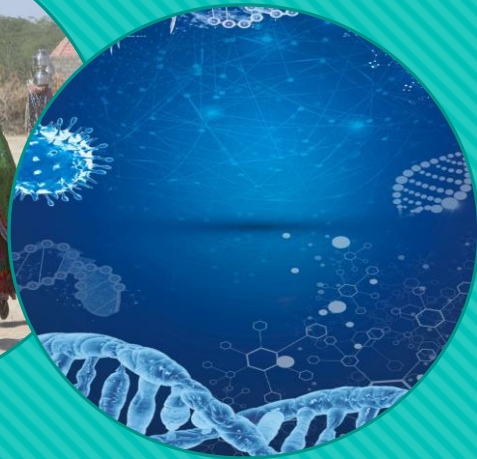


Proceedings

International Conference On Advancement of Science and Technology for Environment, Society and People (ICASTESP-2022) (28-29 January 2022)



Organised by

Society for Technology,
Environment, Science & People,
Kozhikode, India



(<https://www.societytesp.org/>)

Proceedings
of the
International Conference
On
**Advancement of Science and Technology for Environment,
Society and People (ICASTESP-2022)**
Kozhikode, Kerala, India
(28-29 January 2022)

Editors

Devi Dayal

Shamsudheen M

Pankaj Kumar

Organised by



Society for Technology, Environment, Science & People, Kozhikode, India

(<https://www.societytesp.org/>)

Citation:

Devi Dayal., Shamsudheen, M. and Pankaj Kumar. 2022. Proceedings of the International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-2022) organised by the Society for Technology, Environment, Science & People, Kozhikode, India, 28-29 January 2022, Kozhikode, India. Znan Publishers, Kozhikode, India. (ISBN: 978-81-956227-1-9). p. 74.

Title: Proceedings of the International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-2022)

Editors' Names: Devi Dayal., Shamsudheen, M. and Pankaj Kumar

ISBN: 978-81-956227-1-9

Published by:

ZNAN Publishers for

Society for Technology, Environment, Science & People, Kozhikode, India,
(<https://www.societytesp.org/>)

e-mail: societytesp@gmail.com

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Published on: 29 January 2022

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Emergence of vector transmitted animal diseases and their control strategy

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Introduction

Vectors are mostly arthropods that can transmit infectious pathogens between animals or humans and from animals to humans (zoonotic). These arthropods can transmit many viral, bacterial and parasitic diseases from one host to the other. The transmission mode can be either mechanical or biological. In biological transmission, the pathogen completes some part of its life cycle in the vector before being transmitted. The emergence and spread of vector transmitted disease is a function of biotic and abiotic factors associated with socio-demographic characteristics prevailing in animal husbandry in the region. All these three factors are interdependent and contribute to the emergence of existing and new animal diseases spread in the area. Among abiotic factors, changing erratic weather contributed by global warming has gained the researcher's notice. It is estimated that average global temperatures may rise by 1.0–3.5°C by 2100 (Watson et al. 1996). Global warming immediately affects agro-climatic regions of mountains, adjoining ocean borders and deserts. Global warming has exhibited considerable heterogeneity, with more significant warming over land than oceans (Rocklöv and Dubrow, 2020). The most devastating cause for these changes is the increasing population of humans and animals, industrialization, and deforestation, contributing to more greenhouse gas emissions. The livestock population has also been blamed for contributing to the total emissions. A published report by FAO has estimated that the global livestock population contributes to 7.1 Gigatonnes of CO₂-equivalent per year, representing 14.5 % of all anthropogenic greenhouse gas emissions (Sharma et al., 2021). Among all livestock species, cattle are responsible for about 65% of the livestock sector emissions. Among greenhouse

gasses produced by livestock, methane contributes to about 44 %, and the remaining share is from nitrous oxide (29 %) and carbon dioxide (27 %). Increased global temperature by one-degree Celcius has caused more evaporation, resulting in complex, region-specific changes in the hydrological cycle.

Study reports that there has been an increase in overall global precipitation resulting in regional areas have become wetter, while some other regional areas have become drier (Rocklöv and Dubrow, 2020). Most researchers consider that global warming and climate variability (inter-annual and inter-decadal) are likely to significantly impact vector-transmitted infections to animals and humans (Githeko et al., 2000; IPCC, 2014). As the environmental temperature increases, vectors requiring favourable temperature for their life cycle will find newer habitats where the temperature was not congenial initially, and vectors will move beyond their current habitats. Thus, shifting the burden of animal diseases like Surra, tropical theileriosis, poxvirus, Babesiosis, Anaplasmosis, mange, etc., to newer susceptible animal populations, sometimes beyond country boundaries. With the above understanding of the impact of global warming on vectors, animal diseases have emerged and re-emerged in the region. Other factors responsible for the emergence and reemergence of vector transmitted diseases are animal demographic changes, animal import-export policy, the ban on cow slaughter, illegal movement of animals trans-country and geographical location in the tropics sharing country boundaries with many other countries of the region. This lecture will focus on the economically important vector transmitted animal diseases that have recently emerged and re-emerged in this region and generalized vector control strategies.

1. Lumpy Skin Disease (LSD)

The Lumpy skin disease (LSD) is an OIE notifiable, poxviral disease of livestock. LSD is capable of spreading rapidly in bovine, especially cattle. It is an emerging disease affecting livestock economics detrimentally (Kumar et al., 2021). In around ninety years, the virus has

dispersed in numerous world locations, including India, after its first emergence in Zambia, Africa, in 1929. LSD virus emergence in the region had prevailed a concern amongst the bovine farmers due to economic/financial losses associated with the disease. The first outbreak of LSD in India was recorded/reported in 2019 from Odisha and later took a grip in many states (EFSA, 2020).

Cattle affected with LSD shows a characteristic nodular lesion or skin lump over the whole body and may occasionally be associated with systemic signs. Vector-borne mechanical transmission is considered primary and the most common route; however, other transmission routes are related to illegal animal trade. Vector-borne transmission of LSD virus to susceptible hosts may also result in the transmission of other vector associated pathogens, viz., *Anaplasma* spp., *Theileria* spp., *Babesia* spp., etc. and cause complications resulting from their co-infection. Symptomatic diagnosis is based on the appearance of its characteristic lumps and sitfast lesions over the skin. OIE recommends the virus neutralization test as a Gold standard for diagnosing. Diagnosis in LSD free countries requires virus isolation and virus isolate sequencing.

There is no specific treatment to prevent and kill the LSD virus. Most treatment provided to the affected animals is supportive and is aimed to reduce the severity of viral pathogenesis and secondary complications associated with the disease. Control of LSD is possible by isolation, quarantine, restricting animal movement, biosecurity and vaccination. Vaccination is the mainstay in controlling the spread of LSD among livestock. LSD virus-specific vaccine is considered suitable for cattle and buffalo protection over the heterologous vaccine.

2. Tropical and Oriental Theileriosis.

Bovine Theileriosis is an economically devastating haemoprotozoan disease caused by parasites of the genus *Theileria*. They are obligate intracellular protozoan parasites that

infect wild and domestic Bovidae throughout India. In India, the annual loss estimated due to tropical theileriosis alone is approximately US \$800 million (PDADMAS, 2005). The mortality rate for tropical theileriosis varies from 3% to 90%, depending on the parasite species and the animals' susceptibility. Ixodid ticks (*Hyalomma* spp., *Rhipicephalus* spp., etc.) transmit them. There are many identified *Theileria* spp. that infects cattle; the two most pathogenic and economically important are *T. annulata*, *T. orientalis*, *T. hirci*, *T. parva*, *T. velifera* etc. However, in India, most reports of bovine theileriosis are restricted to infection of *T. annulata* (tropical theileriosis) and *T. orientalis* (non-pathogenic). Recent findings support that bovine infected with *T. orientalis* causes pathogenic changes and associated clinical symptoms. *T. annulata* is transmitted most commonly by the ticks of the genus *Hyalomma*, however other species of ticks and fleas may also be involved in transmission. The sporozoite stage of the parasite entering the host undergoes a complex life cycle that involves the replication of schizonts in WBCs and piroplasms in RBCs. The schizonts of the parasite occur in the spleen, lymph nodes, liver and whole blood (mononuclear cells) from tropical theileriosis infected animals.

Cattle that recover from *Theileria* infections become carriers. Theileriosis should be suspected in cattle infested with ticks or immediate past history of tick infestation and clinical symptoms of inappetence to anorexia, lacrymation, eye discharge, pale mucous membrane, mild to high fever and with or without enlarged superficial lymph nodes. OIE recommends field based diagnosis by finding *Theileria* parasites in Giemsa-stained blood smears and lymph node needle biopsy smears to identify Koch's blue bodies (KBB). Still, suffers from limitation that GSBS fails to differentiate species of *Theileria* infection, as most theilerial piroplasms are morphological identical. Therefore laboratory confirmation is essential based on molecular detection and to know the species involved in a particular region. Control of the disease relies on vector control and treatment with buparvaquone. However, the Schizont

vaccine as prophylaxis against Theileria are available but not in practice. Clinical signs of the disease are often not diagnostic for theileriosis, unlike Babesiosis, and blood smear often gives false-negative results when the infection is low.

3. Trypanosomiasis (Surra).

Surra has re-emerged as an important vector transmitted disease of buffaloes, cattle, camel and horses in the region. It is caused by a protozoa *Trypanosoma evansi* and mechanically transmitted by biting and sucking insects like Tabanus, Musca spp., Stomoxys, etc.. Leeches may transmit trypanosomes, especially for buffalo leech (*Hirudinaria manillensis*) in Asia. A total annual loss caused by surra was estimated to Rs 44,740 million in six major livestock species viz., cattle, buffalo, goat, equine, camel and pig (Kumar et al 2017). Surra infection may causes anaemia, weight loss, reduction in milk and draught power. Affected animals may have clinical signs of inappetence, fever, anaemia, abortion, reduced body weight gain, lacrymation, conjunctivitis, oedema in legs, dyspnea, diarrhoea, stiffness, recumbency and sometimes nervous signs with meningoencephalitis, abortion and interrupted oestrous cyclicity. Diagnosis is based on clinical signs and thick and thin blood smear examination from buffy coat or lymph node aspirate, wet mounts and nuclear amplification. Treatment is possible by use of medicines like dimenazine aceturate, surramin, melarsomine, isometamidium, etc at the prescribes dose and route. Control program is dependent on prophylactic medication as no vaccines are available.

4. Babesiosis (Red water disease).

Babesiosis is economically important vector-borne diseases of tropical and subtropical country including India. Babesiosis in cattle is important apicomplexan haemo-parasitic disease caused by the infection with intra-erythrocytic parasites of the genus Babesia, family Babesiidae and order Piroplasmida. The disease is transmitted to the cattle by the bite of tick belonging to genus Ixodes. The parasites (pear-shaped appearance) infects the red blood cells

(RBCs) of cattle and is called piroplasms. These piroplasms multiply in RBCs and causes it to rupture and subsequently infecting other RBCs. Babesiosis in cattle is associated with infection with mostly *Babesia bigemina*, however infection with *Babesia bovis* has also been reported. However, babesiosis in cattle of Europe is also caused by the *Babesia divergens* which is reported to be a lethal zoonotic disease. Treatment is effective by giving parenteral injection of Dimenazine aceturate and Imidocarb at prescribed doses. Control is restricted to vector control by either mechanical picking, cleaning of premises and chemical control by use of acaricidal drugs like amitraz, cypermethrin, deltamethrin topically and parenteral injection of ivermectin at prescribed doses/concentrations and intervals.

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Soil and water conservation in cashew plantations for improving sustainability

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Introduction

Cashew is an important horticultural crop in India, contributing to foreign exchange. In the year 2017-18, the country earned foreign exchange worth of Rs. 5871 Crores from the export of cashew nut kernel and Rs. 32.6 Crores from the export of cashew nut shell liquid. In India, cashew is mainly cultivated along the coastal region. The important cashew growing states are Maharashtra, Karnataka, Kerala, Goa along the west coast and Andhra Pradesh, Odisha, Tamil Nadu, Puduchery and West Bengal along the east coast. It is also grown in other non-traditional areas such as Bastar region of Chhattisgarh and Kolar (Plains) regions of Karnataka, Gujarat, Jharkhand and in NEH region. The total area under cashew cultivation in India during 2018-19 was 11.05 lakh ha with a production of 7.43 lakh tones with average productivity of 707 kg ha⁻¹. The productivity of cashew in India is low compared to other producer countries such as Vietnam, Philippines, Peru and Mexico. Poor soil fertility and lack of adequate care are the major factors of low productivity. Being a hardy, fast growing drought tolerant tree, cashew is predominantly cultivated as a rainfed crop in soils of low fertility and in highly degraded lateritic hillocks. In traditional farming, the cashew trees seldom receive nutrients and water.

