NAVSARI AGRICULTURAL UNIVERSITY

SOIL CONSERVATION SOCIETY OF INDIA

National Conference on

Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate Resilience

October 13–15, 2022

Book of Abstracts

Organized by

Navsari Agricultural University, Navsari, Gujarat, India

In collaboration with

Gujarat State Chapter of SCSI, Navsari, Gujarat

Soil Conservation Society of India (SCSI), New Dehli

Sponsored by

Indian Council of Agricultural Research, Govt. of India, New Delhi

Ministry of Earth Sciences, Govt. of India, New Delhi

National Bank for Agriculture and Rural Development (NABARD)

ICAR

Ministry of Earth Sciences
Government of India

NABARD

International Decade of Soils
2015-2024

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सत्यमेव जयते

प्रधान मंत्री
Prime Minister

MESSAGE

It is a pleasure to learn about the national conference organised by Navsari Agricultural University, Navsari, in association with Soil Conservation Society of India (SCSI) from October 13-15, 2022.

The theme – "Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience" – encompasses important environmental issues.

Productivity of agriculture, profitability for farmers and preservation of the environment – these are the three pillars that the future of agriculture rests upon.

The hardworking farmers of India have ensured records in productivity year after year and boosted food security. The government has worked with them to ensure greater profitability, higher incomes, lesser input costs and risk mitigation.

In the third pillar of preservation of the environment through sustainable agriculture, the government has worked with the farmers by providing them crores of Soil Health Cards to track soil health, promoting natural farming, encouraging the growth of millets for climate resilience, and more.

Following India's proposal, 2023 has been declared as the International Year of Millets. This is an initiative that will be immensely helped by discussions and deliberations in such conferences.

There is a nascent socio-economic mass movement shaping up for sustainable agriculture, involving government, farmers, consumers and other such important stakeholders. This movement needs the scientific community to offer leadership.

Such conferences are an excellent opportunity to bring people together to add momentum to sustainable agriculture and good nutrition.

I am positive that the deliberations in this conference will focus on diverse issues and deliberate upon security, sustainability and climate resilience.

As we celebrate Amrit Mahotsav of our Independence, let us work on making agriculture sustainable. The Amrit Kaal of next 25 years is a period to build a strong, healthy and self-reliant nation.

Best wishes to the organisers and participants of the conference.

(Narendra Modi)

New Delhi
आश्विन 20, शक संवत् 1944
12th October, 2022

Bhupendra Patel

Chief Minister, Gujarat State

Apro/jm/2022/09/19/rs

Dt. 19-09-2022

MESSAGE

Agriculture is the backbone of the Indian economy; nearly 60% of the Indian population directly depends on agricultural activities as a source of livelihood. Indian agriculture is dominated by small and marginal farmers, having only 44% of the total arable land. Also, subsistence farming is the norm for marginal and small farmers, for their own consumption, they instinctively concentrate on cereal-based crops, with high risks of climate anomalies or erratic weather conditions, in addition to severe floods and droughts. The modern agricultural production systems are simplified due to specialization and are intensified with high rates of external inputs to keep production conditions favorable to maintain the productivity levels. Instead of low input sustainable agriculture (LISA), ecological, organic, regenerative, biological or simply alternative agriculture approach should be emphasized.

I am much pleased to learn that **Navsari Agriculture University** is organizing a National Conference on *"Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate Resilience"* from **13th to 15th October, 2022** at **Navsari**. I hope that the scientific community gathered shall give a thought on these burning issues and work for the welfare of the farming community. I extend my warm welcome in Gujarat, to the scientific community and research scholars from all over India and offer my best wishes to the organizers of the event at Navsari.

(Bhupendra Patel)

રાઘવજી પટેલ

ક્રમાંક–મં./કૃ.પ.ગૌ./ VIP/૨૦૨૨
મંત્રી
કૃષિ, પશુપાલન, ગૌસંવર્ધન
ગુજરાત સરકાર
સ્વર્ણિમ સંકુલ–૧, બીજો માળ,
સચિવાલય, ગાંધીનગર.
ફોન –૦૭૯૨૩૨૫૦૧૧૯
Fax- ૦૭૯૨૩૨૫૦૧૨૦
તા. 01/10/2022

MESSAGE

Over the years, due to continuous and mono cropping soil nutrient reserves have depleted significantly, the soils need to be replenished with the essential major and minor plant nutrients. As of now there is hardly any scientific evidence to support detrimental effect of judicious use of fertilizers on soil health, crop productivity or farmers' income. We need to promote farming systems and technologies which enhance income and also prove ecologically sound. Typical mono-cropping system followed in many regions of India is untenable option for sustenance of soil and livelihood of farmers. To overcome the problems encountered by specialized, input driven agriculture, the integration of crops, livestock, fishery components that sustains food and nutritional security with regular and periodic income to farmers is a better option. Integrated farming systems (IFS) that includes temporal and spatial mixing of crops, livestock, fishery, and allied activities in a single farm needs to be encouraged, which is a holistic approach to farming making farms adaptive and resilient. IFS that integrate animal and crop enterprises is already receiving renewed interest in marginal, small and medium farmers who cultivate less than one hectare. Inclusion of tree species along the farm boundaries and Agro-forestry systems that helps in increased carbon sequestration, biomass production, reduced consumption of fertilizers and pesticides, in addition to reduction in greenhouse gas emissions and multiple other benefits needs to be emphasized.

I hope the scientific gathering at Navsari Agricultural University will deliberate at length and come out with recommendations that could be beneficial for the agriculture sector in general and marginal and poor farmers in particular.

Your Regards,

(Raghavji Patel)

सत्यमेव जयते
डॉ. हिमांशु पाठक
सचिव, एवं महानिदेशक
Dr HIMANSHU PATHAK
SECRETARY (DARE) & DIRECTOR GENERAL (ICAR)

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भारतीय कृषि अनुसंधान परिषद
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MESSAGE

I am happy to know that NAVSARI Agriculture University is organizing National Conference on **"Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate Resilience"** during October 13-15, 2022 in collaboration with Soil Conservation Society of India (SCSI), New Delhi and Gujarat State Chapter of SCSI, Navsari. Coastal agricultural areas are particularly exposed to a range of climate-related hazards such as rising sea levels, higher flood levels and storm surges, accelerated coastal erosion and seawater intrusion. These hazards may lead to a series of socio-economic impacts in the coastal zones like reduced agricultural productivity, loss of coastal habitats. Coastal agricultural practices are less stable than upland agriculture because they need to cope with frequent changes in salinity, tidal processes, water stresses and waterlogging. Coastal ecosystems are greatly impacted by location-specific land use. Projections of the precise magnitude, frequency and regional patterns of the impacts from climate change on coastal agriculture are uncertain.

Innovative interventions are required to establish climate resilient agriculture in coastal areas. Application of nano-technology, geospatial technologies, modelling and information technology is required for sustainable agriculture and watershed management. Adoption of natural farming can prove to be a feasible measure for resource conservation in our country. Climatic and non-climatic stressors, such as rise in temperature, rainfall fluctuations, population growth and migration, pollution, land-use changes and inadequate strategies are major challenges to coastal agricultural sustainability. The two most vital natural resources, soil and water, are being affected extensively and therefore, innovative technological interventions are required to be implemented before it is too late. The cascading impacts on the sustainability of coastal agriculture have not been adequately resolved and therefore, scientific studies need to be presented and deliberated in the conference to address these crucial issues.

I wish the conference a grand success.

(Himanshu Pathak)

Dated the 24th August, 2022
New Delhi

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उप महानिदेशक (कृषि शिक्षा)
Dr. Rakesh Chandra Agrawal
Deputy Director General (Agril. Edn.)

PREFACE

I am delighted to learn that Gujarat State Chapter of Soil Conservation Society of India (SCSI) at Navsari Agricultural University, Navsari, Gujarat is organizing the 31st National Conference on "Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience", from October 13 to 15, 2022, in collaboration of Soil Conservation Society of India (SCSI), India.

A critical review and insight of the topics of seminar, it clearly that the main topics *viz.*, Conservation, management and reclamation of natural resources; Technological interventions for sustainable agriculture; Socio economic impacts of climate change; Coastal ecosystem and aquaculture; Biodiversity and land use system (Horticulture/Agroforestry) for nutritional and environmental security and Resource Conservation through natural farming are of prime importance in the present context. Our resources, which not only sustain human beings but wild and domestic animals (both aquatic and terrestrial) and floral diversity, at present needs to be debated. Such debates at national and international level will surely provide insight for policy makers, researchers, NGOs *etc,* a path of deep thinking and planning about conservation and sustainable utilization of these valuable natural resources in the era of climate change. I am sure that such conferences with burning topics would lead scientist and policy makers to work in well-defined and focused research to tap these resources in a way so that we as human being at present would be able to sustain them for future generation. In this way we would not be blamed to make our future generation to be deprived from many natural flora and fauna.

Therefore, conservation and sustainable utilization of natural resources, in view of livelihood and environmental security of generation to come, may it be terrestrial or aquatic is the need of hour, particularly in climatic uncertainty which is being witnessed by us with an increasing trend. I am sure that deliberations in a 3 days conference on very apt themes will provide a baseline for research priorities and future development on these aspects to make the nation natural resource rich and conserve for food, nutrition, livelihood and environmental security.

I extend my best wishes for the grand success of this timely and well thought out themes of the national level conference.

(R.C. Agrawal)

NAVSARI AGRICULTURAL UNIVERSITY

Navsari Agricultural University
Navsari - 396 450, Gujarat

Dr. Z. P. Patel
(Vice Chancellor)

MESSAGE

I am very pleased to welcome all of you to participate in the National Conference on ***"Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate Resilience"*** from October 13 to 15, 2022 at Navsari Agricultural University, Navsari.

Agriculture in India is hindered due to small land holdings, inadequate resources and lack of agro-technological information. Under the changing climatic scenarios, agricultural planning and use of agricultural technologies need to be precise for their effective application in management and sustainability of natural resources over different ecosystems. Collaborative and concerted efforts of the organizers of this Conference are the timely steps in right direction to provide a platform where users, experts and policy makers from different part of the country are intended to deliberate on different emerging issues and challenges in the field of natural resources management. I am sure that thought-provoking discussions/deliberations will be held on conservation and management natural resources, technological interventions for sustainable agriculture, socio economic impacts of climate change, coastal ecosystem, biodiversity for nutritional and environmental security and various other issues covering different themes in this conference. The conference will offer the opportunity to interact and develop network in the field of soil & water conservation through sharing views with experts and possible future collaboration across the India.

I hope that the scientific community gathered at Navsari Agricultural University shall give a thought on these burning issues and work for the welfare of the farming community. I extend my warm welcome in Gujarat, to the scientific community and research scholars from all over India and offer my best wishes to the organizers of the event at Navsari.

(Z. P. Patel)
(Vice Chancellor)

Soil Conservation Society of India
New Delhi

Dr. Suraj Bhan
(President)

MESSAGE

I am happy that the Soil Conservation Society of India (SCSI), in collaboration with Gujarat State chapter of SCSI, Navsari, Gujarat is organising 31stNational Conference on "Innovative resource management approaches for coastal and inland ecosystems to sustain productivity and climate resilience" at Navsari Agricultural University, Navsari, Gujarat.

Natural resources are critically important components of life support system, the efficient conservation and management of which are vital for sustainable agriculture and rural development. With increasing demand on land for agriculture, increase in population, urbanization, industrialization and other non-farm uses of farm lands, diversion of land resources takes place not only from wastelands but also from agriculturally and ecologically significant areas including coastal ecosystem. The soil and water conservation technologies play major role for mitigating the impact of climate change on yield of various crops. The degradation of natural resources, soil and water has become a matter of serious concern for the farmers, researchers, academicians, scientists and policy makers, as these in turn affects socio-economic upliftment of rural population and sustaining agricultural productivity.

The Innovative resource management have been major driving force to enhance agricultural productivity, production, profitability and development in the country. In recent times the coastal and inland ecosystems require to be made sustainable which should be acceptable & affordable to the farmers, fisherman, economic viable, sustainable, ensure any harm on bio-health and also mitigate to climate change impact.

I am confident that the National Conference would provide long way solutions to gather professionals working in the field of Agriculture, Soil Science, Soil & Water Conservation Engineering, Forestry, Horticulture and allied agricultural sciences that include Students, Research Scholars, Faculties and Scientists from academic institutions and R&D and Non-government organizations to participate and present their work on sustaining productivity in the era of climate change, while managing the scarce natural resources.

I hope that the deliberations of the conference will result roadmap to support present status along with policy planning for judicious management of resources to mitigate the climate change in both coastal and inland ecosystem. I convey my best wishes for the success of the conference.

(Dr. Suraj Bhan)
(President)

FOREWORD

Water and Food security remain a persistent and overbearing problem for a large proportion of the world population in general and the Indian population in particular. It has an immediate consequence on soil in terms of determining survival strategies of small and marginal farmers in view of declining productivity, loss of surface soil mass, soil degradation, declining water levels and water scarcity. Global environmental problems such as land degradation, desertification, loss of biological diversities and climate change would dominate the overall objective of soil study in this century. Soil and water are the most essential resources for sustained quality of human life and related activities; therefore, soil resources and agro ecology-based agricultural development should be the strategy for exploiting renewable resources on which our nation must build and grow to fulfil all the cherished dreams.

Despite huge investment on the development of canal commands the irrigated area is hardly 37 % and still 63 % is dependent on rainfed or groundwater irrigation. The country neither has more land nor the viability of any bigger dam projects. In this context, for increasing crop productivity the only way out could be through the utilization of know-how available in Universities and Research Organizations on soil and water conservation, water management, integrated nutrient management, precision farming and comprehensive land use planning. Further, the total coastline of India which includes the island is about 7516.6 km, with a flourishing human population all along the coast, the soil and water problems of coastal districts are different from mainland or hilly areas. The land use plan of the coastal watershed has to deal with coastal erosion, soil degradation, sea water ingress, water pollution due to industrial conglomerates, erratic monsoon impacts, loss of vegetative cover, storms and possible tsunami threats. Agroforestry systems need to be implemented, for carbon sequestration, conservation of water and soil, industrial demand for wood, forest products, biodiversity conservation and environmental sustenance. Unless academia moves from working in discipline-wise silos, to adopting a multi-disciplinary and integrated approach for solving the complex problems of degrading natural resources, food, water, nutritional and economic security will remain a distant dream. With these points in view, a National Conference is organized at NAU, Navsari by inviting scientists, college faculty members and students to present their findings as well as to listen to the renowned experts in the field.

The Organizers are grateful to Dr Z P Patel, Hon Vice Chancellor, Navsari Agricultural Universality, for readily accepting the proposal of SCSI, New Delhi for hosting the 31st National Conference at Navsari Agricultural University. His consent and leadership have enabled the Gujarat Chapter to mobilise the participation of a large number of researchers from various Colleges and Research Units as well as availing the infrastructure facilities for the Conference. We also express our deep sense of gratitude to Dr Suraj Bhan, President of Soil Conservation Society of India for having faith in the newly formed Gujarat Chapter at NAU, Navsari and to host the national event. He is the man behind consistent persuasion to involve the scientific community working for soil and water conservation in Gujarat. The financial assistance received from Research and Development Fund of National Bank for Agriculture and Rural Development (NABARD) towards conduct of Conference including publication of proceedings of the Conference is gratefully acknowledged. The financial support and scientific resource from ICAR are the backbone for making the event successful, but also give due authenticity and meaning to the meet. The major financial help provided by the Ministry of Earth Sciences, Government of India has helped in improving the quality of Scientific Conference, is heart fully acknowledged. We are also thankful for the financial assistance from various organizations and cooperatives, listed in the appendix of publication. The organizing team is thankful to the participants and their respective organizations from across the country, for registering and participating in the three-day conference. Lastly, the organizers acknowledge the manpower support from various colleges, research units of Navsari Agricultural University and the Soil Conservation Society of India, New Delhi for making this event successful.

Organizers Desk

INDEX

Session-III (Theme-II)

Poster Session - II (Theme II) (Day-3)

O/S-II/1

Effect of different methods of irrigation and tillage practices on *Rabi*sweet corn after *kharif* Rice

J.M. Patel, Vineet Kumar Sharma, B.M. Solia and K.K. Patel

Soil and Water Management Research Unit,

Navsari Agricultural University, Navsari – 396 450 (Gujarat)

An experiment was conducted for four years (2017-18 to 2020-21) at Soil and Water Management Research Farm, NAU, Navsari to study the effect of different irrigation methods and tillage practices on the growth and yield of sweet corn and their effect on soil physical properties. The experiment was conducted at a fixed site and the experimental design was a split plot with three replication of each treatment. The main plot treatments comprised of irrigation methods, *viz*., I_1-surface irrigation at 0.8 IW/CPR ratio, irrigated at 60 mm depth, I_2 - drip irrigation at 0.6 PEF, while subplot treatment consisted of three treatments, *i.e.*, L_1 - normal tillage with flatbed and cultivator criss-cross (NTFB), L_2 - normal tillage with raised bed and cultivator criss-cross (NTRB), L_3 - Rotary tillage with (one pass of rotavator) and L_4 - No-tillage. The four years of experimental results indicated that the adoption of no-tillage (zero tillage) with drip irrigation increased the sweet corn cob yield and improved soil physical properties *viz.,* soil bulk density, cone index, and water stable aggregated. Further zero tillage can also be adopted in *kharif* rice. This treatment also confirms a higher net income realization.

O/S-II/2

The nutrient index values for soil organic carbon, Ava. N, P, S, Fe and Zn in the soils of cotton crop under Bharuch, Surat and Narmada district of Gujarat

Dr. S. M. Bambhaneeya*, Dr. N. H. Garaniyaand Dr. K. H. Patel

Department of Soil Science and Agricultural Chemistry,

College of Agriculture, Navsari Agricultural University, Campus Bharuch

**Email: sureshsoilscience@nau.in*

The purpose of soil nutrient analysis is to assess the adequacy, surplus, or deficiency of available nutrients for optimum crop production, to avoid transferring undesirable levels of some nutrients into the environment and to ensure a suitable nutrient content in crop products. To aid interpretation of the different concentrations of individual nutrients in the soil, the use of the index or descriptive scales is in vogue. The result concerning SOC revealed that the soils from both irrigated cotton growing areas though depicted 'medium' status of nutrient index value was (1.91), the nutrient index value for rainfed soils as well as for irrigated and rainfed soils jointly were 'low' status i.e. 1.40 and 1.65, respectively.For the irrigated land, and rainfed lands and the irrigated and rainfed lands jointly nutrient index value of available N was also 'low' i.e. 1.15, 1.02 and 1.08, respectively.In the case of available P2O5, the nutrient index value of irrigated, rainfed as well as irrigated + rainfed soils was 'low' and i.e. 1.40, 1.27 and 1.34, respectively.Available S, the nutrient index value of irrigated, rainfed as well as irrigated + rainfed soils depicted 'medium', 'low' and 'low' status and their nutrient index value were 1.87, 1.36 and 1.62, respectively. The result of available Fe revealed that the soils from irrigated, rainfed and irrigated + rainfed together cotton growing areas depicted 'medium', 'low' and 'medium' status and their nutrient index value were 1.89, 1.62 and 1.75, respectively. In case of available Zn, the nutrient index value of irrigated, rainfed as well as irrigated + rainfed soils was 'low' and i.e. 1.47, 1.04 and 1.25, respectively. The overallresults revealed that rainfed soils concerning SOC, N, P, S and Zn, the nutrient index was 'low'all through and thus, these soils require much attention regarding improvement of the status ofthese parameters through the addition of organic manure and other inorganic sources of nutrients to fulfil crop demand for possible higher yield of cotton and to maintain soil quality/S-II/health as well. However, in irrigated lands with respect to N, P and Zn, nutrient indexes were 'low'showing SOC and sulphur with 'medium' nutrient index. Hence, irrigated soils require moreemphasis on N, P and Zn management as compared to SOC and sulphur to fulfil cropdemand for possible higher yield of cotton and also to sustain soil quality/S-II/health.

Keywords: Cotton, nutrient index, organic carbon, Gujarat

O/S-II/3

Nutrient management through organics for higher yield of black turmeric in acidic soil

Tridisha Deka* and Sanjay-Swami

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Organic agriculture is a holistic production management system that promotes and enhances agro-ecosystem health, including biodiversity, biological cycles, and soil biological activity. The North Eastern states are by default organic in nature. After Sikkim, the government is aiming to make Meghalaya an organic state, except few pockets where intensive cultivation of vegetables using inorganic fertilizer and chemicals is preferred. Turmeric is an important cash crop in the NEH region and shares about 8.30 per cent of the total production in the country. In Meghalaya, black turmeric is an important cash crop. It has high medicinal value. However, farmers cultivate it without applying any nutrient sources or sometimes may apply some household waste and farm yard manure (FYM) resulting in low yield with poor quality produce. Therefore, the present investigation was carried out at School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Umiam, Ri-Bhoi district of Meghalaya to develop an organic nutrient management package for getting higher production wherein farm yard manure (FYM), vermicompost (VC) and poultry manure (PM) alone and in different combinations were tested through eight treatments *viz.,* T_1: FYM @ 20 t//ha, T_2: VC @ 10 t/ha, T_3: PM @ 5 t/ha, T_4: FYM @ 10 t/ha + VC @ 5 t/ha, T_5: FYM @ 10 t/ha + PM @ 2.5 t/ha, T_6: VC @ 5 t/ha + PM @ 2.5 t/ha, T_7: FYM @ 10 t/ha + VC @ 5 t/ha + PM @ 2.5 t/ha and T_8: Control. These treatments were replicated thrice in Randomized Block Design. The soil reaction of the experimental plot was acidic. The results revealed that the highest plant height, number of rhizomes and rhizome yield was obtained in T_7 i.e., the combination of FYM, VC and PM @ 10 t/ha, 5 t/ha and 2.5 t/ha, respectively. Therefore, farmers of Meghalaya may be advised to apply FYM @ 10 t/ha + VC @ 5 t/ha + PM @ 2.5 t/ha for getting a higher yield of black turmeric in acidic soils.

Keywords: Black turmeric, acidic soil, nutrient management, organic sources, rhizome yield.

O/S-II/4

Impacts of the swidden agriculture-based land-use system on soil organic carbon

Jitendra Kumar1, H. Kalita[2], Wangnem Rekhung[2], Nishant K Sinha[1], R. S Chaudhary[1] and A K Patra[1]

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Land-use conversion strives for a clinging impact on soil organic carbon (SOC) dynamics. Therefore, an in-depth study of change in SOC, fractions of SOC and enzymatic activities of Soil Microbial Biomass Carbon (SMBC) and Dehydrogenase (DHA) was undertaken with the conversion of forest land to *jhum*, fallow *jhum* and settle cultivation use on the hills of Arunachal Pradesh of India. Geo-referenced soil samples from 8 different locations, each from different land uses were collected. Part of the soil sample was used for the analysis of SOC and their fraction, the second portion was kept in a deep freezer for determining SMBC and DHA. The third part was used for the analysis of bulk density. The result revealed that the highest loss of SOC stock was recorded in *jhum* land (41.8% to 13.4%), and the labile carbon was also found to decrease in *jhum* land. The highest SMBC was observed on the surface soil of the natural forest, the highest DHA was found in the natural forest and the lowest DHA was recorded in *jhum* land. This study indicates that conversion of natural forest to *jhum* leads to a drastic reduction in the SOC storage, enzymatic activities and C fractions, whereas fallow *jhum* shows the sign of recovery as all these parameters were found to improve compared to the *jhum* land-use system. This study also confirms that the fallow helps in restore the initial situation.

Keywords : Swidden agriculture, Forest land, Fallow *jhum* and Soil organic carbon.

O/S-II/5

Effect of land configuration on soil properties and nutrient uptake by wheat (*Triticum aestivum* L.) under partially reclaimed coastal salt affected soil of South Gujarat

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The field experiment was conducted at Coastal Soil Salinity Research Station, Navsari Agricultural University, Dantiduring *rabi* seasons of2016-17 and 2017-18to study the effect of land configuration and nutrient management on the yield of wheat under partially reclaimed coastal salt-affected soil of South Gujarat. On basis of the pooled result, it was revealed that the land configuration methods significantly influenced the soil properties and nutrient uptake by the wheat crop. The uptake of Nitrogen and Phosphorus by wheat crop was recordedsignificantly highest which were 105.53 and 15.44 kg ha^{-1} respectively while potassium uptake was recorded higher (143.87kg ha^{-1}) in the ridge and furrow which was at par with the broad bed furrow. There was significant reduction in soil electrical conductivity under the ridge and furrow method, at the surface (0-15cm) which recorded 1.90 and 1.92 dSm^{-1} during 2016-17 and 2017-18 respectively. The ridge and furrow method recorded significantly lower ESP values which were 11.45 and 10.28%, but remained at par with broad bed furrow method, whereas significantly higher values of ESP (12.26 and 11.06%) were observed in the flat bed method during 2016-17 and 2017-18, respectively. The maximum values of available N were observed under broad bed furrow method at surface and sub surface which were 297.61, 335.16 and 312.14, 347.92 kg ha^{-1} during 2016-17 and 2017-18 respectively. Higher values of available P_2O_5 were recorded under broad bed furrow method at surface and subsurface which were 43.38 and 44.03 during 2016-17 and 2017-18 respectively. Under the ridge and furrow method, the maximum available K_2O values 621.80 and 652.08 kg ha^{-1}at surface were observed while 587.31 and 636.94 kg ha^{-1} were registered at subsurface during 2016-17 and 2017-18 respectively.

Keywords: *Wheat,Land configuration, Soil Properties and Nutrient uptake and availability etc.*

O/S-II/6

Effect of organic nutrient sources on soil health in North-Western Himalayas

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In the green revolution, intensive use of synthetic agrochemicals, such as fertilizers and pesticides with the adoption of nutrient responsive high yielding varieties of crops has boosted production to a great extent. Of late, concern has been raised time and again over its adverse effects on the degradation of soil health, environment and food quality. There is an urgent need to minimize environmental degradation as much as possible and restore the productivity of degraded soils. In such a situation, organic farming has to emerge for a successful agricultural revolution and a comprehensive management approach to improve soil health and the ecosystem of an area. With this objective, the present study was undertaken to study the effect of organic nutrient sources on soil health in the North-Western Himalayas. The present study comprised different levels of various organic nutrient sources such as poultry manure and vermicompost. The study led to the conclusion that the treatments comprising 100% RDN through VC & PM on 50:50 N-equivalence basis were leads to improving organic matter content, nutrient availability and bulk density. This overall alleviation in soil physicochemical properties through organic matter

addition would lead to better soil health and productivity in long run, due to higher nutrient and water retention and also improved soil structure. Thus, it can be concluded that in the present scenario of deterioration of organic matter content of Indian soils and its ill effects on soil and crop health, the organic nutrient sources i.e FYM, vermicompost and poultry manure will play a promising role in sustaining soil health for future generations.

Key Words: *Organic Nutrients, Poultry Manure, Vermicompost, FYM and Soil Health*

O/S-II/7

Nutrient management practices for organic cotton production

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An experiment was conducted during *kharif*-2021 at Main Cotton Research Station, Navsari Agricultural University, Surat, Gujarat to identify suitable and effective organic nutrient management practices for the productivity of *hirsutum*cotton.The experiment was laid out in a randomized block design replicated thrice with 11 treatments *viz.* T1: Absolute control (No organic& inorganic), T2: Control (RDN through inorganic), T3: RD of Nutrient through organic based on P equivalent basis, T4: Seed treatment and soil application of recommended bio-fertilizers and foliar application of PPFM, T5: Neem cake 250 kg/ha, T6: Raising of Sun hemp between rows incorporated before flowering, T7: Intercropping with green gram, T8: T4+T5, T9: T4+T6, T10: T4+T5+T6 and T11: T4+ T5 + T7. *Hirsutum*cotton variety 'G. Cot. 20' was grown by adopting organic nutrient management practices.

The results revealed that organic nutrient management practices improved the growth attributes which resulted in a significant enhancement in yield attributes, yield and nutrient uptake by cotton. Among different organic nutrient management practices, treatments T9, T10 and T11 were found more effective practices in improving growth and yield attributes of cotton. The addition of more residue in soil and higher uptake of nutrients and help in recording significantly higher seed cotton yield than other organic nutrient management practices and remunerative in terms of higher net returns (Rs. 35532/ha, Rs. 36468/ha and Rs. 34884/ha, respectively).

O/S-II/8

Conservation biological control approaches for pest management in organic farming

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Various farming systems have been adopted for sustainable pest management but none have been entirely successful in managing insect pests. Chemical insecticides are still the predominant pest control measure but cause a health hazards and environmental pollution. In organic farming, few options remain to manage pests and diseases in their crops compared to conventional farming. However, major pests could still be managed through the manipulation of the agroecosystem processes to the advantage of the crops and the disadvantage of pests. The long-term sustainability of agricultural and natural ecosystems depends upon the conservation of natural resources. Conservation biological control is a novel approach as a component of conservation agriculture with a series of practices that strives for acceptable profits with high and sustained production levels while concurrently conserving the environment. It also increases the biodiversity of both flora and fauna which helps in controling insect pests. Conservation biological control refers to indigenous predators and parasitoids, usually against native pests. Various measures are implemented to enhance the abundance or activity of the natural enemies, including manipulation of the crop microclimate, creation of overwintering refuges (like 'beetle banks'), increasing the availability of alternative hosts and prey and providing essential food resources such as flowers for adult parasitoids, aphidophagous hoverflies, aphid lion etc. During non-crop periods, natural enemies may need to benefit from pollen and nectar. Preservation of natural enemies can be achieved by providing habitat resources for natural enemies. Many crops plant flowers fora short time, so flowering plants along the edges of

the field or within the field needed for pollen and nectar. The natural enemies can be saved by providing habitat and resources for natural enemies

Keywords:*Conservation agriculture, Conservation biological control, Organic farming, Natural enemies and Natural resources*.

O/S-II/9

Evaluations of ground water resources and proposing cropping pattern of coastal belt of Saurashtra Region.

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Salinity in the coastal region has created the adverse condition in respect of agriculture, drinking water supply and other aspects having bearing on the lives of people. In Saurashtra and Kutch, about 1125 Km long coastal line comprises about 0.1079 m-ha of saline land which needs to be treated for salinity reduction (Anon; 2000). The coastal belt of Saurashtra extending from Bhavnagar to Okha is known for its vegetable, fruits, sugarcane and other high-value cash crops. But the problem of salinity has rendered the farmers with limited crop options. It has also changed the cropping pattern during the past decade (Pradhan, 1998). The present study is planned to conduct a benchmark survey of existing coastline natural resources and cropping patterns including **groundwater** resources with their quality. The total land resources in Jamnagar, Porbandar, Junagadh, Amreli, and Bhavnagar districts are 1020300 ha, 229500 ha, 880200 ha, 739200 ha and 858000 ha and have a net cropped area of 57%, 51%, 57%, 73% and 63% respectively. The soil health of the coastal belt area (0-20 km) is normal. Most of the areas in coastal districts have a slope 0-1%. The area having slope 1-3%, 3-5%, 5-10%, 10-15%, 15-35% and 35-5-% are 276905 ha, 43490 ha, 15839 ha, 15391 ha, 39509 ha, 60322 ha respectively.The major crops, i.e., wheat, cotton, groundnuts, and pulses, are being cultivated. From the study, it can be suggested that horticultural crops like mango, sapota, lime, papaya, pomegranate, and custard apple can also be cultivated to achieve better income.

Keywords: Cropping pattern, Groundwater,land resources, Soil health, Water quality

O/S-II/10

Role of PGPR to mitigate the drought stress in plants- A sustainable tool for utilisation of natural resources

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Action is needed to face the global threat arising from inconsistent rainfall, rise in temperature and salinization of farmlands which may be the product of climate change. And the increasing population is a significant challenge for agricultural food production.Several approaches are needed, such as the higher use of chemicals including fertilizers, pesticides, and herbicides. Several other factors, such as overcoming the posture, saline, and drought land, can be improved by using stress-tolerant plant growth-promoting microorganisms. Agriculture is a complex network of interactions of plants with microorganisms. There is a growing demand forecologically compatible, environment-friendly techniques in agriculture that might be able to provide an adequatesupply of food for the increasing human population through the improvement of the quality and quantity ofagricultural products. Under the changing climatic scenario of global fluxes of the key biogenic greenhouse gases (carbon dioxide, methane, and nitrous oxide), and some other environmental problems like biotic and abiotic stress. Abiotic stress affects not only crop growth but also its morphological, physiological and biochemical traits which may result in the formation of free radicals that damage the plant defence system resulting in an increase in reactive oxygen species (ROS), such as superoxide radicals, hydroxyl radicals, and hydrogen peroxide induces

oxidative stress. ROS can cause tissue damage, membrane corrosion, and protein and nucleic acids by causing lipid peroxidation. The application of beneficial microorganisms *i.e.*Plant growth promoting rhizobacteria in agriculture can serve as an important alternative natural gateway to alleviate drought stress tolerance in plants. PGPR is usually associated with the roots of the plant and they are capable enough to extend sufficiently and provide effective tolerance to plants from the deleterious effect of drought to stress and other abiotic stress, probably by modulating various physiological and biochemical responses against drought stress. These microorganisms represent a key ecological strategy to rampart drought stress tolerance behaviour by enhancing phytohormone levels like auxin, ABA and GA. Enzymes like 1-aminocyclopropane-1-carboxylate (ACC) deaminase activity and production of bacterial products like exopolysaccharides (EPS) formation of biofilm, antioxidant resistance, including the accumulation of many suitable organic solutes such as carbohydrates, amino acids, and polyamines.PGPR also improves root growth and root architecture, thereby improving nutrient and water uptake. The microbial population are instrumental to fundamental processes that derive stability and productivity of agro-ecosystems through efficient utilization of nutrients and recycling of energy and thereby preserve the natural ecosystem resources under climate change.

O/S-II/11

Effect of anthropological intervention on the land resource of Behaira Governorate's Idku Lake Innovative Resource Management Approaches for Coastal and Inland Ecosystems to Sustain Productivity and Climate resilience

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The Behaira Governorate's Idku Lake and its surrounding regions are included in the research area. Given that more than 30% of Lake Idku has been converted to agricultural land uses, the area has undergone major spatial alterations. The purpose of the study is to evaluate the effects of ongoing human and agricultural activity on the condition of the study area's lands. The study area's various land uses and activities' effects on the soil quality were identified, and the connections between the measured soil variables were categorized. The results of the USLE implementation in the GIS model-builder showed that there are four key concerns for severe soil deterioration in the area: water logging, soil compaction, salinization, and alkalization.One of the issues that stood out the most throughout the fieldwork and inventory of the available land resources in the study area was urban sprawl. The findings of this study suggest that similar agricultural semi-arid regions should utilize the same methodology to establish a database of land resources for agricultural use, which will be highly helpful for decision-makers to track changes in agricultural lands.

Keywords: climate changes; dynamic land degradation; ArcGIS model builder; remote sensing

O/S-II/12

Effect of different resource conservation technologies on water productivity

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Today's agriculture is an energy-intensive farming system. Though the modern technology model remained successful in achieving targeted food demand, it has contributed to environmental problems in some situations as loss of biodiversity and soil fertility, salinization and water scarcity. Declining soil, water and human

resources in rice-wheat and other irrigated cropping systems need resource-conserving technologies (RCTs) for agricultural sustainability. After the era of the green revolution, the use of soil and water resources is over-exploited. The income from irrigated agroecosystems from the rice-wheat system is declining in many areas as cultivation costs are rising faster than crop prices. The various RCTs can save soil, water and other natural resources.Today's real agricultural challenges are resource fatigue with declining factor productivity, decreasing human resources and raising costs and socio-economic changes. Thus, there is a dire need for energy, water and a labour-efficient alternate system that helps to sustain soil and environmental quality and produce more at less cost.The conservation agriculture (CA)-based RCTs have proved to be energy and input efficient, besides addressing the emerging environment and soil health problems. The CA technologies have the potential for improving productivity and soil quality, mainly through soil organic matter (SOM) build-up. The RCTs bring many possible benefits including reduced water and energy use (fossil fuels and electricity), reduced greenhouse gas (GHG) emissions, soil erosion and degradation of the natural resource base, increased yields and farm incomes, and reduced labour shortages.

Keywords: *Resource Conservation Technologies, Soil Quality, Agricultural Sustainability, Natural Resources, Environment.*

O/S-II/13

Effect of biological crust on soil properties in Arid and Semiarid areas

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Soil crust is a thin layer of dense and tough material. Mainly three types of surface soil crusts can be distinguished viz., (1) Physical crusts, which are specific modifications of the topsoil caused by natural or other events, such as raindrop impact or sedimentation and subsequent drying, consisting of a hard thin surface layer with reduced porosity and increased bulk density, (2) Biological crusts, which are living communities of lichen, cyanobacteria, algae or moss growing on the surface of the soil and binding it together. Drylands, areas with a severe and fragile ecological environment, cover more than one-third of the terrestrial land surface. Drylands are characterized by a sparse presence of vascular plants due to low water availability, and low rates of nutrient turnover or a limited ability to acquire resources due to extreme temperatures. The soil surface in drylands is often, occupied by biological soil crusts (BSCs). BSCs are the most important biotic factors in arid ecosystems. BSCs are considered "ecosystem engineers" and indicators of ecosystem health and are linked with the level of dryland ecosystems restoration and degradation and (3) chemical crusts or precipitates, also called salt crusts. From an agronomic point of view, the major limitation of soil seals and crusts is the influenced on seedling emergence and water infiltration rates. On the other hand, biological soil crusts may have a positive impact on the soil, because they protect the surface against water and wind degradation, fix N_2 and carbon, capture dust, accumulate O.M, supply nutrients to vascular plants and enhance seedling establishment.

Keywords: Biological crust, dry areas, cyanobacteria, soil properties

O/S-II/14

Nitrogen mineralisation rate and kinetics of different organic sources in acid soil

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Age-old traditional farming practices are followed by the indigenous inhabitants comprising the use of locally available organic sources for plant nutrition. An incubation study of 100 days was carried out following a completely randomized design (CRD) with four replications using four different locally available organic

sources *i.e.,* Farm Yard Manure (FYM) (T_1), Poultry manure (T_2), Pig manure (T_3) and Vermicompost (T_4) to provide nitrogen equivalent to 120 kg /ha(considering RDF of rice as 120 kg N/ha), along with a control (T_0) where no organic sources were added to quantify the kinetics and rate of mineralisation of these organic sources in acid soil. The observations were recorded every 10 days intervals upto 100 days of Incubation (DOI). The results indicated that the highest values of available nitrogen were found at 60 DOI (144 ppm) with T_3 followed by T_2(142.2 ppm). The highest value of ammonical nitrogen was recorded at20 DOI with T_3 (72.3 ppm), followed by T_4 (64.1 ppm) after which it showed a decline whereas the Nitrate nitrogen content was found to be highest at 60 DOI (41.0ppm). The R^2 (coefficient of determination) of the first-order kinetic equation for different organic sources were found to be ranging from 0.91 (T_3)>0.90(T_2)>0.89(T_4)>0.88(T_1) whereas for second order kinetic equation it was found to be ranging from 0.66 (T3)>0.65 24 (T_2)>0.64 (T_1 and T_4) for Nitrogen mineralisation (N_{min}) indicating the suitability of first-order kinetic equation over second order in predicting N_{min} at any point of time.It can be concluded that T_3 is the best organic nutrient source among the treatments considered for the study. Furthermore, the addition of organic sources attributed to an increase in soil pH and Electrical Conductivity values over control.

Keywords : *Local organic source, Incubation, Nitrogen mineralisation rate, kinetics, acid soil.*

O/S-II/15

Screening of plant growth promoting rhizobacteria from rhizosphere microbiome of Tezpur Litchi

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Tezpur litchi (*Litchi chinensisSonn*.) is a special type of litchi grown in 'Litchupukhuri′and 'Porowa′village of Sonitpur district of Assam which is known for its excellent quality, pleasant flavour, juicy pulp with attractive red colour and small seed with tight pulp. Bombay, Bilati, Shahi, Elaichi, Piyaji and Haldiaare the common varieties grown in litchi growing areas of Tezpur. The same fruit quality cannot be retrieved even when grown under similar set of conditions in different locations of Assam. This may be attributed to various biotic and abiotic factors, including the below ground microbial diversity. The wide array of microbial diversity in the rhizosphere microbiome of Tezpur litchi, more specifically the plant growth promoting rhizobacteria may play significant role in modulating the host environment and also confer requisite taste and quality to the fruit. In the present investigation, rhizosphere microbiome of Tezpur litchi was utilized for screening of native isolates which could play major role in fruit quality of litchi. A total of seventy-four putative isolatescomprising of aerobic nitrogen fixing bacteria (16 nos.), microaerophilic nitrogen fixing bacteria (19 nos.), endophytic bacteria (28 nos.), phosphate solubilizing bacteria (PSB) (6 nos.) and potassium solubilizing bacteria (KSB) (5 nos.) were isolated in their respective media. All the isolates showed were evaluated for different plant growth promoting traits.The total N content of the isolates ranged between 1.9-7.6 mgg^{-1} sucrose consumedin N-free media. The isolates produced indole acetic acid (IAA) in the range of 1.45-42.36 μgmL^{-1} culture filtrate and gibberellic acid (GA) in the range of 2.14-32.14 μgmL^{-1} culture filtrate. Nine isolates showed positive results for siderophore production as indicated by formation of a yellow halo around the colonies, and hydrocyanic acid production was showed by 6.75% of the isolates.62.16% of the isolates showed halo zone in modified Pikovskaya's media indicating zinc solubilization, while 56.75% of the isolates could solubilize tricalcium phosphate in Pikovskaya's media indicating P-solubilisation Based on highest quantitative estimation of total N, the aerobic N fixing bacteria and microaerophilic nitrogen fixing bacteria were selected for further biochemical characterization, while the nutrient solubilizer, PSB was selected based on P-solubilization index, and KSB on the basis of Khandeparkar's ratio. The endophytic bacteria were selected on the basis of antibiotic resistance profile for biochemical characterization. Twelve isolates were bioassayed for their carbon source utilization, citrate, lysine and ornithine utilization, urease detection, phenylalanine deamination and H_2S production, where

the varied results indicated their presence and adaptability in varied ecosystem. Theselected isolates could be further validated in Tezpur litchi and in due course of time utilized for preparation of microbial inoculants for the crop.

Key Words: *Tezpur litchi, rhizosphere microbiome, nutrient solubilizer, siderophore, Khandeparkar's ratio*

O/S-II/16

Effect of organic manures on growth and yield parameters of groundnut (*Arachis hypogaea* L.) grown on a certified organic farm

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Field experiment was conducted on medium black soil of Organic Farm, Navsari Agricultural University, Navsari, Gujarat State during summer season of the year 2014 to study the "Effect of organic manures on growth and yield Parameters of groundnut (Arachis hypogaea L.) grown on certified organic farm". Most of the growth and yield attributes like, plant height, number of branches per plant, number of root nodules per plant, dry matter accumulation per plant, number of pods per plant and pod yield per plant were significantly influenced by different organic manures. Application of 5 t FYM ha-1 (T1) was resulted in significantly higher plant height, number of branches per plant, number of root nodules per plant, dry matter accumulation per plant, number of pods per plant and pod yield per plant over control (T10), but it remained at par with treatment T4, T2 and T9. Significantly higher pod (2626 kg ha-1) and haulm (4475 kg ha-1) yield of groundnut were observed with the application of FYM 5 t ha-1 (T1) which was remained at par with treatment T4 (vermicompost 1.5 t ha-1) and T2 (biocompost 3 t ha-1) for pod yield and treatment T4, T2, T9, T6 and T8 for haulm yield over control (T10).

Keywords: groundnut, organic farming, FYM, pod yield, growthand yield attributes

O/S-II/17

Management of soil and ground water quality, impact on agriculture in the coastal areas of Kachchh, Gujarat, India

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Kachchh is in arid and semi-arid climatic zones. The Kachchh is having a coastline of 406 Km out of 1600 km of Gujarat Coastline. Kachchh has Saline desert of Little Ran and great ran is about 7500 km2, which is 2900 sq miles. The average summer temperature is about 45°C to 480C and the minimum winter temperature remains between 2°C to 5°C. The Average annual rainfall is 340 mm (last decade). The evaporation rate is generally very high which exceeds the precipitation rate. Thus less rain, high evaporation rate, and shallow groundwater depth enhance salts' movement towards soil surface. Agricultural productivity is severely affected by soil salinity because salt levels harm plant growth. In this study, the concentration of ions like Na+ , K+, Ca2+, Mg2+ and Cl- in Groundwater and soil has been analysed in different seasons (Pre-Monsoon and Post –Monsoon). Saltwater intrusion in the coastal areas has been studied based on analysis done in 2015, 2016, 2020 and 2021. There is a wide range of plant species with varying levels of salt tolerance that can be used in saline agriculture like Date palm, Eucalyptus, Wild date palm, Pomegranate, Zizyphus. Most of these plants are found in Kachchh. One of the groups of salt tolerant plants are 'Halophyte'. These plants cannot only tolerate excess salt but also normal growth in saline environmental conditions. Leaching may reduce salinity levels in the absence of artificial drains when there is sufficient natural drainage Salts are most efficiently leached from the soil profile under higher

frequency irrigation. As Narmada Water canal is available in Kachchh, and Kachchh Branch Canal directly benefits 182 villages, reducing soil profile and groundwater salinity.

Keywords: Coastal soil, ground water quality, Agriculture, Kachchh

O/S-II/18

Soil quality of coastal sandy soils in ThiruvananthapuramDistrict (Aeu 1), Kerala

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Kerala has 58950 ha of coastal area distributed all along the western border. This constitutes 1.52% of the total geographical location of the state. About 40% of the people live in or near the coastal zone, and the state's major economic activities also occur within this area.Understanding coastal soil physicochemical parameters is essential for developing innovative resource management strategies. By manipulating the constituent components of the soil through the addition and conservation practices, the potential productivity of these soils can be realized, and innovative management strategies can be developed. A study was conducted to assess the soil quality of the coastal sandy soils in Thiruvananthapuram district (Agro Ecological Unit 1- Southern Coastal Plains), Kerala.Fifty geo-referenced surface soil and surface core samples were collected from Thiruvananthapuram district coming under southern coastal plains having a 19344 ha area.

The analytical results for soil physical properties showed that the bulk density is1.37 - 1.86 Mg/m^3while the particle densityis2.02 - 2.91Mg/m^3, with 22.7 - 56 % water holding capacity, and the soil comes under sandy soil textural class. The soil chemical properties were found to be in the range of 5.11 - 7.32 for pH, 0.03 - 0.23 dS/m for electrical conductivity, 0.3 - 4.5 for exchangeable acidity and cation exchange capacity was also found to be very low. The nutrient content in these soils is very poor. Organic carbon was found to be in range of 0.3 - 1.6%, nitrogen as 100 – 389 kg/ha, phosphorus as 11.2 - 59.9 kg/ha, potassium as 100 – 361 kg/ha. Secondary minerals were found to be:calcium in 80 – 360 mg/kg, magnesium in 47 – 152 mg/kg and sulphur in 4.5 - 20.5 mg/kg. Boron was found to be in the range of 0.11 - 0.82 mg/kg.

Soil biological activity in these coastal sandy soils was also poor, with dehydrogenase activity in the range of 0.57 - 15.3 µg/24hrs and soil microbial biomass in the range of 9.18 - 30 µg/g. So, generally, the fertility status of these coastal sandy soils was low.

Coastal agriculture has immense importance and needs to be addressed for future societal viability and food security. Integrated coastal resource management and proper land-use planning are of foremost importance.

Key words:*Coastal sandy soils, Southern coastal plains, soil quality, soil physical properties, soil chemical properties, soil biological activity.*

O/S-II/19

Resource conservation through natural farming: low input agricultural practices

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In low-input sustainable agriculture (LISA), some purchased inputs are replaced with management, scientific knowledge, and on-farm resources. Rotations, crop and livestock diversification, water and soil conservation measures, mechanical cultivation, and biological pest control are all LISA techniques. Low-input farmers are attempting to replace chemicals with brainpower. Environmental concerns include groundwater contamination brought on by agrichemical leaching. Intensive cropping has adverse effects on and off the farm, such as soil erosion. Farmers are still concerned about pesticide availability and rising prices. High production costs and other issues in agriculture result from using chemicals for increased crop productivity and to make up for the degradation of soil, water, and biological resources.

Due to this, farmers are very interested in sustainable, low-input agriculture. Adapting the agricultural system to the local environment, including the soil, water, climate, and biota present on the site, as well as optimizing the use of biological and chemical/physical resources in the agroecosystem, is the guiding principles of a low-input sustainable agricultural system. The depletion of the resources required for agricultural production is the cause of the high cost of production at the moment. Production costs can be significantly reduced by using various alternative techniques that improve the environment and resource use. Alternative crop management strategies could incorporate current technologies for conserving soil and water. Numerous soil and water conservation technologies could be incorporated into alternative crop management plans. Similarly, a variety of bio-environmental pest control technologies is readily available and may assist in lowering the expense of pesticide inputs. The crop or livestock produced and the soil, water, climate, and biota conditions, will determine which specific combination of alternative practices is used. The agroecosystem's design and adaptation must consider the particular biological and socio-economic environment. The improved use of biological resources for biological control, obtaining nutrients (nitrogen) from legumes and other technologies can help lower production costs and conserve soil and water. By putting the broad principles for an ecological management plan into practice, it will be possible to build a productive, environmentally conscious organization that farms at a much lower cost.

O/S-II/20

Tillage, residue and nutrient management practices influence soil biology and organic carbon pools of sugarcane cropping systems in semi-arid tropics

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Intensive tillage coupled with crop residue burning and conventional agronomic practices in the sugarcane cropping system is a severe issue causing soil degradation and environmental pollution. Globally the principles of minimum soil disturbance, crop residue management and suitable nutrient management practices have emerged as alternative strategies for enriching the soil resource base. For a sustainable agricultural production system, soil organic carbon and soil biology are vital as they regulate all the other chemical, physical and biological properties. Several research studies have reported the potential of these strategies to serve many ecosystem functions such as soil carbon sequestration, increased resource use efficiency, making the system resilient to extreme climate events and climate change mitigation. However, the benefits of those strategies are needed to be effectively reaped in a sugarcane production system that occupies 5 million ha acreage and utilizes more than 5% of the country's irrigation resources on merely 2.6% of the net cultivated area. In this backdrop, a field experiment was conducted in split-split plot design and replicated thrice with three main plot treatments viz., CT : conventional tillage + 10 % of the recommended dose of fertilizers (RDF; 300:150:150; N:P:K; kg ha-1) applied as basal and remaining 90 % doses of fertilizers applied through fertigation, RT1 : reduced tillage (RT) by excluding deep tillage + 10 % of RDF as basal and 90 % through fertigation and RT2 : RT + 10% of RDF as basal, 40 % through band placement and remaining 50% through fertigation. Two subplots of residue management practices viz., M (Mulching with sugarcane trash) and NM (Without residue) and three sub subplots of three nutrient management practices in ratoon sugarcane viz., N1: 25% of RDF as basal and 75% through fertigation; N2: placement of 50% of RDF through SORF and 50% through fertigation and N3: placement of 75% through SORF and 25% through fertigation were imposed. After five years of cropping i.e. one fresh crop and four ratoon crops, reduced tillage (RT) with mulching (M) and placement of 50% of RDF through SORF and 50% through fertigation in ratoon management (N2) registered higher levels of enzymes i.e. (9-11) times dehydrogenase activity, (40-60)% higher alkaline phosphatase activity and (1-1.5) times beta-glucosidase activity at both (0-15) and (15-30) cm soil depth as compared to the farmer's practice. This treatment also recorded the highest soil organic carbon pools and microbial population, viz., bacteria, fungi and actinomycetes in the surface layer. A higher value of basal soil respiration (48%) was also observed with reduced

tillage and trash retention. Hence, adopting management practices involving reduced tillage, residue retention, and nutrient management in sugarcane cropping systems can significantly improve the system's productivity by enhancing soil organic carbon and soil biological quality.

Keywords: Nutrient, residue, soil organic carbon pools, soil biology, sugarcane, tillage

O/S-II/21

Varietal performance of turmeric under organic farming and effect on soil properties

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A field experiment was conducted at an organic farm, Navsari Agricultural University, Navsari, during *the Kharif* season of 2018-19 to 2020-21on the varietal performance of turmeric under organic farming and its effect on soil properties. From the year 2005, the experimental site was purely converted into organic. The experiment was conducted in soil having high initial SOC, available $P_2O_5$and K_2O ranging it from 0.79 to 0.84 per cent, 68.3 to 73.5 kg/ha and 530.2 to 591.5 kg/ha, respectively, while available N was medium ranging from 270.8 to 283.3 kg/ha. The soil was clayey in texture and slightly alkaline but non-saline. In these soil conditions,twelve treatments containing four varieties (V_1: Sugandham, V_2: Kesar, V_3: GNT-2 and V_4: Salem) along with three manure levels (M_1: 100% RDN through NADEP compost, M_2: 50% RDN through NADEP compost and M_3: NADEP compost @ 4t/ha) were imposed to grow turmeric crop in randomized block design with a factorial concept. The results indicated that among the varieties and manure levels, variety Salem and 100% RDN through NADEP compost recorded the highest plant height significantly. The yield attributing parameters like a number of mother rhizome/plant and weight of finger rhizome/plant was significantly influenced due to the interaction effect of YxVxM and YxM, respectively. Significantly maximum weight of the mother rhizome/plant (61.3 g) was recorded with Salem variety when fertilized with 100% RDN through NADEP compost. The seasonal effect was also influenced by fingerrhizome: mother rhizome ratio and the significantly highest ratio was observed during the year 2020-21 with an application of 50% RDN through NADEP compost. The treatments effect was also found significant, and maximum rhizome yield was noted with variety Salem (18.2 t/ha), which was at par with variety Sugandham (17.4 t/ha) and only 100% RDN through NADEP compost gave maximum yield (17.5 t/ha). Whereas curcumin content was found to be significant with interactions YxV and YxVxM. With respect to soil properties, varieties did not influence soil physical and chemical properties, while application of NADEP compost at different levels showed a significant effect on SOC and available N after harvest of a crop.

Keywords: *NADEP compost, rhizome yield, soil properties, organic farming*

O/S-II/22

Characterization, evaluation and efficacy of native isolated phosphate solubilizer bacteria in French Bean(*Phaseolus vulgaris* L.)

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Fruits, vegetables and cereal crops have been shown to enhance in quality with respect to phosphorus availability. Still, they are fixed in various soils and hence become unavailable. The efficiency of applied P fertilizer rarely exceeds 30% due to fixation in acidic and alkali soils forming iron/aluminium and calcium phosphates, respectively. However, most applied fertilizer phosphorus is not accessible to plants, and adding inorganic fertilizers in excess of what is often used to counteract this impact can cause environmental issues such as groundwater contamination and eutrophication. Microorganisms enhance plant nutrient acquisition. They participate in a variety of biological activities, including the transformation of insoluble soil nutrients. The group

of microorganisms capable of releasing phosphorus from total soil phosphorus through the process of mineralization and solubilization are called phosphate solubilizing bacteria: exchange, chelation and acidification processes commonly used by microorganisms to convert poorly soluble phosphorus into soluble forms. Soil samples were collected from prominent French bean-growing locations in the Jammu district. Selected isolates were evaluated for their efficiency in promoting the dry matter yield of French beans in the pot experiment, which showed a significant increase in dry matter yield compared to the control. The present study revealed that diverse PSB population in the rhizospheric soil samples of different areas of Jammu have their potential role as biofertilizers. The different isolated PSBs showed clearing zones from 0.74 to 6.79 mm, whereas phosphate solubilizing efficiency was between 28.06 to 76.66 per cent. The total culturable bacteria from the location showed the peak values on the 6 th day of incubation varying between 6.13×10 6 to 8.77×10 6 cfu g -1 soil. PSB induced the pH changes in the Pikovskaya broth, dropping the pH from 6.51 (control) to 3.61 (PSB1). The optimum temperature for PSB survival varied between 25-35 ?C. phosphate activity in 24 hrs varied between 9.17 to 36.81 ug PNPP ml -1 h -1.

Keywords- *PSB, French bean, PGPR,rhizoshere*

O/S-II/23

Effect of spacing and organic manure on growth, yield and quality of organically grown banana Cv. Grand naine

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A field experiment was conducted at the organic farm, Navsari Agricultural University, Navsari, during the Kharif season of 2018-19 to 2020-21 on the effect of spacing and organic manure on the growth, yield and quality of organically grown banana cv. Grand naine. The experimental site was clayey texture, slightly alkaline and non-saline in nature with high in Organic C; available N, P_2O_5 and K_2O range of 0.78 to 0.81 per cent, 269 to 275, 56.3 to 60.6 and 492 to 502 kg/ha, respectively. An experiment was carried out with nine treatments containing two factors; Spacing level (S)- S_1 :2.4 m X 1.5 m X 1.2m (pair row system),S_2 :2.1 m X 1.5 m, S_3 :1.8 m X 1.5 m and Manure (M)- O_1 : 100 % N through NADEP,O_2 : 75 % N through NADEP, O_3 : 50% N through NADEP in randomized block design-factorial concept.The experimental results data revealed that treatment S_2 noted significantly higher pseudostem girth, no. of hands per plant, bunch weight and yield of banana. While treatment O_1-100% N through NADEP recorded significantly higher pseudostem girth, no. of hands per plant, bunch weight and yield of banana were statistically at par with O_2. In the case of banana fruit, no significant difference was observed in protein content, TSS and reducing sugar content. However, the content of soil organic C; available N and P2O5 was significantly higher due to the application of 100 % N through NADEP. The results further showed that higher net realization was obtained in S_1 and O_1 with respective returns of Rs. 685593 and 681312 per hectare under a premium selling price of Rs. 13.75 per kg banana over a market selling price of Rs. 11.00 per kg.

Key word : Organic farming, Spacing, NADEP, Quality and Premium selling price

O/S-II/24

Agronomical evaluation of different paddy varieties under organic farming

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A field experiment was conducted in the Organic farm, Department of Natural Resource Management, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, from 2018-19 to 2020-21 in *the Kharif* season.The experiment was laid out in Randomized Block design-Factorial Concept (FRBD) with three replications, and it comprised two factors. The treatments were, i) Varieties ($V_{1:}$ GNR-6, V_2: GNR-3, V_3 : GNR-7, V_4 : NAUR-1, V_5 : GAR-13, V_6 : GNRH-1 & V_7: GR-15) andii) Manure levels (M_1:100% RDN through NADEP compost & M_2: NADEP compost @ 4 t/ha). The significantly higher plant height was observed with the variety V_7 in all three years of the experiment and a pooled analysis. The application of M_1 recorded the highest plant height significantly. The variety V_3 recorded the highest tillers/m^2while the application of M_1 significantly recorded the highest tillers/m^2 in all the years and in a pooled analysis. Similar, the variety V_3 and application of M_1 achieved the significantly highest panicles/m^2 in a pooled analysis. The significantly higher panicle length was found with the variety V_4 and was at par with the V_7.The substantially higher panicle weight was recorded with the variety V_7 and was found at par with V_2& V_3 in a pooled analysis. The variety V_2 achieved the significantly highest 1000 grain weight in all the years of experiment and pooled analysis. The significantly higher grain yield was found with the variety V_3 but was at par with V_2 in a pooled analysis. Similarly, the straw yield was significantly higher with the variety V_4 and was found at par with V_2& V_5 in the pooled analysis. The application of M_1 recorded the significantly most elevated grain and straw yield in all three years of the experiment and the pooled analysis.However,the manure level M_1 had significantly affected and recorded higher OC(%) and N content in all three years.In order to achieve economic feasibility, it is evident that the highest net benefits were achieved with the variety V_3 and the application of $M_1$with a premium price as well as without a premium price, and the treatment of $V_2$and M_1 followed it.

Therefore, it can be concluded that the paddy (GNR-7 or GNR-3) is organically cultivated by applying 100 % RDN through NADEP compost. Furthermore, application of bio-fertilizers (*Azospirilum* and PSB each of 0.5%) as a root dipping treatment to the seedlings along with three sprays of Novel organic liquid nutrient @ 1% at 15, 45 and 60 DAT to achieve higher yield and net profit.

Key words:Economics, Growth, NADEP compost, Organic farming, Soil properties, Variety, Yield,

O/S-II/25

Evaluation of rice based crop sequence under aerobic and transplanted method of cultivation in south Gujarat condition

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A Field Experiment was conducted in south Gujarat at Main Rice Research Centre, Navsari Agricultural University, Navsari (Gujarat), from *kharif* 2013 to *rabi* 2015, to study the effect of rice-based crop sequence under an aerobic and transplanted method of rice cultivation. The treatments consisted of the main plot as a Method of crop establishment: aerobic rice and transplanted rice, subplot as rice varieties with two varieties, i.e., NAUR-1 and GNR-3 and sub subplot as *rabi* crops with three *rabi* crops, i.e., Gram, Greengram and Indian bean. The experiments were laid out with a split-plot design with four replication. The result revealed that the crop establishment method significantly influenced rice grain and straw yield, wherein the transplanted rice method recorded significantly higher grain and straw yields than the aerobic rice method of cultivation. The effect of

crop variety on rice grain and straw yields was recorded higher with variety GNR-3 over NAUR-1. In the data pertaining to yields of *rabi* crops, the mean seed yield of green gram was higher over gram and Indian bean. Significantly higher rice equivalent yield was registered under the transplanted rice method over aerobic rice method of cultivation with variety GNR-3 and also with green gram crop over different treatments. From an economics point of view, among crop establishment methods, transplanted rice method of cultivation; with two varieties, GNR-3 variety and among other *rabi* crops, green gram registered the higher net returns and benefit-cost ratio. Overall, variety GNR-3 under transplanted rice methods of cultivation was found suitable and gave a higher yield, and rice-green gram system was found to be the most productive and remunerative cropping sequence.

Keywords*: Rice, crop establishment method, variety, crop sequence, pulses*

O/S-II/26

Prediction of Soil organic carbon by using Spectroscopy : A case study on Mula dam catchment Area

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The carbon stored in soils around the world is known as soil carbon. A quick, precise, economical, and non-destructive alternative method of soil examination is spectroscopy. This study's objective was to assess the spectroscopy's ability to forecast soil organic carbon (SOC) content. For this study, the Mula dam reservoir's catchment area was chosen. Geographically, it covers 2275 km^2. The study region yielded a total of 43 soil sample collections. Using spectral reflectance data, a linear simple regression model was used to predict the SOC content. During the modelling phase, spectral data were used in preprocessing and transformation methods. The dataset was divided into two subgroups at random: a calibration subset and an independent validation subset. The coefficient of determination (R^2), Root Mean Square Error of prediction (RMSE), and Index of Agreement (d)were used to assess the modelling outcomes. Significantly, SOC content impacted the spectral reflectance of soil, with an increase in SOC being associated with a decrease in reflectance over the whole wavelength range. With the R^2, RMSE, and Index of Agreement values of cross-validation 0.94, 0.092(%), and 0.86, respectively, I could produce an accurate prediction model for SOC. This model is accurate for SOC content between 0.47 and 0.80%. Further testing of various calibration procedures is required to forecast SOC content correctly.

Keywords: *Spectroscopy , Spectral Reflectance, Soil organic carbon, Validation*

O/S-II/27

Role of PGPR in the alleviation of drought response in plants- A sustainable tool for utilization of natural resources

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The increasing population is a significant challenge for agricultural food production.Several approaches are needed, such as the higher use of chemicals including fertilizers, pesticides, and herbicides. Several other factors, such as overcoming the posture, saline, and drought land, can be improved by using stress-tolerant plant growth-promoting microorganisms. Agriculture is a complex network of interactions of plants with

microorganisms. There is a growing demand forecologically compatible, environment-friendly techniques in agriculture that might be able to provide an adequatesupply of food for the increasing human population through the improvement of the quality and quantity ofagricultural products. Under the changing climatic scenario of global fluxes of the key biogenic greenhouse gases (carbon dioxide, methane, and nitrous oxide), and some other environmental problems like biotic and abiotic stress. Abiotic stress affects not only crop growth but also its morphological, physiological and biochemical traits which may result in the formation of free radicals that damage the plant defense system resulting in an increase in reactive oxygen species (ROS), such as superoxide radicals, hydroxyl radicals, and hydrogen peroxide induces oxidative stress. ROS can cause tissue damage, membrane corrosion, and protein and nucleic acids by causing lipid peroxidation. The application of beneficial microorganisms i.e.Plant growth promoting rhizobacteria in agriculture can serve as an important alternative natural gateway to alleviate drought stress tolerance in plants. PGPR is usually associated with the roots of the plant and they are capable enough to extend sufficiently and provide effective tolerance to plants from the deleterious effect of drought to stress and other abiotic stress, probably by modulating various physiological and biochemical responses against drought stress. These microorganisms represent a key ecological strategy to rampart drought stress tolerance behaviour by enhancing phytohormone levels like auxin, ABA and GA. Enzymes like 1-aminocyclopropane-1-carboxylate (ACC) deaminase activity and production of bacterial products like exopolysaccharides (EPS) formation of biofilm, antioxidant resistance, including the accumulation of many suitable organic solutes such as carbohydrates, amino acids, and polyamines.PGPR also improves root growth and root architecture, thereby improving nutrient and water uptake. The microbial population is instrumental to fundamental processes that derive stability and productivity of agro-ecosystems through efficient utilization of nutrients and recycling of energy and thereby preserving the natural ecosystem resources under climate change.

O/S-II/28

Influence of integrated nutrient management on quality, nutrient uptake of cowpea [*Vigna unguiculata* (L.) Walp.]and soil status under South Gujarat condition

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A field experiment was conducted during the summer season of 2019 on clayey in texture at College Farm, Navsari Agricultural University, Navsari to study the effect of biofertilizer and fertility levels on the quality, nutrient uptake and soil status of cowpea. In total of eight treatment combinations were replicated thrice in a factorial randomized block design. The treatment consisted of combinations of two levels of biofertilizers (B_1: Control, B_2: Seed inoculation with *Rhizobium* and *phosphate solubilizing bacteria*) and four levels of inorganic fertilizers (F_0: Control, F_1: 50% RDF, F_2: 75% RDF and F_3: 100% RDF). The result of the experiment indicated that Protein content is non-significant but protein yield (217.7 kg/ha) was influenced significantly by the effect of seed inoculation with *Rhizobium* and Phosphate solubilizing bacteria (B_2). Seed inoculation with *Rhizobium* and Phosphate solubilizing bacteria (B_2) indicated content is non-significant and significantly uptake of nitrogen by cowpea than without inoculation. Available nitrogen, phosphorus and potassium status in the soil after harvest of the crop was non-significantly under the treatment of biofertilizers. Inorganic fertilizers were non-significant in protein content but significantly protein yield was found under application of the F_3 (100% RDF) which remained at par with F_2 (75% RDF). Nutrient content was observed non-significantly. Nutrient uptake of N, P2O5, and K was found significant with treatment F_3 (100% RDF) over F_2, F_1 and F_0. Organic carbon, available nitrogen, phosphorus and potassium status of soil after harvest of the crop was non-significantly in biofertilizer treatment and fertility levels but available phosphorus found significantly increased with the application of F_3 (100% RDF) which remained at par with F_2 (75% RDF).

O/S-II/29

Subsurface drain flow and nitrate loss for different drain depths and drain spacings using DRAINMOD NII

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Waterlogging and salinity have a drastic impact on crop productivity and are the main reasons for land degradation in India. There is a potential for surface and subsurface waterlogging in the area if adequate drainage is not provided. The calibrated and validated DRAINMOD-NII model was used to assess the impact of different drain depths and spacing on seasonal drainage water, nitrogen losses and NO3-N concentration in drainage water, for the period 2018–2020. The variation in different variables viz., drain flow, depth to the water table, nitrogen load and nitrogen concentration in drainage water for rice-wheat cropping system at Thehri village of Muktsar, Punjab were studied under two different scenarios. The calibrated and validated DRAINMOD-NII model was used for the scenario-building exercises to assess future trends under various management options.The study revealed that for the given climate-crop soil combination there were two different scenarios of drain depth and spacing which affected the number of nitrogen losses through the subsurface drainage system and also the water table depth. From the two scenarios, a depth of 1.3 m and spacing of 42 m were selected to be optimum, for better crop yield and lesser nitrogen losses. The nitrogen losses were found to be minimum for the depth of 0.9 m and spacing of 56 m, but this combination of depth and spacing may prove detrimental and can cause crop root damage, resulting in lower crop yield for the existing rice-wheat cropping system. Hence an optimum depth and space combination was validated by the model, for further designing of subsurface drainage systems in the region.

Keywords: Nitrate Loss, Subsurface Drainage System, Drain Depth, Drain Spacing, DRAINMOD NII model

O/S-II/30

Ecotourism: A learning tool for a sustainable environment

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Ecotourism is a form of tourism where tourists have a strong sense of responsibility towards the environment. An important aspect of this is interaction with the local community and participation of local people in tourism-related activities. Ecotourism is essential for the sustenance of tourism on one hand and the economic growth of the region on the other. The concept of ecotourism has emerged as an effective platform that offers alternative tourism wherein people tour natural regions intending to execute eco-friendly activities, to learn and research about their environment. The International Ecotourism Society (TIES) defines ecotourism as "responsible travel to natural areas that conserves the environment and improves the well-being of local people". The relationship between people and places is important for geographical understanding, people construct places and places construct people. Components of ecotourism are nature, education, environmentally friendly, & local participation. It is ensured that due regard is given to local customs and culture and ecotourists are encouraged to interact. From a tourism perspective, landscapes are fundamental assets and it is essential to explore their value concerning planning, maintenance, restoration, and development. In the present day, eco-tourism has gained significant prominence and is turning out to be a fast-developing segment in the existing global tourism industry. Ecotourism focuses primarily on experiencing and learning about nature, its landscape, flora, fauna and their habitats, as well as cultural artefacts from the locality. According to The International Ecotourism Society (TIES), ecotourism has been growing internationally by 20-34% each year since the 1990s. The geographical

diversity of India has given us a wealth of ecosystems which have also become the major resources for ecotourism. These include Bio-sphere reserves, Mangroves, Coral reefs, Deserts, Mountains and Forests. India is attempting to utilize the medium of ecotourism as a dynamic instrument that will help the nation to achieve sustainable development.

Keywords: Flora and Fauna, Environment Landscape, Tourism

O/S-II/31

Self-help groups – effective step for women farmers in agriculture in India

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India is an agrarian economy with about 48.04 per cent of the total female population compared to 51.96 per cent of the male population (Census 2020). In India, 85% of rural women are mostly engaged in agriculture, yet only about 13% own land.Women's participation rate in the agricultural sectors is about 47% in tea plantations, 46.84% in cotton cultivation, 45.43% in growing oil seeds and 39.13% in vegetable production. While these crops require labour-intensive work, the work is considered quite unskilled. Women also heavily participate in extra agricultural activities. According to the Food and Agriculture Organization, Indian women represented a share of 21% and 24% of all fishers and fish farmers, respectively. Therefore Self Help Group formation is a prominent way of socio-economic development. A self-help group is a financial intermediary committee usually composed of 10 to 25 local women between the ages of 18 and 60.NABARD, in 1992, formed the SHG Bank Linkage Project, which is today the world's largest microfinance project.From 1993 onwards, NABARD, along with the Reserve Bank of India, allowed SHGs to open savings bank accounts in banks. The SwarnJayanti Gram SwarozgarYojana was introduced in 1999 by GOI to promote self-employment in rural areas through the formation and skilling of such groups. This evolved into the National Rural Livelihoods Mission (NRLM) in 2011. The paper mainly talks about different SHGs from all over India how they came into existence and what are the different strategies they use for the growth of the group. Different types of products made by them and the effective ways which they use for selling the products and also how they get financial assistance from the government and private agencies. Furthermore what level of training do they get for different business activities such as processing, packaging and marketing? Lastly, the problems faced by the SHGs will be also discussed in this paper.

