



ISCAR

**Proceedings of the
13th National Symposium of ISCAR -
“Fostering Resilient Coastal Agro-Ecosystems”
held at Regional Agricultural Research Station, Acharya N.G. Ranga
Agricultural University, Tirupati, Andhra Pradesh
during 22nd-25th February, 2023**

The 13th National Symposium of the Indian Society of Coastal Agricultural Research (ISCAR), Canning Town, West Bengal was organized in collaboration with Acharya N.G. Ranga Agricultural University (ANGRAU), Guntur, Andhra Pradesh and ICAR-Central Soil Salinity Research Institute (ICAR-CSSRI), Karnal, Haryana at Regional Agricultural Research Station of ANGRAU, Tirupati, Andhra Pradesh during 22nd-25th February, 2023.

Inauguration and Technical Sessions

The symposium was inaugurated by Dr. Geethalakshmi Vellingiri, Vice Chancellor, Tamil Nadu Agricultural University, Coimbatore, as Chief Guest in the presence of Dr. A. Vishnuvardhan, Reddy, Vice Chancellor, Acharya N.G. Ranga Agricultural University (ANGRAU), Guntur as President. Dr. V. Padmanabha Reddy, Vice Chancellor, Sri Venkateswara Veterinary University, Tirupati, Dr. P.C. Sharma, Director, ICAR-Central Soil Salinity Research Institute, Karnal, Dr. D. Gourisankar, Director OIIC, ISRO, Bangaluru and Dr. L. Prasanthi, Director of Research, ANGRAU, Guntur were the Guests of Honors. The welcome address was delivered by Dr. P. R. K. Prasad, Secretary, Symposium Local Organizing Committee and Principal Scientist & Head (Soil Science and Agricultural Chemistry of RARS, Amravathi, ANGRAU) and the opening remarks by Dr. U. K. Mandal, Symposium Organizing Secretary and Secretary, Indian Society of Coastal Agricultural Research (ISCAR), Canning Town, West Bengal and remarks regarding the symposium by Dr. B. K. Bandyopadhyay, President, ISCAR. The vote of thanks was proposed by Dr. K. V. Naga Madhuri, Secretary, Symposium Local Organizing Committee, and Principal Scientist (Soil Science), RARS (ANGRAU), Tirupati.

The symposium was held across 4 days and there were eight Technical Sessions under six themes that dealt with various aspects of coastal agriculture as below. Besides there were five poster sessions, a Plenum lecture and invited lectures. On the first day (22nd February, 2023) evening, a gala cultural programme was arranged by the students of ANGRAU for the delegates. The General Body meeting of Indian Society of Coastal Agricultural Research was held on the afternoon of the 2nd day (23rd February, 2023). On the last day (25th February, 2023) a field trip was arranged.

Technical Sessions:

Theme	Sessions	Chairman
1: Development in agriculture, horticulture and plantation crops and their tolerance to biotic and abiotic stresses	I: Agricultural crop management and cropping system intensification	Chaired by: Dr. T. Giridhara Krishna Co-chaired by: Dr. A. Nagavani
	II: Management of horticultural crops and plant protection measures	Chaired by: Dr. V. Rajagopal Co-chaired by: Dr. K. Kandiannan
	III: Agricultural crop improvement including biotechnological approaches, genetic resource management, biotic and abiotic stresses tolerance	Chaired by: Dr. R.P. Vasanthi Co-chaired by: Dr. D. Mohan Reddy
2: Technological advancement in fisheries, livestock and poultry management	Technological advancement in fisheries, livestock and poultry management	Chaired by: Dr. Shakila Co-chaired by: Dr. G.V. Bhaskar Reddy
3: Natural resource management, forestry and bio-diversity in coastal and marine ecosystem	Natural resource management, forestry and bio-diversity in coastal and marine ecosystem	Chaired by: Dr. V. Sailaja Co-chaired by: Dr. B. Saha
4: Climate change and disaster occurrence: impact and mitigation strategies	Climate change and disaster occurrence: Impact and mitigation strategies	Chaired by: Dr. V. Sumathi Co-chaired by: Dr. T. Pratima
5: Technological impact on the socio-economics, gender issues, markets, institutions and new opportunities	Technological impact on the socio-economics, gender issues, markets, institutions and new opportunities	Chairman: Dr. P.V. Satyagopal Co-Chairman: Dr. P. Sandhya Rani
6: Andhra-coast: performance, challenges and opportunities	Andhra-coast: performance, challenges and opportunities	Chairman: Dr. P. Prasuna Rani Co-Chairman: Dr. M. Srinivas

ISCAR has been organizing a lecture in memory of Padma Shri Late Dr. J.S.P. Yadav, an eminent soil scientist. During the 13th National Symposium on 22nd February, 2023, the 4th Dr. J.S.P. Yadav Memorial lecture was delivered by Dr.S.K. Ambast, Joint Director (Edn.), ICAR-National Institute of Biotic Stress Management, Raipur and Former Director, ICAR-IIWM, Bhubaneswar on “Water-Energy-Food Security Nexus in Indian Perspective and Climate Resilient Strategies with reference to Coastal Ecosystem”.