The cashew growing regions are characterised by high intensity rainfall over a short duration which leads to runoff and soil erosion. Cashew experience moisture stress during December/January to May which coincide with flowering and fruit setting phase of cashew, leading to flower drying and immature nut drop. Moreover, the traditional areas of cashew cultivation (hillocks and sloppy laterite terrains) lack access to water sources for irrigation purposes. Research studies indicate that cashew though a hardy crop responds well to water and nutrient management. In areas with no access to irrigation water, the water deficit to the crop can be managed to some extent by the adoption of region-specific soil and water conservation practices. Adoption of such practices is part of cashew production technology in case of slopy areas to prevent the surface runoff and soil erosion.

Soil and water conservation practices

Cashew plantations are raised on landscapes which are unsuitable for many other crops, and generally lack a source of water for irrigation. Arranging irrigation in such landscapes will be a difficult and costly affair. Adoption of proper soil and water conservation techniques *in-situ* in such sloppy and degraded landscapes play a very important role in preventing further soil degradation by controlling soil erosion, conserving soil moisture and improving tree growth and productivity in a sustainable manner. Modified crescent bunds, staggered trenches with coconut husk burial and reverse terrace are some of the recommended soil and water conservation techniques for cashew orchards. The other popular soil conservation practice recommended for cashew is terracing with catch pits. These practices were found beneficial to harvest pre-monsoon rainfall and increase the cashew yield to the tune of 32-35%. Other benefits are reduction in runoff velocity and soil loss, increased soil moisture retention and groundwater recharge. With the adoption of such soil and water conservation practices, barren /slopy lands can be brought under cashew cultivation in order to increase the farm income and land productivity.

Different technologies for in-situ soil and water conservation recommended for cashew are detailed below. The adoption of these practices should be done only in accordance with the local conditions, topography, water holding capacity and infiltration characteristics of the soil.

Trenches/engineering measures

Continuous bench terraces: Terraces stop the downslope soil and water movement and also give the advantage of providing a flat surface for the planting of cashew, thereby further reducing the possibility of erosion (Fig 1).



Fig. 1. Continuous terraces

Continuous contour trench: These trenches are taken in sloppy areas (7 to 8% slope), running through the entire field length along the contour. The trench dimension recommended is 0.5 m x 0.6 m.

Modified crescent bund: The modified crescent bund consists of a crescent-shaped bund of 6 m length, 1 m width and 0.5 m height at 2 m radius, which is to be taken at upstream of the cashew terrace which will help to retain water as well as litter (Fig. 2 and 3).



Fig. 2. Modified crescent bund for soil and water conservation in cashew orchards

Fig. 3. Terrace with crescent bund

Staggered trench: The staggered trenches of size 5 m length, 1 m width and 0.5 m depth are to be taken between two rows of cashew or in the middle of 4 plants, across the slope, in which coconut husks can be buried to enhance water retention (Fig. 4).



Fig. 4. Staggered trenches between two rows of cashew plants

Reverse terraces: The recommended dimensions for reverse terraces are 2 m length, 2 m width and 0.7 m depth, which are constructed so as to be inclined from periphery to the centre (Fig. 5).



Fig. 5. Reverse terrace for soil and water conservation in cashew orchards

Catch pits: The recommended dimensions for catch pits are 3 m length, 0.5 m width and 0.5 m depth, which are constructed upstream of cashew planted terrace, to catch and retain the runoff and to increase the percolation (Fig. 6 and 7).



Fig. 6. Catch pit



Fig. 7. Terrace with catch pits for soil and water conservation in cashew in steep slopes

Tree base terrace: Formation of tree base terrace at 2 m radius around the plant, taken over three years of planting shall be beneficial for moisture conservation. It is made by taking soil from the upper side of the slope and filling at the lower portion. The upside shall be taken in such a way that it forms a catch pit to deposit soil and conserve moisture.

Bioengineering measures

Coconut husk burial: Adoption of coconut husk burial techniques with soil and water conservation measures like modified crescent bund, staggered trenches etc. improve the water retention in the soil for longer periods. This practice of coconut husk burial can be adopted around the cashew plants also. Husks are to be buried in trenches of 3.5 m length, 1 m width and 0.5 m depth, opened across the slope between two rows of cashew. In such trenches, 3 to 4 layers of husks can be buried with the convex side of the first layer of husk touching ground. The last layer of husks should be placed with the convex side upper side. A thin layer of soil and leaf materials can be placed between layers of husks. Then the trench can be filled with soil, leaving about 10 cm depth (Fig. 8).



Fig. 8. Coconut husk burial for soil and water conservation in cashew orchards

Use of bigger pits and mulching: This practice is to be followed during the establishment of cashew plantations. Pits of 1 m³ size are to be dug open at recommended spacing following other soil and water conservation measures such as terracing. These pits are to be filled with topsoil, organic manure and rock phosphate at recommended rate up to 2/3rd depth. Plant the graft at the centre of this pit and proper mulching to be done.

Trenches with vegetative barriers: Inclusion of vegetative barrier along with continuous contour trenches and staggered trenches (in reversely sloppy areas) can substantially reduce the runoff and soil loss. *Stylosanthes hamata*, *Vetiveria zizanioides* are some of the recommended vegetative barriers. Apart from helping to reduce runoff and soil loss, the vegetative barriers can be harvested to provide additional income.

Green manuring and mulching: Growing green manure crops like *Glyricidia* at vacant spaces and borders provide material for mulching. Mulching the tree basin with green mulch helps to conserve the soil moisture.

Circular trench with leaf litter and coconut husk: This practice is generally recommended for east-coast areas, wherein coconut husks and leaf litter are buried in circular trenches of 0.3 m width and 0.5 m depth opened at 2 m away from the cashew trunk (Fig. 9).

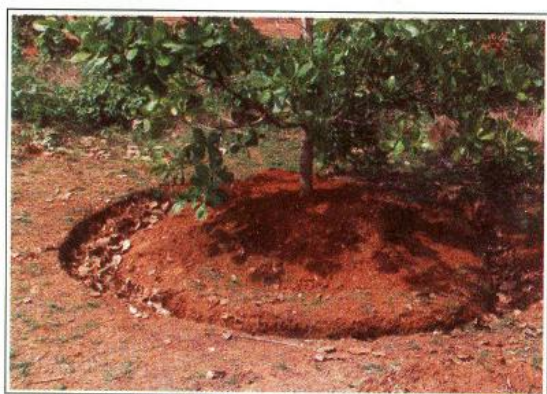


Fig. 9. Circular trench with leaf litter and coconut husk

Success stories

A farmer participatory research cum demonstration was undertaken in three districts of Karnataka, namely, Dakshina Kannada, Uttara Kannada and Udupi during 2018-19 and 2019-20 under Rashtriya Krishi Vikas Yojana – Remunerative Approaches for Agriculture and Allied Sector Rejuvenation (RKVY-RAFTAAR), Government of Karnataka. The farmers were selected based on reconnaissance visits and in consultation with field level extension workers, people's representatives, group discussion and participatory rural appraisal exercises with farmers. The farmers selected were such that they possess cashew plantations in the age group of 5 to 10 years under normal planting density (8 m x 8 m) and ready to implement the programme as per the guidelines. They were insisted to follow the recommended agro-techniques including site specific nutrient management based on mobile App based fertiliser application and recommended pest management practices. For water conservation they were instructed to dig catch pits at the rate of one in the middle of 4 trees. It is aimed at arresting the excess runoff and contributes to ground water recharge. The dimensions of catch pit prescribed were 5 m length, 1 m width and 0.5 m depth. The average baseline yield data was recorded during survey at the beginning of the study, and the yield data was recorded two years after implementation of the demonstration from a total of 60 farmers. The study showed that the adoption of improved technologies by the farmers resulted in a per cent increase in yield in the range of 55.8 to 72.0% and the BC ratio by 13.3 to 43.1% in two years. Kathuli and Itabari (2015) reported that the adoption of soil and water conservation practices together with soil fertility improvement activities helped to realise 50-100% increase in crop yields. The soil and water conservation techniques in oil palm plantation was also reported to be helpful to increase the yield (Murtalaksono et al., 2011). In cashew the beneficial effects of various soil and water conservation techniques were also reported by Rejani and Yadukumar (2010) and Manivannan et al. (2010). A post demonstration survey was also conducted to assess farmer's perception on

usefulness of the soil conservation activities. About 78.3% of them believed that, it is worth of investment, and 86.7% farmers agreed that the adoption benefit to improve the yield. Some farmers (58.3%) opined that such pits could interfere the field operations such as weeding and nut picking. Most of the farmers (90.0%) agreed about its usefulness in moisture conservation and ground water recharge. The soil sample studies showed that the fields with catch pits at the recommended rate conserved moisture in the range of 15.16 to 25.36% higher than adjacent control field.

Conclusions

Cashew is traditionally regarded as poor man's crop and rich man's food and is primarily grown in eroded and degraded landscapes in coastal region of India. The factors causing low productivity in India, among others are negligence on soil nutrition and water management. Adoption of soil and water conservation measures on sloppy lands is helpful in reducing runoff and soil erosion, reducing soil degradation and improving yield and income in a sustainable manner.

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Association of non-chemical and chemical approaches for induction of flowering on non-structural carbohydrates and C:N ratio in mango cv.

Alphonso

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Abstract: Konkan region of Maharashtra is known for best quality mango of cv. Alphonso which is having great demand in domestic as well as international markets. The late harvest of fruits fetches low market price causing huge economic loss to mango growers. Hence an attempt was made to find out association of various non-chemical and chemical approaches in internal content of non-structural carbohydrates and C:N ratio. The experiment was laid out in RBD with three replication and seven treatments viz., T₁- removal of new shoots, T₂- removal of old shoots below new, T₃- foliar spray of paclobutrazol @ 500 ppm, T₄- foliar spray of paclobutrazol @ 1000 ppm, T₅- foliar spray of ortho-phosphoric acid @ 0.5 %, T₆- foliar spray of ortho-phosphoric acid @ 1 % and T₇- control. Among the various non-chemical and chemical approaches T₁ and T₂- recorded highest flowering intensity, non-structural carbohydrates, C:N ratio and maximum yield.

Keywords: Mango, non-chemical and chemical approaches, non-structural carbohydrates, C:N ratio, flowering, yield

Crop production and precision farming

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Abstract: Precision farming is a comprehensive information-based farm management system which provided management concept based on observation and response to intra-field variations. It identifies, analyses and manage variability within fields for optimum profitability, sustainability and protection of land resources. Precision farming basically means adding the right amount of treatment at the right time and the right location within a field. New technologies such as Global Positioning Systems (GPS), sensors, satellites or aerial images and Geographical Information Systems (GIS) are utilized to assess and analyze variations in agricultural and horticultural production. Optimum return and preserving resources are the two primary goals of precision farming. Wireless Sensor Networks has crucial role to management of water resources, to assess the optimum point of harvesting, to estimate fertilizer requirements and to predict crop performance more accurately, disease and pest hazard also. Sensors use to precision farming technology in horticulture, which increasing productivity, decreasing production costs and minimizing the environmental impact of farming. Looking to the pressure arising population and erratic climatic variation, more attention required towards the development of technology driven horticulture precision farming. Due to high cost of technology and need of high-speed internet facility it is not so popular though it has a vital role in agriculture and horticulture sector.

Key words: Precision farming, Sensor application in agriculture, GIS

Perception of rural women towards food in the fight against COVID

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Abstract: The present study assessed the perception of 148 rural women towards importance of making changes and adopting informed choice of food for enhancement of health during COVID era. The type of supportive supplements taken before and during COVID were multivitamin tablets, ayurvedic tablets, *giloy* tablet and iron tablets. Only 25 per cent of the respondents had knowledge regarding role of vitamin C and vitamin D in immunity building before COVID but during COVID 55.41 per cent of the respondents had knowledge regarding role of vitamin C and vitamin D in immunity building. It was observed that the consumption of protective foods like fruits, vegetables, milk with turmeric, buttermilk, paneer and *khoya* increased during COVID. The consumption of ready to eat foods including chips, biscuits, cakes, icecream decreased from 57.45 to 31.91, 76.60 to 68.09, 57 to 12.77 and 36.17 to 14.89 per cent during COVID. However the consumption of homemade recipes increased from 61.70 to 78.72 per cent during COVID. It was observed that the daily, weekly once or twice or thrice, fortnightly and occasionally consumption of ready to eat foods decreased during COVID. Only 10.64 % of the respondents were consuming eggs and 4.26 % of the respondents were consuming chicken. No change was observed in consumption of these foods before and during COVID. The daily consumption of water was also increased during COVID. It was found that rural population was open to adopt righteous food items to protect themselves from COVID.