Keywords- *Women, Self Help Groups,,NABARD, Marketing and Finance*

O/S-II/32

Impact of socio-economic determinants on farm level adaptations to climate change

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The study examines the socio-economic impact of farm-level adaptation strategies to climate change in the South Gujarat region of India based on cross-section data collected from 2400 households. This study uses a multivariate probit econometric technique to analyze the determinants of farm-level adaptation strategies. The study has revealed that farm size, access to credit, possession of machinery and awareness of climate change are the decisive determinants of farm-level climate-change adaptation variables. The awareness generation on changes in climatic conditions among farmers would have a greater impact on increasing adaptation to changes

in climatic conditions. Policies aimed to strengthen the agricultural information system in the region to provide timely information to the farmers about the climatic conditions, climate change impacts and adoption of adaptation strategies such as a change in sowing dates, use of improved seed varieties, adoption of modern technologies, etc.

Keywords: *Climate change, adaptation, probit, socio-economic etc.*

O/S-II/33

Socio economic and value chain analysis of Goat farming in South Gujarat region

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The socio economic and value chain study of goat farming from different herd size groups of surati and local breed has been conducted in South Gujarat region of Gujarat state. The study was undertaken in randomly selected villages of Navsari, Valsad and Tapi districts of South Gujarat region. The goat keeping household of selected villages were divided into two groups maintaining surati and local breeds. The study revealed that the net income derived from different herd size groups of goats was much higher among surati breed than local breed. The study clearly shows large (16 to or more goats, kids & buck) herd size group of goat keepers achieved higher profits than small (1 to 5 goats, kids & buck), and medium (6 to 15 goats, kids & buck) herd size groups in both breed of goats. The overall annual net income per goat was worked out to be Rs. 1283.51 in surati breed and Rs. 994.90 in local breed of goats. The annual income of surati breed of different herd size groups was higher in comparison to local breed of goats. This shows that the improved breed of suratigoats have positive impact on the income of goat keepers. Value chain analysis indicated that there are four marketing channels found in male goat marketing in the study area. The major marketing cost components were assembling, maintenance, animal preparation, labour and transportation for sellers and market fee, labour and levy for buyers. The gross market margin has been found higher in the Farmer – Farmer channel (95.89%). Therefore, this channel has turned out to be most efficient. It has also been found that as the number of intermediaries between producer and ultimate buyer increases, the producer's share goes on decreasing.

Key word: Goat, value chain, socio-economic, marketing

O/S-II/34

Status of Chickpea wilt in Jammu sub- tropics

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A survey in different chickpea growing areas of Jammu sub-tropics was conducted at fortnightly intervalto assess the incidence of wilt disease in Jammu division. The incidence of wilt disease ranged between 8.11-21.67 and 10.98-23.99 per cent respectivelyduring *Rabi* seasons of 2016-17 and 2017-18 with an overall mean disease incidence of 15.64 and 16.86 per centrespectively. *Fusarium oxysporum* f. sp. *ciceri* was isolated from 92 per cent of the wilt infected chickpea plants and soil samples collected from chickpea fields. The pathogenicity test of different isolates of Foc exhibited disease incidence (60.26-86.65%) in susceptible cultivar (C-235). Wilt symptoms in adult plants were quite common at flowering and pod stages. The affected plants showed characteristic wilting *viz.,* drooping of the petioles, rachis and leaflets.

Keywords: *Fusarium oxysporum* f. sp. *ciceri, spore,* survey, incidence, pathogenicity, symptoms

O/S-II/35

Response of irrigation regimes and soil amendments on water productivity, soil properties and rice yield

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A pot experiment was conducted during *Kharif* of 2020, at the Division of Soil Science and Agriculture Chemistry to study the effect of different soil amendments (biochar and polymer) on soil properties, growth, yield and water productivity of rice (Basmati-370). The experiment was laid out in 2-factorial CRD with three replications comprising two levels of irrigation *viz.* I_1 (continuously flooded upto 5 cm) and I_2 (water deficit) as one factor-I and soil amendments (biochar and PAM alone, as well as in combination with each other, 100 % RDF and control) as factor-II. The soil was sandy clay loam in texture, mildly alkaline in reaction, EC within safe limits, with low organic carbon, low available nitrogen, medium phosphorus and potassium.

Among the irrigation regimes, continuous flooding proved superior to water deficit irrigation regimes and obtained higher values of growth parameters, grain and biological yield. An increase in almost all the growth parameters resulted in significant improvement in yield attributes which led to the significantly highest grain yield. Sole or combined application of soil amendments (biochar and polymer) along with 100 % RDF through inorganic fertilizers performed better than 100 % RDF alone in terms of shoot and root parameters, crop yield and improvement of soil properties. Treatment B_{10} PAM_{10} (10 tons biochar per hectare + 10 kg polyacrylamide per hectare) proved to be a promising combination and recorded significantly higher values for growth parameters, yield attributes, and nutrient uptake compared to other treatments. Among the interactive effect of irrigation regimes and soil amendments, conjunctive use of biochar and polymer (B_{10} PAM_{10}) under water deficit conditions improved soil and plant parameters, grain yield and water productivity.

Keywords: *Basmati-370, Soil Amendments, Continuously Flooded, Water Deficit, Soil Properties, Grain Yield, Water Productivity.*

Theme3 : Socio-economic impact of climate change

O/S-II/36

Green supply chain management for climate risk mitigationand food security

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Agriculture is the mainstay of the Indian economy, employing more than half of the 1.3 billion populations in India. Butat present climate change is among the top global risks due to its growing adverse impact on agriculture at the global level owing to a reduction in agricultural productivity and disruption in the food supply chain.In a primarily agricultural nation like India, the impact is significantly greater, causing ripple effects across the whole food supply chain. Global warming has led to a sharp rise in the annual average temperature in India which has likely caused a decline in crop yields over the years, undermining farm income. India has been

witnessing more intense floods, droughts, downward shifts in average rainfall and a higher frequency of cyclones. In India 61 per cent of India's farmers rely on rain-fed agriculture, and 55 per cent of the gross cropped area is under rain-fed farming, and changes in the weather pattern will severely affect the country's food security in the long term.In this regard, it is more important that we drive action towards building a resilient green supply chain that can withstand further shocks such as climate change in the future. In this regard present paper provides an overview of the impact of climate change on India's food security keeping in mind three dimensions i.e. availability, access, and absorption. Also throws light on the challenges faced by businesses due to broad climate change issues, needs, importance and elements of green supply chain management. The paper discusses how green supply chain management is been considered a competitive advantage strategy to bring development and growth to the overall sustainable development of our nation and ensure food security.

Keywords: Climate change, food security, green supply chain management, competitive advantage, challenges

O/S-II/37

Effect of paddy straw management with bio-decomposer on soil properties, crop productivity, environment and human health

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The burning of paddy straw results in extensive impacts on the environment, soil and human health e.g. losses of 3.85 million t of organic carbon, 59,000 t of nitrogen, 20,000 t of phosphorus and 34,000 t of potassium year^{-1}. This also adversely affects the nutrient budget in the soil.It was reported that the burning of 63 Mt of crop stubble releases 3.4 Mt of CO, 0.1 Mt of NO_x, 91 Mt of CO_2, 0.6 Mt of CH_4 and 1.2 Mt of PM into the atmosphere. The emission of these gasses results from severe atmospheric pollution, which causes aggravating asthma, chronic bronchitis and decreased lung function. Management of rice straw is a significant challenge as it is considered a poor animal feed due to its high silica content. An analysis has been made based on reported research results by different researchers. A rice-wheat sequence that yields 7 t ha^{-1} of rice and 4 t ha^{-1} of wheat removes more than N 300, P 30 and K 300 kg ha^{-1} from the soil; the residues of paddy and wheat amount to as much as 7-10 t ha^{-1} yr^{-1}. Using bio-decomposer in paddy fields enhances the decomposition rate of paddy straw. Incorporation of rice residues in the soil increases organic carbon in the soil, enhancing water and nutrient retention capacity, greater microbial biomass and activity near the soil surface than residue removal or burning, which acts as a reservoir for nutrients needed in crop production and increases structural stability and porosity. Rice crop residues are highly siliceous and potentially transform the electrochemical properties of acidic soils that reduce P fixation, improving base retention and increasing the soil pH. Rice straw incorporation and rise in organic manure wheat grain yield improve soil's physical condition. Thus, if rice residues are managed scientifically, it enhances soil properties and sustainability in crop productivity and reduces environmental pollution.

Key words : *Rice residue burning, soil health, crop productivity, environment pollution.*

O/S-II/38

Impact of climate changes on cropping pattern of Uttar Pradesh: Problems & Prospects

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The agriculture sector is the most important carter of economic growth in Uttar Pradesh. An enormous preponderance of the population in the state almost relies on agriculture for its livelihood security. As high as 68% of the total workforce in the state depends on agriculture, and most of them live below the poverty line (29.4% according to agriculture statistics at a glance, 2021). Pressure on the limited natural resources of the state is ever increasing because of the burgeoningpopulation. Consequently, the need to cultivate more and more of our rapidlyshrinking per capita land resources has become crucial. However, this resource isbecoming degraded at an increasing rate due to soil erosion, soil salinity/alkalinity,waterlogging and soil pollution, chemicals and toxic industrial wastes. The shrinking agricultural land and the demand for more food production call for multiplecropping in a single piece of land. Hence, there is a need to pay more attention to bettermanagement of agricultural systems, especially cropping patterns.

The production during 2021-22 is higher by 23.80 million tonnes than the previous five years' (2016-17 to 2020-21) average production of food grains. The net cropped area was 20 282 159.46 ha (84.18% of the total geographical area), and the non-agricultural area observed was 3 437 376.00 ha (14.26% of the total geographical area). Rice was the singlemost dominant crop of the state, occupying about 32.94% of the total geographicalarea during the *kharif* season. Maize/sorghum was the second major cereal crop,accounting for 13.77% of the state's total geographical area. The major cropsgrown during the *Rabi* season were wheat and pulses/oilseed, covering 7979 267.71 ha (33.12%) and 5 974 742.58 ha (24.80%), respectively. Rice-wheat,sugarcane and rice-pulses were the major cropping patterns, occupying about 3958 739.85 ha (16.43%), 3 609 939.74 ha (14.98%) and 2 511 298.24 ha (10.42%),respectively. The areas under pulses/oilseed were significantly higher in the *Rabi*season. Sugarcane-wheat and pulses shared an almost equal area (6.49%). Themaize/sorghum-wheat cropping pattern occupied 6.14% of the state's total geographical area. Single cropping patterns (i.e. rice-fallow, fallow-pulses, fallow-wheat,maize-fallow and sugarcane-fallow) were minor, occupying 6.08, 2.94, 4.06, 2.69and 2.51%, respectively. Wasteland, including gulley, salt-affected, waterloggedand rock land, accounted for 3.80% of the total geographical area.

The cropping pattern of the state depends on rainfall andwater availability. Rice-wheat and sugarcane are common where irrigation facilitiesare available. Hence, rice-wheat and sugarcane are the dominant cropping patterns inthe northeastern and eastern parts of the state. However, the pulses/oilseed cropping pattern is widespread in the southwestern part of the state, where irrigation facilities are limited. The Multiple Cropping Index and Cultivated Land Utilization Index showed values of 175.93 % and 0.63 %, respectively, indicating that high intensity of agriculture was prevalent in the IGP.

Keywords: *Agriculture, climate changes, Cropping pattern, Natural Resources, U.P.*

O/S-II/39

Persistence and downward movement of halosulfuron methyl in different type of soils of Gujarat

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Halosulfuron methyl (HM), a systemic pyrazole sulfonylurea herbicide, is frequently used as a post-emergence herbicide to control broad leaf and cyperaceous weeds in Sugarcane. The study was carried out to determine the persistence behaviour and downward movement of HM in three soils collected from 3 different regions of Gujarat with different textures, i.e., clay (South Gujarat), sandy loam (Central Gujarat) and sandy soil (North Gujarat) under laboratory condition. The dissipation pattern of HM was best fitted in first-order kinetics as a coefficient of determination (R2) was $\geq$ 0.88 when the soil was fortified at the rate of 3.4 and 6.8 mg/kg.

Maximum persistence of halosulfuron methyl was observed in sandy soil (DT50: 6.42 and 7.07 days), followed by sandy loam soil (DT50: 4.20 and 5.78 days) and clay soil (DT50: 4.13 and 4.65 days) at single and double dose, respectively. Halosulfuron methyl was found to be non-persistent (DT50<20 days). Downward movement and depth-wise distribution of halosulfuron methyl were determined by loading the herbicides at the rate of 1.0 and 2.0 mg/kg on three types of soil columns. The total residues of HM detected in leachates of sandy soil were higher (0.86-1.63%) than in clay (0.44-0.49%) and sandy loam soil (0.53-0.67%), which indicates that the 0.4-1.6% residues of halosulfuron methyl over initial application could be lost through the leachates and cause the groundwater contamination. In all three types of soils, halosulfuron methyl was distributed up to 36 cm depth, while the halosulfuron methyl residues were found highest at a depth of 12-24 cm (0.73-1.64%), 24-30 cm (1.17-1.61%) and 30-36 cm (1.60-1.98%) depth in clayey, sandy loam and sandy soil, respectively. The order of soil in terms of % retention of halosulfuron methyl at different doses over total loading of HM is as follows: sandy (6.91-6.96 %) > clay (3.99-4.84 %) > sandy loam (2.94-2.96%).

Keywords:Halosulfuron methyl, sulfonylurea herbicide, dissipation, leaching

O/S-II/40

Persistence of halosulfuron methyl in soil, water and its terminal residues in Sugarcane leaves and juice

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Halosulfuron methyl (HM), a systemic pyrazol sulfonylurea herbicide, is widely used as a post-emergence herbicide to control broad leaf and cyperaceous weeds in graminaceous crops, particularly in rice and sugarcane. A study on the dissipation of HM in sugarcane-grown soil was undertaken at recommended (67.5 g a.i./ha) and doublethe recommended dose (135 g a.i./ha) at 30-40 DAP. Simultaneously, the persistence of HM was also determined in aqueous solutions of different pH viz., pH 4, 7 and 9.2 when spiked at the rate of 3.4 and 6.8 mg/L. As per the SANTE (2021), the modified QuEChERS method adopted for extraction and quantification of HM on LC-MS/MS is accurate, precise and sensitive enough for its analysis from the soil, sugarcane juice and sugarcane leaves and water. The dissipation kinetics of HM in soil was determined by adopting a first-order kinetic model with a half-life of 4.41 and 5.46 days at recommended and double the recommended dose, which classified HM as non-persistent (DT50< 20 days) in nature. The residues of HM were found to be below the quantitation limit (BQL) in sugarcane leaves and sugarcane juice at harvest, which indicates consumption of sugarcane juice and leaves is safer. The persistence and dissipation pattern of HM in three aqueous solutions having different pH (4, 7 and 9.2) followed first-order kinetics. The order of persistence of HM based on their DT50 values obtained for both doses is as follows: pH 7 (4.05-6.36 days) > pH 4 (3.43-3.87 days) > pH 9.2 (0.59-0.65 days) under different pH levels. Based on overall persistence, the HM residues persisted in the range of 3.5 to 38 days in all three aqueous solutions, which indicates that the persistence of HM in water is widely pH dependent.

Key words: Sugarcane, Sulfonylurea , LC-MS/MS, pH, Halosulfuron Methyl, Persistence

O/S-II/41

Potentials of processing and value addition of NTFPs and minor fruits: An opportunity for improving household income and livelihood security

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Non-Timber Forest Products (NTFPs) refer to all biological materials other than timber extracted from natural forests for human and animal use and have both consumptive and exchange value. The NTFPs provide the

products for food, shelter, medicines, fibres, energy and cultural artefacts to communities. They include fruits and nuts, vegetables, medicinal plants, gum and resins, essences, bamboo, rattans and palms; fibres and flosses, grasses, leaves, seeds, mushrooms, honey and lac etc. make significant contributions to rural livelihoods. India is one of the megadiverse nations that harbour a variety of NTFPs and minor fruits in different geographical regions of the country, while almost all indigenous communities have been involved in harvesting, collection, consumption and marketing of NTFPs and minor fruits since immemorial times. There is an organized system of collection, processing and marketing for only few nationalized NTFPs and important fruits, while many others are exploited in an unorganized manner without proper institutional arrangement. Although support prices for some economically important NTFPs and minor fruits were declared from time to time by some state governments and cooperatives were created but still inadequate for commercial exploitation of potential sources. Post harvest processing and value addition are mostly lagging,affecting the quality and economic returns. The postharvest processing of NTFP material may include cleaning, peeling, grinding, shell separation, seed separation, fibre separation, grading, drying, storage or packaging of products, harvesting nearer to maturity, or collecting material with higher proportions of active ingredients. Many processing and preservation techniques such as blanching, drying, dehydration and freezing are being produced at both household and commercial levels with different minor fruits. Postharvest technologies include pre-cooling, cleaning/washing, chemical treatments, trimming/sorting, packaging, curing, transportation, grading, storage, ripening, and distribution. Extending the shelf life of a commodity requires knowledge of all the factors that can lead to the quality deterioration or generation of useful material. The processing and value addition increase the shelf life and improve the quality of products, and able to increase the prices at least 2-3 times higher than raw material. There is ample scope for processing and developing value-added products from fruits like candy, jam, RTS, nectar squash, powders, jellies, tarts, chutneys, beverages, Pickle, concentrates, jelly powders, flakes, dried fruits, Pickle etc. The fostering of processing and value addition is possible through organizing and imparting skill-oriented training. Establishing primary processing centres involving self-help groups (SHGs) and cooperatives will help mainstream and harness the potential of NTFPs. Focusing on NTFP processing, the importance of developing and promoting small-scale processing technologies to achieve high-quality products with longer shelf lives needs to be highlighted. Nevertheless, the appropriate policies and institutional support are crucial in realizing the expected benefits. The paper discusses the role of processing NTFPs and minor fruits in improving household income levels and securing the subsistence needs of indigenous communities, which could be a stepping stone for sustainable development.

Keywords: Commercialization; NTFPs; Processing, Sustainable development, Value Addition

O/S-II/42

Impact of climate change on bees, beekeeping and honey production

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Climate change is one of the most significant anthropogenic influences on ecosystems.Living systems, including bees, are being influenced by climate change. Environmental factors, including photoperiod, temperature, and precipitation, significantly impact honey bees. Since bees are ectothermic, their activity is determined by the change in temperature of their surroundings. Climate change can impact bees through direct impact on bee physiology and behaviour and indirectly affected by altering the availability of floral resources and outbreak of natural enemies. The climate changes potentially affect the geographic range of different bee species. The direct impact on bees includes alteration in foraging activity, colony weight, honey collection efficiency, metabolism, ability to reproduce, dietary preferences, survivability and proliferation of bees. On the other side, harsh climatic conditions may alter the phenology and distribution of flowering plants. This could lead to a disharmony between honey bee activity and the flowering of their food plants, thus affecting honey production. Weather and other abiotic environmental conditions such as soil temperature and humidity directly

impact nectar induction and honey yield by bees, eg. mesquite and heather honey. The amount of flower nectar available for honey bees to collect will decrease in an arid climate. The changing climatic conditions were considered one of the driving factors behind a dramatic and significant bee production decline in many regions. Due to changes in climate, the incidence of predators, pests and diseases of honeybees and their distribution, such as yellow-legged hornet, tropilaelaps mites, varroa, sac brood diseases etc., is also altered. The rising temperatures can negatively impact apiculture, potentially making it unfit and leading to economic losses in coming years. The over-summering, over-wintering, unprecedented rain, storms, frost and drought have greatly influenced bee activities and honey yield. Rainfall is an important climatic factor correlated with honey production in both positive and negative ways. About 73% of the world's cultivated crops depend heavily on honeybees for pollination. Due to change in weather conditions, pollination services by bees in many crops like watermelon and tomato is affected, and it causes financial losses. The emerging issues in beekeeping and production of bee products raised due to climate change that need to resolve with adapted management techniques with resilience of bee colonies. Future modifications require rescheduling of beekeeping procedures. It is necessary to create appropriate strategies such as adapted beehives to safeguard honey bee colonies from stressors caused by climatic change.

Key words:climate change, bees, bee plants, beekeeping, honey yield, management strategies

O/S-II/43

Energy auditing of maize fodder production system of selected the Himalayan Tarai Region

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Maize (Zea mays L.) is one of the most important green fodder crops in India. Green fodder is an essential component of animal husbandry. The energy audit of various resources in agriculture production plays a key role in the management of resources. The study was conducted to work out the contribution of various energy sources in the production of maize in the zaid season at the Instructional Dairy Farm (IDF) NaglaPantnagar, Uttarakhand, India. The energy of humans, machinery, diesel fuel, energy use efficiency, net energy and energy productivity were computed. The total input and output energy consumed for the maize fodder crop was 11466.57 MJ ha^{-1} and 753989.22 $MJha^{-1}$, energy use efficiency was 65.75 percent, net energy was 742522.65 $MJha^{-1}$ and Energy productivity was 3.65 kg MJ^{-1}, out of which the fertilizer energy consumption was 4389 MJ ha^{-1}, containing 3878.4 $MJha^{-1}$, nitrogen, and 510.6 $MJha^{-1}$, phosphorus. Total diesel fuel consumption and human energy were observed as 1903.16MJ ha^{-1} and 747.5MJ ha^{-1}, respectively. The seed bed preparation energy consumption and green fodder crop harvesting consumption were found to be 2011.46 $MJha^{-1}$, and 691.39MJ ha^{-1}, respectively.

Key word: Maize fodder, Net Energy, Energy Use Efficiency, Energy Productivity

O/S-II/44

An assessment of emission of N_2O and CH_4 from forests soils

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An Assessment of emission of N_2O and CH_4 along with some essential soil parameters (EC, pH, SOC, and WFPS) in four forests soils (natural forest, teak plantation, mixed plantation and open (without tree)were carried out during the different seasons for two years (i.e. 2017 and 2018) under south Gujarat condition. The present study observed that among forests, pH and EC were registered maximum in control, i.e. open land. Whereas SOC and WFPS were registered maximum in a natural forest compared to other sites under study. With respect to seasons, the summer season exhibited the highest pH and EC, whereas, in the case of SOC and WFPS, the maximum value was observed in the monsoon season. Soil N_2O was recorded higher in teak plantations and in

the monsoon season. In the case of CH_4uptake, it was registered significantly higher in natural forests and during the winter season. Moreover, higher CH4 emission was observed during the monsoon season.Soil N_2O emission is relatively higher in the sole teak plantation than in the South Gujarat region's natural forest and mixed plantations. Negligible CH_4 is emitted fromall the studied forest soils in the monsoon season only, while in the winter and summer seasons, CH_4uptake was observed. Moreover, higher CH_4 uptake is reported in natural forests than in open soil. WFPS and SOC are found in correlation with the emission of these greenhouse gases.

Key words: CH_4, N_2O, Forest soil, WFPS, SOC

O/S-II/45

Soil fertility, crop productivity, cropping intensity and livelihood enhancement in Titabor, Assam - a participatory approach through Farmer FIRST Programme

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The performance of pea as a relay crop in the prevailing rice-fallow system in the Titabor development block of Jorhat, Assam, was demonstrated and evaluated in a participatory approach through the Farmer FIRST (Farm Innovations, Resources, Science and Technology) programme during 2016-17 to 2021-22. The production and productivity of rice increased in participatory and indirect beneficiary farms. They ranged from 4000 to 4800 kg/ha with a mean yield of 4420 kg/ha in direct beneficiary farms during the five years. The increase was mainly due to the use of good quality seed at optimum planting time and the adoption of balanced fertilizer doses for rice cultivation. Pea yield as a relay crop varied from 625 to 938 kg/ha with a mean yield of 744 kg/ha over the 5 years. The available nutrient contents of soil increased in rice-relay compared to rice-fallow crops, but the organic carbon content was not affected during the period. The cropping intensity increased from 101% in 2016-17 to 112% in 2021-22 in participatory farms and 109% in 2021-22 in non-participatory farms. The farm income increased for both participatory and indirect beneficiary farms with an increase in per unit net return for sole rice crop and rice-pea relay cropping.

Keywords: rice-fallow, relay crop, cropping intensity, farm income

Session -III

O/S-III/1

Derivation of Dual Crop Coefficient Using Reflectance-Based Vegetation Index For Summer Sesame

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A dual crop coefficient approach was applied to estimate seasonal water requirement for *summer sesame* using reflectance-based vegetation indices. A field experiment was conducted to collect various crop physiologic parameters and NDVI data for the study crop during 2018 and 2019. Basal crop coefficients and soil evaporation coefficients collected from FAO-56 for initial, mid and end stages of summer sesame were adjusted for the study area using local weather parameters. Spectrum® FieldScout CM 1000 NDVI Meter were used to collect the NDVI data at various stages of the study crop. The NDVI was measured from crop canopy and soil surface at 7 days intervals between 12.00 to 13.00 clocks. NDVI Based Basal Crop Coefficient and Soil evaporation coefficient were derived using standard methods.FAO estimated crop coefficients were compared with NDVI based crop coefficients. The coefficient of determination of the fitted regression equation was found to be 0.836 and 0.765 for drip irrigation and 0.783 and 0.867 for surface control irrigation system for *summer sesame* during 2018 and 2019, respectively. Crop growing stage-wise water requirement per unit area was estimated for both treatments. Results indicates that among these two methods, NDVI method estimate lowest water requirement in both cases i. e. total water requirement and during all the crop growth stages for both irrigation systems while daily crop water requirement was lower for all growth stages in drip system as compare with control system.

Keywords: basal crop coefficient; dual crop coefficient; soil evaporation coefficient; NDVI

O/S-III/2

Morphometric analysis of Shel dedumal watershed using Remote Sensing & GIS

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Morphometric analysis is the measurements and mathematical analysis of the land surface configuration, shape and dimension of the landforms.The efficiency of the drainage network is essential for understanding the processes of landform formation, soil physical properties and erosion characteristics. The present study is focused on evaluating morphometric parameters for the conversation of soil and water delineated in the basin. Furthermore, morphometric analysis of watersheds using geospatial data and GIS techniques and slope analysis was also utilized to propose suitable soil and water conservation measures in the basin. The results obtained in the analysis revealed that the Shel Dedumal basin tributaries is a 5th order drainage basin which describes that the texture is homogeneous or homogeneous. There is a lack of structural control in soil strata. The relief ratio (R_h), the elevation difference (R_h or H) and circularity ratio (R_c) were found to be 10.73, 222.0 and 0.42, respectively, which represents the basin has moderate relief and gentle to moderately high slope. Some areas of the bay are characterized by variation in Lithology and topography. The mean values of bifurcation ratio (R_b) observed at 4.52 and circularity ratio (R_c) observed at 0.42 of the entire basins show moderate but not vigorous structural control or structural disturbances. An extreme high ruggedness number (R_n) observed as 11.83 indicates the terrain's structural complexity. The Moderate drainage density (D_d) and circularity ratio (R_c) were

observed as 2.63 and 0.42, respectively, which indicates the basin is highly permeable subsoil and vegetative cover. The Form factor (F_f), the elongation ratio (R_e) and circularity ratio (R_c) were observed as 0.39, 0.71 and 0.42, respectively, which indicates an elongated basin with lower / flatter peak flows of longer duration than the average and also the elongation ratio (R_e) values indicating moderate to slightly steep ground slope in a basin which is indicating possibility for soil erosion and other soil and water conservation works.

O/S-III/3

Assessment of micro, secondary nutrients and heavy metal status in soils of Agro-Ecological-Sub-Region 6.3 a (K5Dm4) Akola District of Maharashtra

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The study of soil survey was carried out from the year 2017-18 to 2018-19 in Akola district (M.S) India by using GPS techniques in Agro-Ecological-Sub-Region (AESRs) of Akola district namely, AESR 6.3 a (K5Dm4). AESR 6.3 a is characterized by Deccan Plateau, dominantly black soils, hot semi-arid ecosystem with deep black soil and length of growing period 180-210 days, and moderately well-drained soil. For this purpose 15, representative soil samples (0-20 cm) were collected from different villages of three tehsils in Akola district. These soil samples were analyzed for micro, secondary nutrients, and heavy metal status of the soil. The exact locations of soil samples as well as latitude, longitude, and altitude were recorded with the help of the Global Positioning System (GPS). Thesoils under the study in Akola district were neutral to strongly alkaline in nature,safe in limited electrical conductivity, and calcareous nature of the soil.The deficiencies of Zn, Fe, and B in these soils were 40, 20, and 27 respectively whereas, exchangeable Ca, and S was found sufficient while, Mg was found deficient in some of the soils of three tehsils of the Akola district. The values of Co, Cd, Pb, Cr, and Ni in soil were observed below the permissible limit set by WHO and Indian standards. A high nutrient index was observed in Cu (2.93), Mn (2.80), and S (2.53), while the medium in Fe (2.00) and B (1.93).

Keywords : Physico-chemical characteristics, micro, secondary nutrients, heavy metal, nutrient index

O/S-III/4

Soil moisture distribution in Tomato crop under drip irrigation

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Water is the most important natural resource that plays a crucial role in the economic development particularly in developing countries. Agriculture consumes highest fresh water but the increasing demand of water for expanding urbanization and industrialization has made the situation more critical because the shares of water for agriculture will decline in near future. Drip irrigation has proven an advance and efficient method of irrigation and save water. A field study was conducted at the research farm of Water Technology Centre, Indian Agricultural Research Institute, New Delhi to investigate the impact of different dripper discharges on dynamics of soil moisture and NO3-N in soil. Three pressure compensating drippers (2, 4 and 8 Lph) were used in the present investigation. The soil samples were collected from different depths (0.0–15.0, 15.0–30.0, 30.0–45.0 and 45.0–60.0 cm below the soil and at 0.0, 15.0, 30.0 cm away from lateral). Three access tubes at a distance of 0-0, 15-0, and 30-0 cm from lateral pipe were installed and Time Domain Reflectrometry (TDR) was used to measure soil moisture in the field under different crop growth stages of the tomato crop. Soil moisture content just below the dripper i.e. 0.0 cm away from lateral was more throughout the crop season i.e. 25.6%. Soil water

content did not decrease significantly with the increasing depth of soil from 15.0 to 60.0 cm. Soil water content was found decreasing with increasing distance from the lateral pipe.

Keywords: Drip Irrigation, Dripper discharge, Nitrate movement, Tomato

O/S-III/5

Soilless cultivation and growing media optimization for sustainable agriculture– A review

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The ever-growing human population has seen an exponential increase in the demand for food, whereas land availability per capita has decreased drastically. It has led to the need for producing more food in less time while considering space limitations, especially in urban areas. The cultivation of vegetables in the soil is facing severe threats due to soil and water pollution resulting from rapid population growth, urbanization, and climate change. In the future, vegetable production from soil-based cultivation would not be able to satisfy the growing population's needs. Thus, there is a need to find an alternative to soil-based farming and optimize the growing media to support the production of fruits and vegetables. This review aims for a detailed overview of the soilless cultivation technique and the drivers that form the basis of growing media selection in soilless cultivation. It focuses onthe available growing media for soilless cultivation and the challenges associated with their adoption. It discusses the current status and future challenges associated with the adoption of soilless cultivation.

Keywords: Urban agriculture; soilless cultivation; hydroponics, growing media; closed system cultivation

O/S-III/6

Drip fertigation for improving productivity, use efficiency of water and yield of brinjal

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Brinjal (*Solanum melongena* L.) is one of the most common vegetables grown throughout the country for its purple, green, or white pendulous fruit. It is a member of the Solanaceae family. Brinjal is a hardy crop and is cultivated under a wide range of soils. It is nutritionally rich in dietary fiber, vitamin B1 and copper. It is a good source of manganese, vitamin B6, niacin, potassium, folate and vitamin K. Phytonutrients, present in brinjal possess antioxidant activity. The caffeic and chlorogenic acids are the phenolic compounds. N*asunin is an* anthocyanin phytonutrient found in the skin of the fruit. It is a potent antioxidant and free radical scavenger that has been shown to protect cell membranes from damage and is also an iron chelator. In India, brinjal was cultivated in an area of 7, 30, 400 hectares with a production of 12.80 million tonnes during 2017-18 with productivity of 17.5 tonnes per hectare. In Tamil Nadu, 15,080 hectare was under brinjal with a production of 3, 02, 410 metric tonnes [Anon,2020]. When compared to some other states, the productivity of brinjal in Tamil Nadu is low. Fertigation can be used to avoid problems such as volatilization losses, slow dissolution, and slow fertilizer activation that arise from applying fertilizer onto dryer surface soils. A field investigation was attempted during Kharif 2020 and summer 2021 to evaluate the effect of fertigation in brinjal at Agricultural College and Research Institute under ICAR-AICRP on IWM. The soil of the experimental site was low in available nitrogen, medium in available phosphorus and high in available potassium. The experiment was laid out in a randomized block design with ten treatments. The experiment was conducted in sandy clay loam soil with pH of 7.5, EC 0.92 dSm^{-1} and soil is medium in available nitrogen (285 kg ha^{-1}) and high in available P (30 kg ha^{-1}) & K (319 kg ha^{-1}). Simran hybrid was used as a test crop. The fertigation was given up to 20 weeks in 20 splits at a frequency of 7 days. The treatment comprises a combination of water-soluble fertilizers with conventional fertilizers and application methods as detailed below. RDF for brinjal is 100:150: 100 kg NPK ha^{-1}.

100%RDF N, NPK, N and K applied through fertigation and 25% as basal, 75% of P & K as basal, 75% P as basal and 75% NPK through fertigation with no basal application. 25% NPK as basal and remaining through fertigation. Absolute control is maintained for comparison. The results of the experiment showed 75% NPK applied through fertigation without any basal application resulting in a higher fruit yield of 50.15 t ha^{-1}. The data revealed that drip fertigation levels significantly influenced water use efficiency and water productivity. The WUE and WP were recorded maximum (71.17 kg/ ha-mm and 844.6 Rs/ ha mm) in the treatment that received 75 % NPK through fertigation (T_7). However, it was followed by the 25 % of 100 % NPK as basal and remaining NPK through fertigation (65.68 kg/ ha-mm and 737.2 Rs/ ha mm) and 100 % NPK through fertigation with no basal application (61.92 kg/ ha mm and 695.0Rs/ ha mm) respectively and the minimum WUE and WP of (12.14 kg/ ha-mm and 136.2 Rs/ ha mm) were noticed in absolute control

Keywords: *Brinjal, Drip Fertigation, Water Productivity, Water Use Efficiency, Yield*

O/S-III/7

Simulating the climate change impacts on yield and water footprints of sweet corn crop using AquaCrop model

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The observed data of climate, crop growth, water demands, irrigation and fertigation schedules, biomass and fresh green cob yield of sweet corn crop (*Zea mays* l.) were recorded during two 2 years field experiments in Rabi season. Total of 16 treatment combinations of 2 irrigation levels, 2 fertigation levels and four irrigation types (surface drip with and without mulch and subsurface drip with and without mulch) were studied. The model was calibrated using observed and simulated data under the treatments of the non-stressed irrigation and fertigation with and without mulch and validated using the observed and simulated data under the treatment of 30% irrigation and fertigation stress with and without mulch. The AquaCrop model was run taking into account of the trend of warming and carbon dioxide concentration predicted for the study area. The simulated yield of sweet corn by AquaCrop model for the year 2020-21, 2050-51 and 2099-2100 was obtained. It was found that there will be a positive impact on sweet corn crop. The sweet corn cob yield will be increased up to 4.29 % by the year 2050-51 and 5.01% by the year 2099-2100. The water footprints of sweet corn crop yield will be increased by 2.41% and 4.04% even though the yield was increased.

Keywords: Aqua crop model, simulation, climate change, sweet corn, fertigation, surface drip, mulch, water footprints

O/S-III/8

Calibration, validation and sensitivity analysis of DSSAT 4.7 model

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Winter (*rabi*) maize occupies an important place in agriculture due to its high production potential (7482 Kg ha-1), and greater demand for food, fodder and commercial utilities. It occupies an area of about 285 thousand hectares. DSSAT is an important crop simulation model and it is widely used for determining crop production potential, studies on soil moisture, strategies for enhancing yield, crop yield forecast and assessing the impact of climate variability and climate change in agriculture. Very little information is available on simulation modeling involving *rabi*maize. Hence, keeping all this in view, experiments on *rabi*maize for calibrating and validating the DSSAT 4.7 model for *rabi* maize was conducted. Sensitivity analyses were also carried out to understand the response of the crop to fluctuating temperature regimes occurring during different phonological stages. Simulated values were validated against the observed values of the cultivar obtained from the field experiment.

The results revealed that the model performed satisfactorily and the simulated values of anthesis, physiological maturity andyield closely matched with measured values.

Keywords: Winter maize, DSSAT, simulation, validation

O/S-III/9

Allelic characterization, validation and protein functional analysis of *CcTFL1* reveals association of InDel with growth habit in pigeonpea (*Cajanuscajan* (L.) Millsp.)

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The onset of an optimal reproductive phase and transition of shoot apical meristem into floral or vegetative fate are key developmental shifts in flowering plants in response to seasonal cues. Key regulators of these environmental switches belong to the phosphatidylethanolamine-binding protein (PEBP) family. *Flowering Locus T* and *Terminal Flowering Locus 1*are two important florigens regulating flowering time and growth habits in plants. Growth habit is one of the important adaptive traits, acted upon by evolution while diversification of plant species, amending its morphology and physiology. Wild relatives and cultivars of pigeon pea show vast variability in inflorescence architecture, the majority of which are indeterminate. Indeterminate genotypes exhibit higher yield, disease and pest resistance but take more time to mature and are unfit for intercropping due to their longer vining shoots. In contrast, despite susceptibility to insect pests, determinate growth habit offers early synchronized maturity, higher productivity, mechanized harvesting and is also amenable for intercropping. Allelic characterization of *CcTFL1* locusalong with protein structural and functional analysis elucidated the molecular basis of growth habit in pigeon pea. Six contrasting genotypes exhibiting determinate and indeterminate growth habits were employed to isolate *CcTFL1* locus. This locus was amplified and sequenced using the Sanger sequencing method. Multiple sequence alignment of *CcTFL1* sequences revealed the involvement of InDel, describing deletion of 10 bp in determinate genotypes. However, indeterminate genotypes did not unveil any deletion. Gene prediction of both the alleles divulged differing lengths of the first exon in determinate and indeterminate genotypes. InDel alteredthe translation start point in determinate genotypes leading to the shortening of exon 1. This InDel was validated in 10 genotypes differing in growth habit. *Insilico*protein structure analysis depicted the absence of 27 amino acids in determinate genotypes which was reflected as the absence of two á-helices, connecting loop and shortened â-sheet in mutant CcTFL1 protein. Subsequent motif analysis illustrated the presence of a phosphorylation site for protein kinase C in wild-type protein but its absence in the mutant protein. This InDel-driven deletion of amino acid span harbouring phosphorylation site for kinase protein resulted in non-functionality of CcTFL1 protein, leading to determinate growth habit. Information on the complete characterization of *CcTFL1* locus can be utilized for growth habit modulation through genome editing for climate-smart breeding.

Keywords*: Terminal Flowering Locus, growth habit, allelic characterization, InDel and motif*

O/S-III/10

Response of water expense efficiency, water productivity and yield of broccoli due to drip irrigation and fertigation under south Gujarat condition

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This study aims to evaluate water expense efficiency, water productivity and curd yield of broccoli influenced by different levels of drip irrigation and fertigation under south Gujarat conditions. The experiment was carried out at the Soil and Water Management Research Farm of Navsari Agricultural University, Navsari and laid out in randomized block design with a factorial concept and nine treatment combinations comprising three levels of drip irrigation (I_1: 1.0 PEF, I_2: 0.8 PEF and I_3: 0.6 PEF) and three levels of fertigation (F_1: 100% RDF, F_2: 80% RDF and F_3: 60% RDF) with four replications. The results revealed that significantly the highest water expense efficiency was recorded with lower irrigation levels *i.e.* drip irrigation at 0.6 PEF (I_3) whereas, significantly higher water productivity was registered under higher levels *i.e.* drip irrigation at 1.0 PEF (I_1), which remain statistically at par with drip irrigation at 0.8 PEF(I_2). whereas, both the parameters were found significantly higher when crop fertigated with 100% RDF (F_1), which were remain at par with 80% RDF (F_2). Significant improvement in curd yield of broccoli was found with drip irrigation at 1.0 PEF (I_1) and fertigation with 100% RDF (F_1) which remain at par with treatment I_2 and F_2, respectively.

Keywords: Broccoli, fertigation, drip irrigation, PEF, water expense efficiency, water productivity

O/S-III/11

Identification of potential sites for soil and water conservationmeasures within the Hathmati River basin, India, using RS &GIS

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India's population is expanding, making it necessary to cultivate more land, yet doing so is currently difficult due to a lack of surface water. An appropriate mechanism must be used to investigate if surface and groundwater can be a practical alternative to meet demand. The objective of the current research was to identify prospective locations for soil and water conservation measures (SWCM) in the Hathmati catchment, which is near the end of the Sabarmati basin (India). If there is guaranteed irrigation water available throughout the rabi season, these regions may be viable for cultivating a second crop. For groundwater investigation, soil erosion prevention, and sustained well yield, SWCM prospective locations are required. The entire catchment was divided into suitable sites utilising remote sensing and a geographic information system with the Weighted Sum Analysis (WSA). To identify SWCMs, thematic layers of lithology, rainfall, seasonal groundwater storage, drainage density, geomorphology, soil texture, slope, and land use/land cover were produced and applied. Check dams, bench terraces, Nala bunds, farm ponds, and percolation tanks sites were identified in the catchment areas and occupy a total of 14, 24, 60, 61, and 3 locations, respectively. This work serves as an example of how morphometric analysis could be a useful tool in watershed planning and remote sensing and GIS techniques are effective in locating potential SWCM locations.

Keywords: Morphological parameter, Weighted Sum Analysis (WSA), Soil and Water Conservation Measures (SWCM), Remote sensing, GIS

O/S-III/12

Remote sensing based vegetation monitoring for assessing impact of watershed management practices in the parts of Narmada district, Gujarat

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Monitoring the vegetation dynamics is an essential component of assessing the impact of watershed management practices. Considering the importance of the Narmada watershed for the enriching biosphere of the Gujarat state, we have selected the study region covering agriculture-dominated parts of the Narmada district. With the availability of a historical satellite image database, remote sensing is the only tool to investigate spatial-temporal changes observed in vegetation patterns during the last 20 to 30 years. We have studied the Spatio-temporal variations observed in vegetation dynamics in the study region using time series (2001-2021) of monthly MODIS NDVI data products, with a spatial resolution of 0.05 degrees. We have processed the NDVI time series and generated a database of (i) calendar month-wise and (ii) years-wise pixel-level climatic average NDVI. We have analyzed the climatic monthly and yearly NDVI profile for each pixel to assess the vegetation condition. Geospatial investigation of the monthly profile indicated that in the Tilakwada region, an increase in vegetation was observed during June-September and after that smooth decline in vegetation condition till May month of the subsequent year. However, some of the pixels nearer to Nandod are showing a plateau during the September-October months. Analysis of the climatic profile of the Nandod region highlighted the six-month vegetation growth period from May to October months. This six-month growth period is in contrast to the four months observed in the Tilakwada region. Six-month growth period is also observed for the majority of the pixels in the Dediapada. However, the observed peak NDVI is higher compared to the Nandod and the Tilakwada. This is indicative of better vegetation conditions in the Dediapada at the climatic scale of 21 years. The Sagbara is showing a nearly similar monthly pattern observed in the Tilakwada. Yearly NDVI profile during the 21-year study period for the majority pixels in Tilakwada, Nandod and Sagbara regions are showing a statistically significant increasing trend from NDVI value of the order of 0.35 to 0.55. The yearly pattern in the Dediapada is also showing an increasing trend but with higher inter-annual variations. Considering the dominant agricultural vegetation within the study region, we concluded that the fractional vegetation cover and crop health consistently increased during the study period from 2001-2021. This can be attributed to the implementation of better watershed management practices in the study region.

Keywords: *Narmada watershed, Vegetation condition, Remote Sensing, NDVI, Time-series, Geo-spatial analysis*

O/S-III/13

Estimation of sedimentation rate in small reservoirs using RUSLE, sediment delivery ratio and GIS

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Soil erosion is identified as a global environmental hazard that affects the productivity of all natural ecosystems including agricultural productivity as it severely affects the soil health and hinders the nutrient uptake by the plants. Estimation of soil erosion and sediment yield from small catchments is important for managing natural resources. The catchment sediment budgets and sediment yields have attracted considerable attention, because of their ecological importance and the need to understand the physical processes involved in erosion and sediment yield. The Revised Universal Soil Loss Equation (RUSLE) integrated with the sediment delivery ratio

(SDR) model employed in the GIS environment has been used to quantify the soil erosion and sediment yield for two small reservoirs (Takarla dam and Golu Majra dam) located in *Shivalik* foothills of northwest India. The catchment area of Takarla dam and Golu Majra dam is 72.6 ha and 76.06 ha, respectively. The various thematic layers including rainfall erosivity factor, soil erodibility factor, Slope length and steepness factor and crop management factor were prepared in ArcGIS to estimate the average annual soil loss for two dams. The SDR for the dam catchments was obtained by employing different equations to obtain the sediment yield. The sedimentation rate and sediments collected in the dams were assessed for the last 20 years. The results of the present study revealed that the average annual soil loss varied from 0 to 12 t ha^{-1} $year^{-1}$ and 0 to 8.9 t ha^{-1} $year^{-1}$ for Takarla dam and Golu Majra dam, respectively. The sediments deposited in these dams over 20 years were estimated to be 142603.8 tonnes and 119867.5 tonnes. The results of the present study may provide insight for policymakers to design and execute watershed management practices to reduce erosion hazards and sediment accumulation in the reservoirs. Further, the desiltation of the dams may be carried out to increase the life of the reservoirs.

Keywords: *Dams, GIS, RUSLE, Sedimentation, Soil erosion*

O/S-III/14

Influenceof artificial recharge structures in improving groundwater quantity

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Artificial recharge is a technique used to replenish the groundwater resourcesexploited by pumping for irrigation and drinking purpose. Artificial recharge structures are practised in the hard rock regions of Tamil Nadu for groundwater restoration and management.The effectiveness of recharge structures in improving the recharge process has been evaluated for different recharge structures, namely, check dams, recharge shafts in percolation ponds and recharge borewells.The recharge during the northeast monsoon for a period upto December is about 11.4 per cent and during the southwest monsoon for a period upto September is about 15.6 per cent. In natural recharge, the depth of increase in groundwater is 1.5 m whereas in the areas having artificial recharge structures the increase in groundwater table is 4.7 m. The recharge rate of a check dam and recharge shaft in a percolation pond was estimated as 0.27 $m^3/m^2$of ponding area/month and 0.54 $m^3/m^2$of ponding area/month respectively.Therecharge shaft in the percolation pond was found to be more effective in recharging the groundwater.

Keywords : *Artificial recharge; Check dam; Groundwater level; Recharge shaft; Recharge borewell*

O/S-III/15

Effect of organic manure prepared from agro-wastes by inoculating with isolated cellulolytic and ligninolytic bacteria on the nutritional composition, biochemical parameters and yield of sorghum

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An experiment was carried out from 2014 to 2017 at Food Quality Testing Laboratory,NAU, Navsari to find out the effect of organic manure prepared from agro-wastes by inoculating with isolated cellulolytic and ligninolytic bacteria on the nutrient content, biochemical parameters and yield of sorghum. A total of 103 bacteria were isolated from compost, seawater and soil samples. Based on qualitative and quantitativecellulase, laccase, Lip and MnP enzyme assay, 4 superlative bacterial isolates were selectedand designated as cellulolytic isolate C_1 and cellulolytic isolate C_2 as well as ligninolytic isolate $L_1$and ligninolytic isolate L_2.These selected cellulolytic and ligninolytic bacteria were inoculated on sugarcane trash (S_1), paddy straw (S_2) and banana pseudostem (S_3) and incubated for 20, 40, 60, 80, 100 and 120 days. This experiment was conducted using factorial CRD with two repetitions. The pH, EC, cellulose and lignin content along with major, secondary and micronutrient content of

the substrates were measured at 20, 40, 60, 80, 100 and 120 days of incubation. A pot experiment with the same statistical design and repetition was set up at Food Quality Testing Laboratory, NAU, Navsari to test the prepared organic manures on sorghum plants.The cellulose and lignin content were found lower in paddy straw (S_2) and remained lower during all incubation periods as compared to other substrates. Reduction in cellulose and lignin content of substrates was higher in treatments of cellulolytic isolate C_1 and ligninolytic isolate L_2 as compared to its respective treatment of C_2 and L_1. However, the lignin content of substrates was not affected significantly by the treatment of cellulolytic bacteria. Nutrient content in substrates was increased with the advancement of incubation periods from 20 to 120 days. In each period, higher nutrient content was observed in the treatment of S_3 (banana pseudostem), C_1 (cellulolytic isolate) and L_2 (ligninolytic isolate). A more or less similar trend concerning treatment effect was observed in pH and EC of the substrates. The Green and dry biomass yield of sorghum were affected significantly by the application of manure prepared by different treatments. Manure prepared from banana pseudostem inoculated with cellulolytic isolate C_1 and ligninolytic isolates L_2recorded the highest green and dry biomass yield of sorghum.Therefore, it was concluded that good quality manure in terms of biochemical and nutritional composition can be prepared by inoculating banana pseudostem with cellulolyticisolate C_1 (identified as *Bacillus licheniformis* strain C_1) and ligninolytic isolate L_2(identified as *Bacillus* sp. strain L_2).

Keywords: Bacteria, Enzyme, Cellulose, Lignin, Manure, Organic

O/S-III/16

Modelling and simulating the climate change impacts on groundwater dynamics for the Shingoda river basin

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The study was undertaken for Shingoda river basin (933.044km2) having 21 watersheds and 212 HRUs. The historical records of daily maximum and minimum temperature of 365 days of 33 years (1973-2005) for Shingoda basin were collected from the JAU observatory, JAU, Junagadh and Kodinar. The daily rainfall for 28 years(1978-2005) was collected from the state water data centre, Gandhinagar. The RCA4 RCM simulated daily maximum/minimum temperature and rainfall data(50kmx50km) for the baseline period (1951-2005) and future scenario (2006-2100) for the IPCC SRES rcp4.5 for one grid point falling in Shingoda basin were collected. The rainfall and temperature simulated by RCA4 RCM during the baseline period were compared with observation and that of past (1951-1977) and future periods (2006-2100) for the rcp4.5 SRES scenario which was bias corrected using the most commonly used, accurate and recommended method i.e. Probability Distribution Mapping method. The RCM simulated weather data after bias was corrected were fed as SWAT inputs as well as for the analysis. The water balance approach was used to build the model of groundwater level dynamics to climate. The current trend of climate change in Shingoda basin indicated that the groundwater depletions may increase at 0.023 m/year. The current climate change trend may increase groundwater depletions by 0.015m and 0.008m during the winter and summer seasons respectively. The contribution of the current trend in the maximum temperature, minimum temperature, wind velocity, relative humidity and solar radiation to groundwater depletions can be 0.013m, 0.0m, -0.0039m, 0.004m and 0.0018m per year during the winter season and 0.007m, -0.0023m, 0.0004m, 0.003m and 0.0006m per year during summer season respectively.The model developed for the sensitivity analysis shows that wind speed is the most sensitive climatic parameter to the groundwater depletions followed by maximum temperature, solar radiation and relative humidity. The model of the groundwater level depletions response to climatic parameters shows that a rise of 1 oC in maximum temperature, 1m/s in wind velocity and 1 MJ/sq.m/day in solar radiation in Shingoda basin may increase the groundwater level depletions by 0.64m, 2.33m and 0.40m per year respectively during the winter season while

0.29m, 0.85m and 0.14m during summer season respectively. The increase/decrease of 0.01 in mean relative humidity(1%RH) during the winter and summer seasons may decrease/increase 0.11m and 0.047m per year.
(Keywords: Climate change, Model, Groundwater, reference evapotranspiration, temperature, wind velocity, humidity, sunshine hours).

O/S-III/17

Effect of mulching on moisture conservation and productivity of nectarine (*Prunuspersica* L. Batsch var. *nucipersica*) cv. Snow Queen

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The investigation was carried out on a 10-year-old nectarine orchard, established at the Commercial and Experimental Model farm of the Directorate of Research, Dr. Y.S. Parmar University of Horticulture and Forestry, Nauni, Solan (H.P) during the year 2021. The experiment consisted of six treatments viz. unmulched control (UM), grass mulch (GM), pine needle mulch (PM), black polythene mulch (BP), transparent polythene mulch (TP), nylon mulch mat (MM) were replicated in four times in a Randomized Block Design. The results emanating from the study revealed that mulches significantly influenced the soil hydrothermal regimes. The highest soil moisture contents at 0-7.5 and 7.5-15 cm depth were conserved by BP followed by MM, GM, PM, TP and all-time lowest under UM. Mulches favourably moderated the soil temperature and TP recorded highest maximum and minimum temperature during the course of study and effectiveness of mulches in moderating soil temperature followed the order TP > BP> MM > PM >GM > UM at 0730 hr and TP > BP > MM > UM > GM > PM at 1430 hr. Soil physical-chemical properties and leaf nutrient contents were altered marginally by varied mulch materials during a single fruiting season. In terms of weed growth mulches effectively check and suppress the weeds, application of MM and BP resulted in complete suppression of weeds except for the TP which recorded maximum weed biomass. Under organic mulches viz. GM and PM microbial community flourish and proliferates. GM recorded maximum viable microbial count and biomass-C. BP mulched trees recorded the highest (20.92 t ha^{-1}) fruit productivity closely followed by MM (19.74 t ha^{-1}) whereas lowest under UM (14.17 t ha^{-1}). Among different mulches, black polythene and nylon mulch mat followed by organic mulches was found to be the most effective, economical best to meet multiple objectives of conserving and moderating soil hydrothermal properties and elimination of weeds and improved growth, cropping and productivity in rainfed nectarine orchards.

Keywords: Mulching, nectarine, hydrothermal regimes, weed biomass, microbial count, yield, productivity

O/S-III/18

Status of Land and Water Resources inside Project Core villages of Ambuja Cement Foundation using Geospatial Techniques

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Water is most important for all forms of activities in the world. It sustains life and is the saviour of all living and non-living things on Earth. It is also a necessary component for any kind of planning and development. Water scarcity exists in many parts of the world due to increased demand for water over the years. Traditionally, water resources are strongly linked to rural development. The study was carried out with the objective of mapping existing water bodies, assessment of water in existing water bodies, land use change detection and identification of sites for water harvesting structures in the project villages, which would directly benefit to the local peoples. The study area watershed is located between 21°38' to 21°40' N latitude and 82° 2.3' to 82° 7.3' E longitude, which covers an area of 341.1 km2 and comes inside the Survey of India toposheet No. 64K/2, 64G/14, and 64G/15 on 1:50,000 scale. Under the study, 13 villages was selected which portray the agro-climatic conditions of Chhattisgarh plains in the state. It lies between 21°38' to 21°40' N latitude and 82° 2.3' to 82° 7.3' E longitude.

The total geographical area of selected 13 villages is 60.7 km2 and falls under the Survey of India toposheet No. 64K/2 on 1:50,000 scale. The mapping of existing water bodies were carried out by collecting locations of existing water bodies during field survey, followed by the assessment of water in existing water bodies.The existing water bodies identified in the 13 project villages are 62 village ponds and 19 mining ponds were mapped with the help of Google earth pro in conjunction with ArcGIS, the total water available in existing water bodies was 24.41 Mm3, of which 3.40 Mm3 in village ponds and 21.01 Mm3 in mining ponds. The land use change detection was carried out using IRS-P6 LISS III and Sentinel-2 imagery for year 2008 and 2021, respectively. It was observed that in watershed only water bodies, agriculture and settlements increased by 13.9 percent, 33.15 percent, 78.39 percent, respectively while, barren land, fallow land, and vegetation decreased by 20.3 percent, 21.3 percent, 77.6 percent, respectively. Whereas in village area, water bodies, agriculture and settlements increased by 113.910 percent, 33.15 percent, 78.39 percent, respectively, while other land use classes fallow land, vegetation and barren land decreased by 53.36 percent, 77.09 percent, and 14.19 percent, respectively. The research will aid in the selection of suitable sites for the construction of various water harvesting structures and 4 check dam, 7 nala bund, 20 percolation tank and 22 ponds.

Key words: Geospatial, Land use/land cover, Land and water resources, Water harvesting structures, IRS-P6 LISS III, Sentinel-2

O/S-III/19

Study of the change in land use and land cover in the lower Tapi river basin of Gujarat using Remote Sensing and GIS

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Due to its growing nature and being the activity of economic hub, Lower Tapi River Basin is changing regarding its land use scenario. Land use planning must be based on meaningfully crafted visionary action to avoid any kind of haphazard development. This work was done to provide a fast, accurate and economical procedure for mapping land use and the land cover of any interested area. Remote Sensing and GIS may help on large scale for classifying and mapping an image. Recent development in GIS field software tools may be used for image classification and for performing related functions. The Lower Tapi River Basin case attempted to explore the extent of spatial growth. The present work is a compilation of two different images from 2015 to 2021 obtained by the USGS Earth Explorer. The objectives of the study were availing two decadal sentinel pictures of the Lower Tapi River Basin. The research includes a classification of the images and detection of Land use/Land cover changes in the past two decades. The work was on the derivation of four land use classes i.e. urban area, agriculture, fallow land, water body and forest. Land use/land cover maps of the study area were generated using remote sensing and GIS. False Colour Composite (FCC) sentinel images were used as a base for identification. Interactive Supervised classification is used for the change detection in vegetation cover. Forest cover, agricultural land and water bodies in the study area were around 129.64 km^2, 960.19 km^2 and 3.92 km^2 of the total area in the year 2015. In the year 2021, forest cover and agricultural land decreased to 86.74 km^2 and 700.86 km^2, respectively and water bodies increased to 6.39 km^2.

Keywords: Tapi, river basin, land use and cover, changes detection, remote sensing, GIS.

O/S-III/20

Introducing a New Drought Index- Standardized Precipitation Dry Days Index (SPDDI) for Characterization of Agricultural Drought

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The standardized precipitation index (SPI) is the most widely used index for meteorological drought analysis. However, it is solely based on accumulated rainfall hence several modifications were attempted by incorporating other variables in SPI to improve its performance especially to analyze agricultural drought. The present study was conducted to modify SPI by incorporating maximum consecutive dry days% in SPI for 1, 3 and 6 months time scales to improve the performance of SPI for better quantification of agricultural drought. The precipitation in SPI was replaced with a ratio of precipitation to maximum consecutive dry days% for a specific time scale to formulate a new drought index i.e. standardized precipitation dry days index (SPDDI). The main aim of this modification was to enhance the effectiveness of SPI to explain the relation of precipitation anomalies with crop yield anomalies despite maintaining the major advantages of SPI i.e. use of only precipitation data and capable to analyze drought for multiple time scales. The SPDDI derivation procedure and performance to detect agricultural drought were studied for the Saurashtra region of Gujarat (India). The SPI and SPDDI were correlated with major Kharif crops of the region i.e. cotton and groundnut. The results revealed that for non-irrigated regions, SPDDI showed a higher correlation with crop yield as compared to SPI for 78% of instances. For irrigated areas, the performance of SPI and SPDDI were almost identical. The spatial patterns of droughts were also assessed by preparing drought severity maps based using inverse distance weighing technics. The maps showcased that SPDDI was better in judging spatial patterns of selected dry and wet years as compared to SPI. It is recommended that for rainfed crop production systems, the developed improved version of SPI, i.e. SPDDI should be used instead of SPI to analyze meteorological and agricultural droughts.

Keywords: Drought Analysis, Agricultural Drought, Meteorological Drought, Cotton, Groundnut

O/S-III/21

Response of summer groundnut (*Arachishypogaea* L.) to nano boron in medium black calcareous soil

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A field experiment was carried out during the summer seasons 2018 to 2021 at Main Oilseeds Research Station, Junagadh Agricultural University, Junagadh to know the response of groundnut to nano boron nutrition. There were nine treatments in different levels of nano boron laid out in a Randomized block design with three replications. The soils of the experimental site were medium black calcareous soil having neutral pH, low electrical conductivity, low available nitrogen, medium in phosphorus and boron and high in potassium content. The pooled results showed that application of nano boron @ 0.2 % (three sprays at 30, 45 and 60 DAS) gave significantly higher values of pod yield (2350 kg/ha), haulm yield (2935 kg/ha), plant height (21.37 cm), no. of pods per plant (18.26), shelling % (67.10) and oil content (49.09 %).

O/S-III/22

The combined effect of conservation agricultural practices and irrigations methods on chickpea crop and water productivity and energy consumption pattern under vertisols of Central India

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Identification of suitable machinery, irrigation methods and residue retention for crop production and optimum energy input play a significant role in global food security through the improved production system. This calls for immediate technological interventions for improving crop productivity and better management of inputs. Chickpea is one of the important pulse crops in India and the country shares 70% of the world's chickpea production. However, India is one of the largest importers of chickpeas as there is a remarkable gap in productivity compared to the world's average productivity. In the present study, three years (2018-2020) field experiment was conducted in vertisols of semi-arid tropics of Central India to investigate the effect of irrigation and planting methods and residue loads on chickpea (*Cicer arietinum L.*) yield, water productivity (WP) and energy consumption pattern. The experiment was conducted using split-split plot design comprising three treatments *viz.* two irrigation methods (sprinkler and furrow irrigation) as the main plot, three residue loads (30, 60 and 100%) as subplot and three planting methods (broad bed shaper-cum-planter (BBSP), zero till planter (ZTP) and seed-cum-fertilizer drill (SFD)) as sub-sub plot with three replications each. The sprinkler irrigation strived significantly ($p< 0.05$) higher grain yield (1997 kg ha^{1}) compared to furrow irrigation (1882 kg ha^{-1}) and 34.7, 30.7 and 35.1% higher WP compared to furrow irrigation during the first, second and third year, respectively. Planting methods resulted in similar yield gains and had no significant differences for the first two years of experiments, whereas in the third year SFD reported significantly higher grain yield (1591 kg ha^{-1}) compared to BBSP (1525 kg ha^{-1}) and ZTP (1431 kg ha^{-1}). Approximately, 4.19 and 10.07% higher grain yield was recorded under 100% residue load during the first and third year of the experiment, respectively whereas in the second year, 60% and 100% residue retention proved to be significantly superior (1943 and 1983 kg ha^{-1}, respectively) over 30% residue load (1893 kg ha^{-1}). Significantly higher WP were recorded under sprinkler irrigation compared to furrow irrigation, similarly, 100% residue load reported significantly higher WP compared to 30 and 60% residue loads. The irrigation, fertilizers and planting methods accounted for 64-72% of total energy input in chickpea production. Conservation tillage practices reduced energy usage in land preparation by 14.68, 14.32, and 14.7% for BBSP and 7.07, 6.91, and 7.12% for ZTP as against SFD during three years. It is concluded that higher yield, water productivity and energy use efficiency were obtained for chickpea crop cultivation under conservation agriculture (CA) along with sprinkler irrigation.

Keywords: Conservation agriculture, Crop residue management, Energy budgeting, Maize-chickpea cropping system, Water productivity

O/S-III/23

Development and evaluation of four-row semi-automatic vegetable transplanter for sustainable resource management

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India is the second largest producer of vegetables in the world after China, whichshares 11% in the world's total vegetable production. The critical operations in vegetable cultivation like transplanting, earthing-up, picking/ harvesting, etc. are performed manually, which are not only time-consuming but also involve a lot of drudgeries.The labours required for manual transplanting of the vegetable crops vary from 15-25 man-days/ha

and face labour scarcity during peak season. The productivity and production of the vegetable can be increased by mechanizing transplanting operation which ensures timeliness of operation, reduced labour and cost of transplanting and reduced drudgery.Therefore, a four-row semi-automatic vegetable transplanter was developed and evaluated.It consisted of a frame, inverted T-type furrow opener, covering wheel, trayand finger assembly for transplanting,power transmission unit and ground wheel. The experiment was conductedusing a split-plot design with covering-cum-compaction system as the main treatment and seedling lengths at different ages of the seedling as sub-main treatment with five replications each. The equipment was evaluated for brinjal, cabbage, cauliflower and tomato seedlings.The effective field capacity of equipment was found to be 0.12 ha/h with Rs. 2212/ha cost of operation.The mean per cent of seedlings lying down on the ground and seedling mortality was observed as 4.62 %, and 1.64 % respectively.

Keywords: Horticultural mechanization, Seedling transplanting, Semi-automatic transplanter,Vegetable cultivation, Vegetable transplanter

O/S-III/24

Geospatial Analysis for the Assessment of Land Use Changes and Forest Degradation in Coal MinedLandscape in Central India: Pathways for Eco-Restoration

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Anthropogenic perturbations caused by mining in the tropics pose an alarming threat to curb the negative impacts of land use changes, biodiversity losses, climate change, environmental pollution, and fragmentation of ecosystems. Land degradation is ubiquitously recognized as the key driver of abrupt land use changes, loss of productivity, impairment of ecosystem services, displacement of communities and ruin source of livelihoods of millions of people residing in coal-mined environs of Central India. Land use land cover (LULC)changes and land degradation pattern monitoring are therefore crucial to understand the nature and extent of the damage for adopting measures for reversing the process of degradation. Geospatial techniques advancements combining high spatial and temporal resolutions in the last few decades paved a way for precise estimation of land use dynamics and land degradation at varying scales. The present study was conducted to assess the impact of open cast coal mining on land cover changes and deforestation in the last two decades in part of Korba district of Chhattisgarh, India through conjunctive use of satellite remote sensing and field inventories. Three sets of Landsat satellite data corresponding to the years 2000, 2011 and 2020 were digitally analyzed in ERDAS Imagine and ARC GIS software to detect the land use land cover (LULC) changes and deforestation. Results on LULC of the study area showed that five land cover categories *viz.,* agriculture and fallows, intact forest, fragmented forest, mined areas, and water bodies were distributed in a total area of 1314.5 km^2. Initially, the forest (52.3%) was the dominant land cover followed by agriculture and fallow lands (44.6%), and water bodies (2.57%), while mining was spread only over 0.48% area and represented by 6.4 km^2. The overall accuracy of classified images was highest (88%) for 2020 followed by 2001 (86.3%) and 2011 (81.2%). A rapid increase in mining area was observed from 6.4km^2 to 30 km^2 and agriculture from 586.7 to 642.5 Km^2 areas between 2001 and 2020, while the area under intact forest shrunk from 405.3 to 290.1 km^2 and water bodies from 33.7 to 20.5 km^2 during this period. The rate of change in the mining area was quite high, which accounted for 7.78 $km^2\ yr^{-1}$, while the rate of deforestation was 0.87 $km^2 yr^{-1}$. An extent of 66.1 km^2 of the forest was lost between 2001 and 2020. Results on structural and diversity parameters of intact and fragmented forests revealed that density varied from 240-445 trees ha^{-1}, 3000 to 7000 shrubs $ha^{-1,}$ and 146235 to 192000 herbs ha^{-1}. Average crop height (m) ranged from 16.4 to 23.4 m, crop diameter from 95 to 135 cm, whereas basal area from 24.4 $m^2\ ha^{-1}$ to 39.1 $m^2\ ha^{-1}$.

The density, height, and basal area values were higher in the intact forests and decreased under fragmented forests. The basal area was found to be 60.2% higher under intact compared to fragmented forests. The Shannon-Weiner diversity index values ranged from 0.91 to 1.66, 1.01 to 1.63, and 1.75 to 1.86, whereas Simpson Index from 0.29 to 0.54, 0.22 to 0.38, and 0.18 to 0.2 for the tree, shrub and herbaceous layers, respectively. The study explored the viable strategies for eco-restoration of degraded mined lands and fragmented forests for neutralizing land degradation intended to supplement the targets of sustainable development goals 2030.

Keywords: Deforestation, LULC changes, Land degradation, Opencast Coal Mining, SDGs

O/S-III/25

Estimation of SCS Curve Number Under Different Crop Cultivation Practices and Slope for Natural Rainfall Condition

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The experiment was conducted in the standard runoff-soil erosion measurement plots at the university campus farm for consecutive 3 years (2019 to 2021) during the monsoon season. A total of 13 treatments were studied under natural rainfall conditions among which 12 treatments were different combinations of 3-bed slopes (0.50%, 0.75% and 1.00%), 2 crops (groundnut and cotton), and 2 crop cultivation practices (along and across the bed slope) and 1 control (0.75 % bed slope without crop). The rainfall and runoff were measured for each treatment separately. The AMC conditions were decided based on 5 days of antecedent moisture. The curve number was estimated for the average AMC based on rainfall using SCS CN method.

The annual rainfall was recorded as 1492.20, 1806.9 and 1305.1 mm in 55, 86 and 77 storm events among which 21, 28 and 11 have generated runoff during 2019, 2020 and 2021, respectively. The runoff depth had been measured for each storm and estimated the runoff coefficient. The runoff depth and runoff coefficient were found higher under the treatments of along the slope cultivation practices as compared to across the slope. The runoff increased with an increase in bed slope. The runoff depth was found higher in the cotton crop as compared to the groundnut crop. The effect of treatments on actual curve number (CN) and curve number for average condition (CN II) was found non-significant. The lowest value of CN was found at 74.34 in groundnut cultivation across the bed slope of 0.50% while it was highest at 84.33 in the control (i.e. 0.75 % bed slope without crop) plot. The study indicated that the across-the-slope cultivation has lower values of curve number as compared to along-the-slope cultivation for both crops.

O/S-III/26

Agricultural Drought Monitoring and Assessment Using Remote Sensing and GIS

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Drought is a natural hazard characterized by a shortage of water supply due to irregularities in rainfall; an increase in the temperature rate causesa decrease in the soil moisture ultimately declining the productivity of crops. In the present study agriculture drought in Kandi Mandal, Sangareddy district was monitored using remote sensing. The assessment of drought severity is done using indices NDVI (Normalized difference vegetation index), LST (land surface temperature), TCI (Temperature condition index), VCI (Vegetative condition index) &VHI (Vegetation condition index). Anomalies in NDVI and VHI for the Rabi season of 2015-16 and 2020-21 were computed. The drought severity was mainly triggered in 2015-2016 due to the decreasing trend of vegetation identified by the Normalized Difference Vegetation Index (NDVI). About 52 km2 of the area

is kept under fallow/built-up/barren in the drought year 2015-2016 as compared to the 2020-2021 normal year. From VHI results it is shown that in 2015-16 nearly 80% of the area was under drought in February against 62% in a normal year. Whereas, in 2015-16 December 12% of the area was under extreme to mild drought against no drought observed for the normal year 2020-21. The seasonal agricultural drought severity map block-wise provides an overall idea of drought risk and will help in planning the cropping pattern.

