve by manual labor or conventional mold. Customization not only includes the preference of consumers but also allows variation in shape, texture, taste and has the provision to design the food as per individual's health and activity level. The nutrients, caloric content, allergens and portion size can also be automatically determined and controlled through the automated production of the foods. This technology is useful to apply complicated and extraordinary food designs based on predetermined data files that comprise knowledge and skills from culinarians, nutritionists, technologists and food designers. 3D food printing closely replicates the process in non-food based 3D printing. Food printing involves a single processing step to convert the material into the final form. But, maintaining precise 3D shape throughout the cooking processes is a significant challenge for most printed foods. Three major techniques for printing involves bio driven, bottom-up and top-down approaches which exploit animal based food, non-conventional sources like algae, insects and traditional edible materials like chocolates, dough, puree etc. as raw material. Extrusion based printing, selective sintering printing (SLS), binder jetting, and inkjet printing methods are used to print the foods. 2D and 3D printed foods are available in market. Food printing is successfully being applied on pizza, cakes, chocolates and other products. Food printing may be used as household level, commercial and industrial level depending upon the requirement of customers. Future of food printing is undoubtedly bright but many challenges are need to be focused. Researches are consistently being conducted to focus on the challenges like printing precision, accuracy, process productivity, production of colorful, multi-flavor, multi-structure products to use this technology successfully.

**Key words:** 3D printing, Additive printing, Customized food, Food fabrication, Food printing, Printed foods.

## High prevalence of Uranium and other potentially toxic elements in groundwater along with associated health risk assessment of SW- Punjab.

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Uranium is recognized as one of the pollutant in groundwater sources, having both radiological and toxicological effects. The different sources of uranium can be natural or geogenic, mining or industrial activities and chemical based fertilizers used in agriculture. The aim of our present study is to examine the distribution of uranium, potentially toxic elements and hydrochemical



components in groundwater of Bathinda district situated in SW-Punjab along with its carcinogenic and non-carcinogenic threats to human population due to its ingestion residing in that area. Average uranium concentration was found to be 87.7  $\mu\text{g L}^{-1}$  with 73.8% samples exceeding WHO limit of 30  $\mu\text{g L}^{-1}$ . Distribution analysis revealed that groundwater contamination of the study area was majorly due to the presence of As and Hg with mean values of 175.6  $\mu\text{g L}^{-1}$  and 173.6  $\mu\text{g L}^{-1}$  which are quite above their acceptable limits of 10  $\mu\text{g L}^{-1}$  and 1  $\mu\text{g L}^{-1}$ , respectively. Hydrochemical analysis showed that bicarbonates was the dominating anion present in groundwater. Principal component analysis (PCA) and cluster analysis (CA) were also performed to identify the sources of contamination and it was found that both natural and anthropogenic factors were influencing the groundwater quality. Evaluation of Hazard Quotient (HQ) indicated that HQ values in case of children for As (35.80) and Hg (35.39) were higher than the adults for As (27.66) and Hg (27.34) and these values were also beyond than safe limit (HQ = 1) in the study region which pose negative health effects due to its intake via groundwater.

**Keywords:** uranium, potentially toxic elements, risk assessment, Principal Component Analysis (PCA), Cluster Analysis (CA), groundwater.

### Decreasing trend in ecological sustainability of forests present at Kumaun Himalaya, Uttarakhand

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**Abstract-** Forests present at Himalayan region have always been considered very important in terms of management of global carbon issues. The ratio of dense forest in comparison to other forest is very less. The increasing level of atmospheric carbon dioxide every year need more forest cover to absorb it into their long lived pool. However the forests present at or near transition zone which were earlier considered as the moderately dense forests are converting into open forests and have become a source of net carbon release to the atmosphere instead of sink. To study the change in trend of carbon sequestration by forest of Kumaun region three dominating forest of Kumaun Himalayan region of Uttarakhand were selected. The results revealed that carbon sequestration by the tree species of forests at site I (sal forest) ranged between 4.46 t ha<sup>-1</sup>yr<sup>-1</sup> to 5.02 t ha<sup>-1</sup>yr<sup>-1</sup>, site II (pine forest) 2.20 to 3.89 t ha<sup>-1</sup>yr<sup>-1</sup> and site III (oak forest) 5.81 t ha<sup>-1</sup>yr<sup>-1</sup> to 11.27 t ha<sup>-1</sup>yr<sup>-1</sup>. The values were found less in comparison with earlier studies. Least carbon sequestration by pine forest is a serious matter of concern among other forests. Hence the results for carbon sequestration of tree species present at different forest sites clearly present a picture of decreasing ecological sustainability of Kumaun Himalayan Forests.

**Keywords:** Forests, Himalaya, Carbon sequestration, ecological sustainability

### Rhizospheric and endophytic microbes with multifarious plant growth promoting attributes for agricultural sustainability

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Microbiomes of the plants plays very important role in plant growth and development as they may possess different plant growth promoting attributes. Plant growth-promoting microbes offer an environment-friendly means for enhancing productivity and sustainability in agriculture as they decrease the global dependence on hazardous agricultural chemicals which destabilize the agro-ecosystems. In the present investigation, both rhizospheric and endophytic microbes have been isolated from various cereal crops like wheat, barley, oats, maize, pearl millet, foxtail millet, finger millet, buck wheat and Amaranthus. Total 692 isolates were obtained in which endophytic and rhizospheric are 392 and 200 respectively. They were isolated on different growth media including nutrient agar, King's B agar, tryptic soy agar, rose Bengal agar, potato dextrose agar, and ammonium mineral salts. All the isolates were screened for multifunctional plant growth attributes and found that 221, 74 and 179 exhibited the phosphorus, potassium and zinc solubilizing attributes respectively. Among the 692 bacteria, 151, 142, 58 showed the production of





siderophores, ammonia, HCN respectively where as 45 show the nitrogen fixing attributes confirmed by acetylene reduction assay. The seven selected bacteria on the basis of multifarious plant growth promoting attributes were further evaluated for growth of barley and wheat and found that these culture increases the root length, shoot length, phenolic content, chlorophyll content and biomass of the plant as compared to control. These microbes were identified by 16S rRNA gene sequencing. *Pseudomonas gessardii*, *Pseudomonas panacis*, *Citrobacter* sp., *Acinetobacter calcoaceticus* were rhizospheric cultures and endophytes were identified as *Erwinia persicina*, *Serratia marcescens*, *Rahnella aquatilis*. These efficient plant growth promoting bacteria could be used as bioinoculants for crops growing in hilly region for agricultural sustainability.

**Keywords:** Agricultural sustainability, Diversity, PGP attributes, Plant growth, Soil health

### **Weed Problem And Their Management In Seed Crop of Cowpea (*Vigna Unguiculata*): CV C-152**

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A study entitled “Weed problems and their management in seed crop cowpea (*Vigna unguiculata*): cv C-152” was conducted during *Kharif* season of 2014 at research farm of Agronomy section, ICAR-NDRI, Karnal. Two experiments were carried out under this study. First experiment was to determine the **critical period of weed competition** and Second experiment to evaluate the **efficacy of herbicides with and without hand weeding on weed and their effect on forage, seed yield and quality in Cowpea (cv C-152)**. First experiment consisted of ten treatments viz Weed free (20, 40, 60, 80 DAS, Season long), Weedy check (20, 40, 60, 80 DAS, Season long). Second experiment consisted of ten treatment viz Pendimethalin 1.0 kg a.i./ha PE + 1HW at 40 DAS, Pendimethalin 1.0 kg a.i./ha PE, Oxyfluorfen 0.2 kg a.i./ha PE + 1HW at 40 DAS, Oxyfluorfen 0.2 kg a.i./ha PE, Imazethapyr 0.075 kg a.i./ha POE at 20 DAS + 1HW at 40 DAS, Imazethapyr 0.075 kg a.i./ha POE at 20 DAS, Quizalofop-*p*-ethyl 0.025 kg a.i./ha POE at 20 DAS + 1HW at 40 DAS, Quizalofop-*p*-ethyl 0.025 kg a.i./ha POE at 20 DAS, Weed free and Weedy check. Significantly higher seed yield was obtained when crop was kept weed free for initial 60 DAS compared to 20 and 40 DAS. Seed yield of cowpea remained at par when weeds were allowed to grow with crop for initial 20 days compared to season long weed free. There was significant reduction in seed yield when weeds were allowed to grow with crop beyond 20 DAS. Weed free 60, 80 and season long recorded significantly higher yield attributes and seed quality as compared to season long weedy check. There were reduction in green fodder yield, dry fodder yield and seed yield to an extent of 50.37%, 54.11%, and 41.92% respectively with season long weedy as compared to season long weed free treatment. The critical period of weed crop competition was determined between 25 to 57 DAS. In the second experiment application of pendimethalin 1.0 kg a.i./ha PE + 1HW at 40 DAS caused significant reduction in total weed density and total dry weight over weedy-check resulting in higher weed control efficiency followed by imazethapyr + 1HW. Application of quizalofop-*p*-ethyl 0.025 kg a.i./ha POE at 20 DAS found inferior in controlling the broadleaf weeds resulting higher dry weight accumulation and lower weed control efficiency. There was significant increase in Growth, yield attributes, seed quality parameters, crude protein content, ash content, cell soluble and significantly lower NDF, ADF and hemicellulose at maturity in weed free and pendimethalin + 1HW as compared to weedy check. Green fodder yield, dry fodder yield and seed yield with pendimethalin + 1HW recorded an increase of 53.62%, 84.11%, and 54.69% respectively as compared to weedy check treatment. The highest net returns were recorded with weed free treatment while B:C ratio was obtained with pendimethalin + 1HW and lowest B:C ratio was with quizalofop-*p*-ethyl POE + 1HW.