Key words: Food, intake, changes, COVID, health

Socioeconomic profile, food consumption pattern and dietary habits of rural women of Haryana during COVID

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Abstract: On line survey was conducted on 80 rural women of different districts of Haryana with the help of a well structured google questionnaire. The respondents were in the age group of 18 to 45 years and 26.25 percent of them were in the age group of 18-20 years while 66.25 and 7.50 percent were in the age group of 20-35 and 35-45 years, respectively. Majority of them i.e 42.5 percent belonged to general category, whereas 30 and 27.5 percent subjects belonged to backward and scheduled caste/tribe category, respectively. As many as 96.25 percent of rural subjects belonged to Hindu religion while only 2.5 and 1.25 percent rural women were Muslims and Sikh, respectively. Maximum (83.75%) number of respondents were vegetarian, 8.75 and 7.5 percent were eggetarian and non vegetarian, respectively. Higher number of respondent's family head was farmers i.e. 33.75 percent. An appreciable number (26.25%) worked in a private firm, 17.50 percent had a government job, 12.50 percent were engaged in own business and 10.00 percent were daily earners and worked as labourer. As many as 68.75 percent of them consumed food three times a day while 10.00 and 21.25 percent of them consumed food 4 and 2 times a day, respectively. Sixty percent of them had liking or cravings for fast food and remaining (40%) showed no interest in fast food. As regards frequency about 52.5 percent of them consumed fast food once in a week, whereas 30.00 and 17.50 percent of them took it once in a fortnight and twice in a week, respectively. Wheat was the most (98.80%) preferred/liked cereal by them while 48.80, 23.75 and 6.30 percent of them preferred rice, *bajra* and maize for consumption. There is need to apprise the rural women about beneficial intake of protective foods and have diet diversity.

Key words: Food, intake, rural, women, fast food

Response of spring-planted fodder maize to zinc and iron application in the semi-arid region of Haryana

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Abstract: Agronomic fortification through zinc and iron application in soil or foliar spray could be viable option to improve the productivity and quality of fodder maize, which ultimately helps in alleviate their deficiency in animals. To find out zinc and iron requirement of fodder maize a field experiment was conducted during *spring* season of 2020 at Agronomy Research Area of CCS Haryana Agricultural University; Hisar. The soil of the experimental field was sandy loam in texture, neutral in reaction, low in organic carbon and available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in FRBD design with four zinc levels [No ZnSO₄, 20 kg ha⁻¹ ZnSO₄ (basal dose), 25 kg ha⁻¹ ZnSO₄ (basal dose) and 25 kg ha⁻¹ ZnSO₄ (basal dose) + 1% foliar spray at 45 DAS] and four iron levels [No FeSO₄, 0.5% foliar spray of FeSO₄ at 30 DAS, 1% foliar spray of FeSO₄ at 30 DAS and 1.5 % foliar spray of FeSO₄ at 30 DAS] replicated thrice. Results shows that growth parameters and yield of fodder maize in spring season were significantly influenced due to zinc and iron management effects. Growth parameters like no of leaves /plant, leaf length, leaf breadth, plant height and LAI and yield of spring planted fodder maize were recorded highest with application of 25 kg ha⁻¹ ZnSO₄ (basal dose) + 1% foliar spray of ZnSO₄ at 45 DAS and 1% foliar spray of FeSO₄ at 30 DAS. Similarly foliar spray of 1 % FeSO₄ at 30 DAS recorded better growth parameters and significantly higher yield of fodder maize.

Keywords: Fodder maize, fortification, zinc, iron

Utilization of quinoa flour (*Chenopodium quinoa* Willd.) in gluten-free pasta formulation: Effects on nutritional, dietary fibre, total minerals and sensory properties

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Abstract: Quinoa is considered a pseudo-cereals crop. It is a broadleaf plant with starchy dicotyledonous seed and, therefore not a cereal. Quinoa is protein-rich but gluten-free hence it considers as a miracle grain. Extruded products found the best vehicle for conveying nutrients of quinoa flour to the consumer. In this study, quinoa flour was utilized in gluten-free pasta formulation. Quinoa flour is used in a different ratio (40 to 60 %) in rice flour and its outcome on organoleptic acceptability, nutritional composition and storage stability of developed pasta. Maximum organoleptic score (7.90; liked very much) was achieved by 60 percent quinoa flour pasta. The substitution of rice flour with quinoa flour augmented the crude protein (7.68 to 13.04 g/100g), fat (3.94 to 7.80 g/100), fibre (0.92 to 6.51 g/100g) and ash (1.57 to 2.95g/100g) in pasta. Total, soluble and insoluble dietary fibre content of supplemented pasta ranged from 4.03 to 8.26, 1.29 to 2.45 and 2.74 to 5.81g/100g; respectively. Calcium, iron, zinc and phosphorus content of supplemented quinoa pasta ranged from 14.34 to 141.55, 1.22 to 6.25, 0.36 to 3.13 and 112.59 to 304.32 mg/100g; respectively. Quinoa pasta was superior and can be stored up to 90 days. Quinoa supplemented pasta had significantly ($P<0.05$) higher contents of protein, fat, fiber, calcium, iron, zinc and phosphorus than that of control pasta. As a result, an increasing amount of quinoa flour enriched the nutritional composition of gluten-free pasta. Quinoa is easily available in the market and can be used to enhance the nutritional quality and further utilized in combination with a number of food products.

Keywords: Quinoa, Gluten free, Pasta, Organoleptic acceptability, Supplemented

Foliar application of GA₃ on corms attributes of gladiolus

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Abstract: An experiment entitled “Foliar application of GA₃ on corms attributes of gladiolus” have been conducted at the research instructional farm of AKSU Satna during rabi seasons of 2015-16. The experiment was laid out in RBD (with factorial concept) with three replications and using three levels of GA₃ such as 50ppm (GA₁), 100ppm (GA₂) & 150ppm (GA₃). The results of the experiment showed use of GA₃ influence on the most parameters such as number of corms plant⁻¹ and weight of corms plant⁻¹ was the significant on higher amount of GA₃ @ 150ppm.

Key words: Gladiolus, GA₃, corms, Snow princes.

Role of PGRs on growth and flowering of carnation

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Abstract: Carnation root growth was observed in half-strength MS supplemented with 1.0 mg/l NAA under *In-vitro* condition (Khatun *et al.*). Ali *et al.* (2018) reported positive influence of salicylic acid 90 mg L⁻¹ on flower production. GA₃ give the significant effect on Plant height, highest number of side-shoots/plants, highest number of leaves/shoots, and earliest time period from FBI to colour Showing stage, earliest flower bud initiation to colour Showing stage.

salicylic acid on vase life Roodbaraky *et al.*, (2012), same result observed by Maitra S. and Roy Chowdhury, S., (2015) and Benny *et al.*, (2017).

Key words: Carnation, PGRs, Growth and Flowering.

Occurrence of abortion in the goats reared at the organized farms

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Abstract: In a healthy herd of goats, the proportion of visible abortions is generally below 2 %. Abortion rate between 2 to 5 % indicates its endemic nature and abortion level exceeding 5% requires aggressive investigation. Abortion data for 10 years (2010-2011 to 2020-2021) was collected from Jamunapari, Jakhrana and Barbari sheds of the Institute (ICAR-CIRG, Makhdoom), in which the goats were reared under organized conditions. Decadal abortion rate in Barbari, Jamunapari and Jakhrana goats was found 2.35 %, 1.96 % and 2.23 %, respectively. Hence, Jamunapari goats were found healthy with respect to abortion occurrence during the period. In all three breeds, the abortion rate was observed highest in the late stage of pregnancy (50.66 %, 52.17 % and 47.61 %, respectively) followed by the mid stage (28%, 43.47% and 33.33 %, respectively) and the early stage (21.33 %, 4.34% and 19.04 %, respectively). Hence, in the late stage of pregnancy, occurrence of abortions was found maximum. Likewise, in the winter (47.82% and 46.66 %, respectively) and rainy seasons (47.82% and 50.66 %, respectively), the maximum abortions were seen in Jamunapari and Barbari goats, whereas in Jakhrana goats, most of the abortions occurred in winter season (76.19 %) only. If we combine data, abortions were maximum seen in the winter season (52.10%) and the late stage of

pregnancy (50.42%) during the period. Hence, we have to give extra care to the pregnant goats during later stage of pregnancy and winter season.

Keywords: Goats, abortion, pregnancy

Impact of zinc and boron fortification on yield enhancement in chickpea (*Cicer arietinum* L.)

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Abstract: The present study was conducted in the Division of Plant Physiology, Sher-e-Kashmir University of Agricultural Sciences and Technology of Jammu to evaluate the impact of zinc and boron fortification on yield enhancement in chickpea variety GNG-1958. Foliar application of boron and zinc were applied at different concentration with treatment T₁-Control, T₂-Zn (0.5 %), T₃-Zn (1.5 %), T₄-B (0.5%), T₅-B (1.0%), T₆-Zn (0.5 %) B (0.5%), T₇-Zn (0.5 %) B (1%), T₈-Zn (1%) B (0.5%), T₉-Zn (1 %) B (1%), T₁₀-Zn (1.5 %) B (0.5%) and T₁₁-Zn (1.5%) B (1%). Maximum number of leaves and branches/plant were observed in T₆ (144.00 and 6.22) in comparison to control (76 and 3.11) respectively. Dry weight of roots, shoots and pods were recorded maximum in T₆ and lowest was found in control. Highest crude protein content was recorded in T₆ (21.96) and minimum was found in control (18.70). Maximum soil zinc and boron content were observed in T₆ and lowest was found in control with highest straw zinc and boron content were recorded in T₆ and minimum in control. Highest chlorophyll *a* and *b* content were recorded in T₆ and minimum was found in control. Number of seeds/pods at

harvest was found maximum in T₆ and minimum in control. The highest test weight and harvest index were found in T₆ (29.33 and 33.11 %) and the lowest in control (24.88 and 30.01%) respectively. Foliar application of Zn (0.5 %) + B (0.5%) combination was found best for quantitative yield and quality production of chickpea crop.

Key words: Chickpea, zinc, boron, fortification, crude protein, quantitative yield and harvest index.

Morphological characterization, management and performance of indigenous cattle of Mizoram

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Abstract: A total of 274 local indigenous non-descript cattle were investigated and studied from Champhai and Kolasib districts of Mizoram for morphological characterization, managements and performances. The coat colour of indigenous cattle varies between brown (85%), black (11%) and grey (4%). The average body length, height at wither, chest girth, horn length, ear length and body weight of adult male or bull/bullock are 112.35±0.80 cm, 111.78±0.72 cm, 145.41±0.92 cm, 11.50±0.33 cm, 28.60±0.51 cm and 220.14±3.09 kg respectively. While the corresponding values for adult female or cow are 105.32±0.69 cm, 104.94±0.84 cm, 132.13±1.08 cm, 13.21±0.37 cm, 27.92±0.51 cm and 170.62±2.92 kg respectively. The average age at first estrus and first service are 31.45 months and 32.65 months respectively. The average gestation length and average service period are 296.19 days and 121 days respectively. The average lactation length and daily milk yield are 232.68 days and 1.61 litre milk per day. The average fat % and SNF % of indigenous cow milk are 2.135% and 9.12% respectively. In agricultural lands, these local indigenous bullocks are

employed for ploughing lands upto about 0.5 acres of land in 5-6 hours. They are mainly reared semi-intensively and also by extensive method in many areas. The local indigenous non-descript cattle are managed solely on grazing and are usually not supplemented with concentrate mixture, minerals or vitamins, and no extra ration is given to the animals. Due to their good adaptive qualities and resistant to many diseases as well as low managerial requirements, many small holder and remote farmers prefer rearing of smaller but easily manageable non-descript local cattle. The data generated for indigenous non-descript cattle of Mizoram would be useful to characterize them.

Key words: local, indigenous, non-descript, Mizoram, morphological, management.