Special lectures by eminent researchers were also organised during the symposium. Dr.K.G. Mandal, Director, ICAR-Mahatma Gandhi Integrated Farming Research Institute, Motihari, Bihar delivered a plenum lecture entitled “Efficient water management and cropping system intensification in coastal areas and waterlogged ecosystems” on 23rd February, 2023.

During the symposium, various honours and awards were also conferred by the Society to outstanding researchers working in the field of coastal agriculture. The ISCAR fellow award was conferred to Dr.K.G. Mandal, Director, ICAR-Mahatma Gandhi Integrated Farming Research Institute, Motihari, Bihar and Dr. P.R.K. Prasad, Principal Scientist & University Head, Department of Soil Science and Agricultural Chemistry, ANGRAU, Guntur. The Dr. J. S. P. Yadav Best Paper Award for the years

2021-2022 was conferred to T.K. Samant, L.M. Garnayak, R.K. Paikaray, K.N. Mishra, R.K. Panda, S.K. Swain, S.K. Sarangi and S.N. Jena for their research paper entitled "Effect of nutrient management and rice establishment methods on biochemical and physiological attributes, yield and economics of rice (*Oryza sativa* L.) in rice-groundnut cropping system in coastal Odisha" published in 2022 in the Journal of the Indian Society of Coastal Agricultural Research, Volume 40 No.1, page 38 to 45.

The Dr. H. S. Sen Best Poster Presentation Award was awarded to S.S. Manerikar, P.J. Kshirsagar, V.A. Thorat, S.R. Torane, P.A. Sawant and A.D. Dhunde for the paper entitled "Growth in Area, Production and Productivity of Cashew in the Konkan Region of Maharashtra State" adjudged as the Best Poster Presented during the Symposium. Besides, best oral and poster presentation awards for each session were also given to the participants.

The Society also confers the best paper presentation award to early career researchers (below 40 years). During the 13th National Symposium, the ISCAR Best Paper Presentation Award for Early Career Researcher Award was conferred to Ms. G. Sashikala, S.V Agricultural College, Tirupati, Andhra Pradesh for the paper entitled "Hyperspectral Exploration of Clay Minerals in Anantapuramu District of Andhra Pradesh" co-authored with M.V.S Naidu, K.V. Ramana, K.V. Nagamadhuri, A. Pratap Kumar Reddy and P. Sudhakar.

At the end, the Valedictory session was held with the Chairmanship of Dr. R. K. Mathur, Director, Indian Institute of Oilseeds Research, Rajendranagar, Hyderabad. During the Valedictory session, a Plenary session was held and Dr. K. V. G. K. Rao, former Principal Scientist of ICAR-CSSRI, Karnal and Advisor to the Govt. of Andhra Pradesh was the Convenor of the Plenary session to finalize the recommendations of the symposium. During the plenary session, the summary of the deliberations of different sessions was presented by the Chairman/Co-Chairman of the respective sessions. The experts of different disciplines of coastal agriculture from various parts of the country participated in the discussion and finalized the recommendations for the sustainable enhancement of productivity in the coastal areas of the country.

The symposium was attended by more than 200 delegates comprising researchers, academicians and students from various parts of the coastal states of India. The Symposium was supported by the Indian Council of Agricultural Research, New Delhi as the major sponsor. Besides sponsorship was also received from NABARD, Elementar, Indian Scientific Company, Coromandel, FMC and IFFCO.

The recommendations that emerged out of the deliberations during the symposium are given below.

