वार्षिक प्रतिवेदन
Annual Report
2021

भाकृअनुप - केंद्रीय तटीय कृषि अनुसंधान संस्थान, गोवा

ICAR - CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE, GOA

Ela, Old Goa, Goa - 403 402

Visit of
Dr. Pramod Sawant
Hon'ble Chief Minister of Goa

Visit of
Shri Kailash Choudhary
Hon'ble MoS for Agriculture and Farmers' Welfare

Visit of
Shri Shripad Y. Naik
Hon'ble MoS for Tourism

Visit of
Shri Parshottam Rupala
Hon'ble Union Minister of
Fisheries, Animal Husbandry and Dairying

Visit of
Sushri Shobha Karandlaje
Hon'ble MoS for Agriculture and Farmers' Welfare

Visit of
Parliamentary Standing Committee
on Agriculture

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ICAR-CCARI, Goa
ANNUAL REPORT
2021

Publisher

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Cover Page photos:

(Clockwise) Vulnerable coast line of India, nutmeg selections, salt tolerant rice, Gramapriya chicks, Asian sea bass, Receiving the *Raj Bhasha* prize

PREFACE

The coastal ecosystem of India, covering nearly 7500 km is one of the most diverse production systems in the country, with a wide range of crop, tree, animal and fish biodiversity. It is also one of the most vulnerable ecosystems in the country in view of natural calamities, increase in sea levels, cyclones and climate change events whose frequency of occurrence has increased over the last decade. Further, anthropogenic activities like change in land use, infrastructure development, land reclamation and unplanned urbanization have led to the development of other localized problems like ground water salinity, declining ground water levels, soil erosion, increased sediment load, stagnating crop yields, declining fish catch and loss of biodiversity.

The ICAR-CCARI situated in Goa, with a small but dedicated team of scientists from diverse fields caters to the development of technologies which are primarily aimed toward the conservation of natural resources, increasing productivity of field crops, breeding more productive crops, identifying high yielding fruit trees of local occurrence, developing package of practices for maintaining animal health, keeping crops and vegetables disease free, increasing fish productivity and more recently developing the concept of agro-eco tourism as a new initiative for entrepreneurship development and retaining youth in agriculture besides involving citizens in protecting and valuing ecosystems.

During this year the activities undertaken at the Institute have been promising and have become popular with the vast majority of stakeholders which is evident from their strong participation in institute programs all through the year. The scientists have been involved in developing a rice-based lowland integrated farming system model for small holdings and an upland plantation crop-based model which is also profitable and sustainable. Salt-affected soils were utilized for rice cultivation using nutrient management and a suitable rice variety (Goa Dhan 3) along with the use of a bio-formation (Goa Bio-1) developed by the institute. The Institute also maintains a large germplasm inventory consisting of mango, cashew, jackfruit, cassava, nutmeg and rice.

The Institute has received financial support from agencies like the DST, NABARD, ICAR Seed project, DAMU, DASD for research studies in various themes. During this year the Institute also earned a patent (Patent No.: 355114) on "Extender for the preservation of boar semen" and submitted two FER's for value addition of produce, signed two MoU's and a Material Transfer Agreement for transfer of seed material and promotion of cultivation of *Curcuma longa* (var. CIM-Pitamber) with CIMAP, Lucknow.

The KVK of the Institute organized 63 training programs on various topics and trained 1478 participants, out of which 75 were agricultural graduates. The institute scientists published a total of 61 research papers in different peer-reviewed journals, with 14,13, 21 and 13 papers published in journals with NAAS ratings of >10, >8, >6 and <6, respectively.

This report is a brief summary of work done at ICAR-CCARI, Goa during 2021, which provides a glimpse of the large diversity of activities being undertaken at the Institute. Suggestions for further improvement of our research and extension activities are welcome from our readers.

The support of our sister line departments in the states, farmers and the funding agencies is gratefully acknowledged. I thank Dr. Trilochan Mohapatra, Director General, ICAR and Secretary, DARE for his patronage, support and his keen interest in our Institute's activities. I also gratefully acknowledge the support and guidance of Dr. Suresh Kumar Chaudhari, Deputy Director General (NRM), ICAR for his consistent encouragement and guidance.

Place: Old Goa
Date: 20-08-2022

(Parveen Kumar)
Director

CONTENTS

EXECUTIVE SUMMARY

Natural Resource Management

- Trends of annual and seasonal stream flow of east flowing rivers of India were studied to estimate temporal variability. Data from 26 gauging stations spread over four states and 16 river basins were used for the estimation. Significant decreasing trends in stream flow were noticed in the Krishna and Godavari lower sub-basins in all the seasons, which could be attributed to decreasing rainfall, whereas, significant increasing trends in stream flow in other east flowing rivers during winter and pre-monsoon season were noticed which could be due to increasing rainfall trend. Correlation analysis revealed significant positive correlation between rainfall and stream flow trends in the east flowing rivers.

- A rice-based lowland integrated farming system model (crop + dairy + fishery) has been standardized for 0.5 ha. A net return of Rs. 1.62 lakh per year was obtained from the IFS model with the highest contribution from crops (61%) followed by dairy (22%). About 55 kg of N, 32.5 kg of P, and 67 kg of K were recycled in the system. Employment of 352 man-days was generated from the model.

- An upland plantation crop-based (Arecanut + cashew + coconut + livestock) model comprising 0.8 ha generated a net income of Rs.1.98 lakh per year. The highest contribution to net profit was from the arecanut-based cropping system (46%) followed by the cashew + pineapple system (23%). The system generated employment of 257 man-days and through residue recycling, the system recycled 68.5 kg of N, 42.3 kg of P, and 78.2 kg of K nutrients.

- Six rice-based cropping system was evaluated (with one control) under two tillage practices (conservation and conventional tillage) to assess the impact on grain yield, aboveground biomass, energy efficiency, economics, and soil carbon stock in red lateritic soils. With the adoption of direct-seeded rice-Zero tillage baby corn-Zero tillage *moong* (triple cropping), the production, profitability, estimated gross carbon input, above-ground biomass production, and soil carbon stock increased by 29.1, 48.2, 121, 32.7, and 48.5%, respectively over the farmers' practice.

- Nutrient management using soil test-based fertilizer application for rice cultivation in salt-affected coastal soils indicated that among three rice varieties evaluated, 'Goa Dhan 3' performed the best and yielded 3.61 t/ha.

- 'Goa Bio-1' (a bio-formation) was used to improve rice crop establishment in trials over 29 ha of salt-affected coastal soils. Results indicated that the application of 'Goa Bio-1' @40 g/per kg of seed improved rice yields and increased income by 38% over farmer's practice.

- Climate change vulnerability of coastal districts of India was assessed based on the data collected on sensitivity, exposure and adaptive capacity indicators. Individual indicators were normalized based on their functional relationship with vulnerability and weights were calculated using entropy. The coastal districts of Gujarat were the most vulnerable -to climate change while districts of Maharashtra, Goa, Karnataka and Kerala were less vulnerable.

- Silvopastoral studies under coconut plantations with seven different fodder grasses were studied and the highest green yield was obtained from bajra-napier (Co-5) hybrid (24.7 t/ha). Continuous contour trenches in sloping land also helped to increase grass yields.

Horticultural sciences

- By using soil resource maps procured from ICAR-NBSSLUP, Nagpur, land suitability maps for coconut and arecanut crops for Goa have been developed. Moderately suitable land for coconut and arecanut in Goa is 75,622 ha and 65,638 ha, respectively, while marginally suitable land for coconut and arecanut is 75,181 ha and 40,491 ha respectively. The actual area under coconut and arecanut is 25,000 ha and 1,150 ha, respectively. Hence, there is a huge area available for taking up cultivation of coconut and areca nut in moderately suitable areas within the state and which can be taken up with appropriate management practices.
- Surface area of a dehusked coconut is positively correlated to dry endosperm weight (0.78) and whole fruit weight (0.86). Gini coefficient for seed traits in five date palm varieties varied from 0.101 for seed length to 0.157 for seed width. Shannon Weaver's index of diversity values for the seed traits indicated seed length was uniform (0.00) in yellow dates of Gujarat, whereas high diversity (0.69) was seen in red dates of Gujarat.
- The coconut crop in 59 Indian mainland coastal districts contributed to the tune of 0.073% of the country's GDP.
- Mango field germplasm bank, consisting of a total of 144 collections representing the following groups, is currently being maintained in three germplasm blocks. A field germplasm block of 14 pickling mango accessions, comprising of three collections suitable for matured fruit pickling; 9 local collections and two collections from Sirsi, Karnataka, suitable for immature whole fruit pickling was established. *Garcinia* germplasm with 60 grafts of kokum from 13 promising accessions is being evaluated in the germplasm block. Jackfruit germplasm with twenty-four varieties/ accessions from different coastal states and local Goan accessions have been established at ICAR-CCARI campus.
- A total of 88 cashew germplasm accessions, consisting of the following characteristics are being maintained in the field germplasm bank. Results of evaluation of bold nut accessions led to the identification of an elite accession, Tudal – 1, which has been recording consistently promising performance, with nut yield of 8.88 kg/tree. It has been short-listed for submitting the variety release proposal for cultivation in the state of Goa.
- Spine gourd (*Momordica spp.*) is one of the important dioecious cucurbits yet it is an underutilized vegetable. Altogether, thirty-two collections were made, sixteen male vine tuberous roots and sixteen female vine tuberous roots.
- A coconut-based multi-species cropping system spread over 0.5 ha with more than 10 crop components along with a poultry component was studied with regard to its income generating potential at different time intervals, thereby imparting continuous flow of income. Production of planting material is also an added activity that contributes to total returns. Gross income from the above system was Rs. 2,17,609/- against the total cost of cultivation (COC) of Rs. 107388/- resulting in a net income of Rs.110221/- during 2020-21. Crops and crop residues contributed 53.0 and 13.2% of income, while poultry component contributed 33.8% to the total income.
- The suitability of three jackfruit accessions (BT1, BT2, CT1 and CT2) was studied for chips preparation and it was observed that the accession BT1 had the highest rate of chips recovery (53.33±9.09 %).

- A submergence tolerant cassava germplasm collected from flood-affected Ernakulam District Kerala was screened for field-level submergence.
- Foliar potassium content in coconut and banana was quantified using sodium cobalt nitrate reagent-assisted colorimetric, ion-specific electrode, and smartphone app-based techniques.

Crop sciences

- Six bacteria wilt-resistant varieties of brinjal and other promising green fruit lines were evaluated in green house for wilt resistance. Results indicated that wilt incidence in brinjal varied from 0 to 70%.
- Field evaluation of eco-friendly chemicals on chilli viral disease complex was carried out on two chilli hybrids (VNR 332 and ArkaMeghana). Results indicated that total fruit yield was higher in Spinosad (40.5 t/ha), Rch6-2b (34.4 t/ha), insecticide treatments (33.9 t/ha) and Chitosan @ 50 ppm (32.1 t/ha) treatments. Percentage increase in yield ranged from 21.2 (Chitosan 500 ppm) to 52.5 (Spinosad 0.03%).
- The collection and maintenance of 200 rice germplasms comprising of landraces, wild relatives and breeding lines have been continued. Molecular and morphological characterization studies were carried out to study the extent of variability present in the collection. Identify map of 200 germplasm using 34 SSR markers which revealed 14 unique identifiers which can help identify uniqueness of a variety.
- Besides coconut, whiteflies infestation and its colonies were recorded on banana, guava, cashew, areca nut, triandra palm, mango, black pepper, heliconia, papaya, citrus, avocado, chafa, maize and Indian shot. The predominant natural enemies seen to be feeding on whitefly population were predator *Mallada boninensis* Okamoto and parasitoid *Encarsia guadeloupae* Viggiani.
- Studies on the geographical distribution of rugose spiralling whitefly (*Aleurodicus rugioperculatus*) were carried out using 19 bioclimatic variables through Maximum Entropy (MaxEnt) niche modelling. Initial results of the bioclimatic suitability map of RSW distribution being prepared under current and future climate scenarios indicates that the infection is highly concentrated in the entire coastal and southern states of India.
- Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) infestation on fodder maize was recorded, which indicated that more infestation in the vegetative stage than the reproductive stage. Five larval parasitoids viz., *Campoletis chlorideae*, *Glyptapanteles* spp, *Chelonus formosanus*, *Exorista sorbillans* and *Megaselia scalaris* were recorded on FAW larvae. Egg parasitoids i.e., *Telenomus* spp and *Trichogramma* spp were observed to be parasitizing the eggs. Rove beetle *Paederus fuscipes* Curtis (Coleoptera: Staphylinidae) is a generalist predator found predating on FAW larvae. The *Spodoptera frugiperda* NucleoPolyhedro Virus (SpfrNPV) infected fall armywarm larvae which were also recorded in fields of fodder maize.
- Field trials undertaken to study the effect of different intercrops on the management of fall armyworm indicated that intercropping fodder maize (Var. African Tall) with intercrops like cowpea, green gram, ground nut and red gram led to reduction in damage by FAW and green fodder yields were higher.
- Studies on the release of bacteria (RCh6-2b and STC-4) from talc and capsule formulation with a population of 6 Log CFU g^{-1} has increased within 12 months to 7-8 Log CFU g^{-1} of soil, indicating that the introduced bacteria from talc and capsule formulations survive well and will provide better growth benefits and protection to the crop.

- Observations on a four-year-old field experiment on the effect of bio-formulation on the control of black pepper foot rot incidence in farmer's fields indicated that plants treated with talc formulation of RCh6-2b showed vigorous growth and higher berry-bearing.
- Talc-based bio-formulations (STC-4 and RCh6-2b as Goa Bio-1 and Goa Bio-2) were mass produced and distributed to farmers of Goa in more than 50 disease management field demonstrations on chilli. There was no incidence of wilt or other soil-borne diseases in the bio-agent treated fields.
- Results from 56 field demonstrations indicated that application of Goa Bio-1 and Goa Bio-2 along with spraying of chitosan/ spinosad reduced leaf curl virus disease (27-38% and 23-38% disease reduction, respectively) compared to control. Increase in dry chilli yield in Goa Bio-1 and Goa Bio-2 applied plots (by 46-60% and 28-35%, respectively) was also recorded.
- Weather-based agro-advisory services were provided to farmers in the form of weather-based agro-advisory bulletins issued twice a week (every Tuesday and Friday). Wider and effective dissemination was achieved through bilingual bulletins published in English and Konkani (the local language of the region) languages. In 2021, a total of 105 advisory bulletins were prepared and disseminated. About 130 WhatsApp groups were created to disseminate the AAS bulletins to 7000 farmers spread over 195 villages in the North Goa district. A framework for dissemination of advisories to farmers at the village and block level was also achieved by hosting it on different departmental websites of the Goa government.
- During the year, 19, 2 and 1 quintals of breeder and truthfully labelled seeds of rice, cowpea and green gram respectively, were produced at the CCARI farm.

Animal sciences

- Fish community structures from different estuaries of west coast of India were characterised. In total 224, 174, 197, 68, 65, 169, 102, 59, 80, and 51 species were collected from Zuari, Mandovi, Terekhol, Chapora, Sal, Kali, Aganashini, Sharavathi, Gangavali, Poonthura, estuaries respectively, aggregating 302 species. The estimated fish production is 0.7 lakh tonnes from the Indian west coast estuaries based on the catch per unit of effort (catch per fishermen per day), number of fishing days and number of fishermen in the estuary. The major species/ fish groups identified are - mullets, shrimps, silver-bellies, clupeids, bombay duck, catfishes, Hilsa, anchovies, pearlspot, glassy perchlets, silver-biddies, carangids, gobies, snappers, flatfish, groupers, tilapia, clams, oysters and mussels. The fish community index was modified into an Estuarine Multi-metric fish index (EMFI) and both EMFI and Composite Pressure Index (CPI) were defined for the estuaries along west coast of India. Based on these indices, only three estuaries were identified with good ecological status (Gangavali, Mandovi and Zuari) and all others were moderate (18) and poor (Narmada and Ulhas).
- PCR amplification of Heat Shock Protein genes (HSP70 and HSP90) in cattle breeds has been standardized. Physio-biochemical parameters of Shweta Kapila cattle, Agonda Goan pig and Konkan Kanyal goat were estimated which indicated better heat tolerance without affecting muscle tissue injury, respiration rate and body temperature during hot period.
- Performance of crossbred pigs achieved after fifth generation with birth weight of 1.072±0.03 kg and weight at marketing of 77.22±2.09 kg. Application has been submitted for registration of the same as a variety "GOYA" to the ICAR-National Bureau of Animal Genetics and Resources, Karnal, Haryana.

- Backyard varieties of poultry - Vanaraja, Krishibro, Grampriya, Debendra, Nirveek and indigenous birds were reared during the reporting year. Presently Gramapriya parent stock day-old chicks (319 nos.) are in grower phase @13weeks with body weight of 1008.86 gm for males and 401.90 gm for females respectively.
- Study of the species and virulence properties like slime production and biofilm formation of Coagulase Negative Staphylococci, the most prevalent pathogen group associated with subclinical mastitis, was carried out. Species of candida yeast were isolated from clinical mastitis and antibiotic-resistant profile was characterized. As part of National Animal Disease Epidemiology Network, disease outbreak investigations and monthly outbreak reporting was carried out. Outbreaks of Infectious Bovine keratoconjunctivitis, Bovine tuberculosis, Brucellosis and Babesiosis were diagnosed and reported.
- As part of reproductive characterization of indigenous Agonda Goan pigs, major seminal traits including qualitative and quantitative semen attributes were evaluated. Concentration ranged from 205.9 to 289.6 million/ml while progressive motility ranged from 62.6 to 83.9%. Mean percent of HOST responsive sperms was 68.13% and mean % of live intact acrosome was 53.43%. Mean sperm head length and width were 11.03 ± 0.04µm and 5.58 ± 0.02µm whereas tail length and total sperm length were recorded as 58.51 ± 0.13µm and 69.72 ± 0.15 µm, respectively.
- Status report on indigenous farm animal genetic resources of the coastal region was prepared. Digitalized Record Management was implemented in cattle unit which comprised of online recording of farm milk data, breeding data, herd and medicine stocks and data sharing with Information Network for Animal Productivity and Health for real-time assessment of farm productivity.
- Interview of more than 150 poultry farmers of Goa and Karnataka, revealed that the major constraints faced by small-scale backyard poultry owners of Goa were high cost of feed (92%), incidence of diseases (86%), non-availability of quality replacement stock/ breeding issues for propagation (68%), climatic stress/issues in recent times (54%) and unavailability of skilled labour (40%). Whereas in Uttar Kannada region the major constraint was unavailability of quality poultry germplasm and marketing of poultry produce.
- Breeding and seed production technology was standardized for the endemic ornamental fish species of Western Ghats, Melon barb, (*Haludaria pradhanii).* The technology has a huge potential in the domestic as well as export markets since the rate for marketable size fish is Rs. 50/- per fish. An innovative small-indigenous fish-based polyculture of seabass, (*Lates calcarifer*) was evaluated in freshwater pond systems. The survival rate (72%) and mean weight of seabass (1.25 kg) were observed to be the highest in SIF-based systems compared to tilapia-based polyculture (54%, 0.7 kg). A novel livestock-fish-horticulture based integrated farming system (IFS) that generated 13 types of farm products (including fish, pig, poultry, vegetables, fruits, and vermicomposting) was developed for the coastal region of Goa, which is more profitable, sustainable, and resource-efficient when compared to the traditional fish farming systems. The estimated annual cost (fixed and operational) was Rs. 29.0 lakhs with a gross return of Rs. 75.4 lakhs that produce net profit of Rs. 46.4 lakhs which indicated a B:C ratio of 2.6.
- The optimization of the conditions for thermal processing of chicken Xacuti in both metal cans and flexible retort pouches was standardized at an F0 value of 12 at a retort

temperature of 121.1o and air pressure of 28 psi. The final product is fit for consumption and will be subjected to storage stability studies for 180 days at room temperature.

AICRP

- Under the All India Co-ordinated Research Project on Vegetable Crops (AICRP) 12 trials were conducted which covered Brinjal-3 (varietal/ hybrid yield evaluation), Chilli-2 (varietal/ hybrid yield evaluation), Okra-2 (YVMV varietal), Tomato-5 (hybrid yield evaluation and ToLCV varietal/ hybrid) during the year 2020-2021 for reporting to the co-ordinating unit.
- Under the AICRP on pigs, cross-bred pigs in the fifth generation at the age of eight months have attained the weight at marketing of 77.22±2.09 kg. An application has been submitted for registration of the crossbred pigs as variety "GOYA" to the ICAR-National Bureau of Animal Genetics and Resources (ICAR-NBAGR), Karnal, Haryana.
- A.I technology was transferred to farmers' demonstration unit. Under Tribal Sub Plan (TSP) and Schedule Caste Sub Plan (SCSP) programme, training was conducted on scientific pig rearing along with distribution of germplasm, medicinal supplements and concentrate feed mixture to progressive pig farmers of the western coastal region.

KVK

- During 2021, 63 training programmes were conducted involving 1478 participants. The major training programmes were on - production and management technology, resource conservation technology, vermicomposting, organic input production, integrated pest management, integrated disease management, bee keeping, value addition of major fruit crops, entrepreneurship development, scientific management of dairy, poultry and goatery, design and development of low/minimum cost diet, women empowerment etc.,
- The number of male and female trainees was 522 and 956, respectively. The number of participants who were invited in the SC programmmes was 1068, out of which 408 and 660 were male and female participants. The number of graduate students who participated in various training programs was 75.
- The activities of the KVK covered 35 villages, in 5 districts and 3 states.

Technology dissemination

- A total of twelve Front line demonstrations on Integrated Pest and Disease Management (IPDM) technologies on chilli were undertaken at six *taluks*. Plant protection inputs like Goa Bio 1 and Goa Bio II (200kg) Spinosad, Chitosan and yellow and blue sticky traps were distributed to 200 farmers. Hands-on training was provided to the farmers on nursery drenching of bio-control agents, main field application, installment of sticky traps and their preparation, and spraying of bio-pesticides.
- Water harvesting cum gravity-based drip irrigation and nutrient management interventions under STC were implemented for a group of 30 farmers practicing coconut farming with 500 plants over 2.45 ha. A water harvesting pond (capacity 400 cu m) was established where run-off water during the monsoons and water of perennial spring during post-monsoon season is harvested and used for drip irrigation of the coconut plants. Nutrient management through soil test-based fertigation significantly increased nut yields and income.
- By using artificial insemination methods, total of 178 piglets were born out of 21 farrowings with success rate of 79% in the farmers' herds. In addition, farmers were trained to perform AI and also received technical advice on estrus detection, pregnancy and neonatal care, scientific feeding and health management practices.

Scheduled Tribe Component (STC) and Schedule Caste Sub Plan (SCSP)

- About 72 coconut farm workers were trained and free coconut climbing devices were provided. Six schedule tribal farmers were also provided with brush/grass cutting machines. Many planting materials of coconut and intercrops were given to Schedule Tribe farmers free of cost
- Three SC farmers from Kudal Sindudurg were trained in nursery raising of arecanut by providing 500 seed nuts and required nursery bags and compost. Five farmers were provided with one coconut climbing device each.
- Under this sub-plan, a two-days training programme on Scientific pig farming was held with 27 participants from Palghar district (Maharashtra). Six pig farmers of Schedule Tribe community from Maharashtra and seven farmers of Schedule Caste community from Goa were supplied with piglets (75% CB), feed mixture and medicinal supplement. Seven farmers from Goa were distributed with piglets (30 no's), feed, mineral mixture and medicinal supplements from the AICRP on Pig.
- Under the Schedule caste sub-plan (SCSP) scheme a training and agricultural inputs distribution program for thirty-five beneficiary farmers of Ganvale village of Kudal taluka, Sindhadurga, Maharashtra was organized. Inputs like fertilizer (1500 kg) and sprayers (12 no.) were distributed to the paddy, coconut, and cashew growers.
- Demonstration of the seedlings of Benaulim variety of tall coconut and their distribution was done to 15 persons belonging to Schedule Tribe community through the village level of Divar island. The beneficiaries were also provided with coconut tree climbing devices.

INTRODUCTION

Introduction

ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI) is a premium multi-disciplinary institute working to address issues of developing sustainable agriculture and allied activities in the fragile coastal ecosystem of the country. The coastal ecosystem is spread over nine states, two union territories covering 28.39 m ha. The Institute is mandated to carry out research and extension work in field and horticultural crops, livestock, and fisheries relevant to the natural resource base for ensuring sustainable productivity, to develop climate-resilient land use and farming systems and agro-ecotourism in the coastal region.