Papaya ring spot virus: A threat for papaya cultivation

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Abstract: The papaya (*Carica papaya* L.) is one of the most important tropical fruit crops, with annual production exceeding eleven million metric tonnes (FAO 2018). It is grown on all five continents, but Asia, Central America, and Africa produced the majority of its total production. The top papaya-producing countries are India, Brazil, Nigeria, Indonesia, and Mexico. Due to the prevalence of viral infections, commercial papaya is unable to reach its full potential. In all major papaya-growing areas across the world, Papaya ringspot virus strain papaya (PRSV-P) is the most damaging of the numerous viral infections that afflict papaya farming. PRSV-P has a natural range of dissemination. As a result, the virus has the potential to infect 100% of plants in a particular area. Farmers in badly impacted areas have stopped planting papaya due to the disease's catastrophic effects. Because of technical reasons (viral

sequence homology-dependent resistance) and environmental activism, the use of transgenic cultivars, a successful technique for managing the virus in many parts of India, has not been scaled up in other papaya-cultivating locations. Other attempts to controlling PRSV-P have had mixed results. As a result, in the current situation, conventional breeding to introduce virus resistance in papaya from highland papaya has become the sole viable option.

Cultivation of garden cosmos

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Abstract: Cosmos are renowned in the garden for their many, silky, daisy-like blossoms and their unflappable, low maintenance temperament. While bedding plants are marketed in the spring, cosmos are easy to grow from seeds and are affordable. Cosmos is a Mexican native in its annual form. Sow cosmos seeds outdoors once the threat of frost has passed, or sow seeds indoors four to five weeks before the last spring frost date for an early start on summer blossoms. Cosmos should be grown in full light and protected from severe winds. Plants should be spaced around 2 feet apart; tall cosmos should be spaced closer than the suggested 2 feet apart. Although germination and growth are quick, cosmos plants are frost sensitive, so don't rush them. Cosmos are light sensitive and bloom best in the late summer, as the days become shorter. After the risk of frost has passed and the soil has warmed, transplant these heat-loving annuals to the garden. Cosmos require a light, well-drained soil with average to poor fertility and a neutral or slightly alkaline pH. Tall cosmos may need to be staked to keep their thick, hollow stems from breaking due to heavy rain or other factors.

Keywords: Cosmos, soil conditions, seeds

**Effect of different seasons on the success rate of grafting in Jamun
(*Syzygium cumini*)**

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Abstract: Jamun is a popular indigenous fruit of India. It has got very valuable place in Ayurvedic medicines. It is believed to be a boon for diabetic patients. But in India, its organized orcharding is still lacking mainly because of lack of proper information on cultivation practices and non-availability of dwarf and high yielding varieties. Because of cross pollination, plants grown via seeds are unable to create true-to-type plants. Variation in the plants is caused by seed propagation and grafts developed on seedling rootstocks of uncertain origin. As a result, in order to achieve optimum graft success, it is necessary to determine the best rootstock for growing jamun. The most essential aspect for graft success is the time of grafting, which is controlled by the meteorological conditions of the season as well as the type of rootstocks used. Taking into account the aforementioned factors the grafts performed during September month as it is said to be ideal and fruitful in graft success with increase in graft survival within minimum number of days meanwhile increasing the sprouting, maximum leaf area, graft diameter and graft height. Therefore, the grafts performed during September in poly house maintained with RH (80-90%) and temperature (25° C) leads to maximum graft success and graft growth.

Keywords: Jamun, grafting, success

Off season production technology in fruit crops

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Abstract: Fruit production is seasonal in both tropical and temperate regions. At the peak season oversupply of fruits always happens and during the off-season there is no supply at all. This condition is not economically sustainable as it causes sharp fluctuations in the price of fruit. At the peak of the season the price drops sharply, while during the off season or at the beginning and end of the season the price is quite high. Prolonging the fruiting season, by beginning the season earlier and delaying the end of the harvesting season could benefit to farmers and consumers. If some of the trees in the orchard can be managed to flower at different times, the balance of long-term supply-demand can be improved. This can be achieved by an improvement in off season fruit production technology. The technology for off-season production of fruit crops has been developed and the fruits can be produced year-round. Manipulation for flower forcing and fruit setting has not yet been done commercially. One of the critical points on fruit production is the induction and development of flowers. There are several ways that can be used for flower forcing of fruit trees, including: manipulation of air and soil temperature water stress, girdling and application of plant growth regulators.

Keywords: Flowering, Fruit crops, off season

Improving the harvest index in early generation selection in F₃ population in chickpea (*Cicer arietinum* L.)

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Abstract: This investigation was undertaken to study the genetics of seed related attributes in chickpea (*Cicer arietinum* L.) in F₃ progenies of eighteen different crosses were sown with 8 rows per cross were hand sown with 4.0 meter row length and spacing of 50 cm x 20 cm during *Rabi* 2020-2021 at Pulses Research Farm, CCSHSU, Hisar, Haryana. The observations were recorded at physiology maturity on five randomly selected plants from each 18 F₃ progenies for high numbers of pods/plant, seed index, seed yield/plant (g/plant), biological yield/plant and harvest index. The F₃ cross combination namely (H 12-55 x CSJ 8962) x CSJ 8962 and H 12-55 x GNG 1958 recorded the highest harvest index i.e. 62.0 % followed by H 13-09 x *reticulatum* 237) x H 13-09 GNG 1581 (60.0 %). From two years data studied in early generation selection may be considered useful because it recorded high seed yield in cross (H12-55 x CSG 8962) x CSG 8962 i.e. 4125 kg/ha and 1799 kg/ha in F₂, F₃ progenies during 2019 and 2020 respectively. F₃ progenies were selected for high pod number, seed yield /plant and high harvest index. Selection response through harvest index effective for improvement of seed yield ranged from 36 % to 62.0 % in all the 18 F₃ populations. Improvement in yield through selection was obtained when the response was measured through the harvest index. Selection of harvest index in early generation for improvement of yield was effective when the response was measured in different years in F₂, F₃ progenies because high yielding genotypes may be lost by delay selection. Early generation selecting for high pod number, early maturity, more seed yield and high harvest index were important trait for the genetic improvement of seed yield.

Key Words: Chickpea, Early generation, F₃ population, Harvest Index

Genetic diversity assessment of elite chickpea genotypes (*Cicer arietinum* L.)

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Abstract: Chickpea (*Cicer arietinum* L.) is one of the most important pulses crop with Seventy-five genotypes were sown during *rabi* season 2019-2020. These seventy-five genotypes studied for genetic variability and diversity for seed yield and its contributing traits. Also, the inter-relationship and direct–indirect effects between yield and yield component traits on seed yield were studied. For all the yield and yield attributing traits were observed significant variability among the genotypes. As described in DUS Guidelines for morphological characterization of chickpea were carried out. The seed yield in *Desi* type had significant positive association with plant height, number of primary branches, number of secondary branches, number of pods, pods weight, 100-seed weight, biological yield and harvest index. In *Kabuli* type seed yield had significant positive correlation with days to maturity, number of pods, pods weight, biological yield and harvest index. Path coefficient of *Desi* type have high positive direct effects on biological yield, harvest index, pods weight, days to first flower, number of primary branches and negative direct effect for days to 50% flowering. In *Kabuli* type, maximum positive direct effect on days to first flower was observed for days to maturity, number of empty pods, biological yield and negative direct effects on days to 1st podding, pods weight and 100-seed weight. High estimates of PCV % and GCV % of the *Desi* and *Kabuli* type of chickpea genotypes were observed 4for number of pods, number of empty pods, pods weight, biological yield and seed yield per plant. In *Desi* type of genotypes, Cluster-VII exhibited the highest mean value for high plant height, early flowering and medium

duration, medium number of primary and secondary branches, medium 100-seed weight and highest seed yield. In *Kabuli* type of genotypes, Cluster-III had accessions with maximum number of pods, highest 100-seed weight, maximum biological yield, lowest number of empty pods, high seed yield and harvest index. On the basis of phenotypic variance in *Desi* type genotypes viz. H 19-77, H 19-97, H 19-98, H 19-105, H 19-107, H 19-115, H 19-116 and HC 5 and *Kabuli* type genotypes HK 19-19 were found superior and genetically diverse. These elite genotypes exhibited superiority in the present study for yield and yield contributing traits can be exploited in advanced generation selection in future chickpea improvement programme.

Keywords: Chickpea, DUS, variability, genetic advance, genetic diversity, correlation, path coefficient

Climate change resilience capacity of *Murrah* buffalo-based livestock production system in Trans-Gangetic Plains region of India

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Abstract: Functional understanding of the system in changing climatic scenario and identification of key indicators for policy formulation, resilience capacity analysis based on concerned system was critical important. In line with this, the present study was carried out to analyzed the resilience capacities of *Murrah* buffalo-based livestock production system specifically with identification of indicators responsible for system resilience. A total of 320 farmers, who were involving in *Murrah* buffalo-based livestock production system, were selected from 04 districts of ‘Trans-Gangetic Plains Region’, India. The study identifies eleven indicators with 37 sub indicators under 03 major components of resilience capacity i.e.,

absorptive, adaptive and transformative capacities. Further, Climate Resilience Index (CRI) based on the all three resilience capacities were used to measure households' resilience against impact caused by changing climate on *Murrah* buffalo-based livestock production system. A principal component analysis (PCA) and multiple regression analysis were used to identify determinant factors and indicators to households' resilience, respectively. Findings indicate that, the absorptive capacity (0.602) was the leading contributing factor to resilience followed by adaptive (0.448) and transformative (0.327) capacities. Among selected indicators, PCA and regression analysis both identified factors such as social participation, quick access to climate change information, farm income, herd size, family education, health status of livestock and farming community, access to basic services etc were identified as important determinants of households' resilience. However, buffalo rearers have poor transformative capacities and hence, climate adaptation planning may be for *Murrah* buffalo will be formulated with long term vision particularly focus on enhancing the transformative capacities.

Study the seed germination by the ice cube method of sowing in chickpea (*Cicer arietinum* L.)

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Abstract: Experiment was conducted in pots with the application of Ice cube and control (with irrigation) to see the effect of ice cube technology for the growth of Chickpea at the kitchen garden Rania, Sirsa, Haryana. This study was based on the theory of absorption of water which indicates that plant can take water from micro pores which is present in the soil near the root zone of the plant. During the experiment, took two pots of same soil were applied for the chickpea seed germination. The seed was sown on 24th November in both the pots with five

seed. In pot with Ice cube apply only will emerges in 5 days i.e. on 29th November where as in control it will emerges in 11 days on 3rd December. This studied implies that normally seed emerges in chickpea during rabi season takes 10-15 days depend upon the sowing time. Chickpea being a rainfed boon for the crop if any delay or less rainfall occur during the south west monsoon. By the application of Ice cube method we can introduced on large scale in chickpea cultivation and it will reduced the time of maturity from 15 days early. At the time of maturity period there is very less moisture during end of March or 1st week of April i.e. crucial stage for chickpea maturity

Key Words: Chickpea, Ice cube, rainfed, water absorption

Assessment of vulnerability to climate change on farm economy in Himachal Pradesh

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Abstract: Vulnerability analysis is an important step in developing adaptation strategies against the climate change. The communities residing in Himachal Pradesh have higher susceptibility to suffer harm due to its intrinsic socio-economic and geographical characteristics. The present study examines the district level vulnerability of the state by analysing the secondary data on eighteen indicators; under its three components (exposure, sensitivity and adaptive capacity) over a period of 34 years (1985-2018). Highest vulnerability to climate change is observed in Mandi (0.336) followed by Hamirpur (0.328) and Bilaspur (0.314), while it is lowest in Lahaul-Spiti (0.070), followed by Kinnaur (0.080) and Sirmour (0.091). Out of twelve districts, only four viz., Bilaspur, Kinnaur, Lahaul-Spiti and Shimla have

experienced a declining trend in the vulnerability index over the study period. However, a rising trend has been experienced in rest of the districts. Chamba (35.65) has observed the highest instability in the vulnerability index. On the other hand, lowest instability has been reported in Hamirpur (8.15). The three components of vulnerability index viz., exposure, sensitivity and adaptive capacity index has been reported to be highest in Mandi (0.269), Hamirpur (0.147) and Kullu (0.063) and are lowest in Lahaul-Spiti (0.041), Kinnaur (0.077) and Una (0.048) respectively. Chamba has observed the highest instability in the trend of exposure index (62.98), while Lahaul-Spiti has observed highest instability in sensitivity (13.88) and adaptive capacity index (6.42). The analysis suggests that different components play an important role in determining the vulnerability of farming communities by identifying the target areas in need of adaptation and policy support and thus will be of great help when it comes to prioritizing the adaptive capacity methods required for better management.