Recommendations

Theme 1: Development in agriculture, horticulture and plantation crops and their tolerance to biotic and abiotic stresses

- The FAO Aqua Crop model can be used satisfactorily to assess the impact of salinity and water stresses on crop yield to predict the yields with reasonably good accuracy.
- Hybrid Bajra Napier (cv. DHN 6) as intercrop in coconut gardens under irrigated conditions of the west coast region with combined application of biochar and fly ash with 125% RDF can be recommended to improve soil properties and to obtain higher yield and economic returns.
- Nanoscale nutrients applied through foliar means have the potential to alleviate salt stress in crop plants and in meeting the crop nutrient requirements in low-fertile and saline soils. There is a need to develop a robust methodology for the synthesis of nanoscale particles.
- Application of nano urea as foliar spray @ 4000 ppm at 20 & 40 DAT along with RDN recorded a higher yield of finger millet (41.1 q ha⁻¹) as compared to soil application of RDN (36.1 q ha⁻¹) or only foliar application of nano urea application @ 4000 ppm (18.5 q ha⁻¹) and 2000 ppm (17.2 q ha⁻¹).

- Soil test-based fertilizer management practices + foliar application of 0.5% potassium silicate were found to be the best for increasing the rice yield and managing the biotic and abiotic stress in rice in the coastal plains of Kerala.
- Foliar application of zinc sulphate at ear head emergence and grain filling stages enhanced the yield, quality and quantity parameters of finger millet as compared to soil application.
- Seed priming along with micronutrient spray can be explored as a viable tool for obtaining sustainable yields in dry direct sown rice.
- The highest kernel yield and water use efficiency in maize was recorded with alternate furrow method of irrigation when compared to fixed alternate furrow and conventional furrow irrigation.
- Imidazolinone group of herbicides are effective in the control of sedges as compared to Di-phenyl ether group of herbicides in groundnut crop.
- The naturally ventilated bamboo framed greenhouse can be successfully used for high-rise vegetable production in the coastal areas with a buyback period of 2-3 years.
- Soilless cultivation offers better control of plant nutrition and diseases including nematode problems due to its capability to control water availability, pH and nutrient concentration in the root zone.
- Gamma radiation for induced mutations can be successfully used to overcome the difficulties in papaya breeding to get true-to-type plantlets, especially in dioecious varieties. RLGy 20-1 and RLGy 30-121 mutant lines developed were found to be best in terms of fruit yield and quality attributes. And they can further be used for papaya improvement programme.
- Four *Bacillus* strains (Bs_Abi, Bs_Abi, Bs_Ane and Bs_Ahv) isolated from diverse niches which include rhizosphere and extreme environments of Andaman & Nicobar Islands were found to have the potential to be used for broad spectrum plant health management in multiple cropping ecosystems.
- Use of specialized pheromone and lure technology for pink bollworm with a slow-release mechanism of pheromone can significantly reduce the load of chemical pesticides and cost of protection and is identified as an alternate technology option to chemical pesticides to curb the menace of the pink bollworm due to management difficulties with the present pest control tools.
- Unmanned Aerial Vehicles (UAVs) have great potential to revolutionize Indian agriculture to ensure national food and nutritional security through timely crop protection. Efficacy of insecticides applied was found to be higher using kisan drone as compared to manual spraying.
- Arbuscular mycorrhiza (AM) fungi shield the plants from pathogens by secreting allelic chemicals and physically blocking their entry and also enhance nutritional status of plants by increasing nutrient uptake. It is possible to manage plant diseases in a sustainable manner by combining the AM fungi in biocontrol strategies.
- Poison bait in comparison to commonly used insecticidal control measures was found effectively control grown-up larvae of fall armyworm in maize.
- Pink Pigmented Facultative Methylophs (PPFM) was demonstrated to have beneficial effects on crop growth, drought resistance and productivity of foxtail millet under dryland conditions during *rabi* season.
- Efforts should be made to conserve and propagate bitter melon variety *Momordica charantia* var. *muricata* that has a high content of charantin which could help the farmers to generate more income for its demand in the medicinal industry.
- Bio-stimulants like humic and fulvic acids, protein hydrolysates and other N-containing compounds, seaweed extracts and botanicals, chitosan and other biopolymers, inorganic compounds, beneficial fungi and bacteria, etc., should be promoted as they help to improve the efficacy of the plant's metabolism, enhance yield and quality attributes, increase plant tolerance to biotic and abiotic stresses and recovery from abiotic stresses, facilitate nutrient assimilation, translocation and their use.