Keywords: Drought, remote sensing, drought Indices, NDVI, VCI, TCI, VHI

O/S-III/27

Development and evaluation of an automated drip system for fertigation control in Cucumber Crop

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In agricultural production, soil characteristics play a vital role in maintaining fertility by allowing crops todevelop better through root nutrition with minimal energy inputs. Nitrogen (N), Phosphorus (P), and Potassium(K) are all important nitrogen fertilizers extensively utilized in crops to supply a sufficient level of nutrients andkeep their production level high. However, the application is generally limited to specific crops because of theglobal variability in these essential nutrients. Stability in fertilizer application, growth, and root growth rateincreases crop fertility and crop production. To predict the suitable nutrients for different crops and provide

nutrient recommendations by analyzing the crop fertility and yield production, this paper proposes nutrient recommendations through Integrated soil moisture and nutrient sensor-based drip automation system. The use of an automated fertigation system can help producers to make correct choices that can essentially affect the water and fertilizer utilization and can decrease fertilizer loss. Some automated systems are capable of integrating irrigation scheduling with nutrient dosing activities while other systems only manage the nutrient dosing equipment.

The experiment was carried out in the experimental field of SVCAET&RS, Farm, IGKV, and Raipur. The focus of the experiment was to install the developed integrated soil moisture and nutrient sensor system for the real-time monitoring of the nutrient and to evaluate its performance in the cucumber crop. The results from the study revealed that the developed system performed well at an operating pressure of 1.0 kg cm^{-2} as maximum values of application efficiency, distribution efficiency, emission uniformity and uniformity coefficient were achieved 92.25%, 95.47%, 93.73% and 94.28%, respectively. The integrated soil moisture and nutrient sensor system comprises components including soil NPK sensor, soil moisture sensors, 3.5 inches display, connecting cables, microcontroller, relay module, conductor and Miniature Circuit Breaker (MCB). The integrated soil moisture and nutrient sensor-based automated displayed a prominent effect on the yield and yield attributes observed such as the number of fruits per plant (15), the maximum length of vines (170 cm), yield per plant (2 kg), average fruit weight (170 gm). The sensor-based automated drip system was found to be saving around 20.23% of nutrients as compared to the control normal drip irrigation system with cucumber.

Keywords: *Drip automation, Fertigation, Nutrient, Soil Moisture*

O/S-III/28

Water Quality Index and Geospatial Approach in Mapping of Suitability of Surface Water for Drinking and Irrigation Use

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Freshwater is vital for mankind since it is directly linked to human welfare. The problem of water contamination, water conservation and quality management has become very complex. The formulation and use of indices have been strongly advocated by agencies responsible for water supply and control of water pollution. Once the water quality data has been determined through sampling and analysis, a need arises to translate it into an easily understood form. Once the WQI is developed and applied, they serve as convenient tools to examine trends,

highlight specific environmental conditions, and help governmental decision-makers evaluate the effectiveness of regulatory programmes.

In the present study, the surface water quality of Navsari and Dang districts of Gujarat state was assessed by collecting 50 water samples during Pre-monsoon and Post-monsoon seasons. Water Quality Index (WQI) and Sodium Absorption Ratio (SAR) were determined based on various water quality parameters to check the suitability of water for drinking and irrigation use. Analysis of surface water quality using WQI and GIS indicated that water from 25.05% area of Navsari district in Pre-monsoon and 32.78% area in Post-monsoon is 'unfit for drinking'; whereas in Dang district, water from 0.83% area in Pre-monsoon and 2% area in Post-monsoon is 'unfit for drinking. 'Good' quality surface water is available in 58.43% area of Dang district in Pre-monsoon and 64.43% area in Post-monsoon, whereas it is less than 1% in Navsari district in both seasons. Water samples plotted on the US Salinity diagram indicated that samples of Navsari district under C3S4 and C4S4 category are 'poor zone of water quality, and this water cannot be used for irrigation on soils with restricted drainage and requires special management for salinity control. Surface water in other locations of Navsari and all locations of Dang district belongs to the 'acceptable to suitable' class of water for irrigation. Hence, the geospatial technique, the WQI method and US Salinity diagram for water quality monitoring and subsequent evaluation of the effectiveness of regulatory programmes.

Keywords: Water quality; WQI; Irrigation water quality; GIS

O/S-III/29

Water Resources Management in Salebhata Catchment of Odisha: An Integrated approach of Geospatial Technologies and Hydrological model

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The present study highlights the application of an Integrated Water Resources Management(IWRM) tool, the Water Evaluation and Planning (WEAP) model for hydrologic simulation ofSalabhata catchment of Mahanadi river basin in India with the help of geospatial tools. Decision support systems (DSS) associated with IWRM are an effective tool for water allocation and supply and demand analysis. Salebhata catchment in Ong River basin, Odisha, plays an essential role in the agriculture of western Odisha. Though an ample amount of fresh water is available, catchments are in stressed condition to satisfy the water demand of agriculture and other sectors due to the effect of climate change and the geographical location of the catchment. Therefore, a climate change impact assessment was carried out to evaluate its effect on Rabi and Kharif crops in Salabhata catchment. Trend analysis was carried out by Mann-Kendall test on future climatic data for the period 2011-2030. The future climatic data of Coordinated Regional Downscaling Experiment (CORDEX) East Asia models namely,, HadGEM3-RA, SNU-MM5, YSU-RSM and RegCM4 with two scenarios RCP 8.5 and RCP4.5 were used for the future stream flow estimation on Ong River for Salebhata catchment. Model calibration and validation was based on the past climatic data trend from 2000 to 2009. The result shows that the existing water demand of Salebhatawas 491 MCM for the period 2000-2009 and cumulative stream flow projection of model SNU-MM5 with scenario RCP 8.5is highest whereas modelRegCM4with scenario RCP4.5 is lowest for the period of 2011-2030.

Keywords. Climate change, Downscaling, WEAP, CORDEX, Mann-Kendall test

O/S-III/30

Standardisation of an efficient DNA isolation protocol for *Sonneratia* spp.

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Mangroves are a unique type of ecosystem and habitat with diverse species of flora and fauna. They have complex physiological adaptations and are crucial for coastal areas as they help prevent soil erosion. DNA extraction is the foremost step in conducting any genetic study on mangroves for their conservation. In an

attempt to analyse the DNA barcode regions for two mangrove species viz., *Sonneratia alba* and *Sonneratia apetala*, for their identification and discrimination from other mangrove associates, a comparison of five conventional methods for DNA isolation was carried out. In mangrove species, isolation of suitable purity DNA with sufficient quantity is cumbersome, as they are highly rich in salts and other secondary metabolites like flavonoids, tannins etc. Also, the method developed for tissues of one species does not necessarily result in good DNA extraction for other species, even within the same genus. In our study, the DNA yield from leaves by all the methods was gelatinous, and it was challenging to quantify and load in agarose gel. Thus, a protocol was optimised by a combination of two methods along with certain modifications, which resulted in obtaining non-gelatinous and good-quality DNA, which also gave PCR amplification with universal DNA barcode primers. This method can be used effectively for any downstream processing during genetic studies of *Sonneratia*species.

Key words: Mangroves, *S. alba*, *S. apetala*, Comparison, DNA barcoding

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O/S-III/31

Application of Geospatial Technology for Monitoring the Bio-Physical Variables in Agricultural Fields

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Natural resources like soil, water and vegetation are key components of an ecosystem. Water in agriculture represents the dominant water use in the form of flowing water for irrigation and as rainwater and soil moisture in croplands and forests. Irrigation affects temperature conditions by regulating the temperature of the surface layer of the soil and the ground layer of the air and also makes it possible to control of the growth and development of plants. The attempt was made to apply geospatial technology-based data for monitoring the bio-physical variables in the Uben river catchment agricultural fields in Junagadh district, Gujarat state, India. The Landsat-8 image of 18 January 2019 was used to derive the Soil Adjusted Vegetation Index (SAVI), Land Surface Temperature (LST) and Moisture Stress Index (MSI) using ArcGIS 10.3 software. The average values of SAVI were 0.552, 0.430 and 0.128 in the fields with Wheat crop, Coriander crop and wasteland, respectively. The SAVI values were higher in cropped fields compared to fields without crop. The average values of LST were 26.450C, 28.170C and 30.700C in the fields with a Wheat crop, Coriander crop and wasteland, respectively, the field without crops showed higher LST values. The average values of MSI were 0.605, 0.733 and 1.062 in the fields with Wheat crop, Coriander crop and wasteland, respectively. The field with crops shows less soil moisture stress due to irrigation. The value of SAVI in the study area was ranged from -0.265 to 0.806, the value of LST was ranged from 17.770C to 36.230C and the value of MSI was ranged from 0.442 to 2.981 in the study area. The higher value of SAVI and lower value of LST were observed in agricultural land with the irrigation facility, horticultural plantation i.e. near to the river and the Girnar forest in south-west part of the study area. Where in the northern parts of the study area, the value of SAVI was lower, and LST was higher in the land without crops or exposed soil. The lower value of MSI shows sufficient moisture in the soil. In the South West part of the study area i.e. near the outlet of the river, the area near the river and the Girnar forest shows a lower MSI value, indicating low soil moisture stress and high soil moisture content. This facilitates the identification of the area under crop, an area under crop with soil moisture stress or low soil moisture, which help to decide to schedule the irrigation in the agricultural land. The variable estimated for the different dates of the cropping season can be used to evaluate the changes in the crop and soil moisture for different crop growth stages.

Key Words: Geospatial technology, Soil moisture stress, Land surface temperature, Soil moisture, Irrigation scheduling.

O/S-III/32

A new model for in situ measurement of unsaturated hydraulic conductivity function

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Hydrologic processes of soils helpunderstandwater quality and quantity,atmosphere-terrestrial connection, nutrient cycling,soil erosion and natural hazards such as floods andlandslides. These hydrologic processes are controlled by unsaturated hydraulic conductivity, K_s. K_s is a function of soil moisture suction and is highly non-linear. A largenumber of K_s functions are proposed by researchers from time to time. Field methods to measure K_s are labour and time intensive and may require a large amount of water for a small area. Shani et al . (1987) first gave a field dripper method using Wooding(1968) theory for in-situ measurement of Gardener's K_s function. Singh (1999) proposed amodel using a steady-state theory of buried pointsource, while Singh et al . (2001) proposed anothermodel based on hemispherical water flow geometryfor estimation of K_s function. The use of field drippers for in-situ measurement of $K_s$is continuing. A new model for in-situ measurement of $K_s$using point source field drippers was developed in the present study and tested with field data. The model was corrected for inaccuracy resulting due to short-term experimentation. A new hypothesis was synthesized and transformed into a governing equation solved for K_s. The first hypothesis was the rate of change of water discharge within the saturated soil mass (dQ/dA) is directly proportional to saturated hydraulic gradient (i) and the second one was the rate of change of water flux within unsaturated soil mass (dQ/dA) is directly proportional to hydraulic gradient (i), water flow geometrical shape (g_s) factor and air entry head (h_e= 1/á). The proportionality constant was taken as K_s. The hypothesis was transformed to a governing equation and solved for K_s. An experiment was conducted with point source field dripper (PSFD) discharges of 4.85, 6.17, 11.69 and 15.06 l hr^{-1}, and respective saturated radii were recorded as 11.90, 15.25, 23.57 and 28.65 cm. Water flux density was plotted against the inverse of saturated radii, and the slope of the straight line and intercept were measured as 98.9780 and 2.3557. The K_s value was obtained as 2.36 cm/hr, and á was 0.0303 cm^{-1}. The corrected value of K_s was 1.89 cm/day, and á was 0.0243 cm^{-1}. The values of K_s were also measured by Shani et al. (1987), Warrick (1985), inverse auger hole method (IAHM), constant head permeameter method (CHPM) and infiltrometer method (IM), and respective values were 2.82, 2.15, 1.35 and 0.67 cm/hr. Per cent deviations of corrected K_s value with a proposed model without correction, Warrick (1985), IAHM, CHPM and IM were -24.87, -49.21, -13.76, 28.57 and 64.55%, respectively. The values of K_s measured by the proposed model were fairly close to the other PSFD methods, hence recommended for field applications.

Key words: Unsaturated hydraulic conductivity, point source field dripper method, inverse auger hole method, constant head permeameter and infiltrometer method

O/S-III/33

Development of geomorphological instantaneous unit hydrograph (GIUH) model for an ungauged watershed

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Geomorphological characteristics can be treated as features of hydrological response. Geomorphological Instantaneous Unit Hydrograph (GIUH) is an effective modelling approach in hydrology for ungauged watersheds.In this study, the geomorphological characteristics of the catchment were related to the basic characteristics of the IUH through the Geomorphological Instantaneous Unit Hydrograph (GIUH). TheJagbudi River catchment was selected as the study area for the presentstudy**.** Jagbudi is a tributary of theVashishti River**.** The Chatav watershed is 47 km away from Dapoli, which lies between17°73'12.0"N Latitude and 73°48'01.6"E

Longitude. The Geomorphological characteristics, including Horton's ratios of the catchments, were extracted from Digital Elevation Model (DEM) using RS data and GIS software called ArcGIS 10.4.1. The morphometric parameters considered for analysis includethe basin's linear, areal, and relief aspects. The watershed has an area of 177.73 sq.km and was 4thorder drainage. The mean bifurcation ratio was 1.68, indicating that the drainage pattern has strong structural control. The basin has a low drainage density of 0.93 km/km^2 and is elongated in shape. The basin's length of overland flow value was 0.54, indicating less structural disturbance and high overland flow. The Bifurcation ratio, Stream length ratio, and stream area ratio of the Chatav watershed were 1.68, 1.06, and 2.17, respectively. These values are further used for the estimation of the shape and scale parameters of the Chatav watershed.

Thirty-five rainfall-runoff events were selected from available rainfall-runoff data. The hydrograph for outlet runoff was derived for each event. The Nash parameters were determined. The value of the shape parameter (n) was 2.70. Scale parameter (K) changed accordingly rainfall-runoff event. Scale parameters ranged from 0.587 to 4.117. These values depend on the velocity of the stream, which ranges between 1.014 to 7.11 m/s. The peak discharge varied from 13.27 to 124 m^3/s. The performance of the GIUH model was evaluated using the error functions, namely efficiency, absolute average error, root mean square error, the average error in volume,percentage error in peak, and percentage error in time to peak. The performance indicators were in a very high to the high level of the acceptable range.

GIUH-based Nash model has adequately simulated the shape of the unit hydrographs. It was found that the model was better at simulating theshape of the unit hydrographs. So, it is concluded that GIUH based model can be used for similar kinds of ungauged watersheds for predicting stream flow.

Keywords: Geomorphological Instantaneous Unit Hydrograph, ungauged catchments, Geographical Information System, Nash model, rainfall-runoff event

O/S-III/34

Genetic diversity assessment of male date palm (*Phoenix dactylifera* L.)under hot arid ecosystem of western Rajasthan

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The cultivation of male date palms plays an essential role in pollination, fruit set, fruit maturity, yield, and quality. It is a dioecious plant, and hand pollination is necessary but due to the lack of sufficient numbers and superior type of male plants availability of pollen grains is limited. ICAR-CIAH, Bikaner is one of the DUS centres for date palm in India and maintains 64 variable germplasm along with eight elite male date palm seedling plants in the field repository. The present study was conducted to the identification of promising male date plants under hot arid conditions for higher pollen production, compatibility, stability and suitability in a hot arid region of western Rajasthan.

Eight date palm promising seedlings were evaluated for morphometric parameters, pollen grain yield & chemical parameters under hot arid conditions. Morphological parameters were ranges *viz.,*flower emergence ranges from January to March, time of spath opening (20.4- 39.8 days), length of spath (32.8-122.4 cm), width of spath (12.4- 19.4 cm), number of spadix (15-26.8), weight of spadix (0.516-1.86 kg), weight of spath (0.259-0.875 kg), weight of inflorescence (0.257-0.990 kg), number of strands spath^{-1} (105-156.8), length of strands (13-33.6 cm), length of central axis (16.8-50.6 cm), length of peduncle (11.8-54.6 cm), number of flowers strands^{-1} (44-104.6), weight of pollen spath^{-1} (7.8-24.8 gm) and pollen yield (129-744.86 gm).Further,among the male seedlings, considerable variability was also recorded with respect to the chemical composition of pollen grains like phenolic (7.95-11.90 mg GAE/g), Flavonoids (0.322-0.496 mg E.Cat./g DW), TAA (11.34-17.55 mg AAE/g DW), total soluble sugar (60.99-134 mg/g) and reducing sugar (3.46-11.63 mg/g) etc. Based on the evaluation, CIAH/DP/M1 & CIAH/DP/M6 were found superior with respect to pollen grain yield per plant (744.86 gm & 529 gm) and other observed parameters under the hot arid ecosystem of western Rajasthan.

O/S-III/35

Rainfall simulation using ann based generalized feed forward (GFF) and multi linear regression (MLR) technique

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In agrometeorological research, rainfall is one of the key criteria for the potential field assessment of flora and fauna. In rainfall research, simulation and modelling are indispensable parts of research methodologies. Rainfall modelling is one of the most critical topics in water resources planning, development and management on a sustainable basis. In this study, an effort has been carried out for the development of the Generalized Feed Forward (GFF) and Multi Linear Regression (MLR) technique for daily monsoon rainfall prediction of Akola(Maharashtra).

The daily data of the monsoon period from (1st June to 30th September) year 2005-2012 were used for training of models, and data of the remaining years 2013-2014 were used for testing of the models. The NeuroSolution 5.0 software and Microsoft Excel were used in the analysis and the performance evaluation indices for developed models, respectively. The best input combination was identified using the input-output combination for the simulation; on the basis of the input combination, 10 best combinations. The input pairs in the training data set were applied to the network of a selected architecture, and training was performed.

The performance of models was evaluated qualitatively by visual observation and quantitatively using various performance indices viz. Mean Square Error (MSE), Coefficient of Efficiency (CE) and Correlation Coefficient (A network structure resulting in the highest value of the coefficient of efficiency and correlation coefficient and simultaneously in the lowest value of MSE was designated as the best performing model. Further, the results of the developed ANN models were compared with Multiple Linear Regression models (MLR). *Results show that ANN models are useful tools for rainfall modelling with reasonable accuracy in the study watershed.* It was found that the models showed better forecasting of rainfall as compared to MLR models. It was concluded from the result that the performance of the GFF(Generalized Feed Forward) model is better than the MLR (Multiple Linear Regression) techniques.

O/S-III/36

Estimating Unsaturated Hydraulic Conductivity Function Using Wetted Front Advance Data of Line Source Field Dripper

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Gardener's unsaturated hydraulic conductivity function (K_h) and saturated hydraulic conductivity function (K_s) are required in designing traditional. They drip irrigation systems, subsurface drainage systems, groundwater discharge, recharge, and moisture movement studies. Ploughed top soils have higher hydraulic conductivity, which keeps changing with farming activities. Conventional measuring K_s of top 15 cm soil depth is not suitable for runoff studies. Point Source Field Dripper Method (PSFDM), based on steady-state drip irrigation theories from point source water flow geometry, has been used to estimate (K_h) under such conditions. The method covers only a small soil volume and hence requires large numbers of measurements for a reliable estimate. Line Source Field Dripper Method (LSFDM) has been used recently for the estimation of (K_h), which covers large soil volume giving a reliable and representative estimate of hydraulic conductivity. Demarcating the saturated front under advancing wetted front conditions is tedious and may result in measuring errors. Wetted front advance is a well-demarcated boundary subjected to a minimum error during measurement. Using steady-state wetted front

data instead of steady-state saturated front data may be useful for a reliable estimate of K_h. There exists a functional relationship between the radius or width of the saturated front advance and the radius or width of the wetted front advance of PSFD or LSFD. K_s values calculated by LSFDM with saturated front data were obtained as 4.08, 3.18, 1.77 and 0.426 cm/hr and $\underline{\alpha}$ as 0.100, 0.100, 0.100 and 0.004 cm^{-1} for Cultivated Recently Tilled Normal Soil (CRTNS), Cultivated Untilled Normal Soil (CUTNS), Cultivated Recently Tilled Sodic Soil (CRTSS) and Uncultivated Untilled Sodic Soil (UUTSS), respectively. K_s-index estimated by LSFDM using steady-state wetted front width were 2.203, 1.433, 1.250 and 0.425 cm/hr and α -index were 0.0437, 0.0280, 0.3162 and 0.00452 cm^{-1} for respective soils. Correction factors calculated for converting K_s-index into K_s and $\underline{\alpha}$ -index into $\underline{\alpha}$ were 1.8519, 2.2173, 1.4164 and 1.0020, and 2.2883, 3.5714, 3.1626 and 0.8849 for CRTNS, CUTNS, CRTSS, and UUTSS, respectively. The proposed method eliminates demarcation and measuring errors of saturated front width. Once the correction factor of specific soil is known, it becomes the reliable and quick method for in-situ K_s estimation.

Keywords: Saturated Hydraulic Conductivity, unsaturated hydraulic conductivity, Line Source Field Dripper, Point Source Field Dripper.

O/S-III/37

Protein expression analysis in wheat (*Triticumaestivum* L.) under moisture stress

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Wheat crops need sufficient irrigation for a healthy yield, and drought stress significantly impacts their productivity. Wheat plants have developed an antioxidative defence system that leads to the development of antioxidants that suppress oxidative metabolism. Drought stress results in oxidative metabolism, which produces free radicals. Four different wheat varieties (C-306, HD-2888, RSP-561, and RSP-566) were under control, and drought stress conditions were examined for various biochemical alterations and protein expression studies. The findings were: total phenol and ascorbic acid content increased among four distinct varieties produced under drought stress conditions; however, chlorophyll, carotenoid, and relative water content decreased among those same four different types. Under drought stress conditions, ascorbic acid and total phenols concentration increased by 24% and 18.14%, respectively. With drought stress conditions, the activities of the antioxidant enzymes catalase, ascorbate peroxidase, polyphenol oxidase, and superoxide dismutase all increased by 43.87%, 99.00%, 25.54%, and 48.53%, respectively. SDS-PAGE and two-dimensional gel electrophoresis were used to study additional protein expression. Under drought stress conditions, SDS-PAGE revealed a band of higher intensity at 60 kDa compared to controlled cultivars. Via two-dimensional gel electrophoresis (2D SDSPAGE), a total of 40 polypeptides in C-306 were identified. Their protein expression patterns would include: 15 polypeptides were equally expressed, 12 polypeptides that were upregulated, 5 polypeptides that were down regulated, 5 polypeptides were un-expressed in control that is they were specifically expressed and 3 polypeptides that were not expressed under moisture stress. In RSP-566, a total of 42 polypeptides were found, and their protein expression patterns included: 8 unexpressed, 7 upregulated, 11 downregulated, 4 polypeptides that were not expressed in the control but were specifically expressed and 12 polypeptides that were not expressed in the drought stress. The regions that experienced drought stress specially expressed themselves and can subsequently be used for sequencing and as expressed sequence tags.

Keywords: Wheat, Biochemical, Antioxidant enzyme, SDS-PAGE, 2-DE

O/S-III/38

Kisan Call Centre: A New Vista for Indian Agriculture Extension System

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Given its range of agroecological settings and producers, Indian Agriculture is faced with a great diversity of needs, opportunities and prospects. The well-endowed irrigated areas, which account for thirty-seven per cent of the country's cultivated land, currently contribute about fifty-five per cent of agricultural production. In contrast, rainfed agriculture, which covers sixty-three per cent, accounts for only forty-five per cent of the agricultural output. In these less favourable areas, yields are not only low but also highly unstable, and technology transfer gaps are much wider than those in irrigated areas. To respond successfully to these challenges, greater attention will have to be paid to information-based technologies. Strengthened means of dissemination will be needed to transmit this information to farmers. Technology generation and transfer will have to focus more strongly than ever on themes of optimization in managing their available resources by producers, sustainability, coping with diversity by adapting technology more specifically to agroecological or social circumstances and raising the economic efficiency of agriculture. To make information transfer more effective greater use will need to be made of modern information technology and communication among researchers, extension workers and farmers.

Keywords: Information needs, Kisan Call Centre, Indian Agriculture

O/S-III/39

Evaluating the impact of soil and water conservation measures on soil erosion using geospatial technology

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Soil erosion is one of India's main causes of land resource decline, affecting agricultural productivity. This problem can easily be overcome with the help of suitable soil and water conservation measures. It has been proven that soil and water conservation (SWC) measures make a lasting contribution to the conservation of natural resources. The present study was conducted to highlight the importance of SWC measures for conserving soil resources at the watershed scale. Central MPKV Campus Watershed is selected as a study area. It is located in the tropical rain shadow region of Western Ghats, Maharashtra. SWC measures are proposed for the watershed based on the topography and soil characteristics of the area. Before and after conservation measures, soil loss from the watershed was estimated using the USLE model combined with RS and GIS techniques. It was found that the average annual soil loss rate will be reduced up to 6.51 t/ha/yr from 18.68 t/ha/yr after the implementation of recommended SWC measures in the watershed. Soil loss will be reduced by approximately 65% once recommended SWC measures are implemented. It was found that SWC measures in the watershed contribute to the protection of natural resources and act as a climate change mitigation measure.

Keywords: Soil erosion, USLE model, RS and GIS, Natural resources, Climate change mitigation

O/S-III/40

Automatic real time remote monitoring system for temperature, humidity and soil moisture using ESP8266 development board

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Farmers must accurately monitor key crop growth factors to use smart farming techniques. The proposed work measures and remotely monitors three fundamental parameters for plant growth: soil moisture, temperature, and humidity.The ESP8266 is a low-cost Wi-Fi microchip programmed using the Arduino IDE to obtain real-time data. The DHT11 and soil moisture sensors were pinned to the developed board as input devices for readings. The board was connected to the internet via the router to retrieve the data remotely. Data has been saved in a database server at Junagadh Agricultural University. We built an application for worldwide access of the Results using open source technologies.The low-cost technology provided in this research work is a good option for monitoring data in a specific region and making it visible worldwide. Researchers can access real-time data from any location, at any time, and in any format they desire.

O/S-III/41

Studies on entophytic bacterial siderophores and plant growth promoting activity.

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Microorganisms produce various types of Fe +3 chelating molecules called SIDEROPHORE. Plants have various types of phytosiderophore, but it is not effective to take up their siderophore compared to microbial siderophore. Under various conditions, plants can take the microbial siderophore directly. It can take the Hydroxamatesiderophore, ferrichrome, ferrichrome A, coprogen, Ferrioxamine B (FOB) and rhodotorulic acid. Also, the microbial siderophore can chelate the various metals. So by using this novel plant-microbe interaction, we can solve the problem of plant micronutrients.

In this present study, we find that different entophytic bacteria can produce siderophores and show plant growth-promoting activity.

Key words : Siderophore, plant growth, chelating agent.

O/S-III/42

Evaluation of Customized Fertilizers for Yield and Quality of FCV Tobacco

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Imbalanced fertilization and continuous nutrient mining from native soil led to nutrient deficiency, declining productivity, and deterioration of soil health. Improper application of nutrients simultaneously because of their form (granular, powder etc..) also leads to the imbalanced application of nutrients. Balanced fertilization in the form of a single formulation maintains a dynamic equilibrium between nutrient application and nutrient uptake by crops and thereby aims to harness benefits for farmers. Customized fertilizers have been developed based on the recommended dose of straight fertilizers being followed for tobacco cultivation. A field experiment was conducted at ICAR-CTRI Regional Station, Kandukur, A.P., during *rabi* 2021-22 to evaluate the effect of customized fertilizers on the yield and quality of FCV tobacco. One formulation of customized fertilizer *viz.,* N: P: K: Ca: S mixture (CF) has been developed based on the recommended dose of fertilizers being followed in Andhra Pradesh for FCV tobacco cultivation. Trac sure containing Zn, Mg, Cu, Fe, B, Mo and Akre shield containing C, H, N and S were tested along with customized fertilizers in different combinations. The treatments

consist of Customized Fertilizer (CF) (Basal) @ 375 kg/ha; CF (Basal @ 200 kg/ha + Top dress @ 175 kg/ha); CF (Basal) @ 375 kg/ha + Tracs sure @ 18 kg/ha (Basal); CF (Basal @ 200 kg/ha + Top dress @ 175 kg/ha) + Tracs sure @ 18 kg/ha (Basal); CF (Basal) @ 375 kg/ha + Tracs sure @ 18 kg/ha (Basal) + Akre Shield @ 1 ml/lit at 25th and 45th DAT; CF (Basal @ 200 kg/ha + Top dress @ 175 kg/ha) + Tracs sure @ 18 kg/ha (Basal) + Akre Shield @ 1 ml/lit at 25th and 45th DAT; CF (Basal) @ 375 kg/ha + $MgSO_4$. 7 H_2O@ 11.25 kg/ha, $ZnSO_4$. 7 H_2O @ 5.14 kg/ha & Borax @ 0.38 kg ha^{-1} (Basal) and Straight Fertilizers of NPK through CTRI Recommendation. A total of eight treatments were laid out in RBD with 3 replications. The experimental soil was sandy loam in texture with pH 7.5, electrical conductivity 0.24dSm^{-1}, organic carbon 2.53 g kg^{-1}, available phosphorus 65 kg ha^{-1}, and potassium 350 kg ha^{-1} in the surface layer.The results revealed that customized fertilizers and other secondary and micronutrient products recorded slightly higher green and cured leaf yields and are at par with the straight fertilizers. Split application of customized fertilizers, secondary and micronutrient products, tracsure and acre shield has shown marginal improvement in yield over straight fertilizers. The quality characteristics of FCV tobacco, *viz.,* nicotine, reducing sugars and chlorides, were not affected by the customized fertilizers and are within acceptable limits. Soil properties were also not affected due to the customized fertilizers. Customized fertilizers are the best option for FCV tobacco to enable the balanced application of nutrients.

Key Words*: Customized fertilizer, Secondary Nutrient, Balanced nutrition, FCV tobacco, Split application*

O/S-III/43

Estimation of Soil Erosion Using Revised Universal Soil Loss Equation (RUSLE) in Google Earth Engine (GEE)

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Soil erosion is a severe issue in India which reduces agricultural land productivity and water availability. Soil erosion is defined as the detachment, transportation and deposition of soil particles from one place to another under the influence of wind, water or gravity forces. The selected watershed for this study was the Mula river basin in the Ahmednagar district. The study area is located at 19^{o} 35' N latitude and 74^{0} 60' E longitude having a geographical area of 2570 km^{2}. Watershed characteristics such as flow direction, flow accumulation, slope, soil erodibility, rainfall erosivity, and soil loss were determined using the Google Earth Engine and ArcGIS. A revised universal soil loss equation (RUSLE) was used to estimate soil loss from the study area. The erosivity factor (R factor) was estimated using monthly and annual rainfall data. Sand, silt, clay and organic matter of soil were used to determine the soil erodibility factor (K factor). Flow Accumulation and Digital Elevation Model (DEM) were used to calculate the topographic factor (LS factor). The vegetation cover factor (C factor) was derived from Normalized Difference Vegetation Index (NDVI). The erosivity factor for the Mula river basin estimated for the year 2020-21 was 327.94 – 1175.20 MJ-mm/ha-hr-yr.The soil erodibility factor of the Mula river basin lies between 0.0251 to 0.0388tonnes-ha-hr/ha-MJ-mm. Average annual soil loss for 2020-21 was found at 15.08 tonnes/ha/yr. The result shows that the RUSLE model using Google Earth Engine (GEE) platform provides an easy and reliable technique for estimating soil loss for a large area in a short time.

Keywords: *Google Earth Engine, Erosivity, Digital Elevation Model, Mula river basin.*

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O/S-III/44

Validation of reference genes for quantitative real-time PCR normalization in chickpea under PGPRs and *Foc* stress condition

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Reverse transcription-quantitative real-time PCR (RT-qPCR) is a common way to study gene regulation at the transcriptional level due to its sensibility and specificity. Still, it needs appropriate reference genes to normalize data. The accurate quantification of a true reference gene allows the normalization of gene expression resulting from different biological and technical constraints since the reference gene is exposed to the same preparation step as the gene of interest. *In the present study,* expression stability was studied with five endogenous control genes, *viz. EF1a, GAPDH, ACT1, UBI* and *IF4ain chickpeaunder Bacillus subsitesK18 seed treatment and Fusariumoxysporum*f. sp. *ciceris* (Padwick) Matuo& K. Sato (*Foc*) stress condition for root and leaves tissue in two chickpea varieties *viz*., WR-315 and JG-62 at 0, 3 and 7 DAT. The amplification plot reported amplification of a single product; further melt curve also showed a single peak for all five genes, which indicated a specific amplified product without dimmers. TheC_T value of all genes ranged from 16.12 to 25.85, where gene *EF1* showed the lowest C_T value (16.12) while *ACT1* showed the highest (25.85). This study found *UBI* as highly stable based on RefFinder recommended comprehensive ranking; however, *ACT1* gene was found most unstable under different treatment conditions over time. Thus, *UBI* can be used for gene expression data normalization of leaves and root tissue under different PGPRs and *Foc* stress conditions.

Keywords : RT-qPCR, reference genes, normalization, *Foc* stress, PGRPs

O/S-III/45

Spatial Distribution of Salts in Soils of a Vineyard in Krishna Valley of Northern Karnataka

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Soils and groundwater of Bagalkot district inherently possess high salt contents. Grape,a commercially important fruit crop of the district, is highly sensitive to salt. A soil survey carried out in 69 vineyards indicated that the soils were slight to moderately alkaline in pH (7.09 – 8.47) while the salinity ranged from slight to moderately saline (0.69 - 1.69 dS m^{-1}). Water soluble cations in soils were found in the order of $Ca^{2+} > Mg^{2+} > Na^{+} > K^{+}$ while, the anions were in the order- $Cl^{-} > HCO_3^{-} > SO_4^{2-}$.

The spatial distribution of salts at 15cm (D_1), 30cm (D_2), 75cm (D_3) and 120cm (D_4) from the plant rows were monitored at two different depths (0-20cm, 20-40cm). The vineyard was also categorized into three different elevation zones - high (E_1), mid (E_2), and low (E_3) regions to assess the movements of salts within the grape rows of the vineyard.In the selected vineyard, the pH of both surface and subsurface soils varied significantly in the order $D_1 = D_2 > D_3 = D_4$. Higher conductivity values were recorded in surface soils (0.83 dS m^{-1}) compared to

subsurface (0.74dS m^{-1}) at all the 4 distances. The soils present in low-lying areas (E_3) recorded higher mean electrical conductivity (0.91 to 0.99 dS m^{-1}) compared to high (0.55 to 0.63dS m^{-1}) and mid-elevation areas (0.76 to 0.86dS m^{-1}) (E_1 and E_2) of the vineyard.Amounts of individual ions varied *w.r.t.* to elevations and distances in the order of $E_3 > E_2 > E_1$ and $D_1 > D_2 > D_3 > D_4$ respectively.

Key words : Salinity, Drip irrigation, Black soils, Spatial distribution, Soil Salinity

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O/S-III/46

Phenological behaviour of*Brassica juncea*and thermal indices as influenced by sowing dates, varieties and fertilizer levels in arid western Rajasthan

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A field experiment was conducted at the Agricultural Research Station, Swami Keshwanand Rajasthan Agricultural University, Bikaner, during two *Rabi* seasons to study the phenological behaviour of *Brassica juncea* and thermal indices as influenced by sowing dates(10 October, 25 October and 9 November), varieties (RGN – 48, Pusa Bold, Laxmi and Vasundhra)and fertilizer levels(75 and 100 % RDF) in arid western Rajasthan. The experiment was laid out in a double split-plot design with three replications. The soil of the experimental field was loamy-sand, alkaline (pH 8.3), having 115.00 kg/ha available nitrogen, low level of available phosphorus (15.2 kg/ha) and medium in available potassium (172.60 kg/ha) up to 0-15 cm soil depth. Results from two years' pooled data revealed that the crop sown on 10 October took 136 days to attain physiological maturity compared to 9 November sowing (128 days). The crop duration decreased with a delay in sowing. The early sown (10 October) crop had significantly higher agrometeorological indices (GDD, PTU, PTI, HTU, HTU-I, HTU-II, PHT, NCT and HUE) at all phonological development stages between 25 October and 9 November. These indices can be very well used as crop performance indicators once these relationships are quantified and tested.

Further results showed a higher number of siliquae/plant, many seeds/siliquae, test weight, and seed and straw yield obtained under crop sown on 10 October compared to the rest of the sowing dates. Variety Pusa Bold recorded a higher number of siliquae/plant, number of seeds/siliqua, test weight, and seed and straw yield than RGN–48, Laxmi and Vasundhra. A significantly higher number of siliquae/plant, number of seeds/siliqua, test weight, and seed and straw yield was obtained with the application of 100% RDF than 75% RDF.

Keywords: *Mustard, GDD, PTU, PTI, HTU, PTI, HUE*

O/S-III/47

Assessment of Sediment Yield and Water Quality of Bhogdoi River Basin Using Remote Sensing and GIS Techniques

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An investigation was carried out to assess the sediment yield and water quality of Bhogdoi river basin using remote sensing and GIS techniques. Based on satellite data, three distinct topographic units were identified in the study area which included: Upstream, Middle stream and Downstream covering an area of 46.72 sq. km, 76.40

sq. km. and 21.09 sq. km, respectively. GPS based surface and core soil samples were collected from the study area which were analyzed for various physico-chemical and erosion related properties. Water samples of Bhogdoi river both in pre monsoon and post monsoon season, as well as sediments and groundwater samples were also collected for analyzing various quality parameters. Various thematic maps pertaining to important hydrophysical properties along with soil and nutrient erosion were prepared under ARC GIS environment.

The studied soil samples showed wide variations in texture varying from sandy loam to silty clay loam, while massive and sub angular blocky structure were found to be dominant in the area. The bulk density of the soils ranged from 1.20 Mg/m^3 to 1.68 $Mg/m^3$and the particle density exhibited a range from 2.08 Mg/m^3 to 2.59 Mg/m^3. The porosity of the soils was observed in a range from 30.00% to 48.70%. The hydraulic conductivity of the soils in the studied basin varied from 0.85 cm/hr to 8.32 cm/hr. The water holding capacity of the soils ranged from 14.41% to 53.55%. The value of field capacity, permanent wilting point and available water content of soils in the studied area varied from 11.41% to 30.32%, 3.23% to 15.55% and 5.92% to 19.61%, respectively. Hydraulic properties like porosity, water holding capacity, field capacity, permanent wilting point and available water content was found to be higher in the lower elevation area. The pH and electrical conductivity of the analyzed soil samples ranged from 4.16 to 5.39 and from 0.011 ds/m to 0.066 ds/m, respectively. The organic matter content of the studied soils varied from 6.21 g/kg to 17.58 g/kg. The total nitrogen content of the experimental site was found to be low to medium which varied from 0.085% to 0.228%. Total phosphorus content of the soils was low ranging from 0.012% to 0.043%. Total potassium content of the studied area was found to be varying from 0.472% to as 2.157%. The available nitrogen, phosphorus and potassium in the analyzed soil samples varied from 75.62 kg/ha to 413.95 kg/ha, from 14.50 kg/ha to 52.41 kg/ha and from 45.05 kg/ha to 279.24 kg/ha, respectively. Organic matter, total nitrogen and available nitrogen were found to be maximum in the downslope.

The macro-aggregate of soils of the studied area varied from 40.45% to 69.75%, while the micro-aggregate ranged from 30.24% to 59.54%. The mean weight diameter of soils of the studied area ranged from 1.36 mm to 2.48 mm. The dispersion ratio, erosion ratio and erosion index of soils of the experimental site was found to be within the range of 0.08 to 0.55, 0.02 to 0.33 and 0.05 to 0.37, respectively. The erodibility indices were found to be highest in upper elevation area. The annual soil loss, sediment yield and nutrient erosion were found to be maximum in upstream followed by middle stream and downstream. It was observed that 39.68% area of the Bhogdoi river basin was severely eroded, while 2.64% area was very severely eroded.

The sediments of Bhogdoi river were found to be coarser and sandy loam was the dominant texture. The pH of the collected sediments was found in a wide range from strongly acidic to slightly alkaline (4.81 to 7.70), while the electrical conductivity of the sediments was found to be low which ranged from 0.012 to 0.047 ds/m. The organic matter content (mean value 0.38 g/kg) and total nitrogen (mean value 0.038%) of the sediments of the Bhogdoi river were also found to be low. The total phosphorus and total potassium of the sediment samples exhibited a range from 0.007% to 0.017% and from 0.051% to 1.375%, respectively.

Surface water parameters like pH, electrical conductivity, total dissolved solid, chloride, carbonate, bicarbonate, calcium, magnesium, total hardness, residual sodium carbonate, arsenic and fluoride were found more in pre monsoon period having mean values of 7.05, 0.142 ds/m, 168.54 mg/l, 93.81 mg/l, 19.84 mg/l, 135.18 mg/l, 36.68 mg/l, 5.42 mg/l, 42.10 mg/l, 0.60 me/l, 0.033 mg/l and 0.740 mg/l respectively than that of post monsoon season with average values of 6.90, 0.140 ds/m, 167.76 mg/l, 92.71 mg/l, 9.23 mg/l, 106.08 mg/l, 27.74 mg/l, 4.86 mg/l, 32.60 mg/l, 0.27 me/l, 0.029 mg/l and 0.711 mg/l respectively. On the contrary, quality parameters like dissolved oxygen, chemical oxygen demand, total suspended solid and turbidity were observed more in post monsoon season with mean values of 7.33 mg/l, 12.80 mg/l, 20.07 mg/l and 11.86 NTU, respectively than pre monsoon season having average values of 6.23 mg/l, 10.09 mg/l, 15.50 mg/l and 6.91 NTU, respectively.

All the groundwater parameters like pH, electrical conductivity, dissolved oxygen, chemical oxygen demand, total dissolved solid, total suspended solid, turbidity, chloride, carbonate, bicarbonate, calcium, magnesium, total hardness, residual sodium carbonate and fluoride were found to be under permissible range of FAO irrigation water guidelines with mean values of 7.13, 0.160 ds/m, 2.11 mg/l, 30.10 mg/l, 268.17 mg/l, 25.02 mg/l, 10.14 NTU, 75.63 mg/l, 8.00 mg/l, 186.11 mg/l, 53.11 mg/l, 3.24 mg/l, 56.35 mg/l, 0.40 me/l and 0.972 mg/l, respectively except two samples of arsenic.

Water quality index of Bhogdoi river was found to be low in the upstream which increased towards downstream. It was more in pre monsoon season (mean value 25.80) than in the post monsoon season (mean value 21.10). The water quality index of groundwater was found to be slightly higher (mean value 32.46) than the surface water in the study area. Based on the water quality index value, both the surface water and groundwater of the study could be categorized under Class I with no restriction for using in irrigation purpose.

Soil erosion could be considered as one of the most important land degradation processes having both on site and off site detrimental impacts like sedimentation of the reservoirs, groundwater pollution, decrease of effective root depth, nutrient and water imbalance in the root zone which eventually lead to deterioration in soil quality, structure and stability. The estimation of soil loss and sediment yield following USLE and SDR model respectively aided in demarcating the areas with high sediment yield threat. In the present investigation, it was found that the sediment yield was found more in areas with higher elevation as compared to the lower elevation due to high soil loss in those areas. Hence, by adopting appropriate management practices like vegetative bunds, mulching, use of farm yard manures, growing of nitrogen fixing crops could sufficiently reduce the soil loss as well as nutrient erosion from the area which lead to reduction of sediment yield and increased in productivity of soils.

GIS based sediment yield and thematic maps were prepared which could help the planners and administrations in identifying the potential risk areas for adoption of appropriate conservation practices and better use of agricultural lands.

O/S-III/48

SPAD Meter based Nitrogen Management in Direct Seeded Rice

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Direct seeded rice (DSR) is becoming popular these days due to its low input demanding nature. The short duration cultivars with need based nutrient application and integrated weed management have motivated the farmers towards DSR. A field experiment was conducted at the Bihar Agricultural University, Sabour, Bhagalpur, Bihar, India during *kharif* 2018. The experiment was laid out in a split plot design with three replications consisting of three rice cultivars (Sabourardhjal, Shushksamrat and Shabhagidhan) as main plot treatments: and four N management practices (No N (control), Fixed time N management (FTNM), Real time N management (RTNM) and Adjustable dose of N management (ADNM)) as sub plot treatments. The N management practices markedly affected the growth, yield and yield attributes in DSR. The plant height, leaf area index and crop growth rate was found to be maximum in FTNM in which 100% recommended dose of N was applied. The growth parameters under ADNM using SPAD meter with a lower dose of N (79% recommended dose of N) was found to be statistically at par with FTNM. However, the yield attributes differed significantly among the rice cultivars as well as among various N management practices. Sabourardhjal

recorded the highest number of grains panicle^{-1} (151.7) but the filled grain percentage in Sabourardhjal was found to be statistically lower (67.0) than that of remaining cultivars. Shushksamrat recorded the maximum grain yield (3956 kg/ha) which was statistically at par with Shabhagidhan (3752 kg/ha). Amongst N management treatments, the highest grain yield was recorded in ADNM (4177 kg/ha) with 21% lower dose of N than that of FTNM. The FTNM and ADNM treatment gave similar grain yields but the N use efficiencies were statistically lower in FTNM. The agronomic N use efficiency (AE_N), N recovery efficiency (RE_N) and the partial factor productivity of applied N (PFP_N) were found to be 23%, 17% and 22% higher in ADNM as compared to FTNM. The highest net return (Rs. 48681/-) and B: C ratio (1.56) were also found in ADNM and amongst the main plots, Shushksamrat has gave higher net returns (Rs. 44118/-) and B: C ratio (1.43). Thus the SPAD based ADNM strategy was found to be good for maintaining higher rice grain yield in DSR method with greater N use efficiency and higher profitability.

Keywords: SPAD Meter, Rice, Agronomic N Use Efficiency, N Recovery Efficiency, Partial Factor Productivity

Session-IV

O/S-IV/1

Assessment of groundwater quality for irrigation in Jalalpore taluka of Navsari district of South Gujarat

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Determination of water quality is the most important aspect to determine its suitability to grow crops. Irrigation Water Quality Index (IWQI) is a very useful and efficient method to evaluate the suitability of water quality and for communicating the information on overall quality. The integration of the geographic information system (GIS) platform into the assessment procedure allows the decision maker to create parameter maps for easy visual interpretation. A total of twenty groundwater samples were collected before and after the monsoon in the year 2020-2021 from ten different villagesof Jalalpore taluka of Navsari district of South Gujarat and were measured for physicochemical parameters as well as major ion chemistry to evaluate the groundwater suitability for irrigation purposes. The temporal variations were analyzed by comparing the pre-and post-monsoon groundwater chemistry. Irrigationwater samples were analyzed forpH, EC, TDS, Hardness, Calcium, Magnesium, Sodium, Potassium, Carbonate, Bicarbonate,Chloride and Sulphate with the help of the standard method and IWQI, sodium adsorption ratio (SAR), exchangeable sodium percent (SSP or %Na), residual sodium carbonate (RSC) and permeability index (PI) have been evaluated for irrigation suitability. Overall based on IWQI, 45 % and 65 % of water samples were classified under severe restrictions before monsoon and after monsoon respectively. The presence of high salt content in groundwater during the post-monsoon season reflects the leaching of salts present in the unsaturated zone by infiltrating precipitation.

Keywords- ground water quality, Water Quality Index, Permeability Index, Hardness

O/S-IV/2

Variation of soil organic and inorganic carbon in relation to irrigated and rainfed situations under cultivating of hybrid/*Bt*/*Desi* cotton crop of South Gujarat

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Soil organic carbon (SOC) is a good indicator of soil productivity potential. It affects the physical, chemical and biological properties of the soil and plays a crucial role in sustaining soil quality, agricultural production and environmental quality. Soil organic, inorganic (IC) and total carbon (TC) content have a large bearing on soil quality and ultimately on crop productivity. In these districts, farmers are raising *desi* cotton crops, whereas in other areas farmers are cultivating either hybrid or *Bt*cotton under irrigated conditions. *Desi* cotton in general, are being grown under the rainfed condition with supplementary irrigation. Keeping all the points in view, the study has planned on the determination of soil organic, inorganic and total carbon as influenced by irrigated and rainfed situations under cultivation of hybrid/*Bt*/*Desi* cotton crop of Bharuch, Surat and Narmada districts of Gujarat. The result revealed that Irrigated soils in general were found to have more SOC content as compared to that rainfed soils. The results from surface soils revealed that SOC and SIC ranged from 2.70-9.41 g kg^{-1} and 0.95-14.40 g kg^{-1}, respectively in irrigated soils, while the corresponding values were 2.85-7.90 g kg^{-1} and 1.58-19.40 g kg^{-1}, respectively, in rainfed soils. However, SOC content inirrigated soils of Bharuch district, Surat and Narmada district varied from 'low to high', 'low to high' and 'low to 'medium', respectively with a range from 3.30 to 9.41, 5.41 to 8.55 and 2.70 to 7.42 g kg^{-1}. In the case of rainfed soils of Bharuch district, Surat and Narmada district SOC varied from 'very low to high', 'low to medium' and 'low to 'medium', respectively with varying from 3.15 to 7.90, 4.20 to 7.21 and 2.85 to 5.40 g kg^{-1}, respectively. Overall mean SIC of rainfed soils was higher (8.79

g kg^{-1}) as compared to that of irrigated soils (4.93 g kg^{-1}). In irrigated soils of Bharuch, Surat and Narmada district SIC content was rated as 'low to high', 'medium to high' and 'low to medium', respectively with SIC varying from 0.95 to 14.40, 5.14 to 6.91 and 1.68 to 12.10 g kg^{-1}, respectively. In the case of rainfed soils SIC content in the above districts in chronological order was rated as 'medium to high', 'high to very high' and 'medium to very high', respectively and SIC content varied from 1.58 to 11.64, 9.45 to 19.40 and 2.27 to 10.32 g kg^{-1}, respectively. When the mean SOC content of all irrigated soils was compared with that of rainfed soils, it was noticed that rainfed surface soils were quite inferior to irrigated counterparts showing poor productivity index.

Keywords:*Cotton, organic carbon, inorganic carbon, irrigated, rainfed*

O/S-IV/3

Effect of potassium and zinc on yield and nutrient content of chickpea

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A field experiment entitled "Effect of potassium and zinc on yield and nutrient content of chickpea and fractions of potassium and zinc in soil" was carried out on Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand during the rabi season of the year 2020-21. The experiment comprising nine treatment combinations consisted of three levels of potassium (0, 20 and 30 kg/ha) and three levels of zinc (0, 2.5 and 5.0 kg/ha). These treatments were evaluated in Randomized Block Design (factorial) with four replications. Results of the experiment revealed that seed yield and hulm yield were significantly influenced by different levels of potassium and zinc. The treatment K_2 (40 kg K_2O/ha) significantly increased seed yield (2334 kg/ha) and haulm yield (3767 kg/ha) of chickpea than other treatments except for treatment K1 (20 kg K_2O/ha) in the case of haulm yield. Among different levels of zinc, significantly maximum seed yield (2251 kg/ha), haulm yield (3689 kg/ha) of chickpea were found under the treatment Z_2 (5.0 kg Zn/ha) which remained at par with the treatment Z_1 (2.5 kg Zn/ha). The interaction effect of different levels of potassium and zinc was significant seed yield (2504 kg/ha) was remarkably increased by the treatment combinations of K_2Z_2 (40 kg K_2O and 5.0 kg Zn/ha) than rest of the treatments excluding treatment combinations K_1Z_2 (20 kg K_2O and 5.0 kg Zn/ha) and K_2Z_1 (40 kg K_2O and 2.5 kg Zn/ha). The treatment K_2 (40 kg K_2O/ha) significantly increased the N, P, K and S contents in chickpea seed and haulm than other levels of potassium except for treatment K_1 (20 kg K_2O/ha) in case of N and P contents in seed and N content in haulm. The Zn content in seed and haulm was significantly increased with treatment Z_2 (5.0 kg Zn/ha) and remained at par with treatment Z_1 (2.5 kg Zn/ha). The overall results showed that combined application of K_2O at 40 kg/ha and zinc at 2.5 kg/ha was found to be beneficial for achieving a higher yield of chickpea as well as nutrient contents of chickpe.

O/S-IV/4

The poor yield of paddy in salt-affected soils

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On farm, the trial is one of the unproven technology of the KVK Quality seeds, soil testing and INM is the basic problem of the farmers. KVK(ICAR-CSSRI-RRS) Hardoi II conducted an On Farm Trial on assessment of a salt tolerant variety of paddy with gypsum @10.5 ton/ha application during kharif 2021. The Major problem in the district and farm is alkalinity and salinity of the soil. Therefore, Variety CSR 46 performed well with gypsum in farmer's fields over farmers' practices (T0). The result showed that T1 gave a higher yield i.e.,48.52q/ha in comparison to T0 i.e., 22.35 q/ha, also improvement in BCR and soil health was recorded in trials.Farming situation is irrigated clay loam. I have taken two treatments with five replications. Soil sample taken from all fields initially and after harvest of both crop results indicated that the soil fertility is low N,P ,medium OC per

cent, K, neutral to alkaline in soil reaction and normal conductivity. In case of paddy plant height (105.85), number of tillers per m2 (299.75). number of ear per m2 (275.57).

O/S-IV/5

Efficient utilization of aquaculture effluents to maximize seed oil content of *Salicornia brachaita* Roxb

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This paper focuses on the conference's main objectives, i.e., sustainingproductivity in the era of climate change while managing scarce natural resources. The article also draws attention to one of the conference's thematic sessions: Coastal ecosystem and aquaculture. *Salicornia brachaita*Roxb is an obligate halophyte grows in saline condition. Saline soils are barren land, and integrated management of aquaculture effluent wastewater and *S.brachaita* production can address food security and poverty reduction issues in the face of climate change and energy security. The study addresses the challenge by adopting integrated aquaculture through the utilization of wasteland and recycling the nutrient-rich aquaculture effluent.This work evaluated the effect of aquaculture effluent and seawater on *S.brachiata*Roxboil content for irrigation. *Salicornia* was grown in the field using a split plot design (SPD) with three factors (S- Sources of irrigation, M-Methods of sowing, F-Levels of fertilizer) at Central Soil Salinity Research Station, Dhanti-Umbharat, Navsari, India. The source of irrigation aquaculture effluent (S_2) (26.64 per cent) indicated higher oil content than seawater (S_1) (26.25 per cent). In the case of levels of fertilizer (F) the 100 per cent RDF (F_3) (27.38 per cent) was significantly higher than 50 per cent RDF (F_2) (26.70 per cent) and no fertilizer (F_1) (25.26 per cent). However, all interaction of the factors at different levels was found to be non-significant for seed oil content. The seed oil was high in unsaturated fatty acids (85.87%), compared to saturated fatty acids(11.43%). *Cis*-linoleic acid (C18:2) was the major polyunsaturated fatty acid. Thus, *Salicornia* can be presented as alternative to food/oil production with saline effluent from aquaculture on the coastal salt-affected soils of South Gujarat.

Keywords : *Salicornia*, oil, fat, fatty acid, aquaculture, effluents

O/S-IV/6

Assessment of warming in the coastal belt area of Southern Saurashtra region of Gujarat

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The historical records of daily maximum and minimum temperature of 365 days of 33 years (1973-2005) for Shingoda basin were collected from the observatory, JAU, Junagadh and Kodinar. The RCA4 RCM simulated daily maximum/minimum temperature data(50kmx50km) for the baseline period (1951-2005) and future scenario (2006-2100) for the IPCC SRES rcp4.5 for one grid point falling in Shingoda basin of coastal belt area were collected from IITM, Pune. The temperature simulated by RCA4 RCM during the baseline period was compared with that of past (1951-1977) and future periods (2006-2100), which were bias corrected using the most commonly used, accurate and recommended method, i.e. Probability Distribution Mapping method.

The RCA4 RCM (EC-Earth GCM) simulated daily minimum temperature after bias corrections using Gausian

probability distribution shows that the warming trend of daily minimum temperature from 1951-2005 to 2006-2100 for the annual, winter, summer and monsoon seasons is found to increase from 0.026oC/year to 0.041oC/year, a stable trend to 0.025oC/year, 0.037oC/year to 0.038oC/year and 0.035 to 0.054oC/year for the IPCC projected emission scenario of rcp4.5. It indicated that the Tmin would increase at the mentioned rate in the future. The warming rate of Tmin during the annual, summer and monsoon seasons would be 1.58, 1.03 and 1.50 times higher during 2006-2100 as compared to 1951-2005. The warming trend of minimum temperature in the winter season is found stable during the past(1951-2005) but increases at the rate of 0.025oC/year during the period of 2006-2100. The warming trend of maximum temperature from 1951-2005 to 2006-2100 for the annual, winter and monsoon seasons was found to increase from 0.019oC/year to 0.021oC/year, 0.020oC/year to 0.021oC/year, 0.015oC/year to 0.020oC/year, while the trend reduces in summer from 0.024 to 0.021oC/year for the IPCC projected emission scenario of rcp4.5. It indicated that the warming trend due to Tmax would increase in the future for winter and monsoon seasons while reducing for summer. The warming rate in the winter and monsoon season of Tmax would be 1.05 and 1.33 times higher during the 21stcentury as compared to the latter half of the 20th century. While warming trend due to Tmax will be reduced by 1/1.13 times in the summer season during 2006-2100 with respect to 1951-2005.

The warming trend of daily mean temperature from 1951-2005 to 2006-2100 for the annual, winter, summer and monsoon seasons was found to increase from 0.018oC/year to 0.023oC/year, 0.009 to 0.020oC/year and 0.019oC/year to 0.026oC/year, while reduces for summer from 0.025 to 0.021oC/year for the IPCC projected emission scenario of rcp4.5.Thus, the warming trend will exist at varying rates during different seasons of the year.

Key words: Climate change, RCA4 RCM, Model, warming trend, temperature

O/ S-IV/7

A study to check the efficiency of kitchen waste formulation on soil salinity reclamation.

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Our land is divided into many zones with highly variable climates and weather patterns. These climatic conditions have a significant impact on the ecosystems in these zones. The terrain of Kachchh is semi-arid, with some areas being completely parched. So salinity is a key limiting factor in this area, preventing the availability of fundamental nutrients in the soil.Using traditional fertilizers to solve this problem more quickly risks additional adverse effects. Research using kitchen waste formulation was conducted to examine the impact of formulations made from kitchen waste on soils that are impacted by salinity in several locations of Kachchh. A traditional fertilizer and waste formulation's potential were compared. Three replicates ofeach treatment were put, and pots were sown with mung beans(Vigna radiate L.). The study amply demonstrated that waste formulations are a helpful tool and a viable replacement for chemical amendments to reduce soil salinity.

Key words: bio formulation, salinity, arid climate, organic waste, chemical amendments.

O/S-IV/8

Climate change impact on reference evapotranspiration in coastal region of southern Saurashtra of Gujarat

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The bias correction of the RCA4 RCM for RCP4.5 simulated climatic data of grid pointsfalling in the Shingodabasin was made through a probability distribution approach and fed into the SWAT model. The daily reference evapotranspiration(ETo) as output through the SWAT model run was analyzed for the climate change impacts assessment. The monsoon, summer and winter seasons were considered from 1st June to 31st October, 1st November to 15th February and 16th to 31st May monsoon, winter and summer seasons respectively. The average annual reference evapotranspiration is decreasing from 1951 to 2100 and found as 1771mm, 1746mm, and 1657mm, during the period 1951-2005, 2006-2050 and 2051-2100, respectively. Similarly, the seasonal reference evapotranspiration was 478mm, 498mm and 497mm in the winter season, 586mm, 613mm and 607mm in the summer season, and 707mm, 635mm and 554mm in the monsoon season during the period 1951-2005, 2006-2050 and 2051-2100 respectively. The reference evapotranspiration during the monsoon season was higher than during the summer season because of more considered days. The reference evapotranspiration increases at 0.297mm/season/year during the winter and summer season during the period 1951-2100, while it decreases for the annual and monsoon season at the rate of 1.5335mm/year and 1.025 mm/season. The Maan-Kendall and Sens slope statistics support the stable crop evapotranspiration trend during monsoon.

Key words: Model, simulation, Reference Evapotranspiration (ET0), climate change, Mann-kendall and Sens slope

O/S-IV/9

Extreme temperature events trend over Kerala Coast

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A computation study was conducted to assess the trend in the temperature extremes over a coastal district ofKerala viz., Alappuza and Kannur during 1975-2020 using ETCCDI indices through RClimDex software and statistical significance is estimated using Mann–Kendall (MK) non-parametric test and linear regression. In Alappuza the annual mean maximum temperature (mean T_{max}), Warm days (TX90p), Warm spell duration indicator (WSDI), diurnal temperature range (DTR), and maximum of maximum temperature (TXx) increased by 0.023°C, 0.158 days, 0.524 days, 0.777 days, 0.024 °C, and 0.026 °C respectively. Similarly, in the Kannur district, the annual mean maximum temperature (mean T_{max}), annual mean minimum temperature (meanT_{min}), warm nights (TN90p), warm days (TX90p), warm spell duration indicator (WSDI), diurnal temperature range (DTR), maximum of maximum temperature (TXx) minimum of maximum temperature (TXn), maximum of minimum temperature (TNx), and a minimum of minimum temperature (TNn) increased by 0.054 °C, 0.032 °C, 0.665 days, 0.652 days, 0.854 days, 0.022 °C, 0.054 °C, 0.021 °C, 0.021°C and 0.052 °C respectively while cool nights (TN10p) andcool days (TX10p) were decreased by -0.258 days and -0.577 days respectively. Out of the 13 temperature indices, 6 and 12 showed a significant trend in Alappuza and Kannur, respectively.Warming of both the study districts is evident as most of the warming indices showed a strong positive trend, and cooling indices showed a strong negative trend. It also reveals the increasing incidence of extreme temperature events over Kannur compared to Alappuza.

Keywords: *Temperature, Extreme weather events, Kannur, Alappuza, RClimDex, Trend analysis*

O/S-IV/10

Effect of salinity on bio-chemical parameters of Pearl millet (*Pennisetum glaucum* L.) varieties

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An experiment was conducted at the Department of Soil Science andAgricultural Chemistry, College of Agriculture, Junagadh Agricultural University, Junagadh, to assess the "Effect of salinity on bio-chemical parameters, nutrient composition and yield of pearl millet (Pennisetum glaucum L.) varieties" during the summer season of 2017.The result revealed that the yield and yieldattributes, quality parameters, biochemical parameters and nutrient uptake weresignificantly influenced by the different varieties of pearl millet and salinity levels. Significant differences wereobserved in proline accumulation among varieties. The highest (1.17 µmole gf.wt-1) proline accumulation was found with variety GHB-538 (V1) at 45 DAS. The proline content in varieties was observed in decreasing order of GHB-538> GHB-732> GHB-744> GHB-905>GHB-558. Among the different tested varieties, variety V1 (GHB-538) produced significantly higher RWC, chlorophyll a, chlorophyll b and total chlorophyll content than other varieties. In the case of chlorophyll a, chlorophyll b and total chlorophyll content, it has also remained at par with variety V3 (GHB-732) at 45 DAS. The proline accumulation significantly increased with increasing salt concentration. The maximum (1.22 µmole gf.wt-1) proline accumulation was observed at salinity level S4 (EC 8 dS m-1). The different salinity levels significantly affect biochemical parameters like RWC, chlorophyll a, chlorophyll b and total chlorophyll content. These parameters are highest at salinity level S1 (EC 2 dS m-1). In the case of RWC and chlorophyll, the content remains statistically at par with salinity level S2 (EC 4 dS m-1). The combined effect of variety and salinity significantly affected proline accumulation with variety GHB-538 (V1) and salinity level S4 (8 dS m-1) at 45 DAS. The combined effect of variety and saline irrigation water on RWC and chlorophyll content was found with variety V1 (GHB-538) and salinity level S1 (< 2 dS m-1). In the case of chlorophyll and total chlorophyll content, the combined effect was found with variety V3 (GHB-732) and variety V5 (GHB-558) at salinity level S1 (< 2 dS m-1), respectively, at 45 DAS.

Keywords: Pearl millet, salinity levels, varieties, bio-chemical parameters, proline, chlorophyll

O/S-IV/11

Utility of harvested rainwater in farm ponds of saline area

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Harvesting rainwater through surface storage is one of the options to combat the frequently occurring drought condition in rainfed agriculture. The farming practices in Purna Vally of western Vidarbhaare rainfed since groundwater resources are not suitable for irrigation. Construction of farm ponds in individual farmer's fields or on a community basis for harvesting run-off water and recycling stored water for irrigation and other propose when water is deficient is a very effective and efficient method of facing the challenge of water scarcity in rainfed areas. Irrigation water quality is very important in improving crop productivity and maintaining soil health, especially in saline areas. The information on the water quality of harvested rainwater in farm ponds of the saline area is not available. Hence, an attempt has been made to study the water quality in farm ponds and its effect on soil health and crop productivity after irrigation using different energy sources for lifting the water. The study was carried out on 11 dugout-type farm ponds from the Ghusar village in Akola taluka of Akola district.

The harvested rainwater in farm ponds was only used as protective irrigation for rabi crops through a sprinkler irrigation system operated by either an electric pump, diesel pump, or tractor-operated pump. One protective

irrigation through a sprinkler irrigation system increased gram crops' rainfed productivity by 128.88 per cent and cotton crops by 52.82 per cent. The values of EC (0.16 to 0.36) dSm-1, pH (7.54 to 8.66), SAR (1.02 to1.78) me l-1 and RSC (0.2 to 0.4) me l-1 in harvested rainwater indicated that the cations and anions were in acceptable limits of safe quality water for protective irrigation. The use of harvested rainwater in farm ponds in Ghusar village of the saline area was also found to be within safe limits from a soil health point of view, and it maintains soil fertility.

Keywords - Farm pond, Water quality, Soil Health

O/S-IV/12

Water use efficiency studies and water management techniques for higher water productivity under medium irrigations projects of Telangana state of Southern India

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Water is one of the most important inputs for sustainable and profitable agriculture. The prevailing water use efficiency of irrigation projects is in the range of 30 to 40% which could be enhanced to about 60% through systemic improvement. There is immense scope for improving irrigation efficiency & saving the huge volume of water for additional irrigation/other beneficial use.Keeping these considerations in view, baseline studies for improving water use efficiency of 5 medium irrigation projects namely Sathnala, Vattivagu, Musi, Pedavagu and Taliperu of Telangana State of Southern India was conducted during 2017-2021 under the externally funded project from National Water Mission, Government of India. The main objective of the study is assessing the water use efficiency of medium irrigation project and identification of measures for improving the efficacy of created facilities. The overall water use efficiency of the medium irrigation projects were worked out based on reservoir filling efficiency, conveyance efficiency, on farm application efficiency, drainage efficiency, project water use efficiency, irrigation potential created and utilized. These efficiencies were worked out based on the field experimentation and the data collected from primary and secondary sources. The reservoir filling efficiency of the projects varies from 85-97 %. The conveyance efficiency of the canal networks varies from 62-83%. The overall water use efficiencies of medium irrigation projectes varied from 24 to 52%. The lining of canal networks and proper maintenance of canals has significantly increased the conveyance efficienciesupto 96%. The water saving technologies such as alternate wetting and drying, direct seeded rice cultivation, rotational supply of irrigation water and micro irrigation techniques has significantly increased the on farm efficiency in these project commands. These technologies need to be upscaled for increasing the water use efficiency, productivity and equity in the canal command areas.

Key words: medium irrigation projects, water use efficiency, on farm efficiency, water saving technologies

O/S-IV/13

Horticulture (Fruit tree) based agroforestry systems for livelihood security in India

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India's food production has increased since independence but owing to the rising population of the country, recent reformation in the food supply is insufficient to reach out to the nutritional needs of people. Agroforestry with appropriate tree crops is one of the options to address the challenge of food and nutritional insecurity. Over 1.2 million people practice agroforestry worldwide. In India, approximately around 25.32 Mha area is occupied by agroforestry. Among various kinds of agroforestry systems, combining fruit tree species in agroforestry

systems could ensure a year-round supply of key nutrients. Fruit-based cropping systems can now be considered to be the ideal strategy to provide food, nutrition and income security to the people. Integration of crops with fruit trees yields multiple outputs and is more profitable than sole cropping. However, numerous challenges preclude achieving optimal benefits from the horticulture-based agroforestry system, with the application of suitable solutions that can be faced successfully.

Keywords: *Agroforestry, food, nutrition, security, fruit tree*

O/S-IV/14

Impact of INM and intercrop on soil properties under Teak (*Tectona grandis* L. f.) based agroforestry system

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Thefield experiment was conducted during the summer season of the year 2019 and 2020.Okra was grown as intercrop var. GAO-5 at College Farm (Block-A, Plot No-21), N. M. College of Agriculture, Navsari Agricultural University, Navsari, Gujarat, India. The trial was framed with twelve different treatments comprised of combinations of vermicompost, neem cake and chemical fertilizers in various proportions i.e. 25 per cent, 50 per cent, 75 per cent and 100 per cent of the recommended dose of nitrogen in the form of organic and inorganic fertilizers under teak plantation and open condition in Randomized Block Design (RBD) consisting of three replications. The study revealed that minimum soil pH (7.46), EC (0.652) and maximum available nitrogen (333.05 kg ha-1) and SOC (0.860%) content in soil were noted in T8: 100% RDN through Vermicompost under teak-based agroforestry system. While available phosphorus content (92.90 kg ha-1) in the soil at harvest of okra crop was recorded maximum in T9: 100% RDN through Neem cake under agroforestry systems. At the time of okra harvest available potassium content in soil was found to maximum (734.04 kg ha-1) in T12: 75% RDN from Neem coated urea + 25% RDN through Vermicompost in open condition. Whereas, maximum soil pH (7.76), EC (0.921) and lowest available nitrogen (265.22 kg ha-1), phosphorus (69.46 kg ha-1), SOC (0.477%) was noted in T11: 100% RDF through chemical fertilizer in open condition while lowest available potassium in soil (537.30 kg ha-1) was registered in T10: sole tree crop. From the study, it can be concluded that under a teak-based agroforestry system the soil chemical properties improved as compared to open filed conditions.