**Key Words:** Cowpea, weed management, Herbicide

### **Integrated Weed Management (Iwm)**

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Globally, weeds cause higher agricultural production losses than other agricultural problems. Integrated weed



management is one of the important tools used in today's era to manage weeds. Integrated weed management is defined in a range of ways, but at its core is the idea that many different weed management tools be used in an integrated way to manage weeds. One way to conceptualize integrated weed management is overlapping the four sciences/means of managing weeds: physics, chemistry, biology and ecology. Physical weed management approaches include mechanical techniques such as hoeing and tillage and thermal techniques such as flame weeding; Physical weed management approaches include mechanical techniques such as hoeing and tillage and thermal techniques such as flame weeding; Chemical weed management is dominated by the synthetic herbicides but there are also natural herbicides; Biological weed management uses an understanding of plant biology for example germination to manage weeds; Ecological weed management uses the interactions among species to achieve weed control, e.g., crop-weed competition, allelopathy and crop rotations. It has proved to be a valuable concept in a few cases, though much is still to be done to extend it to the small farmer's level. Integrated Weed Management (IWM) approach aims at minimizing the residue problem in plant, soil, air and water. It aims at bringing down the weeds intensity to such low levels so that they do not pose any significant danger to crops and humans. It uses the creative application of agronomic, biological and chemical methods to control weeds. IWM is the need of the situation as today the world is facing the problem of environment pollution due to the use of harmful and strong chemicals in curing weeds which pollute the land, air & water very badly. So pollution free environment is essential for sustaining life on earth which can be brought by using IWM in weeds. Integrated weed management is a technique consisting of multiple weed control approaches in an integrated manner with an objective of avoiding crop losses and negative effects of different weed control methods. The sole reliance on any of the conventional weed control methods would enhance its negative impacts on crop production and environment as discussed above. Thus, the best approach for weed control is an integrated approach with maximum effect on weed control limits non target effects and sustains crop productivity. Therefore, the existing weed control practices should be integrated with biological weed control techniques in almost all for realizing potential benefits from all component strategies for effective weed control and assuring safety of the environment. **Keywords:** IWM, Weeds, weed competition, conventional weed, crop productivity, agronomic method

### **Mononchids as biocontrol agents against plant parasitic nematodes.**

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The predatory nematodes (Order: Mononchida) play a significant role in regulating the population of plant- parasitic nematodes in soil. Predatory nematodes are classified into different taxonomic categories on the basis of their feeding mechanism. Predation by nematodes of the order Mononchida had been studied in different flower crops grown under protected conditions in Solan district. Four mononchids viz; *Mylonchulus* (*M. brachyuris*), *Iotonchus* (*I. monhystera*), *Mononchus* (*M. truncatus*) and *Clarkus* (*C. papillatus*) were found harbouring the rhizosphere of flower crops (carnation, rose and chrysanthemum), along with plant parasitic nematodes namely; *Meloidogyne* (*M. incognita* J2), *Helicotylenchus* (*H. dihystra*), *Tylenchorhynchus* (*T. mashhoodi*), *Pratylenchus* (*P. coffeae*) and *Paratylenchus* (*P. curvatus*). Among the mononchids, maximum incidence was of *Mononchus* (in 35%), followed by *Mylonchulus* (33%), *Iotonchus* (25%) and *Clarkus* (2%). Highest population was recorded for the *Mylonchulus* (400/ 200 cc soil), followed by the *Iotonchus* and the *Clarkus* (180) while it remained minimum for the *Mononchus* (120). With highest average population of 54.90, *Mylonchulus* dominance the other mononchids. There was recorded –ve correlation between predatory and plant parasitic nematode populations in all the localities surveyed/ sampled.

**Keywords:** Predatory nematodes, mononchids, bio-control agents, management.



## Differentially expressed spikelet specific miRNAs regulate grain filling in rice contrast for compactness and architecture

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Rice is the most widely consumed staple food for a large part of the world's human population, especially in Asia, with the third-highest used commodity worldwide. Rice grain quality and quantity is governed by its grain size and shape and this is determined by various molecular mechanisms. Based on the spatial location on panicle, the spikelets in rice may be apical where there is complete filling or proper metabolite assimilation, or basal where there is an aborted filling, particularly in the panicle bearing large number of spikelets. The reason of differential grain filling in apical and basal spikelets, and the regulation of grain filling process per se is poorly understood. PTGS is an emerging regulation under which the tiny rapidly growing class of small RNA molecules; miRNAs are believed to contribute to the regulation of grain filling in rice. We screened six rice cultivars for differential grain filling and chosen cv. Mahalaxmi showing maximum differential grain weight between apical and basal grains for next-generation sequencing of sRNAs in the apical and basal spikelets. In deep sequencing data analysis, we found differential expression of conserved as well novel miRNAs in spikelets on 5DAA (Days after anthesis). In order to validate we found less explored miRNAs like OsamiR 21180 and OsamiR6248 which are significant differentially expressed among apical vs basal library in sequencing data and few Novel miRNAs were validated through Northern blotting, targeting Pullulanase and 14-3-3 transcript in which former is positively and later transcript is negatively regulate grain size by downstream pathway. Relevant target of Novel miRNAs are soluble starch synthase 1 and transmembrane protein validated through qRT-PCR and 5'RACE. Truncated transcript of these transcripts leads to poor activity in grain of basal position of spikelets via miRNAs cohorts limit productivity. Functional characterization of these miRNAs mediated targets might improve our knowledge to understanding the mechanism lying in grain filling of rice and further improvement of this crop towards productivity.

## Biomass Energy: A Hope for Future

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Fossil fuel stores are receding all over the globe. Consumption of fossil fuel is responsible for increasing global temperature through emission of many obnoxious gases. So, dependence only on fossil fuel has to be reduced at any cost. It will be very beneficial for us to reduce dependency over imported oil and look for some alternative sources that have no or very low carbon emission in the atmosphere such as air, solar energy and hydro-energy are the common energy source. But among all these 'Biofuel' is the only source out of all the various energy sources such as electricity, heat and fuel transport have potential to form organic chemicals and polymers.

In a country like India where our farmers are aimed a better crop for better profit. Agriculture or farm wastes such as by-products, rotten fruits, bark, weeds, grasses, leaves, branches oil and seeds etc. can also contribute towards their profit. Our government has also aimed to increase farmer's income by 2022. This is possible only by adopting new agriculture profession by using the techniques for management of agriculture wastes and certainly it will open a new market for them. There are about 80 million households where firewood and various forms of biomass are used for cooking purposes. Of these, more than 60% consists of twigs, dung cake and agricultural wastes. This burning at low efficacy, releasing high levels of smoke, PM<sub>10</sub> particulate matter, NO<sub>x</sub>, SO<sub>x</sub>, poly-aromatics, poly-ammonia, formaldehyde, and di and mono oxides of carbon etc. Apart from cooking biomass is burnt for heating and disposal of waste material including crop residues.

Biomass is the renewable energy sources comes from biological material such as plants, animals, micro-organisms and municipal wastes. These wastes can be converted into useful substances. Biological conversion of agricultural wastes through fermentation into methanol, ethanol and butanol or through anaerobic digestion into methane and anaerobic respiration bio-battery. Agricultural or farm residues can also be converted into bio-diesel through a series of chemical reactions (Trans-esterification).



Farm or agricultural wastes are the sources of lignocellulosic biomass consisting of about cellulose (35-50%), hemicellulose (25-30%), lignin (10-25%). These lignocellulosic resources with the help of micro-organisms can produce a number of industrially important enzymes such as cellulases, xylanases, ligninases and lipases. These enzymes are of great industrial importance and used in pulp and paper industry, textile industry, chemical industry, detergent industry, bioethanol industry, fermentation industry, food industry, animal feed industry, agricultural and environmental industries for various purposes. Thus eradication and management of solid wastes but can also be a source of additional income for farmers and may be new field of employment of youth.

### **Amelioration of Tomato And Spinach on Sodium Arsenite Induced Hemato-Biochemical Toxicity In Rats**

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Heavy metals are potent environmental pollutants. Recently there has been increasing ecological and global public health concern due to their environmental contamination. Arsenicals are compounds of arsenic, which mainly enter into the environment by rock weathering and anthropogenic activities. Out of organic and inorganic arsenicals, latter has the potential to cause oxidative stress in humans. Now-a-days, more attention is being paid to the role of natural antioxidants to combat metal toxicity. The present work was undertaken to determine the toxic effects of sodium arsenite and its amelioration by tomato and spinach extract in wistar albino rats. Rats were divided into 8 groups of 5 each. Group I rats were kept as control. Group II rats were administered 10mg/kg bw of sodium arsenite orally. Group III rats were given 50mg/kg bw tomato extract. To Group IV rats, spinach extract was given by oral gavage. Group V rats were administered sodium arsenite along with tomato extract. Similarly, in Group VI rats, sodium arsenite was administered along with spinach extract. Group VII rats were given sodium arsenite and both spinach and tomato extract. Group VIII rats were administered combination of spinach and tomato extract. The serum levels of SGOT and SGPT were observed to be raised in rats given sodium arsenite whereas tomato and spinach supplementation showed reduction in their concentration. Total RBC, Hb, HCT and WBC contents were found to be decreased in arsenic treated groups as compared to control rats but spinach and tomato extract supplementation showed increase in red blood indices.

**Keywords** – Sodium arsenite, Toxicity, Tomato, Spinach.

### **Screening of Mungbean Genotypes Against Leaf Blight Pathogen *Macrophomina Phaseolina* (Tassi) Goid**

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Leaf Blight

of Mung Bean caused by *Macrophominaphaseolina* (Tassi) Goid is one of the more severe yield destabilizing factors causing serious yield losses each year in Central India. In recent years, *Macrophominaphaseolina* is becoming more prevalent in agricultural areas where climate change is leading to higher temperatures. Mung bean was also observed severely affected by leaf blight in *Kharif* as well as during summer season. A total of 52 germplasm lines of mungbean were screened against *Macrophomina* blight at Pulse Pathology Field, Block Number-23 of University Research Farm, Raipur with two replications each. The observation on incidence of disease was recorded at flowering and pod initiation stage. Per cent incidence was recorded on the basis of visual observation according to 1-5 scale given by IIPR, Kanpur (1996). Out of 52 entries of mungbean screened for *Macrophomina* blight under natural field conditions, 21 cultivar found resistant, 16 cultivar found moderately resistant, 5 cultivar found moderately susceptible, 9 cultivar found susceptible and KPM 16-50 were found highly susceptible whereas KPM 16-50 used as susceptible check in sick plot of these test lines.



## Constraints in Adoption of Recommended Agricultural Practices

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More than 2000 farmers are living agriculture every single day because of lack of basic knowledge and lack of facility. It is thus, important to spread knowledge of recommended management practices which could bring growth, sustainable resources and equity in the economy for balancing its growth. This issue is very important in the present scenario as many natural resources, which were once abundant have now become scarce and there is immediate need to prevent degradation of these resources to make them sustainable. But however in the present context the farmers are not welcoming the day to day researches and approaches that can give them much more benefits as they are comfortable in practicing the conventional practices they are used to and for these extension workers need to play a crucial role by developing relations and gaining farmer's trust to adopt the new agricultural practices. This can be done by various extension methodology like result demonstration and result demonstration. Another problem faced by the farmers is, they don't have the resources they require for adopting the new practices and they are not willing to risk their source of income as it is the only source for their livelihood. However majority of farmers were found to be well aware about the issues posing threat to the sustainable growth of agriculture but were tied due to constraints emerging mainly on account of their non risk bearing capability and income.

**Key Words:-** Result demonstration, Method demonstration, Extension Workers, Management Practices.

## Sire Evaluation Based on First Lactation Monthly Test Day Milk Yield in HF X Gir Half bred

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The data on first lactation milk production performance of 422, HF X Gir half bred cows were utilized from Research Cum Development Project on Cattle, Rahuri (M.S.). The data on first lactation monthly test day milk yield (FLMTDMY), peak milk yield (FLPMY), and 300 days milk yield (FL300DMY) were analysed by least squares technique considering period of calving and season of calving effects. The genotypic and phenotypic correlation among traits and heritability of traits were estimated. The breeding values of sires were estimated by REML computer programme using univariate model and sires were ranked on the basis of their estimated breeding value. The overall least squares means (kg) of FLMTDMY (T1 to T6), FLPMY and FL300DMY in HG X Gir half bred were  $10.54 \pm 0.14$ ,  $10.57 \pm 0.13$ ,  $10.10 \pm 0.12$ ,  $9.48 \pm 0.12$ ,  $8.93 \pm 0.11$ ,  $14.22 \pm 0.14$  and  $2438.98 \pm 38.49$  respectively. The effect of period of calving was significant ( $<0.01$ ) and season of calving was non-significant on FLMTDMY (T1 to T6), FLPMY and FL300DMY in HF X Gir half bred. The heritability of FLMTDMY (first to sixth month), FLPMY and FL300DMY was  $0.120 \pm 0.121$ ,  $0.115 \pm 0.129$ ,  $0.095 \pm 0.119$ ,  $0.068 \pm 0.118$ ,  $0.096 \pm 0.128$ ,  $0.090 \pm 0.130$ ,  $0.256 \pm 0.146$  and  $0.126 \pm 1.000$  respectively. There were positive and significant correlations among FLMTDMY (T1 to T6), FLPMY and FL300DMY in HF X Gir half bred. Sire No. HG-412 and HG-129 had highest breeding values for FLMTDMY and H-11281, HG-15 had highest breeding values for FLPMY and FL300DMY and ranked first.