- The genotypes with dark green foliage, thick leaves such as TCGS1793, TCGS1779 and TCGS-1775 showed a lower incidence of thrips and leafhoppers compared to genotypes with light green foliage and were identified as promising resistant genotypes which can be utilized for developing pest tolerant high yielding groundnut varieties.
- Two sugarcane clones 2016T36 and 2016T37 showing resistance to sugarcane yellow leaf disease were identified which can be utilized in resistance breeding for developing resistant varieties.
- Pre-harvest fruit bagging was found to be one of the best management practices in mango which not only reduces pest and disease incidence but also to get higher yield and quality fruits.
- The use novel bio rational insecticides such as entomopathogens (*Metarhizium anisopliae* and *Pandora* spp.) which are environmentally safe have resulted in satisfactory suppression of the sucking pest population and damage caused by them and may serve as an environmentally friendly approach to manage sucking pests of groundnut.
- Plant-based extracts such as Pongamia, Eucalyptus and Ginger were found to improve the germination of sugarcane setts and also had significant effects on reducing the development of red rot disease and these could be used as environment-friendly tools for sustainable agriculture.
- Pre-breeding and interspecific gene transfer can be successfully attempted in crops which belong to a monotypic genus and alien gene transfer through genetic engineering approaches and genome editing tools offers great promise for widening the genetic base for plant architecture modification and seed quality attributes to accelerate the breeding program target for coastal ecologies.
- Although conventional breeding has been slow, now, with the identification of robust QTLs its pace of progress has been made faster through marker-assisted selection (MAS) and therefore great scope resides in novel genomic technologies such as genomic selection, haplotype-based selection, gene-editing technologies and genomics assisted recurrent selection for breeding suitable rice varieties with salt, submergence and lodging tolerance.
- Biotechnological interventions such as transcript profiling can be a great alternative to identify, isolate and characterize salt-tolerant gene(s) in tolerant cultivars and can be used very effectively.
- Morpho-physiological evaluation of crop genotypes for yield and yield attributing parameters are very important in the large-scale identification of robust genotypes for abiotic stress conditions.
- For marker-assisted improvement of parental lines in hybrid development programs, Saltol can be very effectively used and this has been demonstrated by two hybrids (IET30165 and IET30176) from IIRR, Hyderabad which are now under evaluation in the AICRP system.
- Pre-released sugarcane clones (2006 V 51, 2007 V 127, 2007 V 83 and 2007 V 44) with tolerance to saline irrigation water have been identified which can be recommended for coastal regions after proper testing in the AICRP system.
- Studies based on *per se* performance of Sponge Gourd Genotypes suitable for the coastal region of Karaikal, identified Kashi Sheya as most suited under a saline coastal ecosystem.
- Seedling vigor in rice is very important in early establishment under direct-seeded rice conditions in coastal regions and marker RM 340 was identified as the most informative marker that showed a highest correlation of up to 60% between high and low seedling vigor in genotypes. Rice genotypes such as BPT 5204, MTU 3626, MTU 1010, NLR 40024 and NLR 3276 can be used as a donor for high seedling vigor.
- Finger millet genotypes SiA 4203, SiA 4213 and SiA 4221 are performing best under unirrigated conditions, with higher mean performance for morphological and physiological traits, particularly higher net photosynthesis and lower transpiration rate. Hence, these genotypes can be used as donors in breeding programs targeted for drought-prone situations.
- Considering the importance of millets cultivation in rising climatic temperature, finger millet genotypes such as SiA 3085, Prasad, Suryanandi and Srilakshmi were identified as best

performing under standardized Thermo-Induced Response (TIR) protocol. This methodology can also be very effectively used to screen genotypic variability in other crops for breeding for climate change.

- Groundnut genotypes viz. Narayani, Kadiri-6, ICGV-06188 and ICGV 171377 are reported as good general combiners based on mean performance and general combining ability (GCA) effects for pod yield, yield attributes and quality characters. Hybrids between genotypes, Kadiri-6 × ICGV 171377, Narayani × ICGV 06188, Dheeraj × ICGV 171377 and Kadiri-6 × ICGV 95165 exhibited highly significant SCA effects in a positive direction for yield and quality. Hence, these crosses could be exploited for obtaining desirable transgressive sergeants in advanced generations with increased pod yield along with quality characters.
- A new finger millet variety CFMV 4 was released in 2022, with high yielding, sturdy culm, non-lodging variety suitable for farming under coastal agroecosystems in Andhra Pradesh, Tamil Nadu and Maharashtra. This is also recommended for mechanical harvesting.
- Winged bean and Yard long bean can be a potential alternative crops for coastal saline regions of Tamil Nadu and Puduchery in South India. These crops are also having variability for yield and yield-contributing traits under coastal saline conditions.
- Based on multivariate analysis of yield and yield contributing traits evaluated under coastal saline regions, TNAU Chilli Hybrid CO1 can be recommended for cultivation under saline agroecosystem.