The Institute was established as the ICAR Research Complex for Goa in April 1976 and after a short period as a part of ICAR Research Complex for North East Hill Region, the Complex was brought under the administrative and technical control of the Central Plantation Crops Research Institute, Kasaragod, Kerala. After functioning at different Government agricultural farm sites in Goa, the location was finally shifted to Ela, Old Goa in 1982. The Institute was upgraded to a full-fledged Institute in April 1989 to cater to the growing needs of agricultural research, education and extension in the state of Goa. While the research activities of the Institute were earlier confined to meeting the agriculture needs of Goa, now the Institute has been further upgraded to ICAR-CCARI since 1st April 2014 to serve the agricultural research needs of 82 coastal districts, 75 in 9 coastal states (Gujarat, Maharashtra, Goa, Karnataka, Kerela, Tamil Nadu, Andhra Pradesh, Odisha and West Bengal) and 7 districts in mainland union territories (Dadra and Nagar Haveli and Daman and Diu and Puducherry).

ICAR-CCARI is under Natural Resources Management (NRM) Subject Matter Division and is situated at Ela, Old Goa. The vision of the institute is "Global Excellence in Sustainable and Sustaining Coastal Agricultural Research". The institute has the following mandates:

- Research on field and horticultural crops, livestock, and fisheries relevant to the natural resource base of coastal India for sustainable productivity.
- Develop climate-resilient land use and farming systems for improved and sustainable livelihood through coastal agriculture.
- Act as a centre of agro-eco-tourism.

The institute has four major divisions namely- Natural Resource Management, Crop Science, Horticultural Science and Animal & Fishery Science. The Institute is headed by the Director, who is supported by 23 Scientists, 13 Technical, 15 Administrative and 19 Skilled Support staff, making the total staff strength of the Institute to 70. The research programmes of the institute are streamlined by the Research Advisory Committee of the institute.

The major areas of research are-

i) Conservation and management of natural resources of coastal region

ii) Conservation and utilization of genetic resources in the coastal region

iii) Development and validation of production technologies of major crops of coastal region

iv) Development and validation of production technologies of livestock and Fisheries

v) Improving livelihood security through post-harvest technologies and other Agri-enterprises.

The Institute has made significant research contributions in identification of promising crop varieties/accessions of field and horticultural crops; development of suitable soil and water conservation measures in cashew, coconut and mango; development of integrated farming system models for low land and upland situations; development of eco-friendly management practices of major insect pests and diseases in plantation field crops and vegetable crops; development and standardization of production technologies for field and horticultural crops of Goa; standardization of low cost protected structures for vegetable and flower production; standardization of packages for rearing cattle, goat, buffalo, pig and poultry; disease diagnosis and animal health management; standardization of ornamental fish culture, carp culture and brackish water fish farming; standardization of mussel farming practices; dissemination of PFZ advisories and validation of advisories; and exploration of fish diversity of Goa.

The Institute is also engaged in the transfer of technology through FLD's, trainings, workshops, etc. The research accomplishments made by scientists, technologies transferred to farmer's fields, awards and recognitions conferred upon the staff and other events organized by the Institute, are presented in the report.

WEATHER REPORT

Information on weather is of paramount importance for agricultural production. Observation of weather parameters is being continuously recorded at the Institute and observations made during January to December 2021 are provided in this section.

Meteorological Observatory: Agro-meteorological Observatory, KVK farm, ICAR-Central Coastal Agricultural Research Institute, Ela, Old Goa, Goa – 403402.

Location of the observatory: 15°29′22″ N, 73°55′10″ E, 67 m above mean sea level.

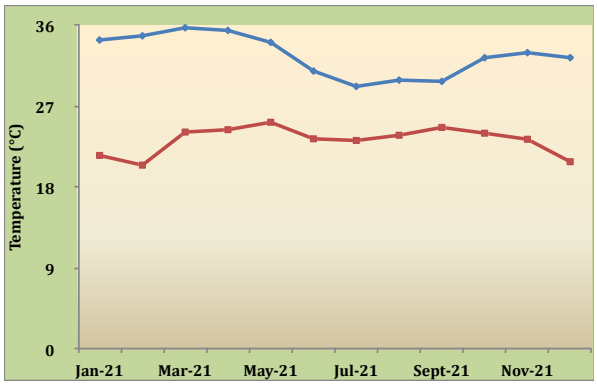
Data presented: January to December 2021.

Time of observation: Morning session I – 0734 (7.34 AM) and afternoon session II – 1434 (2.34 PM)

The patterns of weather parameters observed from January to December 2021 are as follows:

Air temperature

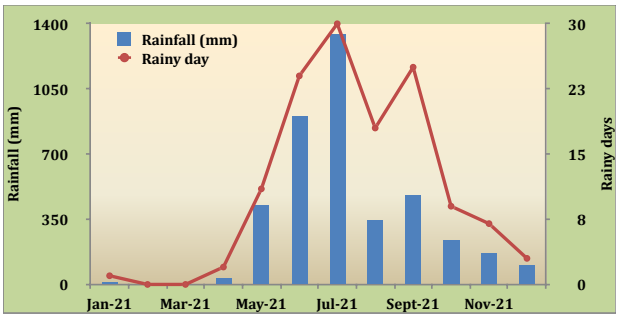
Mean monthly maximum temperature during January to December 2021 varied from 26.0 °C (July 2021) to 39.0 °C (March 2021), whereas mean minimum temperature varied from 17.6 °C (February 2021) to 27.4 °C (March 2021).



Mean maximum and minimum air temperature during 2021

Rainfall and rainy days

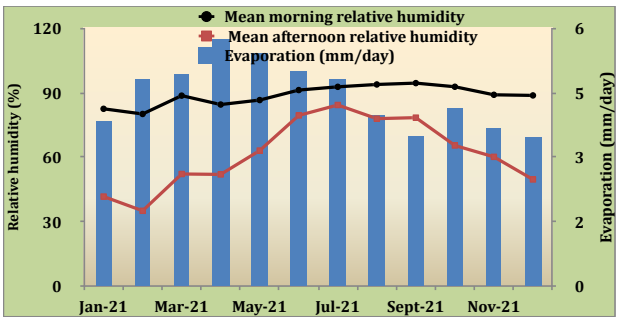
The total rainfall received from January to December 2021 was 4047.6 mm out of which 3074.7 mm was received during *kharif* (June 2021 to September 2021). The annual rainfall for this year was 580 mm lower than that of 2020 (4627.5 mm). Total number of rainy days observed was 130 and was higher compared to last year (118 days).



Trend of mean monthly rainfall and number of rainy days.

Evaporation and relative humidity

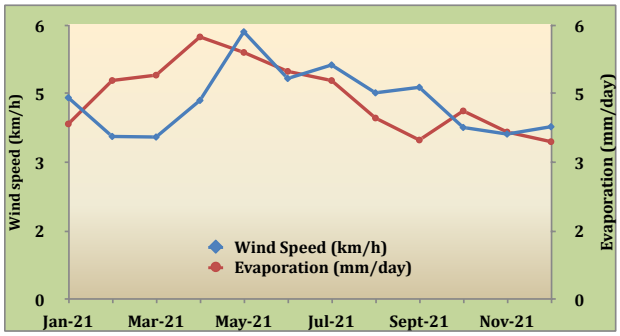
Daily evaporation was measured using USWB-Class A open pan evaporimeter. The total water evaporated from January to December 2021 was 1550.9 mm. The highest morning and afternoon relative humidity was observed during February and May 2021, respectively, whereas the corresponding lowest was recorded during February 2021.



Mean monthly evaporation and morning and afternoon relative humidity

Wind speed

Mean monthly wind speed ranged from 3.55 km/h (March 2021) to 5.85 km/h (May 2021). Mean monthly wind speed started decreasing from May 2021 to November 2021 and it increased there after.



Mean monthly wind speed and evaporation during 2021.

Sunshine hours

The mean monthly sunshine hour recorded ranged from 2.3 hours (July and September 2021) to 9.0 (February 2021). As expected, mean monthly sunshine hours were lower during rainy season compared to the rest of the months.

Soil temperature

The ranges of mean monthly soil temperature recorded in morning hours at 5, 10 and 20 cm depths were 24.0-31.4 °C, 25.2-33.5 °C and 27.1-34.6 °C, respectively, whereas the corresponding ranges for afternoon observation were 30.0-43.1 °C, 29.0-39.9 °C and 27.5-35.9 °C.

Mean monthly weather parameters recorded at ICAR-CCARI from January to December 2021

Month	Temperature (°C)		Relative Humidity (%)		Wind Speed (km/h)	Sunshine (h/day)	Evaporation (mm/day)	Rainfall (mm)	Rainy days	Cloudiness (h)	
	Maximum	Minimum	07.34 AM (0734)	2.34 PM (1434)						07.34 AM (0734)	2.34 PM (1434)
Jan	34.4	21.5	82.5	41.7	4.41	7.7	3.8	9.1	1	4.5	1.3
Feb	34.8	20.5	80.1	35.1	3.56	9.0	4.8	2.0	0	6.6	0.9
Mar	35.7	24.1	88.6	52.2	3.55	7.6	4.9	0.0	0	2.9	0.1
Apr	35.4	24.4	84.5	52.0	4.35	7.8	5.7	27.0	2	2.5	1.3
May	34.1	25.2	86.6	63.1	5.85	5.8	5.4	422.6	11	3.5	3.0
Jun	30.9	23.4	91.2	79.4	4.83	3.3	5.0	903.9	24	4.7	4.7
Jul	29.2	23.2	92.7	84.3	5.13	2.3	4.8	1345.9	30	5.2	5.0
Aug	29.9	23.8	93.8	77.9	4.52	3.6	4.0	343.9	18	4.4	4.2
Sep	29.8	24.7	94.5	78.4	4.64	2.3	3.5	481.0	25	4.7	4.3
Oct	32.4	24.0	92.8	65.5	3.76	6.7	4.1	239.9	9	3.9	3.2
Nov	33.0	23.3	89.0	60.2	3.62	5.4	3.7	166.4	7	4.4	3.5
Dec	32.4	20.9	88.7	49.6	3.78	8.3	3.5	105.9	3	3.4	1.7

Important dates of observations during January to December 2021 with the highest and lowest values of weather parameter

Particular of weather parameter	Value	Date
Highest maximum temperature	39.0 °C	26-03-2021
Lowest minimum temperature	17.6 °C	11-02-2021
Highest rainfall	194 mm	17-05-2021
Highest evaporation	9.0 mm	02-06-2021
Highest wind speed	25 km/h	17-05-2021
Maximum sunshine hours	10.7 h	01-06-2021

Research Achievements

Mega Project 1 : Conservation and management of natural resources of coastal region

Project: Genesis of soils and associated evaporates in the coastal ecosystem for sustainable land use options and carbon management in India

S K Singh, G R Mahajan, Bappa Das, Sujeet Desai, G B Sreekanth

Application of Coastal Agricultural Information System (CAIS): Reconstructing past climate and understanding the present weather

CAIS is the port for data on natural resources and agriculture and this could be used for a variety of studies including evolution of the landscapes, historical climate, projected climate change in the future and multi-functional land use planning for sustainable agriculture. We restrict the present report to understand the processes involved in setting the climate in India including the coastal region. Digital elevation model, geological events, climate, soil and land form data have been used in the analysis.

Red and lateritic soils have been reported in the Kangra valley (Himachal Pradesh), Kashmir valley (Jammu and Kashmir), and occasionally in the desert of Rajasthan (observation recorded at CAZRI farm, huge kaolin deposits in Kolayat, Bikaner district). Climate consisting of high rainfall and high temperature is essential for the development of such soils. These could not be developed in the prevailing climate in the Himalayas or the desert of India. The genesis of such soils can be linked with the origin of Himalayas. It is well known that the Indian plates had been once located at the equator and had gone through high rainfall and high temperature. The geographic setting is ideal at the equator for the formation of red and laterites. It has also been proven that the plates moved to the Tibetan plateau and covered a distance of 8° from its axis to occupy peninsular India. It is also known that the red and laterites in Goa were part of the Indian plate and preserved in the prevailing high rainfall and high temperature for a period of 3 to 4 months in a year. The deviation in the rainfall and the temperature or change in the depositional environment leads to the development of different soils. Thus, the soils other than the red and laterites in extra peninsular India were the newer alluvia/ sediments deposited in the prevailing temperate climate. These observation leads us to conclude that once there was a tropical climate in the northern and the western region of India shifted to a temperate and arid climate due to the rise of the Himalayas.

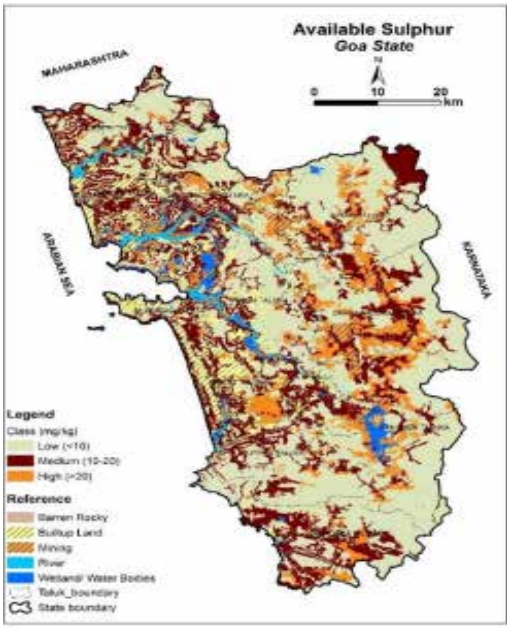
Geo-syncline is the process of rock formation from sediments and is the key for shaping present climate in India. It occurred during the period of Eocene, Miocene, and Pliocene due to the collision of the Indian and Tibetan plateau. These accounted for the rise of Greater and Lesser Himalayas and Shivaliks, which instrumented a fault between Sahyadri and the Western Ghats. It exists today as the Arabian Sea and was fed by both the Sindhu and Ganges river systems. The subsequent geological events including increase in the elevation of Aravalli hills and the rise Andaman/ Myanmar plateau occurred together with the forward movement of the Rajmahal trap. These impacted the development of the cold desert consisting of Pirpanjal, Zaskar range, Karakoram Hills, Akchhai China, Laddakh region and water bodies like Penganga Tiso.

The diversion of the river Ganga from the Arabian Sea to the Bay of Bengal took place and the formation of the Thar Desert in the Arabian

block became a reality. Dwindling river system of Ghagger- Markanda–Hakra flowing in parts of Rajasthan, Punjab, and Haryana could be seen as a remnant of the Ganges. The rise of Aravalli's also obstructed the movement of the hot westerlies which circulates over the horizons of desert and is instrumental for high temperature and long summers in the desert. The impact on air circulation is further accentuated due to the high moisture in the winter and resulted in excess fume, fog, and mist in NCR from October to January. Thus, the geo-syncline was the key to shifting climate from tropics to temperate in the Himalayas and from tropics to arid/desert in parts of Rajasthan, Punjab and Haryana.

The coastal region

The formation of the Aravalli and Andaman plateau restricted water supply in the Arabian Sea which moved westward and left space for the Rann of Kutch in Gujarat. Prior to this, the sea level was higher than the present level. This is evident by a similar level of sulphur content in the soils of the coast and the Ghats in Goa (Fig.1). This is enough to prove that Goa was once under the backwaters before the diversion of the Ganges. Due to shift of the river course, the level of seawater got lowered and the influence of seawater ingression-can-be seen as fallow land in and around North Goa.



Available sulphur in the soils of Goa

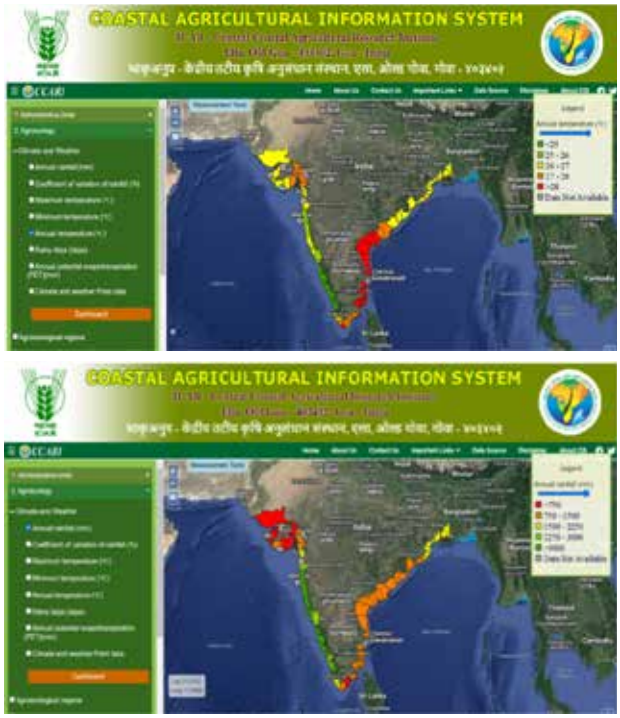
Extent of fallow land in Goa

The rise of the Aravalli and Andaman plateaus also contributed to the development of rift valleys of the Narmada and Tapi rivers. These picked basaltic alluvia and deposited them in the coast of Gujarat. On the westward movement of the sea, the bisque soil profile of Vertisols over saline sediment is exposed for agriculture in the coastal region of Gujarat. High sodicity in the Khandesh region of Maharashtra further attested to the large expanse of the Arabian Sea than the extent visible today. Even the sulphur level could be taken as a yardstick to explain the expanse of the coastal environment in Karnataka and Kerala. The rise of the Aravalli and Andaman plateau also influenced rainfall and temperature of the east and the west coast. The east coast closer to the Andaman plateau severely affected the energy flowing between Aravalli and Andaman and was reflected in terms of lower rainfall and higher temperature than the west coast (Fig.3 and 4). The energy also affected severely the Kutch and Kathiawar peninsula in the coastal region of Gujarat, in terms of excessive aridity.

Indo-Gangetic plain (IGP), and north eastern region

Rise of Aravalli and Andaman plateau also resulted in the twisting of the Himalayas at

Nimcha Barua in Arunachal Pradesh, Maldah depression between the Eastern Ghats and the Bay of Bengal and bending of Nagaland plateau at its axis. However, Meghalaya plateau remained unaffected and the geological formation matched with peninsular India. Huge sediment flowed from Himalayas to Maldah depression, leading to the formation of Indo-Gangetic plains and young to old delta in Bengal basin. The sediment also forced the river Tista to change its course. Alluvia in IGP was further charged by the Brahmaputra river, leading to the development of Assam valley. In the process, the climate remained tropic in the Purvachal and eastern Himalayas, graded to the sub-humid, humid and semi-arid region in Indo-Gangetic plains.



Annual temperature and rainfall

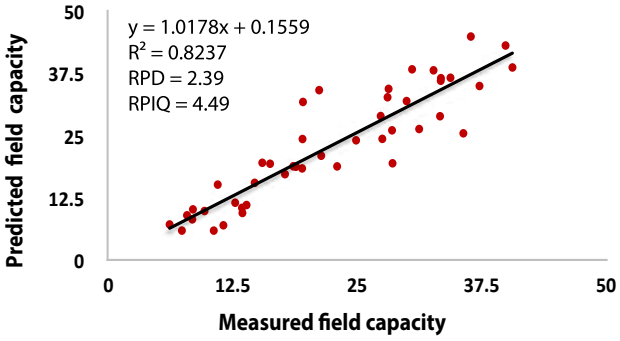
Peninsular India

The upheaval in the Aravalli and Andaman plateau, also led to the development of faults at the Maharashtra plateau that had given birth to rivers like Godavari, Krishna and Bhīma. These three rivers took the basaltic alluvia from Maharashtra to the south, which has led to the development of Vertisols and associated soils in southern part of India and in the coasts of Andhra Pradesh and Tamil Nadu. Elevation governed the spatial distribution of Vertisols and red soils in the southern region. The red soils remained at the higher elevation whereas vertisols covered the red soils at lower elevations. The orientation of Sahyadri, Nilgiri hills, Andhra Pradesh, Karnataka plateau and Tamil Nadu upland affected the distribution of rainfall and resulted in a shift of climate in large part of Karnataka, Andhra and Tamil Nadu, changing from tropical to arid and semi-arid. However, tropical climate remained unaffected in Kerala.

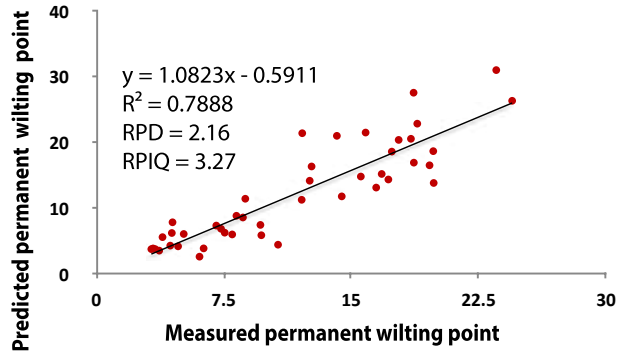
Pedotransfer functions to estimate field capacity and permanent wilting point of the salt-affected coastal soils using multivariate analysis and machine learning

Salinity of salt-affected coastal soils poses a severe constraint to crop production. Excess salt concentration affects the water-related properties of soil including water and nutrient uptake by the plants. Monitoring soil properties like field capacity (FC) and the permanent wilting point (PWP) is time and labour-consuming and also cost-intensive. This study aims to develop pedotransfer functions to predict FC and PWP using soil properties like soil organic carbon, bulk density, electrical conductivity and sand, silt and clay content, which are relatively easy to measure. A total data set of 149 soil samples were divided into calibration data set of 104 (70% of total) and validation data set of 45 (30% of total). Different parametric and non-parametric tests like Elastic Net (ELNET), Support Vector Machine (SVR) Gaussian Process Regression (GPR), Multivariate Adaptive Regression Splines (MARS), Partial Least Square Regression (PLSR), Random Forest (RF), K-Nearest Neighbour (KNN), XG Boost (XGB), Cubist, Step-wise Multiple Linear Regression Model (SMLR) and Artificial Neural Network (ANN) were employed to develop the relationship using calibration data set and predict it using the validation data set. All the models predicted the FC with excellent prediction accuracy of $R^2 \geq 0.76$, root means square error (RMSE) between 4.70 to 5.55, a ratio of performance to deviation (RPD) ≥ 2.02 and ratio of performance to interquartile distance (RPIQ) ≥ 3.79. The permanent wilting point was

predicted by ELNET, SVR, GPR, MARS, ANN, SMLR, and ANN with excellent accuracy of $R^2 \geq 0.75$, RPD ≥ 2.00 and RPIQ ≥ 3.02. Thus, it can be concluded that the FC and PWP of salt-affected coastal soils could be estimated using the soil organic carbon, bulk density, electrical conductivity and sand, silt and clay content. The pedotransfer functions developed could be useful for water-related studies in these soils.



Agreement between the measured and predicted field capacity using the best performing XG Boost (XGB) model

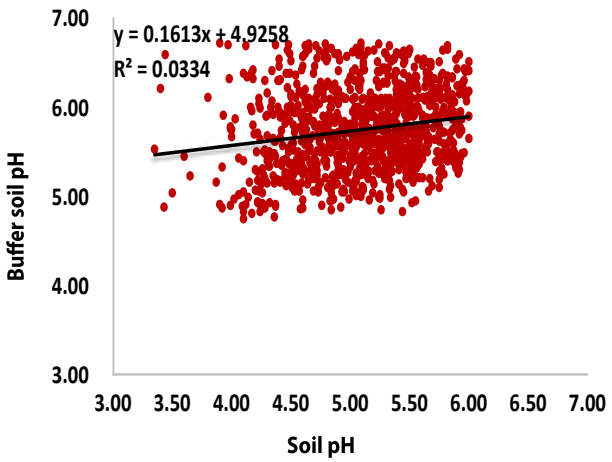


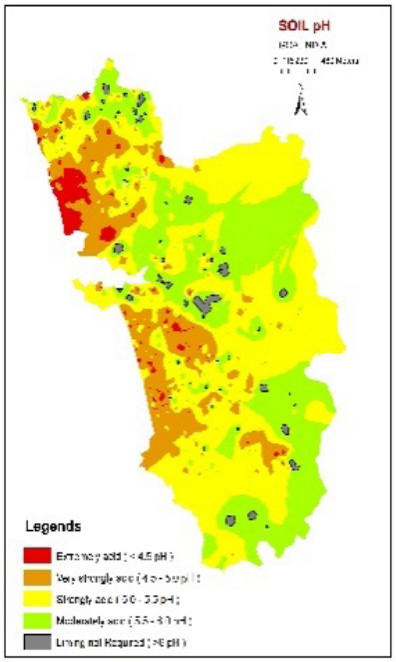
Agreement between the measured and predicted field capacity using the best performing K-nearest neighbour (KNN) model

Estimation of the lime requirement for the agricultural lands of the state of Goa

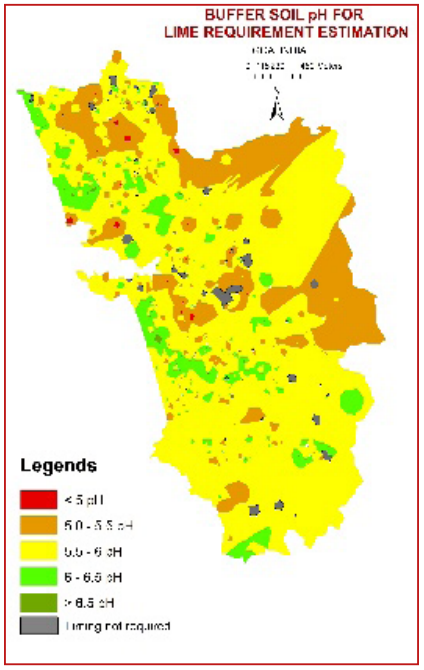
Soil acidity is an important abiotic stress which poses serious limitations to crop production. It affects the soil's chemical processes and imbalances the availability of essential nutrients to plants. By and large, the soils of the state of Goa, are acidic in soil reaction, which is evident from the fact that of the total 1194 soil samples collected for this study and analysed for soil pH, 93.47% were below 6.0 and 98.91% below 7.0. Liming of soil is an effective way to correct soil acidity. For this study, soils with pH less than or equal to 6.0 were considered as a thumb rule for determining the lime requirement which is required for soils with soil pH less than or equal to 6.0. The measurements of the soil pH ranged from 3.35 to 6.00 with a mean value of 5.09 and a coefficient of variation of 10.01% indicating the pre-ponderance of soil acidity. The buffer soil pH measured using the SMP buffer method varied from 4.75 to 6.72 and averaged 5.75. A very poor and non-significant relationship (R^2 = 0.0334) between the soil $pH_{1:2.5}$ (measured in 1:2.5 soil to water ratio) and the pH measured in the SMP buffer method was observed. This indicates that lime requirement recommendation which is based on the soil $pH_{1:2.5}$ will not be of any use and may not reduce the problem of acidity.