**Key words:** Sire Evaluation, HF X, Gir Half bred

## Stress-Tolerant Plant Growth-Promoting Endophytes Associated with *Zea mays* for Sustainable Agriculture

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Stress tolerance is also an important attribute in the selection of bacteria for the development of microbial inoculants. Sixteen morphological different bacterial endophytes were isolated on trypticase soy agar amended with 2.5% NaCl from the root and stem of *Zea mays* growing in Punjab, India. The salt-tolerant bacterial endophytes were assessed for different plant growth-



promoting traits. All isolates showed auxin production in tryptophan supplemented media ranging from 8 to 21 µg/ml after 48 h incubation. The isolates showed tricalcium phosphate solubilization ranging from 126 to 537 µg/ml. In addition, 1-aminocyclopropane-1-carboxylate (ACC)-deaminase activity was shown by 5 isolates, ammonia production by 8 isolates, siderophore production by 7 isolates while HCN production by 3 isolates. Two bacterial isolates also showed antagonistic against *Fusarium oxysporum*, *Fusarium verticillioides*, *Curvularia lunata* and *Alternaria alternata* and abiotic stress tolerance against salinity, temperature, pH and calcium salts. Two stress-tolerant bacterial isolates able to exhibit multiple plant growth-promoting traits significantly enhanced the growth of test plants pea and maize under greenhouse conditions. The bacterial isolate MR1B5 showing highest plant growth promotion was identified as *Burkholderia* sp. on the basis of phenotypic and 16S rDNA gene sequencing. The results indicated that the *Burkholderia* sp. is a potential candidate for the development of microbial inoculants for stressed environments.

**Keywords:** Antagonism, *Burkholderia*, phosphate solubilization, plant growth promotion, stress tolerance, *Zea mays*

### Evaluation of Bottle Gourd (*Lagenaria Siceraria*) to Growth and Yield Parameter

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The experiment was conducted at Instructional-cum-Research farm of Horticulture Section, College of Agriculture, Kolhapur during the *Kharif* 2016. To evaluate the growth and yield performance of ten bottle gourd selections. The data revealed, that among different selection of bottle gourd, the selection RHRBG – 19 also recorded the maximum fruit length (38.53 cm), highest diameter (7.62 cm) and average fruit weight (690.00 g). Similarly the selection RHRBG -19 recorded more number of fruits per vine (23.00), highest fruit yield/vine (15.87 kg) and per hectare (529.00 q) followed by RHRBG - 18 which recorded fruit length (35.73), diameter (7.24), average fruit weight (608.00 g), number of fruits per vine (22.20), fruit yield/vine (13.37) and per hectare (449.66 q).

In view of the experimental results obtained during the present investigation, the selection RHRBG - 19 showed the maximum number of female flowers, fruits per vine, fruit yield and yield contributing characters such as fruit length, fruit diameter, fruit yield per plot and hectare and all the selections exhibited considerable variations in the growth yield parameter.

**Keywords:** Bottle gourd selection, growth and yield parameter

### Balanced reproductive fitness -inbuilt or attained?: Case study of genus *Artemisia maritima* L.

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North Western Himalayas (an integral part the Great Himalayan range) is bequeathed with a vast and varied geobotanical range and offers an interesting scope for assessment of its biodiversity in various fields. This range also acts as a passage for the extension of range of many genera. One amongst them is genus *Artemisia*, commonly known as mugwort or sage brush. It is the largest and most diverse genus of the tribe Anthemideae of family Asteraceae (Martín *et al.* 2003). The genus comprises of more than 500 species (Valles and Garnatje, 2005), distributed mainly across the Northern Hemisphere, with few representatives in the Southern Hemisphere. In India, 45 species of *Artemisia* have been reported.

Plants of genus *Artemisia* L. are used for a multitude of purposes especially in matters connected to digestive system and treatment of worms. Many species of *Artemisia* are used in different ways by the inhabitants of the areas where the populations of these species sprawl, some are cultivated for use as medicine.

Present study deals with an endangered and endemic species of *Artemisia* L. i.e. *A. maritima* of section Seriphidium. Species unique in cytologically flexible genus *Artemisia* L. is being cytologically very stable; with diploid chromosome number of  $2n=18$ . As far as the breeding system is concerned, the plant is an outcrosser and exhibits ambophily. It produces good percentage of seeds on open pollination. In absence of outcrossing, the species keeps provision for selfing too in



the form of dual pollen germination. In addition to the germination of pollen on the stigma, pollen germination occurs on ovary too; latter leads to self fertilization. Detailed studies done on this aspect reveals the species to be setting seed by self pollination also. It thus exhibits mixed mating system. Whether this feature is inbuilt for survival or will form the focus of this presentation.

Keywords: *Artemisia*, variability, sex-expression, reproductive output, rootstock

### Effect of Methyloprophs on Growth and Yield of Mungbean

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A pot house experiment was conducted at Department of Microbiology, College of Basic Sciences and Humanities, CCSHAU Hisar, to study the effects of methyloprophs on growth and yield of mungbean. All the methyloprophs were tested for plant growth promoting traits including IAA production, phosphate solubilisation and siderophore production. The experiment was laid out in Randomized block design with three replications. The treatments comprised of [T1-Control, T2-RDF (Recommended dose of fertilizer), T3-*Rhizobium*(MB703), T4-Phosphate solubilising bacterium P36 (PSB), T5-*Rhizobium*(MB703)+ PSB (P36), T6-Methyloproph(s), T7-Methyloproph(s) + *Rhizobium*(MB703), T8-Methyloproph(s) + PSB (P36), T9-Methyloproph(s) + PSB + *Rhizobium*(MB703)]. The results indicated that significantly higher growth parameters viz., plant dry weight, higher number of nodule number and nodule dry weight was recorded in T9 treatment. Similar trend was observed in yield components viz., number of pods per plant, grain yield was recorded in T9 followed by T7 compared to other treatments and uninoculated control.

### Bioformulation of two plant growth promoting bacteria *Arthrobacter psychrochitiniphilus* (IHB B 13602) and *Pseudomonas trivialis* (IHB B 745) and their application in sustainable Onion production

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The excessive use of chemical fertilizers in farmer field leads to numerous undesirable changes in soil system like salinity, loss of fertility and droughts. We need to overcome such problems by introducing alternative of chemical fertilizers which fulfil the expectation of the farmers in sustainable manner. Earlier, several efforts have been made by the researchers to highlight the applicative potential of these beneficial soil microorganisms providing nutrients and protection to the plants. The role of such microbes in sustainable agriculture has been well documented. Plant growth-promoting rhizobacteria (PGPR) helps the plants in a various ways. Although, the development of bioformulations with these beneficial bioinoculants have seen an upward trend in the last few years. In the present study, the most efficient PGPRs *Arthrobacter psychrochitiniphilus* (IHB B 13602) and *Pseudomonas trivialis* (IHB B 745) having plant growth promoting traits like phosphate solubilisation, ACC deamination, auxin and siderophore production were used for the development of bioformulation. The Shelf life study of these two PGPRs was tested with three solid carrier viz. talcum powder, vermiculite and activated charcoal under room ( $27^{\circ}\text{C}$ ) and cold temperature ( $4^{\circ}\text{C}$ ). The observation was taken for the viable cell count was (cfu) upto 6 months. Different culture condition such as temperature, pH, carbon and nitrogen sources utilization and salts requirement for the growth were also checked using one variate at a time (OVAT) by shake flask method. The field trial experiment was conducted in completely randomised block design (CRBD) with six treatments and each treatment replicated three times at Ludhiana, Punjab. One month old onion seedlings (*Allium cepa*) were treated by dipping in bio-inoculants formulation. The effects of PGPRs bioformulation were evaluated in term of plant growth attributes such as plant height, leaves numbers, and onion yield and bulb diameter.

Keywords: Plant growth-promoting rhizobacteria, Bioformulation, Shelf-life, OVAT, Onion yield.



## Different Tillage, Nutrient Management and Depths Effects on Soil Microbial Communities in Aravali Hills of Southern Rajasthan

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This study was conducted to evaluate the implementation of conservation agriculture in combination with nutrient management at different depths for their legacy of effects on soil health indicators as soil organic carbon (SOC) and soil microbial communities in Aravali Hills of Southern Rajasthan. Soil sampling were done from the pre existing conservation agriculture field experiment during 2014-15 and 2015-16 at Rajasthan college of agriculture, MPUAT, Udaipur (Raj.) in FRBD with 03 replications. The treatments included three tillage (Conventional, Zero & permanent bed) and three nutrient management practices (Farmer practice, 100 % RDF & SSNM). Population of bacteria ( $79.6 \times 10^6$  cfu g<sup>-1</sup> soil), fungi ( $30.7 \times 10^4$  cfu g<sup>-1</sup> soil), actinomycetes ( $44.6 \times 10^5$  cfu g<sup>-1</sup> soil) and *Azotobacter* (679 cfu g<sup>-1</sup> soil) were found high with zero tillage practice compared to conventional at 0-15 cm depth. SSNM also significantly increased the microbial population in the tune of 8.10, 11.24, 21.52 and 6.27 per cent, respectively over farmer's practice after cropping sequence at 0-15 cm during both the years. At 15-30 cm depth population of microbes were found less. SOC was also found higher in zero tillage (7.72 and 7.45 g kg<sup>-1</sup> at 0-15 & 15-30 cm, respectively) whereas in nutrient management SSNM recorded higher SOC 7.74 & 7.47 g kg<sup>-1</sup> at both the depths on pooled basis due to application of balanced fertilization. The significant improvement was recorded in soil microbial communities and SOC under the practice of Zero tillage and site specific nutrient management at both soil depths in compare to conventional tillage and farmer practice for better soil health and sustainability.

**Key words:** Microbial communities, SOC, Zero tillage, SSNM, conventional and famer practice

## Fall armyworm (FAW), *Spodoptera frugiperda*(Noctuidae: Lepidoptera): Invasive Pest of Turf

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Turf is one of the blessings of nature and includes both service and beauty and a concept which originated when man started to domesticate animals. Not every grass can be classified as turf, so there are about 50 species which comes under turf category (Turgeon). A healthy turf means a proper maintained turf. There are many factors responsible for turf health viz. Soil, Species, Irrigation, Pest and Disease Management, etc. Within pests of turf: fall armyworm is a notorious insect with high dispersal ability, wide host range and high fecundity. The first confirmed report of occurrence of invasive pest in India is on maize fields in Raigarh district of Chhattisgarh. The fall armyworm has four life stages: egg, larva, pupa and adult with a complete life cycle. The adult is a moth that migrates as temperature increase in the spring and lays around 1000 eggs in summer. The larvae have five stages or instars and usually feed in early morning or late evening and hide in debris on the soil surface in the middle of the day. When feeding, larvae strip foliage and then move to the next available food. High populations appear to march side by side to the new food. Thus, the name armyworms have been applied. The small larvae will chew the green layer from the leaves and leave a clearing or "window pane" effect. The first three instars do very little feeding while the last two instars consume 85% of the total foliage consumed. The fall armyworm has not shown the ability to diapauses so its ability to survive winter depends on the severity of the temperature. Parasites such as wasps and flies, predators, such as ground beetles, are also effective in limiting outbreaks. Birds, skunks and rodents also consume large numbers of larvae and pupae.