Theme 2: Technological advancement in fisheries, livestock and poultry management

- New eco-friendly and sustainable culture systems such as mussel farming, crab fattening etc. are to be encouraged to harness the huge potential of brackish water aquaculture in the coastal region.
- To meet the supply of seeds for brackish water fish farming which has been the major constraint, intuitional support is need of the hour.
- Different species have different levels of nutritional requirement so it is encouraged to develop a species-specific feed to meet the nutritional requirement of the candidate species for brackish water aquaculture.
- Feed contributes to about 50-60% of operational cost in aquaculture, hence it is recommended to explore the cheaper source of feed ingredients without compromising its nutrient quality to reduce the cost of production. Research efforts should be strengthened in exploring alternative plant-based feed ingredients and in developing easy and efficient methods to remove the anti-nutritional factors. Shift from high-cost fishmeal or stressful DORB (de-oiled rice bran) to leaf meal and plant-based feed for aquaculture is recommended to reduce feed costs.
- The inclusion of polyherbal preparation at an appropriate dose with concentrate ration is encouraged as it improves the growth performance, feed conversion efficiency, and nutrient digestibility in pigs without any adverse effects.
- Incorporation of different tree barks viz., neem, tamarind and acacia at a 10% level in total mixed rations of Nellore Jodipi ram lambs could be an inexpensive and readily alternative to traditional feedstuffs, particularly during times of feed scarcity.
- Emphasis should be given to promote “Cage Farm integration fish farming model” which was developed as a solution to low growth and survival of fishes in deep and sloppy ponds created in Maharashtra state as a source of water for irrigation under “Magel Tyala Shettale” project.
- Integration of artificial intelligence and machine learning in aquaculture through technological innovation to enhance production and provide impetus to food security.

- Biofloc system has the potential to improve the growth performance, haematology and survival of fishes, so it is to be encouraged.
- Farming of improved Catla, Jayanti rohu and Amur common carp is recommended over traditional poly-carp culture with normal Catla, Rohu and Common carp as it would provide increased yield, better survival and better return.
- Integration of the nutrient rich small indigenous fishes into the existing aquaculture ponds with Indian major carps is needed for ensuring the rural nutritional security in the Sundarban region
- Immediate corrective measures are taken to reorient our priorities towards modern, scientific and sustainable animal husbandry for enhanced production and productivity in the coastal region of India against various threats such as climate change, natural disasters, land degradation, urbanization etc.
- In the coastal Sunderbans area of West Bengal, the rearing of Black Bengal goats should be promoted as it plays a vital role in the economy through marketable commodities such as meat, milk and skin.
- Regular screening and control of mastitis by proper prophylactic and therapeutic management are recommended to reduce the impact on milk production and public health.

Theme 3: Natural resource management, forestry and bio-diversity in coastal and marine ecosystem

- Strong policies and integrated approaches are needed to disseminate and realize water and energy-efficient agricultural practices like laser land levelling, conservation agriculture, short-duration rice varieties and to diversify cropping patterns.
- Periodic assessment of major and continuous cropping systems in terms of energetics (energy input, renewable and non-renewable energy, energy output, energy intensiveness, and energy use efficiency), resource use efficiency, soil organic carbon (SOC) stock (C negative or C positive) is essential for the sustainability of cropping of coastal areas.
- Situation analysis, vulnerability assessment and delineation of mapping of flood-prone and waterlogged areas, monitoring of soils and nutrient status of water-congested ecologies, and development of diversified and eco-regional farming in integrated farming system mode are some of the research priorities areas of coastal ecosystems.
- Important climate resilient technologies for enhancing agricultural productivity and efficient water utilization in the coastal region are the lining of rainwater harvesting systems (RWHS), ex-situ/in-situ RWH through farm ponds and three tier farming systems.
- The water quality of the rivers indicated that except for Hoogly river, the water of rivers is not suitable for irrigation in the Ganges Delta region. However, the water of drainage channels in some of the coastal regions is found suitable for irrigation and may be exploited as a source for irrigation.
- Development of auxiliary water storage tanks/ ponds in canal irrigated commands even in coastal areas to enable storage of rainwater, excess canal water delivered and intensification of cropping and/ or farming in the command areas, in the participatory mode and adoption of integrated farming systems.
- The harvesting of freshwater skimming from shallow levels is another option in coastal zones to stabilize crop production without endangering the environmental conditions. The improved freshwater skimming techniques (Improved Doruvu Technology) as practised in Andhra Pradesh for sustaining crop production has wide applicability for future exploitation of coastal zone freshwater reserves without creating an imbalance in the coastal fresh-saline water aquifer system.