For the soils of Goa, lime recommendations based on SMP buffer method to increase the soil pH to 6.0,6.4 and 6.8 was estimated to be 2.43-22.11 (mean=12.15) t ha^{-1}, 2.92-25.76 (mean=14.42) t ha^{-1} and 3.40-30.13 (mean=16.61) t ha^{-1}, respectively. The empirical values estimated look exorbitantly high and may not be economical and cost-effective. Thus, it needs corrections owing to factors like rainfall and crop type. The heavy rainfall received during the monsoon season is to be kept in mind to optimize lime use. The cropping pattern and crop diversity are very high. General and blanket recommendations for lime might not be suitable and thus further crop-specific and site-specific lime requirement needs to be estimated for improved yields. The results of the present study, one of the earliest for the region, could be useful to arrive at crop- and site-specific lime recommendations.





(a)



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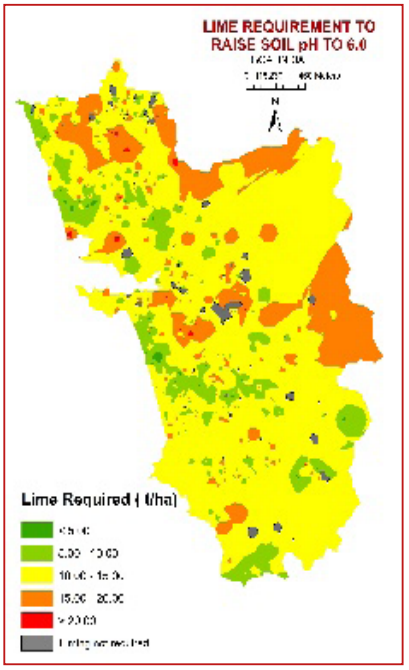

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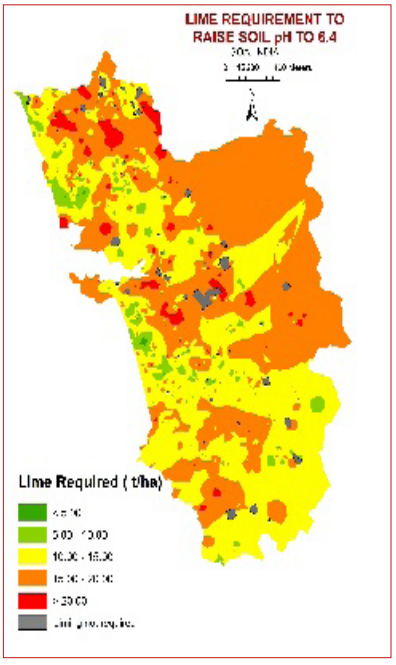

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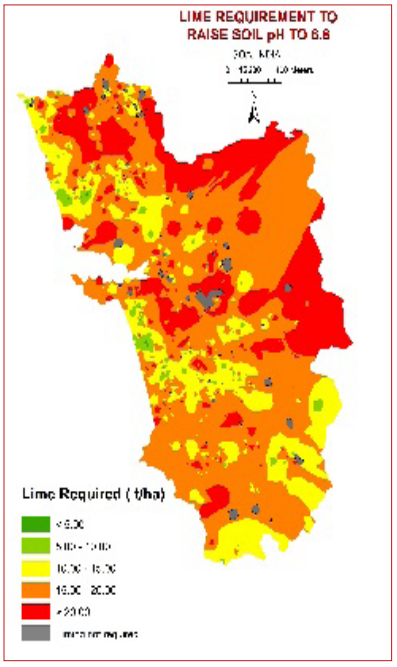


(e)

Soil pH (a) buffer soil pH (b) for estimation of the lime requirement and lime requirement to raise the soil pH to (c) 6.0, (b) 6.4 and (e) 6.8 for the soils of Goa

Project: Study of conservation agricultural practices for sustainability of rice-based cropping systems in the west coast of India

Parameshа V, Parveen Kumar and G R Mahajan

Six rice-based cropping systems were evaluated to know the impact of conservation and conventional tillage practices on grain yield, aboveground biomass, energy efficiency, economics and soil carbon stock. The cropping system covered puddled transplanted rice (PTR)-PTR, direct-seeded rice (DSR)-DSR, rice-moong, rice-cowpea, and rice-baby corn. The rice equivalent yield data varied significantly due to different tillage management practices. By practicing direct-seeded rice-Zero tillage baby corn-Zero tillage moong (triple cropping) the production (REY-12.4 t/ha) and profitability (Net return- 1.66 lakh/hectare) increased significantly. The farmer's practice (PTR-PTR) recorded significantly lower yield and net returns. The estimated gross carbon input was found higher inT_7 – MBR + DSR - RR + ZT baby corn – BBR + ZT Moong treatment (3.3 Mg/ha) due to higher above-ground biomass production (15.8 t/ha) with increased residue incorporation. The soil carbon stock was also found higher in T_7 – MBR + DSR-RR + ZT baby corn – BBR + ZT Moong treatment (31.5 Mg C/ha) and the least values were observed with farmers' practice. The total energy input was higher in farmers' practice 59202 (MJ ha^{-1}) and remaining conservation tillage practices under different cropping systems recorded lower energy input. The reduced energy consumption in different conservation tillage practices was mainly due to a reduction in machinery and diesel usage.

General view of experimental plots

Effect of different tillage practices on rice equivalent yield, C input, soil C stock, energy input, and net returns of different rice-based cropping systems

Treatments	Rice equivalent yield (t/ha)	Above-ground biomass (t/ha)	Total residue input (t/ha)	Estimated gross C input (Mg ha^{-1})	Soil Carbon Stock (Mg C ha^{-1})	Total Energy input (MJ ha^{-1})	Net returns (Rs. lakh /ha)
T_1- PTR - PTR (Farmers' practice)	9.6c	11.9c	3.57	1.49d	21.2d	59202	1.12d
T_2- DSR + BM - ZT Cowpea	10.5b	13.6c	4.08	1.71b	27.5b	30600	1.52b
T_3- DSR - ZT Moong - ZT Baby corn	12.1a	15.1a	4.53	1.91b	28.1b	43860	1.64a
T_4- DSR - ZT Moong - ZT moong	11.6a	14.5b	4.35	1.82b	28.4b	34638	1.57b
T_5- DSR + BM - ZT Moong	9.7c	10.8d	3.24	1.36d	25.0c	32350	1.28c
T_6- DSR - Sweet corn	10.1b	13.1d	3.93	1.65c	21.7d	39116	1.33c
T_7- MBR + DSR -RR + ZT baby corn – BBR + ZT Moong	12.4a	15.8a	7.9	3.3a	31.5a	44342	1.66a

Note: DSR-Direct seeded rice; MBR-Moong bean residue; PTR-puddled transplanted rice; ZT-Zero tillage; BM-Brown Manuring. Similar letters between the treatments indicate non-significance at a 0.05 level

Project: Evaluation of potential rice-based cropping systems under salt affected coastal saline soils for enhancing cropping intensity, sustainability and livelihood security

Paramesha V, Parveen Kumar, Manohara K K, Sukanata K Sarangi and Shripad Bhat

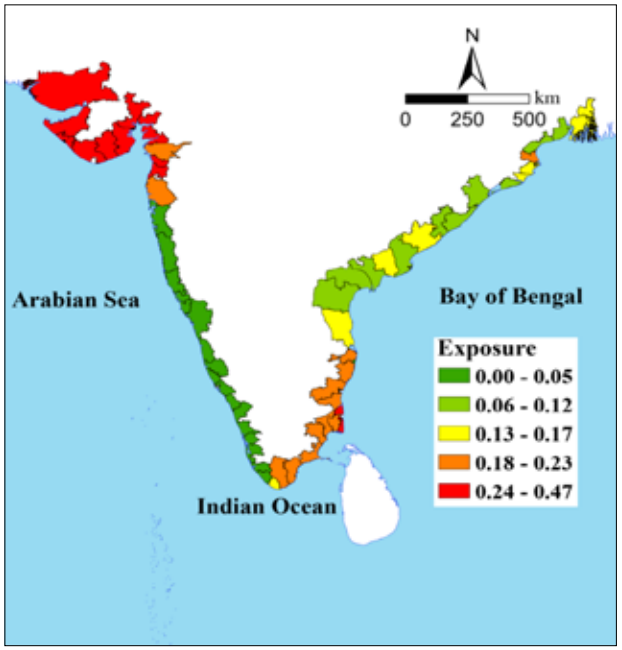
Farm trials were conducted at Diwar and Chorao islands to improve cropping intensity under salt-affected coastal saline soil. The main aim of the study is to assess the production, profitability and sustainability of different cropping systems and to quantify different ecosystem services and environmental impacts associated with varied cropping systems under coastal saline soils. Different rice-based cropping systems evaluated were - rice-cowpea, rice-moong, rice-sweet corn, rice-baby corn, rice-chilli, rice-okra, and rice-leafy vegetables. The preliminary evaluation suggests that cowpea, sweet corn, baby corn, and okra crops performed better, while the germination of moong under coastal saline conditions was affected in both the locations.

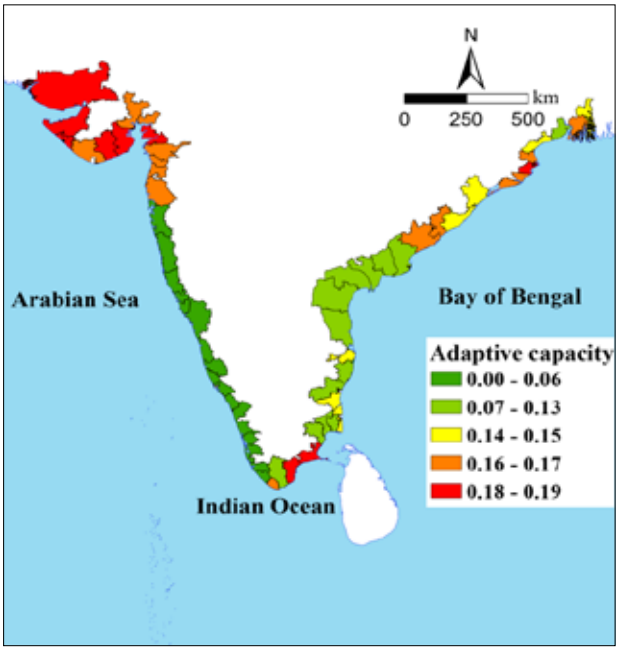
Evaluation of different rice-based cropping systems under coastal saline conditions at the experimental plot at Divar island

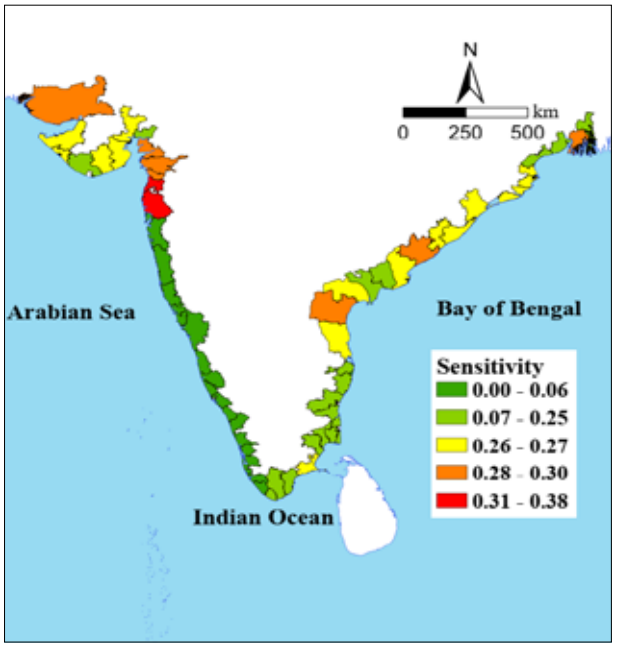
Project: Assessment of climate change vulnerability in coastal districts of India

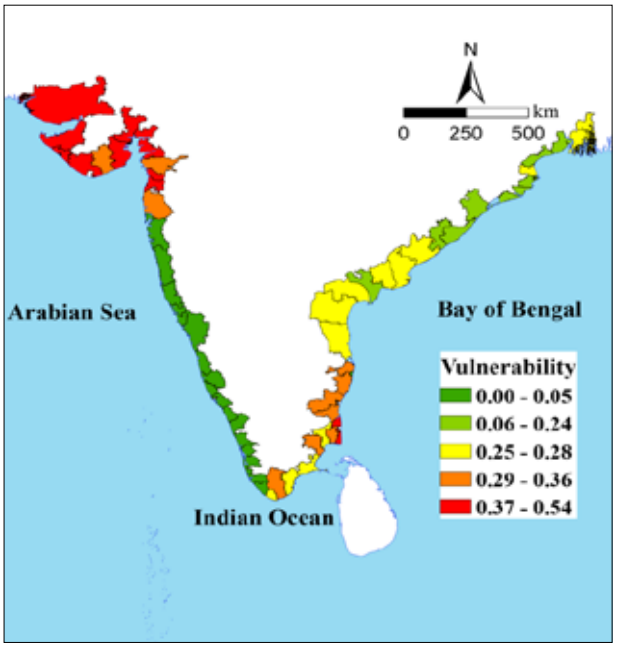
Bappa Das and VK Sehgal

Climate change and extreme weather events have adverse impact on agricultural production and food security in India. Suitable climate change mitigation and adaptation strategies are therefore required to ensure national food security. In this regard, developing climate-smart agricultural policies and technology requires the assessment of vulnerability of regions to climate change. Although climate change is a global phenomenon, its expressions and repercussions vary regionally. Thus, local vulnerability assessment is required to develop mitigation and adaptation measures tailored to local requirements and priorities. Data on sensitivity, exposure and adaptive capacity indicators were collected for coastal districts of India covering nine states. Individually indices were calculated for sensitivity, exposure and adaptive capacity using entropy. The results showed that exposure was maximum for Porbandar district (0.47) of Gujarat while the minimum exposure was recorded for Raigarh (0.034). Among the coastal districts, maximum and minimum sensitivity was observed for Valsad (0.377) and Uttara Kannada (0.037) districts, respectively. The districts of Maharashtra, Goa, Karnataka and Kerala showed lower sensitivity to climate change. The maximum adaptive capacity was observed for Porbandar (Gujarat, 0.191) and the minimum was recorded for Kannur (Kerala, 0.050). The districts of Gujarat showed maximum vulnerability to climate change while districts of Maharashtra, Goa, Karnataka and Kerala were observed to be less vulnerable. Strategies and development activities should be channelized to the climate vulnerable areas to facilitate adaptation strategies.









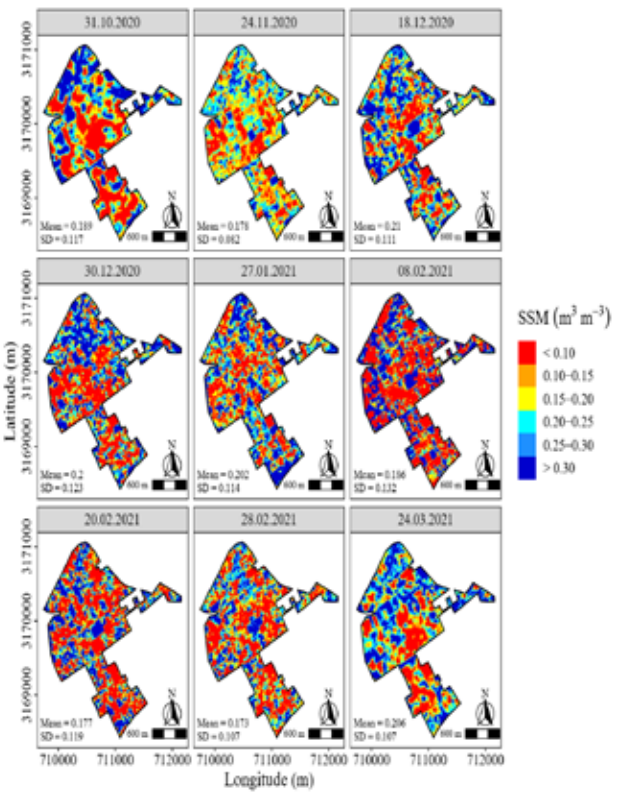
Exposure, sensitivity, adaptive capacity and vulnerability of coastal districts of India
(Higher values indicate higher exposure, sensitivity, adaptive capacity and vulnerability to climate change)

Project: Optical-microwave-thermal remote sensing synergies for dynamic soil moisture mapping

Bappa Das and Debashis Chakraborty

Remote sensing offers a high potential for soil moisture retrieval even though continuous mapping at field scale is impeded by the limited availability of high-resolution, all-weather data and model-based complexities. This study is an attempt to evaluate the synergistic use of microwave and optical/thermal infrared remote sensing and an ensembling-of-all approach for surface soil moisture (SSM) monitoring over a large semi-arid irrigated agricultural farm at ICAR-Indian Agricultural Research Institute, New Delhi. The performance of Water Cloud Model (WCM) using Sentinel-1 & -2, Thermal-Optical TRApezoid Model (TOTRAM) and Optical TRApezoid Model (OPTRAM) using Landsat-8 short-wave infrared (SWIR)/thermal infrared sensor (TIRS) data were evaluated for nine dates covering the entire post-monsoon period and compared with ensemble modelling results.

Although the model performances varied with crop growth stages, the overall lowest RMSE was measured in ensemble model (0.056 $m^3 m^{-3}$) followed by OPTRAM (SWIR2) (0.065 $m^3 m^{-3}$) and the highest for TOTRAM (0.09 $m^3 m^{-3}$). Results indicate that WCM or TOTRAM was better for SSM mapping during the early phases of crop growth, but OPTRAM (SWIR 1 or 2) was observed to be more reliable during the later stages of crop growth. All the approaches could effectively delineate high and low-intensive irrigation zones, although optical and optical-thermal synergy was better towards a dry-moist soil moisture regime. The study highlights the limitations of WCM in terms of its calibration requirement for changing vegetation structure using *in-situ* data, whereas TOTRAM needs local calibration owing to the sensitivity of land surface temperature to ambient atmospheric conditions. OPTRAM, being simple, low data- and resource-intensive, and surface reflectance-soil moisture relationship independent of local calibration, is advantageous for generating soil moisture maps during the post-monsoon period in semi-arid climate with prevailing clear sky conditions. Among the machine learning (ML) models, random forest (RF) performed the best with respect to correlation coefficient (r = 0.71) and root mean square error (RMSE = 0.0517 $m^3 m^{-3}$) while the cubist model had the least bias (MBE = 0.0021 $m^3 m^{-3}$) during independent validation. Stacking of cubist, gradient boosting machine (GBM) and RF using elastic net (ELNET) as meta-learner further reduced the MBE (0.0018 $m^3 m^{-3}$) and RMSE (0.0503 $m^3 m^{-3}$) during the validation. Among the covariates, radar backscatter, modified normalized difference water index and land surface temperature were the most important variables impacting the SSM as indicated by Boruta algorithm. Stacking of multiple machine learning models may be utilized for improving accuracy in digital soil moisture mapping and for irrigation mapping of a farm over the entire post-monsoon period.



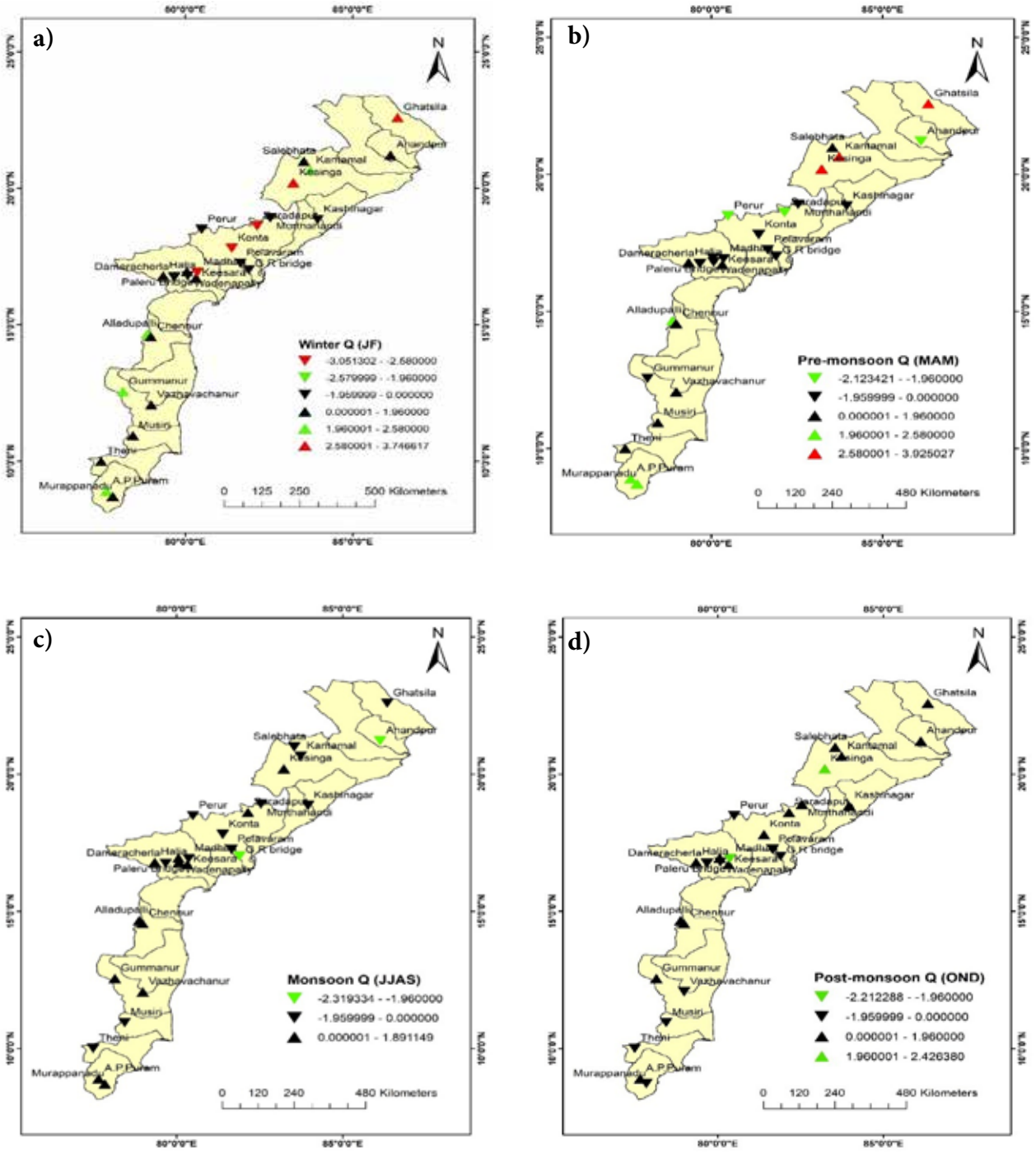
Surface soil moisture maps of the IARI research farm over post-monsoon period

Project: Assessment and mapping of trends in the hydro-climatic variables over the west and east coast regions of India

Sujeet Desai, Bappa Das and Sreekanth G B

Seasonal and annual stream flow trends of east-flowing rivers of India were studied to assess their temporal and spatial variability. The east flowing rivers consists of 16 river basins and sub-basins starting from Vaippar sub-basin in the south to Subernarekha river basin in the east covering the states of Tamil Nadu, Andhra Pradesh, Odisha and West Bengal. Time series data of 26 streamflow gauging stations from 1989-2018 (30 years) was used to analyze the spatio- temporal trends of stream flow. Different statistical tests such as Mann-Kendall test, Spearman's rho test and linear regression were used to analyze the trend in time series and Sen's slope was used to estimate the rate of change. All the tests were considered statistically significant at 1% and 5% significance levels. The analysis revealed that in the winter season significant increasing stream flow trend at 5 ($p < 0.05$) gauging stations and at 1 ($p < 0.01$) gauging station was observed whereas in 3 stations a significant decreasing trend was observed. In the pre-monsoon season, significant increasing trend at 3 ($p < 0.05$) and 3 ($p < 0.01$) gauging stations was observed whereas significant decreasing trend at 3 ($p < 0.05$) gauging stations observed.