**Key Words:** Turf, Industry, Classified, Life cycle, Larvae, Diapauses





### Recent trends and advancements in agricultural research

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Food, organic farming, climate change and improved farming techniques may strike to your mind. But the recent improvements in agriculture are way more advanced. These advancements along with the increase in urbanization are major drivers for the evolution of agricultural research. Recent trends in the area of Agricultural Research comprise of Eco-Agro-tourism, Big Data Analytics, Climate Smart Agriculture, Advanced Marketing Linkages, Integrated Farming System, etc. These trends are important not only from the research context but also from the policy point of view towards ambitious goal of doubling farmers' income by 2022. In today's era technology plays a very important role in encouraging farmers to take up entrepreneurial ventures and agro-based industries. Recent research has also spoken about combining Agriculture technology with the Information technology for improving the agricultural output. Traditional farming approach need to be replaced with the modern farming approaches like Integrated Farming System, Vertical Farming, Forward and Backward integration, etc. With the increase in population and limited resource availability, research related to Urban Agriculture is being emphasized which encourages the urban population to go for organic cultivation for healthy and safe produce. With the increase in per capita income, consumers are willing to spend more on quality products which is impacting backward linkages towards farmers to adopt good practices at production level. For mitigating the environmental challenges, research is focusing on Climate Smart Agricultural Techniques like DSR (Direct Seeded Rice) which reduces the water usage by about 50 to 60 percent and methane gas emission to a large extent ultimately helping the farmers to earn more carbon credits. In nutshell, it can be stated that along with coping up the major challenges such as climate change, boosting farmers' income and feeding the billions, above stated trends in agricultural research are seen as ray of hope for sustaining Indian agriculture.

**Keywords:** Eco-agro-tourism, Big data analytics, Climate smart agriculture, Advanced marketing linkages, Integrated farming system, Direct seeded rice

### *In-vitro* screening for salt tolerance in taro (*Colocasia esculenta* L.)

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Taro (*Colocasia esculenta* Linn.) is an important source of carbohydrates and used as staple foods in tropical and subtropical countries. In climate changing scenario such as rising sea level and frequent dry and wet conditions leads to increased soil salinity particularly in coastal region and it limit taro cultivation. Keeping in view of fact present investigation were carried out for selection salt tolerance lines of taro under in-vitro condition. Taro lines TCR-469, IC-12470, IC-39565, TCR-726A, IC-023575, TCR-385A, TCR-730A, BHS-37, TCR-913 and IC-265045 were established in tissue culture via buds of the seed corm using Murashige and Skoog (MS) medium. Effect of different concentrations and combination of plant growth regulators (PGRs) along with the control were investigated for the standardization of MS media by using *in vitro* culture techniques for direct plantlet regeneration from the buds of the seed corm. The experiment revealed that the explants cultured on MS medium supplemented with IBA 0.1 mg L<sup>-1</sup> + Kinetin 0.1 mg L<sup>-1</sup> was found to be the best as compared to other treatments. Taro buds isolated from seed corms were planted on MS culture media containing different concentrations of NaCl (0%, 0.5%, 1.0%, 1.5% and 2.0%). Data were recorded for days taken for shoot initiation and numbers of shoots per explants after seven weeks, number of leaves per plantlet after seven weeks, number of roots per plantlet after seven weeks, shoot length after seven weeks and roots length after seven weeks. It was found that different lines of taro able to grow up to salinity level 1.5% of Na Cl concentration. Increasing the salinity concentrations resulted in reduction of shoots, leaves and roots numbers of the taro. Only two taro lines named TCR-730A and TCR-913 were able to survive salinity concentrations up to 2.0% of NaCl salt solution.

**Key words:** In vitro selection, tissue culture, micro-propagation, salt tolerance, *Colocasia esculenta*, taro



## Biodegradation of Polyethylene terephthalate: A sustainable Approach

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Polyethylene terephthalate (PET) is a thermo-polymer amalgam of terephthalic acid and ethylene glycol. Carbonated drinks bottles, water bottles and plastic boxes used for the storing and packaging of food materials are made up of this polymer. Its increasing demand, leads to generate the significant amount of waste causing the environmental issues. In today's scenario its mismanagement is becoming a threat & vital reason for the soil and water pollution. It hinders the sunlight and oxygen penetration into the water as it covers the surface area of the oceans or sea. It likewise causes various direct and indirect problems due to pathogen it harbors. Different physical and chemical methods are available to manage and eradicate this waste but they are inclined towards demerits rather than merits. Degradation of PET with the help of microorganisms is one such management approach. It is the most accepted and ecofriendly approaches as the microbe have the ability to breakdown this polymer into its oligomer and monomer. The formed by-products are taken up by the microbial cell for its essential nutrients required for growth instead of forming the harmful by-products. Novel bacteria confirm higher efficiency of degradation of PET giving a solution to plastic industry. With the help of biodegradation, it's possible to convert PET waste covered environment into green habitat.

**Keywords:** Water bottle, Biomineralisation, Plastic waste, Bacteria, Thermopolymer, Environment pollution.

## Mercury Contamination in Water Resources of Central Ganga Alluvial Plain, northern India: A Preliminary Survey

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Mercury is a relatively rare contaminant compared to other chemicals and considered a key element of human health due to its high mobility, non-biodegradable property and high toxicity at low concentrations. Atmospheric deposition and transportation of mercury is a critical concern to aquatic as well as terrestrial ecosystem in a river basin. Across the globe, the biggest consumer and a major emitter are India. This concern is particularly significant in the Ganga Alluvial Plain (northern India) where coal-based thermal power plants and brick kilns presently deliver substantial amount of mercury to the alluvial plain, where elevated levels of mercury were already reported in various environmental components.

As a preliminary study, river, ground and lake water samples were collected from at ten locations in and around Lucknow area in the central Ganga Alluvial Plain during the summer season of 2019. Mercury analysis was performed by using Flow Injection Atomic Absorption Spectroscopy-Mercury Hybride System at the analytical laboratory of Bioinformatics Center in Biotech Park, Lucknow. Mercury concentrations in the shallow drinking water (Lucknow) ranges from 0.08 to 0.21 µg/L and in the Karela Lake water (Hulas Khera) is 0.36 µg/L. Mercury concentrations in the Gomati River Water at upstream and downstream of Lucknow were reported 0.01 µg/L and 0.25 µg/L, respectively. The Ganga River Water (Bithoor) has been reported the maximum concentration of 0.67 µg/L which is above the WHO permissible limit (0.50 µg/L) of drinking water.

The present study underscores the significance of mercury emissions and clearly indicates the significant contribution of anthropogenic mercury in the drinking water resources of the Ganga Alluvial Plain. Therefore, future research must be pursued for a better understanding of the human health impact of mercury contamination as the Ganga Alluvial Plain supports drinking



water resources to nearly 7% of the world's human population.

### **Knowledge and Practices regarding reproductive health as precipitating factors in affecting environment.**

**Vandana Kanwar\*, Ritu Mahal and Parvinder Kaur**

The present study was conducted in Block Doraha in Ludhiana district of Punjab to investigate the existing knowledge level and practices of rural women about Reproductive Health and Hygiene. The total sample was comprised of 350 rural women. The knowledge part was divided into three aspects i.e. Health, Knowledge and Hygiene. Self-structured questionnaire was developed to assess their knowledge and practices. It was observed that respondents were good on knowledge, average on health and poor on hygiene aspect. Respondents were found to be following unhealthy and environmentally unsafe practices in disposing off the used-napkins. The practice was disposing off in open, throwing in the fields where extra labour was engaged by the farmers to segregate the garbage. Majority disposed off by burning in *chullahs*. Thus practice of burying, burning and discarding in open were found to be polluting the environment. Keeping in view the existing status of knowledge and practices of women, interventions were planned and carried out in the villages. Interventions were given in the form of lectures, organisation of camps, dissemination of literature and distribution of hygiene kits. Incinerators were also installed in each village to mitigate their problem of disposal with minimal biomedical waste. Out put of the research was increased level of knowledge and adoption of hygiene practices, less reporting of infections by the rural women. It may be attributed to the interventions. It was found that exposing the rural women to safe disposal and adoption of hygiene practices would remarkably reduce infections among women and pollution in the environment. Proper facility and easy accessibility to dispose off the sanitary waste at village level is highly recommended.

**Keywords:** Reproductive health, Knowledge and Practices, Environmental Pollution, Hygiene

### **Association Mapping of QTLs for Yield Contributing Traits and Identification of Candidate genes for *Alternaria* Blight Resistance in *Brassica Juncea* L.**

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*Brassica juncea* L. is one of the most important oilseed crops grown worldwide and India. Yield contributing traits and biotic stress like diseases are widely targeted traits in oilseed breeding programme. The disease causes upto 80 percent of economic loss in the crop. The present study was conducted to identify genes/QTLs for *Alternaria* blight resistance and yield contributing traits. A set of 64 *Brassica juncea* genotypes were initially collected and evaluated for morphological traits. The core set was developed using STRUCTURE software. The validated core set was subjected to disease pathotyping for *Alternaria* blight at SKUAST-Jammu, Chatha. High-throughput SSR marker genotyping was done at Molecular Breeding Laboratory, Department of Plant breeding and genetics, SKUAST-Jammu and data were generated for 82 SSR markers. The study of marker-trait associations (MTAs) for *Alternaria* blight resistance and yield contributing traits strongly indicated the involvement of some major genomic regions/genes/ markers responsible for these important traits in *Brassica juncea*. The information of population structure matrix and trait phenotypic data on *Alternaria* blight and yield contributing traits were together used in software TASSEL and significant MTAs were identified. Marker A03\_25410649 explained 28.8 percent phenotypic variation ( $R^2$ ) for *Alternaria* blight, while markers Ni4\_A06 and Ni3-E06 were found significantly associated with a major QTL/gene explaining 20.3 percent and 26.4 percent phenotypic variation ( $R^2$ ) for seed test weight. For siliqua per plant, 8 MTAs were observed showing range of phenotypic variation ( $R^2$ ) 11 percent to 16 percent. **The significant marker trait associations identified during the present study will prove useful for marker-assisted breeding programs aimed at enhancing *Alternaria* blight resistance in genotypes.**



**Keywords:** *Brassica juncea*, Alternaria blight, QTL, SSRs, Association mapping, Marker trait associations (MTA).

### **Studies on development of fibre rich pasta from Sweet potato flour fortified with oat flour**

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Pasta products are widely accepted by the children and elder persons, but the major problem is that they are not accepted pasta as a healthy food due to low nutrients and dietary fibres. The present study aimed to formulate nutrient and fibre rich pasta from sweet potato flour (SPF), wheat flour (WF) and Oat Flour (OF). The four samples (C, P<sub>1</sub>, P<sub>2</sub> and P<sub>3</sub>) of pasta were prepared by using wheat flour (30%), sweet potato flour (55%) and oat flour (20%) in different proportions. Sample C was prepared as control sample containing only wheat flour (100%). All the four samples were evaluated for the nutritional properties, cooking and sensory quality. Overall acceptability scores of fibre rich pasta made from (WF:SPF:OF) composite flour were “like moderately” to “like very much” by the panellists. However, further increase the level of incorporation adversely affected the cooking and sensory characteristics. On the basis of results sample P<sub>2</sub> (30% WF, 50% SPF and 15% OF) was found to be best in quality having more nutritional elements and higher overall acceptability.