Keywords: Climate change, Vulnerability, Exposure, Sensitivity, Adaptive capacity.

Financial Support: ICAR SRF Fellowship

Estimating genetic divergence along with principal component analysis in advanced breeding lines of soybean

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Abstract: Soybean [*Glycine max* (L.) Merrill] is a papilionoid legume which has relatively wide range of adaptation including in vast range of climatic, soil and growth conditions. Due to its enormous potential as a major oilseed crop in the world it is necessary to develop varieties with a broad base and high genetic variability. Thus analysis of genetic divergence becomes

the prerequisite for any breeding program. Yield is a complex trait that is determined by several other traits for this reason it is necessary to identify the important traits for selection and genetic gain. The present investigation was carried out on 60 advanced breeding lines of Soybean including 3 best checks to estimate the genetic divergence using D^2 analysis by Mahalanobis 1936 and conducting PCA on eleven yield attributing traits to identify superior genotypes. Based on D^2 statistics the 60 genotypes were classified into 8 clusters out of which Cluster I was polygenotypic with 53 genotypes and the remaining seven clusters had one genotype each. The highest contribution towards genetic divergence was by trait No. of Primary branches per plant (19.77%). The Cluster I showed maximum intra cluster D^2 values (31.70) while other were monogenotypic having no intra culture difference. The highest inter cluster divergence was observed between genotypes of Cluster II and Cluster VIII. On the basis of PCA for eleven characters only 4 PCs showed total 81.03% variability in which the PC1 exhibited maximum variability followed by PC2, PC3 and PC4. The traits that are related to these 4 PCs were number of pods per plant, number of seeds per plant, primary branches per plant, biological yield per plant, seed yield per plant, days to flower initiation, days to 50% flowering, days to maturity and harvest index. These traits should be given importance while selection for yield enhancement.

Bio-fertilizers for soil health management

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Abstract: Food security is a major concern in developing countries. Intensive cropping, imbalanced usage of high analysis chemical fertilizers coupled with an enormous reduction of

recycling of manures and crop residues is contributing to the reduced agricultural productivity besides adversely affecting health of Indian soils. There is thus a renewed emphasis on adoption of biological technologies like composting, bio-fertilizers, integrated nutrient management, bio-pesticides etc. Application of organic manures is required in bulk to meet nutrient demand of crops while on the other hand; chemicals fertilizers being mostly imported are becoming increasingly expensive for use by Indian farmers. Further, the fertilizers use efficiency is quite less for the crops which lead to poor economic returns from the highly expensive chemical fertilizers. Therefore, effort must be made to improve the fertilizers use efficiency by crops. In view of this, the use of cheap and eco friendly inputs like bio-fertilizers is important. Bio-fertilizers are preparations containing live or latent cells of efficient strains of nitrogen fixing, phosphate solubilizing, or cellulolytic micro-organisms that are applied to seed, soil with the goal of increasing the number of such micro-organisms and speeding up those microbial processes that augment the availability of nutrients that are useful for promotion of plant growth and soil health. Microorganisms in bio-fertilizer are mixed with organic manures and reduced dose of chemical fertilizers, produce synergistic benefits enhancing productivity, nutrient use efficiency, crop quality, soil health and diseases suppression. They further encourage an adequate supply of nutrients to the host plants and ensure their proper growth, development and physiology regulation. A study showed that in calcareous soil, direct application of vermi-compost supplemented with effective PSB resulted in the maximum availability of Phosphorus and increased the crop yield. Currently, there is a ten million tonne gap in plant nutrients between crop removal and chemical fertilizer supply which can be reduced by use of bio-fertilizers. Thus, in India, the use of bio-fertilizers will not only have an effect on sustainable agriculture's economic development, but it will also contribute to a sustainable ecosystem and the country's overall well-being.

Keywords: Bio-fertilizers, Soil health, Organic manures, Nitrogen fixing bacteria, Plant growth

Production and utility of maize in India

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Abstract: Maize (*Zea mays*) also called corn which is produced worldwide is believed to have originated in Central Mexico 7000 years ago and has the highest production among all the cereals. It is considered as one of the fastest growing cash crops in the world. India ranks fourth in total area and seventh in total production and it contributes only 2.4% of total world production. The top 10 maize producing states are Karnataka (13%), Madhya Pradesh (12.43%), Kerala (12.17%), Telangana (9.16%), Tamil Nadu (7.56%), Andhra Pradesh (6.16%), West Bengal (6.13%), Bihar (6.11%), Maharashtra (5.98%) and Uttar Pradesh (5.17%) which contributes almost 84% to the nations production. Maize occupied 9.21 Mha, with a production of 25.82 MT in India. The average yield per hectare during 2018-19 was 2804 kg per hectare. Maize is being utilized in different sectors and activities in India. The biggest user of maize in India is the poultry industry with 47% of the share followed by direct consumption at 20%. Other usages include cattle feed, starch, food and beverage industry. By 2050, the demand for maize in the developing world would double and maize would be the crop with the greatest production. FICCI envisages that the existing productivity level of Maize should double from 2.5 MT/ha presently to 5 MT/ha with subsequent increase in farmer's income by 2022. Maize qualifies as a potential crop for doubling farmer's income in future.

Keywords: Maize, Indian production, factors

Iron deficiency anaemia: status and underlying risk factors among rural populations of Rajsamand district of Rajasthan, India

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Abstract: Iron deficiency, and specifically iron deficiency anaemia, remains one of the most severe and important nutritional deficiencies in the world today. The study aims to determine the status and underlying risk factors of anaemia in rural populations of Railmagra block of Rajsamand district of Rajasthan (India) in 2017-18 and a total of 128 subjects of variable age group and gender of 30 families participated in this research. The general information, socio-economic profile and blood samples of all subjects was collected and subjected to haemoglobin estimation excluding children below three years of age and pregnant and lactating mothers. The study group comprised two types of families *i.e* 4 and 5 family size. All members of 30 families were found to be anaemic particularly children and females. Anaemia was widely prevalent in all ages and gender. All three categories of anaemia- mild, moderate and severe were present in the family members. But, moderate anaemia was most commonly present. Anaemia was present irrespective of family size. Majority of adult family members and family heads were illiterate or had poor educational status. Maximum subjects were vegetarian and took two meals a day. There were no toilet facilities inside the house in almost all selected households and subjects go for defecation in the open ground. The drainage system was open in study area and garbage was disposed in open in maximum cases. Maximum households used to keep their animals inside the houses. Subjects had poor personal hygiene habits. Maximum 70.00 per cent families belonged to agriculture caste and were landless or having less land. Majority of the selected families belonged to middle class having low socio economic status.

The main possible reasons behind the wide prevalence of anaemia in the study group were- vegetarian diet, low educational and socio economic status, poor personal hygiene and environmental sanitation practices which need immediate attention at village level.

Key Words- Anaemia, iron, haemoglobin, status, risk factors and rural

Analysis of variety-environment interaction of rice varieties for WRC region of Mizoram

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Abstract: Rice is the staple food crop for North-eastern India including Mizoram and it fulfils a major part of the daily food requirement of the people. However, lower rice productivity has been a major concern for Mizoram rice sustainability under the rainfed wet rice cultivation (WRC). Identification of best performing rice varieties under Mizoram environment is crucial to sustain rice production of WRC region of Mizoram. In this aspects, field experiment has been undertaken with 22 rice varieties (Gomati, NLR-1, NLR-2, NLR-3, NLR-4, NLR-5, NLR-9, PB-1121, PB-1718, RCM-9, RCM-10, Shahsarang, PNR 546, Tripura Nirogi, Tripura Sarat, Tripura Chikan, Tripura Hakuchuk, PS-5, PD-13, TRC-2015-7, TRC-2013-11 and Local cultivar) at WRC region of ICAR Research Farm Kolasib under RBD design for two years (2019 and 2020). Findings showed that rice *cv* Gomati performed best under the humid subtropical hill region of Mizoram with 152.5% higher grain yield as compared with local cultivar. Apart from rice *cv* Gomati; RCM 9, RCM 10, NLR 1, NLR 9, PNR 546 and TRC 2015-7 recorded nearly double yield than that of local cultivar. However, even with high yield performance of above rice varieties, some of these varieties are not very well adopted by Mizo farmers due to taste requirements of local people. Based on appearance, taste, consistency,

aroma and hardness of tested rice varieties, PNR 546, RCM 9 and Tripura Chikan were confirmed at par taste with the local rice cultivar. Most of these varieties matured in about 130-150 days and local cultivar at 159 days. Thus, it was concluded that with adoption of best suitable high yielding medium duration rice varieties with their preference to taste will enhance rice productivity and narrow down the yield gaps that existed in WRC local rice cultivar of Mizoram.

Keywords: Rice, Mizoram, WRC, Yield, Taste, Crop Duration

Market integration in edible oil sector in India- a case of sunflower oil in India

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Abstract: Edible oils play a significant part in the Indian economy since India is the world's largest producer and importer of edible oils. This shows that India is not self-sufficient to meet its domestic demand and thus, there exists a gap. To reduce this edible oil supply gap, both production and marketing efficiency must be enhanced. The current study aims to evaluate the marketing effectiveness of India's edible oil industry by examining the integration of the country's various edible oil marketplaces. The spatial integration of India's key sunflower oil markets, namely Chennai, Bengaluru, Mumbai, Vijayawada, and Thiruvanthapuram, was investigated using econometric methods such as the Johansen co-integration test, the Granger-causality test, and the Vector error correction model. The monthly wholesale price data for the time period 2011-12 to 2020-21 were used for the study. The results of Johansen test indicated the presence of at least one co-integrating relationship which means sunflower oil markets were having long run equilibrium relationship. To analyze the direction of this co-movement

relationship, Granger causality test was used, which confirmed Mumbai to be the price-determining market. The study further employed the VECM model to determine the short run dynamics and speed of price adjustment. The results revealed that there is more flow of information in Chennai market compared to Bengaluru and Thiruvanthapuram market as the speed of adjustment is 18 percent in case of former while 15 percent and 10 percent in case of later. Thus, the study suggests the formulation of policy that creates a network via which price signals and other information from one source may be shared with others.

Keywords: Sunflower, market integration, Johansen test, VECM

Speed breeding in vegetable crops: A future prospect

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Abstract: Since the end of the Black Death, the world's population has been steadily increasing, around the year 1350. The world's population has increased from one billion in 1800 to 7.9 billion in 2020. Plant breeding is critical to alleviate many difficulties and increasing agricultural productivity to feed the world's growing population. Cultivar development needed longer generation times and a time-consuming process. Conventional plant breeding and advanced genomic tools such as genotyping, genome editing, genomic selection, DNA markers and marker-assisted selection allow plant breeders to discover traits quickly and introduce them into the recurrent background, so research developed a new concept of plant breeding to address these issues. Speed breeding is a strategy that allows plant breeders to improve crop production by varying the temperature, duration and intensity of light to

promote plant development. Speed breeding used continuous supplement lighting in a glasshouse with optimal light quantity, light quality and intensity, as well as day length to accelerate earlier flowering, photosynthetic rate, and crop plant generation cycling. In general, various crops respond differently to diverse growing environments, hence it is required to construct and develop crop-specific standard speed breeding protocols. NASA inspired the first ever speed breeding process, which was implemented by scientists at the University of Queensland. The development and standardisation of "speed breeding" protocols in several vegetable crops, including radish, pea, tomato, Amaranthus, Cassava, Potato, Brassica, Sugar beet, pea and some other leafy vegetables, is currently underway. Speed breeding shortens the generation cycle and generates homozygous lines quickly through single seed descent, allowing for more rapid production of improved cultivars. Combining genomic selection, genome editing and resources with speed breeding will give a significant incentive for plant scientists to do direct study on agricultural plants, thereby speeding up crop improvement research. When compared to traditional breeding methods, this procedure leads in the release of several generations of the same crop in a shorter period of time.

Keywords: Speed breeding, World's population, Environments and Plant breeders.