During the monsoon season, significant decreasing stream flow trend ($p < 0.05$) was observed at only 2 stations whereas the trend at all other stations was not significant. Only 1 station showed significant increasing trend ($p < 0.05$) and 1 station showed significant decreasing trend ($p < 0.05$) during post-monsoon season. Annually, out of 26 gauging stations, only 1 station showed significant decreasing stream flow trend ($p < 0.05$) whereas the trend at all other stations was not significant. The upward and downward arrows indicate increasing and decreasing trends respectively. The red and green arrows (Fig.1) indicate significant increasing/ decreasing trends at 1% and 5% levels whereas black arrow indicates non-significant increasing/ decreasing trend in stream flow. A positive correlation between rainfall and stream flow trends in the east-flowing rivers was observed. Significant decreasing stream flow trend in Krishna and Godavari lower sub-basins in all the seasons could be attributed to decreasing rainfall. Significant increasing stream flow trend in other east flowing rivers during winter and pre-monsoon season was due to increasing rainfall.



Temporal stream flow trends in east flowing rivers during four seasons in the east coast
a) Winter b) Pre-monsoon c) Monsoon d) Post-monsoon

Project: Assessment and development of agro-forestry systems for improved livelihood and climate change mitigation in coastal regions of India

Uthappa AR, AR Desai, R Solomon Rajkumar, Shripad Bhat, GR Mahajan, Paramesha V, Bappa Das and Sujeet Desai

The state of Goa faces acute green fodder scarcity almost all through the year and imports about 50% fodder from neighbouring states like Karnataka and Maharashtra. The state has around 56000 ha under cashew and 28000 ha under coconut, but the interspace is poorly utilized for growing inter-crops. To reduce fodder deficit and utilize the interspace in coconut and cashew plantations a silvi-pastoral experimental trial with soil and water conservation measures was initiated in the year 2021. The performance of seven different fodder grasses viz., bajra napier hybrid (Var. CO5, super napier, DHN6), Dharwad Guinea Grass 1(DGG1), Perennial Sorghum (CoFS 29), Kennedy grass (*Brachiaria ruziziensis*) and Rhodes grass (*Chloris gayana*) were studied under the coconut plantation. After the first cut, the highest green fodder biomass was recorded in bajra napier hybrid varCO5 (24.74 tons/ha) followed by bajra napier hybrid var. super napier (17.18 tons/ha). The data also revealed that green fodder yield was highest in plots with continuous contour trench plot (12.93 tons/ha) followed by staggered trench (8.83 tons/ha) and control plot (5.48 tons/ha).

In order to evaluate suitability of different bamboo species for coastal region and conserve the germplasm, a bambusetum consisting of 14 different bamboo species (*Bambusa balcooa, Bambusa bambos var. gigantea, Bambusa nutans, Bambusa polymorpha, Bambusa tulda, Bambusa vulgaris, Dendrocalamus asper, Dendrocalamus brandisii, Dendrocalamus hamiltonii, Dendrocalamus latiflorus, Dendrocalamus membranaceus, Dendrocalamus stocksii, Dendrocalamus strictus, Thyrsostachys oliveri*) has been successfully established in the year 2021. These plants have been obtained from Kudal, Maharashtra and it is expected that performance evaluation will lead to the identification of suitable species for large-scale multiplication and dissemination.

A fodder museum consisting of 35 different promising fodder grasses, legumes and trees has been established in the interspace of coconut garden to act as a live demonstration plot for farmers and farm enthusiasts.

Fodder museum consisting of 35 different fodder

Bajra-Napier hybrid CO5 growing in species the interspace of coconut gardens

Super napier growing in the interspace of coconut in fodder museum at ICAR-CCARI, Goa

Mega Project 2 : Conservation and utilization of genetic resources in the coastal region

Project: Collection, evaluation of genetic resources and management of fruit and spices

AR Desai, SK Singh, Sujeet Desai, Paramesha V, Nibedita Nayak and Maneesha SR

Collection and maintenance of mango germplasm

Mango field germplasm bank, consisting of a total of 144 collections representing the following groups, is currently being maintained in three germplasm blocks.

Status of mango germplasm of ICAR-CCARI

Particulars	No. of accessions
Local varieties (including Mankurad, Hilario & others)	94
Local Pickling types	13
Introduced hybrids	15
Introduced varieties	12
Pusa varieties	04
Exotic/ coloured varieties	06

A field germplasm block of 14 pickling mango accessions, comprising of three collections viz. Karel-1/16, Santhoma-1/16 and Mayem-1/16, suitable for matured fruit pickling; 9 local collections viz, Para Bicholim -1/16, Pissurlem-1/17, PM- ICAR /16, Kudka PM/17, Gaondongri-2 /17, S.Verem PM/16, S. Dargal, PM/17, Narvem PM/16, Gaondongri-3/17 and two collections from Sirsi, Karnataka, viz. Appemidi and Jeeragi Mau, suitable for immature whole fruit pickling were established at the 'Farm C' area, along with collection of six coloured exotic mango varieties.

By and large, the performance of all the mango varieties was not consistent due to extended / erratic and untimely rains during the flowering period. The shortlisted variety, Cardozo Mankurad also recorded scattered flowering resulting in sparse fruit set. Fruit growth and development although late, did not, however, affect fruit quality and shelf life of the fruits. The most regular varieties like Amrapali also were severely affected by the erratic weather aberrations, which requires serious research efforts to address the new challenges affecting commercially important fruit crops like mango in the coastal region.

Similarly, the performance of different Mankurad mango variants under evaluation also recorded a very poor performance due to impact of weather aberrations.

Evaluation of mango hybrids

Among the introduced hybrids, Amrapali, Ratna, HB-56, Neelgoa, HB-87 and K × B inconsistently recorded late fruit set, and the fruits were affected by rains and by fruit fly, although fruit quality analyses of mango and hybrid varieties showed normal trends, *Gajendra* variety of elephant foot yam was intercropped in mango germplasm block for production of planting material.

Staggered fruit setting and growth in mango (Cardozo Mankurad) due to weather aberrations

Erratic flowering in mango (var. Amrapali)

Characterization of Nutmeg genotypes: 1st Group (20 yrs)

Of the first set of 28 genotypes of 20 years age group being maintained as intercrop in coconut plantation, 26 genotypes are monoecious with varied levels of male and female flowering dominance. Two genotypes are pure male types. Monoecious genotypes viz. NMF-6, NMF-2, NMD-1and NMD-2 recorded promising yield performance. Second group (4-6 yrs) comprising of 18 - Monoecious / Dioecious genotypes, of which the genotype NMI-1 has shown precocious bearing with bold nut characters.

NMF-6
Yield: 1008 fruits/ tree
Nut weight: 8.02 g

NMD-2
Yield: 772 fruits/ tree
Nut weight: 4.04 -5.2 g
Mace weight: 1.06g

NMF-2
Yield: 814 fruits /tree
Nut weight: 7.40 g
Mace weight: 1.02g

Characteristic of female dominant monoecious genotypes

Yield performance of different nutmeg genotypes during the year 2020-21

Tamsuli – 1, a promising genotype identified in a farmer's field, recorded higher nut yield of 1.6 kg/ tree dry seed yield (at 7th year) and dry mace yield of 0.78 kg/ tree with mean dry seed weight of 8.55g and dry mace/seed 4.32 g, respectively.

Tamsuli-1: A bold nut selection short-listed for promising performance

New spices introduced

Salem variety of turmeric was introduced for evaluation. Seed spice namely Ajwain (Var. AA2) was introduced and preliminary observations indicated good scope for its cultivation in the agro-climatic conditions of Goa, thereby indicating the possibility of cultivation of this seed spice in *rabi* season in other coastal regions.

Project: Integrated strategies for crop improvement and organic production in cashew for coastal climate resilience

AR Desai, Manohara KK and Paramesha V

Collection, maintenance and evaluation of cashew germplasm

A total of 88 cashew germplasm accessions, consisting of the following characteristics are being maintained in the field germplasm bank.

Characteristics	No. of accessions
Jumbo nut types	10
Bold nut types	40
Medium nut and high yielders	13
High yielders/ cluster bearers	23
Dwarf canopy types	1
Very compact canopy type	1
Total germplasm collections	88

Results of evaluation of bold nut accessions led to the identification of an elite accession, Tudal – 1, which has been recording consistently promising performance, with nut yield of 8.88 kg/ tree, with a nut weight of 8.4g, 28.1% shelling and mean apple weight of 88.6g with 10.8 ° Brix T.S.S. It is short-listed for submitting the variety release proposal for cultivation in the state of Goa.

Bigger apples with bold nut of Tudal-1 selection

Hybridization and selection in Cashew

Evaluation of first set of cashew hybrid progeny resulted in short listing of two promising hybrid hybrids viz.- HB-21/05 and HB-27/05 which recorded raw nut yield of 11.88 kg/tree and 12.78 kg/tree, respectively, with 8.4 g and 7.6 g nut weight; 29.38 and 28.42% shelling during 2019 season. Mean apple weight of 88.6 g with 10.8 ° Brix T.S.S. was recorded in HB 21/05 as against the corresponding values of 76.4 g and 10.6 ° Brix T.S.S. in HB27/05. HB 21/05 has been short-listed for variety release proposal for cultivation in the state of Goa.

Bunch bearing trait and higher grade kernels (W210-240) of HB-21/05

Establishment of Jackfruit germplasm

Jackfruit germplasm with twenty-four varieties/ accessions from different coastal states and local Goan accessions have been established at ICAR-CCARI campus. Konkan prolific, BT-1, Lotulim-1, Rudrakshi red, Lalbaghmadhura, Gumless, Mankala red, Malaysian dwarf, Varshasree, Sadananda, Vietnam super early, Red moon, Sampigevarikka, Chempedekcheeni, 733 red, Ayurjack, Seedless, Ujjire, Golden Pearl, Prakash Chandra, Singapore, Tahiland Pink, Sindhura and Chippu grafts are planted in the germplasm in 8 × 8 m spacing.

Evaluation of jackfruit accessions

Twenty accessions of jackfruit flowered and came into fruiting stage during the year 2020-21 in ICAR-CCARI. Out of these, 11 were firm flesh type (AT1, AT2, BT1, BT2, BT3, CT2, CT6, CT8, CT10, CT11 and CT12, eight were soft flesh type (BT4, BT5, BT6, BT7, CT1, CT4, CT15 and CT16) and one was intermediate type (CT3). The highest number of fruits was recorded in CT4 (88 nos.) followed by BT3 (64 nos.) and BT1 (50 nos.). The highest tree yield was recorded in CT4 (390.16 kg) followed by BT1 (190.21 kg). Among all the accessions, AT2 had the highest mean bulb weight (50.94 g). Bulb length was the highest in BT2 (7.48 cm) followed by AT2 (7.36 cm). Bulb width was the highest in AT1 (8.87 cm) and thickness was the highest in AT2 (4.42 mm). BT1 has the highest seed weight (9.78 g).

Variability of jackfruit accessions of ICAR-CCARI, Goa

Collection of vegetable germplasm

Spine gourd (*Momordica* spp.) is one of the important dioecious cucurbits, yet it is an underutilized vegetable. Phenotypic variation was observed for its flower colour, fruit shape, fruit numbers, as its semi-perennial underground tubers sprouted on receipt of monsoon shower in Goa. Therefore, during July and August months of 2021, collection visits were made to tap the variability in the form of its tuberous roots.

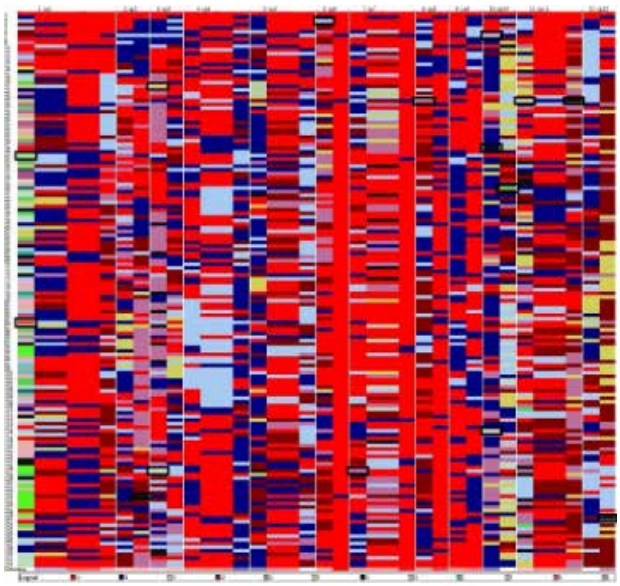
***Momordica dioica* germplasm collection**

Altogether, thirty-two collections were made consisting of sixteen male vine tuberous roots and sixteen female vine tuberous roots. Observations in the following season will help to remove duplicate collections if any. The collections were made from the locations with co-ordinates ranging from 15°30'N 73°55'E, altitude 06 m AMSL through 15°31'N 74°0'E, altitude 25.3 m AMSL and 15°29'N 74°5'E, altitude 60.4 m AMSL to 15°27'N 73°50'E, altitude 48.8 m AMSL. Collection also includes locations with inaccessible GPS coordinates due to internet anomalies.

Germplasm collection and conservation

The collection and maintenance of 200 germplasm of rice comprising of landraces, wild relatives and breeding lines have been continued. Molecular and morphological characterization studies were carried out to study the extent of variability present in the collection. Identified map of 200 germplasm using 34 SSR markers which revealed 14 unique identifiers which can help identify uniqueness of a variety.

Field view of rice germplasm



Identity map of 200 germplasm accessions depicting unique alleles

Screening and selection of rice lines for rainfed shallow lowland and water-logged conditions

***Kharif* 2021**

Five populations in different stages of advancement were screened under rainfed shallow lowland and water-logged conditions during *kharif* 2021 to identify promising lines with respect to grain yield, lodging resistance and plant type. The populations screened were Goa Dhan 3 × Jaddu Batta, Karjat 3 × KS 19-2, Goa Dhan 1 × CSR 27, Goa Dhan 1 × Jaya, Jaya × CSR 27. Out of the 928 lines screened, fifty-one lines were short-listed based on plant type, grain type, non-lodging etc., for further testing.

Populations	Stage	Population size	Number of lines short listed
Goa Dhan 3 × Jaddubatta	F6	112	2
Goa Dhan 1 × KS 19-2	F6	216	4
Goa Dhan 1 × CSR 27	F3	200	15
Goa Dhan 1 × Jaya	F3	200	10
Jaya × CSR 27	F3	200	20
	Total	**928**	**51**

***Rabi* 2021-22**

Multiplied seeds of short-listed 51 lines for testing under coastal salinity and rainfed shallow lowland situations during the *rabi* 2021-22.

Two highly promising entries in terms of plant type, grain type and duration

1. ABL 220 - Karjat 3 × KS 19-2
2. ABL 15 - Goa Dhan 1 × CSR 27

ABL 220 (Karjat 3 × KS 19-2)

ABL 15 (Goa Dhan 1 × CSR 27)
Field view of mapping populations

Hybridization and generation advancement in rice

Populations developed were advanced to next generation following single seed descent method

Kharif 2021

F_2	37 populations (more than 250 in each populations)
F_3	Goa Dhan 1 × Jaya Goa Dhan 1 × CSR 27 Jaya × CSR 27
F_6	Goa Dhan 3 × JadduBhatta (66) Karjat 3 × KS 19-2 (179)
F_9	Naveen × KS 19-2 (80) MTU 1010 × KS 16-1 (71) Pusa 44 × Goa Dhan 2 (65) Karjat 3 × Goa Dhan 2 (104)

Rabi 2021

F_3	21 Population
F_4	Goa Dhan 1 × Jaya (12 Selection) Goa Dhan 1 × CSR 27(11 Selection) Jaya × CSR 27(13 Selection)
F_7	Goa Dhan 3 × Jaddu Bhatta (02 selection) Karjat 3 × KS 19-2 (04 selection)

Field view of F3 populations

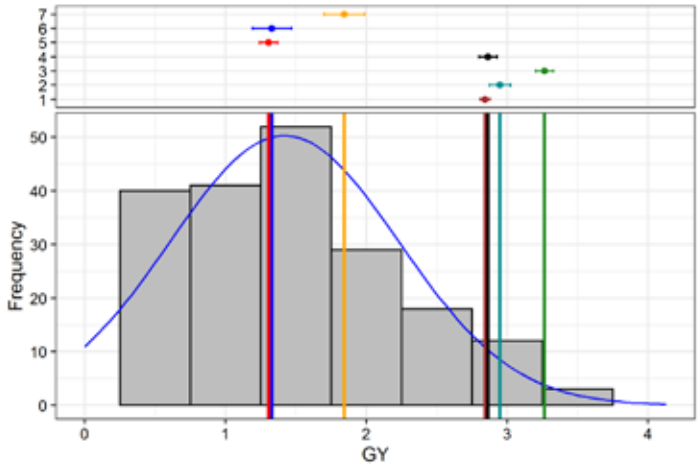
Evaluation of 303 3K panel lines under coastal salinity condition

303 lines from the 3K panel lines were evaluated under coastal salinity condition during the *kharif* season of 2021. The trials were laid out in an augmented RCBD design in three blocks. Final yield could not be recorded in 105 genotypes. The reason could be photosensitive nature of the genotypes or salt stress in the late maturing genotypes etc. Out of the remaining 198 genotypes, days to 50% flowering ranged from 71 days to 127 days, days to maturity ranged from 113 days to 148 days, plant height ranged from 78 cm to 184 cm, productive tillers per hill ranged from 3.57 to 14.79, panicle length ranged from 13.5 cm to 29.5 cm, gains per panicle ranged from 14 to 340, per cent fertility ranged from 19% to 99.18%. The genotype RMSAP 171 (4.08 t/ha) recorded the highest grain yield followed by genotype RMSAP 93 (3.56 t/ha) and Goa Dhan 2(3.31 t/ha).

Field view of 303 3k panel trial in Charao Island under natural coastal salinity conditions

Variability within the 303 3K panel lines of rice for 8 quantitative characters under natural saline (*Khazan)* stress area

Character	Mean	Std. Error	Std. Deviation	Min	Max	GCV	PCV	ECV	h^2	GA
DFF	95.27	0.81	11.54	71	127	11.62	12.25	3.86	90.04	21.68
DM	127.76	0.77	11.02	113.57	148.43	7.76	8.67	3.86	80.19	18.32
PH	132.32	1.5	21.53	78.36	184.2	15.58	16.08	3.94	93.98	41.24
NPT	8.21	0.13	1.9	3.57	14.79	13.71	22.45	17.79	37.26	1.42
PL	23.98	0.44	6.25	13.5	102.96	25.97	26.38	4.64	96.91	12.64
GP	94.34	2.54	36.37	14.96	340.8	34.75	37.62	14.43	85.3	62.46
PF	77.18	1.02	14.59	16.03	99.18	18.38	19.06	5.04	93	28.23
GY	1.42	0.06	0.81	0.12	4.13	55.21	56.38	11.41	95.9	1.58



Frequency distribution for grain yield in the 303 3K panel lines

Project: Assessment, management and designing improvement options for fisheries in selected low impacted estuaries along west coast of India

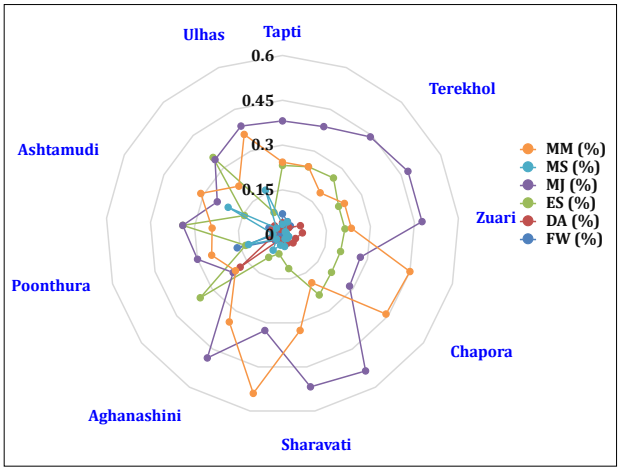
Sreekanth G B and Trivesh Mayekar

Fish community structures from a total of 23 estuaries from west coast of India were characterised. In total 224, 174, 197, 68, 65, 169, 102, 59, 80, and 51 species were collected from Zuari, Mandovi, Terekhol, Chapora, Sal, Kali, Aganashini, Sharavathi, Gangavali, Poonthura, estuaries respectively, aggregating 302 species. For rest of the four estuaries, data from primary and secondary information was used (Ashtamudi-147, Vembanad-122, Ulhas-61, Tapti-78, Narmada-96, Ponnani-112, Paravur-51, Chettuva-68, Talpona-56, Gangoli-78, Jaigad-132, and Galgibag-32). Fish productivity (tonnes km^{-2}) was highest in Aganashini (38.2) followed by Vembanad (23.9) while the lowest values were recorded from Ulhas (1.2), Chettuva and Galgibag (3.1). A total of 1.5 million ha of estuarine area along the Indian coast is used for fishing purposes and about 20% of the total fishermen population is engaged in fishing operations. The tidal range varies from 1 to 10.9 m.

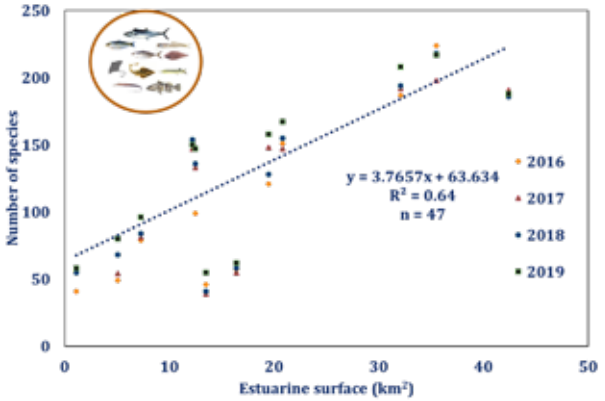
A total of 450 species are recorded from Indian estuaries with an estimated fish production is 0.7 lakh tonnes. The major species/ fish groups identified are - mullets, shrimps, silver-bellies, clupeids, bombay duck, catfishes, Hilsa, anchovies, pearlspot, glassy perchlets, silver-biddies, carangids, gobies, snappers, flatfish, groupers, tilapia, clams, oysters and mussels. The catch per unit of effort (kg per day's fishing) and net returns (income in rupees per

month) were the highest in Zuari (34.4, 23,190) estuary followed by Mandovi (26.5, 17013), while the lowest values were recorded for Ulhas (12.3, 9278), Narmada (12.5, 9279) and Tapti (13.9, 7731). In the overall composition of fish guilds, marine migrants and marine stragglers dominated the fish community structure followed by estuarine species (20%) and freshwater and diadromous types. The order of contribution of estuarine use guild followed marine juvenile (0.54-0.21%), marine migrants (0.54-0.19%), estuarine species (0.35-0.065%), marine stragglers (0.21-0.014%), diadromous species (0.18-2.0%) and freshwater species (0.16-0.01%).