**Key word:** Pasta, sweet potato flour, oat flour, nutritional properties

### **Effect of Growth Regulators on Growth And Yield of Turmeric (*Curcuma Longa L.*) Varieties in Gangetic Alluvial Plains of West Bengal**

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An experiment was conducted to find out the effect of growth regulators on growth and yield of turmeric (*Curcuma longa L.*) varieties in Gangetic alluvial plains of West Bengal at Horticultural research farm, Jaguli, Bidhan Chandra Krishi Viswavidyalaya, Nadia, West Bengal conducted during 2014-15 and 2015-16. Two concentrations of two plant growth regulators namely GA<sub>3</sub> (50 ppm and 100 ppm), and Ethrel (50 ppm and 100 ppm) and five varieties namely Suguna, Alleppy Supreme, Rashmi, Rajendra Sonia and Duggirala were included in this investigation. The regulators were applied as foliar spray at 90 and 120 days after transplanting. There were altogether 25 treatments replicated thrice in RBD with factorial concept. Among the different doses of plant growth regulators maximum plant height (141.80 cm), number of tillers (2.83), number of leaves (17.15), weight of mother rhizomes (118.63 g), length of primary rhizome (6.48 cm), rhizome yield per plot (13.43 kg) and yield per hectare (33.60 t ha<sup>-1</sup>) were observed in plants raised from foliar application of GA<sub>3</sub> 100 ppm. Among the varieties maximum plant height (136.87 cm), maximum length of mother rhizomes (6.37 cm) and primary rhizomes (6.89 cm), maximum weight of mother rhizomes (119.71 g) and primary rhizomes (146.43 g), maximum yield per plot (12.41 kg) and yield per hectare (31.04 t ha<sup>-1</sup>) were observed in Rajendra Sonia variety. Among the interaction studies significant increase of plant height (153.28 cm), number of primary rhizomes (7.85), length of primary rhizome (7.52 cm), yield per plot (13.43 kg) and yield per hectare (33.60 t) was noticed in Rajendra Sonia variety with foliar spraying of GA<sub>3</sub> 100 ppm. Therefore, the results led to a conclusion that, from rhizome yield maximization point of view, the most effective treatment was Rajendra Sonia variety with foliar spraying of GA<sub>3</sub> 100 ppm for commercial production of turmeric in Gangetic alluvial plains of West Bengal. **Keywords-** Turmeric varieties, Growth regulators, Growth and Yield.



## Soil fertility restoration potential of multipurpose trees in Himalayas foothills

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Ecological restoration of degraded lands is of great importance for sustainable development of environment. In order to determine the biological potential of species to aid soil restoration, it is necessary to evaluate litter production, its temporal variation, rate of decomposition and nutrient release. In this study therefore, we examined patterns of litter fall production, quality of litter, and decomposition pattern of selected multipurpose tree species, viz., *Grewia optiva*, *Celtis australis*, *Bauhinia variegata* and *Ficus roxburghii* which are very common in agroforestry systems of western Himalayas. Average litter fall varied significantly among species as follows *Grewia optiva* > *Celtis australis* > *Bauhinia variegata* > *Ficus roxburghii*. In the litter bag experiment, mass loss and mineralization rate were significantly different among the species and were assumed to be effected by the initial chemical composition of the litter. All species followed bimodal pattern of decomposition, initially a slow phase, followed by a rapid phase and again slow phase at the end. Leaf litter of *Celtis australis* decomposed faster than other species exhibiting highest decay constant. *Ficus roxburghii* decomposed at slowest rate. The carbon percentage during decomposition showed a significant decrease throughout the study. P and Ca did not show any particular trend whereas K and Mg decreased through out the period. *Celtis australis* and *Grewia optiva* showed the better results for the rapid recovery of degraded lands as their rate of litter decomposition is relatively higher than *B. Variegata* and *F. Roxburghii*. But for the lands which are prone to erosion, *B. variegata* and *F. roxburghii* will be more suitable as their leaf litter will stay for longer duration as soil cover or mulch due to slow decomposition rate. The faster decomposition increases the more release of nutrient in to the soil and thus increases the rate of organic matter turnover and enhances nutrient cycling. The study recommended that for biological restoration of soil, mix plantation would be the most appropriate.

## Effect of sowing technologies on productivity, profitability and soil health in wheat under rice-wheat cropping system in south-western part of Punjab

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Rice-wheat is the most important cropping system and main contributor to total cereal production, which occupy about 10.3 Mha in India. Huge quantity of crop residues produced due to higher productivity of irrigated rice-wheat system in the region. Crop residues are an important constituent in nutrient cycling. Besides N, P, and K, paddy straw contains about 55%, 80%, 70%, and 70-80% of the total plant accumulated Zn, Fe, Cu, and Mn, respectively. Intensive soil tillage coupled with burning of crop residues has led to soil degradation and environmental pollution by emission of green house gases. Burning of crop residue causes serious environment pollution besides large nutrient and soil organic carbon (SOC) losses. A field experiment was conducted the different sowing methods to study the most suitable method of wheat sowing at Ferozepur, Punjab. Crop residue cover improves soil water retention and enhanced the availability of macro and micro-nutrients in soil. The grain yield was found such as conventional tillage with residue incorporation (CT+R) 53.20 q/ha highest followed by zero tillage with residue retention (ZT+R) 52.90 q/ha and conventional tillage (CT) 52.74 q/ha as compared to zero tillage without residue (ZT-R) 51.10 q/ha. However, benefit-cost ratio was higher in zero tillage with residue retention (2.54:1) as compared to zero tillage without residue (2.37:1), conventional tillage with residue incorporation (2.32:1) and conventional tillage (2.34:1). The high net return obtained in ZT+R treatment Rs. 82645/ha as compared to zero tillage without residue method (Rs. 75978/ha), CT+R (Rs. 81227/ ha) and conventional tillage method (Rs. 80603/ha). In zero tillage with residue retention wheat sowing was completed in advance as compared to other treatments without burning the residue which improves soil health with time.

**Keywords:** Zero tillage, Happy Seeder, Conventional Tillage, Net return



## Diversity, Indigenous Uses and Conservation Status of Medicinal Plants in Khokhan Wildlife Sanctuary of Himachal Pradesh, India

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Indian Himalayan Region (IHR) is the rich source of the medicinal plants which are utilized by local inhabitants for curing various diseases and income generation. The present study is an attempt to assess the medicinal plants diversity of Khokhan Wildlife Sanctuary located in Kullu district of Himachal Pradesh, North Western Himalaya. A total of 369 spp. of medicinal plants belonging to 105 families and 258 genera were recorded. Different parts of the plants were utilized, of which leaf (158 spp.) was used in the majority of cases followed by whole plant (123 spp.) and root (93 spp.). Of the total medicinal plants, 148 were natives, 09 endemic and 56 near endemic to Indian Himalayan region. These medicinal plants comprise of trees (40 spp.), herbs (247 spp.), shrubs (67 spp.) and ferns (15 spp.). The continued over-exploitation, habitat degradation and changing environmental conditions may lead to the extinction of these species from sanctuary. Therefore, regular monitoring of population and habitats using standard ecological methods, development of conventional and in-vitro propagation protocols, establishment of species in in-situ and ex-situ conditions have been suggested.

**Key words:** Conservation, diversity, medicinal plants and Indigenous uses

## Isolation and Identification of Fungi from Gill and Skin of *Mastacembelus armatus* (Lace.)

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Microbiological analysis have been carried out from infected fish samples obtained from fish market for isolation and identification of fungi in infected regions. The infected fish sample with open wound and ulcerative growth found on caudal region and gills of *Mastacembelus armatus*. Extract was prepared from this infected part of fish. Serial dilutions of each sample upto 1: 1000 have been prepared and was streaked over Potato Dextrose Agar (PDA) and the petriplates were incubated at 28°C. After purification of culture, microscopic study was carried out. The fungi isolated from the infected fish samples includes – *Aspergillus flavus*, *A. niger*, *A. ruber*, *A. fumigatus*, *Penicillium decumbens*, *Cladosporium sphaerospermum*, *Rhizopus stolonifer* and *Trichoderma viride*. In the present study it has been found that almost 50% of the fish studied were infected with genus *Aspergillus* and thus, it can be concluded that *Aspergillus* is most dominant fungus among all the fungal genera identified.

**Key words:** Potato dextrose Agar, *Mastacembelus armatus*.

## Effect of different trash management practices on sugarcane yield and soil properties

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Sugarcane is an important cash crop of India and cultivated on around 4.93 mha of land with an average productivity of 70.7 t/ha. India has the largest area under sugarcane cultivation in the world and the world's second largest producer of sugarcane next to Brazil. Uttar Pradesh is the largest producer of sugarcane followed by Maharashtra. Both States now contribute towards 73 percent of India's total sugar production. Traditionally, sugarcane residues are burnt after harvest which contributes to a decline in fertility and productivity of soil. Usually farmers burn the sugarcane residues due to scarcity of labor to remove trash out of the field and lack of knowledge regarding the use of trash as a source of organic carbon and nutrients. When sugarcane is retained on



the soil as mulch, it conserves soil moisture and inhibits the growth of weeds. The incorporation of residues elevate the level of organic matter and, may decrease the pH of soil by releasing of hydrogen ion. Trash provides the energy to increase the yield and conserve soil moisture, C and N in the soil. In addition the trash and green manure also increase the fungi and actinomycetes in soil.

**Key Words:** Trash, Actinomycetes, pH

### **Study on water requirement of using CROPWAT MODEL for Potato crop grown under Drip Irrigation**

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A field experiment was conducted at RRS, Bathinda which was located at latitude 30° 12' 39." N and longitude 74° 56' 43" E, altitude 208 m during year 2016 in the block of 1 ha area with 30 × 50 cm (plant × row) spacing potato crop under drip irrigation. The result indicates that during year 2016 and the total crop water requirement for potato crop was found to be 101 mm. In this study the peak crop water requirement was found to be maximum for February with a value of 39 mm for year 2016. It was observed that during winter season frost was major problem in this area which results some decrement in crop yield.

**Key words:** water requirement, CROPWAT MODEL, Potato, Drip Irrigation

### **Evaluation and assessment of honeybee traits in bee breeding for enhancing honey production.**

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Total world production of honey has increased by 32% probably due to the increase in beekeepers and honey production in various countries. Despite the growing number in honey export figures in recent years, beekeeping is going through a period of technological stagnation; that is, the genetic quality of the honeybees just has not shown significant progress due to lack of new effective management techniques to increase productivity. Thus, there is a great demand for high performance honeybee colonies with desirable behavioural characteristics. The honeybee colonies evaluation and classification are a spontaneous and usual practice by every beekeeper for apiaries colonies done by natural selection. Breeding of honey bee queens is the key to successful beekeepers to rear queens by selecting breeder queens from their stocks and obtaining queens best suited for their region. Colonies in an apiary could be selected on the basis of some of the most important measurable characteristics viz. spring colony development, gentleness and a tendency to remain calm on the comb, over wintering ability, honey production and resistance against diseases. In honeybees (*A. mellifera* L.) the breeding activity is based on the performance evaluation at the level of each honeybee colony. Selective honey bee breeding is a phenomenon that fascinates beekeepers around the world. They often regard it as one of the most enigmatic and complex aspects of beekeeping. Thus, modern techniques of queen rearing, selection and mating control offer very powerful tools to improve the economic, behavioural and adaptive traits of honey bees.