- Other water-saving practices are broad bed furrow (BBF) system, bed planting and alternate furrow irrigation, underground pipeline conveyance of irrigation water, micro-irrigation, appropriate tillage systems including resource conservation technologies and surface retention of crop residues for mulching and horticulture-based integrated farming system.
- Land shaping/ modification approaches viz., raised and sunken bed technology, pond-based integrated farming system model should be promoted for achieving both food and nutrition security and sustainable agriculture by 2030 i.e. SDG No. 2. However, areas with acid soils in deeper layers are to be avoided in undertaking these rainwater harvesting practices.
- Due to cyclonic storms vast croplands along the east coast face water stagnation for prolonged periods causing damage to crops and crop produce. On-farm surface drainage linking to major drains has to be brought into place to reduce losses.
- Application of jute geotextile (JGT) and agro-textiles, made out of 100 % natural fibers of jute, have a very high potential for restoration of fragile coastal eco-system through the protection of surface soil erosion, stabilization of earthen slope & overburden dumps, river bank protection including the growth of seedling/sapling in forest nurseries, soil moisture conservation in the horticultural production system, etc.
- The quantification of the mangrove cover is a big challenge because of its inaccessible terrain and slushy landscape. The Google Earth Engine (GEE) cloud computing facility using satellite images is a very quick massive dataset processing, efficient and cost-effective technique for the quantification of mangrove cover in coastal regions.
- Commercial agriculture in the tribal areas is possible through entrepreneurial development in the agriculture sector by transforming the farmer into an agriprenuer. Agritourism is a promising agriprenuer opportunity for the development of agriculture blended with tourism in the high-altitude tribal areas of India in general and Andhra Pradesh in particular. In order to retain the tribal youth in agriculture, agriculture has to be more aesthetic, attractive and culture integrated.
- Several materials like acid-producing polymers, nano-materials, acidified biochars, elemental Sulphur and S-based novel formulation, MSWC (municipal solid waste compost) and thermal power by-product gypsum [flue gas desulfurization gypsum (FGDG)], siliceous chalk has potential for replacing gypsum as an amendment in future for correcting alkalinity and sodicity problem in coastal soil, if any.
- Adoption of soil and water reclamation techniques for need-based calcium supplementation to sodicity/acidity neutralization and integrated nutrient management with locally available organic amendments (farmyard manure, green manure, vermicompost, smart city waste compost, etc.), confirming surface or underground drainage, rainwater harvesting for rabi crops should be advocated for restoring soil health and improving livelihood security of coastal farm community.
- Airborne Visible Infrared Imaging Spectroscopy – Next Generation (AVIRIS-NG) data can be used to map dominant clay minerals.
- The composition of all basic cations Na^+ , Ca^{2+} , Mg^{2+} and K^+ , and SO_4^{2-} and Cl^- were greater in soil water saturation paste extract of SASs under coastal than those of inland agro-ecosystem. Inland SASs are sodic in nature, but SASs of coastal areas was nearly reaching the critical level of sodicity. Inland soil was highly deficient in available N, sufficient in available P, and variable in available K. SASs under coastal regions contained ~1.6-times more $\text{KMnO}_4\text{-N}$ and 1.8 times more $\text{NH}_4\text{OAc K}$ and sufficient in available P.
- The multi-criteria suitability model can be used to locate suitable regions for aquaculture using land and water resource characteristics, analytical hierarchical process and Monte Carlo simulation-based spatial analysis and environmental regulations.
- The site-specific nutrient management practices are essential for the sustainable production of rice and prawn in the natural organic system of cultivation in *Pokkali* field.

- Phytoremediation has emerged as a versatile technology towards the reclamation of degraded sodic and saline land. Adopting phytoremediation using energy crops may sequester carbon and produce biomass that can be utilized as feedstock in the salt-affected coastal region.
- The satellite-derived indices from Sentinel-1, Sentinel-2, and Landsat-8 can be used as proxies in statistical models to estimate soil pH with individual classes of acidic, neutral, and alkaline soils.
- Thematic soil fertility maps created using the ArcGIS for soil properties provide ready-to-understand information about soil fertility status and act as a decision-making tool for effective crop production.
- Long-term application of organic manures alone or in combination with recommended dose of fertilizers helps in the buildup of soil organic carbon content even under tropical climates. Addition of organic manures is to be encouraged even in soils having relatively higher soil organic carbon content improves the macro aggregates and carbon storage inside the aggregates which are protected from decomposition.
- The higher yield, productivity and saving of nutrients can be obtained by the inclusion of climate-resilient tuber crops like sweet potato in rice-based cropping systems in Kerala.