Keywords: Soil Properties, Integrated Nitrogen Management, Fertilizer, Okra, Teak, Agroforestry System

O/S-VI/15

Correlation studybetween climatic parameters anddifferent phenology stages of mango varieties under South Gujarat conditions

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The present investigation was conducted at Navsari Agricultural University, Navsari (Gujarat, India) during two consecutive seasons (2019-20 and 2020-21) to determine the degree of correlation between climatic parameters and duration for different phenophases in seven mango varieties *viz.*, Sonpari, Alphonso, Amrapali, Kesar, Dashehari, Totapuri and Rajapuri. Climatic parameters *viz*., temperature, relative humidity, wind velocity, bright sunshine hours and rainfall were considered as independent variables and different phenological stages *viz.,* days to FBD, panicle initiation, flower opening, grain stage fruits, pea stage fruits, marble stage fruits and maturity as dependent variables. Results revealed that climatic parameters *viz.,* temperature (maximum and minimum), relative humidity (maximum and minimum) and bright sunshine hours (day^{-1}) were significantly negatively correlated with days to FBD, pea stage fruits, marble stage fruits and mature stage fruits. However, none of the

climatic parameters produced a significant correlation for days to gain stage fruits. It was also observed that extended rainfall delayed flower bud differentiation and temperature fluctuations during panicle initiation adversely affected its occurrence.

Key words : Climatic parameters, correlation study, mango phenophases.

O/S-IV/16

Phenotypic diversity among the natural population of Malabar Neem (*Melia dubia* Cav.) in South Gujarat

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An investigation was carried out during 2020-2021 at the College of Forestry, Navsari Agricultural University, Navsari, Gujarat, India to assess morphological diversity among four natural populations of M. dubia. Significant ($p>0.05$) morphological variations (low to moderate magnitude) were recorded among studied populations for the leaf, fruit and stone characters. Phenotypic attributes like leaf width, petiole length, rachis length, fruit weight, stone weight and pulp weight, and the number of seeds/drupes were some of the main traits which recorded higher variability among populations. The positive and stronger association between leaf length and petiole length, pulp weight and fruit weight, fruit length and stone length portrayed the possibility of utilizing these traits in the selection and improvement of M.dubia for fodder purposes. Further, Kaprada (KP) and Nanapondha (NP) populations showed similar phenotypic appearances. On the contrary, Sagai (SG) populationdisplayed divergence in morphological characters, as revealed by multivariate analysis. Inter-cluster distance matrix confirmed maximum phenotypic divergence between NP and SG populations; thus, the selection of genotypes from these populations can be recommended for the tree improvement programme.

Keywords: Morphological variability, Melia dubia, Malabar Neem, Populations

O/S-IV/17

An investigative study of the climatic signature on radial growth of teak (*Tectona grandis* L. f.)

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Teak is mainly distributed in dry and moist deciduous forests of peninsular India below 24°N latitude. Tree growth and climate relationship of teak have been extensively analysed due to datability of its growth rings to the exact years of formation. Also, teak has a lot of commercial importance and is widely distributed in India. The dendroclimatic studies on teak from different regions of peninsular India show that the radial growth of teak is influenced by the local climatic conditions, especially the rainfall patterns. The pre-monsoon showers, monsoon rainfall and high temperature during March have a positive association withthe radial growth ofteak. Interestingly, the carry-over effect of moisture from the previous year's monsoon and post-monsoon rainfall has a visible change in the radial growth of teak. Thus, by understanding the teak growth and climate relationship in a particular locality, the management of teak plantations can be carried out to curtail its mortality rate and meagre growth. Further, water management of any fast-growing tree species could be planned.

Keywords: Monsoon, water management, climate, moisture and peninsular India

O/S-IV/18

Importance of forest resources in fulfilment of sustainable development goals

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Forest resources including biodiversity are an asset for the economic and livelihood security of most developing countries. At the global level, forests mitigate climate change through carbon sequestration, contribute to the balance of oxygen, carbon dioxide and humidity in the air and protect watersheds. Conservation and management of forest resources in a sustainable way is the need of the hour. Sustainable management of forest resources leads to the long-term conservation of these resources and ensures livelihood as well as environmental security. Forests and non-timber forest products (NTFPs) support the livelihood of more than 1.5 billion people.Sustainable Development Goals (SDGs) also known as global goals, were unanimously adopted by the United Nations general assembly in 2015 with the Agenda for Sustainable Development, 2030 which incorporated seventeen SDGs. The 17 SDGs are **integrated** that is, they recognize that action in one area will affect outcomes in others and that development must balance social, economic and environmental sustainability. Forests and all the resources of forests are directly or indirectly related to many of the SDGs which help to tackle climate change and conservation of forests as well as their resources. Forests play a clear role in supporting SDG-15 (Life on land) *i.e.* forests support 80% of all biodiversity on land. Moreover, forests also play an essential role in achieving most of the other SDGs by helping in poverty reduction (SDG-1), source of food (SDG-2), providing herbal drugs (SDG-3), source of clean water (SDG-6), source of renewable energy (SDG-7) and curtailing the effects of climate change (SDG-13). Tangible and intangible benefits of the forests have a vital part in accomplishing the Sustainable Development Goals directly or indirectly.

Keywords: Climate change, Conservation, Forests resources, Livelihood, SDGs.

O/S-IV/19

Forage yield and quality of single cut fodder Oats (*Avena sativa* L.) under different nitrogen levels in Chhattisgarh plains

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A field experiment was conducted to assess the performance of certain promising entries of fodder oats (Avena sativa L.) and different nitrogen levels on yield and Quality under a single cut system at Research cum Instructional Farm, I.G.K.V, Raipurin Chhattisgarh plains. The experiment consists with ten promising entries of oats viz. OL-1874-1 of PAU, Ludhiana; OL-1876-1 of PAU, Ludhiana; RO-11-1-3 of MPKV, Rahuri; JO-06-23 of JNKVV, Jabalpur; SKO-241 of SKUAST-K, Srinagar; RO-11-1-2 of MPKV, Rahuri; and HFO-806 of CCS HAU, Hisar; and at national check Kent, OS-6 and at zonal check RO-11-1as the main plot and three nitrogen levels viz.60, 90 and 120 kg N/haas a subplot treatment was laid out insplit plot design with three replications.Among different promising entries of oats, OL-1874-1 recorded maximum forage yield (44.9 t/ha), dry fodder yield (9.43 t/ha), forage productivity (0.49 t/ha/day), dry fodder productivity (0.10 t/ha/day), crude protein yield (0.996 t/ha). On the other hand, SKO-241, which was found inferior concerning grain yield attributes gave the highest content of dry fodder matter (25%). The highest crude protein content of 11.16% was obtained in RO-11-1. As regard to different nitrogen levels, forage yield (34.5 t/ha), dry fodder yield (7.62 t/ha), forage productivity (0.38 t/ha/day), dry fodder productivity (0.08 t/ha/day) and crude protein yield (0.85 t/ha). Crude protein content (11%) increased to 120 kg N/ha, but the dry fodder matter showed almost similar performance at 60, 90and 120 kg N /ha.

Keywords: Crude protein, Fodder oats, Forage yield, Nitrogen levels, Quality.

O/S-IV/20

Relative importance of artificial waterhole distribution insite use of sympatric large carnivores in Gir protected area, Gujarat, India

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Low rainfall and hence crunch of water availability in a protected area in the arid ecosystem affects the ecology of large carnivores in different ways, such as changes in distribution patterns, prey-predator relationships and competitive interactions. Such alterations in the ecology of large carnivores could affect their fitness of large carnivores in the long run. Therefore, to avoid such circumstances, protected area management across the world develops artificial waterholes to fulfil the water requirements in arid ecosystems. But how the artificial distribution of waterholes affects the site use of large carnivores is a research question. A present study was carried out in GirProtected Area, Gujarat to answer the research question: Does artificial waterhole distribution affect the distribution of large carnivores (Leopard and Lion)site use? If yes, what is the relative importance of water hole distribution to other ecological factors in the site use of large carnivores?To answer our question, camera trapping was used due to its around the clock functioning without human assistance. Camera traps were deployed in an area of 200 km2divided by square grid of 4km2 resulting 50 sampling units. Distance from waterholes, prey abundance, livestock grazing and tree abundance were the variables collected by laying a camera trap-centred plot of a 20-meter radius. A generalized linear model (GLM) framework was used to assess the relative importance of waterhole in site use of leopards and lion. Captures of leopard and lion were used as response variables, while the variables defined later, along with the distance from artificial waterholes used as predictor variables.GLM analysis found that site use of both leopard and lion was negatively associated with the site use of the leopard (-0.56±0.15 (S.E.)) and lion (-0.66±0.17 (S.E.)) indicating high use of areas near to artificial waterholes. Distance from waterholes was among the strongest predictor of leopard and lion site use in Gir than other predictor variables. High use of sites near the waterholes could alter the prey-predator dynamics and competition among the carnivore communities in Gir. Our research described the pattern between the artificial waterholes and the site use of large carnivores.

Keywords: Large Carnivores; Artificial Waterhole; Gir; Site Use; Conservation

O/S-IV/21

Developing a new model for predicting Eucalyptus height with age

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Use of least fertile land through eucalyptus plantation is recommended to increase the land productivity and economy of the rural people. Reclamation and management of waterlogged salt-affected soils are also possible through bio-drainage, and eucalyptus is a suitable tree species with a tolerance for salt and waterlogging. Eucalyptus may meet the country's increasing demand and become inevitable. Large-scale irrigation projects have resulted in waterlogging and salt buildupin canal commands, adversely affecting crop productivity. Waterlogging in canal command includes excessive seepage, over-irrigation and insufficient natural and manmade drainage provisions. Interceptor drains can be tried to arrest excessive canal seepage to minimize waterlogging and associated problems. Biodrainage using eucalyptus trees is also being advocated for averting waterlogging and salt accumulation in the root zone. The efficacy of the interceptor bio-drainage belt and economic yield of the eucalyptus depends on its height which is a function of time besides soil physic-chemical status. Measurement of eucalyptus height over a long period of time is expensive and time-consuming. Modelling of height is a much simpler way to know the eight of the tree at a specific age. Singh and Verma (1919) developed an analytical model for predicting the eucalyptus height with age. The model was found reasonably good for predicting eucalyptus height with time. Later he correlated height for evapotranspiration modelling. He

used three years of lysimetric data of eucalyptus height grown in a bio-drainage belt. The present study was taken to develop a new model for predicting plant heights against age. Different types of models for predicting eucalyptus heights in different agroecological zones. The model consisted of two components: linear height accelerating response function and tree height retarding response index function. When the linear height accelerating response function was divided with tree height retarding response index function, it gave eucalyptus height against age. The model predicted eucalyptus heights as 1.86, 4.01, 6.63, 9.55, 12.46, 14.95, 16.69, 17.53, 17.58 and 17.05 m at the age of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 year, respectively. The eucalyptus heights predicted by Singh and Verma (2019) model were 2.48, 3.50, 6.10, 9.68, 12.90, 15.20, 16.54, 17.15, 17.38 and 17.45 m against the age of 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10 year, respectively. The per cent deviations of predicted eucalyptus height were 25.04, -14.66, -8.69, 1.32, 3.38, 1.61, -0.89, -2.22, -1.16 and 2.26% against the corresponding age. The model predicted fairly close values to the Singh and Verma model and can be used for field applications.

Key words: Biodrainage, evapotranspiration, salt affected soil, waterlogging and subsurface drainage

O/S-IV/22

Necessity of ethnic food culture in conservation of wild resources; way for food security

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Forests are the repository of diverse products for all needs of humankind. Since ancient times, forest products have been utilized by aboriginals for various needs of life. Food and medicine are the two essential forests produced, which are still in use by two-thirds of the world's population for their food security and primary health care. In India, around fifty per cent of tribal and rural masses depend on wild resources for food and health besides fulfilling other needs. There is a lot of diversity in the ethnic food culture among the forest-dwelling communities of India. However, these diversities are due to the availability of wild resources in the particular region and the traditions of the communities. Over the period, many changes happened in their ethnic culture in general and food system in particular. Local communities collect food sources from the wild and use their traditional knowledge to prepare food. The various wild food sources are tree-based food, tuber crops, leafy vegetables, fruit crops, bulbs, pods, seeds, nuts, and mushrooms. Most of the literature recently reported on the diminishing of ethnic food culture, even among tribal communities. It is declined due to many reasons like unavailability, deforestation, over-harvesting, indiscriminate utilization, change in food preference & socio-culture, modern lifestyle etc. These factors eventually lead to the erosion of genetic resources and their extinction. The awareness regarding judicious utilization of ethnic food, domestication and rational sustainable harvesting from the forest is the need in the present scenario. Safeguarding the ethnic food culture will help protect wild food resources and diversity among the forest-dwelling communities to ensure food security.

Key words: *Diversity, Ethnic food, Food security, Wild resources*

O/S-IV/23

Patterns of biomass accumulationand carbon storage in Teak (*Tectona grandis* L.f.): An implication for development of biomass and carbon tables for sustainable management

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Teak (Tectona grandis L.f.; Lamiaceae) is one of the important timber yielding tree species in a tropical region. Teak timber is used for furniture, doors, windows and other decorative construction purposes. As per ISFR (2021), the growing stock of teak in terms of total volume and a total number of stems is higherthan the Sal (Shorea robusta) in India. Teak is one of the preferred tree species planted by farmers in their farmlands in

boundary plantations, block plantations and even in different agroforestry systems. Biomass accumulation and carbon yield tables are necessary for determining growth rate, economic return and climate change mitigation strategy for important indigenous tree species. Therefore, it is planned to prepare biomass and carbon yield tables for teak by considering diameter and height parameters. This would help the farmers, foresters, timber merchants, and scientists estimate standing biomass and carbon yield. Further, it would also help to know the role of a teak tree in climate change mitigation by CO2 fixation. For this, 1187 teak sample trees distributed in different parts of South Gujarat having a Diameter at Breast Height (DBH) of more than 10 cm were selected for the preparation of biomass accumulation and carbon yield tables. The biometrical parameters such as DBH (cm), mid diameter (cm) and tree height (m) were measured by following standard procedure. Using these data, Form Quotient (=Mid diameter/ DBH) and Stem volume (m3) = (ðDBH2 /4) x Height x Form Quotient were calculated. Further, volumetric equation [Volume= 0.00004D2H + 0.014 (R^2 = 0.908)]was developed. By adopting this equation, a volume table was prepared considering the mid value of the diameter class and height class. Moreover, this volume table of teak was adopted for the preparation of the biomass table by multiplying the estimated basic density of 621.08 kg/ m3 with the volume and carbon yield table by multiplying the estimated value of 44.80 per cent carbon content with biomass. Biomass and carbon yield of 34.16 kg and 15.30 kg, respectively, were recorded in the lower range of diameter and height class, whereas 7702.01 kg and 3450.50 kg of biomass and carbon yield were recorded in a higher range of diameter and height class. The study also provides a separate table for biomass and carbon stock among different diameter and height classes in teak for its use in biomass estimation, carbon content, and carbon trading.

Key Words: Biomass, carbon trading, carbon table, climate change, sustainable management, teak

O/S-IV/24

Assessment of above ground biomass and carbon stock in Saptaparni, *Alstonia scholaris* (L.) R.Br.

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Forests play a vital role in mitigating climate change. Moreover, large-scale captive plantations and Trees outside the Forest (ToF) were also added to improve the country's green cover. Therefore, there is a wide scope for reforestation under the purview of climate change mitigation, which not only produces timber, pulp wood and other products of NTFPs; and provides an ecosystem service including carbon sequestration as beautification of urban, peri-urban and rural landscapes. Trees play an important role in sequestering atmospheric carbon; however, the rate of carbon sequestration potential depends upon the species, growth rate, the physiological and genetic potential of individuals, habitat and silvicultural practices. Therefore, a preliminary study was conducted to map the potential of biomass and carbon stock among standing trees of Saptaparni, *Alstonia scholaris* (L) R.Br. in the urban-forestry land-use system. In India, it is widely planted under afforestation programs, especially in urban forestry programmes, as an avenue or ornamental tree. Wood is used for pattern making, core-stock, plywood, carving and mouldings. Wood charcoal of this species is used as gunpowder. In and around Navsari, the social forest division of the Gujarat forest department has also undertaken avenue plantations with Saptaparni on the main roads around Navsari city. In the present study, trees planted along the roadside from NAU Campus to Railway Station road of about 5 km length were selected for estimation of biomass and carbon stock of standing trees. To estimate this, a total of 38 trees of Saptaparni were marked, and biometric parameters like height, clear bole height, DBH, Mid diameter, form quotient and crown spread were measured. Further, volume, biomass and carbon stock were estimated. Data were divided into four different diameter classes, *viz.* D1: 10-20 cm, D2: 20-30 cm, D3: 30-40 cm and D4: 40-50 cm to understand the accumulation of biomass and carbon stock. Trees with lower diameter class (D1) accounted for 0.11 m3 volume, 39.03 kg tree-1 biomass and 16.78 kg tree-1 carbon stock; whereas in D2, they were 0.24 m3, 87.89 kg tree-1and

37.79 kg tree-1, respectively. The volume, biomass and carbon content of trees belonged to D3 and D4 classes were 0.42 & 0.78 m3, 152.63 & 282.13 kg tree-1, 65.62 & 121.29 kg tree-1, respectively. Trees can accumulate about 10 to 372 kg biomass per tree and 4 to 160 kg carbon stock per tree when they achieve a diameter range of 10 to 50 cm. The total biomass and carbon stock of all 38 trees are estimated to be 1962 kg and 4469 kg, respectively. The study concludes that the Saptaparni tree can accumulate on an average 117 kg biomass and 50 kg carbon stock per tree, and a tree with a diameter of 40-50 cm can accumulate carbon of 121 kg.

Keywords: Above ground biomass, *Alstonia scholaris,* Avenue plantation, Carbon stock

O/S-IV/25

Potential of plant growth promotion in cow pea by application of sulfur-oxidizing bacteria and *different forms of sulphur fertilizer*

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The present study aimed to reveal sulfur-oxidizing bacteria's (SOB) potential to improve plant growth-related traits in response to various sulphur applications. Six bacterial isolates showed a positive response on thiosulphate media. The bacterial isolate belongs to different genus *Viz.* as Bacillus, Delftia, and Rhizobium. These organisms were able to lower the pH of thiosulfate broth. Among them, Delftia Sp. showed higher sulphide oxidase activity along with the production of sulphate ions. All organisms showed PGPR traits such as IAA production, EPS production, ammonia production and phosphate solubilization. The application of sulphur oxidizing Delftia Sp. Significantly improves the cowpea growth-related parameters under the elemental and granular sulphur application. The root length, shoot length, number of roots, number of leaves, and chlorophyll content were higher in the treatment where the organism and sulphur were used in combination compared to their respective control. This organism can be utilized for sulphur oxidation in the soil for better growth of the crops.

O/S-IV/26

Biodiversity conservation and protection for sustainable coastal ecosystems

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With one of the longest coastlines, India holds many biological treasures with an extensive coastal line of 8,148 km and an Exclusive Economic Zone of 2.02 million sq. km. Coastal biodiversity significantly contributes to the country's main roles of economic leadership and social development. Mangroves, coral reefs, seagrass meadows, salt marshes, mudflats, estuaries, creeks, and sandy and rocky beaches make up the most beautiful Indian coastal ecosystems. However, due to industrialization and urbanization, these ecosystems are under pressure. Additional stress, just like more dangerous anthropogenic activities, affects marine ecosystems, notably coastal ones, in multiple ways and at increasing rates, leading to habitat degradation, loss of biodiversity, and greater exposure of flora and fauna to chemical contaminants, sea level change, increase in ocean temperature, ocean acidification and impacts on fisheries and biodiversity, with serious effects on ocean health. For the protection and sustainable coastal environment, they provided awareness to the coastal population and training programs to reduce the risk of biodiversity and ill effects of climate change. With the participation of local communities, NGOs and government organization need step for flood mapping, flood forecasting, development of a hydrological framework and downscaled climate change projection modelling coupled with strengthening coastal protection methods.

Key words: Coastal biodiversity, Climate changes, anthropogenic activities, sustainability and framework

O/S-IV/27

Growth performance of different Bamboo species in different levels of saline irrigation water in nursery

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Bamboo is now very popular among farmers in India and Gujarat due to its fast-growing behaviour and high demand among different industries. In our country and mainly in Gujarat state, most of the areas have different saline irrigation water. Therefore to study the growth performance of different bamboo species in different levels of saline irrigation water in nursery, this study has been carried out from January to June 2022 at Bamboo Resource Centre, College of Forestry, ACHF, Navsari Agricultural University, Navsari,Gujarat in nursery condition. The experiment was carried out with a completely randomized design with a factorial concept in which one-year-old seedlings of three different bamboo species, namely B1: Bambusa bambos, B2: B. vulgaris and B3: B. balcooa were transplanted in to polybags size18x18 cm and irrigated with five different levels of saline irrigation water i.e, S1: 0.5 dS/m, S2: 2.0 dS/m,S3: 4.0 dS/m, S4: 6.0 dS/m andS5: 8.0 dS/mat interval of 2 days. During the experiment, growth, biomasses, physiological parameters, and nutrient content of three bamboo species were recorded along with the chemical properties of soil. Results indicated that all the species of bamboo had significantly higher growth, and biomass was recorded when irrigated with normal water 0.5dSm-1and began to decrease as salinity levels increased. However, all the species were grown efficiently up to 4 dSm-1 without showing toxicity of salinity. Among three different bamboo species, B3: B. balcooa performed better as compared to B1: B. bambos andB2: B. vulgaris for growth, biomass, plant nutrients and physiological attributes. The overall study showed that different salinity levels of irrigation water affected the growth and biomass as well as plant nutrients of three bamboo species B1: B. bambos, B2: B. vulgaris andB3: B. Balcooa and saline irrigation water for bamboo species upto 4 dSm-1is better for growth and development under nursery condition.

Key words: Bamboo sp., saline water, growth

O/S-IV/28

Role of Bamboo to check soil erosion and rehabilitate soil fertility

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Bamboo can provide a wide range of ecosystem and ecological services. Among them, it is very effective in case of soil conservation aspect due to the wide range of lateral root and rhizome networks which will bind the soil and check the soil by gully erosion and flood off on topsoil strata. Also, bamboo leaves play an important role in soil erosion by smoothly runoff groundwater. Moreover, bamboo leaves, branches and stems play an important role in rehabilitating soil fertility by incorporating organic matter, which helps nutrient circulation. It will also improve soil porosity by reducing soil compactness; thus, ecological functions such as water circulation and nutrient cycling will be restored. However, barren/degraded land becomes fertile by influencing the bamboo plantation.

Key Words: *Bamboo, Soil erosion, Fertility, Ecosystem, Ecological*

O/S-IV/29

Biodiversity conservation and nutritional security through Kitchen gardens in South Sikkim, India

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The present study was conducted to know the home gardens and their composition in Sikkim. In Sikkim, the ecological situations vary greatly at very short a distance, which limits the adoption of crop species and their varieties within a narrow range. This has the advantage of growing many kinds of fruits, seasonal and off-seasonal vegetables and other commercial crops in the hills at different altitudes and in different seasons. The kitchen garden may serve as the central feature of an ornamental, all-season landscape, or it may be little more than a humble vegetable plot. A survey was carried out to know the composition of kitchen gardens. It was observed that the kitchen gardens are commonly found in every farmer's house in Sikkim. The farmers in the village Bikmat, Borong, Kerabari, Yuksum, Sankhu and Singling use 06, 09, 15, 11, 12 and 06 components in their kitchen garden. The farmers usually grow seasonal and local vegetables in the garden with some multipurpose tree species. To fulfil the daily requirement of food and vegetables, the farmers depend mainly on these kitchen gardens. These gardens are invariable for home consumption, but sometimes the farmers also take production for commercial purposes. These gardens not only foster the vegetable component but also enhance the biodiversity of the local area.

Key words : Kitchengarden, traditional agroforestry systems

O/ S-IV/30

Effect of foliar application of panchagavya and banana pseudostem sap on the growth, seed yield, and economics of fenugreek

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A field experiment on loamy-sand soil was carried out during the *rabi* season of 2020-21at Sardarkrushinagar, Dantiwada, Gujarat, to study the effect of foliar application of panchagavyaand banana pseudostem sap on the growth and seed yield of fenugreek. The experiment consisting of ten treatments was evaluated in a randomized block design with four replications. The results revealed that the growth and yield attributes of fenugreek *viz;* plant height, nodule weight/plant (fresh & dry), branches/plant, pods/plant, seeds/pod, pod length(cm), and test weight(g) were recorded significantly higher with an application of panchagavya @ 4% spray at pre-flowering + pod setting being equally effective with panchagavya @ 4% spray at pod setting, whereas, for nodules/plant it was significantly superior over rest. Maximum seed (1438 kg/ha) and haulm (3613 kg/ha) yield were found under the treatment panchagavya @ 4% spray at pre-flowering + pod setting followed by panchagavya @ 4% spray at pod setting. The highest gross realization (64,746/ha) and net realization (34,259/ha)were also recorded with the application of (treatment T4) panchagavya @ 4% spray at the pre-flowering + pod setting stage.

Keywords: Banana pseudostem sap**,** Fenugreek, Organic foliar spray, Panchagavya

O/ S-IV/31

Climate smart resource conservation in chickpea through minimum tillage, rice straw mulch and depth of fertilizer placement

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At the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, a field experiment titled "Effect of resource conservation technology on chickpea in rice fallows of south Gujarat" was conducted during the rabi season of 2017–2018. In the main plot, there were four treatments: conventional tillage, conventional tillage + rice straw mulch, minimum tillage, and minimum tillage + rice straw mulch. In the subplot, there were four treatments of fertilizer placement depth viz. broadcast, 5, 8, and 11 cm, which were evaluated in a split-plot design with three replications.The conventional tillage + rice straw mulch approach produced the highest seed and stover yields (2093and 4011kg ha-1, respectively), total N, P, and K uptake (66.67, 11.64, and 29.38 kg ha-1, respectively), available soil nutrients N, P, and K (272.67, 49.00, and 320.67 kg ha-1, respectively), and net economic return of Rs. 92883 ha-1. However, the conventional tillage method had the highest B:C ratio of 4.46.When placing fertilizers, 8 cm delivers the greatest seed and stover production (2085and 3892kg ha-1, respectively), total N, P, and K uptake (94.86, 20.13, and 78.32 kg ha-1, respectively), accessible soil nutrients N, P, and K (262, 50.17, and 303.17 kg ha-1, respectively), and net financial return of 95888 ha-1 with a B:C ratio of 4.12.Conventional tillage plus rice straw mulch resulted in significantly increased soil organic carbon content (0.56%) compared to minimal tillage (0.54%).A placement depth of 8 cm for fertilizers resulted in significantly greater soil organic carbon content (0.57%).

Key words: Chickpea, fertilizer placement depth, tillage method, mulch, resource conservation

O/ S-IV/32

Pranic agriculture as a traditional farming system to enhance yield and RAPD Polymorphism in Cabbage (*Brassica Oleracea* L.)

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Agriculture production is under major threat due to climate change, the green revolution, and excessive usage of chemicals leading to food, soil, air, and water pollution. Farmers should adopt integrated sustainable agriculture practices in their field to overcome these. One such sustainable Farming system is Pranic Agriculture (PA). Pranic agriculture is considered a Traditional Farming system practiced in India. In PA, pranais applied to plants to promote their growth. Prana is also called Ki, Qi, or subtle energy and it is essential to keep the body in healthy conditions. The Upanishads and Vedas mention that Prana is the most vital ingredient and is necessary to survive. PA is complementary to agriculture practice and also helps in achieving sustainability. It works on a holistic concept of environmentally friendly farming systems. In the present study, the influence of PA on the yield of cabbage (Brassica oleracea L.) and Random Amplified Polymorphic DNA (RAPD)was studied. This study was carried out in Mysore, Karnataka on one acre of the agriculture field in the year 2019. The field was divided into half acres each and the field which received PA treatment was referred to as the pranic group, while the other half-

acre was referred to as control. Cabbage seeds and cocopeat were also divided into Pranic and the control groups. Pranic group (field, seeds, and cocopeat) received Pranic treatment. Initially, both the group of seeds (pranic and control) were sown in their respective cocopeat under greenhouse conditions. After 3 weeks, the seedlings were transplanted to the pranic and control fields respectively. The root growth, cabbage head diameter, cabbage head weight, and yield per acre was found to be higher and more significant ($p < .05$) in the pranic group (18.2 cm, 17 cm, 1.3 kg, and 18.4 ton) when compared to control (13.2 cm, 14.4 cm, 1.09 kg, and 15.2 ton). RAPD analysis has shown an average DNA polymorphism of 22 % among the treatments. Thus, the PA technique helps to improve root growth and yield of cabbage. Pranic energy which is applied externally can bring cellular changes at the DNA level. The farmers can get extra income through additional crop growth and yield by adopting the PA technique in their fields. A detailed study for understanding underlying cellular mechanisms needs to be explored.

Keywords: Holistic approach; root length, sustainable agriculture, vegetable, yield

O/ S-IV/33

Sustainable soil and water conservation approaches in the North-EastRegion of India

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The North Eastern Region (NER) represents three provinces (East Himalayas, Brahmaputra Valley, and North East Hills) and covers about 7.7% of the total geographic area of India. Around 56% of the cultivated area of the NER is under low altitude (valley or lowland), 33% under mid-altitude (flat upland), and the rest under high altitude (upland terrace). Traditionally, farmers in both the upland terraces and valleys practice mono-cropping under rain-fed agriculture, where rice (Oryzasativa) is the major crop occupying more than 80% of the cultivated area followed by maize (Zea mays). Nearly 84 per cent of the soils in the NER are acidic in reaction, having low available phosphorus and zinc whereas toxicity of iron and aluminium. The majority of the fields in this region are situated across the hilly slopes. This region contributes only 2.8 per cent to the total food grain production of the nation. Based on the ground realities of this complex, diverse and risk-prone agroecology, farmers opted to retain traditional practices, especially soil and water conservation practices, with an emphasis on stability, resilience, long term sustainability over the attainment of higher productivity. The main innovative and sustainable soil and water conservation approaches are Jhumcultivation, Bun cultivation, Apatanisystem, Zabosystem, Bamboo drip irrigation system, etc.

Jhumcultivation (slash and burn agriculture or shifting cultivation) is practises on about 0.88 million ha. Deforestation and biomass burning in Jhum aggravate soil erosion and ecosystem degradation. Annual soil erosion on steep slopes (44-53%) under shifting cultivation can be as much as 40.9 Mg/ha along with attendant losses (in kg/ha) of 702.9 of soil organic carbon (SOC), 63.5 of phosphorus (P) and 5.9 of potassium (K). Soil erosion during the 1st and 2nd years on the abandoned land, has been estimated at 147, 170, and 30 Mg/ha, respectively. Steep slopes, cultivated along the slope, with negligible nutrient replacement and high rainfall are among the major causes of land degradation in the NER. Bun cultivation, aninnovative modification of shifting cultivation, is followed in the Meghalaya plateau ensuring soil and water conservation. Similarly, the Apatanisystem, a potential water harvesting system is practised in the Apataniplateau of Subansari district of Arunachal Pradesh, the Zabosystem in Nagaland, and the Bamboo drip irrigation system in Meghalaya. The uniqueness of these approaches is their suitability to the local conditions, their economic feasibility and easy implementation. However, indiscriminate use of intensive agriculture has adversely impacted soil and water conservation over the past decades and therefore integration of modern scientific knowledge and proven eco-friendly area-specific techniques of conservation and utilization of natural resources is the best possible way.

Keywords: Soil and water conservation, innovative, sustainable, approaches, North Eastern Region.

O/S-IV/34

Soil acidity and nutrient management through *Azolla* integration in acid inceptisol of Meghalaya

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To investigate the influence of *Azolla* on soil acidity parameters and temporal nutrient availability in the mid-hills of Meghalaya, a field experiment was conducted at the School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Umiam, Meghalaya during *kharif* 2017-18. Rice var. Shasharang was raised as a test crop with six treatments *viz.,* control (T1), fresh *azolla* incorporation @ 16 tha^{-1} (T2), 30 kg N ha^{1} through urea (T3), 60 kg N ha^{-1} through urea (T4), 30 kg N ha^{-1} through urea + *azolla* incorporation @ 16 tha^{-1} (T5) and 60 kg N ha^{-1} through urea with *azolla* incorporation @ 16 tha^{-1} (T6) were tested in randomized block design with four replications. The analysis of soil acidity indices indicated that the highest improvement in pH was observed in T2 over all other treatments. Further, pH increased significantly in the treatments receiving *azolla* incorporation (T2, T5, and T6) compared with the sole application of urea or *azolla* (T1, T3 and T4). The exchangeable calcium and magnesium (meq $100g^{-1}$), CEC (meq $100g^{-1}$), and base saturation percentage also showed the same trends, and the highest values were observed as 1.92, 7.90 and 24.30 in T2. However, in contrast to this, the lowest values of exchangeable aluminium, exchangeable acidity, and acidity saturation percentage were observed in T2 indicating that the sole application of *azolla* improved soil acidity indices. Available phosphorus in T6 was statistically significant over T4 (60 kg N ha^{-1} through urea) whereas T5 was significant over T3 (30 kg N ha^{-1} through urea) with respect to advancement in crop age.

Keywords: *Azolla* incorporation; integrated nutrient management; soil acidity.

O/ S-IV/35

Yield Improvement in Lakadong Turmeric through integrated nutrient management in acidic soil

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Meghalaya is home to a variety of spices of which turmeric (*Curcuma longa* L.) is one of the prominent. The Lakadong one of the finest varieties of turmeric has its uniqueness with a very high curcumin content of about 6-7.5 percent and volatile essential oil (dry) of about 3.6-4.8 percent. The farmers grow Lakadong turmeric traditionally without applying any nutrient sources or sometimes with some household waste and farm yard manure (FYM) resulting in poor rhizome yield. As the organic nutrient sources are limited, it is not possible to meet the high nutrient demand of Lakadong turmeric. The use of chemical fertilizers alone may increase crop yields in the initial years but adversely affects the sustainability at a later stage.Integrated use of organic and inorganic fertilizers can improve crop productivity maintaining sustainability. There is an urgent need to develop a nutrient management package involving renewable resources of plant nutrients that are locally available to farmers. Although FYM is commonly used in organic manure but is not adequately available. The huge amounts of farm wastes can be recycled effectively by preparing vermicompost (VC). Therefore, the present trial was conducted at the School of Natural Resource Management, College of Post Graduate Studies in Agricultural Sciences, Umaim, Meghalaya during 2021-2022 to develop an integrated nutrient management package for higher yield of Lakadong turmeric in acidic soil of Meghalaya. The eight treatments *viz.,* T_1: 100% N through

FYM, T_2: 100% N through VC, T_3: 75% RDN + 25% N through FYM, T_4: 75% RDN + 25% N through VC, T_5: 50% RDN + 50% N through FYM, T_6: 50% RDN + 50% N through VC, T_7: 50% RDN + 25% N through VC + 25% FYM and T_8: 100% RDN (120:50:80 kg/ha) were tested in randomized block design with three replications. Significant differences were observed among the various treatments. The maximum plant height, number of leaves and fresh rhizome yield were recorded in T_7: 50% RDN + 25% N through VC + 25% through FYM followed by T_6: 50% RDN + 50% N through VC. Based on results obtained, the farmers of Meghalaya may be advised to practice integrated nutrient management involving 50% RDN + 25% N through VC + 25% through FYM for higher rhizome yield of Lakadong turmeric in acidic soil.

Keywords: *Lakadong turmeric; integrated nutrient management; acidic soil, rhizome yield, improvement.*

O/ S-IV/36

Meliadubia Cav. drupe pulp: A low input by-product source for small ruminant feed and crop yield enhancement

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We have a plethora of multipurpose trees and shrubs occurring in natural forests and agricultural landscapes. Tapping multifaceted attributes of these valuable resources are needed at a time when we are looking for alternate natural resources to be used for sustainable agricultural production. Many tree species provide fruits which could be utilized as non-timber forest products for one or the other use. One such emerging tree species is Meliadubia Cav. being advocated as fast-growing multipurpose species. Apart from its timber use in paper pulp, plywood and furniture industry, its drupes are noticed to be eaten up by wild and domestic animals. Therefore, from this backdrop, a study on its drupe pulp nutritional and phytochemical attribute determination and its utilization as an alternate feed source for small ruminants were undertaken. A study was also done to utilize the drupe pulp as incorporation in the soil to divulge its effect on soil nutrient status and receptor crop growth and yield. It was observed that theproximate principles, mineral matter and total phenol levelsin M. dubiadrupe pulp are within permissible limits(recommended for livestock), and fall within the rangeor higher than found in leaves, twigs and pods/fruits ofmany commonly used fodder species. Drupe pulp feeding study indicated that dry pulp up to 40 per cent in goat kid's diet replaced with basal feed could be used without anynegative effect on their growth performance. Further, the inclusion ofM. dubia drupe pulp in the different total mixed rations of Surati goat kidsreduced the cost of feeding.Pot culture studies indicated that pulp powder applied at 25 and 50 g had synergetic effects on the growth, development and biomass of C. annuum and V. radiata (2 months after drupe pulp treatment). This indicated that the M.dubiadrupe pulp is not harmful to the test plants; instead, acts as organic material to enhance plant growth. This resulted due to gradual enhancement of soil nutrient status due to increased pulp powder quantity incorporated in the soil. Hence,M. dubiadrupes are a good alternate economic agro-industryby-product for livestock feedvis-à-vis it could be utilized as a soil fertility improvement source for higher growth and yield of receptor crops.

Keywords: Meliadubia, drupe pulp, feed source, goat, economics, soil fertility, growth, yield

O/ S-IV/37

Effect of Bio-organo-chemical fertilizer on periodical available nutrients status in clay soil

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The field experiment entitled "Effect of bio-organo chemical fertilizer on important soil properties and yield of

maize grown in clay soilwas conducted" during the rabi season of 2019-20 at Navsari Agricultural University, Navsari. The field experiment consists of eight treatments viz., Control (T1), RDF through CF (T2), RDF through CF + Bio-compost - 2.5 t/ha (T3), 100 % RDN through BOCF (T4), 75 % RDN through BOCF (T5), 50 % RDN through BOCF (T6), 25 % RDN through chemical fertilizer + 25 % RDN through BOCF (T7) and 25 % RDN through chemical fertilizer + 50 % RDN through BOCF (T8) were tested using a randomised block design with three replication. The maximum content of soil available nitrogen at 30, 60 DAS, and harvest i.e. (226, 211 and 170 kg/ha) was gained through the application of the RDF through CF + Bio-compost - 2.5 t/ha. Considerably greater available P, K, S, B, Cu, Zn, Fe and Mn content in soil at 30, 60 DASand at harvest was found under the application of 100 % RDN through BOCF. According to the results of the experiment, the application of 100 % RDN through bio-organo-chemical fertilizer (BOCF) improves the periodic nutrient status of the soil.

Keywords: Bio-organo-chemical fertilizer (BOCF), available nutrient, Enrichment, Bio-compost, soils

O/ S-IV/38

Influence of different organic manure on release of iron in calcareous soils.

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An incubation study and pot culture experiments were conducted to study the release of iron as influenced by organic manures in calcareous soils in the Division of Soil Science and Agricultural Chemistry at RajarsheeChhatrapatiShahuMaharaj, College of Agriculture, Kolhapur. The experiment consists of two factors. Factor A consist of three soil types based on their CaCO3 levels viz. low, medium and high CaCO3 content. The Factor B consisted different organic manures viz. FYM, vermicompost and press mud compost and no organic manure. These experiments consist of 12 treatment combinations with 3 replications. The incubation study and pot culture experiments were laid out in factorial completely randomized design (FCRD). The low, medium and high level of CaCO3 was having 4.4, 9.06 and 12.20 per cent CaCO3 content respectively. The FYM was added @ 10 t ha-1, vermicompost and press mud compost @ 5 t ha-1 each and all these organic manures were added with FeSO4.7H2O @ 25 kg ha-1.

The incubation study was conducted for 90 days. The moisture was maintained at field capacity throughout the incubation period. The soil samples were collected at 15 days of interval i.e. 15, 30, 45, 60, 75 and 90 days after incubation and analyzed for soil pH, electrical conductivity, organic carbon, calcium carbonate and available iron. Incubation study was conducted by discard method. Pot culture experiment was conducted for 21 days. The test crop wheat (variety- Kedar) was grown in this experiment. The nutrient uptake by wheat crop was analyzed after harvest of crop.

The results of incubation study showed that increasing levels of CaCO3 registered higher values of soil pH. The application of different organic manures viz. FYM, vermicompost, press mud compost along FeSO4.7H2O @ 25 kg ha-1 helped to decrease soil pH in all types of soil. There was no significant difference in electrical conductivity of soil.

The application of different organic manures with FeSO4.7H2O @ 25 kg ha-1 increased electrical conductivity of soil during incubation. Among all treatments, the application of press mud compost @ 5 t ha-1 along with FeSO4.7H2O @ 25 kg ha-1 increased more electrical conductivity of soil. The low level of CaCO3 registered higher values of organic carbon. The application of different organic manures recorded increased organic carbon under all levels of CaCO3 in soil.

Among all treatments, the application of vermicompost @ 5 t ha-1 with FeSO4.7H2O @ 25 kg ha-1 recorded significantly higher values of organic carbon in soil. There was decrease in calcareousness of soil due to application of organic manures. The application of press mud compost @ 5 t ha-1 + FeSO4.7H2O @ 25 kg ha-1 decreased CaCO3 at greater extent than application of FYM @ 10 t ha-1 and vermicompost @ 5 t ha-1 along FeSO4.7H2O @ 25 kg ha-1. The higher CaCO3 content had an adverse effect on available iron in soil. The

application of organic manures helped to improve availability of iron in all the levels of CaCO3 content in soil. The application of vermicompost and press mud compost each @ 5 t ha-1 along FeSO4.7H2O @ 25 kg ha-1 was found better over application of only FeSO4.7H2O @ 25 kg ha-1 in respect of availability of iron in soil.

In pot culture experiment nutrient uptake by wheat crop was studied. The significantly higher dry matter content (1.81 g) of wheat was registered in low calcareous soil treated with vermicompost @ 5 t ha-1 + FeSO4.7H2O @ 25 kg ha-1. The nitrogen uptake was higher at low level of CaCO3 in soil. All the sources of organic manures along FeSO4.7H2O @ 25 kg ha-1 showed higher nitrogen uptake as compared with application of only FeSO4.7H2O @ 25 kg ha-1 without organic manures. The application of vermicompost @ 5 t ha-1 + FeSO4.7H2O @ 25 kg ha-1 showed better nitrogen uptake by wheat crop. The adverse effect on phosphorous uptake was observed due to higher level of CaCO3 in the soil. The application of vermicompost @ 5 t ha-1 with FeSO4.7H2O @ 25 kg ha-1 showed higher uptake of phosphorous compared to application of FYM @ 10 t ha-1 and press mud compost @ 5 t ha-1 along with FeSO4.7H2O @ 25 kg ha-1. The low level of CaCO3 registered higher uptake of potassium. Among different treatments, the application of vermicompost @ 5 t ha-1 with FeSO4.7H2O @ 25 kg ha-1 proved better for uptake of potassium by wheat crop. The iron uptake was more in low calcareous soil. The application of different organic manures along with FeSO4.7H2O @ 25 kg ha-1 found to be increased iron uptake by wheat crop as compared with application of FeSO4.7H2O @ 25 kg ha-1 without organic manures in soil.

Key words: release, calcareous, FYM, Vermicompost, Press mud compost

O/ S-IV/39

Effect of FYM, potassium mobilizing bacteria (KMB) and potassium on potassium and zinc content, uptake, periodic potassium status and KMB count of soil after harvest of Wheat (*Triticum aestivum* L.)

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Organic manures are perhaps the main sources of plant nutrients in traditional agriculture but receive less emphasis with the advent of high-analysis chemical fertilizers. The application of FYM in the soil helps in increasing water holding capacity.Microorganisms play a key role in the natural K cycle. K-mobilizing bacteria (KMB) can release potassium from insoluble minerals. The considerable populations of KMBs are present in rhizospheric soils which promote plant growth. Potassium is the fourth most abundant nutrient constituting about 2.5 per cent of the lithosphere and exists in insoluble forms as rocks and silicate minerals, resulting in very low concentrations of soluble potassium in the soil for plant growth and development. Therefore experiment comprised twelve-treatment combinations of FYM, potassium mobilizing bacteria (KMB) andpotassium (K). It was plotted out in Randomized Block Design (factorial) with three replications. The treatment comprising of two levels of FYM viz., 0 t ha-1 (F0) and 10 t ha-1 (F1) and two levels of Potassium Mobilizing Bacteria viz., without KMB (KMB0) and with KMB (KMB1) and three levels of potassium viz., 0 kg K2O ha-1 (K0), 20 kg K2O ha-1 (K1) and 40 kg K2O ha-1 (K2). The application of FYM showed increased K content and uptake by grain and straw, Zn content and uptake by grain, available potassium in the soil at 30 and 45 DAS and KMB count at harvest. Application of KMB recorded significantly higher K content and uptake by grain and straw and KMB count at harvest. With potassium application increased K content in straw and uptake by grain, Zn content in grain and straw as well as uptake by straw and KMB count in the soil after harvest. Interaction effects on Potassium (39.83 kg ha-1) and Zn uptake by wheat grain were obtained with the treatment combination F1KMB1K2than other treatments, except for treatment combination F1KMB1K0 in the case of zinc uptake by wheat grain.

O/ S-IV/40

Response of preparatory tillage, nutrient management and moisture conservation practices on yield, yield attribute, total water use and water use efficiencyin Barley cultivation under water stress condition

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A field experiment was conducted during consecutive years of 2017-18 & 2018-19 at Soil Conservation and Water Management Farm of the *Chandra Shekhar Azad University of Agriculture and Technology*, Kanpur-2,and entitled "Response of preparatory tillage, nutrient management and moisture conservation practices on Yield, Yield attribute, total water use and water use efficiencyin barley cultivation under water stress condition." The treatment combination of three preparatory tillage viz., T_1 treatment- one cross ploughing with cultivator, T_2 treatment- one ploughing with disc harrow + one cross ploughing with cultivator, T_3 treatment-one ploughing by disc harrow + one pass with rotavator, three nutrient management viz., N_1treatment-100% RDF (60 Kg N + 30 Kg P + 30 Kg K /ha), N_2 treatment- 75% RDF + 25% FYM, N_3 treatment- 50% RDF +50% FYM and three moisture conservation practices, M_1treatment-control, M_2 treatment- dust mulch and M_3 treatment- pinoxaden 5EC @ 50 g/ha + VAM @ 15 Kg/ha. The treatment was laid out in split plot design with three replications with preparatory tillage in main plots, nutrient management in subplots and moisture conservation practices in sub-sub plots. The results revealed that T_3 treatment-one ploughing by disc harrow + one pass with rotavator, N_3 treatment- 50% RDF +50% FYM and M_3 treatment- pinoxaden 5EC @ 50 g/ha + VAM @ 15 Kg/ha produced significantly more yield attributes and yield, grain, straw, and biological yield, total water use and water use efficiency than the other treatments during both the years of study. Thus T_3 treatment-one ploughing by disc harrow + one pass with rotavator, N_3 treatment- 50% RDF +50% FYM and M_3 treatment- pinoxaden 5EC @ 50 g/ha + VAM @ 15 Kg/ha is most productive and profitable for the barley crop.

Key words: Yield, Yield attribute, total water use and water use efficiency.

O/ S-IV/41

Effect of organic and inorganic amendments on soil properties under rainfed conditions

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Out of the net cultivated area of 142 million ha, the rainfed area constitutes about 83 million ha. A highly fragile natural resource base characterizes many rainfed areas. Soils of these regions are inherently low in fertility, organic matter content, and water holding capacity; and are easily susceptible to wind and water erosion. Apart from these, low and imbalanced fertilizer use has also resulted in multinutrient deficiencies in rainfed regions. Therefore, soils encounter a diversity of constraints because of soil quality and ultimately have poor functional capacity (Sharma et al. 2005). A possible method of recovering these soils is to add organic matter to improve soil characteristics. Sharma et al., observed that the control plot recorded the lowest pH of 5.9, whereas solely VC at 50 kg N ha-1 and VC + Fertilizer at 25 + 25 N ha-1 recorded the highest pH of 6.8. The electrical conductivity of the soils ranged from 0.034 to 0.067. Application of VC at 50 kg N ha-1 recorded the highest EC of 0.067. Conjunctive use of VC in combination with Fertilizer, FYM, and Glyciridia at 25 + 25 kg ha-1 showed higher organic C content than solely organic manures.

In comparison to the sole application of organic manure, the combined application of both organic and inorganic manures showed lower values for C: N ratio (Mahmood et al.). Rahman et al. observed that CD, PM and RS contributed to the positive soil nutrient balance. Thus, knowledge of various organic and inorganic amendments and their conjunctive use that affects the soil quality under rainfed conditions is vital to meet the short and long-term nutrient requirement of crops and maintain the soil's physical, chemical and biological properties without deteriorating its quality and health.

Keywords: Soil Properties, Rainfed, Organic manures, inorganic fertilizers, Integrated use

O/ S-IV/42

Studies of preparatory tillage and nutrient management on yields and economics of Barley cultivation under water stress condition

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Field experiments were conducted for two consecutive rabi seasons during 2017-18 and 2018-19 at Soil Conservation and Water Management Farm of the Chandra Shekhar Azad University of Agriculture and Technology, Kanpur-208002, on gangatic alluvial soil having 7.6 pH, light-textured soil with medium soil fertility. Treatments comprises of viz.,three preparatory tillage viz., T1 treatment – one cross ploughing with cultivator, T2 treatment- one ploughing with disc harrow + one cross ploughing with cultivator, T3 treatment-one ploughing with disc harrow + one pass with rotavatorand three nutrient management practices i.e. N1 100% RDF (60 Kg N ha-1 + 30 Kg P2O5 ha-1+ 30 Kg K2O ha-1) through chemical fertilizer, N2- 75% RDF(through chemical fertilizer) + 25% FYM (Farm yard manure) and N3- 50% RDF (through chemical fertilizer) + 50% FYM (Farm yard manure) was researched. It is clear from the results of two-year experimentation that sowing of the barley crop in plots. Applied one ploughing with disc harrow + one pass with rotavator and 50% RDF through chemical fertilizer + 50% FYM brought out the maximum values of growth parameters, yield attributes and grain yields q/ha, straw yield q/ha and biological yield q/ha harvest index as well as gross return, net return and b:c ratio of barley in both the years respectively followed bypreparatory tillageone cross ploughing with cultivator and 100% RDF N_1 100% RDF (60 Kg N ha^{-1} + 30 Kg P_2O_5 ha^{-1}+ 30 Kg K_2O ha^{-1}) through chemical fertilizer.

O/ S-IV/43

Traditional farming systems

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Traditional agriculture can be defined as a primitive style of food and farming that involves the intensive use of indigenous knowledge, land use, traditional tools, natural fertilizers and cultural beliefs of the farmers. Some traditional farming systems include agroforestry, crop rotation, intercropping, polyculture, water harvesting, and mulching. These promote low-cost sustainable development in an ecosystem through optimal use of natural resources. Such traditional systems (many of which are pastoral-based) are generally well integrated with the environment and involve management practices that do not over-exploit the natural carrying capacity of the land.Traditional agricultural practices decrease the soil organic matter and affect the environment through the depletion of soil nutrients, deforestation, and soil erosion. This also leads to the rapid depletion of nutrients and fertility in the soil.This practice lacks surplus production that is only enough for their family, known as subsistence farming. Slash & burn method decreases the organic matter, which leads to rapid depletion of nutrients and fertility in the soil. These methods help in ecological systems and local biodiversity conservation

and improve the quality of food and soil. Indigenous combinations of techniques andpractices lead to community food security and the conservation of natural resources and biodiversity. One of the salient features of the traditional farming systems is their high degree of biodiversity, in particular, the plant diversity in the form of polycultures and agroforestry patterns. It is possible to promote synergy, which enhances farm processes such as the activation of soil biology, the recycling of nutrients, the enhancement of biological pest suppression, etc., all are important in determining the performance of agroecosystems. These systems also help achieve food security and generate income for livelihood. It is also imperative to understand how to sustain and combine indigenous agricultural knowledge systems and scientific knowledge and how to translate this into decision-making processes that provide the necessary support to the local peoples.

Keywords: Sustainable development, Biodiversity, Subsistence farming, Agroecosystems.

O/ S-IV/44

Natural Farming: A vital component for future of Indian agriculture

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The crisis of Indian agriculture is very pertinent as the agricultural productivity under conventional farming is reaching a plateau. The decline in factor productivity, depleting natural resources, negative impacts of climate change, increasing input costs for achieving food security and agricultural sustainability, social instability, and farmer suicide are a few of the major challenges today. Indian farmers frequently find themselves in a constant cycle of debt due to high production input costs, high-interest rates for credit, the volatile market prices of crops, the increasing costs of fossil fuel-based inputs, and private seeds. To ensure food security by reviving Indian agriculture in an environmentally safe way as well as to release farmers from indebtedness and suicides, zero budget natural farming (ZBNF) is a grassroots movement which discards the uses of all chemical farming inputs and relies on natural way of farming, i.e. rejuvenating soil and crop health through its own four pillars of practices, i.e., Jivamrita, Bijamrita, Acchadana, Whapasa. Padma Shri Subhash Palekar is the founder of this technique of ZBNF.ZBNF is an extreme form of low external input sustainable agriculture, where all the inputs are locally available (on-farm). The output of one farming system is mostly used as input in other farming systems. It has attained broad achievement in south India, especially the south Indian state of Karnataka, where it first evolved in 2002 and later successfully spread in many states of the nation through numbers of training, demonstrations, and various promotional activities. In 2015, the Government of Andhra Pradesh (GoAP) instituted the Rythu Sadhikara Samstha (RySS), a state-owned, non-profit organizations revealed that ZBNF practices to all farmers in A.P. ZBNF gained momentum as it rejuvenates soil health for sustainable crop production through diversification, microbial activities, nutrient recycling, and beneficial biological interactions. The most immediate impact of ZBNF is on soil biology. In ZNBF, decomposition of organic matter by microbes and earthworms is encouraged on the soil surface itself, which gradually adds nutrition to the soil over time. Besides, in a rain-fed agroecosystem where the green revolution holds less significance, ZBNF can be a promising option under weather uncertainty. ZBNF agriculture model holds promise for improving soil health and local Biodiversity by enhancing the climate resilience for crops, contributing towards the Sustainable Development Goals, and supporting the achievement of the Global Nutrition Targets 2025 of access to affordable and safe food.

Keywords: ZNBF, 4pillars of ZNBF, Subhash Palekar, Low cost input, Soil health, Biodiversity

O/ S-IV/45

Natural farming practices for improving soil health and reducing the environmental footprint

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Anthropogenic soil degradation and climate change pose severe threats to the millions of smallholder farmers' food security and livelihoods in South Asia. In the last few decades, increased crop production left several constraints, such as stagnation in partial factor productivity, soil health degradation, environmental pollution, and increased GHG emission. Reasons are improper agronomic management, non-judicious use of agri-inputs and lack of awareness and knowledge. Alternative natural farming systems like organic, biochar based and low-cost natural farming are becoming popular among producers and consumers globally. Organic inputs catalyze microbial consortium diversity and offer a low-cost carbon sequestration option. Consumers are now orienting towards toxic-free food alternatives even at higher prices. To promote the adoption of organic farming, the constraints need to be overcome by appropriate interventions that take care to compensate the farmers for low incomes in the early phase of adoption due to initial low yields and the requirements of organic inputs. As these systems are new and have emerged recently, there is a lack of scientific data and evidence to quantify their impacts on soil health, greenhouse gas emissions, and quantity and quality of the product, which is crucial to food and nutritional security. There is a need to scientifically evaluate these systems and generate evidence-based data to ensure that these technologies are sustainable regarding food security, environmental and ecological sustainability and climate change.

An experiment was initiated in Kharif 2020 on natural farming practices (NFP) with low inputs at the International Rice Research Institute South Asia Regional Centre Farm, Varanasi, Uttar Pradesh, India, to capture scientific evidence and data on crop productivity, soil health and nutritional quality. Our result shows a 0.3 t/ha higher rice grain yield under NFP than conventional systems. Crops and varieties responded differently to natural and organic systems: Mustard was highly susceptible to aphid attack. Mentha is highly suitable for organic systems. Indigenous rice varieties like Kalanamak and Kalamegha varieties & basmati rice responded better than hybrids under organic systems. Disease and pest infestation was reduced drastically in rice, wheat and Potato, but weed management is still a challenge in natural farming. Low-input responsive rice varieties are better suited & need to be screened for NFP. After 2-years of experimentation, water holding capacity and soil carbon increased in NFP compared to conventional agriculture, but the increase is at par. Under NFP, the GWP for rice and wheat was reduced by 10.0% and 32%, respectively, compared to conventional agriculture. Long–term research is required to understand the mechanism and performance of NFP in increasing soil carbon and reducing environmental footprint without compromising crop productivity.

Keywords: natural farming, organic farming, biochar, ecozyme, soil health, GHGs emission

O/ S-IV/46

Traditional agricultural tools used by *Tagin* Community in Upper Subansiri, Arunachal Pradesh, India

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In Arunachal Pradesh, modern agricultural machinery is unsuitable due to the hilly and mountainous terrain. During the study, improved hand tools and modern agricultural implements were found hardly in the Upper Subansiri district. Traditional agricultural hand tools are still gaining popularity among the farmers of the Tagin community. In the state, standard hand tools are manufactured by local artisans using bamboo, cane, wood and steel. Moreover, indigenous hand tools used by different tribes throughout the state are not similar in shape, size, overall volume, weight, construction material, etc. From the study, it has been noticed that the local artisans do

not incorporate engineering features while making the traditional tools. However, traditional tools, utensils and apparatus are best fit and gender-friendly for farmers according to their requirements.

Keywords: Jhum cultivation, Traditional, Tagin community, Traditional Agricultural Tools, Upper Subansiri

O/ S-IV/47

Impact of crop residue management options on soil water holding capacity and moisture characteristics

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Crop residue retained or incorporated into the soil leads to improvement in the soil's mechanical and hydrological characteristics. To find the optimum residue management option, a field experiment was conducted with four management options, including full residue incorporation into the soil (T1), partial residue retained in soil (T2), full residue retained on the surface of the soil (T3) and conventional practice (T4) with two irrigation depths i.e. 5. and 7.5 cm. Maximum water holding capacity was observed in TI treatment, followed by T3, T2 and minimum in T4. The T1 treatment retained 21.4 % more moisture than T4 at field capacity level, i.e. 0.3 bar; similarly, moisture retention at permanent wilting point, i.e. 15 bar, was 18.3 % more under T1 than T4 treatment. Among soil mechanical properties, the bulk density was found to be significantly lower in T1 (1.54 Mg m-3) than control treatment (1.61 Mg m-3). The crop residue incorporation further improves the water transmission in soil, i.e. infiltration rate of soil by 20.7 % over without residue retained treatment. The soil aggregation, i.e. mean weight diameter and stable water aggregates, were also higher under residue incorporated treatment than in control. Maximum mean weight diameter was observed in T1, followed by T3, T2 and T1. However, the impact of irrigation depths on soil physical properties was found to be non-significant. To improve the water holding capacity, mechanical and hydrological characteristics of the soil residue incorporation into the soil need to be followed in north-west India.

O/ S-IV/48

Effect of different earthworm species on quality of vermicast

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An experiment was carried on the "Effect of different earthworm species on quality of vermicast" at Plant Protection Laboratory, Horticulture Polytechnic, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India, from September to November 2020. The experiment was conducted in a completely randomized design (CRD) with four replications, which included 6 treatments, namely, T1: Eisenia fetida, T2: Eudrilus eugeniae, T3: Aporrectodea rosea, T4: Lumbricus rubellus, T5: Lampito mauritii and T6: Worm unwork compost (control). The mango plant waste, partially decomposed FYM, and soil was used as substrate.

Among different physical properties of vermicast, the highest particle density of vermicast was noted by treatment Eudrilus eugeniae, which was found at par with Aporrectodea rosea, Eisenia fetida and control, while the lowest particle density was recorded in vermicast of Lumbricus rubellus, it was at par with Lampito mauritii. Compared to different treatments, the highest bulk density of vermicast was noted by Aporrectodea rosea, which was not significant with Lumbricus rubellus and control, while the lowest bulk density was recorded in vermicast of Lampito mauritii, which was found at par with vermicast of Eisenia fetida. The highest porosity was found in the treatment Eisenia fetida, which was at par with vermicast produced by Eudrilus eugeniae and Lampito mauritiiwhile the lowest porosity was recorded in vermicast of Lumbricus rubellus. Vermicast of earthworm species Eisenia fetida recorded significantly higher water holding capacity as compared to other treatments while lowest water holding capacity was recorded in control that was at par with vermicast of treatment Lampito mauritii.

Among different chemical properties of vermicast, the pH of vermicast produced by local earthworm species Lumbricus rubellus and Lampito mauritiiwas found at par with worm un-work compost, while the lowest pH was recorded in vermicast of Eisenia fetida, which was found at par with treatment Eudrilus eugeniae and Aporrectodea rosea. The electrical conductivity of vermicast produced by treatment Eisenia fetidaand Eudrilus eugeniae were found at par with Lampito mauritii, while the lowest electrical conductivity was recorded in treatment compost (control). The total organic carbon content and CN ratio was found to be significantly higherin worm un-work compost and the lowest total organic carbon content and CN ratio in the vermicast produced by Eisenia fetida. The total nitrogen contentwas found to be significantly higherin the vermicast of Eisenia fetida as compared to other treatments, while the lowest total nitrogen content was recorded in control. The total phosphorus content and total potassium content were found to be significantly higher in the vermicast of treatment Eudrilus eugeniaewhile lowest total phosphorus content and total potassium content were registered in compost (control).The total calcium content and total sulphur content were found to be significantly higher in the vermicast of treatment Eisenia fetida as compared to other treatments, while the lowest total calcium content and total sulphur content were recorded in compost (control). The total magnesium content was found significantly higher in the vermicast of treatment Eisenia fetida and Eudrilus eugeniae, while the lowest total magnesium content was recorded in compost (control). The total iron content was found to be highest in the vermicast of treatment Eisenia fetida, while the lowest total iron content was recorded in compost which was found at par with treatment Lumbricus rubellus. The total manganese content was found highest in the vermicast of Eudrilus eugeniae, but it was at par with treatment Eisenia fetidawhile lowest total manganese content was recorded in compost. The total zinc content was found to be significantly higher in the vermicast of treatment Eisenia fetidawhile lowest total zinc content was recorded in compost which was found at par with treatment Lampito mauritii. The total copper content was noted same bar in treatments Eisenia fetida and Eudrilus eugeniae and found higher as compared to other treatmentswhile lowest total copper content was registered in compost (control).

Among different biological properties of vermicast, the total bacterial count and total fungal count was found significantly higher in the vermicast of Eisenia fetidaas compared to other treatments while lowest total bacterial count and total fungal count was recorded in compost (control).The total actinomycetes count was found significantly higherin the vermicast of treatment Eudrilus eugeniae as compared to other treatments while lowest total actinomycetes count was recorded in compost. Significantly higher production and recovery of vermicast noted in treatment Eisenia fetida, which was found at par with Eudrilus eugeniae while lowest production and recovery was recorded in compost (control).

Based on the present investigation, it can be concluded that different earthworm species significantly affected vermicast production, recovery and quality in terms of physico-chemical and biological properties of vermicast. Exotic earthworm species Eisenia fetida and Eudrilus eugeniae produced better quality as well as highest production and recovery of vermicast. Therefore, it can be used for vermicomposting under south Gujarat condition. However, local earthworm species Aporrectodea rosea, Lumbricus rubellus and Lampito mauritii also showed better vermicomposting potential and produced good quality of vermicast over normal composting. Therefore it needs to explore in future.

Poster Session-I

PS-I/1

Effect of solid and liquid organic sources on content and uptake of micro-nutrients by Finger Millet [*Eleusinecoracana* L.] grown under organic farming system

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A field trial was conducted at Rajendrapur Farm, Navsari Agricultural University, Waghai to study the "Effect of organics on soil properties, yield and quality of finger millet [*Eleusinecoracana* (L.) *Gaertn*.]" during*kharif*season of 2018 and 2019. Among the different treatments significantly higher nutrient content Fe in grain and straw were recorded under the treatment of the application of 100% RDN through biocompost (S_1) in pooled results. However, all the liquid organics showed non-significant effect on the nutrient content (Fe, Mn, Zn, and Cu) of grain and straw. While, in the case of nutrient uptake by grain and straw, application of 100 % and 75 % RDN through bio compost as well as enriched banana pseudostem sap @ 1 % and *Jeevamrut* @ 1 % was recorded best nutrient (Fe, Mn, Zn, and Cu) uptake among different treatments under study.

Key Words: Foliar nutrition, Micro nutrient, *Eleuscinecoracana,* finger millet.

PS-I/2

Influence of integrated nutrient management and summer green manuring on productivity and profitability o*f Kharif* rice (*Oryza sativa* L.)

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Field experiments were conducted during the summer - *kharif* season of2014, 2015 and 2016 at Instruction farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat), India. Toevaluate the effect of different sources of green manures in comparison with INM on productivity and profitability of succeeding *kharif*rice (*Oryza sativa* L.). The experiment was laid out in split plot design with three replications. In this experiment main plot treatments such as greem gram, dhaincha, cow pea and summer fallow whereas in sub plot integrated nutrient management treatments *viz*., 100% RDF (100:30:00, NPK kg/ha), 75% RDF, 50% RDF and 50% RDF + 5 t/ha FYM + *Azospirillum.* Green manure crops were sown with their recommended fertilizer dose before rice.On the basis of pooled mean of three years (2014-2016), at harvest growth attributes such as plant height, total number of tillers per hill and leaf area index significantly do not differ. In the case of yield attributes of dry matter per hill, panicle length, no. of filled grain per panicle, grain yield per hill and straw yield per hill of rice were recorded significantly higherwith dhaincha (G_3) as green manure crop in summer which remain at par with greengram (G_1) and cowpea (G_2). Number of panicle per m^2 and effect on rice with green manuring in summer.Growth attributes like plant height, total number of tillers/hill and leaf area index were recorded significantly higher N_1 (100% RDF) (100:30:00 NPK Kg/ha) and remained at par with N_2 (75% RDF) and N_4 (50% RDF + 5 t/ha FYM + *Azosprillium*). Yield attributes *i.e.* dry matter per hill (g), number of panicle per m^2, panicle length, no. of filled grain per panicle, grain yield per hill and straw yield per hill were revealed significantly higher with treatment N_1 (100% RDF) and remained at par with treatment N_2 (75% RDF) and N_4 (50% RDF + 5 t/ha FYM + *Azosprillium*). In case of individual three-year grain yield, straw yield and harvest index of preceding summer greenmamuring treatment greengram (G_1), cowpea (G_2) dhaincha (G_3) and (G_4) summer fallow was recorded nonsignificant effect on *kharif* rice. Based on pooled mean of three years grain yield and straw yield was significantly highest whereas in case of harvest index did not differ significantly. Pooled analysis data on grain and straw yield was significantly highest with N_1 (100% RDF).The principal finding revealed that among various green manures and fertilizers, in situ dhaincha cultivation during summer season (fertilized 20:40:00 kg NPK/ha) and followed by application of 75% RDF (75:22.5:00 NPK kg/ha) for succeeding rice crop resulted into higher growth, yield attributes, yield and economic net returns.

Keywords : *Azosprillium, FYM, Green manuring, Rice*

PS-I/3

Integrated nutrient management on brinjal under coastal salt-affected soils of south Gujarat

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A field experiment was conducted during *the late kharif*season of 2018-19 to 2020-21 at Coastal Soil Salinity Research Station, NAU, Danti-Umbharat. Total eighteen treatment combinations comprising twoorganic levels*i.e.,*O_1: no organic manure, O_2: bio-compost @ 10 t/ha, three nitrogenlevels*i.e.*,N_1: 125 % RDN, N_2: 100 % RDN, N_3: 75 % RDNand three level of nutrient supplement*i.e.*, L_1: Control, L_2: Biofertilizer (*Azospirillum* + PSB, 108 CFU/ml, each1.25 lit/ha), L_3: Banana pseudostem enriched sap 1 % was sprayed at 40, 60, 80 and 100 days after transplanting of brinjal. The experiment was laid in a randomized block design (factorial concept) with three replications.The results revealed that treatmentO_2 (bio compost @ 10 t/ha) recorded significantly higher growth and yield attributes *viz.*, plant height,number of fruits per plant, fruit weight and number of picking. In the case of nitrogen levels, treatment N_1 (125 % RDN) recorded significantly higher plant height (57.86 cm) and the number of fruits per plant (17.28) over treatments N_2 and N_3.Treatments N_1 (125 % RDN) and N_2 (100 % RDN) being at par with each other, both recorded significantly higher values of fruit weight (47.96 g and 46.95 g, respectively) and the number of picking (15.32 and 14.89, respectively) as compared to treatment N_3 on a pooled basis.Among nutrient supplements, treatment L_3 recorded a significantly higher number of fruits per plant (17.04) over treatments L_1 and L_2 and fruit weight (47.02 g) over treatment L_1, while treatments L_3 and L_2 were at par with each other and recorded significantly higher values of plant height (56.15 cm and 54.27 cm, respectively) and the number of picking (14.85 and 14.76, respectively) as compared to treatment L_1 on a pooled basis.The studyconcluded that higherbrinjal fruit yield can be achieved by combined applications ofbio compost @ 10 t/ha + 125:50:37.5 kg NPK/ha (50 % N and 100 % P & K at basal and 50 % N at 30 DAT) along with biofertilizers *Azospirillum*+PSB, 10^8 CFU/ml, each 1.25 l/ha.

Keywords:*INM, Brinjal, Coastal salt affected soil*

PS-I/4

Performance of different fodder grasses with gypsum application on coastal salt affected soil

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A field experiment was conducted during 2018-19 to 2020-21 at NAU, Danti-Umbharat, Gujarat. The experiment was conducted on a fixed plot for three years with a split-plot design by taking different grasses {*viz*., Guinea Grass, Hy. Napier grass, Marvel grass (Local), Para grass, Marvel grass, Anjan grass, Gatton panic grass}and gypsum treatments in main plot {*viz*., No gypsum and gypsum @ 75 % GR}and year as the subplot. The results indicated that treatment G_2 (gypsum @ 75 % GR) recorded significantly higher plant height and total green fodder yield among all fodder grasses during all the individual years as well as in pooled results as compared to treatment G_1 (No gypsum). It was also concluded from this experiment that among the different fodder grasses, Hy. Napier grass (F_2) gave the highest net returns of Rs. 110259/ha followed by guinea Grass (F_1) of Rs. 102091/ha. The growing of grasses with gypsum application reduced soil sodicity and increased soil nutrient status.

keywords: *Fodder grasses, Gypsum, Coastal salt-affected soil*

PS-I/5

Effect of Different Levels of Nitrogen and Bio-Fertilizer on Fodder Sorghum under South Gujarat Condition

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The present experiment was carried out at Collegefarm, N. M. College of Agriculture, NavsariAgricultural University, Navsari. During the year2012 in the summer season, to investigate theresponseof summer fodder sorghum (*Sorghum bicolor* L.)GFS-5 to Nitrogen and Biofertilizer were grown underSouth Gujarat conditions. The experiment comprisedfive levels of Nitrogen and two levels of Bio-fertilizer(*Azospirillium* with and without) and was replicated thricein a Factorialrandomized block design (FRBD). Amongthe different levels of nitrogen (0, 40, 80, 120, and160 kg ha^{-1}), the application of 160 kg N ha^{-1} (N5) foundsignificantly higher growth parameters (plantheight at harvest, leaf: stem ratio, day to 50%flowering), yields (green fodder and dry fodder),quality (crude protein content). Application of*Azospirillium* 2 kg ha^{-1}found significantly highergrowth parameters (leaf: stem ratio) as compared tocontrol, a similar trend was found in green and dryfodder yields. Results reported that application of*Azospirillium* 2 kg ha^{-1} treatments tried inthe experiment did not exert their significant effects onplant height at harvest, day to 50% flowering, crudefiber, crude protein and HCN contents.