**Keywords:** beekeepers, selection, colonies, technique.

### **An impact of climate change on plant microorganism**

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Climate is the primary determinant of agricultural productivity. Climate change is expected to influence crop and livestock production, hydrologic balances, input supplies and other components of agricultural systems. Agricultural systems are



also dynamic; producers and consumers are continuously responding to changes in crop and livestock yields, food prices, input prices, resource availability, and technological change. The initial benefits of climate change is because of more carbon dioxide in the atmosphere reduces “water stress” in plants and may make them grow faster. Altered environmental conditions due to climate change are likely to induce changes in plant physiology and root exudation. Climate change will, in the long term while induce adaptation processes in plants and microorganisms. The effects of climate change factors such as elevated CO<sub>2</sub>, drought and warming on beneficial plant–microorganism interactions are increasingly being explored. Increased temperature had a positive impact on arbuscular mycorrhizal fungi (AMF) colonization and hyphal length. Elevated CO<sub>2</sub> in particularly lead to increased carbon allocation to the root zone and potentially also lead to altered composition of root exudates. Drought reduced AMF colonization and it is frequently responsible for reduced plant growth and both roots and aerial plant parts may be impacted. This may lead to changes in the allocation of photosynthesis in the rhizosphere as well as in extramycorrhizal mycelium formation.

**Key words:** Livestock, dynamic, root exudation, rhizosphere, photosynthesis

### **From dusk to dawn: Success story of a vibrant and progressive beekeeper**

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This story recounts an uplifting tale of heartening success of a beekeeper of district Bathinda of Punjab. Hailing from the holy place of Talwandi Sabo, Mr. Shalinder Singh is now one of the prominent beekeepers of Malwa region. Today his life is altogether different than years ago when he started beekeeping as an enterprise. Mr. Shalinder first started beekeeping as way of livelihood during year 2000 without any technical guidance/ training. He faced failure due to lack of technical knowledge of the subject and had to leave this entrepreneur. Again, his interest was triggered in beekeeping when he went through a skill development training course on beekeeping organized by Krishi Vigyan Kendra, Bathinda during the year 2016. He again started beekeeping with 50 hives with an initial net income of Rs 60000/- as he was selling his produce in wholesale market. The KVK experts suggested him to register his produce with FSSAI and to go for self marketing. Mr. Shalinder started self marketing of his produce with brand name 'Mellifera Honey'. Mr. Shalinder also produces special kind of honey like raw mustard honey and white honey in his farm. Creamy mustard honey of his farm is more in demand in local market for the bakery industry. Besides this, he produces a honey based energy drink (registered with FSSAI) named 'Booster' which is becoming popular among school/ college students. He has created marketing circle in local porch colonies, colleges, parks, medical stores and hospitals where he sells his farm produce in his mobile shop, his own car. Mr. Shalinder is a registered seller of multinational technology company 'Amazon'. He has registered with amazon.com for selling bee's pollen online. Presently, Mr. Shalinder has 350 hives in his apiary with a net annual income of Rs 5 lakh which he earns from selling honey, pollen, wax and other processed products. He uses 30-40% of honey produced in his farm for making energy drink depending upon demand. Mr. Shalinder migrates his hives to other states like Rajasthan, Madhya Pradesh, Uttar Pradesh and Jammu & Kashmir depending upon availability of bee flora. He has also popularized his products by distributing leaflets/ pamphlets pertaining nutritive value of honey and pollen. This innovation of the beekeeper is also creating awareness of consumers besides popularizing bee products. He is an active member of 'Progressive Malwa Beekeepers Association' and presently acting as its cashier. In this way, Shalinder Singh has become an inspiration for many others who are earning with only conventional farming system.

### **Role of Animal Husbandry in doubling the farmer's income.**

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Livestock and agriculture productions are intrinsically inter linked. It forms an important livelihood activity for most of the farmers by supplementing incomes and offering employment opportunities for poor rural households. About 73% of the rural labour force directly depends on agriculture in India. Contribution of livestock and poultry sectors to the Indian GDP is 4.1 and





0.9%, respectively. Average milk production from an individual animal in India is very low (around 2-4 kg/day). Various breeding programmes are used to increase productivity of the individual animal. Availability of fodder deficit in dry fodder by 10%, in green fodder by 35% and concentrate 33%. So, nutrients availability will be enhanced by dietary and microbial manipulation. Establishment of fodder banks locally in fodder scarcity region through dairy federation and organizations can play an important role during drought condition. Supply of mineral mixture along with fodder during lactation period will increase the health status of animal. Organize animal health care camp to encourage farmers to adopt a regular preventive measure. Policy and support services like KISAN CREDIT CARD scheme provide timely and adequate credit support. Women self help group have emerged as effective institution for providing cash credit for small enterprise and that they have very good track record on credit supply and timely recovery.

**Keywords:** Kisan credit card, Vaccination, fodder, Women.

### **Vegetation Analysis of Ban Oak Forest in the Western Himalayas for its Sustainable Management and Conservation**

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Oak forests have been the basis of age-old subsistence agriculture in the Himalayan mountainous region where agro-pastoral communities have inhabited this zone, with increasing overexploitation which has therefore pushed these forests to the verge of extinction in many localities. In view of this, the present investigation into the qualitative and quantitative assessment (core of ecological studies) of Ban Oak forest vegetation of the Himalayas has been conducted so that further various conservation strategies are to be implemented. Ban Oak forest of Kullu District of Himachal Pradesh was studied to assess the variation in composition and diversity in different vegetation layers, i.e., tree, shrub and herb, along three altitudinal zones ( $A_1=1350m-1550m$ ), ( $A_2=1550m-1750m$ ) and ( $A_3=1750m-1950m$ ). In this study, a total of 45 species (7 Trees, 16 Shrubs, 22 Herbs) were recorded. The total species richness recorded was from 39 (5T+14S+20H) to 32 (4T+12S+16H) to 28 (4T+10S+14H) with increasing altitudinal gradient. *Quercus leucotrichophora* was the dominant species in all the altitudinal zones with other associated tree species like *Cedrus deodara*, *Pinus roxburghii*, *Rhododendron arboreum*, *Pinus wallichiana* etc. The dominant shrub species were *Myrsine africana*, *Viburnum cotinifolium*, *Rosa moschata* and *Berberis aristata* etc. while *Achyranthes bidentata*, *Rumex nepalensis*, *Ageratum conyzoides*, *Trifolium repens* and *Viola odorata* etc. were dominant herbaceous vegetation. Total tree density was 441.11  $Nha^{-1}$  whereas total tree basal area was 34.62  $m^2ha^{-1}$ . Total shrub density was 3604.67  $Nha^{-1}$  whereas total shrub basal area was 4.96  $m^2ha^{-1}$ . Total herb density was 147636.79  $Nha^{-1}$  whereas total herb basal area was 1.88  $m^2ha^{-1}$ , all showing a diminishing trend with increase in altitude. This ecological study can be used as a background to suggest strategies to conserve, restore and sustain the forests, taking into account the social and economic concerns of the village community.

**Keywords:** Ban Oak forest, Western Himalayas, altitudinal zones, conservation

### **Doubling the Farmer's Income by Cultivating Tulsi Under Organic Manuring**

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Basil or sacred Tulsi (*Ocimum sanctum* L.) is a shrub and known as “queen of herbs” belongs to the “Lamiaceae” family. This plant has been cultivated for centuries in India for multiple purposes. The oil of Tulsi has 70% eugenol and compared to clove oil. For the cultivation of medicinal plants, under National AYUSH mission government is providing financial assistance to



farmers, large scale production of medicinal plants can be used for diversifying the sources of farm income in Himachal Pradesh. Farmers of many states in India have made the choice of cultivating medicinal plants and making profits by cultivating it. Varieties like Drudriha, Kali, Babi, Amrita, vana and Kapoor used in making Tulsi oil, which is mosquito repellent, and an anti-malarial drug. For plantation use seed rate of 120 g per acre with Mancozeb @ 5gm/ kg as seed treatment. The use of Vermicompost and FYM at appropriate doses was found beneficial for minimizing competition for critical resources. Vermicompost @ 4t/ha was the most effective dose of organic manure, followed by FYM @ 4t/ha. Seeds of about 120 to 150 kilograms are harvested per ha. Whereas, 10 to 18 kg of oil per ha. The price of tulsi seed is around 1500 to 2000 rupees per kg and its oil price is around 7000 to 8000 rupees per kilogram in International market. After calculating the cost of cultivation the net return about 2 to 2.50 lakh can be earned. Cultivating tulsi is a good example of this by applying only 20000 to 25000 rupees to understand the cultivation process; it will be 3 to 4 lakhs in just 3 months. The income is up to Rs3 lakh if climate favor good for proper growth of the plants.

**Key words:** Tulsi, Doubling income, Organic, Farmer, Himachal Pradesh.

### A Short and Stereoselective Synthesis of Hagen's Gland Lactones

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Bracnoid wasps extrude fragrant volatile compounds from their abdominal tips (Hagen's gland). These fragrant volatiles are rich in lactones. The chemical analysis of these glands suggested the presence of two bicyclic lactone which are now known as Hagen's gland lactones.<sup>1</sup>Owing to interesting structural design of Hagen's gland lactones and role as in integrated pest management many strategies there have been considerable efforts in the synthesis of these lactones.<sup>2</sup>

We wish to report a simple, efficient method for synthesis of Hagen's gland lactones. The synthetic route employed is economical as well as practically scalable within five steps without use of any toxic metals. The scheme can even be used for synthesis of bioactive natural products containing bicyclic lactone and tetra substituted THF rings.

The synthesis of Hagen's lactone began with hexanal/octanal by employing epimerization followed by an intramolecular cyclization strategy. Overall 52% yield was obtained.

**Key words:** -Chloro Sulphide, Bicyclic -Lactones, Hagens Gland Lactone, Oxy-Michael Addition, Vinylogous Mukaiyama Reaction.

### Screening of selected potato (*Solanum tuberosum* L.) germplasm for apical leaf curl virus (ToLCNDV) resistance

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In the recent days viral diseases have emerged as major threat for potato, which is the largest vegetable crop in terms of quantity in India with an annual production of more than 52 million tones. Disease caused by the viruses is one of the most important for potato production, especially for seed potato production as these viruses not only affect the quantity but also cause the degeneration of quality. Unlike bacterial and fungal, viral diseases cannot be managed effectively by the application of pesticides. There are more than 30 viruses known to infect potato but only few cause serious threat to its production. A new leaf curl disease of potato is emerging at an alarming rate in northern India caused by potato apical leaf curl virus (PALCV) also called tomato leaf curl new delhi virus (ToLCNDV). Within 15 years of its first report, it has become a major limiting factor for potato production with 40–100% infection and posing major threat for potato seed production system. This has led to making the germplasm and parent material screening mandatory for the disease in all potato breeding programs. Considering the importance of the disease, 52 selected potato germplasm lines including Kufri Bahar (tolerant) and Kufri Pukhraj (susceptible) were screened for their reaction to the viral disease at Hissar for two years. The disease incidence was observed on 30, 60 and 80 days after



planting (DAP). A total of 5 potato accessions did not show any symptoms similar to the resistant Kufri Bahar. Eight lines showed moderate resistance with 30% disease incidence even after 80 DAP, while all other lines were susceptible to the disease. The resistant lines along with both controls were further taken for testing under controlled glass house conditions using a novel vacuum agro-infiltration technique. The field and the glass house results were further verified for presence of virus and viral load using PCR and qRT-PCR respectively. The results indicated that all the resistant lines contained viral load but were symptomless. The work undertaken would greatly help in the breeding programs targeting virus resistance.