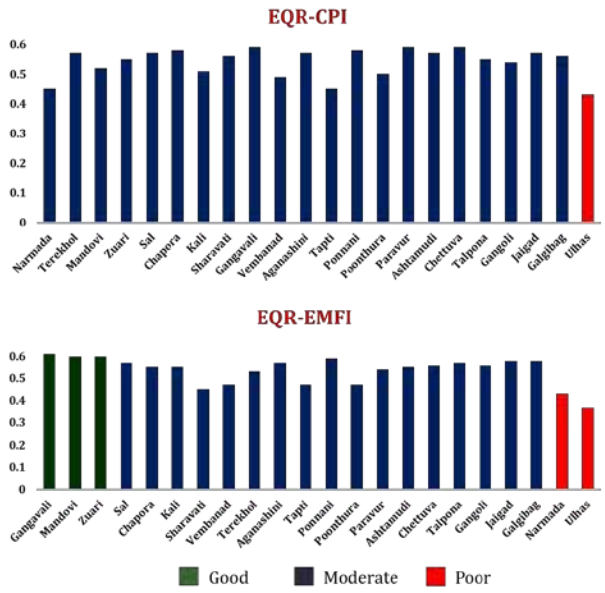
The fish community index was modified into an Estuarine Multi-metric fish index (EMFI) and both EMFI and Composite Pressure Index (CPI) were defined for the estuaries along west coast of India. Based on these indices, only three estuaries were identified with good ecological status (Gangavali, Mandovi and Zuari) and all others were moderate (17) and poor (Narmada and Ulhas). The seasonal abundance of finfish seeds was analysed across six estuaries (Zuari, Mandovi, Terekhol, Chettuva, and Kali) and the results showed the dominance of *Caran xignobilis, Mugil cephalus, Etroplus suratensis, Lutjanus argentimaculatus, Lates calcarifer, Epinephelus coioides, Lutjanus johni, Sillago sihama, Siganus javus,* and *Chelon parsia.* For all these species, the highest counts were observed during the post-monsoon season followed by pre-monsoon season. Ecosystem models were constructed using Ecopath approach to analyse the trophic network and ecosystem structure of Zuari, Mandovi, Terekhol and Ulhas estuaries. Based on ecological indices, Terekhol and Ulhas estuaries were classified as moderate to high impacted estuaries and Zuari and Mandovi as moderately impacted estuaries.



The fish guild composition of Indian west coast estuaries
(FW: freshwater, DA: Diadromous, ES: Estuarine, MJ: Marine juvenile, MS: Marine straggler, and MM: Marine migrant).



The relationship between number of fish species and estuarine surface area



The ecological quality ratios (EQRs) based on CPI and EMFI and the divisions of estuaries into ecological quality classes (Good, Moderate and Poor)

Project: Genetic variability of thermo-tolerance in selected breeds of livestock under coastal environment

Amiya Ranjan Sahu and and Gokuldas P P

Average rectal temperature (°F) observed during morning and afternoon of the day were 100.51±0.44 and 103.21±0.48 in ShwetaKapila cattle, 100.95±0.28 and 103.72±0.85 in AgondaGoan pigs; 100.29±0.55 and 102.62±0.67 in KonkanKanyal goats. Average respiration rate/ minute recorded during the morning and afternoon was18.92±0.64 and 27.19±0.84 in ShwetaKapila cattle, 34.11±0.62 and 47.37±0.75 in AgondaGoan pigs; 26.23±0.59 and 31.68±0.41 in KonkanKanyal goats. Designing of primers was done by Primer3 software for Heat Shock Protein genes (HSP70 and HSP90) and standardization of PCR amplification was done in gradient PCR for both the genes gene. PCR products of some of the amplified regions were sent for sequencing and results are awaited. The sample collection targeted different breeds of livestock species in coastal districts of different states was hampered due to COVID-19 pandemic.

Mega Project 3 : Development and validation of production technologies of crops of the coastal region

Project: Assessment of the properties of the coastal saline soils and development of integrated nutrient management practices and crop establishment methods for improving its productivity

G R Mahajan and R Ramesh

Improving the productivity and income through improved crop establishment and nutrient management practices of the salt-tolerant rice varieties (Goa Dhan 1, Goa Dhan 2 and Goa Dhan 3) under the salt-affected soils of the coastal region

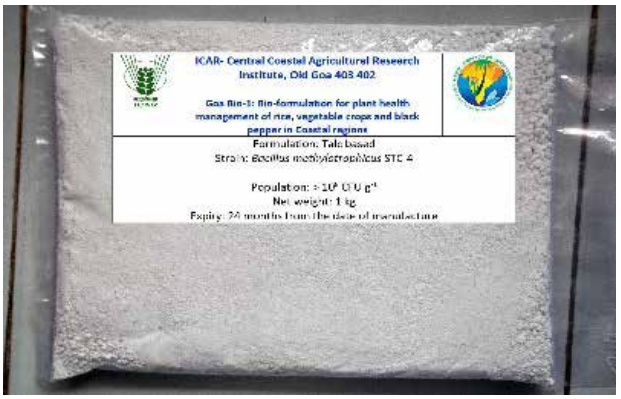
A two-year study was carried out to evaluate the effect of crop establishment methods and nutrient management in salt-tolerant rice varieties (Goa Dhan 1, Goa Dhan 2 and Goa Dhan 3) using a split-split-plot design. The nutrient management strategy was assigned as main plot, crop establishment method as sub-plot and varieties as sub-sub-plot. The effect of nutrient management strategy, crop establishment methods and variety were significant on the grain yield, straw yield, net income and benefit to cost ratio. A nutrient management strategy of using soil test-based fertilizer recommendation over modified blanket recommendation (120-30-00 kg $N:P_2O_5:K_2O$ ha^{-1}) recorded significantly higher grain and straw yield, net income and benefit to cost ratio compared to control (without nutrient management) and farmers' fertilizer practice. Significantly higher grain (2.92 t ha^{-1}), straw yield (4.62 t ha^{-1}), net income (Rs. 35276/ha) and benefit to cost ratio (2.09) were achieved after transplanting 35-days old Goa Bio-1 nursery treated seedling over the broadcasting method (2.41 t/ha, 3.08 t/ha, Rs. 28313/ha and 1.92). The variety, Goa Dhan 3, outperformed Goa Dhan 1 and Goa Dhan 2 with the highest grain yield (3.61 t/ha), net income (Rs. 49334/ha) and benefit to cost ratio (2.50), though the grain yield of Goa Dhan 1 and Goa Dhan 2 was at par but the performance with respect to net income and benefit to cost ratio the order was Goa Dhan 3 > Goa Dhan 2 > Goa Dhan 1. Thus, the practice of transplanting of 35-days old Goa Bio 1 nursery treated seedling of an improved salt-tolerant rice variety with soil test-based fertilizer recommendation or modified blanket fertilizer application has been identified to improve the productivity and income under coastal saline soils and can be recommended for salt-affected coastal paddy growing areas.

Improved crop establishment with Goa Bio-1 (a bio-formulation for plant growth promotion) in paddy cultivation under salt-affected soils of coastal regions for enhanced income and profitability

In salt-affected soils of the coastal region, productivity of paddy is very low. Apart from salinity stress, low soil biological activity, imbalanced use of fertilizers and poor crop establishment also reduce farmers' income. The farmers' practice in this region is of broadcasting germinated seeds but the plant population is generally sub-optimal due to initial salinity stress. Further, farmers usually undertake a blanket application of fertilizers. Considering these existing problems and practices, Goa Bio-1, a talc-based halo-tolerant plant growth-promoting rhizobacteria (PGPR) was developed for plant growth promotion under salt-affected coastal soils. Goa Bio-1 improves soil biological activity, crop establishment and plant growth

parameters and helps in nutrient mineralization, alleviation of salinity stress leading to higher yields. Improved crop establishment method for paddy cultivation involves seed treatment with Goa Bio-1 (@ 40 g/kg seed) followed by three to five days of imbibition and broadcasting the germinated seeds along with the application of 75% of the soil test-based fertilizer recommendation.

These improved practices for crop establishment and nutrient management were demonstrated under coastal saline soils as well as under normal soil conditions in an area of 29 hectares covering 35 farm families of Dulape village, Tiswadi, North Goa for two consecutive years. The net income from the farmers' practice was Rs. 32,862/ha whereas the improved practices yielded a net income of Rs. 45,275/ha, which amounted to an additional income of Rs. 12,413/ha, which is 38% higher than the farmers' practice. Goa Bio-1 is an eco-friendly, economically viable technology that is sustainable in the long term. The technology has the potential to generate an additional net income of about Rs. 22 crores by covering 18,000 hectares of coastal saline soils in the state of Goa alone. These successful demonstrations would encourage farmers in coastal regions to adopt these improved practices for boosting productivity, enhancing income levels and improving their livelihood security.



Experimental plot at Dulape village, Tiswadi, North Goa

Project: Study and the management of major diseases of vegetable crops in Coastal Regions

R Ramesh, R Maruthdurai and Ganesh Chaudhari

Evaluation of bacterial wilt-resistant brinjal varieties in glasshouse

Bacterial wilt-resistant brinjal varieties (Goa Brinjal-1, Goa Brinjal-2, Goa Brinjal-3, Goa Brinjal-4, Goa Brinjal-5 and Goa Brinjal-6), three promising green fruit type lines (5-8-1, 92-3-7 and 93-8-1) with other promising resistant lines were evaluated in a glasshouse for the incidence of bacterial wilt upon challenge inoculation. Incidence of wilt ranged from 20 to 70 % (Goa Brinjal-1); 33 to 47 % (Goa Brinjal-2); 0 to 8 % (Goa Brinjal-3); 20 to 47 % (Goa Brinjal-4); 0 to 20 % (Goa Brinjal-5); 0 to 8 % (Goa Brinjal-6). Wilt incidence was 0-13% among the three green fruit type lines.

Screening of *S. torvum* for bacterial wilt resistance

Seeds of *S. torvum* from two plant sources were used to screen them for bacterial wilt

resistance before using them as rootstock for making brinjal/ tomato grafts. Results from four experiments indicated that *S. torvum* plants did not wilt when inoculated with *R. solanacearum* with or without root injury. However, 100 per cent plants of *Agassaim* wilted within 21 days. Hence, it is concluded that *S. torvum* from both plant sources can be used as rootstock for bacterial wilt management.

Field evaluation of bacterial wilt-resistant varieties

Released bacterial wilt-resistant brinjal varieties (Goa Brinjal-1, Goa Brinjal-2, Goa Brinjal-3, Goa Brinjal-4, Goa Brinjal-5 and Goa Brinjal-6) and three promising green fruit type lines (5-8-1, 92-3-7 and 93-8-1) are being evaluated along with susceptible local cultivars (*Agassaim* and *Taligao*) in the field. The experiment is in progress.

Field evaluation of eco-friendly chemicals/ inducers on chilli viral disease complex

Field trial was conducted with microbial insecticide (Spinosad), antagonistic bacterium (*B. methylotrophicus* RCh6-2b), entomophagous fungus (*Isariatenuipes* RSP-2) and resistant inducing chemicals on chilli virus disease complex. Treatments were given from nursery stage and continued till 60 days after planting. Two chilli hybrids (VNR 332 and Arka Meghana were planted.

VNR 332: Percent disease index (PDI) of virus infection was comparatively less in Spinosad, Rch6-2b, *I. tenuipes* and chitosan treatments over a period of 140 days after planting. Total fruit yield was higher in Spinosad (56.6 t/ha), Rch6-2b (42.6 t/ha), insecticide treatments (40.1 t/ha). Percentage increase in yield ranged from 21.0 (Chitosan 50 ppm) to 84.9 (Spinosad 0.03%).

Arka Meghana: Percent disease index (PDI) of virus infection was comparatively less in Rch6-2b, *I. tenuipes* Spinosad and chitosan treatments over a period of 140 days after planting. Total fruit yield was higher in plots treated with insecticide (31.5 t/ha), Chitosan 500 ppm (28.0 t/ha), Spinosad (27.5 t/ha), and Rch6-2b (27.1 t/ha). Percentage increase in yield (among non-insecticide treatments), ranged from 36.3 (*I. tenuipes*) to 44.1 (Chitosan 500 ppm). Results of two years of study indicated that total fruit yield was higher in Spinosad (40.5 t/ha), Rch6-2b (34.4 t/ha), insecticide treatments (33.9 t/ha) and chitosan 50 ppm (32.1 t/ha) treatments. Percentage increase in yield ranged from 21.2 (Chitosan 500 ppm) to 52.5 (Spinosad 0.03%).

Detection and diagnostics of plant pathogens, antibiotics producing genes from bio-agents

Diagnosis of bacterial wilt and black leg diseases in potato

Potato crop introduced in Goa (during 2021) started wilting after 45-60 days of planting. Observations indicated two distinct types of symptoms. In one case presence of black lesions in stem region, rotting tissue beneath and subsequent wilting of plants indicated symptoms of black leg disease. In the other case, just wilting of plants without any lesions on stem etc., were noticed indicating the symptoms of bacterial wilt. Infected plant samples taken from fields indicated that black leg was present in all the samples. Bacterial wilt was present from the samples collected from four places. Identification and confirmation of bacterial wilt pathogen *Ralstonia solanacearum* have been completed. Identification of bacteria associated with black leg disease is in progress.

Differentiation of species of Klebsiella variicola, a plant pathogen from K. pneumoniae and K. quasipneumoniae by PCR

Three forward primers specific to each species and a common reverse primer were used. Different *K. variicola* isolates were tested using all three primer pairs. A specific 485bp amplicon was amplified only with the *K. variicola* specific primer. No amplification (995bp) was observed with *K. pneumonia* specific primer. However, many non-specific amplification (expected 348bp) was observed with *K. quasipneumoniae* specific primer.

Detecting antibiotics producing genes from bio-agents

B. methylotrophicus RCh6-2b, *B. methylotrophicus* STC-4, *Bacillus* sp RP-7 and *Bacillus* sp XB177 were screened for the presence of antibiotics-producing genes by PCR. Iturin, Surfactin, Bacillomycin and Fengycin genes were screened in the first phase. Results indicated that RCh6-2b, STC-4 and RP-7 were positive for Iturin A and Iturin D genes and negative for other antibiotic-producing genes.

Production of talc formulation of bio-control agents for various experiments and field trials

Talc-based formulation of *Trichoderma* (260 kg) was produced and sold to farmers and state agriculture department and used in various experiments and field trials. Bacterial antagonists (440 kg of Goa Bio-1 and Goa Bio-2; 1000 capsules) were produced and given to farmers of Goa under STC, Institute and NABARD projects. Further, the bio-agents were used in demonstration plots to treat black pepper plants for management of foot rot and plant health management experiments of chilli and paddy.

Project: Studies on emerging insect pests white flies, fall armyworm and their management in coastal region of India.

R Maruthadurai and R Ramesh

Occurrence of exotic white flies and their natural enemies in coconut-based cropping system

Sampling of exotic whiteflies in coconut-based plantations revealed the presence of two invasive species viz., rugose spiralling whitefly (RSW) *Aleurodicus rugioperculatus* Martin, and Bondars nesting whitefly *Paraleyrodes bondari*. Both the population of white flies were co-existing and were observed to be damaging coconut and other horticultural crops. The population of *P. bondari* was higher in comparison to *A. rugioperculatus*. Moderate to severe incidences of both the whiteflies were recorded in coconut. Whiteflies populations were monitored with instalment of yellow stick traps. An average of 23 adults of whitefly were attracted per trap. Besides coconut, whiteflies infestation and its colonies were recorded on banana, guava, cashew, areca nut, triandra palm, mango, black pepper, heliconia, papaya, citrus, avocado, chafa, maize and Indian shot. The predominant natural enemies seen to be feeding on whitefly population were predator *Mallada boninensis* Okamoto and parasitoid *Encarsia guadeloupae*Viggiani.

Paraleyrodes bondari affected leaf of coconut

Geographical distribution of rugose spiralling whitefly (*Aleurodicus rugioperculatus*)

Rugose spiraling whitefly (RSW), *Aleurodicus rugioperculatus* Martin (Hemiptera: Aleyrodidae) is a recent invasive pest in India causing widespread damage to coconut and other horticultural crops. This study aims to predict the potential geographical distribution of RSW under present and future climate change scenarios with 19 bioclimatic variables through Maximum Entropy (MaxEnt) niche modelling. The MaxEnt model performed significantly better than random predictions. The bioclimatic suitability map of RSW distribution under current and future climate scenarios indicates that the infection is highly concentrated in the entire coastal and southern states of India.

Damage incidence of fall armyworm Spodoptera frugiperda on fodder maize and their natural enemies

Fall armyworm (FAW), *Spodoptera frugiperda* (J.E. Smith) is a highly destructive insect pest of several crop plants. FAW infestation on fodder maize was recorded, which indicated that more infestation in the vegetative stage than the reproductive stage. Generalist predators like earwig, spiders, reduviid bug, pentatomid bug, rove beetle, coccinellids and predatory wasps were found predating on various stages of fall armyworm. Five larval parasitoids viz., *Campoletis chlorideae*, *Glyptapanteles* spp, *Chelonus formosanus*, *Exorista sorbillans* and *Megaselia scalaris* were recorded on FAW larvae. Egg parasitoids i.e., *Telenomus* spp and *Trichogramma* spp were observed to be parasitizing the eggs. Rove beetle *Paederus fuscipes* Curtis (Coleoptera: Staphylinidae) is a generalist predator found predating on FAW larvae. Adult rove beetle population varied between both in vegetative and reproductive phases of the crop. The *Spodoptera frugiperda* NucleoPolyhedro Virus (SpfrNPV) infected fall army warm larvae were also recorded in fodder maize fields.

Fungus infected FAW larva

Reduviid bug on maize

Effect of intercropping system for the management of fall armyworm

A field trial was undertaken to study the effect of different intercrops for the management of fall armyworm. Fodder maize (Var. African Tall) was sown with intercrops like cowpea, green gram, ground nut and red gram. Weekly observations were recorded on number larvae/plant, presence of natural enemies and per cent damage. All the intercrops with maize have registered less per cent damage by FAW and higher green fodder yield as compared to sole crop. Higher activities of natural enemies were recorded in plots of maize with intercrops than in sole crop.

(a) (b) (c)

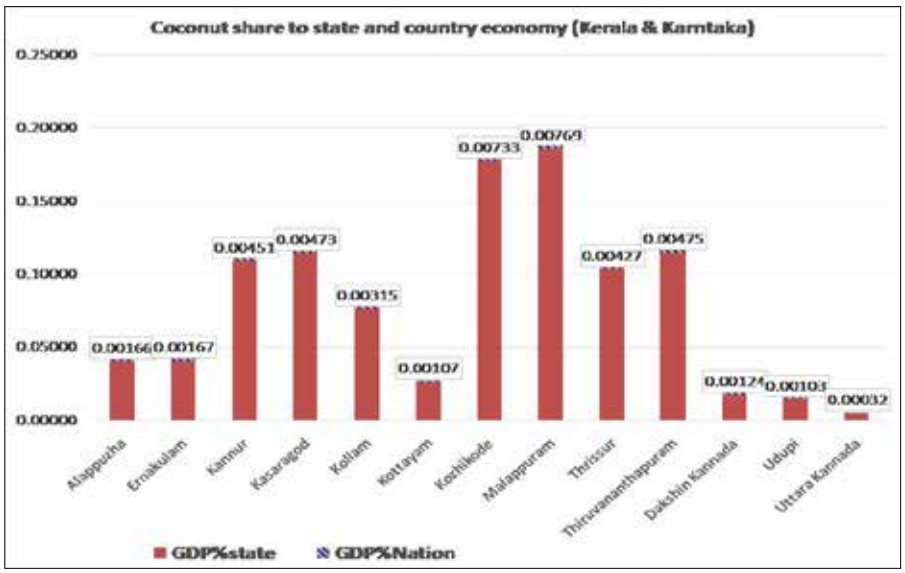
Fodder maize with intercrops of (a) cowpea (b) green gram (c) groundnut

Cultivation of palms forms a major livelihood option of coastal farming communities of India. The study explores the area under palms, production, productivity, economic dependence, utilisation activities, employment generation and livelihood security of people depending on cultivation and utilisation of selected palm species in each of the 73 coastal districts. Secondary data was collected on area, production, productivity, price, value of output over the past 17 years which were compiled for each coastal district where one or more cultivated palms are grown. Total geographical areas, population figures of each coastal district, along with GDP of the coastal state/UT and of the country were also collected. Based on these, per cent area of cultivation to total geographical area, per cent contribution of the crop in the district to total GDP of the state /country were worked out. Annual growth rate, compound growth rate was worked out for area, production, value of output for each district. Major coconut-growing coastal districts of Kerala and Karnataka with significant contribution (more than 0.0045% to state or 0.00032% to National GDP) to the economy have been identified.

An online survey was conducted to assess the priorities of coconut in coastal districts. Review of coconut-based cropping systems was conducted. Meta-analysis of banana as intercrop in coconut and areca gardens and other perennial agroforestry systems was conducted using global literature from 1966 to 2019.

About 72 fruits representing 16 genotypes including local tall populations of Goa state (Benaulim, Calangute, Rivona, Canacona, Gaodongri) and dwarf varieties (Malayan Yellow Dwarf, Chowghat Orange Dwarf, and Gangabondom Green Dwarf), and one Dwarf × Tall hybrid formed the material. Fruit shape, length, breadth, weight of fruit, endosperm thickness, nut water volume, cavity volume, shell thickness, shell weight, dry endosperm weight and dry endosperm thickness were recorded. Image analysis of fruit samples was attempted using Shape, Fiji software. Six traits of 20 seedlings each of each variety were recorded from one-year-old seedlings. Euclidean distances were worked out between coconut varieties using fruit or seedling traits. Distance matrices for foliar traits, floral traits and geographical distances were compared using Mantel's correlation test using the zt software. Results indicated that the surface area of a dehusked nut was positively correlated to dry endosperm weight (0.78) and whole fruit weight (0.86). Surface area of whole and dehusked fruit recorded high eigenvector in PCA. Morphological distance of populations based on fruit surface area and de-husked nut surface area were positively correlated (0.68).

A local arecanut variety with unique large fruit size trait which had won the Limca book of World Records with bold fruits



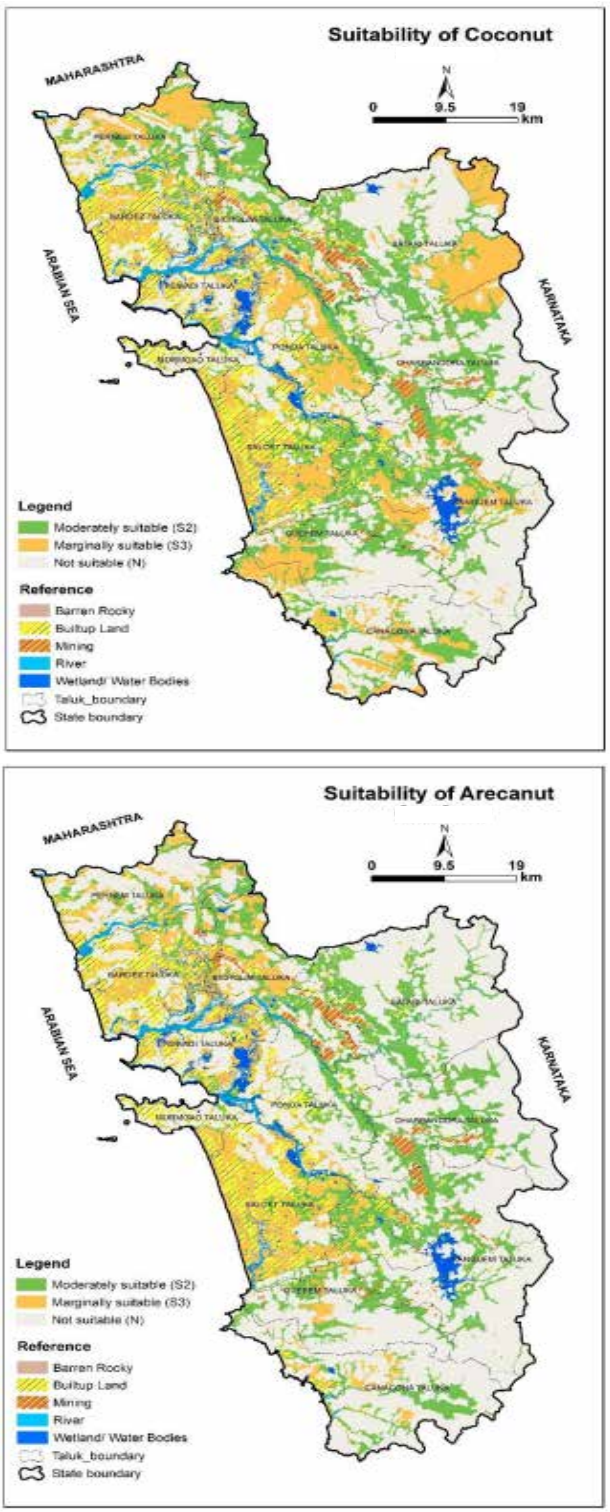
Contribution of coconut cultivation in coastal districts to the economy of Kerala, Karnataka

(5.3 to 6.01 cm long, 4.27 cm to 5.02 cm wide, weight 36.5 to 56.43 g) and dry kernel weight / chali (10.5-11.6 g/fruit) was collected from Mr. Subhramanya Bhat, Kudavalli, Kumta, Uttara Kannada district was characterised and seedlings were raised for conservation and DUS testing.