Theme 4: Climate change and disaster occurrence: impact and mitigation strategies

- Geospatial technology has a significant role in monitoring, forewarning and post-facto damage assessment due to these extreme events like floods and drought. The synthetic aperture RADAR data is used to map flood inundation (riverine or cyclonic) with a time delay of 1-3 days. Satellite data are used recently to assess the delay/failure of crop sown area, and damage of crops due to unseasonal rainfall. SAR and Optical satellite data are also found to be useful to assess localized damage of the crop due to hailstorms/lodging/cyclones.
- The life cycle assessment for effective GHG mitigation strategies showed that the rice-based cropping systems in lowland coastal ecologies functioned as carbon sinks with net ecosystem carbon budget: 1523 and 944 kg C ha⁻¹ yr⁻¹ in rice-rice and rice-cotton systems, respectively but GHG source except under reduced tillage with residue management which was a GHG sink (-68 to -228 kg CO₂-e ha⁻¹ yr⁻¹) and can be used as a green technology for the coastal region.
- Massive mangrove reforestation programmes and agroforestry systems buffer farmers against climate variability and hence reduce atmospheric loads of greenhouse gases in the coastal region.
- An adequate combination of transplanting date shift and drainage outlet and strategic nutrient management was considered as best management practice with the highest water productivity and yield in paddy and reducing the negative impacts of climate change.
- Nano fertilizers are crucial instruments in agriculture to boost nutrient usage efficiency, lower fertilizer waste, and lower cultivation costs while also enhancing crop growth, yield, and quality metrics and are useful in precision agriculture practices in coastal regions. The use of ZnO nanoparticles increased the germination percentage of soybean seeds under water stress and when applied in soils the sorghum productivity and nitrogen uptake were increased.
- The 1°C increase in temperature across the country leads to a decrease of 32-40% in rice yield by shortening the growth period of the crop. The increase in the concentration of CO₂ in the atmosphere also decreases the nutritional quality of grains, decreases the head size percentage, spikelet number per panicle, grain weight, increases the number of chaffy grains and decreases the total biomass production in paddy. Climatic projections indicated that significant climate change will lower the rice yield by 8.10% by 2080. Climate resilient varieties and crop adaptation strategies are needed to avert climate change impacts for harnessing sustainable rice yields in the context of climate change.
- There is a need to identify and promote rice-based millet cropping systems as an adaptation strategy to climate change.

- The oceans act as a "buffer" against climate change since they contain the most carbon on Earth. Large amounts of carbon, often known as "blue carbon," are captured and stored by coastal ecosystems such as mangrove forests, saltmarshes and seagrass beds. This "blue carbon" coastal flora sequesters carbon far more quickly and permanently than terrestrial forests, often up to 100 times faster. At the local, national and global levels, efforts for mitigation and the preservation of carbon stocks should include the conservation, protection, and restoration of blue carbon ecosystems.
- Based on the grain yield under high-temperature conditions, IET 29952 (5340 kg h⁻¹), IET 29953 (5110 kg h⁻¹) and IET 29958 (5110 kg h⁻¹) could be selected as relatively heat-tolerant genotypes of rice.
- CoA 12323 is an early maturing, high-yielding, sucrose rich and climate-resilient sugarcane clone suitable for the tropical zone of coastal districts of Tamil Nadu, Karnataka, Telangana, Andhra Pradesh and Orissa states of India.

Theme 5: Technological impact on the socio-economics, gender issues, markets, institutions and new opportunities

- Strengthening Education Learning Programme (ELP) through the intervention of different millet-based crops for encouraging entrepreneurial culture among Agri graduates.
- Focus should be made on fruit wastage which is causing nearly 14% income loss, particularly in retail marketing. Necessary steps should be initiated to reduce wastage by establishing needed storage facilities and other transactional measures.
- Organic vegetables should be popularized not only to get good quality vegetables but also for the realization of better income for the farmers. FYM and other organic inputs should be made as an integral part of vegetable cultivation particularly in coastal areas.
- Creating awareness and providing knowledge to the farmers on the mechanism and functioning of the National Agriculture Market (e-NAM) along with its advantage over informal selling to the traders is the need of the hour. Proper steps need to be taken to minimize the role of traders in quality assaying.
- Strengthening of District co-operative societies, Primary agricultural credit societies (PACS) should be done by providing necessary government support for efficient utilization of credit as well as other benefits by the farmers.