Keywords: *Green and Dry fodder, Nitrogen, Bio-fertilizer,Crude protein content and HCN content*

PS-I/6

Impact of previous crop and its residues on growth and yield of *kharif* rice

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A field experiment entitled "**Impact of previous crop and its residues on growth and yield of *kharif* rice**" was conducted during the summer and *kharif* season of the year 2021 at College Farm, Navsari Agricultural University, Navsari, Gujarat. The experiment was laid out in a split-plot design and replicated thrice. The treatments consisted of three summer legumes *viz*., T_1 – Green gram, T_2 – Cowpea, T_3 – Dhaincha and T_4 – Fallow kept in the main plot and six subplot treatments *viz*., W_1 – 100 % RDF (100-30-00 NPK kg/ha), W_2 – 75 % RDF, W_3 – 50 % RDF, W_4 – 75 % RDF + 25 % N from FYM, W_5 – 50 % RDF + 50 % N from FYM and W_6 – No fertilizer application.Significantly higher values of growth attributes such as plant height, dry matter/plant, number of productive tillers and yield parameters such as panicle length, number of grains/panicles, number of filled grains/panicle, grain and straw yield (kg/ha) and harvest index of rice grown in *kharif* season were recorded when the crop was sown after incorporation of dhaincha than summer fallow treatment. Application of 100 % RDF (W_1) registered maximum growth and yield parameters and it was found statistically at par treatment W_4 (75 % RDF + 25 % N from FYM) as compared to other treatments. However, treatment W_6 (No fertilizer application) recorded the lowest values of growth and yield parameters. The soil microbial count was recorded higher in dhaincha incorporated treatment before sowing of rice in the summer season and during *kharif* season, the microbial count was higher in treatment consisting of 75 % RDF + 25 % N from FYM (W_4) after the harvest of rice crop.

Keywords: Dhaincha, Green gram, Fallow, Cowpea, Rice, FYM

PS-I/7

Bio-aesthetic planning: A ray towards eco-conservation

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With the development of wildlife conservation as a specialized subject, the aesthetic aspect dominated the concept of Bio-aesthetic planning. With the advancement in agriculture and increase in population, large settlements developed and the beginning of urbanization happened. More and more people moved to urban areas for a comfortable life. Increasing human needs resulted in large-scale exploitation of natural resources, a great reduction in forest cover and extinction of many species of flora and fauna. The extent of forest cover is a good indication of the health of the land. The large-scale deforestation in recent decades has rendered sensitive catchment areas and hilly areas particularly vulnerable to soil erosion. In such conditions, Bio-aesthetic planning can play important role in the environmental amelioration of urban and industrial areas along with their beautification. Professor Lancelot Hogben coined the term 'bio aesthetic planning defined as planning of flora and fauna with the object of beautifying the piece of land (country). It has been popularized in India by M. S. Randhawa. Bio-aesthetic planning may create space, block obnoxious views, stabilize steep slopes, provide a track to route, unify and harmonize a group of buildings and modify exposure to sun and wind. Besides, these trees can answer the major environmental problems and aid in the removal of air, noise and water pollution. Besides this, major objectives are the encouragement of plantations of selected ornamental flowering trees in the towns and villages, protection of beautiful harmless birds like wild ducks, egrets, geese, & sarus cranes by the legal declaration of some big lakes as bird sanctuaries and protection of some graceful animals in national parks & zoological gardens in the vicinity of big cities.

Keywords: Aesthetic, amelioration, urbanization, deforestation and soil erosion

PS-I/8

Estimation of Soil Erosion using USLE Model in a Watershed of Central India

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Soil erosion is a common land degradation problem arising from agricultural intensification, land degradation and other anthropogenic activities. In the present study, the soil loss model, Universal Soil Loss Equation (USLE) integrated with GIS has been used to estimate soil loss in the Satbahiniya watershed located in the central part of India. The objective of the present study is to estimate the annual soil loss using USLE model for Satbahiniya watershed, sub-basin of Mahanadi basin, Chhattisgarh using RS and GIS techniques. Land use land cover and topographical data for the study area were derived using GIS and carried out geographical data analysis. Data collection includes annual rainfall data, a digital elevation model (DEM) from shuttle radar topographic mission (SRTM), and soil maps obtained from FAO (2012), Ministry of Agriculture (MoAE). The five major input parameters used in the study are rainfall erosivity factor (R), Length slope factor (LS), soil erodibility factor (K), vegetation cover factor (C) and erosion control factor (P). The rainfall erosivity factor was determined from the annual rainfall data of the study area. The soil survey data was used to develop the soil erodibility factor and DEM of the study area was used to generate the topographic factor (LS). The value of the cover management factor and practice factor was generated by NDVI (normalised difference vegetation index) developed by McFarlane et al. (1991). After the generation of input parameters, analysis was performed for the estimation of soil erosion using the USLE model by spatial information analysis approach. The estimated rainfall erosivity, soil erodibility, slope length and steepness factor, topographic and crop management factors range from 798.339-812.012 MJ/mm/ha/hr/year, 0.17359-0.188315004, 0-261.53 and 0.03-0.04 and 0.55-1

(slope) respectively. The results indicate that the estimated total annual potential soil loss was of 414.88-tonnes/ha/year.

Keywords: Remote Sensing, GIS modelling, USLE model, Land use land cover, Erosion

PS-I/9

Soil physical properties and seed germination as affected by various tillage operations

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A field experiment was conducted to evaluate the effect of different tillage operations on soil physical properties, infiltration characteristics and germination percentage of gram seeds. Six tillage operations which include primary and secondary tillage operations (M. B. plough, cultivator, Rotavator, M. B.plough + rotavator, cultivator + rotavator and No-tillage) were carried out for field preparations. It was revealed that tillage methods significantly affected the soil's physical properties and consequently, infiltration characteristics of the soil. Among the tillage treatments average soil moisture content up to the depth of 100 cm was recorded to be maximum in rotavator tilled soil (17.75%) and lowest was recorded in the soil tilled by M. B. plough (14.68%). While cultivator + rotavator revealed higher moisture content (17.38%) compared to soil tilled by M. B. plough + rotavator (16.54%). Whereas the soil was not disturbed in No-tillage treatment the soil moisture content was found to be 18.41%. Soil bulk density was found to be maximum in undisturbed soil (1.48 g cc^{-1}) while minimum in M. B. plough (1.19 g cc^{-1}). Whereas, bulk densities in other treatments were revealed to be, 1.39 g cc^{-1} in rotavator, 1.31 g cc^{-1} in cultivator + rotavator, 1.25 g cc^{-1} in, M. B.plough + rotavator, 1.21 g cc^{-1} in the cultivator. Seed germination percentages for gram seed also followed a different trend as it was seen in bulk density. Seed germination was highest in M. B. plough tilled land and lowest in no-tillage treatment followed by rotavator tilled soil. The basic infiltration rate was revealed to be higher in M.B. ploughed soil (0.10 $cmmin^{-1}$) and lowest in no-tillage treatment (0.01 $cmmin^{-1}$).

Keywords: Tillage, soil physical properties, basic infiltration rate, germination percentage

PS-I/10

Comparative study between three KVK soil Climate

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At present there are 731 out of which 66 are under ICAR Institute the major mandatory activity of KVKs are OFTs, FLDs and training soil testing laboratory is neglected due to unavailability of any funds from any sources myself taking soil samples from farmers' fields from 2009-2022 maximum samples were analysed by me in my laboratory at KVK Kushinagar but some soil samples bring to state departments of agriculture & at RRS Lucknow. According to the results of the soil status of KVK, Kushinagar is medium soil fertility, Bhadohi soils are low fertility and Hardoi – II soils are very low in majority of soil parameters. The major problem of Kushinagar is waterlogging due to river Budhi Gandak and in Bhadohi/Hardoi-II soils are having salinity and alkalinity problem. All the districts are clay loam to sandy loam soils with low major and micronutrients status in all three districts and in case of biological properties Kushinagar ranks first.

PS-I/11

Response of Indian bean variety GNIB 21 to irrigation and nitrogen levels under south Gujarat condition

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Field experiment was conducted during *rabi*season of 2016-17 **at Pulses and Castor Research Station,** Navsari Agricultural University, Navsari to study the **response of Indian bean variety GNIB 21 to irrigation and nitrogen levels under** south Gujarat condition. Total nine treatment combinations comprising of three levels of irrigation of 50 mm depth (I_1: Three Irrigation at sowing, branching and flowering, I_2: Four Irrigation at sowing, branching, flowering and 1st picking and I_3: Five Irrigation at sowing, branching, flowering, 1st picking and 2nd picking) and three levels of nitrogen (N_1: 20 kg N/ha, N_2: 40 kg N/haand N_3: 60 kg N/ha) were evaluated under randomization block design with factorial concept with four replication**.** From the results, it was concluded that application of either one (I_2) or two (I_3) irrigation after each pod picking along with three irrigation at sowing, branching and flowering stage resulted in significantly higher green pod yield at 2nd picking and total green pod yield and number of pods per plant at 3rd picking over treatment I_1. Similarly, application of 40 kg N/ha (N_2) to Indian bean resulted in a significantly higher number of pods per plant and green pod yield per plant at each pod picking except pod yield per plant at 3rd picking than 20 kg N/ha (N_1). Still, it remained at par with higher doses of nitrogen i.e. 60 kg N/ha. A similar trend was observed for green pod yield at each picking and it's total except for green pod yield at 3rd picking.

Keywords: *Indian bean, irrigation, nitrogen, green pod yield, picking*

PS-I/12

Nutrient management in Indian bean (*Lablab purpureus* L.) under south Gujarat condition

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A field experiment was conducted during *rabi* season of 2015-16 on vertisols of Navsari, Gujarat to study the Nutrient management in Indian bean (*Lablab purpureus* L.) under south Gujarat condition. Almost all the growth and yield attributes such as plant height at 60 DAS and at harvest, number of branches per plant at 60 DAS and at harvest, dry matter accumulation per plant at 60 DAS and at harvest, number of inflorescences per plant, number of pods per plant, number of seeds per pod, length of pod and 100 seed weight at harvest were recorded significantly higher with the application of 125% RDF through inorganic fertilizer over 100% RDF. Similarly, seed (728kg/ha) and stover yield (1484 kg/ha) of crop were also noted to be significantly higher with application of 125% RDF than 100% RDF. An application of 2 t/ha biocompost resulted in significantly higher seed yield and stover yield (727 kg/ha and 1490 kg/ha, respectively) over other treatments because of significant enhancement in growth and yield attributes under the same treatment (2 t/ha biocompost). Foliar application of 1% banana pseudostem enrich sap to Indian bean at 30 and 60 DAS was resulted in significantly higher growth and yield attributes over without foliar spray (control). Ultimately resulted in significantly higher seed and stover yield of Indian bean and higher economic returns.

Keywords: *Indian bean, nutrient management, biocompost, growth and yield attributes, seed yield, economics*

PS-I/13

Conservation, management and reclamation of natural resources

Soil Ecology and Management

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Soil ecology is the study of interactions between the physico-chemical components of the soil and organisms living within the soil. They live within the pore spaces between solid particles and contribute vitally to plant nutrition, in symbiotic association with roots or by releasing essential nutrients into the soil solution around roots. The breakdown of plant and animal residues, as well as many synthetic chemicals, is catalyzed by soil microorganisms and facilitated by soil animals. Soil bacteria and fungi produce binding substances that stabilize aggregates, building a soil structure that allows for root penetration, water infiltration, chemical buffering and gas exchange. Soil pedogenesis involves mixing organic material and mineral particles by soil fauna such as collembola, enchytraeids, mites and earthworms. Soil bacteria and fungi produce binding substances that stabilize aggregates, building a soil structure that allows for root penetration, water infiltration, chemical buffering and gas exchange. Soil ecology and management describes the organisms inhabiting the soil, their functions and interactions and the dimensions of human impact on the activity of soil organisms and soil ecological function. Humans depend highly on the soil ecosystem, which provides food, fibre, fuel and environmental services, such as recycling atmospheric gases. At present, we are experiencing unprecedented global change, induced mainly by anthropogenic activities such as fossil fuel burning and land use change. Food and fuel insecurity, environmental pollution, and ecological degradation are tremendous societal challenges in the 21st century. It is, therefore, essential to understand the function and nature of the soil ecosystem to predict and mitigate the long-term consequences of presentday actions.

PS-I/14

Conservation, management and reclamation of natural resources

Organic and natural farming for climate resilience

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Climate change poses critical risks for farmers and endangers the soil, water, and other resources on which food production depends. Rising temperatures have already intensified droughts, heat waves, and storms, making it harder to grow crops and raise livestock. So, the intersection between climate change and agriculture is crucial to understanding agriculture's role in contributing to and mitigating global warming. Organic and natural farming has additional potential against changing climatic conditions. The careful management of nutrients, carbon sequestration, lower input of fossil fuel-dependent resources and use of renewable energy all present opportunities for organic agriculture to lead the way in reducing energy consumption and mitigating the adverse effects of energy emissions. Organic agriculture provides management practices that can help farmers adapt to climate change by strengthening agro-ecosystems, diversifying crop and livestock production, and building a farmer's knowledge base to prevent and confront climate changes. The main organic strategies are diversification and increasing soil organic matter, which could enhance resilience against extreme weather events. Organic farming avoids nutrient exploitation and increases soil organic matter content; hence soils under organic farming capture and store more water than soils under conventional cultivation. Production in organic farming systems is thus less prone to extreme weather conditions, such as drought, flooding, and waterlogging. Organic farming also comprises a highly diverse farming system and thus increases the diversity, which further helps to cope with the adverse climatic condition. Organic farming helps solve climate change by reducing greenhouse gases, a significant cause of climate change. There is a direct correlation between nitrous oxide emission and the amount of nitrogen fertilizer applied to agricultural land. Organic farming also helps improve

soil carbon sequestration and increases resilience by building healthy soil and crops which may adapt to climate change. Many practices in organic and natural farming, such as minimum tillage, returning crop residues to the soil, use of cover crops, crop rotations, and greater integration of nitrogen fixing legumes, increase the return of carbon to the soil and hence increase productivity. Thus, organic and natural farming enables farmers to minimize risk due to stable agro-ecosystem and yields and lower production costs.

PS-I/15

Effect of *TATVA*-G liquid organic formulation on germination and yield of green gram

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An experiment was carried out at Organic Farm, ASPEE College of Horticulture, Navsari Agricultural University, Navsari, to study the effect of *Tatva*-G liquid organic formulation (LOF) on germination and yield of green gram. First, *Tatva*-G LOF was evaluated by preparing different combinations of *gliricidia*-based plant extract. The best formulation based on their incubation period and nutritional value were *Tatva*-G. This LOF was tested for germination study and yield of green gram. During germination study, germination sheets were treated with different concentration of *Tatva*-G LOF (2%, 4%, 6%, 8%, 10%, 20%, 30%, 40% and 50%) along with control. On every sheet, 100 green gram seeds were covered with another sheet. The sheet was rolled and kept for incubation a5 25 º C temperatures for days. After 6 days, the observations were recorded. In another study, different concentration of *Tatva*-G LOF (2%, 4%, 6%, 8%, 10% and 100%) was applied through spraying and drenching when the green gram crop was grown in a micro plot. The experimental results indicated that seed germination percentage for green gram was higher for the control treatment even though seeds treated with up to 50% of *Tatva*- G LOF had recorded acceptable germination values as per the standards by the Central Seed Certification Board, New Delhi. 2% Tatva-G LOF observed the highest seedling fresh weight. The shoot length and root length were shown highest with 2% *Tatva*-G LOF which was at par with 4% *Tatva*-G LOF. Further, the seedling vigour index was also highest in 2% *Tatva*-G LOF with an index value of 3216. While in the field experiment, the highest plant height of green gram was reported with the drenching of 4% *Tatva*-G LOF. Significantly the highest yield of a green gram of 76.54 g/net plot was attained by 2% spraying, and 4% drenching of *Tatva*- G LOF, and it was at par with the yield obtained in M_2C_1 (2%) and M_2C_3 (6%) treatments.

Key words: *Tatva*-G, Gliricidia, liquid organic formulation (LOF), germination, yield

PS-I/16

Potential of soil bacteria for arsenic transformation in soil in presence of metal pollutants

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An essential aspect of the reclamation of natural resources is the study of soil quality in various environments. This includes a study of soil in regions likely to be high in metal concentration. Soil near industrial regions and soil near ship-breaking yards in the coastal region are likely to have certain metal pollutants in excess. This study collected and studied samples from such areas for arsenic content. Arsenic is a metalloid found in organic and inorganic compounds with variable oxidation states. The common oxidation states are arsenate (As V), arsenite (As III) and elemental arsenic (As°). Biologically, the trivalent arsenite is significantly more active than the pentavalent arsenate, including the ability to induce gene amplification in mammalian cells. Several disorders are also linked to the presence of Arsenic in drinking water

which occurs over a period of time though the initial point of contamination is in industrial/other regions. Most remediation strategies are based on the chemical removal of Arsenic from the contaminated body. Biologically arsenite oxidizing bacteria for oxidizing arsenite into less toxic arsenate can be used to decrease toxicity and could be employed for maximum remediation of contaminated soil.

In our study, soil from the coastal ship breaking yard region was not found to be having arsenic content (using kit). However, soil from the near industrial region was found to contain Arsenic. Weobtained two bacillus-species*megatherium* and *aryabhattai* identified using 16S rRNA sequencing to bring about the arsenite oxidation. They also can tolerate other heavy metals. However, arsenite oxidation could not be seen in the presence of other heavy metals.The bacteria can be studied further for other properties which may influence soil quality and plant growth. Polymer formation in the presence as well as the absence of arsenite, was studied.

Keywords: Arsenic, Metals, Soil, Bacteria

PS-I/17

Effect of different crops and different levels of compost on soil microbial population under organic ecosystem

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After cultivating five crops of vegetables (C1: maize, C2: Indian bean, C3: cauliflower, C4: garlic, C5: carrot) and three levels of NADEP manures (M1: 100% RDN, M2: 50% RDN, M3: 4t ha-1),) in an organic farm Navsari Agricultural University, Navsari the effects of different application rates of compost (M1, M2 and M3) were compared with the effects crop environment and no application of fertilizer treatments for some selected soil microbial populations. Organic matter is the food of soil microorganisms. Also, it improves the soil's physical properties, which might be a probable reason for the higher microbial count in the treatment received the higher dose of manure. The maximum population of bacteria (11.05×106), fungi (12.04×103) and actinomycetes (7.58×104) were recorded in treatments C3M1, C4M1 and C3M1, respectively. While the minimum population of bacteria (3.56×106), fungi (4.03×103) and actinomycetes (1.56×104) were recorded in treatments C2M2. In general, higher microbial populations were observed where applied higher doses of NADEP compost were, and lower microbial populations were observed where applied lower doses of NADEP compost. Organic manure contains more growth-promoting substances, vitamins, and enzymes. This increases the root biomass production; thus, higher root exudation increases the beneficial bacteria, fungi and actinomycetes populations in the rhizosphere region.

Keywords: Microbial population, NADEP, compost, organic system, crops and soil

PS-I/18

A study of long term fertilizers and manure application on nutrient status

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The experiment was undertaken in soybean-wheat cropping sequence under the ongoing All India Coordinated Research Project on Long Term Fertilizer Experiment at Jawaharlal Nehru Krishi Vishwa Vidyalaya, Jabalpur (M.P.). The resultshowed that the application of a recommended dose of N, P and K with FYM @ 5 t ha^{-1} significantly superior treatment with respect to soil fertility. The results indicated that 100% NPK with 5 t FYM ha^{-1} improved the organic carbon content of soil over its initial value and observed a substantial buildup of available P. Thus, the integrated use of inorganic fertilizer and organic manure improved and sustained soil fertility. The available S status declined over the years of experiments when sulphur was not included in the fertilizer schedule.

PS-I/19

Estimation of rooftop rain water harvesting potential for NAU campus

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Water harvesting is progressively turning into an essential component of sustainable water management in peri-urban and suburban areas around cities. To meet the nutritional security of the urban population as well as to meet the water demands of cities roof water harvesting is becoming the unavoidable measure to sustain groundwater quality. The study was undertaken at in Navsari Agricultural University(NAU) campus which comes under the South Gujarat heavy rainfall zone, where the water availability is not an issue but depleting water quality is a major concern, mainly due to seawater intrusion. Rooftop water harvesting was one of the most appropriate options to improve groundwater quality effectively. With an increase in staff and student strength, the water demands have progressively increased in the last few decades. The situation of groundwater quality will further worsen, with an increase in a number of colleges, students, and staff strength and due to over exploitation of groundwater in the colonies surrounding the campus. Apart from making several waterbodies in the campus to harvest and conserve rain water, it is required to estimate the rooftop rain water harvestingpotential..The Rooftop areas of NAUcampus that could harness rainwater were digitized in google earth and mapped using QGIS. The effective area that contributes to rain water harvesting was found to be 87848 sqm. Average monthly rooftop rainwater harvesting potential was found as 17592 m^3, 51985 m^3, 37066 m^3 and 23849 $m^3$for June, July, August, and September month, respectively. The rooftop water harvesting technique is a practical and promising alternative for groundwater quality development and it will be beneficial to meet the domestic and drinking water demands of residents of the campus

Keywords: Rainwater, Rooftop water harvesting, GIS, NAU

PS-I/20

Dynamics of nitrogen and phosphorous fractions as affected by integrated use of inorganic fertilizers and organic manure under yam bean (*Pachyrhizus erosus* L.) cultivation in Alfisols

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An investigation was carried out to study the combined effect of inorganic and organic manure on the occurrence of different forms of nitrogen and phosphorous in lateritic soils of the Konkan region.The experiment was conducted for three consecutive years under yam bean cultivation, at the All India Coordinated Research Project on Tuber Crops, Central Experiment Station Wakawali, Dr. Balasaheb Sawant Konkan Krishi Vidyapeeth, Dapoli, in Maharashtra. Thirteen treatment combinations comprising different levels of nitrogen (80,100,120 kg ha^{-1}), phosphorous (40, 60, 80 kg ha^{-1}), FYM (10, 15, 20 t ha^{-1}), a constant dose of potassium (100 kg ha^{-1}), and an absolute control were replicated thrice in randomized block design.

Among the various nitrogen fractions, total hydrolysable N was the dominant N fraction. On average, hydrolyzable NH_4-N, amino acid-N, hexosamine-N, and unidentified hydrolysable-N contributed about 27.54, 43.07, 10.81, and 18.58 percent of total hydrolysable-N, respectively. The nitrogen fertilizer applied in different levels along with different levels of FYM significantly increased all nitrogen fractions except unidentified hydrolysable-N over their initial status and control treatment. The relative abundance of nitrogen fractions was in the order of exchangeable NO_3-N< exchangeable NH_4-N< fixed NH_4-N< unidentified non-hydrolysable-N < total hydrolysable-N. Similarly, the phosphorous fertilizers applied in different levels along with different FYM

levels significantly increased all phosphorous fractions except residual-P over their initial values and control treatment. The relative abundance of phosphorous fractions was in order of organic-P > residual-P > Fe-P > reductant soluble-P > occluded-P > Al-P > Ca-P > saloid-P. Averaged across treatments, the saloid-P constituted the lowest about 1 per cent, whereas organic-P contributed 39 per cent of total-P.

As far as the quality of yam bean tubers was concerned, the quality parameters such as reducing sugars, non-reducing sugars, starch, crude fiber, protein, moisture content, and shelf life of yam bean tubers were significantly improved due to various treatments receiving a combined application of inorganic fertilizers and organic manures over control treatment.

Based on the experimental findings, it could be concluded that the lowest dose of inorganic nutrients i.e., 80:40:100 N, P_2O_5, K_2O kg ha^{-1} along with an application of FYM @ 15 t ha^{-1} sufficiently improves nitrogen and phosphorous fractions and organic carbon content eventually improving quality and quantity of yield of the yam bean in lateritic soils of Konkan region.

Key words: *Nitrogen and phosphorous fractions, yam bean, Alfisols.*

PS-I/21

Effect of spacing and hybrid on quality of summer pearl millet (PennisetumglaucumL.) under south Gujarat condition

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A field experiment conducted during the summer season of 2018 on College Farm, Navsari Agricultural University, Navsari on heavy black soil consisting of nine treatment combinations was laid out in Randomized block design with the factorial concept with four replications. The results revealed that the highest yield and net return of summer pearl millet were obtained with row spacing of 45 × 15 cm or 60 × 15 cm along with hybrid GHB – 732 or GHB – 558. Sowing of pearl millet at 45 × 15 cm row spacing showed significantly higher protein yield (508.85 kg/ha), grain yield (4775 kg/ha), straw yield (7828 kg/ha), nutrients uptake by grain and straw, and maximum net realization of ₹ 81295/ha with BCR of 3.07. The hybrid GHB-732 gave significantly higher protein yield (498.75 kg/ha), grain yield (4579 kg/ha), straw yield (7536 kg/ha), nutrients (N and K) uptake and total uptake by grain and straw, and maximum net realization of ₹ 77014/ha with highest BCR 2.91. The row spacing was influenced non-significant effect on available N, P2O5 and K2O status in the soil after harvest of the pearl millet crop. However, the highest available N (178.55 kg ha-1), available P2O5 (32.31 kg ha-1) and available K2O (343.86 kg ha-1) in soil was recorded by 30 × 15, 60 x 15 and 30 x 15 cm row spacing, respectively. The pearl millet hybrids influenced a non-significant effect on available N, available P2O5 and available K2O in the soil after harvest of the pearl millet crop. However, the highest available N (176.80 kg ha-1), available P2O5 (32.27 kg ha-1) and available K2O (339.37 kg ha-1) in soil were recorded by hybrid GHB - 538, GHB – 732 and GHB-732, respectively

Keywords: Pearl millet, hybrids, row spacing, yield, quality, nutrient content and uptake

PS-I/22

Nutrient management in Indian bean and its *ratoon* crop sequence under south Gujarat condition

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An experiment was conducted during the *rabi*season of 2017-18 at Pulses and Castor Research Station, Navsari Agricultural University, Navsari to study the effect of nutrient management in Indian bean and its *ratoon* crop sequence under the south Gujarat condition. The experiment was laid down in a split-plot design in which the main plot has four treatments i.e. M_1: Control (Native fertilizer), M_2: 20: 40 kg N: P_2O_5/ha, M_3: 5 t FYM/ha and M_4: 3 t Biocompost/ha imposed to plant crop and subplot treatments i.e. S_1: Control, S_2: 10: 10 kg N: P_2O_5/ha, S_3: 10: 30 kg N: P_2O_5/ha, S_4:20: 30 kg N: P_2O_5/ha and S_5: 20: 40 kg N: P_2O_5/ha applied to *ratoon* crop were replicated thrice. From the results, it was observed that application of 5 t FYM/ha and RDF (20: 40 kg N: P_2O_5/ha) to plant Indian bean crop were at par with each other for total green pod yield of *ratoon* Indian bean as well as at 1st and 2nd picking than other treatments. Application of 20:40 kg N: P_2O_5/ha(M_2), 5 t FYM/ha (M_3) and 3 t bio compost/ha (M_4) remained at par with each other for the significantly higher number of pods/plant at first and second picking over control(M_1). Similarly, the application of 20:30 kg N: P_2O_5/ha to *ratoon* Indian bean resulted in significantly higher green pod yield at 1st and 2nd picking and its total, but it remained statistically at par to treatment S_5 *i.e.* 20: 40 kg N: P_2O_5/ha than other levels of fertility. The number of pods/plant at first and second picking was recorded significantly higher under fertility level of 20: 40 kg N: P_2O_5/ha (S_5) applied to *ratoon* crop which remained statistically at par to 20: 30 kg N: P_2O_5/ha (S_4) over other levels of fertility except for fertility level of 10: 30 kg N: P_2O_5/ha for Number of pods/plant at first picking. Moreover, the interaction effect between 5 t FYM/ha applied to plant crop and 20:30 kg N: P_2O_5/ha to *ratoon* crop (M_3S_4) recorded significantly higher total green pod yield of *ratoon* Indian bean which remained at par to treatment combination of M_3S_5, M_2S_4, M_2S_5, M_2S_3 and M_3S_3. While, at first picking treatment combination of M_4S_3 had noted significantly higher green pod yield which remained at par with M_2S_4, M_3S_4, M_2S_5 and M_3S_5 over other treatment combinations. Similarly, the Treatment combination of M_2S_3 recorded significantly higher green pod yield at second picking over other treatment combinations but it remained statistically at par to treatment combinations of M_3S_2, M_1S_5, M_4S_4, M_3S_4 and M_3S_5. The treatment combination of M_2S_5 recorded a significantly higher number of pods/plant at second picking over other treatment combinations except for the treatment combination of M_3S_5, M_3S_5, M_3S_4 and M_2S_4.

Keywords: *Indian bean, Nutrient management, ratoon crop, Pod yield, Pod picking, FYM*

PS-I/23

Response of *rabi* castor to row spacing, date of sowing and intercropping of Indian bean (var. GNIB 21) under south Gujarat condition

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An experiment was conducted in *rabi*season of 2018-19 at Pulses and Castor Research Station, Navsari Agricultural University, Navsari to study the response of *rabi* castor to row spacing, date of sowing and intercropping of Indian bean (var. GNIB 21) under south Gujarat condition. In all, twelve treatment combinations comprising two dates of sowing (D_1: Last week of October and D_2: Second week of November),

three-row spacing (S_1: 120 cm x 90 cm, S_2: 150 cm x 90 cm and S_3: 180 cm x 90 cm) and two levels of intercropping (W_0: without intercropping and W_1: with intercropping) were evaluated in split-plot design with three replications**.** The results indicated that castor crop sown during the last week of October resulted in a significantly higher number of capsules/spike, castorseed yieldand castor equivalent yield than crop sown during the second week of November. Treatment of spacing *i.e.* S_2 (150 cm x 90 cm) gave the highest seed yield and castor equivalent yield than treatments S_1 and S_3. Number of capsules/spike was higher under 150 cm x 90 cm and 180 cm x 90 cm over 120 cm x 90 cm spacing. Castor sown with one row of Indian bean as intercrop resulted in higher castorseed yieldand castor equivalent yield over castor sown without intercrop of Indian bean. The green pod yield of Indianbean was higher under treatment of castor sown during last week of October, spacing of 120 cm x 90 cm and intercropping of Indian bean in castor.

PS-I/24

Resource management to sustain cotton productivity of Hirsutum Cotton Hybrid in inland Ecosystem

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Hirsutum Cotton hybrids play a pivotal role in improving the yield of cotton in Gujarat state. An experiment was conducted at Main Cotton Research Station, Navsari Agricultural University, Surat during kharif seasons of 2018 to 2020 under the irrigated condition of South Gujarat to optimize agronomic requirements viz; plant spacing and nitrogen level for an intra hirsutum cotton hybrid; GSHH-2799. The experiment was laid out in Factorial Randomized Block Design with three replication including two plant spacings (S1- 120 x 45 cm and S2- 120 cm x 60 cm) and three Nitrogen levels (N1:180 kg N/ha, 240 kg N/ha and N3- 300 kg N/ha).

Based on the three years pooled results, it was found that sowing of cotton hybrid; GSHH-2799 at 120 cm x 45 cm spacing (18518 plants/ha) recorded significantly higher seed cotton yield (1902 kg/ha) than the crop sown at 120 cm x 60 cm spacing (13889 plants/ha). Application of fertilizer @ 300 kg N/ha (N3) recorded significantly higher seed cotton yield (1900 kg/ha) as compared to 180 kg N/ha (1644 kg/ha), but was found at par with 240 kg N/ha (1849 kg/ha). Sowing of the crop at 120 x 45 cm spacing recorded higher N, P and K uptake by cotton seed and stalk. Soil nitrogen status after harvest of the crop was found to increase with the application of higher doses of N i.e. 240 kg N/ha and 300 kg N/ha. Economics of different treatments revealed that the crop sown at 120 cm x 45 cm recorded higher net returns (74886 Rs./ha) and B:C Ratio (2.29). Among N levels 300 kg N/ha recorded higher net returns (133000 Rs./ha) and B:C Ratio (2.29).It can be concluded that growing of hirsutum cotton hybrid; GSHH-2799 at 120 x 45 cm spacing with the application of 240 kg nitrogen/ha in five equal splits (each of 48 kg N/ha) at 30, 60, 75, 90 and 105 DAS may obtain higher seed cotton yield as well as net income.

PS-I/25

Hydrogel: A sustainable technology in ornamental horticulture

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In India, more than 68 % area is under dry land conditions and more than 40 % of the area faces the problem of insufficient rainfall. To overcome this problem, Hydrogel may prove as a convenient and eco-friendly feasible option to achieve the goal of crop productivity under conditions of water scarcity. Hydrogels are cross-linked polymers with a hydrophilic group which can absorb large quantities of water without dissolving in water. It is commonly known as plant gel or super absorbent polymer which can absorb 400-1500 times water by its dry weight. When its surroundings begin to dry out, the hydrogel gradually releases up to 95 % of its stored water. As it is hydrophilic, it has a good swelling capacity, lack of toxicity and controlled water released thus, there is immense scope for ornamental plants. It plays an important role in conserving water, reducing irrigation frequency and releasing sufficient moisture to the growing roots of ornamental plants. It improves plant growth and density and increases flowering and dense foliage. Moreover, it helps to plant withstand prolonged moisture stress as well as delays the onset of permanent wilting point. Hydrogels also improve the physical soil properties like soil porosity, soil permeability and water infiltration which will significantly reduce surface runoff and soil erosion.

Keywords: Hydrogel, polymers, water absorption, water stress and moisture.

PS-I/26

Green buildings: A step towards sustainable lavish life

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The speed and scale of rapid urbanization have brought social, economic, and environmental sustainability into challenging grounds. This necessitates the exploration of their entwined relationships, especially in a rapidly developing country like India. Simultaneously, urban ecosystems and landscapes have gradually become more vulnerable to the evolving construction prospects in the country. Any urbane construction harms the surrounding ecology, as it habitually adopts the path of heavy construction work which eventually consumes a large chunk of our green space, further intensifying the impact of the existing eco-environmental problems, such as resource consumption, climate change, and environmental degradation. Green building is a high-quality building in the whole life cycle, which saves resources, protects the environment, reduces pollution, provides people with healthy, applicable and efficient use of space, and maximizes the harmony between man and nature. The ' green ' of ' green building ' does not mean the general sense of vertical greening, or roof garden, instead, it represents a concept or symbol that refers to a building that is harmless to the environment. These buildings usually contain algae, grass, herbs, vegetables or other leafy green or micro-green plants on their interior or exterior surfaces. It can make full use of environmental natural resources and is built without destroying the basic ecological balance of the environment. These can also be called sustainable development buildings, ecological buildings, or natural

buildings. Green buildings have a less negative impact on the environment than standard buildings. Their construction minimizes on-site grading, saves natural resources by using alternative building materials, and recycles construction waste rather than sending truck after truck to landfills. Most green buildings' interior spaces have natural lighting and outdoor views, while highly efficient HVAC (heating, ventilating, and air-conditioning) systems and low-VOC (volatile organic compound) materials like paint, flooring, and furniture create superior indoor air quality. These buildings use less water, energy and other natural resources. In some cases, they can increase biodiversity, produce their energy and reduce the urban heat island effect. Recent research shows that green buildings can also improve the health and productivity of those who live or work inside them. In some cases, green buildings can have the same benefits as spending time in nature, which can benefit people living in cold climates.

Keywords : Buildings, Urbanization, Quality of life, Energy efficiency, Ecosystem and HVAC

PS-I/27

Climate cleverness vis-à-vis flower production

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Climate-Smart Agriculture is a leader in green growth. In the era of increasing population and constantly changing climate, the world needs various growth forms that are socially and environmentally sustainable and utilize limited natural resources. Digital tools and data sciences are accelerating agriculture innovation and transforming farming to advance how we convert natural resources into beneficial outcomes and have a positive impact on sustainability. IPCC has projected 0.5 to 1.2 ^{0}C rise in temperature by 2020, 6.88 to 3.16 ^{0}C by 2050 and 1.56-5.44^{0}C by 2080, depending on the scenario of future development. Recently, many regions have witnessed a considerable increase in the number of floods, droughts and cyclones while the water, soil and land resources continue to decline. Increased temperature, change in rainfall pattern, climate-related extreme events, water scarcity etc. will increase the pressure for more production in agriculture. As a result, yield stagnation, change in land use patterns, and competition for land, water and other resources will arise. It may alter the quality, colour and other parameters which may need appropriate investment for targeted quality produce. Climate-resilient floriculture is a blend of technical, cyber-computerized automation in crop production and maintenance of floricultural produce which uses artificial intelligence, informative resources, better weather forecasting powered with automated machinery and equipment, various sophisticated software which provides an exact growing condition for the crop, genetic- engineering and many novel technologies. To satisfy these challenges trained manpower equipped with the latest technology will be required who can apply for the scientific advances in all disciplines in an integrated manner.

Key words: Climate-smart, digital, cyber and IPCC

PS-I/28

Fabrication and testing of a manually operated maize seed planter

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A manually operated maize seed planter was fabricated and tested in the Department of Farm Machinery and Power Engineering, SHUATS, Allahabad. Performance evaluation was done based on laboratory and field tests. Parameters taken under laboratory tests were calibration test, seed germination test, seed damage test, and uniformity of intra-row seed spacing, while the field test examined the field efficiency, field capacity, and missing average seed spacing within the row. The planter was calibrated in the laboratory of the Department of Farm Machinery and Power Engineering, SHUATS, Allahabad. The seed rate of Maize during calibration of the manually operated maize planter in the lab was 21.50 kg/ha without missing. Whereas the damage test, seed germination, seed to-seed distance, and missing rate were 2.10 %, 89 %, 24 cm, and 2.9 %, respectively. It has a field efficiency of 89.83% and field capacity of 0.15 ha/hr with an average planting depth and spacing of 3.5 cm and 19.10 cm respectively. Overall performance of the manually operated maize seed planter was found quite satisfactory. The machine might be acceptable because it is easy to operate, simple in fabrication and mechanism, light in weight, requires less labour and cost of planting, and can also be used for maize planting.

Keywords: Field Efficiency, Field Capacity, Germination, Missing rate, Seed damage etc.

PS-I/29

Global scenario of carbon sequestration in Teak plantation: A Review

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Teak (*Tectona grandis*) is known as an economically important tree species belonging to the Lamiaceaefamily and is native to Southeast Asia, mainly found in Bangladesh, India, Indonesia, Myanmar, Malaysia, Sri Lankaand Thailand. India has states with natural teak forests and plantations such as Madhya Pradesh, Maharashtra, Tamil Nadu, Karnataka, Kerala, Gujarat, Orissa, Andhra Pradesh, Rajasthan and Manipur. Teak has earned the title of "King of Wood" due to its attractive wood quality, aesthetics and highdurability level.Teak plantations can store carbon and absorb carbon dioxide.Carbon sequestration is the process of capturing and storing carbon dioxide from the environment. Carbon sequestration through plants is a major approach for reducing the rise in atmospheric concentrations of carbon dioxide and other greenhouse gases. Growing Teak (*Tectona grandis*) contributes significantly to carbon sequestration and has more potential to contribute to climate change mitigation. The variation in carbon stocks/sequestration among teak plantations is mainly due to the locality and age of trees.India (Gujarat, Jharkhand, Orissa, Karnataka, Madhya Pradesh), Nigeria, Myanmar, Indonesia, Thailand and Central America (the Isthmus of Panama) have carbon stocks ranging from 1.61 to 181.13 tonnes/ha at the ages of 1-50 years.

Keywords:*Carbon, Sequestration, Teak, climate change, Plantation*

PS-I/30

Home gardens: Traditional system of biodiversity conservation, food security and socio-economic development

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Over the last two decades, the conservation of genetic resources has received increasing attention due to the over-exploitation of natural resources. The traditional home gardens serve as conservation units for the native plants and reservoirs of exotic species from different origins. Home gardens are the traditional agroforestry systems where multipurpose trees and shrubs (woody components) are grown in intimate association with herbaceous species (mainly annual, perennial and seasonal crops) and/or livestock which all are managed within the compounds of individual homes, maintained by members of the household and their products are intended primarily for household consumption. Home gardens are normally found in almost all the tropical and sub-tropical hot humid regions. The home gardens produce a variety of food such as vegetables, fruits, cereals,medicines as well as timber, small timber, fuel wood, cash crop *etc*. Moreover, the production of diversified foods helps in improving the nutritional intake capability and additional income of the farmers. In developing, countries such as Bangladesh, Indonesia, India and Sri Lanka home gardens are the major source of food production, and nutrient supplements and contribute to the socio-economic development of farmers.

Keywords: ***Biodiversity,conservation, food security, home garden, socio-economic***

PS-I/31

Socio-Economic Impact on Climate Change and An Approach towards Mitigation risks in India

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Industries and agriculture play a pivotal role in economic uplifting and feeding India. Growth in industrial and agricultural developments is helping in eliminating the dependency on other countries for the supply of essential goods. But for a long time, they are also a significant contributor to global warming as they are contributing to greenhouse gas emissions. Although India's contribution to greenhouse gases emission is less than the world average still it is suffering from rising temperatures. Today, no country is immune to the impacts of climate change. It is adversely affecting our societies as well as the economy. According to August 2022 report from the Indian Express newsletter, India may lose 3-10% GDP annually by 2100 due to climate change. In socio-economic aspects, climate change has increased risk and uncertainty in agriculture as crops are extremely vulnerable to climate change. Extremely unpredictable summers and monsoons are causing colossal losses in agricultural production, food insecurity and threatening farmers' lives. In the present year 2022, International Food Policy Research Institute in its Global Food Policy report states that climate change may push many Indians towards hunger by 2030 due to a decline in agricultural production and disruption in the food supply

chain. Also report that although global food production may increase by 60 per cent by 2050, 50 crores of Indians would still be at the risk of going hungry, out of which about 7 crores people would suffer from hunger due to climate change. More frequent and intense heat waves, drought, melting glaciers *etc.,* are directly harming animals and causing destruction to people's livelihood. Even, India Today also reported that Global warming made India's 2022 killer heat wave 30 times more likely to climate change. World Bank Group action plan 2021-2025 is also aiming for measurable improvements in adaptation, resilience and measurable reduction in greenhouse gas emissions. Major strategies that can help in the alleviation of the potential negative effects of climate change are incremental improvements in current vehicle technologies like the use of electric drive technologies *etc.*, use of alternate fuels like natural gases, climate change adaptation in agriculture *i.e.,* use of adaptive crops, modifications in local agricultural practices and many more. From an agricultural point of view, the measures that can help us to surmount the socio- economic impacts of climate changeareNo-till agriculture that can promote carbon sequestration, rehabilitation of degraded pastures or adapting climate - smart agriculture *i.e.,* an approach to help the farmers.

Keywords : *Climate change, Socio-economic impacts, Strategies, Climate-smart agriculture, Agricultural management practice*

PS-I/32

Effect of nutrient management on *rabi*vegetable crops in rice based crop sequence

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A field experiment was conducted during 2018-19 to 2021-22 during both *kharif*and *rabi*seasons at the Main Rice Research Centre, Navsari Agricultural University, Navsari, Gujarat, to evaluate the effect of nutrient management on *rabi*-vegetable crops in rice-based crop sequence. Six nutrient management practices *viz.*, types organics-bio compost @ 10 t/ha, FYM @ 10 t/ha and vermicompost @ 5 t/ha and nutrient supplement-banana pseudo stem enriched sap (enriched novel organic liquid nutrients) 1 % at 20 and 40 DAS were evaluated on three cropping sequence rice-beetroot, rice-radish and rice-carrot were conducted in split plot design and replicated thrice. The results showed that among different *rabi*root crops, root yield was recorded highest with radish compared to beetroot and carrot crop further it was found significantly highest with the application of biocompost @ 10 t/ha and banana pseudostem enriched sap spray (enriched novel organic liquid nutrients) 1 % at 20 and 40 DAS. Rice equivalent yield was also highest with these treatments. A maximum number of panicles, panicle length, test weight, grain and straw yield of rice grown after the harvest of *rabi* crops on residual fertility were registered higher where bio compost applied @ 10 t/ha and spraying of 1 % enriched novel organic liquid nutrients at 20 and 40 DAS. The maximum economic return was recorded under rice-radish crop sequences. Thus, among the different cropping sequences, rice-radish was the most productive and remunerative cropping system.

Key words*: Rice, nutrient management, banana pseudo stemenriched sap, crop sequence, rabi root crops*

PS-I/33

Microbial mediated mitigation of lead stress by siderophore and ACC deaminase producing lead (Pb) tolerant bacteria in black gram(*Vigna mungo* L.)

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Lead is a major heavy metal with a soil retention time of 150-5000 years which adversely affects flora and fauna by entering the food chain through the water. The accumulation of excessive lead (Pb) in the soil affects plant growth and productivity. Under high concentrations of lead in soil, ethylene hormone is produced in high amounts inhibiting plant growth and development. The current research is focused on siderophore and ACC deaminase producing Pb- tolerant bacteria for mitigating lead stress, as the ACC deaminase-producing bacteria convert ACC (ethylene precursor) to ammonia and á-ketobutyrate, thereby decreasing the inhibitory plant ethylene level. Moreover, siderophore-producing bacteria protect plants from the oxidative stress generated by heavy metals such as Pb. In this study, 53 bacteria were isolated from 10 soil samples near the Tapi river and examined for Pb- tolerance potential and plant growth promotion. Among these, 16 isolates were found to be tolerant up to 2000 ppm of Pb; from these, 4 isolates produced ACC deaminase, siderophore, IAA, and phosphate solubilization in a tremendous amount. Their ability to promote *Vigna mungo* L. plant growth under Pb- stress in greenhouse conditions was evaluated. The results revealed that the two bacteria, *Bacillus tequilensis* (CWTS 5) and *Bacillus albus* (CWTS 10) combat Pb stress during *in-vivo* studies in profound amounts. The increase in root length by CWTS 5 and CWTS 10 was 132.67% and 80.43%, respectively, and the increase in shoot length was 104.13% and 103.65%, respectively, compared to the control. Siderophore and ACC deaminase enzyme production was also quantified in the soil samples after plant-microbe interaction. The percentage increase in siderophore production by CWTS 5 and CWTS 10 was found to be 113.03% and 107.72%, respectively,compared to the control. ACC deaminase production in soil by CWTS 5 and CWTS 10 was found to be 4 µmol/mg and 3.66 µmol/mg compared to control, which was 1.10 µmol/mg during 2000 ppm concentration of lead. Thisstudy revealed that siderophore and ACC deaminase production is essential for developing a successful remedial mechanism.

Keywords: *Siderophore, ACC deaminase, lead stress management, Bacillus tequilensis, Bacillus albus*

PS-I/34

An Ergonomically Assessment of Manually Operated Maize Planter for Male Operators

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Ergonomics is the scientific study of the relationship between a human and his/her working environment. A study was conducted on an Ergonomically assessment of manually operated maize planter for male operators. Anthropometric data of age groups operators of (25-28, 29-32, 33-36, and 37-40 years) were determined. Heart rate, oxygen consumption rate, energy expenditure rate, and body part discomfort score of age groups were determined during working on maize planter. Anthropometric data of stature, arm length, standing eye height, knee height, and elbow height, and body mass index were determined for different age groups. Heart rate, oxygen consumption rate, energy expenditure rate, and body part discomfort score were increased when

age groups increased at weight sample of seed (1.5 & 2.0 kg). Heart rate, oxygen consumption rate, energy expenditure rate, and body part discomfort score of 25-28 yrs age groups were found minimum and varied from 92-101 b/min, 0.36-0.37 l/min, 8-10.03 kJ/min, and 20.75-22.02 respectively on working. Heart rate, oxygen consumption rate, energy expenditure rate, and body part discomfort score of 37-40 yrs age groups were found maximum and varied from 140-143 b/min, 0.90-0.93 l/min, 19-20 kJ/min, and 51.23-53.87 respectively during working operators on maize planter at different weightsamples.

Keywords: Heart rate, Energy expenditure, Oxygen consumption, BPDS

PS-I/35

UV-B radiation-resistant phyllosphere associated methylotrophic bacteria for their potential role in plant growth promotion under UV-B radiation

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Ultraviolet (UV) radiation damages plants by entering leaf stomata, oxidizing tissues during respiration, and tends to result in reduced plant survival. UV-B (280-315 nm) radiation intensity is comparatively higher in tropical regions, and terrestrial plants encounter this radiation. Phyllosphere methylotrophs (PMs) encounter harmful UV rays and must develop adaptive strategies to combat this irradiation. Therefore, in this study, we isolated 15 phyllosphere methylotrophic bacteria from extreme environmental areas and screened them for UV-B radiation resistance and methanol dehydrogenase gene (MD gene). Screening of these PMs revealed that all isolated possessed MD gene and UV-B radiation resistance. Furthermore, the PMs had the ability to survive at 45°C temperature, 16% PEG (polyethylene glycol), and plant growth promoting activity such as N_2-fixation, IAA production (120 µg/ml), and siderophore production. The seed germination assay under UV-B radiation revealed that all isolates showed up to 80% seed germination compared to the control seed. After 10 days of seed germination, the isolates showed remarkable shoot lengths between 57.89% to 133.57 % and root lengths in the range of 66.66% to 233.33%. These results suggest that PMs bacteria are a good target for future work on alleviating photo-irradiation to improve plant growth.

Poster Session-II (Theme-II)

PS-II/1

Application of ArcGIS Interface to measure Erosion Susceptibility of Dhaman Khadi Sub-Watershed of Eastern Gujarat

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An attempt has been made to model land degradation in water erosion of selected Dhaman Khadi sub-watershed (7710.64 ha.) in Eastern Gujarat, India, through Revised Universal Soil Loss Equation using ArcGIS interface. The average erosivity of 30 years (1986-2015) annual rainfall using the standard formula was estimated to be 480.63 MJ mm ha- 1 hr- 1 per year. The erodibility factor K was computed as 0.236 and 0.177 mt·hr MJ- 1 mm- 1 per unit R respectively for clay loam and clay soils using modified formula.. 20 m Digital Elevation Model was prepared from Toposheet No. F43N10 by using the 'Topo to Raster' interpolation method. The slope length factor L was derived from DEM using Unit Stream Power Erosion and Deposition (USPED) Model. The raster layers of slope steepness factor for slope having < 9 % and $\geq$ 9 % was prepared separately to form the final slope steepness factor map. The cover management factor map was derived based on the cropping pattern for the various land cover categories of the study area. The assigned standard conservation practice factor values for cross-sloped agricultural lands to the attribute table of the intersected map of LU/LC and slope maps to prepare the P factor map. The average gross soil erosion was minimum for evergreen forest and maximum for wasteland without scrub. The highest area covered by agricultural land (i. e. 41.54) of the Dhaman Khadi sub-watershed having 33.28 tons/ha/yr gross soil erosion, needs immediate treatment to prevent land degradation. The soil loss tolerance limit of the studied area to derive an erosion susceptibility map for identifying the priority of conservation programs. As all the factors of RUSLE was estimated precisely at the sub-watershed level, the study could help for rapid and reliable planning of watershed development programs in combination with the use of RS and GIS technology.

Keywords: *Erosion risk area, GIS, Gross erosion, RUSLE, Sub-watershed*

PS-II/2

Rainfall Erosivity Index Estimationfor Dediapada Region of South Gujarat

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The rainfall erosivity index is one of the key factors in the USLE model and hasgained increasing importance as the environmental effects of climate change havebecome more severe. In the present study, the different available models widely usedfor the estimation of rainfall erosivity index based on the daily, monthly and annualrainfall were evaluated to estimate the rainfall erosivity index for the Dediapada region.On a daily basis, Isikwue Model was used to estimate erosivity, while Loureiro Model,Grimm Model (GJRM), Modified Fourier Index Method, and Tiwari Model wereused to estimate erosivity based on monthly rainfall data. Statistical AnalysisSoftware (SAS) was used to compute the region-based parameters. For annualrainfall basis, Bonilla Model and Singh Model were used for the estimate oferosivity of the study area. The statistical analysis for the results obtained from all themodels was carried out using a co-efficient of determination to judge theperformance and applicability of the models for the Dediapada region. The coefficient of determination values indicated that annual rainfall basis models estimatethe erosivity with better accuracy compared to monthly and daily rainfall basis forthe study area.

Keywords: Rainfall Erosivity Index, Rainfall, Rainfall, USLE

PS-II/3

Computation of Crop Co-Efficient using Various NDVI Models for Summer Sesame

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Crop coefficient estimation using best-suited NDVI models for summer sesame based on the single crop coefficient approach for South Gujarat Agro Climatic Zone of Gujarat was carried out at college farm, CAET, NAU, Dediapada. A field experiment was conducted during the summer season of 2019. The NDVI data was captured using Field Scout CM 1000 NDVI Meter on a weekly basis during the growing period of the crop. The FAO crop co-efficient data was taken from FAO irrigation and drainage paper no. 56.Drip and surface control irrigation systems were used as treatments. The crop coefficient was directly estimated from the NDVI value using NDVI-Kc Models. There were four different models used in the study. The stage wise crop coefficient was derived from the stage-wise average NDVI data for each model separately. This stage wise crop co-efficient data of various models were compared with the FAO crop co-efficient data for both systems.The regression analysis derivedR2 values for Muttibwa & Irmak, Kamble, Singh & Irmak, and Vashisht models were 0.918, 0.926, 0.930 and 0.868 for drip irrigation systems and 0.840, 0.850, 0.857 and 0.856 for surface control irrigation system respectively. The Singh & Irmak model was most suitable for summer sesame crops for the Narmada region among the available models and can be used to determine the crop coefficient (Kc) value for the Narmada region.

Keywords: Crop-coefficient, NDVI, Sesame

PS-II/4

Study of Wetting pattern under Drip Irrigation with varying discharge and irrigation time for the Soil of Dediapada

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A drip irrigation system should be designed so that the soil volume being wetted should match the root characters. To achieve this, the shape and the dimensions of the wetted soil volume underneath drip irrigated crops should be accurately determined. This is used for a better understanding of the movement of water in the soil in response to a surface point source. To understand the wetting pattern of drip irrigation under the soil of Dediapada, the experiment was conducted at the field College of Agricultural Engineering & Technology, Dediapada, during the year 2017. The investigation treatments were 3 levels of emitter discharge, i.e., 2, 4 & 8 LPH and 3 levels of irrigation duration, i.e., 1, 2 & 3 hours. The results revealed that horizontal wetting is higher than vertical wetting; using 8 LPH emitters with an irrigation time of 3 hours gave the highest horizontal and vertical wetting. From the results obtained under this study, it could be concluded that during the summer season, using a low emitting dripper is more beneficial due to higher vertical wetting than horizontal wetting.

PS-II/5

Study of morphometric characteristics of lower tapi river basin using Remote Sensing & GIS

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The rapid growth of mining activities, industrialization, and construction of building structures, roads and other facilities at ground level with the growing human population the land area under forest is decreasing day by day, resulting in lesser availability of land and water resources and degradation of land. The Tapi River has an area of 1296.38 Km2. Lower Tapi River Basin is elongated in shape with a length of 78.89 Km. The Lower Tapi River Basin is located at 21050'00" N and 72040'00" N to 73040'00" E and 21010'00" N in the Southern part of Gujarat State, and it drains into the Arabian Sea. The average annual rainfall in the basin varies from 900 – 1500 mm, while the average annual temperature is around 27.8°C. Land use dynamics was studied based on classifications made by visual interpretation using digital satellite data. Changes in land use area were analyzed by class statistics process. After supervised classification, class stats were generated, and the areas under different land uses were estimated for different years (2015-2021).Results revealed that there was a rapid change in land use, particularly in an urban area which increased by +159.32 km^2 in Lower Tapi River Basin; it is because of fulfilling the growing needs of the increasing population.The area under forest land decreased by -42.9 km^2 in the Lower Tapi River Basinduring the past six years (2015-2021), and The area under Agricultural land decreased by -259.33 km^2 in the Lower Tapi River Basin during the past six years (2015-2021). The area under Fallow land increased by +14.72 km^2. The area under urban area grew by +159.32 km^2 in the Lower Tapi River Basinduring the past six years (2015-2021), and The area under water body minor increased by +2.47 km^2 in the Lower Tapi River Basinduring the past six years (2015-2021).In 2015 the study had a classification accuracy of 83.33% and a kappa coefficient of 73.27. And 2021, the study had a classification accuracy of 86.67% and a kappa coefficient of 76.63. The kappa coefficient is rated as substantial, and hence the classified image was found to be fit for further research.

PS-II/6

study of morphometric characteristics of lower tapi river basin using Remote Sensing & GIS

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The Tapi River, having an area of 1296.38 Km^2. Lower Tapi River Basin is elongated in shape with a length of 78.89 Km. The Lower Tapi River Basin is located at $21^0$50'00" N and $72^0$40'00" N to $73^0$40'00" E and $21^0$10'00" N in the Southern part of Gujarat State and it drains into the Arabian Sea. The average annual rainfall in the basin varies from 900 – 1500 mm, while average annual temperature is around 27.8°C. The morphometric parameters have been evaluated from four different aspects drainage network, basin geometry, drainage texture, and relief. The different parameters were then correlated to understand how they interact with and influence each other. Morphometric analysis is the measurements and mathematical analysis of the land surface configuration, shape and dimension of the landforms. Analysis of morphometric parameters comes to the following conclusions: The integral use of remote sensing data and GIS technique becomes helpful to find out the area which is affected by the sedimentation process. From the morphometric analysis of the basin, it has been found that the study area of Tapi river tributaries is a 5th order drainage basin which describe that the texture is homogeneous or homogeneity still exists and lack of structural control in soil strata. From first to fifth order stream, stream length decreases hence gradient is increased from flat to steep as

the stream order increases. The relief ratio (R_h) was observed as 2.71, the elevation difference (Bh or H) was observed as 287.0 m and circularity ratio (R_c) as 2.73 which represents the basin having moderate relief and gentle to moderately high slope. Some areas of the basin are characterized by variation in Lithology and topography. The mean values of bifurcation ratio (R_b) as 1.80 and circularity ratio (R_c) as 2.73 of the entire basin shows a moderate but not strong structural control or structural disturbances. An extremely high value of ruggedness number (R_n) calculated as 2.91 indicate the structural complexity of the terrain. The Moderate drainage density (D_d) found to be 0.84 and circularity ratio (R_c) as 2.73 which indicates the basin has a highly permeable subsoil and vegetative cover. The Form factor (F_f) was calculated as 0.22, the elongation ratio (R_e) as 0.53 and circularity ratio (R_c) as 2.73 these values indicates the elongated basins with lower / flatter peak flows of longer duration than the average. The elongation ratio (Re) values indicate moderate to slightly steep ground slope. The overland flow (Lg) was calculated as 0.60 indicating basin is having old topography.

PS-II/7

Influence of Integrated Nutrient Management on Productivity of Summer Groundnut (Arachis hypogaea L.) Under Climate Change Condition.

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A field experiment entitled "Integrated nutrient management in bold seeded summer groundnut (Arachis hypogaea L.)" was carried out at the College of Agriculture, Junagadh Agricultural University, Junagadh during the summer of 2016. The experiment comprised of ten treatments viz., T1 (control),T2 [Biofertilizer (Rhizobium and PSM)],T3 (FYM 5 t ha-1), T4 [100% RDF (25-50-50-20 kg N-P2O5-K2O-S ha-1)], T5 (50% RDF + 50% N through FYM), T6 (50% RDF + 50% N through FYM +Biofertilizer),T7 (75% RDF + Biofertilizer), T8 (75% RDF + 25% N through FYM), T9 (75% RDF + 25% N through FYM + Biofertilizer) and T10 (75% RDF + 25% N through Vermicompost + Biofertilizer) which were evaluated in randomized block design with three replications. The experimental soil was clayey and was low in N and medium in available P, K, and S. Bunch groundnut variety 'GJG 31' was tested. The results revealed significantly higher values of growth parameters viz., plant height, root length, and yield attributes viz., pod weight plant-1 while, yield viz., pod yield (2324 kgha-1) and haulm yield (3080 kgha-1); quality parameters viz., 100 kernel weight, oil and protein content were recorded significantly highest under the application of 75% RDF + 25% N through FYM + Biofertilizer (T9). This treatment was also noted at par with application of 50% RDF + 50% N through FYM + Biofertilizer, 75% RDF + 25% N through Vermicompost + Biofertilizer. Thus the results revealed the practical and significant application of INM and its effect on growth, development, and ultimately on yield of groundnut.

Key words: Integrated nutrient management, Groundnut, Growth, and Yield

PS-II/8

Integrated nutrient management in turmeric (*Curcuma longa* L.) cv. GNT-2

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The field investigation was carried out, to study the "Integrated nutrient management in turmeric (*Curcuma longa* L.) cv. GNT-2 during *kharif* season of the year 2021-22 at Regional Horticultural Research Station, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. The experiment was conducted in randomized block design (RBD) which included ten treatments and three

replications consisting *viz*., T_1: RDF (FYM @ 20 t ha^{-1} + 60:60:60 NPK kg ha^{-1}), T_2: FYM 15 t ha^{-1} + 75 % RDF, T_3: FYM 20 t ha^{-1} + 50 % RDF, T_4: Vermicompost 10 t ha^{-1} + 75 % RDF, T_5: Vermicompost 15 t ha^{-1} + 50 % RDF, T_6: Bio-compost 10 t ha^{-1} + 75 % RDF, T_7: Bio-compost 15 t ha^{-1} + 50 % RDF, T_8: FYM 15 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 %, T_9: Vermicompost 10 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 % and T_{10}: Bio-compost 10 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 %. Organics (FYM, vermicompost and bio-compost) were applied at the time of planting whereas,inorganic (N-Urea, P-SSP and K-MOP) *i.e*., nitrogen and potash were applied in three equal splits (basal, 30 and 60 DAP) while, full dose of phosphorus was applied at the time of planting. The foliar application of Novel organic liquid nutrients was done at 60, 90 and 120 days after planting.

The growth parameters*i.e.,* plant height (29.71 cm), number of leaves (5.20), length of leaf (25.15 cm) and breadth of a leaf (10.39 cm) was recorded maximum at 45 days after planting when the plots are treated with T_1: RDF (FYM @ 20 t ha^{-1} + 60:60:60 NPK kg ha^{-1}). Among all treatments, application of FYM 15 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 % (T_8) gave the maximum plant height (62.78 cm, 130.13 cm, and 135.47 cm), number of tillers$plant^{-1}$(1.60, 3.43 and 5.22), number of leaves$plant^{-1}$(7.08, 9.77 and 12.27), length of leaf(32.65 cm, 58.50 cm and 81.21 cm) and breadth of leaf (12.13 cm, 14.44 cm and 18.09 cm) at 75, 135 and 195 DAP, respectively.

In the case of yield and yield attributes, the maximum number of mother rhizomes$plant^{-1}$(3.54), number of fingers rhizomes$plant^{-1}$(18.57), the weight of mother rhizomes (53.26 g$plant^{-1}$), and fresh rhizomes yield (317.80 g$plant^{-1}$and 34.26 t ha^{-1}) were observed under the application of FYM 15 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 % (T_8).

Quality aspects *viz.*, curcumin content (4.93 %) and essential oil (3.67 %) were found significantly higher in T_9 (Vermicompost 10 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 %).

From the economic point of view, the highest benefit-cost ratio (3.77) and the maximum net realization (6,76,970 Rs. ha^{-1}) were obtained under FYM 15 t ha^{-1} + 50 % RDF + Novel organic liquid nutrients 5 % (T_8). Moreover, the application of FYM 20 t ha^{-1}+ 50 % RDF (T_3) improved the soil nutrient status.

Key words : Turmeric, nutrient, growth, yield and quality.

PS-II/9

Study on energy use pattern of papaya production based on scheduling of irrigation and fertigation under drip

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Efficient use of energy especially in agriculture is one of the vitally important issues in most countries. Today's agricultural production relies greatly on the consumption of non-renewable energies such as fossil fuels. Energy Audit attempts to balance the total energy inputs with their use and serves to identify all the energy streams in the systems and quantifies energy usage according to its discrete function. Energy Audit helps in energy cost optimization, water control, and safety aspects and suggests methods to improve the operating & maintenance practices of the system. The quantity of energy applied in agriculture operations needs to be remarkably more to feed the increasing population and to gain the added social and economic objectives. The adequate availableness of the appropriate energy and its effectual and efficacious use is essential for increased agriculture response. It is noticed that crop response and food requirements are directly associated with energy. Energy is needed in the farm for operating various tools, and machines for different agricultural operations. While flexible power is applied for performing field works, fixed power is applied for elevating water and irrigating fields, threshings , selling, cleaning, grading, and other related

agricultural operations. Hence, a field experiment was conducted to work out the energy requirement for the cultivation of papaya under drip irrigation with different fertigation levels during the year 2020-21 at Borsi Instructional Farm of Dau Kalyan Singh College of Agriculture and Research Station, IGKV, Bhatapara (C.G.). The experiment was laid out in a randomized block design with nine treatment combinations and three replications. The experiment comprised nine treatments under the drip method of irrigation with the combination of three irrigation regimes viz. 60, 80 and 100 percent of cumulative pan evaporation (CPE), three different levels of fertilizer 80, 100 and 120 percent of the recommended dose of fertilizer (RFD). Energy equivalents (extracted from scientific sources) were used to calculate energy balance and indices. The results on energy use pattern depicted that maximum input energy, output energy, energy ratio input and energy productivity were found to be 135195 MJ ha-1, 405919.8 MJ ha-1, 3.00, and 1.06 kg MJ-1 respectively in treatment irrigation of 100 percent of CPE and fertigation of 120 percent of RDF. It was also found that minimum energy of 0.95 MJ was required to produce one kg of papaya in this treatment.

PS-II/10

Fertigation study in cauliflower grown on clay soils of south Gujarat

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A fertigation field experiment was conducted at Soil and Water Management Research farm, NAU, Navsari on cauliflowerfor three years (2018-19 to 2020-21). The experiment was laid out in a randomized block design with three replications. There was a total of eleven treatments viz., T1 – 100% N through fertigation with 100% P & K applied as basal; T2 – 100% N & K through fertigation with 100% P applied as basal; T3 – 100% NPK through fertigation; T4 – 75% NPK through fertigation with 25% NPK applied as basal; T5 – 75% N through fertigation with 25% P & K applied as basal; T6 – 75% N & K through fertigation with 75% P applied as basal; T7 – 75% NPK through fertigation; T8 – 19% NPK applied as basal and 56% NPK through fertigation; T9 – 100% NPK fertilizer applied by a conventional method with drip irrigation; T10 – Absolute control (no fertilizer application); T11 – Surface irrigation with 100% RDF. The recommended dose of fertilizer for cauliflower is 100: 50: 50 kg NPK/ha. A common dose of 5 t/ha bio compost was added before the transplanting of cauliflower seedlings. The experimental results revealed that application of 100% N and K through fertigation and 100% P (T2) as basal increased the cauliflower head yield as well as net income. The treatment T3fertigation of N, P and K through 100% water soluble fertilizer (17:44:00) urea phosphate and remaining N and K in the form of urea and muriate of potash also performed well in increasing the yield of cauliflower and net income. The water use efficiency was also higher in these treatments.

PS-II/11

Response of sugarcane varieties to different levels of phosphorus application on yield and quality parameters of sugarcane under south Gujarat condition

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A field experiment was conducted at college Farm, N.M. College of Agriculture, Navsari Agricultural University, Navsari (Gujarat)to study the response of sugarcane varieties to phosphorus levels under South Gujarat conditions for two years during 2015-16 and 2016-17 on clay soils. In all 16 treatments combinations arising out of four variety *i.e.,* V_1 = Co 86002, V_2 = Co 86032, V_3 = Co N 5071 and V_4 = Co N 7072 and four levels of phosphorus *i.e.,* P_0 = control, P_1 = 50, P_2 = 100 and P_3 = 150 kg/ha P_2O_5 were tested in factorial RBD. In the case of the number of millable cane and millable cane yield treatments V_4 and V_3 remained at par with each other and both recorded a significantly higher number of millable cane and millable cane yield in comparison to treatments V1 and V_2, while in quality parameters treatment V_2 and V_3 showed their superiority over treatment V_1 and V_4 over respect to most of the quality parameters of sugarcane. Application of 150 kg/ha

P_2O_5 (P_3) noted a significantly higher number of millable cane and millable cane yield as well as quality parameters of sugarcane *viz*., commercial cane sugar yield (t/ha) and P and K content in juice (ppm). Interaction effect of different varieties of sugarcane and different levels of phosphorus application that treatment combination of V_4P_3 (Co N 7072 and 150 kg/ha P_2O_5) recorded a significantly higher number of millable cane per hectare and millable cane yield.

Keywords: Sugarcane, Phosphorus, Variety, Millable cane yield, Quality parameters

PS-II/12

Fertilizer scheduling through the drip irrigation system in garlic (*Alliumsativum* L.)

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Garlic (*Allium sativum* L.) is one of the most important remunerative bulbous spices and medicinal crops are grown commercially. Garlic is the second most widely cultivated spice after onion. It has long been recognized as a valuable spice all over the world. India ranked second in the area (3.6 million ha) and production (2.9 million t) of garlic followed by China. In fertigation, nutrient use efficiency could be as high as 90 % as compared to 40 to 60 % in conventional methods. The drip fertigation method is a highly efficient method of fertilizer application that is ideally suited for controlling the placement and supply rate of fertilizers. For this, the experiment was conducted in a larger plot size of 600 m^2 for three years during *the rabi* season from 2017-18 to 2019-20 at Vegetable Research Station, Junagadh (Gujarat) to study the fertilizer scheduling through drip irrigation system in garlic.The experiment was carried out with four treatments and five replications and laid out in Randomized Block Design. The treatments included were T_1: surface irrigation at 50 mm CPE with soil application of 100% RDF (100:50:50:30 kg NPKS/ha), T_2: drip irrigation at 100% PE with fertigation of 100% RDF (100:50:50:30kg NPKS/ha), T_3: drip irrigation at 100% PE with fertigation of 80% RDF (80:40:40:24 kg NPKS/ha) and T_4: drip irrigation at 100% PE with fertigation of 60% RDF (60:30:30:18 kg NPKS/ha).

In all the treatments 5 t FYM/ha was applied at the time of sowing. While fertigation was done at 6 days intervals after 15 days of planting with eleven splits. The initial status of soil was low in available N and Zn, medium in available P, K and S and high in Fe, Mn, Cu and B. The pooled results of three years revealed that there was a significant difference in bulb yield of garlic due to irrigation and fertigation. Significantly the higher bulb yield (7.87 t/ha) and B:C ratio (3.54) were obtained under the treatment T_2 but found par with T_3 (7.58 t/ha and 3.38). The crop water use efficiency (CWUE) was the highest under T_2 which was 0.649 kg/l of water followed by 0.633 kg/l of water under T_3.