Study was conducted on five cultivars of date palm namely- Bumaan, Fard, Barhi, Qyno and Zahidi using market samples. Fruit data was recorded from 10 fruits of Barhi dates and 15 fruits of Bumaan dates. Seed data were recorded from 60 seeds of each cultivar (Bumaan, Fard, Barhi, Qyno and Zahidi). Physical characteristics of the length, breadth, thickness, and weight of both fruits and seeds were measured. Gini coefficient for seed traits in five date palm varieties varied from 0.101 for seed length to 0.157 for seed width. Shannon Weaver›s index of diversity values for the seed traits indicated seed length was uniform (0.00) in Bumaan, yellow date of Gujarat, whereas high diversity (0.69) was seen in Red dates of Gujarat.

About 27 (12 quantitative and 15 qualitative traits) morphological traits were recorded on 89 leaves of 66 seedlings of date palm of one-year-old during August 2021. Leaf data was recorded from the 2nd and 3rd leaf of the seedlings. Observations from 7 seedlings of Bumaan, 15 seedlings of Fard, 7 seedlings of Barhi, 22 seedlings of Qyno and 15 seedlings of Zahidi were recorded. Photographs of fruits, seeds, and seedlings were taken to perform image analysis.

Soil resource maps of coastal states/UTs were procured from ICAR-NBSSLUP, Nagpur and the scanning of the images was completed. Land suitability maps for coconut and arecanut crops for Goa have been developed. The land suitability mapping of coconut and arecanut for Goa was taken up using the following criteria - soil depth, slope, rooting depth, drainage, water table depth and soil nutrients. Moderately suitable land for coconut and arecanut in Goa is 75,622 ha and 65,638 ha, respectively, while marginally suitable land for coconut and arecanut is 75,181 ha and 40,491 ha respectively. The actual area under coconut and arecanut is 25,000 ha and 1,150 ha, respectively. Hence, there is a huge area available for taking up cultivation of coconut and areca nut in moderately suitable areas within the state and which can be taken up with appropriate management practices.



Map indicating the area suitable for the cultivation of coconut and areca nut in the state of Goa

Project: Identification of edaphic and climate factors affecting mango production in coastal region and its management

Maneesha SR, AR Desai, SK Singh and Bappa Das

Biometric parameters of 20-year-old Amrapali (V1), Alphonso (V2), Kesar (V3) and Mankurad (V4) mango trees were evaluated for growth parameters and it was observed that trunk girth was significantly different among the varieties and Alphonso variety had the highest trunk girth (90 cm). Number of shoots per branch was more than 10 in all varieties except Amrapali. Leaf length of Kesar (27.15 cm) was significantly higher than the other varieties. Number of secondary veins too significantly differed among the varieties and it was seen that Alphonso had the highest number of secondary veins in the leaf (49.18) which was at par with Mankurad (49.01) and Kesar (47.35). Chlorophyll 'a' content was the highest in Amrapali (1.81 mg/ 100 g) and chlorophyll 'b' content was the highest in Mankurad (3.14 mg/ 100 g) which was at par with Alphonso (2.96 mg/ 100g and Kesar (3.03 mg/ 100g). Total chlorophyll content and leaf carotenoid content had no significant differences among the varieties during the vegetative stage. Relative water content was the highest in Amrapali (76.58%) and Mankurad (72.54%) during the vegetative stage.

During the flowering stage, Alphonso had the highest chlorophyll 'a'content (2.02 mg/ 100 g) which was at par with Amrapali and Mankurad. Chlorophyll 'b' was also highest in Alphonso (1.21 mg/ 100 g) in flowering stage. Total chlorophyll was the highest in Alphonso (3.33 mg/ 100 g) which was at par with Mankurad (2.82 mg/ 100 g). Leaf carotenoid content was 1.18 mg/ 100 g (Alphonso) which was at par with Amrapali and Mankurad. Relative water content was the highest in Amrapali (69.59%) which was at par with Alphonso (64.96%) and Kesar (64.79%). In the year 2021, flowering in mango was sparse and very few panicles emerged in the selected mango trees. There was no significant difference in number of panicle, flowering intensity, panicle length, panicle width, number of branches in the panicle and number of male flowers among the four varieties. But there was significant difference in number of bisexual or hermaphrodite flowers and flower sex ratio. Mankurad had the highest number of hermaphrodite flowers (10.295) and flower sex ratio (1.322).

Plant physiological parameters of mango varieties at vegetative and flowering stage in the year 2021

Parameters	Vegetative stage				CD (0.05)
	Amrapali	Alphonso	Kesar	Mankurad	
Chlorophyll a (mg/ 100g)	1.81^{a}	0.38^{b}	0.33^{b}	0.27^{b}	0.19
Chlorophyll b (mg/ 100 g)	0.81^{b}	2.96^{a}	3.03^{a}	3.14^{a}	0.65
Total chlorophyll (mg/ 100g)	2.69	3.39	3.51	3.45	NS
Chlorophyll a/ b	2.35^{a}	0.12^{b}	0.11^{b}	0.08^{b}	0.32
Leaf carotenoid content (mg/ 100 g)	0.87	0.79	0.92	0.8	NS
Relative water content (%)	76.58^{a}	49.10^{b}	54.43^{b}	72.54^{a}	14.31
Parameters	**Flowering stage**				**CD (0.05)**
	Amrapali	**Alphonso**	**Kesar**	**Mankurad**	
Chlorophyll a (mg/ 100g)	1.75^{a}	2.02^{a}	1.36^{b}	1.90^{a}	0.31
Chlorophyll b (mg/ 100 g)	0.82^{ab}	1.21^{a}	0.55^{b}	0.84^{ab}	0.44
Total chlorophyll (mg/ 100g)	2.64^{ab}	3.33^{a}	1.98^{b}	2.82^{a}	0.73
Chlorophyll a/ b	2.27	1.89	2.62	2.34	NS
Leaf carotenoid content (mg/ 100 g)	1.11^{a}	1.18^{a}	0.82^{b}	1.06^{a}	0.18
Relative water content (%)	69.59^{a}	64.96^{a}	64.79^{a}	51.69^{b}	11.62

Superscript values a, b, c, ab, bc, abc etc. given in the table is the ascending order of mean values.

Amrapali

Alphonso

Kesar

Mankurad

Flowering development in mango trees during March 2021

Project: Assessment and strengthening of vegetable production in coastal region through acquisition, utilization of local germplasm and strategic introduction of commercial vegetables

Chaudhari GV, AR Desai, R Ramesh, Maruthadurai R and Shripad Bhat

The Indian coastal conditions with its characteristic climatic and soil conditions offer a wide range of rich horticultural options and these occupy a sizable area. The richness of options, however, has not been fully realized due to comparatively less area under vegetable cultivation in the coastal region. It is crucial therefore to compile the area and production data of vegetable crops under coastal districts to assess the coastal vegetable status. Moreover, a good diversity of vegetable germplasm can be acquired from coastal regions to utilize in the future. Important vegetable crops, as well as potential vegetable varieties, can be evaluated for their suitability under coastal conditions to enrich the vegetable basket of the coast.

Strategic introduction of commercial vegetables

Varieties or hybrids of four different vegetables were selected for their field evaluation, primarily under Goa conditions. Cauliflower and Potato varietal/hybrid evaluation trials were also planted in '*Verlem*' and '*Saljini*' respectively under South Goa district. All these trials are currently being executed.

Potato (*Solanum tuberosum*)

Cauliflower (*Brassica oleracea* var. botrytis)

Chilli (*Capsicum annum*)

Muskmelon (*Cucumis melo*)

Varietal/hybrid evaluation trials in different vegetable crops

List of varieties/hybrids being evaluated in different vegetable crops

Varietal / Hybrid				
no.	**Potato**	**Cauliflower**	**Muskmelon**	**Chilli**
1	Kufri Kiran	Amazing*	Arka Sirsi	Co-I**
2	Kufri Lima	Pusa Ash-wini	Kesar*	Arka Haritha
3 Kufri Pukhraj		Pusa Kartiki	Lyallpur 257*	Arka Khyati
4	Kufri Surya	Pusa Meghna	Sugar sum-mer*	Arka Meghana
5	Kufri Thar -1	Pusa Sharad	NMMH-24*	Arka Swetha
6	-	-	IN-DAM-MH38*	-
7	-	-	NS 7455*	-
Seed Source	ICAR - CPRI	ICAR-IARI	ICAR-IIHR	IC-AR-IIHR

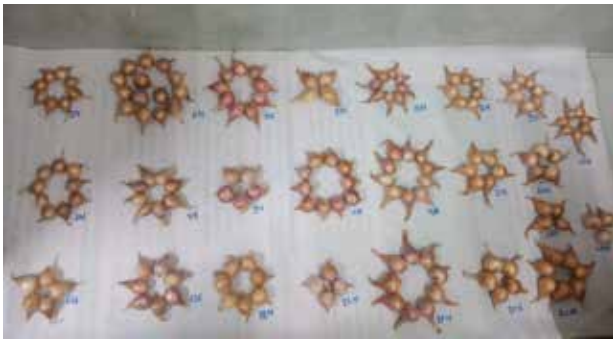
*Private Sector and ** TNAU

Economics of coconut-based multi-species cropping system

This system spread over 0.5 ha has more than 10 crop components along with a poultry component contributing to the total returns at different time intervals, thereby imparting continuous flow of income. Production of planting material is also an added activity that contributes to total returns. Besides this, the entire system will ensure nutritional security by providing nutritive food to a family. Gross income from the above system was Rs. 2,17,609/- against the total cost of cultivation (COC) of Rs. 107388/- resulting in a net income of Rs.110221/- during 2020-21. Crops and crop residues contributed 53.0 and 13.2 % of income, while poultry component contributed 33.8 % to the total income.

Production, economic analysis and energy analysis of coconut-based multi-species cropping system

Particulars	Production	Income (Rs.)
Coconut	2880 nos.	35,997.00
Coconut leaf	697 nos.	2788.00
Coconut (copra)	1 kg	140.00
Nutmeg mace	5.675 kg	4540.00
Nutmeg seed	48.2 kg	28920.00
Nutmeg taffy	28.7 kg	14350.00
Nutmeg mouth freshner	0.52 kg	208.00
Nutmeg soda	4 bottles	60.00
Papaya fruit	25.8 kg	387.00
Banana	217.5 kg	6525.00
Banana leaves	290 nos.	145.00
Tarvatti chilli	1.4 kg	560.00
Chekkurmanis leafy vegetable	62.35 kg	1247.00
Eggs	4343 nos.	43430.00
Sale of birds	30 nos.	9000.00
Manure		2746.00
Sale of planting materials		66567.00
Gross returns		217609.50
Production economics of coconut based multi-species cropping system		
Cost of cultivation (COC)		107388.00
Net returns		110221.50
Energy analysis of coconut based multi-species cropping system		
Energy input		18280 MJ/ ha
Energy output		67707 MJ/ ha
Energy efficiency		3.70



Local onions (*Gawatikanda*) market collection

Vigorous root emergence post-treatment in local onion- (*Gawatikanda*)

Pilot study on local onion (Allium cepa) 'Gawatikanda'

Local onions (*Allium cepa*), with light colour, thin tunic, around or less than 2.5 cm bulb diameter is locally referred to as '*Gawatikanda*' in Goa. As per common knowledge, they have better storability a trait attributed to good dormancy. Market collections of the *Gawatikanda* were made and attempts were targeted to break the dormancy of freshly harvested onions by employing different treatments. It was observed that under dark conditions exposure of bulbs to cold temperature (< 10°C) for 9 to 10 days (216 hrs to 240 hrs) followed by tap-water soaking of bulb root-disk for 1 to 2 days under room conditions helps to break partial-dormancy of onion bulbs as is evident by production of vigorous root emergence.

Further lowering of temperature can be explored along with accordingly reduction in bulb exposure time to cold temperature to reduce the time required for root emergence. This information can help in attempting annualization of seed-to-seed cycle in onion which otherwise demands two years.

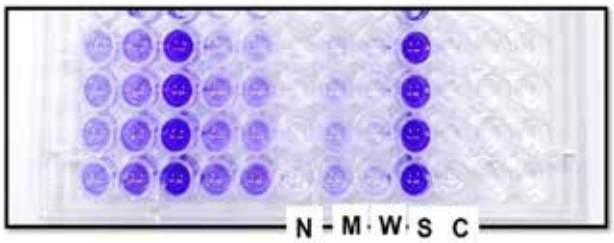
Mega Project 4 : Development and validation of production technologies of livestock and fisheries

Project: Prevalence, impact and management of the economically important diseases of dairy animals in coastal India

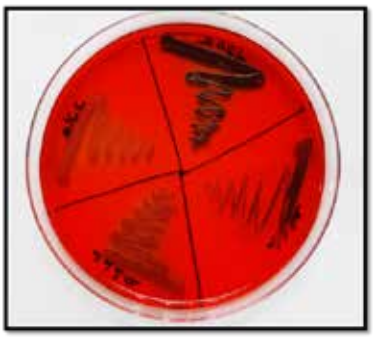
Susitha Rajkumar and Shivasharanappa N

Species identification of Coagulase negative *Staphylococci* from bovine subclinical mastitis and study of its virulence properties

Mastitis including clinical and subclinical mastitis (SCM) is an important disease of dairy animals. Species identification of the most prevalent pathogen group Coagulase negative *Staphylococci* (CNS) isolates (15 No) was carried out by biochemical tests and NCBI BLAST analysis of *16srRNA* gene sequence. Identified species were *S. chromogenes, S. cohnii, S. epidermidis, S. sciuri, S. warneri, S. haemolyticus, S. simulans, S. saprophyticus, S. hominis* and *S. pasteuri.* Slime production and biofilm formation are important virulence properties of *Staphylococcus* which help the bacteria to persist in animal tissue and offer protection against antibiotics and disinfectants. The CNS isolates were screened for slime production based on colony characteristics on Congo Red Agar and biofilm formation by tissue culture plate biofilm assay using Crystal Violet and also screened for the presence of biofilm-associated genes *icaA*and *icaD.* The Crystal Violet assay showed that 52.72%, 25.45%, and 12.72% of the CNS isolates were strong, moderate and weak biofilm producers, respectively and among the biofilm producers 23.91 and 21.73% were positive for *Ica*A and *Ica*D genes and 8.69% had both the genes which are associated with biofilm production. Growth on Congo Red agar showed 9% of the CNS isolates are slime producers. The study shows high prevalence of virulent CNS isolates in samples from subclinical mastitis in coastal region.



TCP biofilm assay showing strong, medium and weak biofilm producing CNS isolates



CRA agar plate showing black coloured colonies of slime producing CNS

Isolation of yeast pathogen from clinical mastitis and study of the antibiotic resistance profile

A total of 40 milk samples were collected from cows affected with clinical mastitis and were unresponsive to antibiotic treatment. Isolation of bacteria and fungus was attempted.

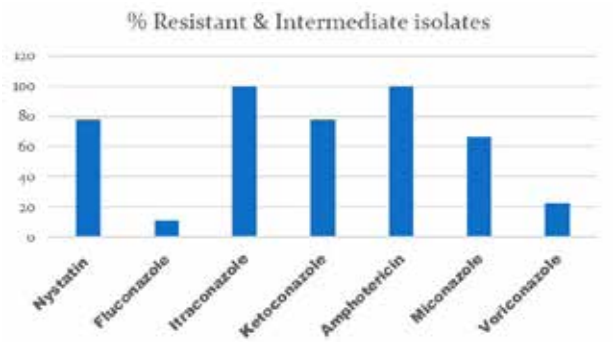


Figure showing percent resistance and intermediate isolates for different antifungal antibiotics

Yeast could be isolated from 12 milk samples. Species identification using biochemical test identified 5 species *Candida tropicalis, C. famata, C. lipolyttica, C. rugosa*and *C. pintolopsii.* The isolates were subjected to antibiotic susceptibility test by Kirby Bauer disc diffusion test on Meuller Hinton agar which showed high resistance against antifungal antibiotics. The percent of *Candida* isolates resistant against various antibiotics resistance are mentioned in figure. Fluconazole showed the least resistance followed by voriconazole.

Project: Augmenting backyard poultry production through technological interventions in breeding, feeding and management aspects pertaining to Indian West coast

Nibedita Nayak, Gokuldas PP, Susitha Rajkumar, Amiya Ranjan Sahu and Monica Singh

To reduce the cost of feed, various technological interventions in feeding were carried out such as - modification of feeding system (scavenging + supplement), inclusion of unconventional feed (like azolla, BSFL, breadcrumbs, broken rice etc.), and preparing own feed with locally available feedstuffs (Maize-60 parts, Soyabean Meal-17, Groundnut Cake-3, De Oiled Rice Bran-10, Shell Grit-8, DCP-0.8, Salt-0.5. Vit Mix:0.05 and Trace Minerals-0.1). Breeding problems in field were addressed by following the strategies like culling of uneconomical birds, mating of selected stocks with proper ratio, management of breeders and proper collection of semen from elite males and inseminating the selected hens artificially. Awareness about vaccination and biosecurity measures (cleaning and disinfection) in poultry farms were provided to farmers for healthy flock management. Summer and winter management of poultry birds, housing for heavy rainfall areas was demonstrated for effective stress and optimum production management in poultry. Training of available manpower was conducted through collaboration with KVKs and Central poultry development organization (CPDO), Mumbai. Backyard poultry farmers of Uttar Kannada formed a Co-operatives (PRIMCO-OP) and branded their egg in name of "BANDAL GHAT NATI KOLI" and getting reasonable prices for their produce. A feeding trial was conducted in early chick period from 0-6 weeks in CARI-Debendra (30×3) backyard variety with herbal supplement named Phytogen X1 and its effect on haematological and biochemical parameters was studied. The feeding formula followed was from nutrient requirements of poultry by ICAR, 2013. Numerical difference in various parameters is presented in Table 1 and Table 2 between control and treatment group.

Effect of herbal supplement on haematological parameters in early chick period (0-6 wks) raised in backyard (var. CARI-Debendra)

Treatment	Hb (g/dl)	WBC cmm	RBC (million/ cmm)	PCV (%)	Neutrophils (%)	Eosinophils (%)	Platelet
Control	14.17	72225	13250	2.40	27.25	41.25	0.5
Herbal Supplements	14.47	76125	15500	2.39	27.5	32.5	0.5

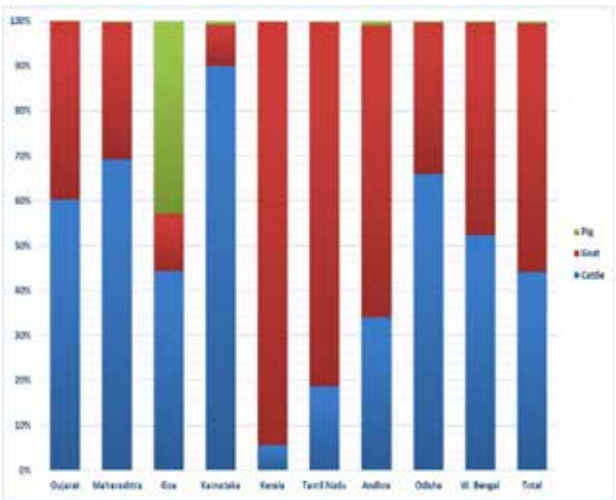
Effect of herbal supplement on biochemical parameters in early chick period (0-6 wks) raised in backyard (var. CARI-Debendra)

Treatment	Cholesterol (mg)	LDH (IU/L)	Creatinine Phosphokinase (IU/L)	Sodium (mmol/L)	Potassium (mmol/L)	Chloride (mmol/L)
Control	134.66	1706.9	2060	152.68	8.65	141.83
Herbal Supplements	101	1331.5	1504	148.74	9.66	99.99

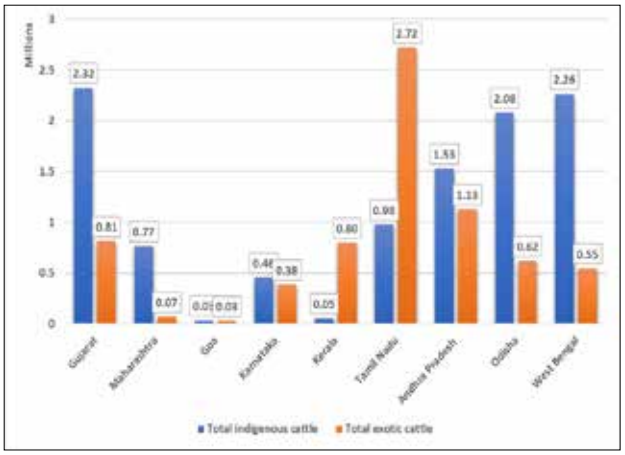
Project: Conservation of major farm animal resources in the coastal region through evaluation of seminal traits, semen processing and preservation protocols

Gokuldas PP and Amiya R. Sahu

In this project, primary and secondary data along with information on livestock resources of coastal region from the latest livestock census were collected and status report on indigenous farm animal genetic resources of the coastal region was prepared. Coastal region possesses 19.5% of the population of total Indian livestock and is of vital importance in generating additional employment opportunities and supplemental income for small and marginal farmers. Data collected across nine states shows significant changes in different indigenous livestock population. Cattle breeds in the region represent 26.32% of the total Indian breeds. As per the 20th livestock census (2019), total number of cattle in India is 192.49 million showing an increase of 0.8% over previous census but, there is a decline of 6% in total Indigenous population over the previous Census (2012). The indigenous and non-descript cattle population in the coastal region is 7.8 million. About 32.23% of the total livestock in the region is contributed by goats and total population estimated was 13.10 million. Out of 0.23 million pig population in the region, total indigenous population accounts for 59.75% and there is also a decline of 8.66% in the total indigenous pig population over the previous census.



Indigenous livestock population in the coastal region

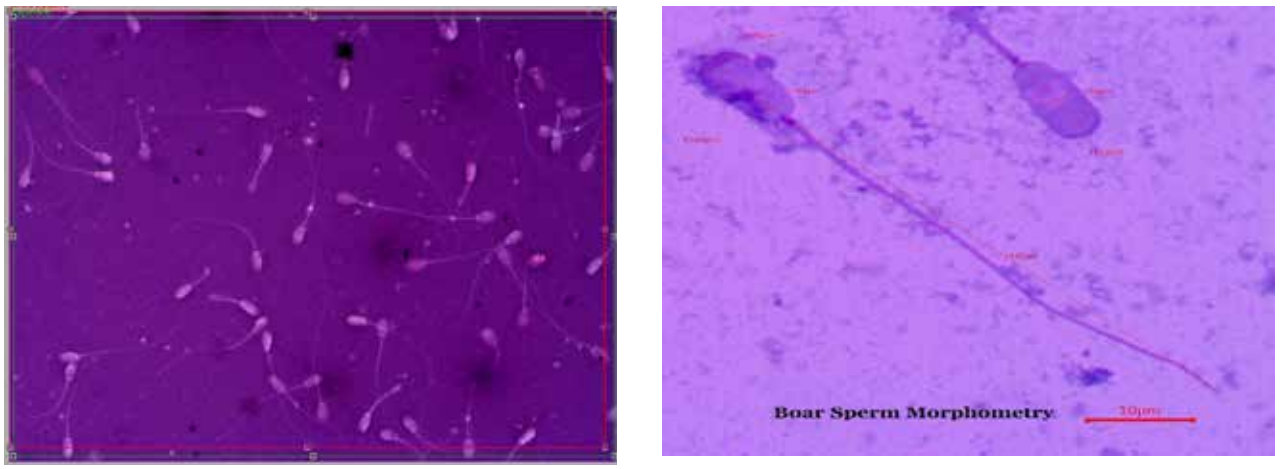


Indigenous and exotic cattle population in the coastal region

Evaluation of male reproductive function was performed through preliminary breeding soundness examination in indigenous ShwetaKapila breed of cattle. In addition to routine examination, procedures for bull priming and training for semen collection and colour doppler ultra-sonographic imaging for morphological assessment and evaluation of testicular perfusion were also initiated. Digitized Record Management was implemented in dairy cattle unit which comprised of data compilation and online recording of milk data, breeding data, dairy herd and medicine stocks and animal data sharing with Information Network for Animal Productivity and Health (INAPH) for real-time assessment of farm productivity.