**Key words:** Germplasm, Tolerant, Susceptible, Breeding, Seed production

### **Performance of tropical sugar beet (*Beta vulgaris* L.) as influenced by sources of nitrogen and liquid manures in Deccan plateau of peninsular India**

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Field trial was conducted during two consecutive *kharif* seasons of 2010 and 2011 to evaluate the influence of sources of nitrogen (SN<sub>1</sub>, SN<sub>2</sub>, SN<sub>3</sub>, SN<sub>4</sub> and SN<sub>5</sub>) and liquid manures (LM<sub>1</sub>, LM<sub>2</sub>, LM<sub>3</sub>, LM<sub>4</sub> and LM<sub>5</sub>) on growth, yield and quality of sugar beet (*Beta vulgaris* L.) at Agricultural Research Station (ARS), Madhurakhandi, University of Agricultural Sciences, Dharwad, Karnataka. The experiment was laid out in split plot design with three replications where in sources of nitrogen and liquid manures were assigned to main and subplot, respectively. Results of the study revealed that among the sources of nitrogen, application of 100 % RDN through inorganic fertilizer (IF) (SN<sub>1</sub>) recorded significantly higher tuber (77.16 t/ ha) and sugar yield (8.50 t/ ha) than other sources of nitrogen. All the liquid manure treatments did not differ significantly, but differed significantly with that of control (no spray). Interaction results clearly revealed that application of 100 % RDN (120 kg/ ha) through IF along with foliar spray of VW (20 %) and CU (10 %) at 30 and 60 DAS (SN<sub>1</sub>LM<sub>4</sub>) was found optimum for getting higher sugar beet tuber yield (80.13 t/ ha), sugar yield (9.28 t/ ha), net returns (Rs. 64528/ ha) and B:C ratio (2.49). However, application of 75 % RDN through IF + 25 % RDN through vermicompost and poultry manure in equal proportions along with foliar spray of VW (20 %) and CU (10 %) at 30 and 60 DAS (SN<sub>2</sub>LM<sub>4</sub>) remained on par with SN<sub>1</sub>LM<sub>4</sub>.

**Keywords:** Growth, Liquid manure, Nitrogen, Poultry manure, Sugar beet, Quality, Vermicompost, Yield

### **Production Potential of Tropical Sugar beet Cultivars in intercropping with Sugarcane at different row proportions in Northern Karnataka**

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The field experiment was carried out during 2010-11 at Agricultural Research Station (ARS), Madhurakhandi (Dist. Bagalkot), University of Agricultural Sciences, Dharwad to evaluate tropical sugar beet cultivars (Cauvery, Shubhra, Magnolia and Calixta) with different row proportions (1:1, 1:2 and 1:3) in sugarcane. There were seventeen treatment combinations laid out



in randomised complete block design with three replications. Results indicated that sole sugarcane and sugarcane (SC) + sugar beet (SB) in 1:1 RP recorded significantly higher cane (103.56 and 98.58 (average of all cultivars) t ha<sup>-1</sup>, respectively) and sugar (11.40 and 10.85 (average of all cultivars) t ha<sup>-1</sup>, respectively) yield when compared to other intercropped treatments (SC + SB in 1:2 and 1:3 RP). Sole sugar beet cultivars Cauvery and Shubhra recorded significantly higher tuber (88.68 and 82.74 t ha<sup>-1</sup>, respectively) and sugar (10.15 and 9.35 t ha<sup>-1</sup>, respectively) yield than intercropped treatments. In intercropping system sugar beet cultivars Cauvery and Shubhra in 1:3 and 1:2 row proportions recorded significantly higher tuber and sugar yield than 1:1 RP. Sugarcane (SC) + sugar beet (SB) (cv. Cauvery) in 1:2 and 1:3 RP recorded significantly higher gross returns (Rs. 285404 and 278083 ha<sup>-1</sup>, respectively) and net returns (Rs. 199087 and 187457 ha<sup>-1</sup>, respectively) when compared to other treatments, but B:C was significantly higher in 1:1 RP(3.33).

**Key words:** sugarcane, sugar beet, intercropping, cultivar, row proportion

### Effect of post-harvest treatment of Salicylic acid on Shelf Life of Kinnow Fruits Stored Under Ambient Conditions

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The post-harvest treatment comprising five applications of salicylic acid was laid out in a completely randomized block design with four replications. Mature Kinnow fruits of uniform size, bruise and disease free were harvested from all four sides of the Kinnow tree canopy with the help of secateurs. The Kinnow fruits were subjected to washing with chlorine solution (100ppm). The treated fruits were packed in Corrugated Fibre Board boxes with newspaper lining and each replication comprised of four kilogram fruits. The boxes were kept at an ambient temperature and relative humidity in the post-harvest laboratory. The physico-chemical changes in the fruit were recorded at harvest and after five days interval during storage. The fruits treated with Salicylic acid (3.0mmol/L) and Salicylic acid (2.5mmol/L) minimizes the physiological loss in weight and decay loss and retains fruit firmness as compared to control. The microbial counts were found significantly lowest in Salicylic acid (3.0mmol/L) followed by Salicylic acid (2.5mmol/L) as compared to control under ambient storage condition. The quality parameters viz., total soluble solids, acidity, total sugars, reducing sugars and ascorbic acid were found non-significant with different treatments as compared to control.

**Keywords:** Kinnow, salicylic acid, physiological loss in weight, shelf life, storage

### Effect of different nutrient management schedule on growth and yield of different strawberry cultivars under Punjab Condition

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Field experiment was conducted at Farm of Agriculture Department, Baba Farid College, Bathinda to study effect of different nutrient management practices on growth and yield of different cultivars of strawberry during 2018-19. The three different strawberry cultivars were planted combination with 13 different treatments of nutrients. The runners were planted in each plot which was replicated three times randomly. The experiment design was a split plot fitted to randomized complete block. The result revealed that treatments T11 (100% NPK + FYM + vermicomposte + Azotobacter), T12 (75% NPK + FYM + Vermicompost + Azotobacter) and T8 (100% NPK+FYM + Azotobacter) showed better results of growth and yield characters in all three cultivars Chandler, Winter Dawn, Camarosa. T1 (control) and T4 (50% NPK) were found poor results with respect to growth and yield characters. The Cultivars Camarosa performed better than Winterdawn and Chandler with respect to growth and yield.



**Key words:-** strawberry, growth, yield, NPK, FYM, Biofertilizer

### **Effect of non-genetic factors on reproduction traits in crossbred cattle**

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The data for the present investigations were collected from the history and pedigree sheets maintained at Research Cum Development Project on Cattle, M.P.K.V., Rahuri, (MS), for the period of 40 years (1972 to 2011) on reproduction and production traits of Girhalfbreds, triple cross and their *Interse*. The data were classified according to genetic group, season of birth/calving, period of birth/calving and lactation order. In order to overcome non-orthogonality of the data due to unequal subclass frequencies, least squares techniques (Harvey, 1990) was used to estimate the effect of different factors using different effects of genetic and non-genetic factors. The results obtained in the present investigation of the overall least squares means of AFS in FG and FJG were  $455.95 \pm 6.91$  and  $496.72 \pm 5.08$  days while in *Interse* of FG and FJG were  $638.99 \pm 8.31$  and  $660.31 \pm 8.86$  days, respectively. The DMRT revealed that the POB (1975-1977) had significantly lower AFS in FJG group. In *Interse* of FG cows born during period 2004-2009 had lowest AFS which was at par with the period 1980-1982 and significantly differed than rest of the period. AFS of cows born during *Interse* of FJG group and born during period 1983-1988 had significantly lower AFS followed by cows born during the period 1977-1982, 1989-1994, 2007-2011, 1995-2000 and 2001-2006. The season of birth had non-significant effect on AFS in all genetic groups. The generation had significant ( $P < 0.01$ ) effect on AFS. The overall mean for AFS as affected by generation was  $628.91 \pm 6.09$  days in FG and  $645.81 \pm 5.18$  days in FJG. The effect of genetic group on AFS was non-significant. However, the FG group had lowest AFS. The overall least squares means of AFS in  $F_1$  cows of FG and FJG was  $533.41 \pm 6.37$  and  $538.82 \pm 0.37$  days, while in cows of *Interse* of FG and FJG it was  $743.13 \pm 10.72$  and  $760.44 \pm 12.61$  days, respectively.

**Key words:** Effect, non-genetic, reproduction traits, crossbred cattle

### **Biochemical basis of floral transition and its influence on bearing behaviour in mango (*Mangifera indica* L.)**

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Alternate bearing is a phenomenon that determines production in mango during on and off years. This bearing behaviour is regulated by different biochemical and molecular mechanisms. In this context, a systematic study was conducted to evaluate the biochemical parameters that regulate floral induction in mango, sampling were done during flower bud differentiation stage (October) and flower bud swelling stage (January) in regular bearing variety 'Amrapali' and alternate bearing cultivars 'Dashehari', 'Langra' and 'Chausa'. The biochemical changes in terms of chlorophyll *a*, chlorophyll *b*, total chlorophyll, total sugar, total phenol and total anthocyanin content were recorded in all the four mango cvs. Chlorophyll *a* and *b* content was found to depict an increasing trend from bud differentiation to bud swelling stages in all four cultivars. Similarly shoots destined to carry floral buds had higher chlorophyll content in comparison to vegetative shoots. Estimations of total soluble sugar indicated high content in floral bud bearing shoots in all varieties. Highest value for TSS was recorded in Amrapali FBS (30.31) and least in Dashehari VBD (7.84). Nonetheless interestingly both Amrapali and Dashehari FBD and FBS possess high TSS in both sampling times. Corresponding high percent enhancement of TSS in Langra FBS (38.73) and Chausa FBS (79.91) shoots is missing. Furthermore in Amrapali there is a increased concentration in total phenol and anthocyanin content in floral flush with the advancing stage i.e (FBS) as compared to 'Dashehari', 'Langra' and 'Chausa'. Lower phenol content in vegetative bud swelling stages in all varieties implicates its inhibitory role in cell proliferation. On the basis of maximum sugar, phenol and chlorophyll content in 'Amrapali' during flower bud swelling stage, it may be concluded that a faster rate of synthesis of these metabolites in leaves of regular bearing cv. Amrapali and accumulation in Dashehari allows flower bud swelling stage. These studies



elucidate interplay between various biochemical attributes responsible for floral induction in different varieties. The comprehensive analysis for understanding the function of biochemical parameters associated with floral and vegetative bud formation, the information may pave way for better regulation of flowering shoots towards enhanced fruit productivity under subtropics.