The application of drip irrigation at 100% PE with fertigation of 100% RDF (100:50:50:30 kg NPKS/ha) gave significantly the highest uptake of N (99.50 kg/ha), P (22.34 kg/ha), K (75.09 kg/ha), S (14.37 kg/ha), Fe (628.19 g/ha), Mn (26.07 g/ha), Zn (57.73 g/ha) and Cu (31.26 g/ha) by bulb.

Key Words: *Garlic, Fertigation, Drip irrigation, Surface irrigation*

PS-II/13

Nano fertilizers for Efficient Fruit Production: A Review

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Fruit crops are heavy feeders of nutrients as a result, for optimum growth and production, a better nutrition management plan is essential.Nano fertilizers are effective technology for increasing nutrient use efficiency

in fruit crops compared to conventional fertilizers. Nano fertilizers are nanomaterials with sizes ranging from 1 to 100 nm that provide at least one type of nutrient to plants. Nanoparticles are categorized as macro-nano fertilizers, micro-nano fertilizers, nano-bio fertilizers, nanoparticulate fertilizers, and nanocoatings or packaging materials based on plant nutritional requirements. Nano-fertilizers outperform even modern conventional fertilizers in terms of effectiveness due to their high surface area-to-volume ratio. The plant nutrients encapsulated in nanoparticles also boost nutrient availability and consequently crop plant nutrient uptake. When very low quantities of nano fertilizers are sprayed on fruit trees, these compounds have a significant influence by enhancing the growth, yield, quality, and leaf nutrient content of these fruit crops. Nano fertilizers also help plants to tolerate different biotic stresses.The use of nano fertilizers on fruit trees contributes effectively to improving fruit quality and increasing the productivity of trees.

Keywords: Nano fertilizers, Nanoparticles, Fruit crops, Fruit yield, Nutrient uptake, Nutrient use efficiency.

PS-II/14

Precision application of irrigation, fertilizers and Novel organic nutrient on sweet corn in the South Gujarat region

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Sweet corn (*Zea mays* L.) is a popular multi-purpose cereal crop. Corn is used for human consumption as both fresh and processed products; it is used for livestock feeding and industrial uses. Sweet corn is generally cultivated for table purposes and its demand throughout the year in the country. Water is scarce input and directly affects the growth and yield of corn. Precision application of irrigation through the drip method reduces the water requirement for the corn crop. Fertilizer is another important input for crop production and requires throughout the growth period. As nitrogen is a mobile element, the time and rate of nitrogen splitting with different quantities as per the requirement of the crop growth stage is most important for efficient utilization as well as for the maximization of crop yield. A novel organic nutrient is a natural product that contains plant nutrients and growth-promoting substances which promotes the growth of crop and the ultimate effect on production.

A field experiment was conducted during 2015-16 to 2017-18 with sweet corn variety Sugar-75. The experiment was laid out in a split-plot design and the main plot treatments consisted of drip irrigation and nitrogen levels, *viz*., 0.6 PEF, 0.8 PEF and 1.0 PEF and 100, 120 and 140 kg N/ha. However, subplot treatments consisted of foliar applications of 1% Novel organic nutrient prepared from banana pseudo stem sap at 30 and 60 DAS and control. Nitrogen was applied in form of urea through fertigation in six equal splits at weekly intervals starting from 15 DAS. The result revealed that significantly higher cob weight, grains per cob and cob yield were recorded with 0.8 PEF, while cob length, cob girth, cob weight, grains per cob and cob yield were higher with 140 kg N/ha. Application of Novel organic nutrients significantly affected on cob weight, grains per cob, and cob and fodder yields. Remarkably more cob yield was registered in the treatment combination of 120 kg N/ha along with a foliar spray of 1% Novel organic nutrient. Treatments of 0.8 PEF, 140 kg N/ha and foliar application of Novel organic nutrients at 30 and 60 DAS recorded the maximum cob yield and net returns.

It can be concluded that adopting drip irrigation at 0.8 PEF, fertigation of nitrogen 120 kg/ha and 1 % foliar spray of Novel organic nutrients at 30 and 60 DAS in *rabi* sweet corn for achieving 8.9 per cent higher net profit and water use efficiency long with 10 % water saving. Nitrogen should be applied in form of urea through fertigation in six equal splits at weekly intervals starting from 15 DAS, while the full dose of P_2O_5 (60 kg /ha) and K_2O (40 kg/ha) applied as basal.

Keywords : *Drip irrigation, Fertigation, Nitrogen, Novel organic nutrients, Sweet corn*

PS-II/15

Dynamics of Land Use in South Gujarat

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The land is the major factor of production in the agriculture sector. The extent of production of any particular crop mainly depends on productivity and the area under that crop. Production of agricultural commodities provides food security all over the nation. Thus, the use of land is directly related to the production of agricultural commodities and thereby food security. Land use patterns also affect the ecology and environment. Analysis of land use pattern got prime importance in deciding the future strategies and policies of land use planning for agriculture production and to maintain ecological balance. Therefore, the investigation was done to study the inter-sectoral land use dynamics and pattern of distribution of the particular classes of land across South Gujarat. The study is based on secondary data from 2000-01 to 2019-20 collected from the different publications of the Government of Gujarat like Gujarat State Forest reports, the website of the Directorate of Economics and Statistics, Government of India etc. Analysis of data was done by using a simple identity of linearly additive land use changes model and Location Coefficient. The results of the study showed that barren and uncultivable land, forest land and land under miscellaneous tree crops and grooves declined whereas land area under current fellow land, non-agriculture and permeant pasture and grazing raised in South Gujarat during the study period. The land area under forest and land under miscellaneous crops and grooves shifted towards agricultural land or land for non-agriculture activities or both over the study period in South Gujarat. The unfavorable shift in land use in the desirable ecological sector and favourable shift in land use in the undesirable ecological sector were observed in South Gujarat. The land area under the agricultural sector annually increased by 92106 ha which was at the cost of the desirable ecological sector. The location coefficient for the area under forest, the area under non-agricultural uses and the net sown area was higher during the study period indicating that there was a higher concentration of these categories of land in South Gujarat. The Location Coefficient of Current fellow land indicated a sharp increase in the area under fallow land during the study period, implying that the measures needed to bring this area under cultivation to increase agricultural production.

Keyward: land use, dynamics, location coefficient, inter-sectoral shift

PS-II/16

Watershed management by Geospatial technology

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Management and utilization of natural resources - land and water have assumed prime importance in the wake of increasing pressure on them. In this context, the watershed approach has gained momentum all over the world for addressing environmental issues and implementing various developmental programs. Though a watershed represents a hydrological unit of an area, it is also considered as management of natural resources. These developmental activities in any watershed focus not only on the management of rainwater, reducing soil loss, runoff and increasing productivity but also focuses on sensing, GPS and GIS are being increasingly used to address various aspects of watershed developmental programs namely preparation of critical issues with respect to soils/water/crops, generation of action plans and impact assessment.

Stereo data obtained from aerial and satellite platforms play an immense role in obtaining terrain height information in the watershed. Essentially the height information thus extracted is represented in the form of the Digital Elevation Model (DEM). When clubbed with drainage information, hydrological DEM can be generated which inturn is useful to delineate watersheds automatically as well as hydrological modelling of a watershed. Besides, high spatial resolution data are increasingly being used to monitor various soil

conservation activities, and to assess watershed performance.

In recent years, with the development of communication collection and transmission, which will be of immense use for real-time monitoring of watershed activities. A large network of AutomaticWeather Stations across India is being created with state-of-the-art communication tools to serve the data on the web in almost real-time. This has ushered new ideas of developing a sensor web where these sensors can communicate with each other and use the information intelligently as a single system. The sensor network can function independently and collaboratively to provide parameters need to measure in the nanosatellites and their networking with ground-based sensors; the data can be used for real-time applications in watershed management. Further, Geoinformatics and web GIS tools can bring a major impact on watershed management.

PS-II/17

Green nanotechnology for sustainable agriculture

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Nanotechnology is the art of manipulating matter at the nano-scale because at this scale materials behave differently. 'Nano'means extremely small with the particle size ranging from 1 to 100 nm with one or more dimensions. Green nanotechnology is a safe process, energy efficient, reduces waste and reduces greenhouse gas emissions using various formulations for different uses.

Nano-agrochemicalsrepresent an emerging technological development that offers a range of benefits like improved efficacy, increased systemic activity due to smaller particle size and higher mobility and decreased toxicity, durability and a reduction in the amounts of active ingredients that need to be used, higher solubility in suspension, higher penetration in plant tissue and thus better bioavailability of molecules to the cells, improved targeted activity leading to desirable improvement in crops. Number of formulation types have been suggested like nano-emulsions, nano-capsules and products containing engineered nanoparticles such as metals, metal oxides, and nano-clays.

Nano-herbicides will be able to blend with the soil, eradicate weeds in an eco-friendly way without leaving any toxic residues, and prevent the growth of weed species that have become resistant to conventional herbicides.Barik et al. (2008) reviewed the use of nano-silica as nano-insecticide which could be successfully implemented to manage a variety of ectoparasites of animals and agricultural insect pests. A nano-fertilizer refers to the nutrient that can be encapsulated inside nanomaterials. This releases nutrients slowly and steadily for more than 30 days which may assist in improving the nutrient use efficiency without any associated ill-effects. Some commercial products of nano-fertilizers are Nano green, TAG nano [NPK, PHOS, ZINC, CAL,]etc. Nano-sensors are used to monitor the health of crops and magnetic nanoparticles to remove soil contaminants. The sensors will be able to monitor plant conditions, such as the presence of plant viruses or the level of soil nutrients. Some packaging materials incorporated with "nano-sensors" to detect the oxidation process in food have been produced and used in the food industry. This technology has been successfully applied in the package of milk and meat. A mesoporous silica nanoparticle ie a nano-carrier can be exploited in delivering DNA and chemicals into isolated plant cells. Mesoporous silica nanoparticles are chemically coated and act as containers for the genes delivered to the plants. Nano-machines in such robotics may be also more convenient for farmer use. The Wearable-Agri-Robot shows radish harvesting, cucumber harvesting, and fruit tree pruning. Thus, nanomachines may be a helpful tool for the improvement of sustainable agriculture.

Recent research on nanoparticles in several crops is evidence of enhanced germination and seedling growth, improved physiological activities including photosynthetic activity and nitrogen metabolism, mRNA expression and protein level and also positive changes in gene expression indicating their potential use in crop

improvement without any adverse effect on the environment. [eg. Indian neem -> Azadirachtin -> Nano encapsulation-> Sustainable Agriculture]

Keywors : *Green nanotechnology, Nano-herbicides, Nano-insecticide, Nano-fertilizer, Nano-sensors, Nanocarriers,sustainable agriculture*.

PS-II/18

Prioritization of sub -watersheds for soil erosion based on morphometric parameters using fuzzy AHP and GIS in Mand catchment of Middle Mahanadi Basin

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River basins are vulnerable to deterioration as a result of soil erosion brought on by human activity and natural disasters. As a result, watershed prioritising has become more significant in the management of natural resources, particularly in the context of watershed management. For efficient planning and management of natural resources for sustainable development, sub-watersheds within a watershed must be identified and prioritised. It is not feasible or cost-effective to delineate suitable zones for the execution of conservation measures above the entire watershed at the same occurrence; as a result, it is necessary to use a feasible approach for prioritising sub-watersheds (SW). To identify critical sub-watersheds in the Mand catchment of the middle Mahanadi basin, the current research attempted to study various morphological characteristics and to apply Geographical Information System (GIS) and Multi-Criteria Decision Making (MCDM) through Fuzzy Analytical Hierarchy Process (FAHP) techniques. The measurement of three distinctive linear, areal, and relief aspects over the twenty-five sub-watersheds identified by ArcSWAT gave the morphometric characterisation. The topographical and hydrological behaviour of the watershed may be feasibly distinguished according to the morphometric characterisation. According to the values and weightings derived from the linkages between the morphometric parameters derived by the categorization of the SW by connecting the potency of fuzzy analytical hierarchical processes (FAHP), each morphometric parameter was rated. The FAHP approach was used to evaluate sub-watersheds and classify them into five priority zones: very less, less, moderate, high, and very high classes. Of these, seven sub-watersheds have a very high to high susceptibility to erosion, eleven sub-watersheds have a moderate susceptibility to erosion, and the seven sub-watersheds have a low to very low susceptibility to erosion. It signifies that soil and water conservation measures in the "very high category" must be adopted first, followed by the "high" and "moderate" categories. The FAHP procedures are a valuable method for defining sensitive priority zones and are helpful for improved management strategies including the adoption of conservation and sustainable agricultural growth. The multiple stakeholders participating in the watershed development and management initiatives may benefit from the study's findings.

Keywords : Morphologic parameters, FAHP, Prioritization of sub-watersheds, Soil erosion, Watershed management

PS-II/19

Drip Fertigation Strategy for Reducing the Water Footprints of Cotton Crop Cultivation

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The experiment was conducted to assess the Bt cotton yield response to various fertigation strategies through a drip system for theconsecutive two years (2018-19 and 2019-20) during monsoon-winter seasons with 10 fertigation treatments. The highest seed cotton yield of 2681 kg/ha, water use efficiency of 4.242kg/ha-mm, fertilizer use efficiency of 6.09 kg/ha-kg, net return of 77182 Rs./ha, the ratio of gross return/total cost of 1.93 and ratio of additional benefit/additional cost of fertigation as 1.95 could be obtained when 25 % NPK of RDF as basal and remaining NPK through fertigation is applied. The contribution of the rainwater and irrigation water for cotton cultivation was observed as 46 % and 54 % respectively. The lowest total water footprints of 2357 lit/kg of seed cotton yield could be achieved under the same drip fertigation strategies, among which green and blue water footprints would be 1074 lit/kg and 1283 lit/kg, respectively. The seed cotton yield and net return could be enhanced by 20.01 % and 38.64 % respectively and water footprints could be decreased by 16.67% when 25 % NPK of RDF as basal and remaining NPK through fertigation was applied to the cotton crop in comparison to that of under conventional fertilizer applications adopted by farmers.

PS-II/20

Nanotechnology: A tool for enhancing the postharvest quality of flowers

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Horticulture is the branch of agricultural science where it is defined as the science and art of cultivating and handling fruits, vegetables, ornamental plants and several plants having unique medicinal and aromatic values. These horticultural crops provide farmers with high income and have good quality, but they have concern about postharvest losses. Hence, increasing productivity and decreasing postharvest losses by using scientific techniques like biotechnology and nanotechnology could be the simplest solution to the problem. Nanotechnology is known as molecular manufacturing which involves designing, modelling, fabrication and manipulation of material and devices at an atomic scale. Some metals, their oxides, sulphides, carbon, volcanic ash etc. are being used to manufacture nanoparticles that have potential application in horticulture. Nanoparticles modify the permeation behaviour of covering material, increasing barrier properties and thus influencing on postharvest quality in fresh produce. Nanoparticles like silver, zinc and copper in vase solution alleviate and delay vascular blockage, suppress bacterial growth, inhibit leaf transpiration, retain pigment content and enhance the postharvest vase life of flowers. Nanoemulsion of turmeric oil also improves postharvest life and restricts the opening of flowers. Spraying of sulphur nano-powder on various flowers maintains moisture, freshness, fragrance and also ornamental period. Clay and Aluminium nanoparticles dispersed throughout the plastic, making it lighter with increasing strength and blocking the oxygen, carbon dioxide and moisture from reaching inside the packaging. Next-generation packaging like Intelligent, smart and active packaging and films like Imperme, Duretham (LanXess Gmbh) and Aegis OX (Honeywell), nano silver-based polyethene and polypropylene have also come up having smart potential applications in the packaging of fresh flowers.

Keywords: Nanotechnology, volcanic ash, nanoemulsion, Imperme, Duretham

PS-II/21

Temporal drought analysis of Coimbatore District using Standard Precipitation Index (SPI) method

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Drought assessment and monitoring are essentially important for agriculture and water management planning. Over the years several indices have been developed and proposed to assess and monitor droughts. Every method has its strengths and weaknesses. The most widely accepted index is Standard Precipitation Index (SPI) which is based on the probability concept. In the present study, the SPI is used to detect drought events on a temporal basis in the Coimbatore area of Tamil Nadu. Monthly precipitation data from 1982 to 2019 for Coimbatore were used to compute SPI values. Temporal SPI results show that the years 1989, 1992, 1993, 2001, 2003, 2014 and 2016 were found to be moderately dry years. Mild dry occurred for 13 years (34%) of 38 years in the Coimbatore region. 12-month SPI calculation indicates that year 2013 experienced extreme dryness.

Keywords:Drought assessment; Drought monitoring; Precipitation; Probability; SPI

PS-II/22

Artificial Intelligence in Agriculture: An Emerging Era of Research

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The global population is expected to reach more than nine billion by 2050 which will require an increase in agricultural production by 70% to fulfil the demand. Use of the latest technological solutions to make farming more efficient. The scarcity & increasing labour costs raised the cost of cultivation and crop failures associated with unpredictable yield due to diseases, failure in rainfall, climatic variations and loss of soil fertility, the fluctuating market price in agriculture commodities etc., has made a significant negative impact on the socio-economic status on this backbone population. Using Artificial Intelligence, we can develop smart farming practices to minimize the loss of farmers and provide them with high yields. AI platforms can gather large amounts of data from government and public websites or real-time monitoring of various data is also possible by using **IoT** and then can be analysed with accuracy to enable the farmers for addressing all the uncertain issues faced by farmers in the agriculture sector. In the future, a farmer's skills will increasingly be a mix of technology and biology skills rather than pure agricultural. It is proposed to make use of Digital solutions aided with Artificial intelligence to uplift the habitat of the trampled farmer community while providing yet a new opportunity for businesses and entrepreneurs by enabling smart farms as a service. Currently used AI technologies in Agriculture are Blue River Technology, FarmBot,Harvest CROO Robotics-Crop Harvesting, Plant diseases diagnosis app-Plantix, Prospera.AI technologies help farmers to analyse land/soil/health of crop etc and save time and allow farmers to grow the right crop in each season that has the best yield. Vertical cropping can reduce water usage, and can be cultivated in urban areas in buildings.

Keywords: *AI,FarmBot,Blue River Technology, IoT, Plantix*

PS-II/23

Assessment of available macronutrient status and their correlation studies with important soil properties in soils of Narmada district

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Soil survey information is the key to understanding soil resources. The information assembled in a soil survey can be used to predict or estimate the potentials and limitations of the soils' behaviour under different uses. Soil surveys also provide insight into the kind and intensity of land management that will be needed. Surface soil samples (0-22.5 cm) were collected from 125 locations in five *talukas* of the Narmada district using GPS. The soil samples were analyzed for available macronutrients. Available N, P_2O_5, K_2O and S content varied from 45.27 to 225.71 kg ha^{-1}, 2.01 to 66.35 kg ha^{-1}, 207.21 to 518.63 kg ha^{-1} and 1.26 to 25.5 mg kg^{-1}, respectively. Out of 125 samples, 100 per cent samples were deficient in N, 72.8 per cent samples were deficient in P_2O_5, and 40.8 per cent samples were deficient in available S. whereas, 76.8 per cent samples were high in K_2O. Available N (0.552**), available P_2O_5 (0.245**), available K_2O (0.242**) and available S (0.343**) showed a significantly positive correlation with soil organic carbon and available N (-0.291**) significantly negative correlation with soil pH.

Keywords : *Macronutrients, GPS, correlation*

PS-II/24

Change detection analysis and flood Susceptibility Mappingin the Baitarani River basin, India by using the cloud-based GIS-AHP Technique

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River basin planning includes hydrological and ecological analysis, in which decisions are made over different uses and demands of water resources and associated parameters involved in the sustainable use of natural resources. Land use land cover changes are dynamic and continuous. Hence updated accurate land use land cover maps are required for proper planning and management of natural resources. Nowadays multispectral and multi-temporal high-and medium-spatial-resolution satellite data have emerged as essential tools for estimating various components like vegetation cover, delineation of water bodies, forest degradation, and urban expansion which directly or indirectly affect the changes in land use and land cover over the period. Spatial-temporal LULCC studies on river basins are required to understand the cause of such changes and devise remedial measures to ensure water resource sustainability. Baitarani being one of the 6th largest river basins in Odisha faces all water-related challenges in both upper and lower catchments.

The Baitarani River basin has a total of 14,218 sq. km catchment area located in Odisha and the Jharkhand States of India. The major portion of the Baitarani River basin with 13482sq. km catchment area lies within the state of Odisha. In this study, remote sensing and GIS techniques were used to monitor the changes in LULC patterns within the Baitarini river basin for the period 1995 to 2020. Landsat 5 Thematic Mapper (TM), Landsat 8 and Sentinel 2A (Multispectral instrument) MSI data were used to extract land cover maps. Supervised classification using Maximum Likelihood Classifier (MLC) was used to prepare the maps. Seven major LULC classes viz; water, dense forest, open forest, agricultural land, fallow land, mining area and residential areas were identified in the river basin. As flood is one of the most prevalent natural disasters that frequently occur in the eastern part of

India reported in hot spots of flood occurrences. Hence, flood susceptibility maps were developed using the analytical hierarchy process (AHP) and GIS with a cloud computing API on the Google Earth Engine (GEE) platform. Nearly 10 flood-conditioning factors were prepared including in the flood modelling: elevation, land use/land cover, geology, rainfall intensity, drainage density, distance from the drainage network, slope, Normalized Difference Vegetation Index (NDVI), topographic wetness index and stream power index. The impact of each factor contributing to the flood risk was examined by weights using the analytical hierarchy process method. The results obtained show that the most prominent flood occurrence factor is the elevation, around 15% of the total area is flooded and the flood hazard index is evaluated. The analysis also showed that there is a decrease in the agricultural area and an increase in fallow land 8% and 13.93%, respectively within the Baitarini river basin between 1995 and 2020. The results of this study can be useful for managers, researchers, and planners to manage natural resources and identify susceptible potential areas for flood management and reduce damages.

Keywords: Analytical Hierarchy Process (AHP), Flood Susceptibility, Geographic Information System (GIS), Multi-Criteria Decision Support System, Land use land cover

PS-II/25

Modelling the coriander crop yield response to deficit irrigation

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The experiment was conducted consecutively for 3 years during the winter season (2015-16, 2016-17 and 2017-18) at Instructional Farm, CAET, JAU campus, Junagadh. The coriander crop (GC-2) was sown at 0.3m row spacing. A total of 10 treatments were studied having different combinations of 3-irrigation stress levels and 3-growth stages. Among these, 6 treatments were having combinations of 2 irrigation stress levels (0.4 and 0.6 PFE) and 3 growth stages (vegetative, flowering and seed setting/development). Another 1 treatment has stress free irrigation (0.8PFE) during the entire season, 1 has stress-free irrigation (0.8PFE) during the first two seasons but no irrigation in the last stage, 1 has stress-free irrigation (0.8PFE) during the first stage but no irrigation during last 2 stages and 1 having full irrigation by the surface at 0.8 PFE during the whole season were also studied. The observations on irrigation water applications and yield were recorded. The adopted statistical design was a randomized block design replicated thrice. The water balance approach was adopted to estimate the actual evapotranspiration. The yield and the evapotranspiration recorded under the stress-free water application were taken as the maximum yield(Ym) and maximum evapotranspiration(ETm). The actual evapotranspiration under moisture-stressed conditions in different stressed treatments was taken as ETa of that respective treatment. The Stewart model could be fitted best to express the crop yield response to deficit irrigation under a drip system. The crop response factor (Ky)by best fit Stewart model for vegetative, flowering and seed setting stages was found as 1.02, 1.31 and 0.49 respectively indicating that flowering is the most sensitive stage followed by the vegetative and seed setting/development stage. The empirical models for the coriander crop yield response to deficit irrigation could be developed as (a) 1- Y . Ym-1 = 1.02 (1- ETa. ETm-1) (if deficit irrigation during the vegetative stage only); (b) 1- Y . Ym-1 = 1.31 (1- ETa. ETm-1) (if deficit irrigation during flowering stage only) and (c) 1- Y . Ym-1 = 0.49 (1- ETa. ETm-1) (if deficit irrigation during seed setting/development stage only), where Ym and Ya are the maximum and actual yields ETm and ETa are the maximum and actual evapotranspiration.

Keywords: coriander crop, deficit irrigation/stress level model, growth stage, crop response factor)

PS-II/26

Morphometric study of dhatarwadi river basin Using RS and GIS techniques

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Morphometric study of the Dhatarwadi river basin was analyzed, which involved the determination of linear, aerial and relief aspects of the Dhatarwadi river basin, which was carried out using 30 X 30 m SRTM DEM in ArcGIS 10.5 software using standard formulae. The obtained results revealed that the Dhatarwadi river basin is a 6th order drainage basin.A total number of 1327 streams were identified out of which 1st, 2nd, 3rd, 4th, 5th and 6th orderstreams are counted as 1036, 239, 42, 7, 2 and 1 number, respectively. The mean bifurcation ratiovalue is 4.31 for the study area indicates that the geological structures are not distorting thedrainage pattern. The stream length ratio varies between 0.14 and 2.14 indicates the late youth geomorphicstage. The length of overland flow was found as 0.3084 km which also indicates very less structuraldisturbance, low runoff conditions and higher overland flow. The stream frequency of thebasin is 1.5448 km-2, which indicate that this basin have high permeable geology, low relief andalmost flat topography. The form factor, elongation ratio, circularity ratio and compactnesscoefficient found are as 0.3951, 0.7094, 0.3126 and 1.7882, respectively in the study basin suggesting that the Dhatarwadi river basin shape is elongated. The drainage texture is 7.1426 km^{-1}which shows that the Dhatarwadi river basin has a short duration for peak flow. The relief, relief ratioand relative ratio of the basin are found as 0.438 km, 0.009372 and 0.2352, respectively.All these parameters indicate that the Dhatarwadi river basin is of flat terrain with smallhillocks/inselbergs having low to medium runoff potential.

Keywords: *Dhatarwadi; morphometry; runoff potential; river basin; linear aspect; aerial aspect; relief aspect.*

PS-II/27

Assessment of Surface Runoff and Soil loss in the Manair River Sub-Basin

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The main objective of this study is to identify suitable technological interventions for sustainable management based on runoff and soil loss under the current scenario using the Soil and Water Assessment Tool (SWAT) model.A SWAT model has been setup with the dataset of the upper Manair sub-basin and simulated total Runoff and soil loss from the sub-basin from 1951 to 2020. The model was calibrated from (2011-2015) and validated from (2016-2020). The two statistical models performance measures namely Nash Sutcliffe Efficiency (NSE) and coefficient of determination (R2) used in calibration and validation. The model has a predictive capability with R2 as 0.87 in calibration and 0.807 in validation and NSE as 0.79 in the calibration period and 0.65 in the validation period. The surface runoff was 216.53 mm and Soil loss was 9.45 t ha-1. Site selection for soil and water conservation measures was carried out by overlaying slope, soil, land use/land cover, and stream order maps. The sites for check dams and percolation tanks were identified in the agriculture and wasteland zone.The proposed structures will aid in improving the availability of groundwater resources.

Keywords: Manair river sub-basin; Soil loss; Surface Runoff; SWAT applicationand Technological interventions.

PS-II/28

Nutrient status of soil, yield and nutrient content of onion (*Allium cepa* L.) as influenced by foliar application of various fertilizers

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A field experiment was carried out on medium black calcareous soil during the rabi season of 2018-19 and2019-20 at Junagadh Agricultural University, Junagadh, Gujarat to evaluate the effect of foliarapplication of various fertilizers on growth, yield and nutrients uptake by onion (Allium cepa L.). The results revealed that the application of RDF + 1% foliar spray of WSF and Banana pseudostem sap at 45and 60 DAT gave a significantly higher value of available N, P2O5, K2O and S in the soil after the harvest ofonion. While the effect of different fertilizers on micronutrient content in soil was found non-significant.The significantly higher value of plant height, bulb polar diameter, bulb equatorial diameter, average bulbweight and bulb yield was recorded with RDF + 1% foliar spray of WSF and Banana pseudostem sap at45 and 60 DAT. The magnitude of increase in bulb yield in pooled results was 13.01and 12.14% owingto the application of RDF + 1% foliar spray of WSF and Banana pseudostem sap at 45 and 60 DAT and RDF+ 1% foliar spray of WSF and Grade IV at 45 and 60 DAT, respectively over control. The application ofRDF + 1% foliar spray of WSF and Banana pseudostem sap at 45 and 60 DAT gave significantly higherN and P content in the bulb and leaves and S content in the bulb and the application of RDF + 1% foliar spray ofWSF and multi-micronutrient formulation Grade IV at 45 and 60 DAT gave significantly higher K andCu content in bulb and leaves, respectively and Fe content in the bulb. While, significantly higher Mn and Zncontent in bulb and leaves, S and Fe content in leaves were observed with the application of 75% RDF + 1%foliar spray of WSF and Grade IV at 45 and 60 DAT.

Keywords: *Onion, available nutrients, yield, nutrients content, WSF, Multi Micronutrients mixture*

PS-II/29

Economics of Seedling Raising of Broccoli (*Brassica oleracea* L, var. *italica*) in Protected Structure

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Timely sowing and optimizing plant population significantly increase vegetable production. Therefore, availability and required seedling in time play a major role in vegetable cultivation. The seedlings of broccoli are sown in the *rabi* season. Therefore, farmers have to prepare seedlings in the late monsoon. The germination percentage and survival of seedlings are reduced in the traditional method in the open field due to extreme weather and water logging condition. Therefore present work was carried out on the economic feasibility of seedling raising of broccoli in a natural ventilated net-cum-poly house. The seeds of broccoli of Namdhari seeds of F1 were sown in a plug tray in September 2020 and 2021. Plug trays were filled with the mixture of cocopeat and vermicompost in an equal proportion of 1:1 (V/V). The germination was recorded at 94% and each seedling of broccoli was sold for Rs. 1.60/-. The gross income, net income, and benefit-cost ratio of the seedling raising of broccoli were recorded as 556.80 Rs/m2, 254.69 Rs/m2 and 1.84.

Key words: seedling raising, Broccoli, Plug tray, soilless media, Natural ventilated net-cum-poly house

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PS-II/30

Nanotechnology in Sustainable Agriculture: Recent Developments, Challenges, and Perspectives

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Nanotechnology monitors a leading agricultural controlling process, especially by its miniature dimension. Additionally, many potential benefits like enhancement of food quality and safety, reduction of agricultural inputs, enrichment of absorbing nanoscale nutrients from the soil, etc., allow the application of nanotechnology to be a resonant encumbrance. Agriculture, food, and natural resources are a part of those challenges like sustainability, susceptibility, human health, and healthy life. The ambition of nanomaterials in agriculture is to reduce the number of spread chemicals, minimize nutrient losses in fertilization and increase yield through pest and nutrient management. Nanotechnology has the prospective to improve the agriculture and food industry with novel nanotools for controlling rapid disease diagnostic and enhancing the capacity of plants to absorb nutrients. The significant interests of using nanotechnology in agriculture include specific applications like nano fertilizer and nano pesticides to trail products and nutrient levels to increase productivity without contaminating soils, water and protection against several insect pests and microbial diseases. Nanotechnology may act as sensors for monitoring the soil quality of the agricultural field and thus maintain the health of agricultural plants. This review covers the current challenges of sustainability, food security and climate change explored by the researchers in the area of nanotechnology in the improvement of agriculture.

Keywords: nanoemulsions; nanoencapsulation; nano fertilizer; nano pesticides nanotechnology; sustainable agriculture.

PS-II/31

Development of an App for the design of sprinkler irrigation system

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In India, farmers are irrigating their crops by different methods of irrigation. Sprinkler irrigation is one of the best methods of irrigation for irrigating different cereal crops and increasing their production. Sprinkler irrigation is the method of irrigation by which water is sprayed on the land surface in the form of artificial rain. Farmers irrigate the crops through sprinkler irrigation but do not get full advantages from this irrigation facility, due to improper design and management of the system. Designing a sprinkler irrigation system is a very difficult task for any farmer or extension worker and manually it is very difficult to calculate the various parameters. There is numerous software available to deal with the design-related issues but the drawback is the hardware requirement for the same. Android platform-based smart mobile phones and mobile applications are being readily used and adopted by farmers, extension workers, students and researchers with the advancement in information & communications technologies.

Therefore, the present study deals with the "Development of an app for designing of locating specific sprinkler irrigation system". The App was developed through Android Studio Software. *The application is coded in JavaScript and html programming language.* This android app is an open-source mobile operating system by Google and it can be easily installed by farmers or extension workers through Google Play Store. *The result from the study revealed that the developed App can calculate some basic design parameters for a sprinkler irrigation system as per user requirements and input data. The developed App has been run successfully but it depends on the proper input parameters.* In the developed App input data changing facilities are also provided to the users as per their requirements. After finalization and entering all the important input parameters and clicking the finish

button, the Sprinkler Irrigation System Design App will create a PDF file as a design report for the users based on input data. The developed App is simple in operation and maintenance so this App could be used by the farmers without any extensive training. *This App helps the user to design their field and install the whole sprinkler irrigation system and minimizes their extra designing cost and can get a higher return.*

Keywords : Sprinkler Irrigation System, Design, Crops, Android Studio Software, Android Apps

PS-II/32

Effect of zinc and thiourea application on growth and yield of summer greengram in loamy sand

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A field experiment was conducted during the summer season of 2020 at Agronomy Instructional Farm, SDAU, Dantiwada (Gujarat). The soil of the experimental plot was loamy sand in texture. There were 15 treatments, and each was replicated thrice.The experiment was laid out in Randomized Block Design with factorial concepts.The experiment comprised three levels of zinc(1.5, 3.0 and 4.5 kg/ha) and five treatments of thiourea application (control (no spray), seed soaking with thiourea @ 500 ppm, foliar spray of thiourea @ 500 ppm at 25-30 DAS, foliar spray of thiourea @ 500 ppm at 40-45 DAS and foliar spray of thiourea @ 500 ppm at 25-30 and 40-45 DAS).Significantly influenced almost all the growth and yield attributes, as well as yield, were due to various treatments. The plant height (47.02 and 46.60 cm, respectively),the total number of pods per plant (15.92 and 19.82, respectively) and the number of seeds per pod (7.91 and 8.26, respectively) and seed yield and stover yield were also found significantly higher in the application of either 4.5 kg Zn/haor foliar sprays of thiourea @ 500 ppm at 25-30 and 40-45 DAS.Based on experimental results, it can conclude that obtaining higher and more profitable yield of green gram crops responds positively to the application of zinc and thiourea with enhancement in the agronomical performance and productivity.

PS-II/33

Modelling of infiltration rates of different soils under different land use patterns in Chhattisgarh Plains

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Infiltration is the procedure by way of which water at the ground surface enters the soil. The infiltration model is very helpful in designing and evaluating surface irrigation systems. The objective of the research work is the estimation and inter-comparison of infiltration models which are used to evaluate the infiltration rate at SVCAET&RS, FAE, IGKV, Raipur. The double ring infiltrometer method was used for the measurement of infiltration rates. The study aimed to determinethe constant infiltration was calculated for four different types of soils (vertisols, inceptisols, alfisols and entisols) under two different soil conditions (unploughed and ploughed) and compared it with the infiltration rates obtained by Horton's, Kostiakov, Philip's, Green-Ampt and Modified Kostiakov Models with measured values from the double ring infiltrometer The value of various constants of the models was calculated using the approach of averages counselled throughgraphical technique.

The results from the study revealed that the constant infiltration rate for Vertisols under ploughed circumstances was 1.8 cm/hr, while under unploughed conditions 1.35 cm/hr. The infiltration rates for Inceptisols under ploughed conditions were 3.0 cm/hr, while under unploughed conditions 2.7 cm/hr. For Alfisols' constant infiltration rates under ploughed circumstances 1.2 cm/hr, while unploughed conditions 0.9 cm/hr. But in

Entisols, it was observed that penetration rates remain stable under unploughed environments which fluctuated 3.5 cm/hour, whereas under ploughed situations had been found 3.7 cm/hr. Comparison of the statistical parameterssuch as RMSE, NSE and R^2 for the five infiltration models indicated that Philip's model agreed well with the measured values and performed better than the Horton's, Kostiakov, Green-Ampt and Modified Kostiakov Models.

Keywords: Double ring infiltrometer; Empirical models; Infiltration rate; Soils

PS-II/34

Effect of Nitrogen, Phosphorus and Potassium on Yield, Quality, Nutrient Content and Uptake on Hybrid Maize (*Zea mays* L.)

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Background: Maize (*Zea mays* L.) is one of the most versatile emerging crops having wider adaptability under varied agro-climatic conditions. Nitrogen though an expensive input, is essential as it is intimately involved in the process of photosynthesis and directly reflected in the total dry matter production. Phosphorus is involved in a wide range of plant processes from permitting cell division to developing a good root system and ensuring timely and uniform ripening of the crop. Potassium is a vital macronutrient in plant growth and sustainable crop production. The current study aimed to study the effect of nitrogen, phosphorus and potassium on yield, quality, nutrient content and uptake on hybrid maize (*Zea mays* L.) under south Gujarat condition

Methods: A field experiment was conducted during *the rabi* season of the year 2019-20 to study the effect of different levels of nitrogen, phosphorus and potassium on yield, quality, nutrient content and uptake by hybrid maize (*Zea mays* L.). In this experiment, twelve treatment combinations consisting of three levels of nitrogen fertilizer, two levels of phosphorus fertilizer and two levels of potassium fertilizer were tried in a factorial randomized block design with three replications. The protein content and nitrogen, phosphorus, potassium content and their uptake by seed and stover and available nitrogen, phosphorus, potassium status in the soil after crop harvest are determined by different methods.

Result: The result showed that quality parameter *viz*., crude protein content, crude protein yield, nutrient content and uptake by grain and straw of hybrid maize were increased with the increased in nitrogen (180 kg N ha^{-1}), phosphorus (60 kg P_2O_5 ha^{-1}) and potassium (30 kg K_2O ha^{-1}) level.

Key words: Crude protein, Maize, Nitrogen, Nutrient content and uptake, Phosphorus, Potassium, Quality, Yield.

PS-II/35

Estimation of Crop Water Requirement of Major Crops for Chhattisgarh Plains

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In this study, estimation of crop water requirement of major crops for the CG plains zone of Chhattisgarh has been carried out. The CROPWAT 8.0 model has been used to estimate crop water requirement for all major crops of CG plains zone viz. Rice, Wheat, Maize, Gram, Black gram, Pea, Soybean, Groundnut, Sesame, Mustard, Potato, Tomato, Onion, Cabbage and Cauliflower etc. The 30 years of collected climatic data of 1991-2020 from the Department of Agro-meteorology, IGKV, Raipur. It was observed that out of 30 years, 6 years (i.e. 1991,

1992, 2000, 2002, 2008, and 2017); were found rainfall deficityears in which the highest rainfall deficit year 2002 was used to calculate the crop water requirement for this zone. The finding shows that the annual average rainfall of CG plains zone is 1200.1 mm while in 2002 the annual rainfall was 767.2 mm.

The results revealed that the reference evapotranspiration was found maximum in May, i.e. 7.53 mm/day, whereas the same was found minimum of 2.50 mm/day in December. The average daily reference evapotranspiration of CG plains zone was obtained 4.21 mm/day. The average value of crop evapotranspiration for kharif crop such as rice, maize, black gram, soybean, groundnut and sesame was found 631.5 mm, 349.9 mm, 161.6 mm, 255.7 mm, 377.9 mm, and 253.2 mm respectively. While for the rainfall deficit year crop evapotranspiration for rice, maize, black gram, soybean, groundnut and sesame was found 695.3 mm, 382.3 mm, 183.6 mm, 283.0 mm, 409.8 mm, and 270.6 mm respectively. The average increment in crop evapotranspiration value for rice 10.10%, maize 9.26%, black gram 13.61%, soybean 10.68%, groundnut 8.44%, while for sesame was found 6.87%. The average value of crop evapotranspiration in Rabi crop such as wheat, gram, pea, mustard, potato, tomato, onion, cabbage, and cauliflower was found 343.5 mm, 265.3 mm, 251.3 mm, 258.3 mm, 333.9 mm, 401.1 mm, 475.7 mm, 464.9 mm and 369.7 mm respectively. While for the rainfall deficit year of crop evapotranspiration for wheat, gram, pea, mustard, potato, tomato, onion, cabbage, and cauliflower was found 355.1 mm, 276.5 mm, 265.2 mm, 273.6 mm, 347.5 mm, 420.4 mm, 498.2 mm, 487.4 mm and 391.4 mm respectively. The average increment in crop evapotranspiration value for wheat 3.38%, gram 4.22%, pea 5.53%, mustard 5.92%, potato 4.07%, tomato 4.81%, onion 4.73%, cabbage 4.84%, and cauliflower was found 5.87%.

Keywords: Chhattisgarh Plains; CROPWAT 8.0 model; Crop Water Requirement; Crops

PS-II/36

Geospatial technologies in sustainable agriculture and watershed management in India

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The fast-growing world population and limited resources will lead to enormous pressure on land resources to produce food for 11 billion in 2050 (FAO). However, to meet the challenges of feeding the world population; there is a need for a technology to be used and prioritized intervention to halt the declining trends in crop productivity, minimizing the rate of land degradation, efficient use of resources and enhancing farm income through a sustainable resource development plan. In the high-tech society and widespread use of IT tools in various sectors, up-to-date information on crop production and water resources isvital to support economic development, enhance the quality of life, and conserve nature and the environment. In this regard use of modern technologies should be intensified at regional level for better management and utilization of available resources.

The adoption of Geospatial Technologies encompassing techniques and tools related to Remote Sensing (RS), Geographic Information System (GIS), Global Positioning System (GPS), advanced data processing, Information Technology (IT)-driven outreach, and Internet of things (IoT) might play the much-needed role of a fulcrum to increase future agricultural productivity along withsustaining the environment. Geospatial technologies can pave way for significant improvements in efficiency of input-use, resulting in cost savings on inputs. Geospatial toolscan be used for soil profiling, satellite imagery, and mapping which can be used proficiently to assess nutrient deficiencies in site-specific location and fine tune products (*i.e.*, area-specific fertilizer mixtures for crops), promote judicious and balanced use of fertilizers rather than blanket applications that can lead to several environmental issues, digital elevation models (DEM) which can help to manage watersheds. The goal is to develop agricultural resources management options for advancing global food security, adapting and mitigating climate change, watershed management.

This review concludes that geospatial techniques can be successfully retrieving and spatial interpolating various soil properties and efficiently using resources while cropping. This can be highly beneficial in site specific management, leading to improved input use efficiency and sustained agricultural productivity for future food security and practising broad survey techniques for better management of watersheds.

Keywords - *DEM-Digital Elevation Model, IoT- Internet of things, GIS- Geographical Information System, Remote Sensing, Geospatial technologies.*

PS-II/37

Nano-Technologies for Sustainable Agriculture in India

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The realm of agriculture has to confront an expansive scale of challenges, including ecological imbalance, pollution, climate changes, stagnant crop yield, and the increasing resistance against pesticides, food crises, numerous diseases, and malnourishment continue as a significant concern for generations all over the world. In recent years, intensifying traditional agricultural practices has acted as an immediate strategy for increasing global food supply, but excessive use of agrochemicals causes pollution. Imbalanced nutrient management and decreased soil organic matter are the main factors responsible for yield declination.To solve these problems, researchers attempt to incorporate modern technology to boost supply and bridge the gap between production and consumption. Nanotechnology in sustainable agriculture is an ample opportunity for small particles. Nano-technology offers excellent potential to tailor fertilizer production with the desired chemical composition, improve nutrient efficiency, and boost plant productivity. These astonishing functions of nano-materials (NMs) are rummage-sale in sustainable agriculture for developing nano-insecticide, nano-fertilizer, nano-pesticides, nano-herbicides, nano-sensors, and nano-capsules. Nano-materials are unique carriers of agrochemicals which facilitate the site-targeted and site-specific controlled delivery of nutrients, fertilizers, pesticides, herbicides and insecticides at exact sites and location with increased crop protection. Nano-tools and devices such as nano-biosensors support the development of high-tech agricultural farms. Nanotechnology has provided new opportunities to advance nutrient use efficiency encompassing nano-fertilizer (Nano-urea liquid (nano N), nano-zinc (Zn), and nano-copper (Cu)), replacing the conventional fertilizer practices and improving the soil characteristics.

The significant challenges we face, mainly due to population explosion and climate change, nanotechnologies and the use of nano-material in agriculture, can significantly contribute to sustainability.

Keywords: *Nanotechnology, Sustainable Agriculture, Nano-material, Nano-insecticide,nano-herbicides, Nano-fertilizer, Bio-sensor and Nano-capsule.*

PS-II/38

A green expertise: Biogenic Synthesis of Goldnanoparticles Mediated plant extracts and its applications

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Synthesis of metal nanoparticles using plant extracts is one of the most simple, high yields, convenient, economic, easy handling and environmentally friendly methods that mitigate the involvement of toxic chemicals. In recent years; several eco-friendly processes for the rapid green synthesis of silver nanoparticles have been reported usingaqueous extracts of plant parts. These plant parts, leaf, bark, roots, etc. use plant extract as reducing and stabilizing agents in the biogenic synthesis of gold nanoparticles is attractive due to the production of large quantities of different phytochemical materials. Furthermore, this synthesisprocess coats the nanoparticles with biomolecules derived from the plant extract, whichcan improve stability and may confer biological activity. This research aims to describe studies in which gold nanoparticles synthesized using plant extract as reducingagents, discussing the mechanisms and optimization of the synthesis, as well as the adjusting parameters such as temperature, pH, gold precursor concentration, amount of plant extract, and time. Gold nanoparticle has well adorned for their wide availability and medicinal property.The gold nanoparticles have antibacterial/antifungal properties that can be used to protect plants against pathogens. In addition, they can be applied for pesticide identification and water purification.

Keywords: Biogenic Synthesis; Plant extract; gold nanoparticles; Antimicrobial property

PS-II/39

Development of Remote Sensing Based Index for Estimation of Suspended Sediment Concentration

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Suspended sediment is of concern in water bodies as it affects the water quality. Traditional methods of monitoring and modelling the suspended sediment are time-consuming and require considerable field work. Remote sensing allows for accurate and reliable monitoring of water sources and identifying areas with significant water quality issues. Hence the research was done to apply the remote sensing and G.I.S. technologies for developing remote sensing-based index to estimate suspended sediment concentration (S.S.C.). An experimental method was used to investigate the fundamental relationships between spectral reflectance and varying concentrations of suspended sediments. Spectral readings of soil samples collected from Maheshgad catchment were recorded for different suspended sediments concentrations ranging from 1000 to 10000 ppm at an interval of 1000 ppm, at controlled conditions during afternoon hours at Dr. Annasaheb Shinde College of Agricultural Engg. and Technology, M.P.K.V. Rahuri. In this study, the spectral reflectance for different concentrations of suspended sediments was observed using a spectroradiometer and the analysis of observations led to suggesting an index, Modified N.D.S.S.I., for estimating S.S.C. using remote sensing data. Three spectral indices ie. Normalized Difference Suspended Sediment Index (N.D.S.S.I.), Modified Normalized Difference Suspended Sediment Index (Modified N.D.S.S.I.) and Normalized Suspended Material Index (N.S.M.I.) were calculated. The different statistical criteria, such as Akaike Information Criterion (A.I.C.) and Bayesian Information Criterion (B.I.C.) were used for finding out best fit index. The preliminary results indicate that (1) with the increase in S.S.C., spectral reflectance also increased in 400-900 nm wavelength region, (2) the spectral

reflectance of suspended sediments showed marked peaks in Red and Near-Infrared region, (3) Modified N.D.S.S.I. using the reflectance in the region of blue, red and NIR, was the most suitable for estimating S.S.C. at higher concentrations (1000 to 10000 ppm).

Keywords: *Remote Sensing, Suspended Sediment Concentration, Spectral Reflectance, Spectral Index, Modified NDSSI*

PS-II/40

Application of Various Sentinel-2 Band Ratios for Estimation of Suspended Sediment Concentration in Mula Dam Reservoir, Rahuri, Maharashtra

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The estimation of suspended sediment concentration (SSC) over large areas of water using in situ samplings is lengthy, expensive and often inaccurate. Remotely sensed spectral reflectance measured by satellite sensors can provide an alternative, synoptic, speedy and economical method for assessing the SSC of reservoirs, lakes and rivers. Therefore, various sentinel-2 satellite-based band ratios after observing the spectral signature of suspended sediments in the Mula dam reservoir were calibrated against observed SSC at various locations in mula dam reservoir located at Rahuri, Maharashtra, during October 2021 and February 2022. Observed SSC ranged between 15.62 to 137.65 mg/litre during this period. Widely used linear, power, quadratic, exponential and logarithmic functions of various band ratios were calibrated using 80% data set. Best performing power function of (Red + Green) / 2 (R^2=0.8), Red + NIR (R^2=0.79), polynomial function of Red / Blue (R^2=0.71) and logarithmic function of Red Edge 1/ Blue (R^2=0.62) were further validated to estimate SSC. Estimated SSC and observed SSC of validation dataset (20%) were compared using visual interpretation and further subjected to linear regression t-test and student t-test. Statistical error and efficiency models (RMSE, MAPE and NSE) were applied after validation to find the most suitable band ratio for estimating SSC in Mula dam reservoir. Power function of (Red + Green / 2) with R^2=0.73, RMSE = 16.185, NSE=0.728 and MAPE = 26.70 % of validation is selected for spatio-temporal mapping of SSC in Mula dam reservoir indicating its applicability of SSC mapping.

Keywords: *Remote sensing, Band ratios; Spectral reflectance; Suspended sediment concentration, Mula dam reservoir.*

PS-II/41

Assessment of Rice Water Requirement using CROPWAT Model for Pindrawan Tank Canal Command Area in Chhattisgarh

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The Pindrawan tank (Command area 2592 ha) is one of the medium irrigation projects in Tilda block of Raipur District in Chhattisgarh. The study area is characterized by the frequent threat of drought, more due to uneven temporal distribution rather than deficient rainfall. Water Requirement of Rice was assessed using CROPWAT 8.0 software having an in-built database developed by Food and Agricultural Organization FAO-56 based on the Penman-Monteith equation (Hashem A, 2016). The software uses primary data pertaining to information about the altitude, latitude and longitude of a particular meteorological station coupled with climatic data. The

predominant soil type in the command area is Clay (Vertisol), where soil depth varied from medium to deep with soil moisture of 13.3 to 16.0%. As per the local conditions of the Rice crop (Variety: Swarna sub-1: erect growing with an average rooting depth of 20 cm) a fixed percentage method has been adopted, and adequate rainfall has been considered as 80% of rainfall. Direct sown Rice with average sowing date 23rd June and average harvesting date 14th November having145 days duration is grown in the command area during Kharif, which falls in four distinct stages namely; initial stage (25 days duration), development stage (40 days duration), mid- season stage (60 days duration) and late season stage (20 days duration).

The crop coefficient values (Kc dry and Kc wet) differ in various stages. In this study, the average value of Kc dry for land preparation is taken as 0.5, while for different stages, namely initial stage, development stage, mid-season stage and late season stage, the Kc value is taken as 0.5, 1.05, 1.05 and 0.7, respectively. Similarly, the Kc wet values are 1.05, 1.1, 1.3, 1.3 and 0.6, respectively. 15 years of climatological data of the study area involving maximum temperature (Tmax), minimum temperature (Tmin), average relative humidity, wind speed, sunshine hour and daily rainfall for the years from 2007 to 2021 have been analysed in CROPWAT 8.0 to work out the crop water requirement. It was revealed that the ETc value varied from 0.894 mm/day to 11.913 mm/day, whileseasonal ET_c varied from 492.8 mm (2013) to 667.9 mm (2009). The maximum and minimum evapotranspiration were associated with the maximum irrigation requirement (528.1 mm) in 2009. Similarly, the minimum evapotranspiration is also associated with the minimum irrigation requirement (267.1 mm) in 2013. The total average adequate rainfall in Pindrawan area has been computed as 782.5 mm. The average adequate rainfall was maximum in 2020 (1209.7 mm) and minimum in 2008 (397.5 mm). The average ETc during the 15 years period was found to be 573.8 mm while average effective rainfall is about 782.5 mm; even then, there is an average irrigation requirement of 358.7 mm. The reason is the decadal mismatch and the mismatch during critical crop growth stages. This calls for assured irrigation by means of canal supply, supply from borewells or small farm reservoir/percolation tank etc. as secondary storage.

Key words: Pindrawan, CROPWAT, Water requirement. Rice, Command area, Effective rainfall, Chhattisgarh,

PS-II/42

Nano Technologies for Sustainable Agriculture

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Global agricultural systems are experiencing enormous, unprecedented difficulties in the age of climate change. Advanced nano-engineering is a valuable technology for increasing agricultural output and ensuring sustainability to attain food security. By boosting input efficiency and reducing pertinent losses, nanotechnology contributes to better agricultural productivity. Fertilizers and insecticides can have a greater specific surface area because of nanomaterials. When added to agricultural soil, the partially pyrolyzed biomass known as biochar, both in nanoparticulate and bulk form, has been shown to have improved physical, chemical, and biological qualities that significantly reduced greenhouse gas emissions.

Additionally, the site-targeted regulated administration of nutrients with better crop protection is made possible by nanoparticles as distinctive agrochemical carriers. Nanotools, like nano biosensors, enable the development of high-tech agricultural farms because of their direct and intended applications in the exact management and control of inputs (fertilizers, insecticides, and herbicides). The ability of nanosensors to monitor and recognize environmental conditions or impairments has significantly grown because to the merging of biology and nanotechnology. In this memento, we review recent efforts at novel nanotechnology applications in agriculture that could reduce the harmful effects of agricultural practices on the environment and human health, thereby reducing climate change.

Key words: Nanotechnology, agriculture,nanosenser, nanotools,environment,climate change, sustainability

PS-II/43

Technological interventions for sustainable agriculture Information technology for sustainable agriculture

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Sustainability is the need of the hour as it is impossible to fulfil the growing population's demands under changing climatic conditions. The current growth trajectory in agricultural production is unsustainable because of its adverse impacts on natural resources and the environment. So, the focus must be on new technologies and inventions that increase agriculture production sustainability. Information technology is one such technology which provides farmers with vital information pertaining to sowing, crop protection and improving soil fertility that enables them to increase agricultural productivity. Information technology utilizes computers and telecommunication equipment for storing, retrieving, transmitting and manipulating data. The recent advancements in information technology delivered smart devices, computing and sensor technologies which have the potential to enable the industry to meet its productivity and sustainability challenge. The fourth revolution in agriculture may be possible through information and communication technology. Information technology plays a pivotal role in agriculture sector such as in improving productivity, community involvement, good post-harvest practices and value addition of farm produce, improved decision making by farmer, improved efficiency and service delivery at the farm, weather forecasting and climate smart farming, Remote sensing and GPS location etc. Access to reliable, timely and relevant information can help farmers significantly in many ways to reduce farmer's risk and empower them to take the right decision. This transmission of information is possible through computers, the internet, networking hardware and software, satellites, broadcasting technologies and telephony. The generation and transmission of agricultural knowledge is essential, particularly for small and marginal farmers. Information technology brought huge advantages like an efficient use of water, optimization of inputs and many more. It can potentially improve the entire agricultural ecosystem by monitoring the field in real-time. The sensors and interconnectivity in information technology in agriculture have saved farmer's time and led to optimum resource use. Information technology is one of the technologies which helps the farmer understand the modern cultivation methods, availability of agriculture inputs, irrigational sources, and availability of pesticides and fertilizers to increase crop production and productivity.

PS-II/44

Technological interventions for sustainable agriculture Nano technologies for sustainable agriculture

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Nanotechnology involves the ability to see and to control individual atoms and molecules. It consists of understanding the fundamental physics, chemistry, biology and technology of nanometer-scale objects. The use of nanotechnology for sustainable agriculture is of utmost importance as it combats different global challenges such as population growth, climate change and limited availability of essential plant nutrients. The potential applications of nanotechnology include increasing the productivity using nano-pesticide and nano-fertilizers, improving the soil quality using nano-zeolites and hydrogels, stimulating crop growth using nanomaterials (SiO_2, TiO_2 and carbon nanotubes), provide smart monitoring using nano-sensors by wireless communication devices. Nanotechnologies not only help improve food security and productivity but also minimize the adverse effect of faulty agricultural practices on the environment and human health. To increase sustainability in agriculture nanotechnologies could be used in every agriculture practice. It could be used to produce innovative seed imbibed with nanoencapsulations with a specific strain of bacteria, ensuring its germination only when adequate moisture is available. The application of materials such as hydrogels, nano-clays and nano-zeolities helps improve soil quality by improving soil's water holding capacity. Using target-specific nanoparticles can reduce the damage to non-target plant tissues and the amount of chemicals released into the environment.Many

nanoparticles (Ag, Fe,Cu, Si, Al, Zn, ZnO, TiO2,CeO2, Al2O3 and carbon nanotubes) have been reported to have some adverse effects on plant growth apart from antimicrobial. Nanotechnology helped form smart fertiliser which enhances the efficiency of nutrient use and reduces environmental pollution. Nutrients, either applied alone or in combination if bound to nano-dimensional adsorbents, tend to release nutrients slowly as compared to conventional fertilizer. These new inventions in the field of nanotechnology pave the way toward sustainable agriculture, which not only fulfil the demand of the present generation but also conserve it for the future generation. Likewise nano-fertilizer, nano-pesticide are used in minute amounts, thus enabling sustainable use and being eco-friendly. Nanotechnology may act as sensors for monitoring soil quality of agricultural fields and therefore maintain the health of agricultural plants. Thus, we can say that the use of nanotechnology provides a new approach toward sustainable agriculture, particularly when the world is facing problems such as growing population and climate change.

PS-II/45

Effect of drip irrigation and fertilizer application on yield and quality of tomato (*Solanum lycopersicum* L.) cv. Arka Rakshak

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Tomato (*Solanum lycopersicum* L.) is an important and widely grown vegetable crop worldwide and belongs to the family Solanaceae. It is a tropical day-neutral plant. It has a robust tap root system with a highly branched system of adventitious and fibrous roots. Determinate and indeterminate are the two growing habits found in tomatoes. It contains lycopene, an essential antioxidant. It is the dominant carotenoid responsible for the attractive red colour in tomatoes and helps to prevent the development of many forms of cancer. In the surface method of irrigation, various problems, such as waterlogging and salinity, are avoided in the method of drip irrigation. Tomato, a heavy feeder of nitrogen, phosphorus and potassium, responds well to applying fertilizers. Drip irrigation reduces deep percolation and evaporation and controls soil water status more precisely within the crop root zone. Similarly, in fertigation, applied fertilizer through the drip system is placed in the active plant root zone and improves fertilizer use efficiency.In drip fertigation systems, which combine drip irrigation with fertilizer application, the fruit yield of tomatoes was 20-30% higher in drip fertigation than in furrow irrigation. For this, the present investigation was carried out to achieve higher growth, yield and quality of tomatoes. In this regard, an experiment was conducted at Agricultural Research Station, Ummedganj-Kota (Agriculture University, Kota) during 2021-2022 in Factorial Randomized Block Design with twelve treatments in different combinations (drip irrigation levels [I0(50% PE) and I1 (75% PE)] and fertilizer application methodsi.e., F1- Entire fertilizers applied to soil with furrow irrigation (RDF), F2- 50% NPK fertigation + 50% NPK as basal, F3- 75% NPK fertigation + 25% NPK as basal, F4- 75% NPK fertigation, F5- 100% NPK fertigation and F6- 100% N fertigation and P and K as basal) of the drip irrigation and fertilizer application methods with three replications of each treatment. In this experiment, drip irrigation levels 50% PE and 100% NPK through fertigation were found superior in all the yield and quality attributes, followed by 75% PE and 75% NPK fertigation + 25% NPK as basal.

Key words : Drip irrigation, potential evaporation (PE), tomato, fertigation and fertilizer application methods

PS-II/46

Feasibility study on drip irrigated Dragon (*Kamlam*) Fruit in UV stabilized polybag

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Dragon fruit crop is recently introduced in South Gujarat due to its high market demand, which is because it possesses highly nutrient, anti-oxidant fat-free and high in fibre. Until now, it was grown in the north Gujrat region alone; it got prominence only when Hon. Prime Minister Narendra Modi publicly talked about its benefits while encouraging a few farmers to grow the crop in Kutch. A couple of years back, fruit scientists tried the crop on Navsari Agricultural University farm and observed the climatic and soil conditions of South Gujarat, also giving encouraging results. Several studies on the crop are already in the pipeline and farmers are demanding the package of practices for the crop. It is observed that there is hardly any literature on irrigation scheduling for the crop. The experiment was carried out in poly bags on an open terrace, looking at the demand for the fruit and its nutritional quality, high price, and land constraints in city areas. This could have wider applicability in terraces – balconies – rooftops that shall meet domestic consumption. Therefore, an experiment was planned on Dragon fruit*var*. Red Flesh; with the objectives to grow the crop in terraces with little and saline water using the drip method of irrigation and various PEF fractions, viz.0.4 PEF, 0.6 PEF, 0.8 PEF, 1.0 PEF and control. A large plot technique with CRD with 5 treatments in 4 replications was established on the rooftop of the ASPEE College of Horticulture & Forestry, NAU, Navsari. The biometric observation shows that the crop grew luxuriantly on rooftop with drip-irrigated saline (2dS/m) water and also showed flowering ten months after planting dragon fruit.

PS-II/47

Describing instantaneous and cumulative infiltration rate with same function

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Infiltration function is an important parameter required for designing of irrigation and drainage systems, groundwater recharge and transportation of water soluble contaminants. It is controlled by soil texture, structure, presence of salts, compaction and land use and land covers etc. These factors cause significant spatial variability in infiltration process causing serious challengesto for hydrologists, drainage experts, irrigation experts and water managers. There are large numbers of infiltration function describing the flow of water at air and soil interface. Kostiakov gave the first equation for cumulative infiltration depth as a function of time. Kostiakov-Lewisand Horton are empirical models and Philip, Kutílek and Krejèa, Swartzendruber,Stroosnijderand Brutsaert are process based models quite frequently documented in the literature. The infiltration process is mainly governed by macro-pores and relatively low-permeable layers present in vadose zones in tropical sub-humid regions besides its dependence on texture and land use and land cover. The Brutsaert model estimates Ksaccurately followed by Swartzendruber and Horton models. Brutsaert and Swartzendruber models are reliable in predicting infiltration behaviour and Ks. The major flaws of this equation is that it predicts the infiltration capacity to be infinite at t equals zero and approaches zero for long times, while actual infiltration rates approach a steady value. Also, it cannot be adjusted for different field conditions known to have serious effects on infiltration, such as soil water content. Mezencev modified Kostiakov's equation by adding a Ks value in the final infiltration rate. Infiltration rate and cumulative infiltration depths functions are generally described by two different functions. A new model is being proposed, which is common for infiltration and cumulative depths function with changed constants.

$$I_r \text{ or } d_c = \frac{a\,b + c\,T^d}{b + T^d} \quad (1)$$

Where,

dc= infiltration depth, [L]

Ir= infiltration rate, [LT-1]

T= time, [T]

a, b, c an d are the constants of the model

Values of a, b, c and d were observed to be 0.44500844, 3944.04, 889.02529 and 0.64426517 for location-1 and 0.26753004, 290.488, 251.83936 and 0.40361439 for location-2 for cumulative infiltration depths. Similarly a, b, c and d were observed to be 21.235761, 10.219163, 1.0306668 and 1.3612128 for location-1 and 1220.7902, 0.0161659, 1.1377084 and 2.0272792 for location-2 for infiltration rates. The value of d was less than unity for cumulative infiltration depth function and greater than unit for infiltration functions. The same model has capability of explaining infiltration rate and infiltration depth. The equation holds good for short as well as long time.

Keyword: Infiltration rate, cumulative depth, irrigation and drainage systems, groundwater recharge

PS-II/48

A new model to measure in situ saturated hydraulicconductivity using auger hole with flat bottom

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India is suffering from salt accumulation in soil over an area of 9.5 Mha, out ofwhich 3.0 Mha is sodic. Indo-Gangetic plain has about 1.31 Mha of the area under sodic conditions. A sizable area of sodic soil located in large canal command is suffering from twin problems ofwaterlogging and sodicity. The natural subsurface drainage of the area is insufficient to handle the seepage loss from the large canals at different reaches of the canals. Waterlogged saline soil mainly lies in arid and semi-arid region and are easily reclaimed by improving internal drainage through subsurface drainage. Design and proper functioning of subsurface drainage in waterlogged saline soil, as well as elevated field bed of integrated farming system in the waterlogged sodic area, is dependent on saturated hydraulic conductivity (K_s) ofthe soil, which is a basicinput parameter to the drain spacing or raised bed width calculation equations.The K_s are space and time dependent; henceone must adequately assess a representative value.Estimating a representative value of K_s is time-consuming and expensive; therefore, one has to optimize for the available budget and desired accuracy. The value of saturated hydraulic conductivity (K_s) is essentially required for subsurface drainage design and elevated field beds for reclamation and management of waterlogged saline and sodic soils. Hooghoudt auger hole method for in-situ K_s measurement was modified in the present study to improve the error associated with the estimated value. A new model for K_s measurement was also developed and compared with the widely used existing Ernst model for field application. The newly proposed model calculated the value of K_s as 0.248 m/day. Hooghoudt, modified Hooghoudt and Ernst model gave the values of K_s as 0.436 and 0.255 m/day. The K_s value obtained by the newly developed model was closest to the value obtained by the Ernst model with a per cent deviation of 0.8%. The new model is quite simple to understand with the best accuracy; hence recommended for field application.

Key words: Auger hole method, elevated field bed, saturated hydraulic conductivity, subsurface drainage, and waterlogged saline soil

PS-II/49

A new model for in situ measurement of gardener's unsaturated hydraulic conductivity function of the soil using point source field dripper

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The unsaturated hydraulic conductivity function (Kh) of soil is required to explain hydrologic processes, which helps understandwater quality and quantity,atmosphere-terrestrial connection, nutrient cycling,soil erosion, natural hazards and groundwater recharge. Kh is a function of soil moisture content or suction and is non-linear. Largenumbers of Kh functions are available in the literature. The most common Kh function used for linearization of Richards moisture flows equation to obtain various numerical and analytical solutions for different water flow geometries of drip irrigation systems. Shani et al. (1987) first proposed a point source field dripper method (PSFDM) for in-situ measurement of Gardener's Kh function using Wooding's (1968) theory for water flow under the shallow circular pond. Singh (1999) and Singh et al. (2001) gave models for Kh estimate using a steady-state theory of buried point and hemispherical surface source. Researchers are still working on developing such models. A new model is developed for in-situ measurement of Kh using point source field drippers with only one dripper discharge. Shani et el. (1987) model requires three minimum drip discharges, while the present study requires only dripper discharge. The proposed new model drastically reduces the time and resources needed for Kh estimate. A new hypothesis was synthesized and transformed to governing equation which was solved for Ksand á. The first hypothesis was the rate of change of water discharge within the saturated soil mass (dQ/dA) is directly proportional to saturated hydraulic gradient (i) geometrical shape (gs) factor and air entry head (he=1/á). The hypothesis was further simplified by replacing q with wetted soil volume and average change in volumetric moisture content (VwsÄè). An experiment was conducted with point source field dripper (PSFD) discharges of 3.65 up. Saturated and wetted front radii were measured against time up to one hour. R3/rs2 was plotted against the inverse of saturated radii and the slope and intercept of the line were measured as 170.48 and 16.649. The average change in volumetric moisture content (Äè) was calculated as 0.5916 cm3/cm3. The î (=(2/3)Äè) value was calculated as 0.39442. The Ks value was obtained as 6.57 cm/hr and á was 0.1243 cm-1. The importance of Ks was also measured by inverse auger hole method (IAHM), constant head permeameter method (CHPM) and infiltrometer method (IM) and respective values were 2.15, 1.35 and 0.67 cm/hr. Ks value measured by CHPM and IAHM is lower than the value obtained by the proposed model, which is quite apparent. The surface soil is tilled and pulverized, while subsurface soil is more compacted. The soil sample taken of Ks measurement through the core is disturbed and compacted while driving into the soil. The model seems quite good but needs to be tested on various types of the soil before large-scale adaption.

Key words: Unsaturated hydraulic conductivity, point source field dripper method, inverse auger hole method, constant head permeameter and infiltrometer method

PS-II/50

Response of ber varieties at different training systems under hot arid ecosystem

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Ber (*Ziziphus mauritiana* Lamk.) is drought hardy fruit plant of arid and semi-arid ecosystems. Present time area under ber around 40,000 ha with production 414,000 MT annually. More than 300 varieties of ber are available, but only a few are commercially important. The goal, Seb, Thar Sevika, and Mundia are suitable for extremely dry areas, whereas Banarasi Kadaka, Goma Kirti, Umran, Thai and Meharun are for comparatively humid regions. Usually, 60 % of space on one side is allotted for the skeleton and 25 % for the fruiting area. The remaining 15% space is left as a gallery for aeration and light penetration which are also used for various orchard operations in a normal square planting system.

A field experiment was conducted in July 2017 on four ber varieties (Gola, Thai, GomaKirti and TharSevika) trained on four systems (Y shape, espalier, telephone and control) to standardize training systems in *ber* varieties. The treatments (varieties & training systems) were allocated in an RBD fashion. Per variety on one training system has sixteen plants, so a total of 256 plants were planted at 6 x3 metre spacing. All crop bounded cultural practices were uniformly followed. Selection of varieties based on growth habit (spreading-Gola) to erect -Thai) and maturity group (early-Gola to late-Goma Kirti) and training systems framed on angle iron (35x35x5 mm) and GI wire (2 mm) with rows arranged in the East to West direction for harnessing of maximum solar energy and least shading effect. The results revealed that the maximum canopy gain and volume were recorded in cv. Gola, further branch intermingling and trunk cross-section area, was found in Thai ber, and these parameters were lower in cv. Thar Sevika. Photosynthetic activities radiation (PAR) value (184.6-534 µmol m^{-2} s^{-1}) maximum in espalier system and Pn value in Thar Sevika (34.24 µmol m^{-2} s^{-1}) however, photosynthetic rate maximum in Y shape (35.74 µmol m^{-2} s^{-1}) training, maximum fruit yield was recorded in Thai variety (20.46 kg plant-1 & 11.35 tha^{-1}) followed by Gola and minimum in Thar Sevika (17.56 kg $plant^{-1}$ and 9.75 tha^{-1}) it is probably due to difference in the genetic makeup of the genotype. Among the training system, Y-shape recorded higher fruit yield (21.21 kg $plant^{-1}$& 11.77 tha^{-1}) over other systems, which might be due to higher canopy coverage. Fruit physical quality (grade), uniform fruit maturity, easy harvesting better in training system over control.