Hydroponics farming - a revolution in Indian agriculture

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Abstract: Now-a-days traditional agriculture is confronting with major challenges and the most importantly, decrease in per capita land availability as well as agricultural production. In addition to this, the two dimensional traditional farming is unable to meet the food requirements

of exponentially increasing population owing to the constant land tract and rising food demand. Consequently, there is a pressing need to switch to an alternate farming system, which is well known as ‘Hydroponic farming’. Hydroponic agriculture provides many benefits to the ecosystem. Being a soilless production, it doesn’t need herbicides or pesticides and so, it positively affects human health and the environment. Moreover, commercial hydroponic food production method allows on average four times the number of crops in the same space as traditional soil-based farming, and it can guarantee a faster growth for many kinds of crops. Furthermore, it can reduce water consumption by up to 90% compared to traditional agriculture’s water usage. Sometimes it is also referred to as vertical farming, because this type of farming allows for crops to be grown in layers – in shelves or trays, one layer over another. Hydroponic farming is setting up roots all across India. Sakina Rajkotwala, Joshua Lewis, Linesh Pillai, Rahul Dhoka’s, Arvind Dhakar, Anubhav Das, Vijay Krishnamoorthy, and Navin Jindal are some of the top entrepreneurs of India who are indulged in hydroponic farming and they are successfully growing Green leafy and other vegetables such as Kale, Spinach, Mint, Tomato, Egg plant, Bitter gourd, Arugula, Lettuce, Cucumber, etc where as some are even growing fruits, medicinal plants and flowers like Italian basil, Stevia, Strawberries, Blueberries, Roses, Jasmine, etc. Hence we can say that hydroponic agriculture can bring revolution in the upcoming years.

Key Words: Hydroponic, Agriculture, Production, Environment and Consumption.

Early weaning of silver pompano (*Trachinotus blochii*) larvae using different micro-diets to evaluate the growth and digestive enzyme activities

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Abstract: Early weaning of fish larvae with formulated micro-feeds can reduce the dependency on live feeds to a significant extent in hatchery operations. A feeding trial of 27 days was conducted to evaluate the growth and digestive enzyme activities in *Trachinotus blochii* larvae fed with micro-feeds. The larvae (10 days' post hatch, average weight 2.98 mg, and length 4.6 mm) were randomly distributed in three distinct experimental groups (T1, T2 and T3 with 500 larvae in each) at a stocking density of 2 Nos. L⁻¹ and 35 g kg⁻¹ salinity in FRP tanks. T1, T2 and T3 were fed with weaning feeds having 52, 40, 52 g 100g⁻¹ crude protein and 12, 9, 12 g 100g⁻¹ ether extract respectively and fed 8 times daily to avoid cannibalism. The Control larvae were reared following the standard hatchery protocol of commencing the weaning diet as co-feeding with artemia nauplii from 17 dph. After the weaning trial, the highest growth (P<0.05) was recorded in the Control, followed by T1, T3 and T2. The digestive enzyme activity (amylase, protease, lipase) was highest (P<0.05) in the Control, with no significant difference among T1, and T3, while the lowest (P<0.05) activity was recorded in T2. In conclusion, the results of the present study indicate that early weaning using formulated micro-feeds along with co-feeding is feasible in pompano larvae, although improvements in attractiveness of formulated micro-feeds need further improvement.

Keywords: Pompano larvae; Weaning; Growth; Micro-feeds

Financial Support: Department of Biotechnology, Govt. of India. Project Number: BT/AAQ/3/SP29267/2018

Assessment of evidences of fishing gear losses from selected areas of Indian waters

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Abstract: Fishing gears may be lost into the seas because of rough climatic conditions, damages of the gear, entanglement with bottom obstructions like wrecks and reefs or dragged away by other fishing vessels or ships etc. These lost gears designated as abandoned, lost or otherwise discarded fishing gears (ALDFG) result in ghost fishing, a phenomenon defined as “the ability of fishing gear to continue fishing after all control of that gear is lost by the fisherman” and contributes to species mortality by continuing to entangle and kill target organisms and non-target species such as turtles, birds and mammals. Passive gears like traps, gillnets may catch fish for several months or even years after they are lost. Locating ALDFG will be helpful to understand the fate and transport of lost fishing gear and to remove them from marine waters, thus eliminating its harmful impacts to species and habitats. Present study was undertaken for evidences of fishing gear losses and ghost fishing through underwater investigations from selected areas of Indian waters. Underwater investigation by scuba diving were conducted at Enayam, Tamil Nadu & Vizhinjam coast of Kerala. About 33kg lost gears were recovered by scanning an area of 700m² seabottom at Enayam. Six types of lost gears were retrieved in which Nylon monofilament gillnet panels (47.3%) were the predominant gear types followed by pieces of trawl codends, parts of long lines, ropes, traps, and squid jigs. Retrieved traps contained Molluscs, Arthropods, Echinoderms, Annelids and Cnidarians, Poriferans at various degrees of decomposition. From Vizhinjam coast of Kerala, gillnet

webbings and ropes were recovered. This baseline information will be useful to understand the scale and distribution of ALDFG and identification of the hotspot areas of gear losses.

Keywords: Fishing gear loss, Indian coast

Framing the potential larval preservation strategy for the precise metagenomic research

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Abstract: The major bottleneck in successful marine aquaculture practices is the non-availability of adequate good quality juveniles caused by poor larval survival. As the detrimental larvae-microbe interactions are the primary reasons for the poor survival, beneficial microbial manipulation strategies through precise knowledge on the host-microbial interactions *via* microbiome research can improve survival and is urgently required. The metagenomics is the preferred technique for larval microbiome studies as it simplifies the analysis of any complex microbiome. Nevertheless, the metagenomics approach is susceptible to biases through inappropriate sample preservation methods. The application of suitable sample preservation methods thus forms the major prerequisite for the effective implementation of metagenomics in larval microbiome research. As no studies have been conducted in this line, a systematic comparison of preservation techniques in terms of different metagenomics metrics was performed in the present study using cobia larvae, a marine aquaculture candidate species. The results showed that a total of ten metagenomics metrics, including DNA yield, taxonomic and functional microbiome profiles, and diversity measures, were significantly ($p < 0.05$) influenced by the preservation method. Activity ranking based on the performance and precision showed that three methods, namely immediate direct

freezing, room temperature preservation in absolute ethanol, and preservation at -20°C in lysis, storage, and transportation buffer, could be recommended for larval microbiome research. The higher inter-replicate variability and the least diversity measures observed for Tris-EDTA buffer preserved frozen samples suggested the non-suitability of this method. The microbial taxa responsible for the dissimilarity across different methods were identified. The larval samples preserved in ethanol showed the maximum dissimilarity due to the bias towards *Vibrionales* and *Rhodobacterales*. Altogether, the paper sheds light on the preservation protocols of fish larval microbiome research for the first time, which can be directly explored for the effective implementation of microbiome research in marine larviculture practices.

Keywords: Absolute ethanol, larval microbiome, TE buffer, Room temperature storage

Financial Support: Department of Biotechnology, India

Nutrigenomics approach to solve the issues in marine fish larviculture

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Abstract: It is of note that the capture fisheries are under stress for many targeted species. To reduce the pressure on wild, research on mariculture had been practising for decades. Even though technologies for captive breeding are standardized, the growth and survival of the larvae of candidate marine fish species are still not up to the mark. It is necessary to focus and encourage new approaches to standardize the hatchery protocol for enhanced production and sustainable management towards the future demands. The major concern facing at the marine fish hatchery is the delivery of nutritionally enriched feeds to the larvae. Inadequate nutrition is one of the major reasons for early mortality, weaning mortality, cannibalism, inadequate

growth, lowered immunity etc. In India, nutrigenomics research is an up-and-coming field, especially transcriptomics approach can be applied to understand the gene expression profile of the larvae and juveniles due to nutritional interventions. With the help of RNA sequencing (RNA-seq) technology, a clear understanding about the growth, development, metabolism, immune function, stress, adaptation and differential gene expression is possible. In addition, the specific effects of selected nutrients on targeted genes can be studied to alter the diet composition accordingly for improving the growth, condition and survival of candidate species of marine fish larvae. This novel approach has the potential to unravel valuable information required to address the issues in marine fish larval nutrition and for the development of species and life-stage specific micro-feeds for sustainable larviculture.

Keywords: Larviculture, Mariculture, mRNA, Nutrigenomics, Transcriptomics

Financial Support: Department of Biotechnology, Govt. of India. Project Number: BT/AAQ/3/SP29267/2018

Escape pattern from a bottom trawl: Assessment with *Leiognathus dussumieri* and *Metapenaeus dobsoni* in the coastal waters of Kerala, India

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Abstract: Experiment was carried out onboard departmental research vessel M F B Matsyakumari-II off Cochin with 27m shrimp trawl. Individual hauls were analysed to segregate *Leiognathus dussumieri* and *Metapenaeus dobsonii* from codend and pockets sewn to various parts of trawl. Assuming that the coefficients of the mesh gapes are identical on the whole surface of a given segment, the quantity of fish getting out beyond the range of the given

segment and the bag (u) may be calculated using equation of proportionality, $u = (g/m) \times M$ (Kg) ; where: g-quantity of specimen in catchers sewn on the segment (kg), m-number of meshes on the surface of the inlet of the catchers sewn on the segment, M- number of meshes on the whole surface of the given segment. Knowing the amount of caught fish (kg), the amount of fish (kg) getting out to the outside of the trawl, the percentage of individuals escaping to the outside of the trawl was calculated. Results shown that 20-25% of the catch escaped through wing portion of net, followed by throat (0.02 to 0.11%) and codend (1.6 to 6.2%) irrespective of the species. Wing is the first zone of contact of gear with catch and maximum escapement was occurred through the same. Hence wing portion has led to maximum escapement of *M. dobsoni* whereas throat and codend portions shown highest escapement of *Leiognathus sp.* Hence reducing mesh size of wing portion may retain the catch but smaller meshes at wing will reduce speed of trawling. It is suggested that mesh size of wing may be increased when fast swimming fishes are targeted and regarding shrimp trawling, reducing wing mesh size will be beneficiary.

Key words: Trawl, escapement, selectivity, bottom trawl

An empirical study on consumer practice and usage of plastic bags

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Abstract: A plastic material is any of a wide range of synthetic or semi-synthetic organic solids that are flexible. Plastics are typically organic polymers of high molecular mass, but they often contain other substances. They are usually synthetic, most commonly derived from petrochemicals, but many are partially natural. Plastics are inexpensive, lightweight, strong,

durable, corrosion-resistant materials, with high thermal and electrical insulation properties. The study was executed to know the current practices of plastic bags and usage among the housewives of urban areas of Dharwad city. The sample of 200 households were selected for data collection on usage and practices of plastic bags through questionnaire. Results of the study indicated that majority of the respondents are having graduation and PUC level of education and belongs to 30-55 years of age. Cent percent of the respondents using plastic container for storage and purchase of material. Plastic bags are available free of cost and low price are the reasons for usage. The respondents are followed good practice for usage of plastic bags. Now a day's most of the respondents are facing problems while marketing are non-availability of plastic bags due to plastic ban effect in India. They opined that paper bags are available to carry the purchased materials while shopping and said that paper bags are costlier than plastic bags.

Key words: Plastic bags, Practice, Usage, Type of material

Mastitis control program and its impact on economics of a dairy farm

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Abstract: Mastitis is a significant economic and animal welfare issue in the dairy industry. Mastitis treatment has been unsatisfactory due to variations in drug distribution and concentration in the udder, indiscriminate antibiotic use and the subsequent development of antibiotic resistance in common mastitis pathogens. The mainstay of mastitis control is prevention through implementation of a mastitis control programme. Studies have found that mastitis treatment accounts for nearly half of the total treatment costs. Mastitis prevention

contributes to more than 40% of total disease prevention costs, thus making it a significant limiting factor for a dairy farm's economics. The implementation of a five-point mastitis control programme, which includes udder hygiene and proper milking methods, proper installation, function, and maintenance of milking equipment, dry cow management and therapy, appropriate therapy of mastitis cases during lactation, and culling chronically infected cows, has demonstrated a positive effect on mastitis control and prevention. Several studies have been conducted to estimate the economic impact of mastitis control programme and how it can significantly reduce mastitis outbreaks and mastitis-related economic losses, particularly milk production losses. It has been beneficial to keep mastitis costs low at the herd level. It has also been shown to have a positive impact on farmers' attitudes, knowledge, and behaviour changes regarding udder hygiene and mastitis.