Theme 6. Andhra-coast: performance, challenges and opportunities

- In the Godavari delta, the impact of ESP, SAR and RSC declined with the increase in distance of paddy field from the aqua pond and it was recommended that the minimum distance required for the cultivation of paddy nearby aqua ponds will be 5 m in sandy soils and 10-15 m in fine-textured soils.
- Satellite remote sensing and GIS has scope for assessing soil suitability for maize crop and it was tested in the Krishna delta region of Andhra Pradesh.
- In the coastal Godavari zone, introduction of foxtail millet or black gram in fallow- maize system and black gram or cauliflower as intercrop in maize-maize cropping systems improved the productivity and profitability of the fallow-maize and maize-maize cropping systems.
- For obtaining higher seed and straw yields of black gram combined application of 75% RDF + soil application of liquid *Rhizobium* @ 1250 ml ha⁻¹ + liquid PSB @ 1250 ml ha⁻¹ + liquid KSB @ 1250 ml ha⁻¹ is recommended under Tirupati conditions.

- For achieving a maximum yield of groundnut (Bold seeded), 50% RDF + 50 kg ZnSO₄ +10 kg borax per ha is recommended in the southern agroclimatic zone of Andhra Pradesh.
- In an intensive saline soil evaluation of rice genotypes at Agricultural Research Station, ANGRAU, Machilipatnam, five salt tolerant lines MCM 134, MCM159-1-2-2, MCM 153-1-1-1, IR 04A115, IR17F1107 (both at the seedling and reproductive stage) with a score of 3 or 5 (survived under higher salinity of EC 14.5dS m⁻¹) were identified. The salt tolerance in these lines might be due to novel genes other than *saltol* which can be traced out by advanced genomic tools.
- Site specific nutrient management (SSNM) implemented as Variable Rate of Fertilization (VRF) is one of the best tools for precision agriculture to keep the nutrients in the root zone. The site-specific NPK fertilizer recommendations based on STCR to targeted yields of maize developed utilizing the thematic maps of spatial variability of N, P and K status at the village level of Guntur district revealed that the corresponding recommendation and application of fertilizers was essential to improve the efficacy of fertilizer application and enhancing the returns to the growers.
- A high-yielding, long-duration, non-lodging rice variety MTU Rice 1318 was developed for cultivation in the state of Andhra Pradesh for the coastal irrigated ecosystem with a yield advantage of 10% as an alternative to Swarna rice variety, owing to its high-yielding, non-lodging nature, good quality and tolerance to major pests and diseases.
- The net GHG emission from wetland IFS model comprised of rice-based cropping system, dairy, fishery, poultry, horticulture and other components in 0.5 ha area under Godavari delta region was - 5042 CO₂-e during 2020-21 and - 4696.9 CO₂-e during 2021-22 which indicates the established IFS model is more suited for an environmentally sustained model as it sequesters more carbon in the system and emits less CO₂.
- The ideal air temperature for groundnut growth and development is between 25 and 30°C in Tirupati and groundnut crop exposure to a daytime temperature of 35°C caused a 33% reduction in the number of pegs and pods compared to a daytime temperature of 30 °C. Climate-smart agriculture practices should be followed to maintain the sustainable yield of groundnut in the region.
- The sugarcane clone CoS 08279 has recorded cane yield of 124.6 t/ha at the time of harvest under drought conditions in Andhra Pradesh.
- Encouraging as many as Agri graduates as possible for the best utilization of ANGRAU POSHAN incubation with their innovative ideas and convert them as successful business enterprises.
- There is a need of more Cold chains and FPOs for the proper utilization of farm products.
- The gap between farmers' harvested yields and their potential yields can be closed by integrating suitable crop selection and balanced nutrient management complemented with scientific research.
- Useful microorganisms in soil should be multiplied and used as bio-fertilizer so that dependency on chemical fertilizers will be reduced.
- Nano-gypsum can be considered an eco-friendly soil amendment for reclaiming saline-alkaline soil.
- Drone use for agricultural applications needs to be standardized to make it user-friendly and cost-effective.
- Ca⁺²/Ca⁺²+SO₄⁻² (%) and Mg⁺²/(Ca⁺²+Mg⁺²) (%) may be used as good indices for assessing seawater intrusion of the Kolleru- Upputeru estuary.
- MTU Rice 1293, a salinity-tolerant rice variety need to be upscaled.