PS-II/51

Groundwater potential zone mapping using RS& GIS

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The most important natural resource for supplying dependable and long-term water is the groundwater of the ecosystem. Groundwater resources are threatened due to several factors, including the growing population, urbanization, and industrialization. The area's groundwater level has decreased due to the continuous removal of water for agriculture, domestic, commercial, and other uses, and it is at entire risk of natural calamities. It is a common practice to assess groundwater resources using geographic information systems (GIS) and remote sensing (RS). The Integrated RS-GIS-based Analytical Hierarchy Process (AHP) and Technique for Preference according to Ideal Solution approaches were used in the current study to estimate the groundwater potential zones (GWPZs) of the Sandia watershed in the mid-Narmada basin. From reliable sources, several thematic layers were acquired, including land use-land cover, soil, slope, geology, and geomorphology. The AHP and RS & GIS approaches were used to assign weights to the parameters and their characteristics and discovered that the geomorphology layer has the most influence. Finally, the final GWPZ map was created by combining the selected theme maps using a weighted overlay analysis in ArcGIS software. For both, AHP and RS & GIS approaches, the resultant groundwater potential (GWP) map has been categorized into five classes: very low potential, low potential, moderate potential, high potential, and very high potential zone. The study has proved uneven distribution of these potential groundwater zones is controlled by the observed parameters. The study's findings can be used to create an effective groundwater action plan for the study area, assuring the long-term usage of significant groundwater resources. This research will be beneficial to water managers in terms of long-term groundwater supply.

Keywords: Remote sensing, GIS, Ground Water Potential Zone, Analytical Hierarchy Process.

PS-II/52

Foliar application of urea and micronutrients on nutrient content and uptake by groundnut in loamy sand soil (Typic*Ustipsamments*)

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*A field experiment was*conducted at Agronomy Instructional Farm, Chimanbhai Patel College of Agriculture, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar, Gujarat, to study the Foliar application of urea and micronutrients onnutrient content and uptake by groundnut in loamy sand soil (Typic*Ustipsamments*) during *the summer season of* 2019-20. The soil of the experimental field was loamy sand in texture with slightly alkaline in reaction, with electrical conductivity within a safe limit (0.14 dSm^{-1}). The soil was low in organic carbon (0.23 %), available nitrogen (158 kg ha^{-1}) and DTPA-extractable Zn (0.47 mg kg^{-1}); medium in available P_2O_5 (37.9 kg ha^{-1}), K_2O (186 kg ha^{-1}) and DTPA-extractable Fe (5.19 mg kg^{-1}). Total eight treatments viz., Control/RDF (T_1), T_1 + 1.5 % Urea spray at 35 DAS (T_2), T_1 + 1.5 % Urea spray at 50 DAS (T_3), T_1 + 1.5 % Urea spray at 35 DAS and 50 DAS (T_4), T_1 + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS (T_5), T_1 + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_6), T_1 + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS (T_7), T_1 + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8) were laid out in randomized block design with four replications. Significantly the highest iron content in the kernel was reported with an application of RDF + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8); but it was at par with treatments T_5, T_6 and T_7. Significantly the highest zinc content was recorded with application of RDF + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8). Significantly the highest iron content in haulm was recorded with the application of RDF + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_6); it was at par with treatment T_5, T_7 and T_8. Application of RDF + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_6) registered the highest zinc content significantly in haulm, but it was at par with treatment T_8.

Significantly the highest nitrogen (38.8kg ha^{-1}), phosphorous (2.3 kg ha^{-1}), potassium (12.2 kg ha^{-1}), iron (1439.6 g ha^{-1}) and zinc (33.5 g ha^{-1}) uptake by kernel were noted with the application of RDF + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8). But, nitrogen and iron were statistically at par with treatment T_6 and T_7, while potassium uptake by the kernel was at par with treatment T_7; but phosphorous uptake by the kernel was statistically at par with the application of T_5 and T_7. Zinc uptake by the kernel was statistically at par with the application of T_6.

Significantly the highest nitrogen uptake by haulm was recorded with the application of T_1 + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS (T_7); but, it was at par with treatment RDF + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_6) and T_1 + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8). Significantly the highest potassium and iron uptake by haulm were noted with the application of RDF + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8). But, it remained statistically at par with treatment T_6 and T_7. The highest zinc uptake by haulm was significantly reported with RDF + 1.5 % Urea spray + 0.5 % $FeSO_4$ and $ZnSO_4$ at 35 DAS and 50 DAS (T_8). But, it remained statistically at par with treatment T_6.

Keyword : *Urea,$FeSO_4$, $ZnSO_4$, Groundnut,Nutrient content and uptake*

PS-II/53

Estimation of genetic variation in *Phaseolus vulgaris* L. genotypes using SDSPAGE and RAPD marker

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Information about the genetic mixture of any crop is vital for meaningful employment of breeding programmes and is a significant implication of accomplishing sustainability in crop production. In this study, an initiative was taken to estimate the genetic mixture among the *Phaseolus vulgaris* L. genotypes collected from growing areas of Jammu province of Jammu and Kashmir, India. Two methods such as protein profiling and RAPD markers, were used on 20 and 14 genotypes of common beans (*Phaseolus vulgaris* L), respectively. The UPGMA cluster analysis of twenty studies genotypes via biochemical markers with SDS PAGE with Jaccard's similarity coefficient range varied from 0.30 to 1.00. The 20 genotypes were grouped into five main clusters. Similarly, fourteen genotypes of common beans were characterized by molecular markers, and UPGMA analysis showed four main clusters. Jaccard's similarity coefficient was noted to range from 0.11 to 0.64. The genotypes collected from the same area were highly similar to each other. The above results of this study showed that biochemical and molecular marker-based characterization is a useful tool to identify genotypes unequivocally and assess their germplasm variability.

Keywords: *Phaseolus vulgaris* L., Biochemical markers, RAPD markers, Polymorphism, Genetic diversity.

PS-II/54

The approach of geospatial technique in the investigation of morphometric parameters and its impact on hydrological features

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The increasing trend of Remote Sensing and GIS technology is becoming an efficient tool for collecting remote and large areal extent of data periodically. The digital elevation model (DEM) launched by different satellites helps to get the terrain heights data to characterize any size of the watershed by estimating various linear, areal, shape and relief morphometric parameters important for better watershed resource management and planning. The present study attempted to understand the morphological and hydrological characteristics of the Western flowing Vashishti river basin in the district of Ratnagiri, M.S. The river basin was delineated by 30m resolution-based ALOS World 3D DEM in ArcGIS 10.8 software. The different categorized linear, areal, shape and relief aspects of 32 morphometric parameters have been computed. The drainage area of the basin is 2129.97 km2 and comprises a 5th-order drainage basin having a maximum stream number of 316 obtained in 1st order indicates most dominant while the lowest 28 stream number obtained in 5th order. The linear aspects, Mean Bifurcation Ratio (1.86) and Mean Stream Length Ratio (0.98), indicate basin is the less structurally disturbed and initial stage of geomorphic development. The areal aspects like Drainage Density (0.536 Km- 1), Drainage Texture (2.20), Stream Frequency (0.296 Streams/Km2) and Length of Overland Flow (0.934 Km) indicate the basin is highly permeable and resistant to subsurface strata with coarser drainage texture tends to more infiltration and less runoff potential due to a large area having a low slope, with the longer flow path. The areal aspects like Form factor (0.205), Elongation ratio (0.511), Circulatory ratio (0.32) and Compactness coefficient (1.755) indicate elongated basin shape, less possibility to attains flatter peak flow in flood hydrograph, reduce the chances of the flood having previous strata, low relief and younger stage of the basin. The relief aspects like, Relief Ratio (0.012), Relative Relief (0.425 m/Km), Ruggedness Number (0.66), Melton Ruggedness Number (0.03), Constant of Channel Maintenance (1.86), Infiltration Ratio (0.16 Km- 3), Dissection Index (1.013), Time of Concentration (12 Hr 45 Min) And Time Of Recession (3 Days 21 Hr) indicates rolling and gentle slopes, moderate roughness and unevenness also moderate risk of flood hazard risk, basin comes under debris flood basins basin has permeable strata with mature to the old stage of the basin, dissected characteristics of the basin

with minimum denudation stage, stream flow takes more to travel time due to large area and topographic features. The integrated analysis of morphometric parameters concludes that the basin has less flood susceptibility than previous strata, and these parameters will help in prioritization.

Keywords: Remote Sensing and GIS technology, Watershed, Morphometric parameters, DEM (Digital Elevation Model) and ALOS World 3D DEM.

PS-II/55

Genetic analysis of tomato (*Solanum lycopersicum* L.) using SSR markers

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Genetic diversity information of any crop is essential for the efficient application of breeding programmes and is enormously decisive in achieving sustainability and crop productivity. This study assesses the genetic diversity among tomato genotypes cultivated in India. A total of 28 tomato genotypes were studied using SSRs molecular marker. Further, cluster analysis was done based on molecular markers data to assess genetic similarity among these genotypes. There were 28 genotypes divided into 7 significant clusters using the UPGMA cluster analysis driven by SSR data. Ten tomato genotypes make up 35.71% of Cluster 3, whereas only two tomato genotypes, Swarn Naveen and Kashi Anupam, were found in Clusters 5 and 7, respectively. The range of the Jaccard similarity coefficient was 0.03 to 0.92. According to what we anticipated, molecular marker analysis revealed similarities between genotypes from the same genetic basis. Tomato breeders may find it useful to use the data from SSR markers to discover a small number of highly distinct genotypes that may be used further to produce acceptable varieties and genotypes with high-quality prospects. Hence genetic variation in tomatoes via SSR markers could be analyzed at a molecular level.

Keywords: Tomato, Genetic diversity, Multivariate hierarchicalclusters, SSRs.

PS-II/56

Effect of zinc source and application methods on yield of hybrid rice

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The field study was conducted at the Main Rice Research Centre, Navsari Agricultural University, Navsari, Gujarat, during *kharif* 2019-2021 tocompare the growth and yield of hybrid rice in response to zinc sulphate and zn-ethylene diamine tetraacetate as zn source, which were incorporated into the soil as basal application and applied as a foliar spray at tillering and panicle initiation stage and carried out in randomized block design with four replications. The results revealed that growth and rice yield were significantly enhanced by adding zinc sources over control. The maximum panicle length, panicle weight, grain and straw yield were recorded with the application of zinc as per soil test-based application through Zn EDTA and was on par with a spraying of 0.05 and 0.1 % Zn EDTA both at tillering and panicle initiation stage. Zn EDTA resulted in greater values for these parameters than other Zn sources. Among soil and foliar application of Zn EDTA, the total cost of cultivation was recorded lower under foliar spraying of 0.05 % Zn EDTA than soil application of Zn EDTA. Thus, Zn EDTA proved to be an efficient and economical source as foliar spray @ 0.05 % for rice production.

Keywords: Hybrid rice, zinc sulphate, Zn-EDTA, application methods, yield

PS-II/57

Productivity and profitability of summer groundnut (*Arachis hypogaea* L.) influenced by crop geometries and nutrient management under South Saurashtra agroclimatic condition.

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A field experiment was conducted during the summer season of 2019-20 at Instructional Farm, Department of Agronomy, College of Agriculture, JAU, Junagadh, Gujarat, with three crop geometries (C_1-30 cm × 10 cm, C_2-20 cm × 10 cm and C_3-Broadcasting) and three fertilizer doses (F_1-100% RDF @ 25-50-50 kg N-P_2O_5-K_2O ha^{-1}, F_2-125% RDF @ 31.25-62.5-62.5 kg N-P_2O_5-K_2O ha^{-1} and F_3-150% RDF @ 37.5-75-75 kg N-P_2O_5-K_2O ha^{-1}) were tested in split plot design with four replications. The results indicated that the 30 cm × 10 cm crop geometry registered significantly higher growth parameters and yield attributes values. Pod and haulm yields remained statistically at par with the treatment C_2 (20 cm × 10 cm). Higher gross and net realization of 1,36,827 $ha^{-1}$and 89,047 ha^{-1},respectively, with a B: C ratio of 2.86, was obtained under the crop geometry of 30 cm × 10 cm. Almost all the growth characters, yield attributes, pod and haulm yield of groundnut were significantly higher under the application of 150% RDF. Higher gross and net realization of ₹ 1,34,834 $ha^{-1}$and ₹ 84,473 ha^{-1},respectively, with a B: C ratio of 2.67, was found under the treatment 150% RDF (F_3). Interaction effects between crop geometries and fertilizer doses were observed to be significant for the 100-pod weight (g), pod yield kg ha^{-1} and haulm yield kg ha^{-1} under the treatment combination of C_1F_2 (30 cm × 10 cm and 125% RDF).

PS-II/58

Response of potassium and zinc on yield, yield attributes and nutrient uptake by coriander (*Coriandrumsativum*L.)

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An experiment was conducted at the Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh, to assess the "Response of potassium and zinc on yield and nutrient uptake by coriander" during the *rabi* season of 2016-17. The pot experiment comprising of five levels of potassium (0, 10, 20, 40 and 60 kg ha^{-1}) and four levels of zinc sulphate (0, 10, 20 and 30 kg ha^{-1}) in a factorial, completely randomized design replicated three times were tested in the experiment, in respect of yield attributes and yield andnutrient uptake by coriander. While the plant height and dry matter yield were recorded at 30, 60 DAS, and harvest time. The experimental soil was medium black calcareous, clayey which was slightly alkaline in reaction, $pH_{2.5}$ - 8.0, $EC_{2.5}$ - 0.58 dS m^{-1}, low in available nitrogen (242 kg ha^{-1}), medium in phosphorus (39.20 kg ha^{-1}), available potassium (208 kg ha^{-1}) and DTPA available zinc (0.55 mg kg^{-1}). Applying potassium @ 60 kg ha^{-1} and zinc sulphate @ 30 kg ha^{-1} significantly increased the plant height, dry matter yield, seed yield, No. of branches per plant, No. of umbels per plant, No. of umbellate per umbel, No. of seed per umbellate and 1000-seed weight, uptake of nutrients by coriander, but most of nutrients uptake by stover at different growth stages significantly increased with the application of potassium @ 40 kg K2O ha^{-1} and zinc 30 kg $ZnSO_4$ ha^{-1}. The uptake of N, P, K, S, Fe, Mn, Zn and Cu were found to be higher in stover as compared to a seed. The highest qualitative yield of coriander can be achieved by applying potassium @ 60 kg K_2O ha^{-1} and zinc @ 30 kg $ZnSO_4$ ha^{-1} in the medium black calcareous soils of the Saurashtra region of Gujarat. While the application of potassium @ 60 kg ha^{-1} and zinc sulphate at 30 kg ha^{-1} gave significantly higher plant height, dry matter yield, seed yield and No. of seed per umbellate of coriander.

Keywords: *Coriander, rabi, potassium level, zinc levels, growth attributes, yield, quality*

PS-II/59

Partial root zone drying irrigation (PRZDI) in Pomegranate (*Punicca granatum* L.) for improves water use efficiency.

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In India, pomegranate is cultivated in Maharashtra, Andhra Pradesh, Uttar Pradesh, Tamil Nadu, Karnataka, Gujarat, Rajasthan, Madhya Pradesh, Punjab and Haryana regions.In these regions, rainfall is scanty, evaporation is very high, and a partial root-zone drying irrigation system is one of the most scientific and modern approaches to sustainable agriculture in general and horticulture in particular that has gained popularity in the 21st century. Certainly, pomegranate is very hardy and is grown on rocky land. Various soil types and standardized partial root-zone drying irrigation systems for pomegranates suitable for such conditions also play a vital role. In the pomegranate growing regions of India, water is a scarce commodity, and there is a need to apply water according to water requirements and a suitable partial root-zone drying irrigation system for the crop.Therefore, a field experiment was carried out during 2019-2020 in late *hasta bahar* at Solapur (*i.e.* $17^0 10^{"}$, $74^0 42^{"}$and 483.5 m msl) to evaluate the effect of partial root-zone drying irrigation strategies on growth, yield and water use efficiency. In this experiment, split-plot design with main-plot treatments of different irrigation regimes [*i.e.* 40, 60, 80,100%*ET_p] and sub-plot treatments of shifting of irrigation at drying sides (*i.e.* 20; 40, 60%*ASWD) for 8th old age pomegranate Bhagwa Cv.were undertaken. The irrigation water was applied with four replications.

The results showed that less water produces a good vegetative growth performance, no water shoot and luxury. Reduced moisture content and maximum plant height, branches, flowers and yield is recorded at 80 %* ET_c with 20% ASWDfor the 8thold age pomegranate tree. The moisture content and relative leaf water content in % age vary between 17.22 to 38.60 and 64.2 to 82.42 % age, respectively. The root geometry results showed that the higher and lower root length, weight and density (68.45 cm, 88.91 gm and 1.48 kg/m^3) and (41.66 cm, 42.80 grams and 0.67 kg/m^3) were observed in giving more irrigation. The yield and water use efficiency under the partial root zone drying irrigation system were 18.25tones^{-1} and 3.55 kgm^{-3} at 80 %*$ET_c$with 20% *ASWD for 8thold age pomegranate trees.In conclusion, 80 %*$ET_c$with 20%*ASWD for 8th old age pomegranate treeis recommended, an applicable water saving strategy and a good alternative for other techniques of water managementwhen water resources are limited to increase WUE while other physiological growth, roots, soil moisture, relative leaf water and water use parameters are maintained at an acceptable level.

Keywords : Pomegranate, Evapotranspiration, Partial root zone drying irrigation system, Water use and Water use efficiency

PS-II/60

Microbially synthesized iron oxide nanoparticles for the alleviation of salinity stress in rice plants (*Oryza sativa L.*)

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Salinity unfavourably affects crop production and poses a major global challenge for farmers. The application of microbes is an eco-friendly method to resolve salt-based osmotic stress; however, their survival in salinized soils poses a significant challenge. Microbial synthesis (biosynthesis) of metal nanoparticles is an eco-friendly, green, economical, and easy method that is gaining increasing interest in agricultural research. In this study, four different bacteria, Bacillus subtilis, Bacillus cereus, Rhodococcus kroppenstedtii, and Enterobacter cloacae were used to synthesize iron oxide nanoparticles (FeNPs). The NPs were synthesized extracellularly, and UV-

Vis spectra and DLS were used to confirm the size of the FeNPs. All four microbially synthesized FeNPs showed maximum absorbance spectra between 200-400 nm, and their size ranged between 61-107 nm. The effect of FeNPs on their plant growth promotion on rice plants was evaluated under salt stress conditions. The results revealed that the FeNPs-coated seeds showed maximum germination (100%), root length (88%) and shoot length (48%) compared with the untreated control. Among the four bacteria, E. cloacae synthesized FeNPs showed maximum enhancement compared to other bacteria. This result suggests that the size of the NPs and the source of synthesis play a vital role in salinity alleviation. Further greenhouse and field trial experiments are needed before salinity management can be used.

Keywords : Green synthesis, nanobiotechnology, agriculture, iron oxide nanoparticles, abiotic stress.

PS-II/61

Response of on Soil and Foliar Micronutrient application on Raw and Economic Seed Yield, Nutrient Uptakeand Soil Fertility in SeedOnion

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A field experiment was conducted to study the effect of soil and foliar micronutrient application on raw and economical seed yield inseed onion grown on silty clay textural soil (*Typic Haplustept*) for three consecutive years (*rabi seasons of* 2014-15 to 2016-17). The treatments were the application of only GRDN (100:50:50 kg/ha N : P_2O_5: K_2O + 20 t/ha FYM), T_1+ soil application of zinc sulphate, ferrous sulphate and borax,two foliar sprays of Government micro grade IIand Phule micro grade II (A and B). The pooled results revealed that the treatment T_7(GRDN + Two foliar sprays of Phule micro grade II 'B' @ 0.3 %) resulted in a significant increase in the average number of umbels per plant (9.68), raw seed yield (6.11 q/ha), economic seed yield (5.80 q/ha),total uptake of N (50.63 kg/ha), P (16.60 kg/ha), K (59.21 kg/ha), Fe (1781 g/ha), Zn (926 g/ha), Mn (1435 g/ha), Cu (92.07 g/ha), B (99 g/ha) and higher returns per rupees (B: C ratio of 5.69). The available soil phosphorus (10.03 kg/ha) was found to be significant in the treatment of T_2. However, Soil available N, K, DTPA-Mn and Cu showed a non-significant result. DTPA-Fe showed a significant increase (4.74 mg/kg) in treatment T_3 Over all treatments. DTPA-Zn was found significant sufficient status (0.64 mg/kg) in treatment T_2. Available boron was found significant sufficient status (0.56 mg/kg) in treatment T_4over all the treatments under study.

Key words : soil and foliar micronutrient, seed yield, nutrient uptake, soil fertility, seedonion

PS-II/62

Performance Evaluation of Laser Land Leveler

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Declining water table and degrading soil health are the major concerns for the current growth rate and sustainability of Indian Agriculture. In India, the total fresh water withdrawal from groundwater was approximately 90 % of this was used for agricultural production, including both irrigated crops and livestock production. Keeping in view, the need for judicious use of our natural resources, concerted efforts are being

made to enlighten the farmers for efficient use of irrigation water at farm level. Land development is the one of themajor components of precision farming. Land leveling through laser leveler is one such proven technology that is highly useful in conservation of irrigation water and enhancing productivity. The performance evaluation was done on the basis of leveling index, fuel consumption, draft, and coefficient of variation of land elevation.The leveling index of field number 1, field number 2 and field number 3 were 2.71, 2.05 and 4.30 respectively after laser leveler operation.

Keywords: Precision leveling, Laser leveler and Field evaluation.

PS-II/63

Study of Precipitation Concentration Index for Rahuri Tehsil

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Precipitation Concentration Index (PCI) is a strong parameter to determine the variability in rainfall patterns, floods and drought in any region. As Rahuri tehsil belongs to the scarcity zone, it is become necessary to decide on PCI values. PCI values were estimated using monthly and annually data from 1975 to 2021. Annual PCI values show variation in PCI ranges. Annual PCI index contains 36 years of strong irregularity of precipitation distribution having 78.26% of total years, 7 years of irregular precipitation distribution having 15.21% total years and 3 years of moderate precipitation distribution having 6.52% total years and no uniformity range found, while seasonal (Jun-Sept) shows 100% strong irregularity of precipitation distribution. It means there was no irregular precipitation distribution, no moderate precipitation distribution and no uniform precipitation distribution. It is seen that PCI's seasonal values vary yearly and have irregular rainfall patterns. Analysis of PCI will help in crop planning accordingly annual and seasonal PCI ranges for the Rahuri tehsil. Precipitation Concentration Index is necessary to understand rainfall patterns, hydrological study, and crop planning for flood and drought analysis and management. PCI may also help analyse soil erosion and loss by knowing rainfall patterns' variability.

Keywords: *Drought, Flood,Irregularity Precipitation concentration index, Rainfall pattern*

PS-II/64

Uptake kinetics of micronutrients in fennel (*Foeniculum vulgare* Mill.) with N input

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The study of nutrients uptake kinetics in crop plants is very important to determine the need of nutrients during crop growing period at a specific time, which relies upon a wide variety of factors, like plant species and their varieties, environmental conditions, soil properties, nutrients supply and soil microorganism etc. Therefore, to study the uptake kinetics of micronutrients, field experiments were carried out on sandy loam soil of Typic Haplustepts with six N levels, i.e. 0, 40, 60, 80, 100 and 120 kg ha^{-1} and compared with absolute control. Uptake of micronutrients and their uptake rate was calculated at 11-60, 61-90, 91-120 and 121-180 day intervals. Results revealed that the uptake of iron, zinc, manganese and copper increased with increased levels of applied nitrogen and the advancing age of crop plants. It was highest at 120 kg N ha^{-1} during 121-180 days after sowing (DAS). The uptake of Fe and Mn was exponential, while Cu was linear up to 180 days, whereas Zn made a plateau beyond 120 DAS of the crop. The uptake rate of Fe and Cu showed a linear pattern with increasing levels of N

(upto 120 N kg ha^{-1}) at all four stages of the crop. However, the uptake rate of Mn and Zn was different from that of N application and was nearer to the linear trend up to 91-120 DAS. Fe uptake rate was remarkably higher during 121-180 DAS over the 91-120 DAS with all the levels of applied N. Uptake rate of Mn drastically reduced during 121-180 DAS than 91-120 DAS with all the levels of N. Hence, it can be concluded that the application of N has a positive response for the uptake and uptake rate of micronutrients in fennel irrespective of growth stages. In contrast, the uptake rate of Mn and Zn varied with stages, whereas the uptake rate of Fe and Cu continued or even increased after plant senescence appeared, reflecting that Zn and Mn are more responsible for the growth of areal parts of fennel and Fe and Cu for root growth. Hence, later stage application of Zn and Mn may be discouraged, while Cu and Fe application may continue for higher yield, nutrients use efficiency and ratooning. Whereas Mn and Zn uptake rates reduced with the senescence of the crop. This is because fennel is a 'Herbaceous perennial bushy' plant, and the root remains active beyond the senescence of the aerial part of a crop.

Theme: Resource Conservation through natural farming - Low input agricultural practices

PS-II/65

Studies on effect of different doses of nitrogen and potash on yield parameters of banana cv. Phule pride

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A field experiment was conducted at Banana Research Station, Jalgaon, during 2018-19 to2020 - 21 to find out the optimum dose of N and K for Banana cv. Phule pride through fertigation. The experiment was laid out in Factorial Randomized Block Design (FRBD) comprised of nine treatment combinations and four replications. The treatment was three levels of nitrogen i.e. 100,125 and 150 g N/plant, and three levels of potash, i.e.100,150 and 200 g N/plant

The yield and yield contributing characters, *viz.*number of hands per bunch, number of fingers per bunch, bunch weight and banana yield, were significantly influenced due to nitrogen levels. The treatment of the application of 150 g nitrogen recorded a significantly higher number of hands per bunch (8.23), number of fingers (146), higher bunch weight (21.34 kg) and higher yield (94.81 t ha^{-1}). However, it was on par with the treatment of 125 g nitrogen concerning the number of fingers per bunch.

The levels of potash significantly influenced the yield and yield attributes of bananas. The treatment of the application of 200 g potash was very superior; however, it was on par with the treatment of 150 g potash in respect of the number of hands per bunch and the number of fingers per bunch.

The interaction effect between nitrogen levels and potash levels was found to be significant concerning yield and yield contributing characters. The treatment combination of 150 g nitrogen with 200 g potash was found to be significantly superior; however, it was on par with the treatment combinations of 125 g nitrogen with 150g potash, 125 g nitrogen with 200 g potash and the treatment combinations of 150g nitrogen with 150 g potash .

Key words: *Nitrogen, potash, bunch weight, yield*

PS-II/66

Reviews of developed technology on soil moisture content measurements and its estimations

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Agricultural crop productivity is directly dependent on the status of soil moisture. The measurement of soil moisture is cumbersome. The soil moisture sensor to measure soil moisture content has been developed around the globe based on different working principles. The present paper emphasized reviews of research conducted on soil moisture sensors and their principles. The summary of other sensors reviewed, with the benefits, constraints and influencing factors of various measurement methods employed, were compared and analyzed. The improvements and future development suggested by several researchers have been compiled. Has been reviewed from previous research, the future scope in the development of soil moisture sensors comprising automation, costing, accuracy, precision, non-destructive, user friendly and highly integrated systems. Based on different applications and scenarios, low-cost and farmer-friendly technologies to measure soil moisture content are the future's need. This review research aims to offer references to different researchers in the fields of agricultural engineering, agronomy and soil science. The paper helps scientists select proper soil moisture sensors to measure soil moisture.

Poster
Session-III
(Theme-IV, V & VI)

PS-III/1

Effect of seawater irrigation and sowing time on seed yield and component of salicornia (*s. Brachiata* roxb.)

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A field experiment was conducted during *the kharif-rabi* season of 2012-13 on coastal salt-affected soils of Coastal Soil Salinity Research Station, NAU, Danti-Umbharat in a split-plot design with four replications. The three dates of sowing *viz*., D_1: 1st week of June, D_2:3rd week of June and D_3:1st week of July were allotted to the main plot and three levels of irrigation *i.e*., I_1: 0.6 IW/CPE, I_2:0.8 IW/CPE and 1.0 IW/CPE in the subplot. On an overall basis, almost all the growth parameters were found to increase with the delay in sowing *i.e.,* 3rd week of June or 1st week of July. This was true for the fresh biomass and seed yield also. In the case of seawater irrigation regimes, irrigation at 0.8 IW/CPE ratio outyielded the rest of the irrigation regimes. The interaction effect was also significant on the fresh biomass yield of *salicornia*. Treatment combinations involving 0.8 IW/CPE ratio with sowing date D_3 produced significantly higher fresh biomass (34.24 t/ha) as compared to early sowing (23.78 and 31.12 t/ha). In the case of seed yield, late sowing and frequent irrigation had an edge over early sowing with lower levels of irrigation. For getting higher biomass production and seed yield of *salicornia* under South Gujarat conditions, it is essential to sow the crop during either 3rd week of June or 1st week of July and irrigation should be scheduled at 0.8 IW/CPE ratio.

Keyword: *Salicornia, seawater, irrigation, IW/CPE, Soil Salinity*

PS-III/2

Irrigation Water Management & Climate Change

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Water is the most critical input for agriculture and its efficient use is crucial for the development and sustainable productivity. Keeping this in view, large-scale development of water resources has been undertaken during the post-independence period which has reduced the susceptibility of agriculture to the vagaries of monsoons India is perhaps the most vulnerable country in the world to climate change. Climate change and its effects on natural resources therefore also, livelihood is a major global concern. The long coastline and the vast Himalayan glaciers are the two important fronts on which the climate change risk is a major concern. Rigorous science-based assessments are therefore important in designing adaptation strategies against climate change. The analysis has revealed that under GHG scenario severity of droughts and intensity of floods in various parts of the country is going to have deteriorated. Moreover, a general reduction in the quantity of the available runoff was predicted under the GHG scenario. The country has a highly seasonal pattern of rainfall, with 50 % of precipitation galling in just 15 days and over 90 per cent of the river flows occurring during just four months (Shekh and Gaur, 2013). The Indian mainland is drained by 15 major, 45 medium and over 120 minor rivers besides numerous ephemeral streams in the western arid region. The Himalayan glaciers feed India's most important rivers. But, due to rising temperature, many of the Himalayan glaciers are melting fast and could diminish significantly over the coming decades with catastrophic results. In long run, flows in the Ganges could drop by two third, affecting more than 400 million people who depend on it for drinking water. The water consumption for agriculture will be around 70%, the industry around 20% and residential and commercial around 10%. Due to the effects of climate change and uncertain rainfall, the use of water in agriculture will increase with the expansion of irrigated land. By late 1970, almost all developed and developing countries started intensive irrigation development to ensure increased crop production. In short term rapid melting of ice high up in the Himalayas might cause river swelling and floods. Floods, droughts and climate change are the three most important influences of climate on India's water resources.

Keyword: *Climate change, Irrigation Management, Rainfall, MIS, Adaptation &Mitigation strategies*

PS-III/3

Need for Aqua Agroforestry in Coastal Area of Dandi Navsari

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This paper based on a survey shows that most of the farmers of this region are depends on aqua agroforestry. The majority of farmers include aquaculture farming with agroforestry. Farmers of this region are rearing different species of fish viz. Rohu, Catla, Grass carp and Mrigal with agroforestry trees species grow on the bunds of the fish pond and better utilization of agroforestry. The soil type of this area comes under saline (pH 8.5) and water (pH 8) which are not useful for irrigation. Most of the farmers mostly depend on rainfall in *kharif* seasons. Moreover, farmers of the region harvest the water in a fish pond in kharif season for aquaculture as well as irrigation purpose in another season. Growing mainly Horti-silviculture (HS), Agri-Silvi-horticulture (ASH), Agri-silviculture (AS), Agri-horticulture (AH), Homegardens and Horti-pasture (HP) systems in their fields. Farmers of this region are mainly adopting the Horti-silviculture system as teak main tree components on the boundary with sapota or mango as main crops. Some farmers are also adopting teak-based paddy agroforestry systems (Agri-Silviculture system). These exiting agroforestry systems provide more return per unit area as compared to other existing agroforestry practices in these regions and also require less amount of irrigation water

Keywords: Labeorohita (Rohu), Catlacatla (Catla),Ctnopharyn godonidella (Grass Carp) and Cirrhinusmrigala (Mrigal), Agroforestry

PS-III/4

Impact of integrated nutrient management on growth and yield of brinjal under coastal salt-affected soils of South Gujarat

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A field experiment was conducted during *the late kharif* season of 2018-19 to 2020-21 at Coastal Soil Salinity Research Station, NAU, Danti-Umbharat,Gujarat to study the impact of integrated nutrient management (INM) on the growth and yieldof brinjal under coastal salt affected soils. Total eighteen treatment combinations comprising twoorganic manurei.e.,O_1: no organic manure and O_2: bio-compost @ 10 t/ha, three nitrogenlevels i.e.,N_1: 125 % RDN, N_2: 100 % RDN and N_3: 75 % RDNand three levels of nutrient supplementi.e., L_1: Control, L_2: Biofertilizer (Azospirillum + PSB, 108 CFU/ml, each1.25 lit/ha) and L_3: Banana pseudostem enriched sap 1 % spray at 40, 60, 80 and 100 days after TP, were evaluated in factorial randomized block design with three replications.The result revealed that treatmentO_2 (bio compost @ 10 t/ha) recorded significantly higher growth and yield attributes *viz.*, plant height,number of fruits per plant, fruit weight and number of picking. In the case of nitrogen levels, treatment N_1 (125 % RDN) achieved significantly higher plant height and more fruits per plant over treatments N_2 and N_3. The treatments N_1 (125 % RDN) and N_2 (100 % RDN) were at par with each other and recorded significantly higher values of fruit weight and the more number of picking as compared to treatment N_3. Among nutrient supplements, the treatment L_3 recorded a significant increase in the number of fruits per plant over treatments L_1 and L_2 and fruit weight over treatments L_1, while treatments L_3 and L_2 were at par with each other and recorded significantly higher values of plant height and the number of picking as compared to treatment L_1. The studies proved that combined application of bio compost @ 10 t/ha + 125:50:37.5 kg NPK/ha

(50 % N and 100 % P & K at basal and 50 % N at 30 DAT) along with soil application of biofertilizers (Azospirillum+PSB, 10^8 CFU/ml, each 1.25 l/ha)for achieving highest brinjal fruit yields with improve the coastal salt affected soils.

keywords:*INM, Brinjal, Coastal salt affected soil*

PS-III/5

Management of coastal saline soil, crop production and groundwater

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Agriculture is facing many adverse factors like high temperature, salinity, and drought, including those generated by climate change. Among various abiotic stresses, the yield losses in agriculture claimed 40% and 20% due to high temperature and salinity, respectively (Chang *et al.,* 2014). Among various stresses, salinity alone is emerging as the environmental threat to crop production which refers to the accumulation of excessive salt contents (Na^+, Mg^+, Ca^+, SO_4^{-3}, NO_3^-, CO_3^-, HCO_3^- and Cl-) in the soil eventually resulting in inhibition of growth leading to the death of plants. India has a coastal line of 7516 km, and Gujarat state has the largest coastal line covering about1660 km. The salt-affected area is increasing day by day and spreading all over the world. In India, which is about 6.74 M ha, Gujarat state with an area of 2.22 M ha constitutes the largest proportion of saline soils (Anil, 2019). Salinity is escalating due to the presence of saline groundwater at shallow depths and frequent seawater inundation in low-lying areas. Sea water intrusion into the aquifers may be direct, but also a range of complex geochemical processes like inter-aquifer mixing, mobilization of brines, water-rock interaction and anthropogenic contamination. There are so many preventive/remedial measures *viz.*, salt leaching, drainage, gypsum application, afforestation, magnetized water technology, proper use of irrigation water, organic and inorganic amendments, salt-tolerant varieties, grafting *etc*.

Keywords: Salinity, Crop production, Salt affected areas, Groundwater, Preventive/remedial measures

PS-III/6

Assessment of irrigation water quality of tube wells in Navsari Agricultural University

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The quantity and types of dissolved salts present in water determine its quality, especially for irrigation and domestic use. Moreover, the quality of water is ever deteriorating due to the over-exploitation of groundwater in the changing climate scenario. Continuous use of irrigation water having poor quality not only decreased crop productivity but also degrades agricultural lands. For the determination of water quality, several water quality indices (WQIs) have been developed by researchers. Among these, the irrigation water quality index (IWQI) has been considered one of the ideal indices for evaluating the quality of irrigation water. Therefore, the present study was carried out to assess water quality based on IWQI. Water samples were collected from the seventeen tube wells located on the Navsari Agricultural University (NAU) campus, which are widely used for irrigating crops in the year 2021**.** These samples were analysed for various quality parameters *viz.* EC and dissolved ions (Ca^{++}, Mg^{++}, Na^+, Cl^- and HCO_3^-) in the laboratory and subsequently SAR and IWQI were calculated. Besides, the Geographic Information System (GIS) was used to develop the visualized GIS zoning maps of the studied area by using values of investigated quality parameters. The results revealed that the calculated IWQI values of different tube well water samples varied from 35.94 to 74.44. No single tube well's water was categorized under the unrestricted category of IWQI. Out of the total, 17.65 % and 23.53 % of tube wells' water were categorized under low and moderate irrigation restrictions, respectively. It was indicated that these waters could be used for

irrigating the crops under high permeable soils along with appropriate management practices. Moreover, 29.41 % of tube wells' water was found under high irrigation restrictions and thus, suggesting that it can be used for irrigating moderate to high salt tolerance crops only. Whereas, equally (29.41 %) tube wells were categorized under severe restrictions indicating that these tube wells' watershould be avoided for irrigation under normal conditions.

Keywords: *Irrigation, Tube well water, Irrigation Water Quality Index (IWQI), GIS, Water quality*

PS-III/7

Lotus: a potential aquatic flower crop for the coastal region

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Nelumbonucifera, (2n=16) commonly known as lotus or sacred lotus is an aquatic perennial plant belonging to the family *Nelumbonaceae*. The national flower of a country should tie in with the culture, history and heritage of the nation. It is an important aquatic economic plant, not only as a dainty and ornamental flower but also as a source of herbal medicine with strong antipyretic, cooling and astringent properties. Many parts of Gujarat having clay soil with marshy or water-logged conditions are very much suitable for cultivating lotus. Waste damp lands; roadside trenches and undulating areas can be utilized, which can convert dreadful, and barren into an aesthetic and economic one. Apart from aesthetic value, farmers can also get extra income by mixed farming (fishes, crabs and other aquatic farming).*Almost every part of the lotus is useful i.e.,* leaves are used for wrapping food (sweet and spicy rice) for steaming and used as plates. The young leaves, leaf stalks, and flowers are consumed as vegetables and unopened flower buds are used in the flower arrangement. The flower is used for the preparation of lotus perfume. Dried flowers are used in the preparation of fragrant herbal tea. Makhanas (roasted lotus seeds) are low in cholesterol, sodium and saturated fats and are good for the heart. They are a good source of magnesium, potassium, manganese, phosphorous and protein. This highly nutritionalmakhana makes a perfect and healthy snack. Tender rhizomes and stems of lotus are edible, can be cooked along with other vegetables, soaked in syrup or pickled in vinegar and rhizomes are used to prepare chips, made sliced and dried, later made into powder or flour. *India exports dried lotus pods to USA, UK, the Netherlands, Germany, Japan, Singapore and certain other European countries. The Himalayan region contributes great business regarding some naturally dried plant parts which confined to about 60 private companies is operating in Kolkata (W.B.), Tuticorin (T.N.) and Mumbai (M.H.), all close to the sea routes.* Hence, there is a good business opportunity. To catch that potentiality, farmers should be motivated by the public or private extension system.

Keywords: Aquatic, herbal, makhanas, rhizome and dried flowers

PS-III/8

Role of bio-formulations in paddy production & soil reclamation

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KVK(ICAR-CSSRI-RRS) Hardoi II conducted an On Farm Trial on reduction in the cost of cultivation by the use of bio-formulations developed by ICAR-CSSRI-RRS, Lucknow during Kharif 2021. The major problem in the district is soil alkalinity and salinity of the soil. Therefore, Variety CSR 46 performed well with bio-formulations at farmer's fields over farmers practices (T0). The result showed that T1 gave a higher yield i.e.,49.46q/ha in comparison to T0 i.e., 22.58 q/ha,also improvement in BCR and soil health was recorded in trials.Farming situation is irrigated clay loam. I have taken two treatments with five replications. Soil sample

taken from all fields initially and after harvest of both crop results indicated that the soil fertility is low N,P ,medium OC per cent, K, neutral to alkaline in soil reaction and normal conductivity. In case of paddy plant height (115.24), number of tillers per m2 (305.05). number of ear per m2 (285.5).

PS-III/9

Preliminary Survey of Plant Diversity at Goima Forests – Riparian Ecosystem of River Kolak in South Gujarat

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Forests are essential for the survival of all living beings. Forest protection is, therefore, one of the central goals of forest management to maintain the sustainability of forest resources.The importance of forests cannot be underestimated.Our survival depends on forests, from the air we breathe to the wood we use. Forests not only provide animal habitat and human life but also provide protection from watersheds, prevent soil erosion, and mitigate climate change. As far as the preliminary survey in the selected area matters, the main objective was to determine the species diversity and provide baseline data that can utilized for further work on distribution in the area and occupancy under different canopy classes. Goima forest falls under (type 3B tropical moist deciduous forests, Champion and Seth, 1968) is under the jurisdiction of Valsad South Forest Division, Gujarat and is traversed by river Kolak forming a riparian ecosystem and riverine forests of South Gujarat.A total of 217 plant species from 71 different families were recorded during the survey. The plants were categorized as per plant forms, *i.e.*, Trees (88 spp), herbs (66 spp), shrubs (28 spp), grasses (12 spp) and climbers (23 spp), respectively. Maximum 30 plants were recorded from the family Fabaceae, followed by Asteraceaewith 17 species, Poaceae with 12 species, Moraceae and Acanthaceae with 9 and 8 species, respectively. Goima forests also have a few Rare and Endangered species like *Sterculia urens, Oroxylum indicum, Careya arborea, Hemidesmus indicus, Celastrus paniculata* and *Gloriosa superba.*

Keywords: Goima forest, Riparian, Rare, Endangered, Kolak River

PS-III/10

Effect of foliar spray of water soluble fertilizers on growth and yield of wheat (*Triticumaestivum* L.)

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A field experiment was carried out during rabi season of 2019-20 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. The soil of the experimental

field was medium black clayey, slightly alkaline soil in reaction with pH 7.8 and EC 0.33 dS/m. The results of the experiment indicated that growth parameters viz., plant height at 60 DAS and harvest and the number of effective tillers per metre row length at harvest increased significantly with the application of 75% RDF + foliar spray of 19:19:19 @ 0.5% at 30 DAS, 60 DAS &90 DAS. Significant improvement in yield attributes viz., length of the spike, number of spikelets per spike, grain and straw yields were observed with the application of 75% RDF + foliar spray of 19:19:19 @ 0.5% at 30 DAS, 60 DAS & 90 DAS over 75% RDF and 100% RDF.

Key words: Water soluble fertilizer, growth and yield

PS-III/11

Study of coastal vegetation surrounding Ambika river estuary in South Gujarat

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Coastal vegetation serves as an ecological bridge between the terrestrial and marine realms and forms one of the vital nature conservation sites. Coastal areas include mangrove, estuarine and mixed ecosystems; their stability is an essential pre-condition for the environmental sustainability of marine and inland life. They form one of the World's most biologically productive habitats. The state of Gujarat, with its longest sea coast, harbors one of the potential coastal habitats. South Gujarat zone, under AES Zone – III, are watered by Purna, Par, Damanganga, Auranga,Kolak, Ambica, Darota, Narmada and Tapi rivers. Mendhar village is located between 72 87' 44" E longitude and 20 74' 70'' N latitudes in Southern Gujarat, which forms an estuarine region of river Ambika. As the coastal areas are rapidly changing and are most prone to devastation, there is a need to create baseline information about the floristic diversity in and around the coastal areas. The present study was undertaken to know the vegetation and flora of Ambika estuary. Total taxa in Ambika river estuary account to 31species – 11 species of trees, 5 herbs, 5 shrubs, 3 climbers and 7 types of grass and 6396 total no. of individuals are enumerated in a total of 3195.8 square meter area and 10 m wide belts for assessment of floral species and 12 belts for evaluation of different forms of plants. Besides this, information on the uses of the plant species by the fisherman community is also reported to know the utilization pattern. Also, this species' ecology has been worked out to see the diversity and distribution pattern. Some of the important plants of this region are *Porteresiacoarcata*, *Salvadorapersica*, *Aeluropuslagopoides*, *Ipomoeapes-capre*, *Suaedafruticosa, Avicennia marina*and *Avicenniaofficinalis.* In all, 22 species are utilized by local inhabitants for medicines and non medicinal purposes. Ecological parameters likefrequency, density and abundance were worked out to analyze Shannon Weiner Index. Further, Simpson Species Diversity Index, Species richness and Species evenness of 31 plant species were reported.

Key Words: *Ambika, Estuarine, Ecosystem, Mangrove, Ecological*

PS-III/12

A Study to Compare In-Situ Saturated Hydraulic Conductivity Measured by Inverse Auger Hole Methods In Reclaimed Sodic Soil

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Waterlogged saline soils are reclaimed by adapting a subsurface drainage system by removing excessive salt in the soil profiles. Reclamation and management of waterlogged sodic using a subsurface drainage system is not feasible due to dispersed soil conditions and the unavailability of gravity outlets in central Indo-gangetic plains. The fish pond-based integrated farming system (FPBIFS) model has the potential to reclaim waterlogged sodic soil. Nearly 6.74 M ha of soil is salt affected in India and needs immediate attention for their reclamation. The State of Uttar Pradesh has about 10-15% of sodic soil waterlogged and can be reclaimed by adapting FPBIFS Model. Saturated hydraulic conductivity (K_s) is required for designing groundwater recharge systems, irrigation systems, subsurface drainage systems and groundwater ion structures. Infiltrometer and inverseauger hole methods (IAHM) are used for measuring in-situ surface and subsurface K_s of soil. The raised fish pond-based integrated farming system model design also requires K_s value. IAHMwith various bottom geometries recently became available for field application. Bottom flow geometries of augers depend on the shape of the auger bit and soil types. In medium textured soil with medium size auger bitcreates a hemispherical cavity, while in heavy textured stable soil with a long auger bit conical cavity is formed. The conical frustum at the bottom is formed with a long conical auger bit in medium-textured soil. In light textured soil equivalent cylindrical bottom is expected. IAH methods with flat, hemispherical, conical, frustum cone and equivalent cylindrical bottom geometries were applied to measure K_s in recently tilled sodic soil and compared with the K_s value obtained by infiltrometer. The K_s obtained by infiltrometer, IAH with flat, hemispherical, conical, equivalent cylindrical and frustum cone geometries were 1.75, 2.87, 3.06, 2.77, 3.03 and 3.58 cm/day, respectively. Per cent deviations of K_s ranged from 3.30 to 38.95% for infiltrometer and IAH with different bottom geometries compared to IAH with a flat bottom. In highly dispersed sodic conditions, either of the methods could be applied for in-situ measurement of K_s without giving much different value. The model with suitable bottom geometry based on a sound hypothesis should be used for K_s measurement.

Key words : Infiltrometer, Inverse auger hole, sodic soil, salt affected, waterlogged soil

PS-III/13

*Bauhinia malabarica*Roxb.: seed treatments on germination and early seedling growth for conservation of LKT species

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*Bauhinia malabarica*Roxb.is a small or moderate-sized deciduous Lesser Known and Threatened tree speciesthat belongs to the Fabaceae family. The wood of *B. malabarica* is used mainly as fuel, whereas leaves are used as fodder and rated as good fodder. Parts of the tree are used as traditional medicines for curing various diseases. The young shoots of *B. malabarica* are edible and are commonly prescribed to treat cough, gout, glandular swellings and goitre, haemorrhage, leprosy, menorrhagia, scrofula, urinary disorders, wasting diseases, worm infestations wounds and for liver disorders. Leaves are a good source of calcium and iron—decoction of this plant root bark is used for liver problems. The root and stem of this plant used for treating cholera would heal diuretics and dysentery. The seed coat of this tree species is very hard and efficiently does not germinate in natural habitats. Further, the seedling growth in the initial stage is slow. Thus the present

experiment was conducted to evaluate the effect of presowing treatments on seed germination and further early seedling vigour in *Bauhinia malabarica.*For the trial,Completely Randomized Design with four repetitions and six different presowing treatments *viz.,*soaking seeds in hot water for 24 hrs, soaking seeds in conc. H_2SO_4 for 30 minutes, soaking of seeds in conc. H_2SO_4 for 60 minutes, soaking of seeds in conc. H_2SO_4 for 90 minutes, soaking of seeds in conc. H_2SO_4 for 120 minutes and soaking of seeds in cow dung slurry for 24 hrs were adopted for assessment of seed germination, whereas for seedling growth and vigour study, due to very low germination in soaking of seeds in cow dung slurry for 24 hrs was not considered. For the germination trial, treated seeds (100 seeds/ treatment/ repetition) were sown in the tray containing soil: sand: farm yard manure (2:1:1 ratio)and after 30 days of sowing, seedlings were transferred into polythene bags having same media of germination for growth and vigour study.Results showed that significantly maximum germination, mean daily germination, germination valueand germination rate index recorded in soaking of seeds in conc. H_2SO_4 for 60 minutes of treatment. However, a maximumpeak value of germination was recorded in the soaking of seeds in conc. H_2SO_4 for 90 minutes, whereas minimum mean germination time was recorded in soaking of seeds in conc. H_2SO_4 for 30 minutes. The growth and vigour parameters of*B. malabarica*seedlings at 180 days after transplantingshowed maximum shoot height, collar diameter, total fresh weight of plant, total dry weight of plant, total leaf area and seedling quality index in soaking of seeds in conc. H_2SO_4 for 60 minutes of treatment. However, the maximum root: shoot ratio was noticed in the soaking of seeds in conc. H_2SO_4 for 120 minutes and minimum sturdiness quotient recorded in soaking of seeds in hot water for 24 hrs. The overall result showed that soaking of seeds in conc. H_2SO_4 for 60 minutes was found to be the best treatment for seed germination and seedling growth and vigour of *B. malabarica.*

Key Words: *Bauhinia malabarica, conservation, germination, seed treatment, seedling vigour*

PS-III/14

Assessment of Ground Water Quality Status by Using Irrigation Water Quality Index Method in Navsari Taluka

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An attempt has been made to understand groundwater quality by using the irrigation water quality index (IWQI) in Navsari Taluka. IWQI, a technique for rating water quality, is an effective tool to assess spatial and temporal changes in groundwater quality. A total of seventy five groundwater samples were collected pre monsoon (May, 2019) and post monsoon (November 2019) from 18 villages. Irrigation water quality index rating was carried out to quantify the overall groundwater quality status of the area. Among cations, strong alkalies predominate over alkaline earth metals, exhibiting a pattern of Na+>Mg++>Ca ++> K +. While, anions were dominated by bicarbonates > chlorides > sulphates > nitrate > boron $\approx$ fluoride > bromide. The values of IWQI of the samples were found in the range of 25.29 to 82.27 in the pre-monsoon season, while it was 9.98 to 85.45 in the post-monsoon season. Before the monsoon, the bulk of groundwater was classified as moderately or severely restricted for agricultural purposes. However, following the monsoon, a large amount of groundwater was limited to a low to moderate degree. As a result, seasonal changes have had a major impact on groundwater composition, as irrigation water quality indicators improved during the post-monsoon period compared to the pre-monsoon period.

Key words: Ground water, Seasonal variation, IWQI, Navsari

PS-III/15

Effect of drip irrigation scheduling on growth of *ailanthus excelsa* grown inSouth Gujarat

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*Ailanthus excelsa*Roxb. is an important fast-growing tree species It is one of the promising fast-growing multipurpose trees of dry areas due to its ability to grow well with less rainfall and in strong light conditions. The importance of irrigation efficiency is increased, and drip irrigation may drastically enhance irrigation efficiency by making the most effective use of water for agriculture.To assess the effect of irrigation scheduling on growth of *Ailanthus excelsa*, the treatments were imposed in plots as, irrigation at 0.6IW/CPE, at 0.8 IW/CPE, at 1.0 IW/CPE, at1.2 IW/CPEirrigation once in 3 days' interval and one surface irrigation plot were maintained under large plot technic design at NRM farm of Navsari Agricultural University. The long-term experiment result revealed that maximum growth of tree was observed in 1.0 IW/CPE treatment. Overall, the study demonstrated the appropriate irrigation practices to increase the growth of *Ailanthus excelsa*.

Keywords:*Ailanthus excelsa, Drip Irrigation, Irrigation scheduling*

PS-III/16

Response of summer groundnut (*Arachis hypogaea* L.) to irrigation level and anti-transpirant on growth, yield and quality

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The present research was carried out during the summer of 2019-20 at Junagadh.The experiment *comprised three irrigation schedules (IW/CPE ratio of 0.6, 0.8 and 1.0) in main plots and three anti-transpirants (Kaolin 6 % spray at 45and 75 DAS, PMA 0.032 % spray at 45 and 75 DAS and water spray) in a subplot in a split plot design with four replications.* The growth parameter (plant height, total dry matter per plant, number of branches per plant at 45 and 75 DAS at harvest) and yield attributes(the number of pegs, the number of mature pods per plant, haulm yield, pod yield and test weight of groundnut increased with increasing frequency of irrigation and application of anti-transpirant. Irrigation at IW/CPE 1.0 and spray of kaolin 6 % at 45 and 75 DAS significantly improved the growth and yield attributes and resulted in a higher pod and haulm yield over other treatments.Higher pod yield and net realization can also be obtained by imposing irrigation scheduling at a 1.0 IW/CPE ratio along with Kaolin 6 % spray at 45 and 75 DAS.

PS-III/17

Land use Pattern of Valsad District in Gujarat.

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Land use land cover pattern is the outcome of natural and socioeconomic activity over the earth's surface. Land use land cover is something used interchangeably, but they are different, land cover is what covers the surface of the earth, and land use describes how the land is used. An integrated approach of remote sensing and GIS has been used to study the land use and land cover changes in the Valsad district in Gujarat. Landsat satellite imageries of two different periods for the years 2000 and 2011 were used to study land use land cover changes. The ERDAS imagine software is used for unsupervised classification of Images. The Classified images were categorized into nine different classes.The map showed that the area of vegetation with orchards, built-up areas and barren land increased. In contrast, shallow water, deep water, the agricultural field, open fields without a

crop, forests and marshy regions decreased from 2000 to 2011. Further, to assess the accuracy, the Kappacoefficient has been calculated, and the overall classification accuracy is more than 75 per cent, whereas the overall Kappa statistics is more than 0.65 per cent for both years.

Key Words: Remote sensing, GIS, Classification, Land use, Change detection, Images.

PS-III/18

Evaluation of Growth Characters for Cotton Hybrids and Parents under Different Saline Environment

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Cotton "white gold" is grown in different climate regimes and is one of the mostimportantcommercial crops worldwide. Salinity is one of the biggest problems as it covers 7 % of landworldwide. It has been estimated that salinity-affected areas are increasing at 10 %annually for various reasons. The identification of suitable cotton (*Gossypium hirsutum* L.) genotype for a saline environmentis the prime requirement. Hence, this experiment was laid out with twelve F1 hybrids and fourparents in three different saline environments in RBD design during 2019-20. Dry biomass ofplant, dry leaf weight and leaf area were estimated at 50 days after sowing (DAS) and 100 DAS.The results indicated that the total dry biomass, dry leaf weight and leaf area of cotton parentsand hybrids at 50 DAS and 100 DAS were significantly reduced due to the saline environment. Thereduction in total dry biomass, leaf dry weight and leaf area of cotton parents and hybrids was49.81 %, 54.98 % and 54.89 % at 50 DAS and 58.53 %, 51.20 % and 52.23 % at 100 DAS, respectively. The genotypic variation was also found significant for all studied parameters. Thesignificantly higher dry biomass pooled was found in G. Cot 16 and GSHV 185 at 50 DAS and100 DAS, respectively. The genotype G. Cot 16 and cross GSHV 185 x L 1384 showed significanthigher leaf dry weight at 50 DAS and 100 DAS, respectively. Leaf area per plant was significantlyhigher in the crosses L 1384 x G. Cot 16 and GSHV 185 x L 1384 at 50 DAS and 100 DAS,respectively. The information generated in this study would be more beneficial in planning breedingstrategies to develop salinity-tolerant cotton varieties for the saline environment.

Keyword: Cotton variety, hybrid, parents, Saline environment, hirsutum .

PS-III/19

Evaluation of some post-emergence herbicides and their mixtures for weed control in wheat (Triticumaestivum L.)

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A field experiment was carried out during the rabi season of 2015-16 to evaluate some post-emergence herbicides and theirmixtures for weed control in wheat on calcareous clayey soil having a medium status of available N, P and K at Junagadh. Theresults revealed that pendimethalin 900 g ha-1 as pre-emergence fb either pre-mix sulfosulfuron + metsulfuron 30 + 2 g ha-1 orclodinafop + metsulfuron 60 + 4 g ha-1as post-emergence at 30 DAS enhanced growth parameters viz., plant height, dry matter/plant and number of total tillers m-1 row length, yield attributes viz., number of effective tillers m-1 row length, length of a spike,number of spikelets spike-1, number of grains spike-1, grain weight spike-1, 1000-grain weight, 1000-grain volume and ultimatelygave higher grain and straw yield.

Keywords: *Herbicides, weed management, wheat*

PS-III/20

Effect of Amendmentsand Micronutrientson Nutrient Availability, Yieldand EconomicsofPigeon Pea Grownon Calcareous Soil

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A field experiment was conducted to study the effect of amendments and micronutrients on nutrient availability and yield of pigeon pea grown on calcareous silty clay soil (Typic Haplustept) for three consecutive years (kharif seasons of 2015-16 to 2017-18). The treatments applied only GRDN (25:50 kg/ha N : P2O5 + 5 t/ha FYM) and GRDN with different amendments and different micronutrients with cow dung slurry. The pooled results revealed that the treatment T8 (GRDN + FeSO4 + ZnSO4 + Borax @ 25, 20 and 5 kg ha-1, respectively incubated with cow dung slurry @ 500 L ha-1) resulted in a significant increase in hydraulic conductivity (1.83 cm/h), soil available P, availability of micronutrients (Fe, Zn, Cu and B) in the soil and also recorded a significant increase in total chlorophyll content in fresh leaves at 45 DAS, total uptake of N, P, K, Fe, Zn, Mn, Cu and B, and maximum grain (21.77 q/ha) and straw (78.20 q/ha) yield of pigeon pea resulting in higher returns per rupees (B: C ratio of 2.64). The soil pH and CaCO3 content at the harvest stage were significantly reduced (8.20 and 12.43%, respectively) by applying GRDN along with PBSW @ 80 m3/ha, where the electrical conductivity was decreased (0.24 dS/m). The application of GRDN. The available soil nitrogen showed non-significant results, whereas treatment T5 reported a significant increase in available potassium in soil (417 kg/ha).

Keywords: Amendments, micronutrients, nutrient uptake, calcareous soil, yield of pigeonpea

PS-III/21

Response of *kharif* paddy to bio fertilizers and inorganic fertilizers

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A field experiment was conducted during *the kharif* season during 2009-10 and 2010-11 at Instructional Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, to study the "Response of *kharif* paddy to bio fertilizers and inorganic fertilizers". The experiment was laid out in a randomized block design with four replications in 8 treatments. The results revealed that the treatment which received 100 per cent RDF (100 - 30 kg NP /ha) + ZnSO4 @ 25 kg /ha+ Azospirillum as seedlings treatment +Azotobactor + PSB + Zn + Potassium solubilizer as soil application recorded significantly higher all growth and yield parameters such as plant height, number of tillers per plant, number of panicles per hill, length of panicle, test weight and grain as well as straw yields of rice, while 100 per cent and 75 per cent RDF alone recorded the lowest value. The highest total uptake of N, P, K and Zn and residual available N, P, K and Zn in soil were also found to be highest in this treatment. Similarly, The highest gross returns, net returns and B:C ratio were recorded with 100 % RDF + ZnSO4 @ 25 kg /ha + Azospirillum as seedlings treatment + Azotobactor + PSB + Zn + Potassium solubilizer, which is found to be promising for increased rice production.

Keywords :*Kharif paddy, Azospirillum, Azotobactor, PSB , Potassium solubilizer*

PS-III/22

Effect of salinity stress on antioxidative enzyme activities in spider lily cv local

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Under inappropriate environments, plants respond by changing their metabolisms to maintain homeostasis; acclimation abilities are different among species and varieties. Saline tolerance of different ornamental plants is an alternative way to overcome soil salinity and poor quality irrigation water, i.e. saline water of some areas in

coastal belts. Evaluation of salt tolerance in bulbous ornamental plants was performed with potted plants under nursery conditions. This study aims to select salinity tolerance bulbous flowering plants from mostly used commercial ones. Commercial grown bulbous plant spider lily cv Local was grown in polythene bags and irrigated with water of different salinity levels (2.0, 4.0, 6.0, 8.0, 10.0 and 12.0 dSm-1) along with the control (best available water) to evaluate different biochemical parameters, i.e. catalase (CAT), superoxide dismutase (SOD), peroxidase (POD), sucrose synthase (SoS) and glutathione reductase (GR) activities as well as the amount of chlorophyll content. The data suggested that the CAT, SOD, POD, SoS and GR exhibited increased trends nearly the same pattern in salinity responses but with different activity levels. The maximum activities of CAT (23.35 µmol/min/g protein), SOD (35.33 µmol/min/g protein), POD (84.17 µmol/min/g protein), SoS (0.58 µmol/min/g protein) and GR (1.14 µmol/min/g protein) were observed in irrigation with 12.0 dSm-1 salinity level. Furthermore, the chlorophyll content decreased with an increase in the salinity level of irrigation water.

Key words: *salinity, catalase, superoxide dismutase, peroxidase, sucrose synthase*

PS-III/23

Fractionation of Sulphur Forms in Rice Growing Soils of District Kupwara of North Kashmir for better soil management

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Sulphur is one of the essential elements for plant growth. It is an important constituent of many enzymes and amino acids. In Indian agriculture, the information regarding different forms of sulphur is very limited. Today, the sulphur research has extended to various soils, crops and cropping systems and different sources of sulphur. In order to apply sulphur fertilizers more efficiently, an evaluation of the sulphur transformations in relation to its availability in soil for crops is very important. In soil, sulphur is present in both organic and inorganic forms and the proportion of inorganic to organic sulphur varies widely depending upon the nature and quality of soil, its depth and management factors to which the soil is subjected. Inorganic sulphur composed of water soluble and adsorbed sulphur, is generally believed to be the immediate and easy source for plant uptake . Sulphate sulphur generally accounts for < 5% of total soil sulphur. Sulphate sulphur's concentration at a particular time depends on the balance between plant uptake, fertilizer input, mineralization and immobilization.The present investigation is therefore undertaken to study the ¯ "Fractionation of Sulphur forms in Rice growing soils of District Kupwara of North Kashmir". Fifteen (15) soil samples (0-15 cm) were collected from rice field of Kupwara district. The collected samples were analyzed for different sulphur fractions. It can be concluded that the different forms of sulphur, i.e. sulphate sulphur, water soluble sulphur, non sulphate sulphur, organic and total sulphur were present in various range with the average value of 31.32, 42.23, 1379.71, 217.47 and 1670.72 mg kg^{-1} respectively under different rice field soil of Kupwara district. From the preceding summary it can be concluded that the percentage contribution of soil sulphur fractions to total sulphur were in order of non sulphate sulphur > organic sulphur > water soluble sulphur > sulphate sulphur.

Key words: *Sulphate Sulphur , Water Soluble Sulphur , Organic Sulphur , Non Sulphate Sulphur , Total Sulphur*

PS-III/24

Water saving techniques for increasing on farm water use efficiency in paddy ecosystem

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Rice is one of the most cultivated grain crops in India as well as the Asian countries and a staple diet for more than half of the world's population. Generally, rice is known to be a water-intensive crop, requiring between 3,000 and 5,000 litres of water per kilo of rice production under conventional flooded conditions. It is the most popular method for rice establishment in India. This conventional method of rice production is labour, water and energy intensive system to sustain productivity of rice. In climate changing situations, With water scarcity in agriculture, there is a need to popularize the alternate methods of rice cultivation like Alternate wetting and drying as well as cultivation of paddy under drip and direct sowing of rice with water management. By keeping all the above aspects in view, a field experiment has been conducted at WALAMTARI, Himayatsagar, Rajendranagar to cultivate paddy with different water saving technologies from 2018-19 to 2020-21 successively in both Kharif and rabi seasons. It is observed that there is 20 – 25% reduction in water usage and 10-15 % improvement in yields in these methods when compared to conventional method of rice cultivation.

PS-III/25

Potential of Leguminous tree species: Restoration of Degraded Soil

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Natural resources are imperative fundamental source required for meeting the diverse needs of humans. Where, soil is one of the most important resources for human livelihood. It is one of the biotic factors which play crucial role in supporting the food security in ecosystem. Soil is major Influence factor on Crop productivity. Today the soil has virtually turned lifeless in places with increasing civilization. Nearly 30 per cent of land is degraded in India. Leguminous trees species are capable to reclaim the degraded soil with the help of symbiosis relation nodulating N2-fixing bacteria and arbuscular mycorrhizal fungi. From the present discussion, information generate that soil were improved under legume tree species by increasing the OC and available N, P, K and also by reduced the bulk density of soil. Moreover, it has better capacity to grow quickly and withstand in degraded land, thus, leguminous tree species have potential to established and grown in degraded land and improved soil health through the nitrogen fixation nature and organic matter then non leguminous tree species. From the literatures, several researchers have reported that leguminous tree species are one of the best alternatives for the reclamation of soil. Leguminous trees i.e.Prosopisjuliflora, Dalbergia sisoo, Glyricidia sepium, Leucaena leucocephala, Albizia lebbeck,Prosopis cineraria, Pithecellobium macradenium etc... are important tree species for reclaim the soil health by adding organic matter in soil from the leaf litter and fixing nitrogen. These leguminous tree species not only improved soil health but is also has multipurpose use which help the grower to generate income.

Keywords: *Leguminous tree, Nitrogen fixation, Soil properties, Restoration, Degraded soil*

PS-III/26

Conservation of natural resources for sustainable fruit production

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Soil and water are the more valuable natural resources on earth's surface considered basic needs of food, feed and fiber for human beings. The land is the basic unit of all agricultural production. It is to be used very judiciously to meet the need of the growing population for sustained quality of human life and also agricultural development. Water is one of the most important inputs for raising fruit plants successfully. After soil, water is perhaps the second important resource required by plants. Thus it is considered one of the most limiting factors for plant growth and development. Land provides food, fuel, fodder and shelter besides supporting secondary and other economic life-supporting systems. However there has been a continuous depletion of land resources and the quality of land is deteriorating due to various factors like soil erosion caused mainly due to shifting cultivation, high rainfall, large-scale deforestation, overgrazing, general mismanagement, *etc*. There for, the best way to protect natural resources (Soil and Water) against deterioration in quality or erosion is 'Conservation'. Different physical(Contour bunds, Bench terracing, Grass waterways, Half moon terrace and Water harvesting ponds), agronomical(Mix cropping, Intercropping, Mulching, Strip cropping and Agroforestry) and biological measures(Vegetative strip, Protective bushland, Live fences, and Reforestation) are adopted to protect natural resources from this types of calamities. Choice & Design of Soil & Water Conservation measures depend on soil, rainfall, land slope and wind character of the area.

Keywords : *Natural resources, Soil, Water, Conservation and Fruit Production*

PS-III/27

Effect of integrated nutrient management on seedling growth and biomass of sandal wood (*Santalum album* L.)

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The investigation entitled "Effect of integrated nutrient management on seedling growth and biomass of Sandalwood (Santalum album L.)" was undertaken during the year 2018-2019 at the Net House Complex, College of Forestry, ASPEE College of Horticulture and Forestry, Navsari Agricultural University, Navsari, Gujarat, India. The experiment was laid out in CRD comprising Leucaenaleucocephalaas the host plant and 12 INM treatments of different organic, inorganic, and biofertilizers and their combinations application along with control (T0). Among different integrated nutrient management treatments, seedling height, collar diameter, number of leaves per plant, fresh and dry weight of shoot, leaves and whole plant were recorded maximum in T10 (1 g of NPK and VERM @ 25 g/seedlings). Moreover, fresh and dry weight of root and root length were registered maximum in T4 (Vermicompost @ 50 g/seedlings). The seedlings without integrated nutrient treatment (T0: Control) were found poorest for all parameters under study. However, root: shoot ratio was noted as maximum in T3 (Vermicompost @ 25 g /seedlings).

Keywords : Sandalwood,INM, Growth, Biomass, NPK, Biofertilizers and Vermicompost

PS-III/28

Study of soil chemical properties of Eucalyptus plantations and open farmer's field in South Gujarat Region

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The investigation entitled "Effect of the physico-chemical properties and microbial population in soil under Eucalyptus plantations in South Gujarat Region" was carried out during the year 2019-21 at the Eucalyptus plantation field and non Eucalyptus Farmers field at the College of Forestry, NAU, Navsari (Gujarat). The soil samples were collected twice a year (pre-monsoon and after monsoon) from both sites for three years. The collected soil samples were analyzed at the NRM laboratory for chemical properties (pH, EC, OC and available N, P2O5, K2O). The obtained results revealed that Soil pH was significantly influenced by eucalyptus plantations, fields, depth of sampling along with seasons. It was reported significantly higher in nearby agriculture fields as compared to eucalyptus plantations. Among the fields, it was also noted as significantly higher under farmer's agriculture fields as compared to NAU fields. Whereas, soil EC was not affected significantly due to Eucalyptus plantations. As far as soil fertility is concerned Soil organic carbon was influenced significantly by location, seasons, Eucalyptus plantations and depth of sampling. It was reported significantly higher in the surface soils of farmer's fields and Eucalyptus plantations than in their respective treatments. Like organic carbon, available nitrogen also differed statistically due to plantations, location and depth of soil sampling. It was recorded significantly higher under Eucalyptus plantations over the agricultural fields. Similarly, surface soil also recorded significantly higher available nitrogen than the subsoil. The availability of nitrogen was also influenced significantly by seasons as significantly higher values were observed in post monsoon season over the pre-monsoon. In the case of available P, significantly higher available P2O5 was recorded under Eucalyptus plantations over the agriculture fields. It was also noted significantly higher in surface soil than sub-surface soil. Whereas available K2O was influenced significantly due to only Eucalyptus plantations and depths of soil. Like available nitrogen, available K2O was also found significantly higher in the surface soil of Eucalyptus plantations than in agriculture fields.