Keywords: Mastitis, prevention, control, economic impact

A recycled composite handmade paper: An approach for sustainable environment

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Abstract: Jute is an annual plant which grows to the tune of about 1.5 million tons. Jute can be used as an alternative raw material if we can produce value added handmade paper from jute. The pulp and paper industry is under constant pressure to reduce and modify environmental emission to air and water. In order to keep up with the increasing demand for

pulp and paper and to meet increasing stringent environment regulations, the industry is looking towards technological improvements in the conventional pulping methods. Eco-friendly paper is a solution to solve all environmental related problems. Though some tools and equipment are used in making eco-friendly, paper it is still called traditionally as a handmade paper only all over the world. It is a paper that does not utilize wood for its manufacturing – is free from all chemicals and is dried using most eco-friendly means of energy – it is a biodegradable product. This paper highlights the tremendous possibilities for handmade paper making in India, which with its eco-friendly and environmentally cleaner production technology will be an appropriate sustainable production system. Hence the experimental research study was carried out on standardization of recycling and reuse of waste jute gunny and trimmed cotton (Hosiery) waste were used for production of papers. In this study jute gunny and cotton waste were used for production of handmade paper in different ratios such as 100% Cotton, 100% Jute, 50% Cotton and 50% Jute gunny, followed by in the ration of 75:25 and 25:75 percent of Cotton and Jute gunny respectively. It was found that, the effect of blend ratio of cotton and jute on breaking length (km) was more in hand sheet with pure cotton (8.50-9.5 km) and less in hand with pure jute for hand sheet (1.28-9.50 km). In case of blended hand sheets, the breaking length (km) of jute: cotton 25/75 ranged from 7.48-8.22 km followed by jute:cotton 50/50 ranged from 5.40-5.7 and jute:cotton 75/25 ranges 2.46- 2.90. It is also pointed that this method is very cost effective. On the basis of its production cost estimation; this method of handmade paper production requires low investment than the conventional paper making process and it has a lot of environmental benefits

Keywords— Composite, Cotton hosiery Handmade and Jute gunny

Synergy of essential oils with synthetic antibiotics

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Abstract: In the present study we investigated the combinatorial antimicrobial interaction between various essential oils derived from different parts of plants with two standard antibiotics (chloramphenicol and ampicillin) against two Gram negative (*Escherichia coli* and *Klebsiella pneumoniae*) and three Gram positive (*Staphylococcus aureus*, *Micrococcus luteus* and *Bacillus subtilis*) bacteria. The binary combinations of different essential oils and antibiotics showed diverse types of interactions such as synergistic, partial synergistic and no effect by calculating their fractional inhibitory concentration (FIC). In the experiment, binary combination of Essential oil with chloramphenicol and ampicillin showed significant decrease in Minimum inhibitory concentration (MIC) value of these antibiotics thus was observed that association of essential oils with antibiotics significantly enhanced the antimicrobial potential of the later there by minimizing its effective dose and possible secondary effects. It is suggested that synergistic interactions between essential oil and standard antibiotics might be a promising strategy for developing multidrug resistant strain treatment strategies. Future research is warranted on investigating the molecular mechanism of the synergistic interaction between essential oils and antibiotics so that novel antimicrobial therapies can be developed for combating bacterial infections.

Keywords: Synthetic antibiotics, essential oil

Women empowerment through self help groups in rural communities of Haryana-A sociological study

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Abstract: Self-help groups have paved a new path in rural economic development and play an important role in women empowerment. It is a small economic venture at the village level and defined as sustainable basic goal of development by meeting out all day to day expenditures without any external aid while creating profit, social upliftment of members and that ultimately brings prosperity in a rural area. The study was conducted in Fatehabad and Kurukshetra Districts of Haryana. On the whole, a total of 120 farmers were surveyed with the help of well structured interview schedule. The analysis revealed that maximum number of farmers i.e. 47.50 percent belonged upto 35 years of age group. In Kurukshetra district, 75.00 percent of the farmers had taken pot and planter making activities and rest 25.00 percent were making pickles. In Fatehabad district, maximum numbers of farmer 48.33 percent were involved in embroidery, 36.67percent in stitching and 15.00 percent in cooking at dhabas. Regarding economic changes experienced by the farmers increase in income was reported by 85.00 percent farmers followed by 15.00 percent farmers as same and none of the farmers reported decrease in income. It was concluded that maximum number of farmers i.e. 47.50 percent belonged upto 35 years of age group. The analysis revealed that 41.67 percent farmers belonged to general caste 40.83 percent to backward caste and 17.50 percent to scheduled class. Regarding educational qualification 41.67 farmers had education upto secondary school level and 24.17 percent farmer upto middle level. The major reason to join SHGs as reported by the farmers 95.00 percent was to generate personal income.

Key words : empowerment ,self help ,group ,women

Reasons for adoption and socio – economic factors affecting knowledge level of happy seeder farm technology in Haryana

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Abstract: When the rice is harvested, straw and stubble is left behind and With no cost-effective and environment friendly way to clear the fields in time to sow wheat for the winter season, farmers resort to burning the crop. Keeping in mind the advantages of Happy seeder and to check the knowledge level of the farmers regarding Happy Seeder along with factors affecting the knowledge level and reasons for adoption of Happy Seeder farm technology, a study was carried out among 80 Happy seeder adopter farmers in rural areas of Fatehabad district. Analysis of data clearly revealed that maximum number of the respondents (42.50%) had medium level of knowledge regarding Happy Seeder. Rest 40.00% and 17.50% respondents had high and low level of knowledge respectively regarding Happy Seeder farm technology. The factors associated with level of knowledge of the respondents revealed that age ,education,size of land holding, mass media exposure, socio economic status and annual family income were found significantly associated. Caste was found non-significantly associated with knowledge level of the respondents. The reasons for adoption of Happy Seeder as reported by more than 3/4th of the respondents that adoption of Happy Seeder (77.50 %) saves time and money as there is possibility of sowing wheat crop just after harvesting of rice followed by increased yield than conventional method (72.50%) and it is environment friendly technology (70%) followed by higher net return, reduce fuel and labour cost and helps to recycle the plant nutrients present in paddy residues leading to improved soil health (60%, 55% and 53.75% respectively).

Key words: Happy Seeder, technology, knowledge, Socio-economic

Monitoring and improving water use efficiency in flower crops grown under protected structure

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Abstract: Water availability is becoming increasingly limited and threatens the agriculture sector. According to International Water Institute over 70% of the world's developed water supplies are for irrigation. So there is a need to use water efficiently for irrigation of agricultural crops by adopting such advanced technology of irrigation and other techniques to improve and monitor water use efficiency. Factors affecting the irrigation water use efficiency in protected structures are light, temperature, humidity, Evaporation and Evapo-transpiration. The ratio of plant biomass over the evapotranspiration is water use efficiency (WUE) and it is generally considered as a measure of its efficiency in utilizing water for biomass production. Improvement of water use efficiency can be achieved by adopting the suitable irrigation technology, water saving production technology i.e., hydroponics and aeroponics and by modifying the plant environment like by selecting suitable cladding material and appropriate seasons for cultivation of flower crops. Drip Irrigation Method is the best and most adopting methods to improve and monitor water use efficiency. Irrigation scheduling is also one of the most standardised methods in protected conditions for improving water use efficiency. In carnation, Aydinsakir *et al.* (2011) reported that low frequency irrigation water regimes may improve water use efficiency by reducing water consumption and also resulted in flower production. Kazaz *et al.*, (2010) also studied the effects of different irrigation regimes on yield and some quality parameters of carnation. Effect of Irrigation Scheduling on gerbera flower yield and quality was studied by Tsirogiannis *et al.* in 2010 and revealed that positive results regarding number of cut flowers were found in low irrigation frequency. There are some

advanced irrigation techniques like soil moisture sensors which can be adopted in floricultural crops to monitor water use efficiency.

Key words:- water use efficiency, protected, ornamental crop

Effect of vacuum impregnation of Rosemary Essential Oil (REO) and Vacuum packaging on the quality of Yellowfin tuna (*Thunnus albacares*) chunks at chilled storage condition (1-2°C)

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Abstract: Tunas are one of the highly sought-after seafood commodity due to its nutritional value, unique taste and culinary properties. Tunas, like other fishery commodity are highly perishable and many technologies are being adopted to enhance the quality and shelf life. Present study investigated combined effect of rosemary essential oil using vacuum impregnation method and vacuum packaging on the quality of Yellowfin tuna (*Thunnus albacares*) chunks at chilled storage condition (1-2°C). Yellowfin tuna used for the study had 20.24% protein, 2.18% crude fat and 1.64% mineral content. Rosemary (*Rosmarinus officinalis*) essential oil extract (REO) with carnosic acid 5.2% was used for vacuum impregnation (1% w/v). Tuna chunks without vacuum impregnation of REO (control) was compared with treated samples. Additionally, effect of vacuum packaging with and without REO treatment was evaluated. Various physico-chemical (pH, drip loss, TVBN, TMAN, histamine, instrumental texture) and sensory quality was monitored at regular intervals. Trimethylamine nitrogen content increased from initial 2.81 mg N₂% to over 15 mg N₂ % on 10, 12, 18th day for control air, vacuum packed sample without REO treatment and control REO treated samples respectively. TMAN value did not cross beyond 15mg N₂ for samples treated with combination of REO treatment and vacuum packaging. Similar trend was observed

for TVBN, sensory overall acceptability and histamine formation. Higher drip loss was observed for vacuum packed samples compared to control sample. Histamine level was least for combination treated sample and highest for control sample indicating the positive influence of vacuum impregnation of REO and vacuum packaging in inhibiting the quality deterioration. Shelf life of Yellowfin tuna chunks extended up to 16 days for combination treated samples, compared to only 8, 10 and 14 days for control pack without REO treatment, control vacuum pack, control REO treated samples, respectively.

Keywords: Yellowfin tuna, Vacuum impregnation, Rosemary essential oil, Histamine, Fish quality

Malting improves nutritional profile of value-added biscuits from pearl millet cultivar

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Abstract: Pearl millet (*Pennisetum glaucum*) is the most widely grown type of millet. Because of its ability to produce good yield of grains under unfavorable conditions, the crop contributes substantially to food and nutritional security in dry regions worldwide specially among the poor and low-income groups. However, the nutrient availability to the human gut is restrained inherently due to the presence of antinutritional factors, such as phytic acid, polyphenols and tannins. Malting is one of the popular methods that have been employed to improve the nutritional quality of such cereals. The present study was taken up to study the acceptability and nutritional profile of biscuits value added with malted pearl millet viz. HHB 234. Three types of biscuits were subjected to evaluation viz. without pearl millet (I), with 50% pearl millet (II) and with 50% malted pearl millet (III). Highest protein content of 7.21 per cent was found

in Biscuit I followed by Biscuit II (7.03%). Value addition with unprocessed or malted pearl millet (Biscuit II and III) significantly ($P \leq 0.05$) increased the total dietary fibre content of control biscuits (Biscuit I). The soluble dietary fibre content was significantly ($P < 0.05$) higher in biscuit III (2.81 g/100g) as compared to biscuit I (1.64 g/100g). The amount of insoluble dietary fibre content was significantly ($P \leq 0.05$) higher in biscuit II (5.52 g/100g) than biscuit I (2.49 g/100g). A significant difference ($P \leq 0.05$) was observed in total and HCl extractable mineral (calcium, Phosphorus, Iron, Zinc) content of control (biscuit I) and pearl millet containing biscuits (biscuit II & III). The phytic acid and polyphenol content decreased while protein and starch digestibility of biscuits increased significantly ($P \leq 0.05$) with malting.