**Keywords:** *Mangifera indica*, flowering, biochemical parameters, flower bud differentiation, flower bud swelling.

### **Aquatic Pollution due to Industrial Waste – A Review**

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In the era of moderation pollution is the main man made problem. Aquatic pollution is problem in water bodies like water pounds, water lakes, rivers, oceans and many water containing bodies. Water pollution is a global challenge that has increased in both developed and developing countries, undermining economic growth as well as the physical and environmental health of billions of people. Human settlements, industries and agriculture are the major sources of water pollution. Globally, 80 percent of municipal wastewater is discharged into water bodies untreated, and industry is responsible for dumping millions of tonnes of heavy metals, solvents, toxic sludge and other wastes into water bodies each year. In India groundwater is a critical resource, which accounting for over 65% of irrigation water and 85% of drinking water supplies. Groundwater is the world's largest freshwater resource, is important for irrigated agriculture and hence for global food security. The groundwater is considered to be less vulnerable than surface sources to climate fluctuations and can therefore help to stabilize agricultural populations and reduce the need for farmers to migrate when drought threatens agricultural livelihoods. The basic approach in the Clean Water Act (CWA) over the past 25 years has been greater control of "point sources" of water pollution - primarily factories and city sewers, along with controls on activities that destroy wetlands. In the last decade, federal law and policy has been strengthened several times. These include changes in federal farm policies to substantially improve technical and financial assistance to farmers to protect the environment, new changes in federal land management policies to increase protection of aquatic resources and watersheds, and new authorities to protect coastal waters.

**Keywords:** Aquatic pollution, Industries

### **Genetic Variability and Heritability Estimation in *Amaranthus* (*Amaranthus* spp.) Genotypes**

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The experiment was conducted at Horticulture Research cum Instructional Farm, Department of Horticulture, Indira Gandhi Krishi Vishwavidyalaya, Raipur (C.G.) during Rabi 2014-15. Twenty five genotypes of *Amaranthus* were evaluated and observations were recorded on leaf yield and its attributes on five randomly selected competitive plants from each plot and replication. The analysis of variance indicated the existence of sufficient amount of variability among genotypes for all the characters studied except for test weight and stem girth. The phenotypic variance was in general higher than the genotypic variance for all the characters. Among different yield attributing characters studied, seed yield (gm) plot<sup>-1</sup> had the highest magnitude of PCV (39.89 per cent) and GCV (38.83 per cent).

**Keywords:** Amaranth (*Amaranthus* spp.), Genetic variability, Phenotypic, Genotypic, Coefficient of Variation, Heritability, Genetic Advance, leaf yield.



### Soil restoration potential of different bamboo species in mid-hill conditions of HP

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The nutrient cycling in bamboo forests had shown improvement in soil fertility due to its vigorous growth and litter production. The bamboos growing in wild play an important role in soil nutrient buildup and maintenance of soil fertility. However, the cultivated one that has been managed by farmers in Asia over millennia for their livelihood was little studied with respect to its role in soil nutrient status and growth characteristics. Therefore, present study was conducted to describe the usefulness of different species of bamboo in improving soil quality under pure plantation. The experiment was carried out in mid hill conditions of HP in pure plantation of bamboo species viz. *Dendrocalamus asper*, *D hamiltonii*, *Bambusa tulda*, *Phyllostachys aurea*, *D strictus*, *Malocanabaccifera* and *Phyllostachys bambusoides*. The soil properties viz., soil pH, EC, bulk density, organic carbon, SOC stock, available N, P, K, Exchangeable Calcium and Magnesium were studied at two soil depths i.e. 0-20cm and 20-40cm. The results revealed that the bamboo species and soil layers had no significant influence on soil pH, EC and bulk density whereas, organic carbon decreased with the increase in soil depth and was found highest (16.12 g/kg) in 0-20cm soil depth and lowest (14.02 g/kg) in soil depth of 20-40cm. Among species, the soil organic carbon was found to be maximum (16.20 g/kg) under plantations of *D asper*. SOC stock was found maximum (36.41 Mg/ha) in *D hamiltonii*. Available N (333.77 kg ha<sup>-1</sup>), K (319.52 kg ha<sup>-1</sup>), Exchangeable Calcium (818.63 mg kg<sup>-1</sup>) and magnesium (626.49 mg kg<sup>-1</sup>) all were significantly higher in *D asper* whereas, the available P was maximum (44.42 kg ha<sup>-1</sup>) under *D. strictus*. All mineral nutrients were observed to be maximum at soil depth of 0-20cm. The higher quantity of mineral nutrients under *D asper* plantation suggest its potentials in restoring soil quality through on site enrichment, conservation and cycling of carbon and nutrients.

**Keywords:** Bamboo, soil nutrients, *Dendrocalamus*, *Bambusa*, *Phyllostachys*, *Malocana*

### Effect of spacing and fertigation on flowering and yield in processing varieties of tomato

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The var. Abhinav was recorded the lowest number of days to 50% flowering (59.40 days) with highest fruit yield per plot (970.24 kg). Planting density at 75 cm x 40 cm (S<sub>2</sub>) recorded significantly the lowest number of days to 50% flowering (59 days) followed by 60 cm x 60 cm (S<sub>3</sub>). The highest number of days to 50% flowering (61.70 days) was recorded by 120 cm x 40 cm. Application of 180N: 90P: 90K kg per ha (F<sub>3</sub>) recorded the highest number of days to 50% flowering (66.01 days) and fruit yield per plot (1066.04 kg) followed by 150N: 75P: 75K kg per ha (F<sub>2</sub>). The lowest readings of these parameters were recorded by the application of 120N: 60P: 60K kg per ha (F<sub>1</sub>). Among three way interactions, the lowest number of days to 50% flowering was recorded by the combination of variety Abhinav + 75 cm x 40 cm (S<sub>3</sub>) + 120N: 60P: 60K kg per ha (54.26 days).

Key words: Tomato, days to 50% flowering, yield, planting density, Fertigation

### Socio-economic Status of Buffalo Dairy Owners in Parbhani district

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The present study was structured with interview schedule and the data were collected through personal interviews of the dairy selected farmers. The survey was conducted through 8 districts of Marathwada region & around 960



farmers were identified. The data were classified on the basis of age, education, caste, family size, herd size, land holding, occupation, family type, annual income, social participation of the farmers and their adoption to various buffalo management practices and constraints faced by them in adopting such practices. The data collected were classified and analyzed for frequency and percentage and Least squares method as suggested by Harvey (1976).

Age-old dairy farmers have no significant contribution towards dairying also the contribution of those with graduation and post-graduation level of education is very low. The caste has no relation with the quality or quantity of milk produced. The dairying business is mainly controlled by medium and small family but where the family size is large (member with 9 and above) contributed least. The highest number of animals, possessed very few dairy farmers, had large size herds. Very low proportion of landless labourer (14.79 per cent) contributed to dairying in Marathwada region. Out of 960 dairy farmers studied, majority had single type family (59.47 %) and remaining were of joint type family (40.52 per cent). The majority of the dairy farmers (40.83 per cent) were in high income group followed by medium, low and very high group. The participation in various social activities was 20 per cent (low), 34 per cent (medium), 27 per cent (high) and 19 per cent (very high) among 960 dairy farmers of the region. Only 20.83 per cent of dairy farmers were having high adoption level.

**Key words :** Buffalo, Dairy Farmers, Dependent and Independent variables etc.

### **Efficacy of Bio pesticides for management of Banana scarring beetle (*Basilepta sp.*, *Colaspis sp.*) in Koshi region of Bihar**

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Banana is cheapest, plentiful and wonder berry forming staple food for people in the world. The ripe banana fruit is the high source of vitamin A and medium source of Vitamin C, B<sub>1</sub> and B<sub>2</sub>, while the unripe banana fruit is rich in minerals mainly iron and various types of vitamins. In Koshi region of Bihar, particularly in Katihar, Purnea and Naugachhia sub division of Bhagalpur, banana is grown by farmers on commercial basis and they use good agricultural practices. Although different types of pests attack on Banana plant causing damage to the plant, but it has been observed that the magnitude of problems of Banana scarring beetle has increased due to improvement of nutritive quality of host plants, coupled with dense cropping system. The scarring beetle, a serious insect pest species has drawn considerable attention to the banana entomologist. In India it has become a national insect pest since last decade of the last century and it has been reported from states like Bihar (Sen and Prasad 1953, Kumar 1996), Assam (Sharma and Debroy 1995; Bardoloi 1996) and West Bengal (Maiti and Hansda, 2002) by different workers. Banana was found infested with scarring beetle that causes scars on fingers of banana. Due to scars appearance on banana fingers and deterioration of quality, it ultimately fetch low price in the market. The present observations revealed that the occurrence *Basilepta sp.*, *Colaspis sp.* under Koshi region of Bihar caused serious damage to young and developing fruits well as to leaves. Earlier this pest of Banana not found in winter season during December to January but now it was also observed in that period and now got the status of a major pest of Banana in Koshi region of Bihar. To study the bio efficacy on Banana scarring beetle, *Basilepta sp.*, *Colaspis sp.*, a field experiment was conducted at Bholu Paswan Shastri Agricultural College, Purnea, which is situated Koshi region of Bihar during kharif March, 2014 to February, 16. Purnea is situated at 25°13'80"N-27°07'59"N Latitude and 86°59'06"E-87°52'55"E Longitude. Tissue culture banana plant cv. Grand Naine (G9) was planted in BPSAC, Purnea. Count was taken from randomly selected 16 plants on the number of adults beetle and its scars at 15 days interval from top leaf (furred or unfurred) of plant from 4 PM onward, during the active period of the beetle. The adult of this pest come out early in the morning and causes damage to top whorl leaf and fruits of Banana by making scratches.

Almost all banana plants were found infested from vegetative to flowering stage. In 2014-15, among different bio pesticide, Neem seed kernel (NSK) Powder @ 15 g per banana whorl application was found most effective, lowest scarring beetle population (12.28 adult per plant) and the lowest scars (14.07 scars/20cm<sup>2</sup> area of banana) on leaves and fruits. In 2015-16, among different bio pesticide, NSK Powder @ 15 g per banana whorl application has found most effective. It recorded lowest scarring beetle population (14.34 adult per plant) and the lowest scars (13.98 scars/20cm<sup>2</sup> area of banana) on leaves and fruits of





banana. This article bears BAU communication number **720/2019**.

### **Evaluation of fungicides, botanicals and bio-agents against *Alternaria alternata* incitant of leaf spot of soybean**

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*Alternaria* leaf spot of soybean is an important disease of soybean inflicting heavy losses in now days. The present investigation was carried out to test the efficacy of fungicides, botanicals and bio-agents in vitro. Among fungicides tested, Hexaconazole, Propiconazole, Propineb and Cymoxonil + Mancozeb showed 100 percent mycelial inhibition of *Alternaria alternata*. Among the botanicals evaluated against *Alternaria alternata* in vitro, Garlic clove extract@ 10% was found most effective giving (87.50%) inhibition against *Alternaria alternata*. Bio-efficacy of bioagent also tested by dual culture technique and results revealed that *Trichoderma harzianum* and *Trichoderma asperellum* gave the best effect against *Alternaria alternata* forming maximum percent mycelial inhibition i.e. 79.65% and 76.55%.

**Keywords:** Soybean, *Alternaria alternata*, fungicides, botanicals, bio-agent



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