PS-III/29

Climate-smart Horticulture

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Climate-smart horticulture denotes the status burly enough to mitigate the ill effect of greenhouse gases and its adaptability to extreme weather conditions, the climate change is inevitable. As per the report of the United Nations Conference on Trade and Development (UNCTAD), India will be the most effloresce economy in the world even with a sluggish growth rate of 6.7% but it is stock-still tenacious by poverty and hunger. Agriculture (Horticulture- a branch of that) is responsible for 70% of water use globally as well as 30% of greenhouse gas emissions. Due to the increasing population day by day, which has resulted in increasing demand for food, processing, trade, etc., it is essential to increase horticultural production with the surety that its environmental impact is minimal. An increase in productivity, adaptation to the growing environment, reduction in greenhouse gases, achievement of national food security etc. are important issues and challenges which require technology to make horticulture climate smart. Technology which encourages good agricultural practices like integrated crop management, horticulture conservation, intercropping, multistorey cropping, improved seeds and fertilizer

management etc. need to be focused with concern pragmatically. Another potent technology for climate-smart horticulture is the development of community-based water storage, rehabilitation of forest areas, elite seed production programmes, etc. The level of development in different countries varies according to its emphasis on climate, smart horticulture is also variable. To meet the challenges posed by changing climatic conditions, developing countries like India might focus on adapting agricultural/horticultural systems. On the other hand, developed countries may look forward to carbon trading to keep their agricultural production continuing even at the cost of more input and emissions. The attempt is required to characterize the potential of horticulture as a sink of carbon emission to draw benefits from the outgrowing agriculture towards climate-smart options from a global perspective.

Keywords: UNCTAD, Greenhouse gases, multistorey, rehabilitation, carbon emissions

Theme5: Biodiversity and land use system (Horticulture/Agro-forestry) for nutritional and environmental security

PS-III/30

Potential of Teak-based agroforestry system

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The agroforestry system is a reliable strategy to integrate a sustainable supply of wood, food, medicine, NTFPs and environmental services in a single land use system. Many timber-yielding species are grown in agroforestry systems. However, Teak (*Tectona grandis*) trees are globally used for timber-based agroforestry systems. Teak is a high valuable tropical hardwood timber species which is popular at the global level for its excellent wood quality, unique grain pattern and texture, and strong and high durability of its heartwood against fungi, termites and other biological attacks. This species gives better financial revenues and low labour power. Fast-growing teak can pay to local and international timber industries. Small plantings have also been aided by the lower rotational age and its effectiveness as a face veneer.Alternatives to properly integrate crop and forest areas to improve environmental conservation are a matter of increasing interest. Many Teak-based agroforestry systems are followed in India viz., medicinal (Sarpagandha) and aromatic crops (Patchouli), arable crops (Sorghum, Groundnut, Chilli and Ragi), horticultural crops (Papaya, Sapota, Mango) and pasture crops (Subabul and Guinea grass). This review paper illustrates different promising teak-based agroforestry systems.

Keywords: *Agroforestry systems, Teak, Intercropping, timber, financial*

PS-III/31

Effect ofpractising *Melia dubia*-Hybrid Napier silvipasture systems on soil physicochemical and biological *properties*

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M. dubia-Hybrid Napier (HN) silvi-pasture and sole cropping systems were developed by integrating HN withM. dubiaspaced at 2 x 2, 3 x 2, 3 x 3, 4 x 2, 4 x 4 m and sole HN for 2 consecutive years from 2018-2019. All these systems were assessed for their effect on soil physicochemical properties viz. pH, electrical conductivity (EC), organic carbon (OC), nitrogen (N), phosphorus (P) andpotassium (K). and biological properties i.e. microbial population (bacteria, fungi and actinomycetes).Practising MD-HN systems, to some extent had an

ameliorative effect on the soil physicochemical (pH, EC, OC, N, P and K) and biological properties (microbial populations). At the end of the second year, pH, EC, N, P and K under silvi-pasture systems decreased while OC showed increment. Soil pH was recorded maximum in silvi-pasture systems with narrow spatial geometries (2 x 2 m and 3 x 2 m) and was lowest in sole cropping systems. EC was higher under HN sole cropping system, at intercropping and at the time of final forage harvest, it was under the closest tree spacing based silvi-pasture system. In M. dubia-HN silvi-pasture systems, maximum EC was found in 3 x 3 m and minimum was in 3 x 2 m. OC at planting and final harvest of intercrops was recorded maximum under closely planted M. dubia trees (2 x 2 m and 3 x 2 m) based on silvi-pasture systems and showed a decreasing trend with an increase in tree spacing. At planting of HN, nitrogen was higher under silvi-pasture having narrow spatial configurations, while, P and K contents were higher under sole HN. microbial populations i.e. fungi, bacteria and actinomycetes differed among various M. dubia spatial compositions and sole cropping systems and also substantiated that integration of HN as understory crops, increased microbial populations in all LUS.

Keywords: Melia dubia, Hybrid Napier, Silvi-pasture, soil physicochemical and biological properties

PS-III/32

Effect of different salinity levels of irrigation water on young teak plants

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Teak is one of the most important timber species, which is widely growing for plantation and afforestation purposesunder the Gujarat agroclimatic condition of Gujarat. Plant characteristics such as salt and waterlogging tolerance, adaption, uses, propagation and productivity are the critical factors to be considered while selecting tree spices for the rehabilitation of salt-affected lands. In this context, the present investigationaimed to assess the effect of salinity levels of irrigation water on the growth of young teak seedlings. It was laid out using a completely randomized design with four repetitions in the Polyhouse, College of Forestry, Navsari Agricultural University, Navsari, during the years 2014-2016. The treatments were comprised of three clones (CPT-262, CPT-266 and Local) along with five salinity levels of irrigation water (0.5, 2.0, 4.0, 6.0 and 8.0 dS m-1). The tissue culture clones (CPT-262, CPT-266) were collected from Gujarat Forest Research Institute, Gandhinagar (Gujarat state), and the local one was selected from the natural teak plantation of the University campus.The experimental soil was heavily textured in nature, having a neutral reaction and safe levels of soluble salts.

Irrespective of clones, the results revealed that the growth parameters of teak seedlings, viz. plant height, collar diameter and a number of leaves, measured periodically (at 60, 120 and 180 days after transplanting (DAT)), were recorded significantly higher in the plants wherein irrigated with regular water (0.50 dS/m) and then tended to decrease with each level of increases in salinity levels of irrigation water. The accumulation of shoot and root biomass recorded at 180 DAS was also registered significantly higher in the same treatment. Among the clones tested, CPT-266 was performed considerably superior with respect to all these growth parameters measured periodically and biomass yield recorded at 180 DAT, followed by CPT-262. Besides, the growth parameters and root and shoot biomass accumulation were significantly decreased with increasing salinity levels of irrigation water; however, the extent of decreases in these parameters was relatively less in the clone CPT-266 up to the salinity levels of 4.0 dS m-1over the remaining clones.

The contents of N and P in both root and shoot biomass were found to decrease as the salinity levels of irrigation water increased, while a reverse trend was recorded in the case of K and Na contents in the plant. Furthermore, the Na/K ratio was increased with increasing salinity levels in irrigation water, but the magnitude of the increase was comparatively less in clone CPT-266 than in others. Overall, the results showed that all the clones tested were salt sensitive and thus should not be recommended to plant in salt-affected soils or irrigated with saline water (> 0.5 dS m-1). Among the clones, the clone CPT-266 was found to be relatively more salt tolerant and, therefore, needs to be tested under field conditions for recommendation to the farming community.

Key words: Teak, Salinity levels, Clones, Growth Parameter, Nutrient Content, Na/K ratio

PS-III/33

Rehabilitation of sodic soils by Growing Multipurpose Tree Species

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Among degraded lands, sodic soils are the most devastating abiotic stress faced by agricultural crops worldwide. In India, it is scattered extensively in the states of Haryana, Punjab, Uttar Pradesh, Bihar, Rajasthan and Madhya Pradesh, covering an area of about 3.78 m ha of agricultural land. Poor physical conditions, specific ion toxicity, nutrient imbalances and high pH are the major crop production constraints always associated with sodic soils. A compact hard subsurface layer is also characteristic of this soil, which restricts root penetration and aeration. The research carried out worldwide revealed that sole plantation and/or agroforestry with Multi Purpose Tree species (MPTs) viz. Acacia nilotica, Albizia lebbeck, Prosopis cineraria, Prosopis juliflora, Pongamia pinata and Terminalia arjuna were one of the viable options to ameliorate the sodic soils over a long period of time. These species improve the physical and chemical properties of surface soils owing to enhancement in the organic matter and nutrient cycling and pumping. Accumulating OM and subsequent decomposition processes improved the physico-chemical environment while reducing the alkalinity and ESP on the exchange complex of the soils. These encouraged changes, along with a favourable microclimate, also improve the soil's biological activities, which helps improve the aggregates and permeability of soils. Overall, growing MPTs found to be very effective in rehabilitating the adverse effect of alkali soils through a series of biogeochemical cycles over a long period.

Key words: MPTs, Microclimate, Organic matter, Soil amelioration, Sodic soil, Trees

PS-III/34

Assessment of pre-sowing treatments on seed germination in lesser known tree species *Milliusa tomentosa* (Roxb.) J. Sinclair

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Miliusatomentosa is a large deciduous tree, growing up to 20 m tall belongs to the Annonaceae family. It is a lesser-known tree species with multiple utilities such as yielding Karee gum; fruits are edible and given to children to build up stamina and cure respiratory disorders; the wood is used for making cots, rafters, and agricultural implements. Germination of this species is difficult as seeds have a hard seed coat and are recalcitrant.Moreover, it is a slow-growing tree species in the early stage. So the present experiment was conducted to evaluate the effect of pre-sowing treatments on germination in *M. tomentosa*. For germination enhancement, ten different pre-sowing treatments *viz.,*control, soaking seeds in normal water for 24 hrs,soaking seeds in normal water for 48 hrs, soaking seeds in cow dung slurry for 24 hrs, soaking seeds in cow dung slurry for 48 hrs, Soaking seeds in 100 ppm GA_3 solution for 12 hrs, soaking seeds in 250 ppm GA_3 solution for 12 hrs, soaking seeds in 500 ppm GA_3 solution for 12 hrs, soaking seeds in 750 ppm GA3 solution for 12 hrs and soaking seeds in 1000 ppm GA_3 solution for 12 hrs were used. For the present trial, treated seeds (100 seeds/ treatment/ repetition) were sown in the tray containing soil: sand (1:1 ratio) as germination media. An experiment was arranged in a completely randomized design with three repetitions in a polyhouse for germination.At 140days after showing, significantly maximum germination, mean daily germination, a peak value of germination, germination value,germination rate indexandminimum mean germination time was recorded by soaking seeds in normal water for 24 hrs. The overall result showed that soaking seeds in normal water for 24 hrs was found to be the best treatment for seed germination of *M. tomentosa*.

Key Words: *GRI, germination value,lesser known trees, Miliusa tomentosa, peak value, seed treatment*

PS-III/35

Effect of different salinity levels of irrigation water on clones of *Casuarina equisetifolia*

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Casuarina is one of the essential fast tree species suitable for the coastal agro-climatic situation that is widely praised for plantation and afforestation. However, using saline water for propagation can seriously affect the success rate of cutting growth. Small amounts of salt in a commercial nursery can lead to huge economic losses over a more extended period. Species and varieties differ significantly in their response to salinity in root medium. The difference among species and varieties for salinity tolerance may reside in their differences in salinity tolerance mechanisms such as Na/K selectivity, Na exclusion, compartmentation inside a cell, accumulation of osmolytes, protection of cell integrity and ion homeostasis etc.Hence, the present study is oriented to study the effect of different salinity levels on growth and nutrient uptake by casuarina.The clones were selected and prepared through cuttings. The result indicated that the growth parameters, viz. plant height and collar diameter as well as shoot and dry root biomass of casuarina, recorded significantly higher with S2 (4.0 dS/m) salinity levels of irrigation water. But, it can be survived up to S3 (8.0 dS/m) without a significant reduction in shoot biomass. Among the clones tested, C2 proved its superiority with respect to shoot biomass which C6 closely followed. C2 and C6 performed better up to 16.0 dS/m salinity levels of irrigation water without a remarkably reduced plant height and shoot biomass. P and K content was found to be decreased with increasing levels of saline in irrigation water. In contrast, Na content and Na/K ratio increased with increased salinity levels. Clone C6 recorded a significantly lower Na/K ratio, indicating that it survived well under a saline environment. Determining soil properties were found to have deteriorated under different salinity levels of irrigation water with the exception of available K2O, where thecritical limit of casuarina seedling was found to be 16.0 dS/m. However, for the critical level (CL) of ECiw for casuarina seedlings grown on clay soils of South Gujarat, correlations between pooled dry shoot biomass obtained at 180 DAT and ECiw were worked out. Irrespective of different clones, the shoot biomass of teak seedlings was shown significantly higher with saline irrigation water of 4.0 dS/m; after that, it decreased gradually with increases in salinity levels of irrigation water.

Key words: Casuarina equisetifolia, Saline water, Growth parameter, Soil Properties, Na/K ratio

PS-III/36

Legal Frameworks for Biodiversity and Environmental Conservation in India

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It is biodiversity that determines the structure and function of all ecosystems. It is the foundation on which the future well-being of human society rests. Forest biological diversity can be considered at different levels, including the ecosystem, landscapes, species, populations and genetics. It can occur within and amongst these levels. Many efforts have been made to conserve the country's biological diversity and environmental health. But the attempts will not be effective unless the legal frameworks are worked out very efficiently and adequately. The great Indian Constitution encompasses the protection of the Environment, and this sentiment is enshrined in Articles 48A and 51A (g). In India, the need to integrate environmental concerns into economic development was voiced as far back as in the late 1960s, during the formulation of the 4th Five-Year Plan (1969-74). They were integrating environmental resource management with national economic planning initiated with the 6th five Year Plan (1980-85). A good number of policies and acts related to the Environment, forests and biodiversity were enacted in our country from time to time. National Forest Policies (1894, 1952 and 1988), National Agroforestry Policy, 2014, Indian Forest Act, 1927, The Wildlife (Protection) Act 1972, The Water (Prevention

and Control of Pollution) Act 1974, Forest (Conservation) Act 1980, The Air (Prevention and Control of Pollution) Act 1981, The Environment (Protection) Act 1986, Geographical Indications of Goods (Registration and Protection) Act, 1999, The Protection of Plant Varieties and Farmers' Rights Act, 2001, The Biological Diversity Act, 2002 and The Scheduled Tribes and Other Traditional Forest Dwellers (Recognition of Forest Rights) Act, 2006. Apart from these, many state acts and rules were also enacted to safeguard the Environment and biodiversity of the country. Proper modifications and necessary amendments were also attempted as and when required to make them effective in implementation. These acts, policies and rules are directly or indirectly relevant to national biodiversity conservation strategies, environment stability and sustainable utilization of the country's natural resources.

Key words: Biodiversity, Ecosystem, Environmental protection, Legal framework

PS-III/37

Ecological risk assessment of chlorantraniliprole residues in sugarcane grown soil

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A fieldexperiment was conducted to determine the chlorantraniliprole residue and its related ecological risk assessment in sugarcane-grown soil under south Gujarat conditions. To determine the residues of chlorantraniliprole in soil, QuEChERS (Quick, Easy, Cheap, Effective, Rugged, and Safe) based extraction procedure was adopted and quantified on ultra-high-performance liquid chromatography-tandem mass spectrometry (UHPLC-MS/MS).In this study, we assessed the potential ecological risks of chlorantraniliprole residues in sugarcane-grown soil using European Food Safety Authority methods such as risk quotient (RQ) and toxicity exposure ratios (TER). Residues of chlorantraniliprole were found up to 30 days after application and reached below the quantification limit 60 days after application. Ecological Risk Assessment (ERA) was evaluated and observed no risk forEisenia fetida due to chlorantraniliprole (TER>5 and RQ<0.01), but it was higher to moderate risk (TER<5 and RQ>1) in the case of Hypoaspis aquifer, carbon and nitrogen mineralizing microorganisms.

Key words: Chlorantraniliprole,Ecological risk,Risk Quotient, Toxicity-Exposure Ratio

PS-III/38

Wood production and Economics of Eucalyptus based Agroforestry systems

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Agroforestry is a sustainable land use and management system with numerous benefits.Agroforestry is recognised throughout the globe with the view of enhancing of socioeconomicstatus of farmers, employment generation, climate change mitigation, biodiversityconservation etc. Particularly, small farmers adopt agroforestry models to overcome thefinancial burden. Growing intercrops along with the tree crops can fetch someimmediate returns in the first two years. Such tree-based farming systems have been highlyeffective in preventing migration of rural families and supporting livestock husbandry toenhance their income by 35 to 40 per cent. Eucalyptus is the most extensively planted genusworldwide with an approximately 20 million hectares area and is expandingrapidly. Eucalypts have wide acceptance due to their versatility in providing huge income andstability of market prices. Eucalyptus is the most popular choice to be planted along the edgesor bunds of agricultural fields and appears to be well incorporated and accepted inagroforestry in India. Meanwhile,

Eucalyptus had established their credentials as an excellentsource for pulp and paper, particle board and hardboard industries, and an excellent source offirewood and charcoal.

Moreover, Eucalypts timber is used for light and heavyconstruction, railway sleepers, bridges, piles, poles and mining timber. Farmers planting onbunds are economically viable without sacrificing the crops. Combining agricultural crops with Eucalyptus trees for pulpwood production can bring a higher profitthan pure plantings. The reviews confirmed the productivity of Eucalyptus in therange of 48.79 to 58 m3ha-1yr-1 at the age of 4 years. However, wood biomass productionrates of Eucalyptus on bund increased from 168 to 2901 kgha–1yr–1 with corresponding age offour to twelve years. Farmers can expect, on average net returns up to Rs.3 00,000/ hectareat 4 years rotation from irrigated clonal Eucalyptus plantations assuming a yield of 150 tonesand current farm gate price of Rs.2000/ per ton for Eucalyptus logs. Further, each hectare ofclonal plantation of Eucalyptus with a productivity of 20 cum/ha/yr can produce enough fuelwood and small timber to conserve 20 ha of natural forests. Thus, Eucalyptus in the agroforestrysystem produces Wood for various purposes and enhances the economic benefit compared to the sole crop.

Key Words: Agroforestry systems, Eucalyptus, Economic benefit, Land use system, Wood production

PS-III/39

Early growth, biomass and carbon stock of Big-leaf mahogany (*Swietenia macrophylla* King) trees in South Gujarat

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Big-leaf mahogany, *Swietenia macrophylla* King (Family: Meliaceae), is one of the most valuable hardwood tropical timber species and is valued for its esthetic characteristics and wood properties. Wood is mainly used for construction materials, veneer production, high-grade furniture and cabinet making. Many farmers across the country have started planting this species in the block plantation and agroforestry land-use systems. A block plantation was established by incorporating big leaf mahogany trees with a spacing of 2m x 3m, and about 200 trees were maintained. The study was conducted to monitor the growth and establishment of big-leaf mahogany in the NAU campus, which represents the south Gujarat heavy rainfall (AES-III) agroclimatic zone, and the location is near the coast with an aerial distance of about 10 km. In the present study, periodic growth of trees of Big leaf Mahogany was measured using 198 trees grown on a block plantation at the NAU campus. Periodical height and basal diameter of plants were measured. Trees achieved >10 cm diameter at 2 ½ to 3 years. Accordingly, DBH was measured at the age of three years. Standing trees' overall height and basal diameters were 7.46 m and 9.19 cm, respectively, within 3 years. The general height increment of 6.82 m and basal diameter increment of 7.99 cm was achieved within three years. In the present study, tree height ranged from 4.30 to 10.90 m with a mean of 7.46 m, and DBH ranged from 3.85 to 10.06 cm with a mean of 7.02 cm from 198 standing trees. Accordingly, standing volume (0.007-0.083 m^3), above-ground biomass (4.51-55.68 kg $tree^{-1}$) and carbon stock (1.88-23.16 kg $tree^{-1}$) also varied among studied trees. Estimated tree volume, above-ground biomass and carbon stock show that trees of big leaf Mahogany can achieve an average of 0.031 m^3 volume, 20.75 kg biomass per tree (about 33.2 t ha^{-1}) with 8.63 kg carbon stock per tree (about 13.8 t ha^{-1}) within three years growth.

Keywords: Big leaf Mahogany, Biomass Production, Tree growth, Carbon stock

PS-III/40

Growth performance of multipurpose tree species in problematic conditions

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India's total geographical area is 328.7 Mha, of which 264.5 Mha is used for agriculture, forestry, pasture and other biomass production. Some 120.40 million hectares (29.7%) of India's total geographical area (TGA) underwent land degradation during 2018-19. Around 23.79% of the area undergoing land degradation with respect to TGA of the country was contributed by Rajasthan, Maharashtra, Gujarat, Karnataka, Ladakh, Jharkhand, Odisha, Madhya Pradesh and Telangana. Land degradation is also increasingly becoming a major concern for Indian agriculture, on which two-thirds of the population depend for their livelihood. It is estimated that about 44 per cent of India's land area is degraded. Afforestation requires site-specific knowledge of the suitable multipurpose tree species (MPT's) and their adoption to stress environment, which is necessary for the successful restoration of degraded agricultural lands. The local people prefer multipurpose tree species for multiple products derived from them, such as fuelwood, fodder, timber, etc. The basic aim of planting MPTs is to rehabilitate the highly eroded area, check the soil and water-related problems, improve the problematic land, and provide income to nearby household. The problematic land includes barren land, desert plain,eroded land, and several types of soil related problem like steep slopes, degraded soil, salinity, soil acidity, waterlogged soil, soil sodicity etc. Multipurpose tree species have a positive influence on growth from these problematic sites.Based on the growth performance of different MPTs it can be reviewed that the following MPTs can be successfully grown under various problematic conditions. The tree species which can grow in saline soil and water are Acacia nilotica, A.tortilis, A.tortilis (hybrid), Cassia siamea, Eucalyptus teriticornis, Prosopis juliflora, Tetraclinis articulata, Dendrocalamus strictus, Bambusa bambos and Casuarina equisetifolia. The tree species which can grown in sodic soil are Acacia nilotica, Prosopis juliflora, P. chilensis, P. silaquarstrum, Eucalyptus teriticornis, E. hybrid, Leucaena leucocephala, Tamarix aphylla, Millettia pinnata, Pithocellubium dulce, Albizia procera, Azadiracta indica, Acacia catechu, Eucalyptus camaldulensis, Terminalia arjuna, Dalbergia sissoo and Albizia procera. The tree species which can grow in acidic soil are Leucaena leucocephala, Melia azedarach, Acacia mangium, A. auriculiformis and Paraserianthes falcataria. The tree species which can grow in waterlogged soil are Acacia nilotica, Millettia pinnata, Acacia farnesiana,Parkinsonia aculeata, P. juliflora, Albizia procera, Terminalia arjuna and Casuarina equisetifolia. The tree species which can be grown in drought are Morus alba, Dalbergia sissoo and Prosopis juliflora. The tree species that can grow in degraded and eroded areas are Alnus nepalensis, Dalbergia sissoo, Albizia lebbek, Gliricidia sepium, Acacia auriculiformis, Dendrocalamus strictus and Ochlandra travancorica. The tree species which can be grown in slopy areas are Pinus kesiya, Michelia oblonga, Alnus nepalensis, Dendrocalamus hamlitonii, D. memebranceous and Oxythenantera abyssinica.

Key words: Bamboo sp., saline, sodic, drought, waterlogged, growth

PS-III/41

Variation in oil content at different storage and drying conditions in Neem seeds

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Azadirachta indica A. Juss (Meliaceae) is a tropical and subtropical species indigenous to India and Southeast Asia, commonly known as 'Neem' or 'Margosa'. Various neem tree parts have medicinal value and are also used as fuel wood, minor timber products, and fodder in the dry period. The kernels of Neem contain 40 to 50 per cent of oil. There are limitations in neem seeds to retaining oil content for a longer period of time; therefore, this study has been conducted at IGKV, Raipur, to identify the effect of seed storage and dry conditions on oil content in the kernel of Azadiractha indica. The result revealed that, in kernel percentage loss of oil content was minimum (4.19) in the treatment (A1B2D1) when seeds were dried in the shade and kept in desiccators at room temperature, while maximum loss (7.58) was observed in the treatment (A2B1D2) whensun dried seeds were kept indesiccators and stored at low temperature (20C+2).

Key words : Azadirachta indica, dry period, kernel, desiccators

PS-III/42

A comparative study on soil properties and nutrient status of Tezpur litchi growing areas of Assam

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The litchi grown in Tezpur, known as 'Tezpur litchi',carries distinctive quality in terms of taste, flavour and colour and the same differ for all the varieties cultivated in other parts of the state. The environmental factors, management practices and competition for nutrients greatly influence the quality of fruitfor a specific litchi genotype. The surface (0-20 cm) and sub surface (20-40 cm) soils of Tezpur litchi growing areas of Assam and compared with those from Tezpur for the *Elaichi*, *Piyaji* and *Bombaya* varieties. The surface soils (0-20 cm) of Tezpur exhibited lowest exchange acidity, exchangeable Al^{3+}, total acidity and higher base saturation. The cation exchange capacity was relatively low in Tezpur soil, while the organic carbon content was high in all the locations. There was no definite trend observed for chemical properties and nutrient status in sub surface soil among the locations. The exchange acidity, exchangeable Al^{3+} and total acidity was lower in soils under *Elaichi* variety.

Keywords: Tezpur litchi, fruit quality, agroclimatice zone, surface soil

PS-III/43

Effect of Seed Priming with Low Cost Input And Irrigation on Seed Production of *Rabi* Sunnhemp Under *Kyari* Land of South Gujarat

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A field experiment was conducted at the college farm, Department of Agronomy, N. M. College of Agriculture, Navsari Agricultural University, Navsari (GJ), during *the rabi* seasons during 2018-19 to 2020-21. The experiment was laid out in a randomized block design with a factorial concept with three replications. The factors consisted of three irrigation levels *viz*., No irrigation, One Irrigation at 30 DAS and Two Irrigation at 30 & 60 DAS, Five seed priming treatment *viz*., No treatment, *Water Soaking for 2 hr in 2 lit./kg seed,* Soaking of seeds in the solution of *Rhizobium* culture for *2 hr in 2 lit. water + 10 ml culture/kg seed,* Soaking of seeds in the solution of PSB culture for *2 hr in 2 lit. water + 10 ml culture/kg seed*and Soaking of seeds in the solution of *Rhizobium* + PSB culture for *2 hr in 2 lit. water/kg + 10 ml culture each/kg seed*. The results revealed that Irrigation applied at 30 & 60 DAS has produced significantly higher seed yield (1301 kg/ha) and stover yield (2793 kg/ha), but it was at par with irrigation applied at 30 DAS. In case of seed priming, soaking of seeds in the solution of *Rhizobium* + PSB culture for *2 hr in 2 lit. water/kg + 10 ml culture each/kg seed then sowing the sunhemp seed recorded significantly higher seed yield (1312 kg/ha) and stover yield (2884 kg/ha),* but it was at par with treatment soaking of seeds in the solution of PSB culture for *2 hr, 2 lit. Water + 10 ml culture/kg seed* and Soaking of seeds in the solution of *Rhizobium* culture for *2 hr in 2 lit. water + 10 ml culture/kg seed* treatments. Water applied with no irrigation, Irrigation at 30 DAS, and Irrigation at 30 & 60 DAS were 6, 12 and 18 ha-cm, respectively which getting 67, 33 percent water saving with no irrigation and irrigation applied at 30 DAS, respectively over Irrigation applied at 30 & 60 DAS. From the results of the sunnhemp yield and economics, it can be concluded that for getting higher yield and net returns with high benefit: cost ratio sunnhemp crop sown in *rabi* season and applied irrigation at 30 DAS and soaking of seeds in the solution of *Rhizobium* + PSB culture for *2 hr in 2 lit. Water/kg + 10 ml culture each/kg seed in an inland condition of kyari land.*

Key words: *Biofertlizers, irrigation, Seed priming, and sunnhemp yield*

PS-III/44

Nutrient management in finger millet (*Eleusine coracana* l.) under hilly region of South Gujarat

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A field experiment entitled "NUTRIENT MANAGEMENT IN FINGER MILLET (Eleusine coracana L.)UNDER HILLY REGION OF SOUTH GUJARAT" was conducted at Rajendrapur Farm, Hill Millet Research Station, Navsari Agricultural University, Waghai (Dist-Dangs) during the years 2021-22. The soil was slightly acidic in reaction (pH 6.54) and with EC 0.280 dSm-1 during the experiment. The treatments consisted of integrated nutrient management with eight treatments given to finger millet in kharif season in a randomized block design.

The results of the experiment indicated that growth attributes and yield attributes like plant height at 60 DATP (110.42 cm) and harvest (119.67 cm), no. of productive tillers (3.11), no. of fingers per earhead (9.01), finger length (6.93 cm), total dry matter production per hill (23.89 g) along with grain (3274 kg ha-1) and straw (8324 kg ha-1) yield were significantly higher due to the application of

5 t ha-1 Bio compost + RDF which was at par with 5 t ha-1 FYM + RDF. This was followed by application 75 % RDF + 5 t ha-1 Bio compost + BDLM Two spray of 1 %, at basal and 30 DATP, 75 % RDF + 5 t ha-1 FYM + BDLM Two spray, 75 % RDF + 5 t ha-1 Bio compost + EBPS Two spray of 1 %, and 75 % RDF + 5 t ha-1 FYM + EBPS Two spray of 1 % at 30 and 40 DATP, which were at par with each other. Nitrogen content in

grain and N, P and K uptake by grain and straw along with protein content in grain were significantly higher with the application of RDF +
5 t ha-1 Bio compost. In available soil nutrients, N remained significant through the application of RDF + 5 t ha-1 Bio compost. From the economic point of view, the highest net monetary returns of ₹ 78087 ha-1 and BCR of 2.36 was found under the application of RDF + 5 t ha-1 Bio compost, followed by the application of 75 % RDF + 5 t ha-1 Bio compost + Bio-digester liquid manure with 60482 ha-1 and Benefit-cost ratio of 2.03.

PS-III/45

Effect of different legumes in castor relay cropping system

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In the scenario of conventional farming system, limited chances are available to cope with sustainability and productivity issues at the same time. Relay cropping may play a crucial role in tackling this concern, by increasing the sustainability with minimum tillage, continuous soil cover along with increase in land productivity. Lot of studies already reflected the benefits to crops sown after legume crop, so more emphasis was given in this study to directly relate the research towards a best choice of legumes for relay cropping in castor crop. With these thoughts this research was framed to study different legume-castor relay cropping systems viz.,greengram-castor, clusterbean (veg)- castor, blackgram-castor, cowpea-castor and sole castor (control). The results revealed that greengram-castor and blackgram-castor are the best identified relay cropping system for obtaining higher castor equivalent yield and monetary returns as per the three years of experimentation. However, the study also showed that legume-castor relay cropping gives more than two folds returns than sole castor.

Keywords: Castor, Legume sequence, relaycropping

PS-III/46

Growth and yield of soybean [*Glycine max*] to foliar nutrition applied at different growth stages under rainfed condition

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A field experiment with an object to study the Growth and yield of soybean [Glycine max] to foliar nutrition applied at different growth stages under rainfed conditions was conducted at College farm, Navsari Agricultural University, Bharuch during kharif season, 2020. The soil of the experimental field was clayey in texture with low available nitrogen (236 kg ha-1), available phosphorus (25 kg ha-1) and higher available potassium (340.21 kg ha-1) and moderately alkaline in reaction. The experiment was laid out in a factorial randomized block design with three replications and a total of twelve treatments. The result revealed that apparent values of growth and yield parameters were influenced significantly due to different foliar sprays. Significantly higher plant height at 60 DAS and harvest, dry matter accumulation at 60 DAS and harvest, and a maximum number of branches per plant were recorded with the application of 1.5% 19:19:19 which remained at par with 0.5% 19:19:19 and 1.0% 19:19:19 at 60 DAS and harvest in case of plant height, 1.0% 19:19:19 at 60 DAS and harvest in case of dry matter accumulation and numbers of branches per plant. The significantly higher number of pods per plant, number of seeds per pod, seed yield and stover yield were recorded with 1.5% 19:19:19 remained at par with 1.0% 19:19:19, While 100 seed weight remained unaffected.

Keywords: Soybean, foliar nutrition, growth stages, 19:19:19, rainfed agriculture

PS-III/47

Performance Evaluation of Zero Till Seed- cum-Fertilizer Drill For Pulse Crop

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The present study was undertaken on zero-till fertilizer seed drill for pulses crops under the rice-wheat cropping system in the Aligarh region. This study of zero-till fertilizer seed drills compared with the conventional method shows its effectiveness over the sowing technique. The seed drill was set as per recommended seed rate of 25-30 kg/ha. The operating speed was 3.5 km/h under a moisture content of 15.56% to study the effect on different bulk density, seed rate, germination test moisture content, and field efficiency. The bulk density of soil varied from 1.58 to 1.69 g/cc and the average seed germination was found to be 82 %. The field efficiency of the zero-till fertilizer seed drill was 71.11% for seed drill at an operating speed of 3.5 km/h. The average germination count in the field after 10 and 30 days was found as 55 and 57 per square meter, respectively. It was observed that the zero-till drill system was found to be an acceptable machine for the farmers of the district of Aligarh (U.P.). As zero-till drill system gave the highest benefit-cost ratio of 1.76 in comparison to the conventional tillage system. But zero-till fertilizer seed drill is a unique technique for sowing pulses in the combined harvested wheat fields.

Keywords : Bulk Density, Moisture Content Field Efficiency, Seed Rate, Conventional Method

PS-III/48

Effect of potassium and zinc on yield and nutrient content of chickpea and fractions of potassium and zinc in soil

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A field experiment was conducted at Agronomy Farm, B. A. College of Agriculture, Anand Agricultural University, Anand during rabi season of 2020-21 to study the effect of potassium and zinc on the yield and nutrient content of chickpea and fractions of potassium and zinc in soil was on. The experiment consisted of three levels of potassium (0, 20 and 30 kg/ha) and three levels of zinc (0, 2.5 and 5.0 kg/ha) which were evaluated in a randomized block design (factorial) with four replications. Results of the experiment revealed that the treatment receiving 40 kg K2O/ha significantly increased the plant height, number of branches/plant, number of pods/plant, seed and haulm yield, seed index, crude protein,N, P, K and S contents in seed and haulm as well as macro (N, P, K and S) and micronutrients (Fe, Mn, Zn and Cu) uptake by chickpea seed and haulm. While, the plant height, the number of branches/plant, the number of pods/plant, seed and haulm yield, seed index, Zn content in seed and haulm as well as macro and micronutrient uptake by seed and haulm were significantly increased with the application of 5.0 kg Zn/ha and was remained at par with the application of 2.5 kg Zn/ha in most of the cases. The available K2O and Zn in soil were significantly increased with the application of 40 kg K2O/ha and 5.0 kg Zn/ha, respectively. The number of pods/plant, seed yield,N, P and K uptake by seed were significantly increased by combined application of 40 kg K2O along with 5.0 kg Zn/ha and was found to be at par with the application of 20 kg K2O along with 5.0 kg Zn/ha and 40 kg K2O along with 2.5 kg Zn/ha. The water-soluble K and exchangeable K fractions in soil were found to be significantly higher with the application of 40 kg K2O/ha. Except total Zn fraction, all the zinc fractions in soil significantly increased with the application of 5.0 kg Zn/ha andremained at par with 2.5 kg Zn/ha.

PS-III/49

Effect of potassium and potassium mobilizing bacteria (KMB) with and without FYM on yield of wheat (*Triticum aestivum* L.)

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Potassium (K) is considered an essential macronutrient and a major constituent within all living cells. About 98% of the potassium in the earth's crust exists in insoluble forms as rocks and silicate minerals, resulting in very low concentrations of soluble potassium in the soil for plant growth and development. Naturally, soils contain K in larger amounts than any other nutrients; however, most of the K is unavailable for plant uptake. There are certain microorganisms which use several biological processes to make potassium available from unavailable forms. These potassium-mobilizing bacteria (KMB) can be used as a promising approach to increase K availability in soils, thus playing an important role in crop establishment under K-limited soils. The experiment comprising twelve-treatment combinations was laid out in Randomized Block Design (factorial) with three replications. The treatment consisted of two levels of FYM viz., 0 t ha-1(F0) and 10 t ha-1 (F1) and two levels of Potassium Mobilizing Bacteria viz., without KMB (KMB0) and with KMB (KMB1) and three levels of potassium viz., 0 kg K2O ha-1 (K0), 20 kg K2O ha-1 (K1) and 40 kg K2O ha-1 (K2). The application of FYM, Potassium Mobilizing Bacteria and potassium showed a marked increase in root biomass, dry matter, spike length, total number of tillers and grain yield. Interaction effects between FYM, KMB and potassium were found to be significant. Treatment combination KMB1K2 (KMB along with potassium @ 40 kg ha-1) recorded significantly the highest spike length (10.54 cm). Treatment combination F1KMB1K2 (FYM @ 10 t ha-1 along with KMB and potassium @ 40 kg ha-1) recorded significantly higher grain yield (5640 kg ha-1).

PS-III/50

Effect of different sources of nutrients on growth, yield attributes and yield of cluster beans

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Afield experiment was carried out at the Agronomy Instructional Farm, Sardarkrushinagar Dantiwada Agricultural University, Sardarkrushinagar during kharif 2019. The experiment consists of eight treatment combinations comprising two nitrogen sources (urea and ammonium sulphate), two phosphorus sources (diammonium phosphate and single superphosphate) and two levels of biofertilizer (Rhizobium + PSB and no inoculation biofertilizer) were tried in randomized block design with factorial concepts with four replications. Application of nitrogen in form of ammonium sulphate recorded 6.47% and 7.07% higher seed and stover yield, respectively over urea. Between two phosphorus sources, single superphosphate produced 5.34% and 6.84% higher seed and stover yield, respectively over diammonium phosphate. Seed inoculation with biofertilizer (Rhizobium + PSB) gave 16.5% and 15.68% higher seed and stover yield, respectively as compared to no seed inoculation.

Keywords: Ammonium sulphate, urea, diammonium phosphate, single superphosphate, biofertilizer, cluster bean

PS-III/51

Effect of silicon and organic manures on yield and quality of wheat

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The pot experiment was carried out at the Department of Agricultural Chemistry and Soil Science, College of Agriculture, Junagadh Agricultural University, Junagadh to assess four levels of silicon (0, 100, 200 and 300 kg/ha-1) and three different organic manures viz., No organic manures (control), FYM, vermicompost and city compost each 10 t/ha-1 on wheat by adopting factorial CRD with three replications. The application of vermicompost 10 t/ha-1 showed its superiority over the rest of organic manures by significantly increasing growth parameters viz., plant height, number of effective tillers per plant; yield attributes viz., length of the spike, number of spikelets per spike, number of grains per spike and quality parameter viz., protein content and 100 seed weight as well as grain yield. While significantly higher number of tillers per plant and straw yield were observed with the application of 10 t FYM ha-1. In the case of silicon treatments, significantly higher growth parameters viz., plant height, number of tillers per plant and number of effective tillers per plant; yield attributes viz., length of the spike, number of spikelets per spike, number of grains per spike; quality parameter viz., protein content and 100 seed weight as well as grain yield and straw yield were recorded with the application of silicon 300 kg/ha-1. The interaction effects between vermicompost 10 t/ha-1 and silicon level 300 kg/ha-1 exhibited their significant effect on length of the spike (11.08 cm), grain yield (2.126 g plant-1) whereas, 10 t FYM ha-1 and 300 kg silicon ha-1 exhibited their significant effect on straw yield (3.470 g plant-1).

Keywords: Wheat, organic manures, silicon, vermicompost, FYM, city compost

PS-III/52

Effect of different fertilizer levels and organic spray on growth and yield of linseed

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An investigation was carried out during the rabi season of 2019-20 at College Farm, N. M. College of Agriculture, Navsari. The experiment was laid out in a randomized block design with four replications and nine treatments viz., T1: (50% RDF), T2: (50% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T3: (50% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T4: (75% RDF), T5: (75% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS), T6: (75% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS), T7: (100% RDFi.e., 60-30-00 kg NPK/ha), T8: (100% RDF + Foliar spray of 1% vermiwash at 30 and 60 DAS) and T9: (100% RDF + Foliar spray of 1% banana pseudostem sap at 30 and 60 DAS. The application of treatment T9recorded significantly higher values of the growth parameters viz., plant height at 60 DAS (43.81cm) and 90 DAS (63.37cm) and the number of branches per plant at 90 DAS (6.94). An application of treatment T9 significantly increased the yield attributes viz., number of capsules per plant (51.85), number of seeds per capsule (8.95), seed weight per plant (1.89 g), seed yield (1157 kg/ha) and stover yield (2051 kg/ha), but it was found statistically at par with the treatments T8, T7, T6 and T5.Based on experimental results, it can be concluded that to obtain a higher and more profitable yield of rabi linseed crop and for the improvement in soil fertility, the crop should be fertilized with75% RDF along with foliar spray of 1% vermiwash or 1% banana pseudostem sap at 30 and 60 DAS.

PS-III/53

Effect of tillage practiceon sugarcane production

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Tillage operation alters the soil bulk density and soil strength. Soil physical properties are affected by various tillage practices. These soil properties change the environment within the soil and make it favourable for plant growth.Thus, we aim to study the impacts of tillage systems on the soil physical attributes, root system and yield of sugarcane propagated by pre-sprouted seedlings.A field experiment was conducted at the research farm of Main Sugarcane Research Centre,Navsari (Gujarat), for during spring season of 2008-09 to 2015-16. The treatments were: T1: Normal ploughing (22.5 cm depth), T2: Deep ploughing (37.5 cm depth) and T3: Sub soiling.The higher number of tillersin first year plant found in the treatment T3 for 90 and 120 DAP (i.e. 181895 and 196776) as compared to rest of the treatments.The plant tillers found non-significant effect in various treatments. The root depth taken from new plant and ratoon crop; indicatedsignificantlyhighest cane root depth recorded in subsoiler tillage treatment T3 (i.e57.7 and 61.1 cm respectively) as compared to normal and deep ploughing treatments.On a sequence basis (Pant +Ratoon), the significantly highest cane yield of239 t/ha (Pant +Ratoon) was recorded with the treatment T3 [i.e., tillage with sub soiler] as compared to the rest of the treatments and which was 22% higher than the normal ploughing treatment.

Keywords: sugarcane, tillage, subsoiling, cane yield, & quality

PS-III/54

Response of little millet (*Panicummiliare* L.) to organics

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A field experiment was conducted during the kharif season of 2016, 2017 and 2018 at the Hill millet research station, Navsari Agricultural University, Waghai, Gujarat to assess nutrient management practices' impact on growth and growth yield of little millet. The experiment was set up in a randomized block design with seven treatments: T1 (100% RDN through FYM +2 lit Azotobactor + 2 lit PSB), T2 (100% RDN through biocompost+ 2 lit Azotobactor + 2 lit PSB), T3 (100% RDN through castor cake+ 2 lit Azotobactor + 2 lit PSB), T4 (50% RDN through FYM + 25% RDN through biocompost + 25% RDN through castor cake), T5 (33% RDN through FYM + 33% RDN through biocompost + 33% RDN through castor cake), T6 (100% RDF through chemical fertilizers + 2 lit Azotobactor + 2 lit PSB) and T7 (100% RDN through chemical fertilizers) each have three replications. The results of a three-year pooled analysis revealed that nutrient management treatments significantly influenced growth, yield attributes, yield and nutrient uptake. The significantly higher plant height, number of effective tillers per plant, grain and straw yield, gross return, N, P and K uptake by little millet were recorded under the treatment T1. At the same time, maximum net income and B:C ratio were estimated under the treatment T2.

Keywords: Little millet, Azotobcter, PSB, Biocompost

PS-III/55

Effect of climate change to approach for Sustainable food Production through: - Traditional Farming

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Traditional farming is integrated into nature. Humans interact with ecosystem services to practice the oldest agriculture primitive style of food production that involves the intensive use of indigenous knowledge, land use, traditional tools, natural resources, organic fertilizers and the cultural belief of farmers. However, it's still the dominant agricultural production practice used by half of the world's population today. Although modern agriculture has been adopting every corner of the globe, by the end of 2030, 90% of farmers will adopt modern farming techniques, but in India, 82% of farmers are being small and marginal, are still adopting some traditional methods like slash and burn agriculture, crop rotation, intercropping, polyculture, water harvesting to operate in farmland practices. Smallholder farmers adopt cropping based on environmental changes through their indigenous knowledge and experience. Sustainable food production is a significant challenge for twenty-first century in the present global problem such as emission of greenhouse gases, loss of ecosystem, biodiversity loss, increasing population and natural resource degradation, including soil degradation. Climate change is among the greatest factors threatening the agriculture system and intimidating traditional practices. Traditional farming has a high potential to adopt and mitigate climate change in the environment and is also an alternative method for sustainable food production. Farming methods like agroforestry, intercropping, crop rotation, cover cropping, traditional organic composting and integrated farming adopt model practices for climate change approach in agriculture. Increasing food productivity by indigenous methods will address climate change in the environment and is also helpful for human safety, natural resources management, energy conservation and socio-ecological integrity.

Keywords: Traditional farming, Sustainable food production, Climate change and Indigenous practices.

PS-III/56

Resource conservation through natural farming Low input agricultural practices

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Conventional agriculture involves using chemicals for high crop productivity and results in soil, water and biological resources degradation. It has also caused economic problems associated with overproduction of crops, increased costs of energy-based inputs and decreased farm incomes. So, to alleviate these economic and ecological problems, low input agricultural practices must be practised. Two essential principles are considered under low input agricultural practice; (1) adapting the agricultural system to the region's environment; (2) optimizing the use of resources in the agroecosystem. Low input agricultural practices are one of the major approaches under sustainable agriculture production systems. It seeks to optimize the management and use of production inputs (i.e., on-farm resources) and to minimize the use of production inputs (i.e.,off-farm resources) such as purchased fertilizer and pesticides. It is the integration of agriculture with nature and natural processes. Various alternatives to be used in low input agricultural practice; use of organic waste from the crop as well as animal, crop rotation, legume rotations; pest and disease forecasting, seed treatment with fungicide, insecticide; biological and cultural pest cultural; use of pulses as live mulches, integrated pest management and mechanical weed control; conservation tillage; specialized innovative cultural practices including intercropping, strip cropping, trap cropping etc. The integration of all these processes should minimize energy-based, produce good yields, increase farm profits and decrease environmental problems. These practices also improve soil and crop health which in turn also helps in adaptation to climate change conditions. Some examples of low-input farming

are poultry litter, which can replace nitrogen fertilizer in watermelons, and legumes as cover crops. Apart from several benefits, there are several challenges met in this practice. The prime challenge is the non-availability of seeds suitable to respond under low-input agricultural practice. The challenge ahead is to help farmers improve their management abilities to give them the information they need to make the right decision.

PS-III/57

Effect of tillage, seed bed preparation and FYM on sorghum

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A field experiment was conducted during kharif seasons of 2017-18 and 2018-19 at Bharuch with twelve treatments combinations consisting of two main plot treatments viz., tillage (shallow tillage with cultivator and deep tillage with mould board plough and planking with cultivator) and three seed bed preparation (flat bed sowing, raised bed with three rows and raised bed with six rows and two sub plot treatment viz., application of FYM (no FYM and FYM 10 t/ha). The experiment was laid out in a split plot design with four replications.Based on the findings of two years' experimental results, it can be concluded that for achieving higher yield and net return of sorghum crop, land should be prepared by deep tillage with mould board plough followed by planking with a cultivator. Further, sowing should be done on a raised bed with six rows (furrow after six rows) and be nourished with FYM 10 t/ha (considering the common application of RDF 80:40:00 kg NPK/ha).

Key words:Tillage, Seed bed Preparation, FYM, Yield and Net Returns

PS-III/58

Influence of imazethapyr and foliar spray of urea on growth and yield attributes and yield of blackgram (*Vigna mungo* L.)

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A field experiment on "Effect of imazethapyr and foliar spray of growth and yield attributes and yield of blackgram (Vigna mungo L.)" during kharif season. The experiment was laid out in a randomized block design (Factorial) with four replications. Among herbicide treatments, imazethapyr was applied post-emergence @ 75 and 100 g ha-1 at 15 days after sowing (D.A.S.) and compared with intercultural (I.C.) + hand weeding (H.W.) carried out at 20 and 40 D.A.S. In foliar spray, 2 % urea spray at one day after herbicide application(D.A.H.A.), 2 % urea spray at five days after herbicide application, and 2 % urea spray at one and five days after herbicide application and compared with control. In growth attributing characters and yield of blackgram crop, higher plant height (93.06 cm), higher plant dry matter (152.70 g), higher dry root biomass (0.36 g plant-1), higher dry weight of Rhizobium nodules (36.61 mg plant-1) and higher seed yield (801 kg ha-1) of blackgram crop recorded at different growth stages of blackgram were significantly higher under I.C. + H.W. carried out at 20 & 40 D.A.S. than an application of imazethapyr @ 100 g ha-1 as P.O.E. but was found at par with post-emergence application of imazethapyr @ 75 g ha-1. In a foliar spray of urea, plant height (95.25 cm), The highest plant dry matter (161.12 g), The highest dry root biomass (0.38 g plant-1), higher dry weight of Rhizobium (36.97 mg plant-1) and the highest seed yield (835 kg ha-1) was recorded at different growth stages of blackgram were significantly the higher with foliar spray of 2 % urea at 1 & 5 D.A.H.A. than other treatments but was at par with foliar application of 2 % urea at 5 D.A.H.A. Interaction effect of post emergence application of imazethapyr and urea spray was found significant for seed yield of blackgram. A combination of 2% urea spray at 1 & 5 D.A.H.A. (U4) and I.C. + H.W. carried out at 20 & 40 D.A.S. (H1) recorded significantly higher seed and stover yield than the rest of the combinations but was at par with the combination of 2% urea spray at 5 D.A.H.A. post-emergence application of imazethapyr @ 75 g ha-1. It can be concluded that weeds can be managed by adopting interculturing and hand weeding carried out at 20 and 40 D.A.S. or post-emergence application of imazethapyr

@ 75 g ha-1 along with a foliar spray of 2 % urea at one and five days after application of imazethapyr for better yield of blackgram and to maintain soil fertility.

PS-III/59

Effect of hydrogel and irrigation scheduling on growth, yield and quality of summer pearl millet (*Pennisetumglaucum* L.)

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A field experiment entitled "Performance of Summer Pearl Millet (Pennisetumglaucum L.) under application of Hydrogel and Irrigation Scheduling" was carried out during the summer season of 2020 at the Instructional Farm, Department of Agronomy, College of Agriculture, Junagadh Agricultural University, Junagadh. There were 9 treatment combination consisting of three irrigation scheduling based on IW/CPE ratio (I1= 0.6, I2= 0.8 and I3= 1.0) and three hydrogels (H1= 0.0 kg ha-1, H2= 2.5 kg ha-1and H3= 5.0 kg ha-1) were tested in a split plot design with threereplications.The results indicated that scheduling irrigation at an IW/CPE ratio of 1.0recorded significantly higher values of plant height and number of tillers per plant. Similarly, irrigation scheduling at 1.0 recorded significantly higher value of yield and quality components, viz., effective tillers per plant, length and girth of earhead as well as grain weight per earhead, grain yield (4563 kg ha-1), stalk yield (7718 kg ha-1)and protein yield. Almost all the growth characters, yield attributes, grain and stalk yields, as well as net return and B: C ratio of pearl millet were found to be significantly higher when the crop was sown at H2 (hydrogel at 5.0 kg ha-1) over H1 (hydrogel at 2.5 kg ha-1) and H0 (hydrogel at 0.0 kg ha-1). Interaction between irrigation scheduling and hydrogel levels was also observed significant for a number of effective tillers per plant, grain weight per ear head, and grain and stalk yield ha-1 under treatment combination I3H2 followed by I2H2. Higher gross and net realization of 1,02,133 and 60,383 ha-1 with a B: C ratio of 2.45 were obtained when the crop was irrigated with IW/CPE ratio of 1.0, followed by a 0.8 IW/CPE ratio.

Key words: Pearl millet, Irrigation, Hydrogel, IW/CPE ratio, Water use efficiency

PS-III/60

Impact on growth, yield and quality of Indian bean through bio stimulants

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An experiment was conducted during 2019-20 at vegetable Research Farm RHRS, ACHF, to know the effect of bio-stimulants on the growth, yield and quality of Indian beans.The experiment was laid out in Randomized Block Design (RBD) with three replications, which include 10 treatments, namely, T1: No spray (Control), T2: Novel organic liquid nutrient (1 %), T3: Novel plus organic liquid nutrient (1 %), T4: Novel prime organic liquid nutrient (1 %), T5: Cow urine (1 %), T6: Vermiwash (5 %), T7: Seaweed extract (2 %), T8: Grade IV Micronutrient (1 %). Based on the result of the present experiment, it can be concluded that foliar spray of 2 % Seaweed extract is effective in increasing growth parameters (plant height and number of tillers per plant), green pod yield (5,817.46 kg ha-1) and quality of Indian bean with a maximum net return.

Key word: Indian bean, bio stimulants, pod yield

PS-III/61

Critical period of crop-weed competition in aerobic rice

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A field experiment was conducted at the College Farm, N. M. College of Agriculture, Navsari Agricultural University, Navsari, during the kharifseason of 2014. Ten treatments viz., T1-weed free up to 15 DAS, T2-weed free up to 30 DAS, T3-weed free up to 45 DAS, T4-weed free up to 60 DAS, T5-weed free up to harvest, T6-weedy up to 15 DAS, T7- weedy up to 30 DAS, T8-weedy up to 45 DAS, T9-weedy up to 60 DAS and T10-weedy up to harvest, were evaluated on rice cv. NAUR-1. The experiment was laid out in Randomized Block Design with three replications. The results revealed that significantly the highest values of all growth and yield parameters such as plant height, number of tillers, number of panicle/m2, length of panicle, and number of grains/panicle were recorded under the treatment T5-weed free-up to harvest, which were at par to those of obtained with treatments T4 -weed free up to 60 DAS and T6-weedy up to 15 DAS, Ultimately the highest grain yield was under treatment T5, i.e. weed free up to harvest being statistically at par with the treatment T4and T6. Weed population, weed dry weight, the least number of weeds and dry weight of weed were recorded under the treatment T5(weed free up to harvest), closely followed by the treatment T4(weed free up to 60 DAS) and T6(weedy up to 15 DAS).The highest net realization per ha was obtained with treatment T4(weed-free up to 60 DAS), followed by treatment T5. It can beconcluded that higher and more profitable yieldand less weed infestation ofkharifaerobic rice are obtained by keeping thecrop weed-free up to 45 to 60 days after sowing.

Key word: Aerobic, Crop-weed competition, Rice, Weedy and Weed free

PS-III/62

Yield and economics in grain amaranth -sesamum cropping sequence influenced by INM under south Gujarat condition

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An experimenton Integrated nutrient management (INM) in grain amaranth (Amaranthus hypochondriacus L.) – Sesamum [Sesamum indicum L.]cropping sequence under south Gujarat conditions was conducted during the rabi and summer seasons of 2017-18 and 2018-19 at the College Farm, NAU, Navsari. The treatment consisted of INMviz., T1 : FYM 5 t/ha + 75% RDF through inorganic fertilizer, T2 : FYM 5 t/ha + 100% RDF through inorganic fertilizer, T3: Bio compost 5 t/ha + 75% RDF through inorganic fertilizer, T4: Bio compost5 t/ha + 100% RDF through inorganic fertilizer, T5: Vermicompost1 t/ha + 75% RDF through inorganic fertilizer, T6: Vermicompost 1 t/ha + 100% RDF through inorganic fertilizer, T7: 100% RDF through inorganic fertilizer to grain amaranth in rabi season as main plot treatment replicated three times in randomized block design. During the summer season, each main plot treatment was split into two sub-plot treatments with two levels of the recommended dose of fertilizers viz., F1: 75% RDF, F2: 100% RDF, applied to Sesamum, resulting in fourteen treatment combinations replicated three times in split plot design. Based on a pooled analysis of rabi grain amaranth and during the summer season of the sesamum crop, yields were significantly improved due to a combination of organic manures and inorganic fertilizer. The significantly higher grain yield (1802 kg/ha) and straw yield (4870 kg/ha) were recorded under treatment T4. The highest net return (74642/ha) with B: C ratio (2.48) was registered under the treatment T4, followed by the treatment T6 and T2. The significantly higher sesamum seed yield (903.22 kg/ha) and stalk yield (1647.70 kg/ha) remained at par with the treatment T2 and T6. The highest net return (67232/ha) and B:C ratio (2.40) of Sesamum were also obtained under the residual effect of the treatment T4.

Keywords: INM, Amaranthus, FYM, Bio compost, Vermicompost, Sesamum.

PS-III/63

Vermicompost yield and quality as influenced by use of poultry litter as substrate

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The performance of poultry litter as a substrate with or without rice stubble through partial replacement of cattle dung and plant biomass for vermicompost production was evaluated. The composting was carried out using earthworm Eiseniafetida in concrete tank (110 cm x 90cm x 75 cm in length x breadth x height) with 200 kg (w/w) substrate comprising plant biomass and animal dung at a ratio of 60:40. The plant biomass used was Eichhorniacrassipes with or without partial substitution by rice stubble. The cattle dung recommended for vermicompost production was partially substituted with poultry litter collected from InstructionalPoultry Farm, Dept. of Animal Husbandry and Dairying of Assam Agricultural University at Jorhat campus. The highest compost yield, compost recovery and earthworm yield ratio were recorded with 10% substitution of cattle dung by poultry litter and was at par with recommended practice. The substitution of cattle dung by poultry litter with partial replacement of plant biomass by rice stubble significantly reduced these parameters after completion of 72 days composting period. Among the substation levels, 20% substitution of cattle dung by poultry litter alone recorded significantly lowest compost yield, compost recovery and earthworm yield ratio. The pH and total nitrogen content of vermicompost was not affected by the substitution of cattle dung and rice stubble. The C:N ratio, total P and K content of the vermicompost differed significantly due to partial substitution of the substrate, but the overall contents were within the acceptable levels for improved compost.

Keywords: chicken litter, crop residue, compost quality, Eiseniafetida

PS-III/64

Modelling of nitrate movement in high density apple orchard using HYDRUS

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The present study was conducted to evaluate nutrient distribution (NO_3-N) under various soil depths in high density apple orchard in temperate region of Kashmir. The field experiment was conducted in the high density Apple orchard at University farm, Sher-e- Kashmir University of Agricultural Sciences and Technology of Kashmir, Srinagar, India during 2017-2019. The study simulate nitrate-nitrogen movement at various soil depths in high density apple orchard using HYDRUS model. The experiment was laid out with complete randomized design (CRD) with twelve treatments and two replication. Three fertigation levels (75%, 100% and 125% of recommended dose of fertilizer (RDF) of nitrogen in the form of urea) and four soil depths 15, 30, 45 and 60 cm were included as treatments in the study. NO_3-N was found more at 15 cm soil depth in all treatments.The observed and the simulated nitrate content were compared to examine the predictability of the model. Coefficient of determination (R^2) ranged from 0.85 to 0.97 indicating better matching between observed and simulated results and mean absolute error (MAE) as well as root mean square error (RMSE) ranged from 0.0002 to 0.0194 and 0.0044 to 0.0219, respectively indicating the accuracy and effectiveness of HYDRUS-1D model for simulating nitrate distribution in the soil. The results showed that the nitrate-nitrogen movement was successfully simulated by HYDRUS-1D under different soil depths during the study period.

Keywords: HYDRUS-1D, NO_3-N movement, Soil depth, Modelling.

PS-III/65

Soil and Water Conservation- Key Factors for Success of Regenerative Agriculture

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South Asia is home to about 1.5 billion people, or about one-fourth of the world's population that lives on less than 5% of the earth's land area. The region has a total land area of 514 million hectares (Mha), of which 39.5% is arable, 9.6% is permanent pasture, and 15.2% is forest and woodland. The western region of South Asia is arid, and a large proportion of cropland is irrigated by canal and tube wells. However, rainfed agriculture is practiced widely on some 123 Mha or 56% of the cropland area in South Asia. Because of the high population density, the per capita cropland area, renewable fresh water and natural resources are decreasing rapidly.

Furthermore, environmental pollution and climate change aggravate the scenario to the worst. Anthropogenic soil degradation is a severe problem throughout the region. In South Asia, the land area affected by different degradation processes is estimated at 55 Mha by water erosion, 24 Mha by wind erosion, 80 Mha by desertification, 17 Mha by salinization, 12 Mha by waterlogging, 11 Mha by nutrient depletion and large area by groundwater depletion caused by excessive withdrawal for irrigation. The stagnation or decline in productivity of the rice-wheat cropping system practiced on 12.5 Mha in the region is attributed to soil degradation, nutrient imbalance and climate change.

Regenerative agriculture (RA) has started gaining attention from land managers, researchers and policy makers due to its proposed ability to simultaneously contribute to climate change mitigation, adaption and ameliorate degraded soils by sequestering SOC through changes in management practices. Although multiple definitions exist, RA can best be defined as "an approach to farming that uses soil conservation as the entry point to regenerate and contribute to multiple ecosystem services."

Using RA practices, soil can remove 65 to 75 parts per million of carbon dioxide from the atmosphere. It would mean that in 25 to 50 years, the 135 billion tons of carbon lost into the atmosphere can be restored to the soil where it belongs. This has a positive impact on the prevalence of climate change. While many operations may boast decreased greenhouse gas production, RA takes it further with the farmland's elimination of greenhouse gas. For farmers, regenerative agriculture is thus a win-win – it is an approach that leads to better, more resilient crops grown using sustainable methods and, simultaneously, fights a crisis that threatens all agriculture commodities. Therefore, we must strengthen RA policies and institutional interventions that are market-oriented yet inclusive.

To develop inclusive RA systems, IRRI initiated work on designing and creating a baseline, identifying key performance indicators, and cost-effective and efficient methodologies for monitoring the context-specific interventions for RA in a landscape. Developing public-private partnerships and networking with crucial players for incentivizing the farmers who adopted RA is crucial for adoption at scale.

Keywords: *Regenerative agriculture, GHGs mitigation, carbon sequestration, South Asia*

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NOTES

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- Soil Conservation Society of India, New Delhi

दशकूपसमा वापी दशवापी समो ह्रदः।
दशह्रदसमः पुत्रो दशपुत्रसमो द्रूमः।।

“**A** pond is equal to ten wells; **A** reservoir is equal to ten ponds; **A** son is equal to ten reservoirs and **A** Tree is equal to ten sons'
This shloka highlights the importance of trees. It is ultimately said that tree is greater than a son because; a son would take care of his family… but a tree gives shelter to everyone irrespective of who they are…

:: શુભેચ્છક ::

શ્રી ખેડૂત સહકારી ખાંડ ઉદ્યોગ મંડળી લિ.,

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એસ.ટી.ડી. કોડ : ૦૨૨૨૨ પ્રમુખ : ૨૨૦૭૦૬ ઠેરા નંબર : ૨૨૦૪૪૩
મેનેજીંગ ડીરેક્ટર : ૨૨૧૩૩૫ પીળીએરા: ૨૨૦૧૭૦,૨૨૦૧૭૨

૦૧.	રજીસ્ટ્રેશન નંબર	:	જી-૨૬૫
૦૨.	ઠેરાટરી શરૂ થયાનું વર્ષ	:	૧૯૫૫
૦૩.	ઉત્પાદન શરૂ થયાનું વર્ષ	:	૧૯૫૬-૫૭
૦૪.	કુલ સભાસદોની સંખ્યા	:	૫૬૯૫
૦૫.	શેર ભંડોળ રૂપિયા	:	₹ ૨૯૪.૯૦ લાખ

વિલાણ વર્ષ : ૨૦૨૧-૨૦૨૨

(ક)	વિલાણ શક્તિ	:	૧૭,૦૦૦ ટન પ્રતિદિન
(ખ)	સ્ટોપેજ સહિત વિલાણ	:	૦૩૫૯.૩૩ ટન પ્રતિદિન
(ગ)	સ્ટોપેજ વિના વિલાણ	:	૧૦૮૦૧.૯૨ ટન પ્રતિદિન
(ઘ)	વિલાણ ઠરેલી શેરડી	:	૧૭૧૮૩૦૩ મે.ટન
(ચ)	ખાંડનું ઉત્પાદન	:	૧૯૦૬૧૦૦ ક્વીન્ટલ
(છ)	રીકવરી	:	૧૧.૦૨ %

- ટ્રાન્સવર્લ્ડ ટ્રેડફેર – ન્યુ દિલ્હી તરફથી "ઓલ્ડ મેડલ" વિજેતા
- ઈન્ટરનેશનલ ટ્રેડફેર – ન્યુ દિલ્હી તરફથી સુપર સીલેક્શન "ડાયમંડ મેડલ" વિજેતા
- વર્ષ: ૧૯૮૬ માં અકસ્માત સિવાય દશ લાખ માનવ કલાકો કામ કરવા માટેનું *"ગુજરાત સેફ્ટી કાઉન્સીલનું કલ્પવૃક્ષ"* વિજેતા.
- વર્ષ: ૧૯૯૦-૯૧ દરમ્યાન સર્વશ્રેષ્ઠ કામગીરી બદલ *"ડો. પંજાબરાવ દેશમુખ એવોર્ડ"* વિજેતા
- *"ડાયના-સીયલ મેનેજમેન્ટ એવોર્ડ"* (નાઈ રીકવરી એરીયા) વર્ષ: ૨૦૦૧-૦૨, ૨૦૦૮-૦૯, ૨૦૧૨-૧૩, ૨૦૧૩-૧૪ અને ૨૦૧૪-૧૫ દરમ્યાન પ્રથમ પ્રાઈસ તેમજ ૨૦૦૦-૦૧, ૨૦૦૪-૦૫ અને ૨૦૨૦-૨૧ દરમ્યાન દ્વિતિય પ્રાઈસ વિજેતા
- વર્ષ: ૨૦૦૩-૦૪ દરમ્યાન *"મહત્તમ ખાંડ નિકાસ"*નો એવોર્ડ
- ગુજરાત રાજ્ય સહકારી સંઘ, અમદાવાદ તરફથી સહકારનાં ૧૦૦ વર્ષ (૧૯૦૪ થી ૨૦૦૪) નિમિત્તે ભારતીય સહકારી ચળવળ મહોત્સવ-૨૦૦૪ નો *"સહકારી વિકાસ રત્ન એવોર્ડ"*.
- વર્ષ: ૨૦૦૭-૦૮, ૨૦૦૮-૦૯, ૨૦૦૯-૧૦, ૨૦૧૦-૧૧, ૨૦૧૫-૧૬, ૨૦૧૬-૧૭ અને ૨૦૧૯-૨૦ નો *"બાઈએસ્ટ સુગર કેઈન ક્રશિંગ ઈન ઈન્ડીયા"* એવોર્ડ.
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- ઈન્ડીયન ઓર્ગેનાઈઝેશન ફોર કોમર્સ એન્ડ ઈન્ડસ્ટ્રી-દિલ્હી તરફથી *"ઈન્ડીયન એચીવર્સ એવોર્ડ ફોર ઈન્ડસ્ટ્રીઝ ડેવલપમેન્ટ-૨૦૦૮"*
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- ભારતેલી પ્રદેશની શૈક્ષણિક તેમજ વૈદકીય સંસ્થાનાં વિકાસમાં બહુમુલ્ય ફાળો.

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વિશિષ્ટતાઓ

- બારડોલી પ્રદેશની સહકારી ક્ષેત્રે ગૌરવ અને પ્રતિષ્ઠા પ્રાપ્ત કરનારી સંસ્થા
- બારડોલી પ્રદેશ અને આજુબાજુનાં વિસ્તારમાં શેરડી ઉગાડનાર ખેડૂતોની આર્થિક, શૈક્ષણિક અને સામાજીક વિકાસ કરનારી સંસ્થા.
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રમણલાલ ચુનાભાઈ પટેલ	*ભાવેશભાઈ નગીનભાઈ પટેલ*	*હેમ પ્રકાશ સિંહ*
પ્રમુખ	ઉપપ્રમુખ	ઈ.ચા.મેનેજીંગ ડીરેક્ટર

તથા

વ્યવસ્થાપક સમિતિના સભ્યો અને સભાસદ પરિવાર

સહકારી ખાંડ ઉદ્યોગ મંડળ લિ., ગણદેવી
વાયા. બીલીમોરા, જી.નવસારી
પીનકોડ-૩૯૬ ૩૬૦

* * * * *

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૨૦૨૧-૨૦૨૨ ના વર્ષની સિધ્ધિઓ

શેરડી પીલાણ	ખાંડની રીકવરી	ખાંડ ઉત્પાદન ગુણી
૧૨,૦૦,૯૬૩	૧૧.૬૦ ટકા	૧૩,૯૧,૫૩૦

ઈથેનોલ - ૬૬,૧૬,૮૧૮ લીટર રેકટીફાઈડ સ્પીરીટ-૧,૩૦,૮૪,૬૭૬ લીટર
દૈનિક પીલાણ ક્ષમતા ૫૦૦૦ ટી.સી.ડી.
૪૫ કે.એલ.પી.ડી.ડીસ્ટીલરી પ્લાન્ટ
૪૦ કે.એલ.પી.ડી. ઈથેનોલ પ્લાન્ટ
બાયો કંમ્પોસ્ટ પ્લાન્ટ

ગણદેવીની સફેદ પાસાદાર ખાંડ વાપરવાનો આગ્રહ રાખો

શ્રી રતિલાલ છગનલાલ પટેલ	- કાર્યકારી ચેરમેનશ્રી	શ્રી અરવિંદભાઈ ચંદુભાઈ દેસાઈ	-ડીરેક્ટરશ્રી
શ્રી જયંતિલાલ બાવજીભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી ગણપતસિંહ પરબતભાઈ ચૌહાણ	-ડીરેક્ટરશ્રી
શ્રી રાજેન્દ્રકુમાર બીપુભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રીમતી કામિનીબેન અનિલભાઈ નાયક	-ડીરેક્ટરશ્રી
શ્રી અભિષેક મહત્તમલાલ પટેલ	- ડીરેક્ટરશ્રી	શ્રીમતી પુનમ અનિરૂધ્ધ દેસાઈ	-ડીરેક્ટરશ્રી
શ્રી રણજીતભાઈ નાથુભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી વિનુભાઈ રમણભાઈ પટેલ	-ડીરેક્ટરશ્રી
શ્રી અરૂણભાઈ ઓધેદભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી અમલભાઈ ખંડુભાઈ નાયક	-ડીરેક્ટરશ્રી
શ્રી મનસુખભાઈ મહાસુખભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી ઓધેદભાઈ ટી. પટેલ-પલસાડ જી.સે.કો-ઓ.બેન્ક લિ., પલસાડના પ્રતિનિધીશ્રી	
શ્રી મેહુલકુમાર ગિરીશભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી ખાંડ નિયામક રજિસ્ટ્રારશ્રીના પ્રતિનિધી-ગાંધીનગર	
શ્રી નટુભાઈ દીપ્રભાઈ પટેલ	- ડીરેક્ટરશ્રી	શ્રી અમલભાઈ એચ. પટેલ-રાજ્ય સંઘ પ્રતિનિધી-ગાંધીનગર	
શ્રી રતિલાલ દયાળજી પટેલ	- ડીરેક્ટરશ્રી	શ્રી બાલાજી ડી. પબ્બલેત્વર -મેનેજીંગ ડીરેક્ટર	

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