Keywords: Pearl millet, Malting, Protein digestibility, Phytic acid, Value addition

Enhance the wheat productivity through precision nutrient management under conservation agriculture

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Abstract: Traditionally, wheat is grown in the *rabi* season following rice. therefore, to sowing the wheat crop multiple tillage operations perform after rice harvest. due to the intensive tillage operations to an increased cost of cultivation leading to decreased profitability. Instead of tillage we can use conservation tillage practices like zero tillage and reduced tillage. In the high-yielding wheat production systems in Northwest (NW) Indo-Gangetic Plains of India, intensive tillage operations and blanket fertilizer recommendations have led to high production costs, decreased nutrient use efficiency, lower profits and significant environmental externalities. No-tillage (NT) has been increasingly adopted in this region to reduce costs and

increase input use efficiency. Opportunities exist to further enhance the yield, profitability, and resource use efficiency of NT wheat through site-specific nutrient management (SSNM). To examine the effect of SSNM on NT practices a field experiment was conducted as On-farm trials in seven districts of Haryana, India for two consecutive years (2010–11 and 2011–12) to evaluate three different approaches to SSNM based on recommendations from the Nutrient Expert® (NE) decision support system in NT and conventional tillage (CT) based wheat production systems. Performance of NE based recommendations was evaluated against current state recommendations and farmers' practices for nutrient management. Three SSNM treatments based on NE based recommendation were (1) 'NE80:20' with 80% N applied at planting and 20% at second irrigation (2) 'NE33:33:33' with N split as 33% basal, 33% at Crown Root Initiation (CRI) and 33% at second irrigation; and (3) 'NE80:GS' with N split as 80% basal and further application of N based on optical sensor (Green Seeker™)-guided recommendations. Yield, nutrient use efficiency and economic profitability were determined following standard agronomic and economic measurements and calculations. Cool Farm Tool (CFT), an empirical model to estimate greenhouse gases (GHGs) from agriculture production, was used to estimate GHG emissions under different treatments. Wheat grain and biomass yield were higher under NT in 2010–11 but no difference was observed in 2011–12. The three NE-based nutrient management strategies increased yield, nutrient use efficiency as well as net return as compared to state recommendation and farmers' fertilization practice. Global warming potential (GWP) of wheat production was also lower with NT system as compared to CT system and NE-based nutrient managements as compared to farmers' fertilization practice. State recommended nutrient management had similar GWP as NE-based nutrient managements except NE80:GS in which GWP was the lowest. Results suggest that no-tillage system along with site-specific approaches for nutrient management can increase yield, nutrient use efficiency and profitability while decreasing GHG from wheat production in NW India.

Sugarcane clones suitable for quality cane juice used for Beverages of consumer preference

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Abstract: India is the second largest producer of sugarcane next to Brazil. Out of 359 million tonnes of sugarcane produced in India, about 67.64% is utilized by sugar mills for the production of white sugar and the rest for the preparation of different forms of jaggery, seed, feed and chewing. The Consumer purchasing sugarcane juice as beverage for drinking in local markets are preferring light green colored juice rather than dark green or brown colored juice. In general *Sacharum officinarum* clones are known for the low fibre content with high juice quality which is being highly used for chewing purpose. The juice vendors also prefer sugarcane clones with higher juice quantity with less bagasse which results in more juice extraction per cent. The light green colored juice producing canes were identified in the study during 2020-21 for consumer preference due to its attraction. The sugarcane juice consumer always prefers light colored juice. Among 15 sugarcane clones tested, sugarcane clones 2015A 222 (1.8), 2015A 199 (1.9), 2015A 152 (1.9), 2015A 137 (1.9), 2015A 59 (1.9), 2015A 230 (1.9) & 2015A 93 (1.9) recorded less color intensity values denotes light colored juice after cane extraction. The standard 87A 298 significantly recorded a high color intensity value of 2.2. Among the clones tested, sugarcane clone 2015A 222 recorded a color intensity value of 1.8 correspondingly recorded higher sucrose percent (19.45) with purity of 95%, low reducing sugars percent (0.21%) and low dextran percent (4.25%) which is an indication for less deteriorated cane after juice extraction over other clones tested which attracts consumers preference.

Key words : Light colored juice, sucrose%, reducing sugars%, dextran%, fibre and baggase.

Sugarcane clones tolerance to post harvest cane quality deterioration under stale cane

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Abstract: Cane quality deterioration after the harvest of sugarcane in the field, loading and transportation of cane a major thrust to the sugar industry). The quality loss in cane is primarily due to chemical (acids and enzymatic) inversion and those from microbial inversion through cut ends of damaged sites of stalks. It is reported that, the field loss in Commercial Cane Sugar (CCS) some tones 1.0 unit/ day during late crushing period i.e., March onwards. It exceeds more than that, if it is billet harvesting rather than whole stalk green cane harvesting. Generally, cane quality deterioration depends cane quality, maturity status, size of billet, atmospheric condition, harvesting practices, pest and diseases, storage methods, cut to crush delay and moisture in cane. To evaluate canes to identify sugarcane clones tolerant to post harvest cane quality deterioration, a field experiment was conducted during 2018-19 and 2019-20 at RARS, Anakapalle (ANGRAU) duly following all crop management practices with juice analysis of 24 hrs. interval upto 76 hours after cane harvest. Among 15 sugarcane clones tested for their cane quality deterioration at 76 hours after harvest (76 hah), in terms of sucrose reaction was low (< 10%) in sugarcane clones 2011A 313 (3.87%) and 2011A 252 (4.43%) in January cane harvest. Correspondingly 2006A 102 (3.62%) and 2011A 313 (3.88%) recorded less percent of cane weight loss in 76 hah. In February cane harvest sugarcane clones 2011A 294 (3.36) and 2009A 252 (3.28%) recorded less percent sucrose reaction and less cane weight loss was recorded with 2011A 175 (3.38%) and 2015A 359 (3.42%) over 76 hah. In March cane harvest,

sugarcane clones 2011A 262 (3.91%) and 2011A 260 (4.05%) recorded less percent sucrose reduction and sugarcane clones 2011A 252 (2.47%) and 2006A 223 (3.11%) recorded less cane weight loss over 76 hah over other clones tested. Cane quality deterioration in terms of percent sucrose less, percent cane weight loss was high in March month cane harvest over January & February cane harvests due to atmospheric conditions.

Key words: Cane quality deterioration, sugarcane clones, % sucrose, % cane weight loss, hours after cane harvest (76 hah)

Development and evaluation of the value-added eggless muffins supplemented with Germinated pumpkin seed flour

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Abstract: The study was planned to evaluate the value-added eggless muffins supplemented with germinated Pumpkin Seed Flour. The value-added eggless muffins recipe was supplemented by the incorporation of germinated pumpkin seed flour by replacing 10, 20, and 30 percent to refined wheat flour. The developed products were subjected to organoleptic and nutritional evaluation. The results were subjected to statistical analysis using ANOVA. Sensory evaluation of developed products was carried out using a 9-point hedonic scale. The samples were further analyzed for moisture, ash, crude fat, crude protein and crude fiber, total, soluble and insoluble dietary fiber, total and available minerals using standard methods. The supplementation resulted in a significant ($P \leq 0.05$) increase in ash, crude fat, crude protein, and crude fiber while total carbohydrates decreased. The supplemented product had crude protein ranging from 12.57-19.27g; crude fibre 1.74-2.88g; and ash 4.50-7.10 g/100 g at different levels of incorporation as against 9.47, 0.65 and 2.65 g/100 g, respectively in the control product.

Significant increase was observed in mineral content also. The supplemented products had calcium, magnesium, zinc, iron, potassium and phosphorus ranging from 37.42-69.50, 55.59-57.47, 2.43-5.63, 4.57-9.45, 245.63-489.56, and 126.45-139.45 mg/100 g on dry matter basis. The developed products were acceptable to judges. The incorporation of germinated pumpkin seed flour significantly ($P \leq 0.05$) improved the nutrient and mineral profile of value-added eggless muffins. It may be concluded that pumpkin seeds which are otherwise discarded as vegetable waste can successfully be used for value addition. Such developed products have a good protein and mineral profile and therefore can be used to combat malnutrition. Food security in its essence means 'Availability' 'Accessibility' and 'Utilization' of food for an active and healthy life of human population. It is about 'Nutrition' or its reverse 'Malnutrition'.

Keywords: Germinated pumpkin seed flour, eggless muffins, Sensory, nutritional evaluation and Food security.

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Dr. Devi Dayal is former Head, ICAR- Central Arid Zone Research Institute, Regional Station, Gujarat. He started Agricultural Research Service in January 1984 and has worked in different capacities in technology development and dissemination related to groundnut and other dryland crops for about 36 years in different institutes such as Directorate of Groundnut Research, Junagadh. He was instrumental in developing paired row planting pattern and in-situ moisture conservation technologies for groundnut and other dryland crops. During his career, he mobilised external funding from different agencies such as PPV&FRA, NATP, NAIP and NASF for various research activities and handled collaborative projects with international CGIAR institutions like ICRISAT, Hyderabad & ICARDA, Jordan. He conducted many national seminars in the capacity of organising secretary. He has edited 15 books and published more than 100 research papers in journals of national and international repute. He has also contributed to several book chapters to books and proceedings of the symposia apart from many technical bulletins and training manuals. He has received many awards including Fellow 2015 by the Indian Society of Oil Seeds Research and Gold Medal and Distinguished Plant Scientist Award-2013 by the Academy of Plant Sciences. He serves as member of Editorial Board for Indian Journal of Oil Seeds Research and Advances in Plant Sciences. He acts as external examiner for post-graduate and doctoral students for several universities Junagadh Agricultural University, Junagadh and MPKV, Rahuri, TNAU, Coimbatore and Osmania University, Hyderabad.

Dr. Shamsudheen Mangalassery

Dr. Shamsudheen Mangalassery Has joined ICAR as scientist in the year 2007 at Central Arid Zone Research Institute, Jodhpur and presently working as Senior Scientist at ICAR-Directorate of Cashew Research, Puttur. His main research interest are arid soil and ecosystem management. He is actively engaged in research in the area of soil carbon sequestration, different tillage practices, soil biology and abiotic stress tolerance. His previous research includes research on organic farming in spices in tropical humid environment. He completed M.Sc.

(Agri.) Soil Science and Agricultural Chemistry from University of Agricultural Sciences, Dharwad in 2003 and Ph.D. from the University of Nottingham, United Kingdom in 2013. He has published 37 research papers in journals of national and international repute, 3 books, and contributed to 28 book chapters and has 52 conference proceedings/abstracts to his credit apart from 28 extension folders 9 technical bulletins and 4 training manuals and several other publications/compilations. He has received different awards including International Research Excellence Scholarship from the University of Nottingham and International Fellowship by the Indian Council of Agricultural Research, ICAR JRF for post graduate studies. He also bestowed with the Lamming award of the University of Nottingham and also Travel grant from the University. He has received 3 best research paper awards, 3 best poster, one best oral presentation award and distinguished scientist award. He has developed 16 software/mobile apps and has 4 copy rights and involved in development of three cashew varieties. He has organised one national review meeting and 4 trainings. He is currently a member of International Soil Tillage and Research Organisation and serves as reviewer of different national and international journals. He has brought external grants from different organisations such as NASF, ISRO, RKVY amounting to more than Rs. 4 Crores. He was instrumental in developing advanced laboratory facilities at CAZRI, Regional Research Station, Bhuj, Gujarat and ICAR-DCR, Puttur. He has developed one state of art cashew museum at DCR, Puttur. He has visited countries such as UK and Italy.

Dr. Pankaj Kumar

Dr Pankaj Kumar has graduated from College of Veterinary Sciences, Mathura and latter completed his MVSc and PhD in Veterinary Medicine from ICAR-IVRI, Izatnagar, Bareilly UP. He joined services of ICAR as Scientist, Veterinary Medicine in Division of Medicine, ICAR-IVRI, Bareilly in 2007 and served till July 2012. At present he is working as Senior Scientist, Division of Livestock and Fisheries Management, ICAR RCER, Patna. He is also faculty of Division of Medicine, IVRI, Izatnagar and engaged in teaching PG courses. He has co-guided 3 PhD and 4 MVSc students of Veterinary Medicine, IVRI. He has completed 6 intra-mural

projects and working on two ongoing project as Principal Investigator. He is Fellow of Academy of Sciences for Animal Welfare and Society for Upliftment of Rural Economy, Varanasi and Associateship of National Academy of Veterinary Sciences India. He has been awarded with UG university medal, CSAUA&T Kanpur; Dr C M Singh Gold Medal for Best PhD Research, IVRI; ICAR JRF, and many other society Awards. He has published more than 70 research papers in journals of repute and edited one Book, 24 NCBI sequence submission and many conference papers. He has also delivered many radio and TV talks for AIR and Doordarshan. He has expertise on animal health with focus on mineral deficiencies disease, heavy metal toxicity, animal disease diagnosis, etc.

ABOUT THE BOOK

This book consists of compilation of abstracts and papers presented in the International Conference on Advancement of Science and Technology for Environment, Society and People (ICASTESP-2022), Organised by the Society for Technology, Environment, Science & People, Kozhikode, Kerala during 28-29 January 2022. A wide array of topics covering natural resource management, crop production, protection, post-harvest handling, developments in livestock and fisheries science, women empowerment and social science were some of the major highlights in the conference.

ZNAN Publishers

Society for Technology, Environment, Science &
People, Kozhikode, India,
(<https://www.societytesp.org/>)
G-Road, Kozhikode, 673602, India
Email: societytesp@gmail.com

ISBN: 978-81-956227-1-9