Towards reproductive characterization of indigenous AgondaGoan pigs, major seminal traits including qualitative and quantitative semen attributes like - gross appearance, volume, colour, consistency, seminal pH and sperm morphometry were evaluated. Mean volume of sperm-rich fraction was 84.50 ml and sperm concentration ranged from 205.9 to 289.6 million/ml while progressive motility ranged from 62.6 to 83.9%. Hypo-Osmotic Swelling Test (HOST) was employed to evaluate the functional integrity of sperm plasma membrane and modified ES Giemsa staining

method was used to assess acrosomal integrity. Mean percent of HOST responsive sperms was 63.75% and mean % of live intact acrosome was 53.43%. Studies on sperm morphometric analysis were undertaken for characterization of sperm dimensions using semi-automated Magnus Pro image analysis system. Mean sperm head length and width were 11.03±0.04 µm and 5.58±0.02 µm whereas tail length and total sperm length were recorded as 58.51±0.13 µm and 69.72±0.15 µm, respectively. Pilot trials on sample processing and standardization of analysis procedures for boar semen profiling using minimally invasive biophotonic method of Fourier Transform Infrared (FTIR) Spectroscopy were also initiated. This technique enables non-perturbative, label-free extraction of information for diagnosis and assessment of sperm cell functionality and biochemical variations. Standardized AI using liquid boar semen combined with controlled breeding involving estrus induction and synchronization were also carried out in farmers' fields and, total of 178 piglets was born through AI out of 21 farrowings with success rate of 79% in the farmers' herds during the period.



Sperm morphometric analysis in Agonda Goan pigs

Project: Assessing status of coastal aquaculture practices and improvement through technology intervention for promoting livelihood of fish farmers in west coast of India

Trivesh Mayekar, Sreekanth GB, GR Mahajan, Manohara KK, Rajkumar S and Paramesha V

Length-weight profile of Small Indigenous Fishes (SIFs) of Goa

Small Indigenous Fishes (SIFs) can grow up to 25-30 cm in their life cycle inhabiting in rivers, tributaries, floodplains, ponds and tanks, lakes, etc. Many of these can be introduced into freshwater aquaculture systems as candidate species. Length-weight relationship (LWR) of fishes is considered as the basic biological information useful in designing management practices, estimating growth, reproduction and overall condition of fish, biomass estimation, analysis of fish populations, stock assessment models, and evaluation of fish conditions in aquaculture systems. During the study, a total of 83 species were recorded from Goa, out of which the length-weight relationship of four finfish species (*Systomus sarana, Rasbora dandia, Puntius vittatus* and *Puntius mahecola*) belonging to the Cyprinidae family was estimated during 2020 to 2021. Samples were collected by different gears like cast net, drag net, hand net. The length and weight range for four species, *Systomus sarana, Rasbora dandia, Puntius vittatus*, and *Puntius mahecola* varied as follows- 3.0 to 24.3 cm and 2.0 to 126.0 g, 2.5 to

Natural habitat of Small Indigenous fishes

Fish sampling

9.8 cm and 3.0 to 13.0 g, 1.0 to 5.1 cm and 1.0 to 3.0 g and 1.7 to 8 cm and 2.0 to 20.0 g. Juveniles formed 99.2%, 46.3%, 46.3% and 56.3% of the total samples of *Systomus sarana, Rasbora dandia, Puntius vittatus*, and *Puntius mahecola,* respectively. The matured individuals shared 0.8%, 53.7%, 9.2% and 43.7% for the four former species respectively. Data gained in this study formed the baseline information for preparing another database for management of wetlands and rivers along the coast of Goa and developing breeding programmes for the species.

Length-weight relationship of SIFs

Fish species	Number	Length range (cm)	Weight range (g)
Systomu ssarana	400	3.0 to 24.3	2.0 to 126.0
Rasbora dandia	423	2.5 to 9.8	3.0 to 13.0
Puntius vittatus	410	1.0 to 5.1	1.0 to 3.0
Puntius mahecola	400	1.7 to 8	2.0 to 20.0

Length-Weight observations of SIFs

Asian seabass polyculture experiment with Small Indigenous Fishes (SIFs) as forage fish

The Asian seabass (*Lates calcarifer*) is a highly preferred food fish commonly known as *Chonok* in Goa, with a high meat content and commercial value compared to Indian major carps. Asian seabass is a hardy, euryhaline fish and is suitable for culture in coastal marine, inland saline, brackishwater and freshwater ecosystems. The second cycle of polyculture experiment of the Asian seabass along with live feed of SIFs and Tilapia is under progress. A total of 300 nos. of wild seabass seed was stocked in a pond of 1000 m^2. In this second trial, the Small Indigenous Fishes (SIFs), tilapia along with an additional species of Glassfish (*Ambassis ambassis*) being used for the feeding of Asian seabass. The species used in SIFs are *Rasbora dandia, Systomu ssarana, Punitus vittatus* and *Puntius mahecola*. Use of Glassfish along with SIFs and Tilapia will be a better alternative for feeding purposes for achieving faster growth, higher yield and quality fish production. The stocked size of wild Asian seabass seed was of an average length of 10.24±0.2 cm and average weight of 12.34±0.5 g. During the first sampling carried out after two months of culture period,

Asian seabass growth sampling

Puntius vittatus

Puntius mahecola

Rasbora dandia

Systomus sarana

Ambassis ambassis

Asian seabass (wild seed) culture pond

the mean seabass growth from SIFs polyculture experiment recorded was 277 ± 0.10 g.

Asian seabass polyculture on pelleted feed

Asian seabass culture by only using pelleted feed was also carried out and the results are being compared for better growth with the polyculture experiment. A total of 300 weaned seabass seed was stocked in a pond of 1500 m^2. The stocked size of seabass for artificial pelleted feed culture was of average length of 11.20±0.2 cm and average weight of 12.17±0.5 gm. Sampling for comparative growth analysis is being carried out. During the first sampling carried out after two months of culture period with artificial pelleted feed, the mean seabass growth recorded was 200±0.12 g.

Water quality parameters during culture period

Water quality parameters	Wild seabass culture	Weaned seabass culture
Temperature	26-29° C	28-29° C
pH	6.0-7.0	6.5-7.0
Dissolved oxygen	3.3-5.0	3.0-5.0
Alkalinity	10-20 ppm	10-20 ppm
Ammonia-N	0.005-0.05 mg/L	0.005-0.05 mg/L
Nitrate-N	0.05-0.2 mg/L	0.05-0.2 mg/L

Soil quality parameter during culture period

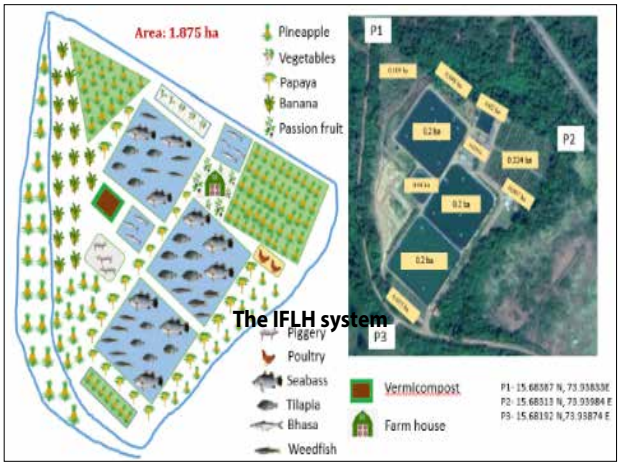
Soil quality parameter	Wild seabass culture	Weaned seabass culture
pH	6.0-7.0	6.0-7.0
EC	100-400 µS	100-400 µS
OC	1.5-3.0%	1.5-3.0%
P	0.05-0.5 kg/ha	0.05-0.5 kg/ha
K	200-400 kg/ha	200-400 kg/ha

Asian seabass (weaned seed) culture pond

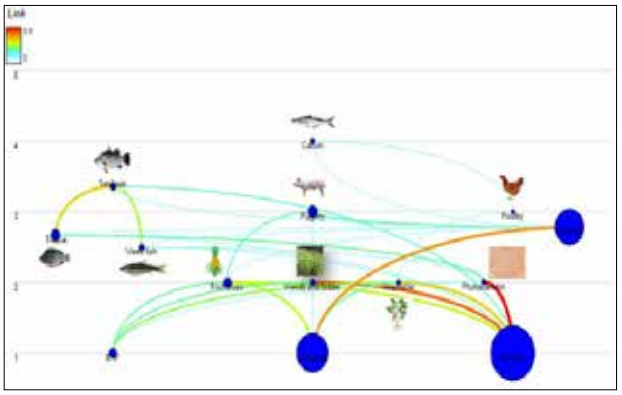
Pelleted feed

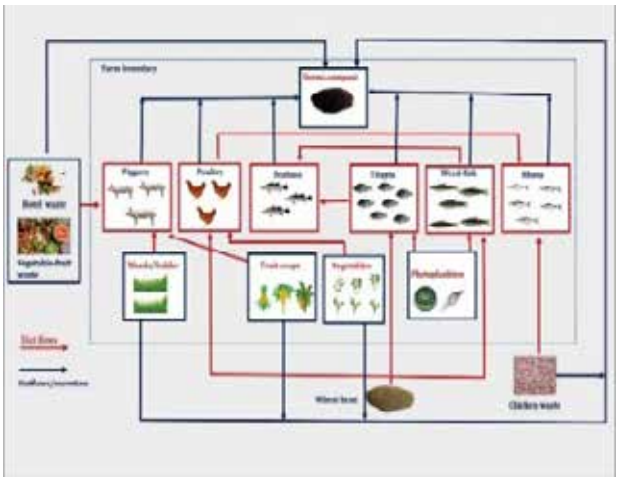
Energy efficiency and trophic organization analysis in an integrated fish-livestock-horticulture (IFLH) system in farmer's field

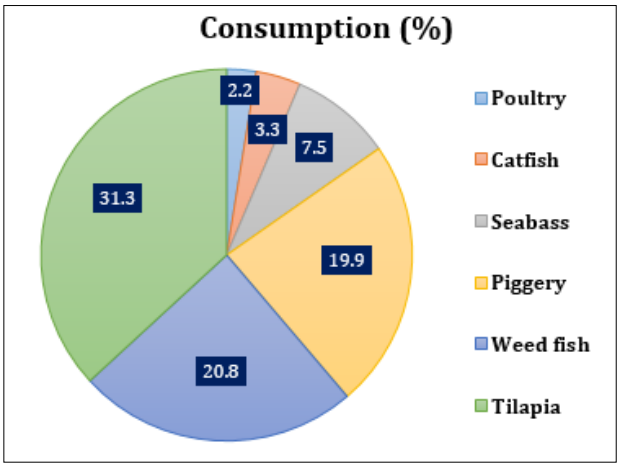
An integrated farming system (IFS) is a farming approach that helps to conserve agro-biodiversity, provides food security, enhances ecosystem services, maintains environmental quality, and also achieves sustainability. In this study, the energy transfer and trophic organization in an IFS comprising of fish (seabass, catfish, tilapia), livestock (piggery and poultry), and horticulture components situated in Goa, were analysed. An Ecopath model was constructed for the IFLH to delineate the trophic organization and generate ecological indicators on energy transfer, resource use and recycling, ecosystem maturity and stability. In the IFLH model, thirteen ecological groups were defined ranging from trophic level 1.00 (detritus and benthic nitrogen fixers (BNF)) to 4.00 (catfish), seabass (0.99) and piggery (0.98) demonstrated the highest ecotrophic efficiencies and the lowest value was recorded for detritus (0.20). The energy transfers from detritus (90%) were much higher than the transfer from primary producers (10%). The transfer efficiency at the second trophic level was as high as 0.6 for the IFLH. The fish and livestock components (tilapia-31%, weedfish-21%, piggery-20%, and seabass-8%) showed the highest consumption rates in the IFLH. A high total system throughput (22,417.9 kg N ha^{-1} $year^{-1}$) and gross efficiency (0.34) for the IFLH indicated greater levels of ecosystem activity and growth rate at low maintenance energy costs. This model serves as the first IFLH model from India's western coast and would supplement the evaluation of other IFS using the modelling approach.



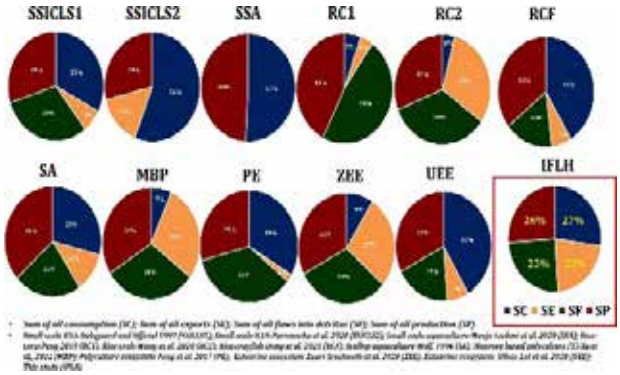
The IFLH system


Trophic levels and flows in the IFLH system

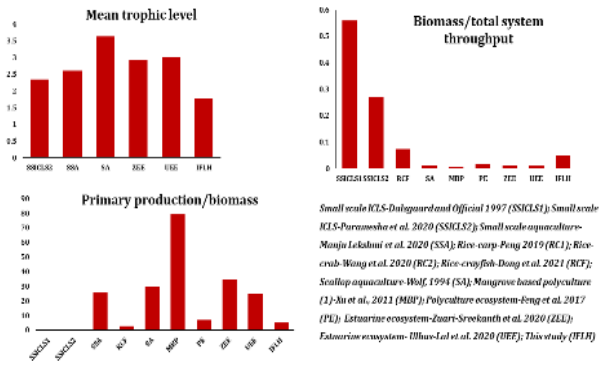

The components, on-farm and off-farm flows model in IFLH system



Percentage consumption of various consumer groups in IFLH system



Comparison plot in various integrated farming, aquaculture and natural systems



Comparison of mean trophic level, biomass throughput and primary production in various integrated farming, aquaculture and natural systems

Glassfish (Ambassis ambassis) feeding trial for Asian seabass

Development of an alternative feeding method for Asian seabass foraging on *Ambassis ambassis* (Glassfish) was studied. Commonly known as the Asiatic glassfish, it is one of the commonest fish of Goa and is found widely in fresh, brackish, and coastal marine waters. Three treatments of salinities were studied [T1 (10 psu), T2 (5 psu) and T3 (0 psu)] and a control of 15 psu with a tank volume of 400 litres and two replications each. Each tank was stocked with two nos. of Asian seabass (mean weight: control: 705±5.00 g, T1: 710±0.00 g, T2: 710±0.00 g, and T3: 705±5.00 g). Total experiment period of 30 DOC (days of culture) with the feeding of glassfish (mean weight: 5.5 gm, mean body depth: 3.66 cm) @ 4% per day was carried out. During the total DOC, feed utilization by seabass for glassfish observed for control, T1, T2 and T3 were 8-9%, 7-8%, 4-5% and 1-2%, respectively, and the survival percentage was 1-2%, 2-3%, 5-6% and 8-9%, respectively. The species can be used as a foraging fish in saline to low-saline culture systems for Asian seabass grow-out culture (after 700 g). This will be a better alternative to the pelleted feeding method to save upon the cost of production, achieving faster growth, higher yield and quality fish production, leading to a sustainable and eco-friendly culture system.

Length-weight observations on *Ambassis ambassis* (Glassfish)

Conservation and pond breeding of Small Indigenous Fishes of Goa

Small Indigenous Fishes (SIFs) have importance as food fish and other local significance and play a remarkable role in aquarium business, local nutritional and livelihood security since they are nutrient-dense and are a rich source of micro-nutrients. Many of these can be introduced into freshwater aquaculture systems as candidate species. With the aim to promote natural breeding in pond ecosystem, small indigenous fishes like *Rasbora dandia, Systomu ssarana, Puntius vittatus, Puntius mahecola* and *Salmostoma bupa* were collected locally from Goa with traps, cast net, drag net, hand net, etc. and stocked in freshwater ponds for promoting natural breeding. Feeding

was done daily twice with rice bran at 2% of body weight. The small young ones bred in pond were used as forage feed in Asian seabass polyculture experiment.

Small Indigenous Fishes (SIFs)

Feeding activity

Fish trap

Fish sampling

Fish seed produced of SIFs

Conservation and management of Small Indigenous Fishes of Goa

To highlight the significance of the conservation of Small Indigenous Fishes, on the occasion of World Fisheries Day on 21st November 2021 at Mangueshi temple, Mardol, Goa, a program on Conservation and management of Small Indigenous Fishes of Goa was organized. A total of 500 individuals of seven indigenous fish species were released into the temple pond, which is considered as a method of *in-situ* conservation. To spread awareness about fish conservation, tourists, students, and local villagers were also invited for the campaign. An extension folder entitled, "Promoting indigenous ornamental fishes of Goa: Breeding and seed production of the melon barb, *Haludaria pradhani* for conservation and management" was released. Posters displaying the freshwater fishes of Goa were also distributed to tourists, students, villagers and staff of Mangueshi Devasthan.

Views of activities done on World FisheriesDay at Mangueshi temple

Mega Project 5 : Improving livelihood security through postharvest technologies and other agri-enterprises

Project: Development of ready-to-eat (RTE) animal and fish based traditional foods of coastal India by retort processing

R S Rajkumar, CO Mohan, MJ Gupta, Sunetra Talaulikar

A new project on the Development of ready-to-eat (RTE) animal and fish-based traditional foods of coastal India by retort processing was initiated to standardize the formulation and optimize the thermal process conditions of various animal and fish-based traditional foods of coastal regions in retort pouches. The formulation of the ethnic Goan Chicken Curry (Chicken Xacuti) was standardized at ICAR-CCARI, Goa based on the preliminary trials conducted supported by the Hedonic Sensory Scores. Optimization of the conditions for the thermal processing in both metal cans and flexible retort pouches was done at ICAR-Central Institute of Fisheries Technology, Kochi. Chicken pieces (85±5 g) and gravy/ curry medium (100±2 g) were filled in cans and retorted pouches using a specially designed stainless-steel funnel to avoid spillage. Residual air was removed by steam flush technique and sealed by a pneumatic impulse sealing machine (Model QS300X10PNIV2). The optimization of the F0 value was done at three different levels, 10, 11, and 12 for 8 minutes, and based on sensory evaluation, the F0 value of 12 was standardized. A pilot-scale mill walls Model 24 rotary retorting system (John Fraser and Sons Ltd., Newcastle-upon-Tyne, UK) was used for the experiment. The retort was operated in the steam/ air mixture mode during the sterilization cycle. The temperature was set at 121.1°C with a steam pressure of 1.05 bar and an overpressure of 2.1 bars was maintained during each process cycle. After processing, all the pouches were wiped dry and kept in a dust-proof cabinet at ambient temperature (25–30°C). The heat penetration studies were studied using copper-nickel thermocouples capable (85°C to145°C with 0±0.1°C accuracy and 0.2 s response time). The retort temperature (RT) was maintained at 121.1°C and air pressure was maintained at 28 psi throughout the heating and cooling periods. The final product is a fit for consumption after the completion of the thermal processing as per the sensory evaluation. The processed product in metal cans and retort flexible pouches will be evaluated for storage stability for 180 days at room temperature.

Thermally processed Chicken *Xacuti* in metal cans

Thermally processed Chicken Xacuti in flexible retort pouches

Project: Agro-biodiversity, nursery techniques, and post-harvest technology of ornamental crops for livelihood diversification in coastal India

V Arunachalam and Maneesha SR

The project has been initiated with the objective of evolving ornamental crop-based livelihood opportunities for coastal farmers. It aims to provide policy makers, researchers, and extension personnel in framing activities for socio-economic development in coastal mainland India by harnessing the potential of ornamental crops and their products. Jasmine germplasm block has been rejuvenated where accessions native to Goa state (14 accessions) have been collected and established. Propagation by stem cuttings of selected jasmine accessions by rooting and for subsequent gap filling and supply to farmers was carried out. A review of literature on ornamental crops for coastal regions of India was compiled. Five orchid species native to Goa were established in pots and the collection was maintained. *Anthurium* varieties were maintained under shade net house. Propagation work of roses, crotons, and crossandra by cuttings has been initiated.

Project: Assessment and development of cropping systems based harvest and post-harvest management technologies for coastal India

Mathala Juliet Gupta, AR Desai, R Ramesh, Maneesha SR, Shripad Bhat and Monica Singh

Secondary data analysis of 75 coastal districts was carried out and based on the relative spread index of various crops, a table on the primary cropping systems of the coastal districts was summarized, which is given below.

Cropping systems of the coastal districts

Coastal States	Districts	Number of major cropping systems identified
Gujarat	Ahmedabad	6
	Anand	2
	Amreli	3
	Bhavnagar	5
	Bharuch	4
	Jamnagar	4
	Junagadh	5
	Kachchh	6
	Navsari	3
	Porbandar	4
	Rajkot	3
	Surat	3
	Vadodara	4
	Valsad	2
Maharashtra	Raigarh	5
	Ratnagiri	5
	Sindhudurg	5
	Mumbai	-
	Thane	5
Goa	North Goa	3
	South Goa	3
Karnataka	Dakshin Kannada	3
	Udupi	3
	Uttara Kannada	6
Kerala	Alappuzha	3
	Ernakulam	2
	Kannur	1
	Kasaragod	2
	Kollam	2
	Kottayam	2
	Kozhikode	1
	Malappuram	1
	Thrissur	2
	Thiruvananthapuram	2

Tamil Nadu	Chennai	-
	Cuddalore	3
	Kanchipuram	2
	Kanyakumari	2
	Nagapattinam	2
	Pudukkottai	3
	Ramanathapuram	2
	Thiruvarur	3
	Thanjavur	4
	Thiruvallur	3
	Thoothukudi	6
	Tirunelveli	7
	Villupuram	2
Andhra Pradesh	East Godavari	6
	Guntur	7
	Krishna	9
	Nellore	7
	Prakasam	5
	Srikakulam	5
	Visakhapatnam	5
	Vizianagaram	8
	West Godavari	9
Odisha	Baleshwar	3
	Bhadrak	3
	Ganjam	3
	Jagatsinghpur	3
	Kendrapara	3
	Khordha	3
	Puri	3
West Bengal	East Midnapore	3
	North 24 Parganas	3
	South 24 Parganas	3

Based on the farming systems identified from secondary data, a questionnaire was developed to corroborate the cropping systems and prioritize on-farm processing problems. According to the responses received from stakeholders of Goa and Karnataka, a package for on-farm processing has been developed in the first phase, and further work is in progress.

Project: Production and postharvest management of fruit crops - kokum, jack fruit and breadfruit of West coast region of India

Maneesha SR, R Ramesh and Mathala Juliet Gupta

Evaluation of Garcinia accessions

Garcinia germplasm with 60 grafts of kokum from 13 promising accessions *viz.,* A1P1(03 nos.), BAN-3 (04 nos.), KAS-11 (21 nos.), KAS-5 (07 nos.), KAS-6 (04 nos.), KUR-9 (04 nos.), KUR-8 (03 nos.), M-16 (1 no.), P-115 (2 nos.), P-36 (1 no.), P-38 (5 nos.), PED-1(03 nos.) and SK-3(02 nos.); tissue culture kokum plants (10 nos.), Konkan Hatis (03 nos.), Konkan Amruta (02 nos.), Bell Shape kokum (02 nos.), Yellow kokum (03 nos.); *Garcinia tinctoria* (07 nos.), *Garcinia hombroniana* (03 nos.), *Garcinia mangostana* (04 nos.) and kokum seedlings (99 nos.) are being evaluated in the germplasm block. Among the grafts, KAS11 (104/16) has dwarf stature with a height of 79 cm, stem girth of 36 cm and canopy spread of 245 sq.cm. This graft yielded 14.15 kg (528 fruits) in the year 2021. Among the seedlings, SDL-54/14 had the highest yield (98 kg) followed by SDL-136/14 (75.31 kg) and SDL-43/14 (73.46 kg). SDL-1/14 had the highest mean fruit weight (45.62 g), rind weight (24.93 g) and rind thickness (3.33 mm).

KAS-11/104 plant and fruits

This accession has 20.45% fruits under the class I (> 40 g fruit weight). Fruit rind T.S.S., pulp TSS and acidity were the highest in KAS-11(58/16) (15.44 °Brix, 15.52 °Brix and 87%), respectively.

Kokum seed decorticator

A manual decorticator for facilitating kokum seed shelling for further processing into butter was designed and developed. The testing of the machine with four pre-treatments and control (without any pretreatment) was carried out - T1-Dry roasting for 8 minutes, T2- oven drying at 60 °C for 20 minutes, T3- oven drying at 70 °C for 20 minutes T4- oven drying at 70 °C for 90 minutes and control- untreated. Dry seeds showed that the shelling efficiency was the maximum for treatment T4 (72.17%), followed by T3 (67.59%), T2 (66.94), Control (58.55%) while T1 had the minimum shelling% of (49.22%). Butter extraction using these pre-treatments showed that maximum butter extraction was for T2-13.40% followed by T3-11.28%, Control-9.83%, T4-8.55%, and minimum for T1-6.02%. The capacity of the sheller was observed to be the best for T3-5.15 kg/h followed by T4-4.87 kg/h, T2-4.17 kg/h, T1-2.10 kg/h and minimum for control- 1.99 kg/h. Hence the optimum performance of the machine was observed with treatment T3.

Manual Kokum Decorticator

Standardization of kokum wine brewing process using consortia of micro-organisms isolated by ICAR-CCARI

Two new micro-organisms were isolated at ICAR-CCARI and the process of kokum wine brewing with these two new micro-organisms is in progress. First set of experiments with four treatments using the isolated micro-organisms as *Saccharomyces*, singly and as a consortium with local yeast, with local yeast as control were done for kokum wine production and the wine produced has been kept for maturation. Second set of experiment with three treatments using these isolates as aroma enhancers with wine yeast has been done and the wine produced has been stored for maturation. Further tests on alcohol content and organoleptic test will be done after maturation of the wine.

Treated kokum wines kept for maturation

Dehydrated jackfruit bulbs

Whole jackfruit bulbs of both *rasal* and *kappa* types were dehydrated and stored to use as Ready To Eat products. The initial T.S.S. and moisture content of both were 22.74±0.94 and74.98±2.39 %W.B. respectively and final M.C. was 23.95±0.31(soft flesh type) and 8.06±0.63 (firm flesh type). The dehydrated bulbs have been vacuum packaged and stored for further studies.

Studies on jackfruit products to reduce the variability in characteristics

To standardise the process for uniform product quality of traditional products like jackfruit leather and jackfruit papad, products were procured from the market and analysed. The jackfruit leather samples had an average moisture content of 11.86±2.13% and average T.S.S. of 10.98±0.82 ° Brix. Jackfruit papad samples had average moisture content and T.S.S. of 16.5±5.05 % and 4.27±1.33 ° Brix, respectively

Suitability of jackfruit accessions for chips preparation

The suitability of three jackfruit accessions (BT1, BT2, CT1 and CT2) was studied for chips preparation and it was observed that BT1 had the highest chips recovery (53.33±9.09%). The results are summarized below:

Effect of storage in minimally processed tender jackfruit

The effect of the storage method on minimally processed tender jackfruit and its effect on consumer acceptance were studied. Produce stored up to six months in a freezer had an overall acceptance of 7.64 as cooked vegetable and further studies are in progress.

Standardization of jackfruit wine brewing process

Standardization of wine brewing process of over-ripened *kappa* and *rasal* jackfruits was initiated and preliminary results showed good results with acceptable alcohol content.

Particulars	BT1 (firm flesh type)	BT2 (firm flesh type)	CT1 (soft flesh type)	CT2 (soft flesh type)
Initial weight (g)	100.00±00	1700±0.52	450.00±86.60	130.00±40.62
First fry time (min.)	4.33±0.94	6.50±1.12	5.50±0.5	5.25±0.43
First fry temperature-1(°C)	182.00±12.75	146.25±2.17	146.75±2.04	160.50±.87
Second fry time -2(min.)	5.00±00	6.00±1.00	5.50±0.50	4.25±1.09
Second fry temperature (°C)	184.67±6.18	172.50±10.40	137.50±4.33	168.75±6.50
Final weight (kg)	53.33±9.09	0.36±0.19	213.75±18.79	57.50±22.33
Chips recovery (%)	53.33±9.09	288.83±4.02	48.50±6.69	44.16±3.27
Colour	Yellow	Pale yellow to brownish yellow	Yellow to pale yellow	Yellow
Appearance				

Project: Impact analysis of ICAR-CCARI technologies

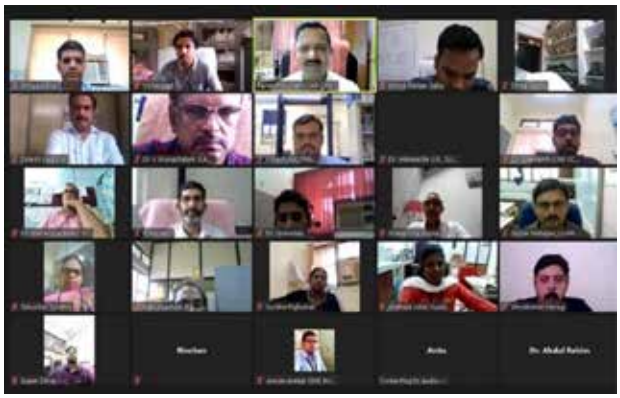
(Shripad Bhat, AR Desai, Manohara K K, G R Mahajan, Paramesha V, Amiya Ranjan Sahoo and Monica Singh)

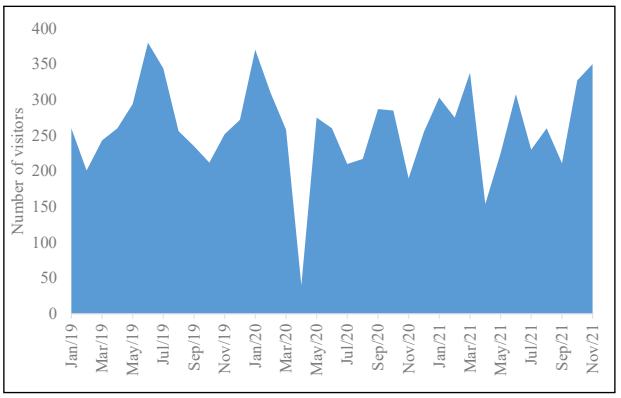
Over the past several years, for four salt-tolerant rice varieties (Goa Dhan 1, Goa Dhan 2, Goa Dhan 3 and Goa Dhan 4) and cowpea variety (Goa Cowpea - 3) have been developed by the Institute. On the basis of indents received from the State Agricultural Department, breeder seed quantities of 5.15 q, 1.95 q, 5.35 q, 3.90 q of rice varieties of Goa Dhan 1, Goa Dhan 2, Goa Dhan 3 and Goa Dhan 4, respectively) and 1.50 q of Goa cowpea, were provided. Nucleus grafts of ICAR-CCARI improved cashew varieties (Goa cashew 1,2, 3 & 4) were also distributed to a large number of farmers and data on the performance and yields are also being collected. Data collection schedules to assess the socio-economic impact through partial budgeting technique were prepared and data collection from farmers cultivating the released varieties is underway. Further, during the last five years, around 1.5 lakh quality planting materials of mango, black pepper, coconut, arecanut, medicinal plants, fodder crop saplings, etc., have been sold to many farmers by the Institute. Based on the data collected, the value of production, employment generated, environmental benefits, farm families benefitted, etc. will be estimated.

Project: Assessing research needs of stakeholders of ICAR-CCARI, Goa and their perceptions about Institute's services

(Shripad Bhat and Monica Singh)

A Stakeholders Consultation Meeting on enhancing effectiveness of research and seeking opinion on future directions of research was organized on 31-07-2021 through virtual mode. An interaction was held with the stakeholders to assess the research needs, to identify issues faced by the farmers, fisher folk, entrepreneurs and other stakeholders from the coastal region and feedback were documented. A total of 60 participants involving progressive farmers, entrepreneurs, processors, representatives from KVKs of coastal districts, state government officials, Agricultural Research Stations and other stakeholders from Maharashtra, Goa, Karnataka, Kerala, West Bengal and other coastal states along with scientists of the Institute participated in this meeting. Online questionnaires (Google Forms) were developed and data collection on research needs and perception about Institute's services are underway.





Number of visitors to the Institute

Project: Prospects and promotion of agro ecotourism in coastal region of India

(Parveen Kumar, RS Rajkumar, AR Desai, V Arunachalam, MJ Gupta, GR Mahajan, Maneesha SR, Sujeet Desai, R. Ramesh, R. Maruthadurai, Shripad Bhat, Uthappa, AR, TriveshMayekar. Chaudhari GV, Nibedita Nayak, Sreekanth GB and Paramesha V)

Recycling the organic waste and organic preparations: Eco-friendly and economical components of Agroecotoursim

The activity of agroecotourism (AET) generates biodegradable waste through farm operations and it offers a scope to convert the 'waste to wealth'. Integration of such environment-friendly practices and biodegradable waste recycling is important to augment the income of AET and impart knowledge to visitors. Different components on vermicomposting, organic preparations, azolla cultivation, green manuring, etc. were integrated into the AET unit of the Institute. Based on the amount of biodegradable waste generated annually, a vermicomposting unit was established to recycle approximately 6 tonnes of biodegradable waste annually.In a year, two cycles of vermicomposting recycled 6.0 tonnes of biodegradable waste to produce 4.0 tonnes of vermicompost in 8 months with a conversion ratio of 0.67. The gross and net income was Rs. 0.88 Lakhs and Rs. 0.52 Lakhs with a benefit-cost ratio of 2.45. For one cycle of four months to recycle 3 t of biodegradable yielded a net income of Rs. 0.25 Lakhs.The amount of nutrients recycled through vermicomposting was 57 kg nitrogen, 3 kg phosphorus and 36 kg potassium.The organic preparations like Jeevamrut were prepared and demonstrated to the visitors and it was applied to the different

crop plants of the AET unit. These practices are eco-friendly and generated additional income. All these green practices enlightened the visitors on how traditional and scientific knowledge can be blended and used for the AET for improved income and profitability.

Maintenance and Management of herbal garden '*Dhanavanatari*vatika'

The garden is established in an area of 1670 m^2 with 150 species of plants which consist of herbs (65), shrubs (25), climbers (20) and trees (40).Minimal processing of medicinal and aromatic plant species by drying and powdering of leaves, roots, seeds and flowers. Herbal extract blended pineapple RTS was prepared and found that blending Lemon grass extract in 5-10 % with pineapple RTS had comparatively good quality and consumer acceptance. Recovery percentage of aloe vera gel was 65. 44 % and shelf life of the solidified gel can be extended up to two months inside refrigerator. Essential oils were extracted from the aromatic grass available in the garden. The oil recovery was the highest in lemon grass variety Sugandhi (0.8 %). Qualitative and quantitative analysis of phytochemicals in Kalmegh (*Andrographispaniculata*)and Kaalaadulsa (*Justiciajendarussa*) was done in extracts obtained from different solvents and found that acetone extracts gave positive results for most of the phytochemical test than other solvents.

Establishment of *Navagraha / Rashi/ Nakshatravatika* (Astral Garden)

*Navagraha/Rashi/ Nakshatravatika*was established at block C of the institute on 5th June 2021 as part of environmental day celebrations. In earlier days, such gardens were established to worship and please the deity for good health and fortune. This can be considered as a wise practise to conserve the rare and powerful medicinal plant genetic resources near the sacred places by our ancestors. *Navagraha/Rashi/ Nakshatravatika* will be a part of AET centre of our institute that can be a perfect place of relaxation and the layout and name plates of each tree will help the visitors to gain knowledge about the traditional wisdom of plants and its conservation measures followed by our ancestors.

Studies on contribution of value addition of farm produce to Agro Ecotourism enterprise

Value addition can make a significant contribution to the Agroecotourism enterprise as compared to the sale of farm fresh produce and also it will make year-round processed produce available to the tourist visitors. Also if we can cash in on the hands-on experience of processing to tourists throughout the year using minimal processing and storage of the farm produce.

Greenhouses in Farm C

Crops of Cucumber and tomato were grown in the farm C greenhouses. These could be used as a revenue source for the agrotourism enterprise. Allowing visitors in the greenhouse with hands-on experience of transplanting, pruning, training, and harvesting could give us additional income.

Project: All India Co-ordinated Research Project on Integrated Farming Systems

Paramesha V, Parveen Kumar, Manohara KK, Shripad Bhat and Sukanta K. Sarangi

Development of rice-based lowland integrated farming system

For typical lowland situations of Goa, a rice-based farming system model (crops-dairy-fishery) has been standardized for 0.5 ha. The model includes different components such as crops (rice, cowpea, and moong (2 crops)/ vegetables (Bhindi, chilli, leafy vegetables, cluster bean, radish)/baby corn/sweet corn – 0.4 ha), fodder grown on bunds (Hybrid Napier CO 5 - 0.032 ha), dairy (24 m^2- 2 crossbred cows, one female calf), fish pond (250 m^2), FYM unit (4 units-30 m^2), a kitchen garden (80 m^2). The system produced in 2021 20.3 q of rice, 378 kg of baby corn, 680 cobs of sweet corn, 132 kg of moong (2 crops), 55 kg of cowpea, and 2.9 tons of fodder maize with 1350 liter of milk. The monetary advantage in terms of net return was Rs. 1.62 lakh with the highest percentage contribution obtained from crops (61%) followed by dairy (22%). Crops straw/ stover, green fodder, and crop residue produced from the cropping system module were 8210, 9200, and 855 kg, respectively, and these were recycled in the system as animal feed and organic manure. Likewise, 5925 kg of cow dung was recycled. Employment of 352 man-days was generated from the model during the current year and about 55 kg N, 32.5 kg P, and 67 kg K were recycled.

Integrated farming system model for lowland situations of Goa

Rice + Dairy-based Integrated farming system model

Development of plantation crop-based upland integrated farming system

An upland model covering 0.8 ha including enterprises such as Plantation crops: Cashew (variety Bhaskara) + Pineapple (Variety Giant Kew), Coconut (Benaulim) + Pineapple (Giant Kew) + Turmeric, Arecanut (Mangala) + Banana (Grand naine) + Turmeric, goatery (7 no.), duckery (52 no.), compost unit, and water harvesting ponds (300 m^3) was standardized for upland situations of Goa. The model produced a net income of Rs.1.98 lakh per year. The highest contribution to net profit was from the arecanut-based cropping system (46%) followed by the cashew + pineapple system (23%).

The system generated employment of 257 man-days and through residue recycling, about 68.5 kg of N, 42.3 kg of P, and 78.2 kg of K were recycled in the system and the purchase of fertilizers was reduced. From the model, 680 kg of turmeric (Salem variety), and 2000 arecanut (Mangala variety) seedlings were distributed to promote the cultivation of turmeric and arecanut cultivation.

Coconut + turmeric, arecanut + turmeric cropping system of upland Integrated farming system

Plantation crop-based integrated farming system model

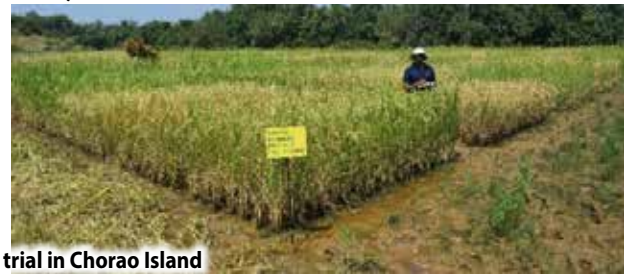
Kuttunad Ducks and Konkan Kanyal goats in the upland IFS model

Project: All India Co-ordinated Rice Improvement Project

Manohara K K

Initial varietal trial - Coastal Saline Tolerant Variety Trial (IVT-CSTVT), kharif 2021

Thirty-five entries and a local check were evaluated under IVT-CSTVT trial during *kharif* 2021. Lines were evaluated under RCBD design with two replications. Top three entries with total grain yield are IET 30191 (4.32 t/ha) followed by IET 30192 (3.98 t/ha) and IET 30204 (3.72 t/ha). The check entry recorded grain yield of 3.47 t/ha. None of the entries could record significantly higher grain yield when compared to the check entry.



Field view of CSTVT trial in Chorao Island

Mean data of yield and its attributing traits among the entries in IVT-CSTVT

Characters	Mean	CV (%)	Minimum	Maximum	LSD (5%)
Days to 50% flowering	96.94	2.95	87.50	111.00	5.82
Days to maturity	130.89	2.26	120.00	148.00	6.01
Plant height (cm)	113.94	4.43	80.33	153.67	10.25
Productive tillers per hill	8.19	15.49	5.33	11.17	2.58
Panicle length (cm)	23.08	7.43	17.29	28.42	3.49
Grains per panicle	104.64	19.46	29.67	195.17	41.38
Per cent fertility	50.79	18.80	34.38	56.09	19.40
Grain yield per hectare	2.34	24.83	0.25	4.32	1.18

Coconut-based cropping systems for different agro-climatic regions: Evaluation of coconut-based cropping system models

Coconut-based cropping system models have been evaluated at Goa center over the past five years (2016-20). The system of inter-cropping coconut with pineapple and passion fruit with a coconut equivalent yield of 9937 nuts /ha, gave an average net return of Rs. 1.412 Lakhs per year per ha with a benefit-cost ratio (BCR) of 2.16 over the coconut monocrop with nuts per year per ha which gave only Rs.0.58 Lakhs per year per ha with a BCR of 1.18. During the current year (2020-21), coconut-soursop model gave promising results of net return of Rs 2.02 lakhs per ha and BCR of 3.08.

Coconut-pineapple-passion fruit cropping system model

Nucleus seed gardens for dwarf arecanut

Nucleus seed garden of Hirehalli Dwarf was established and is being maintained with 284 surviving palms of which 82 are at the reproductive stage. The vegetative characters recorded from 113 plants indicates that the mean height of the plants (from plant base to the base of the crown) was only 1.35±0.03 m after 10 years of planting. High dry kernel weight (> 10 g/fruit) was recorded in nine dwarf palms with transgressive segregation for *chali* weight and has potential for *chali* improvement.

Dwarf arecanut palm – 'Hirehalli dwarf'

Yield of intercrops in coconut-based cropping system January to December 2021

Sl. No.	Treatment	Crop & part harvested	Jan. to Dec. 2021 (kg/ha)
T1.	Coconut + Black pepper + Papaya + Drumstick	Papaya fruit	1060.59
T2.	Coconut + Black pepper + Heliconia	Heliconia flower	14400 stems/ha
T3.	Coconut + Black pepper + Banana + Lemon	Lemon fruit	1.80
T4.	Coconut + Black pepper + Passion fruit + Pineapple	Pineapple fruit	1117.28
		Passion fruit	5.55
T5.	Coconut + Black pepper + Soursop	Soursop fruit	607.41
T6.	Coconut + Black pepper + Crossandra	Crossandra flower	39.39

Ganesh Choudhary and R Ramesh

Under the AICRP on Vegetable Crops, 12 trials including Brinjal-3 (varietal/ hybrid yield evaluation), Chilli-2 (varietal/ hybrid yield evaluation), Okra-2 (YVMV varietal), Tomato-5 (hybrid yield evaluation and ToLCV varietal/ hybrid) were evaluated during the year 2020-2021 for reporting to the Coordinating unit.

Okra (YVMV) Varietal IET

Three entries under the trial namely, 2020/OKYVRES-1, 2020/OKYVRES-4 and 2020/OKYVRES-6 showed 0.00% YVMV affected plants among the entries tested. There were non-significant differences among entries for average number of fruit per plant and average fruit weight per plant. Although, 2020/OKYVRES-1 produced maximum (8.26) fruit per plant weighing 0.12 kg per plant.

Okra (YVMV) Varietal AVT I

A total of twelve entries including checks were evaluated under the trial, out of which entries coded as 2019/OKYVRES-1, 2019/OKYVRES-2, 2019/OKYVRES-6, 2019/OKYVRES-11, 2019/OKYVRES-12 and 2019/OKYVRES-13 showed no YVMV affected plants. While there was non-significant difference among entries, with regard to the average number of fruit per plant and average fruit weight per plant, however, 2019/OKYVRES-2 produced 13 fruits per plant weighing 0.14 kg.

Brinjal Long- AVT-II

Among the entries tested under the yield evaluation trial, 2018/BRLVAR-8 produced 1.41 kg of fruit per plant which was significantly superior compared to other entries. There was no bacterial wilt infection recorded for the entry 2018/BRLVAR-8, which was noteworthy. Other entries in the trial namely 2018/BRLVAR-9 and 2018/BRLVAR-10 recorded 100% bacterial wilt incidence.

Brinjal Hybrid Long- AVT-II

Out of the entries tested, 2018/BRLHYB-8 produced maximum (1.32 kg) fruits per plant with 5% bacterial wilt incidence, for both these observations the entry showed significant superiority over rest of the entries.

Brinjal Hybrid Round- AVT-II

Entry coded as 2018/BRRHYB-10 produced around 1.1 kg fruit per plant which was statistically significant over rest of the tested entries with 8.33% bacterial wilt incidence. Whereas, 100% bacterial wilt was observed in entries namely - 2018/BRRHYB-6 and 2018/BRRHYB-7.

Chilli /Hot Pepper- AVT-II

A total of six entries including checks were evaluated during the trial. Fruit yields were non-significant as well as considerably lower than average yield of the crop due to heavy bacterial wilt incidence recorded, which ranged from 20 to 68.33%.

Chilli Hybrid/Hot Pepper- AVT-II

Out of the tested entries 2018/CHIHYB-13 produced maximum (4.8 kg) yield per plot of 4.5 sq m) and minimum bacterial wilt incidence of 9%. Fruit yield was non-significant as well as considerably lower than the average yield of the crop in rest of the entries.

Tomato Hybrid Det. IET

A total of seven entries including checks were evaluated under the trial; fruit yield was non-significant as well as considerably lower than average yield of the crop segment because of severe bacterial wilt incidence recorded, which ranged from 46.67 to 100%.

Tomato Hybrid Det. AVT-I

Among the eight entries including checks tested for the yield evaluation trial, two entries namely - 2019/TODHYB-6 and 2019/TODHYB-8 produced respectively 6.37 kg and 4.93 kg, which is statistically at par with the yield obtained per 4.5 sq m plot. Whereas, the same entries recorded nil and 49% leaf curl incidence, respectively

Tomato (ToLCV) Hybrid IET

Eight entries including checks were evaluated in the trial however there was very severe bacterial wilt incidence recorded ranging from 71 to 100% for the trial and fruit yield was non-significant as well as considerably lower than average yield of the crop segment.

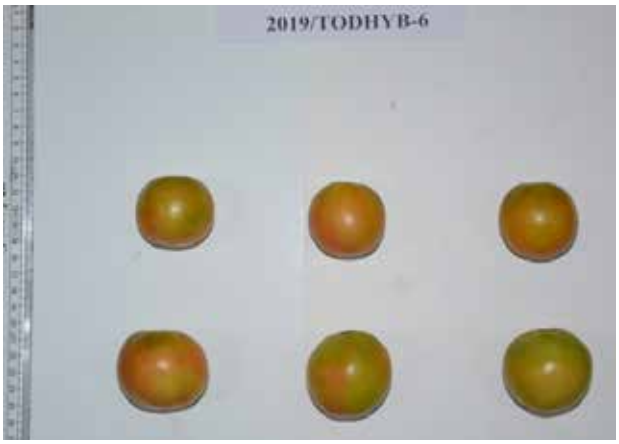
Tomato (ToLCV) Hybrid AVT-I

For the trial, eight entries were tested including checks. Bacterial wilt incidence recorded ranged from 6.67 to 97.78% and fruit yield was non-significant as well as considerably lower than average yield of the crop segment.

Tomato (ToLCV) Varietal AVT-I

Out of the seven entries including checks evaluated under the trial, only one entry namely-2019/TOLCVRES-7 from the trial recorded fruit yield of 4.48 kg from 4.5 sq m plot with a leaf curl incidence of 2.22%. The other entries/ checks produced below average yield of the crop segment due to both bacterial wilt and /or leaf curl incidence.

Entry No. 2018/BRLVAR-8
from Brinjal Long- AVT-II trial



Entry No. 2019/TODHYB-6
from Tomato Hybrid Det. AVT-I trial

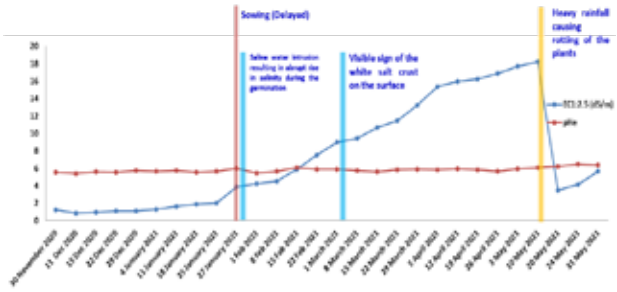
Project: All India Co-ordinated Research Project on Groundnut (ICAR-DGR)

GR Mahajan and R Ramesh

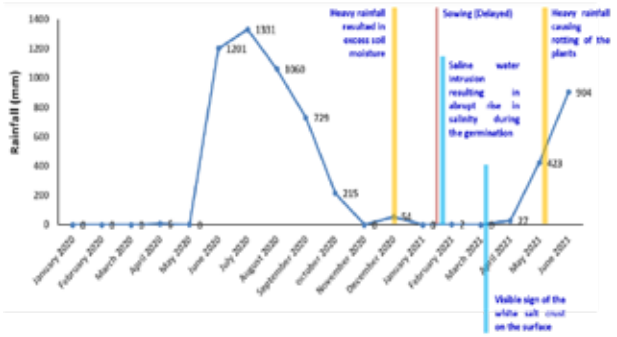
Fallowing after rice crop and abandonment of agriculture is now prevalent in the salt-affected coastal soils. Fallowing typically after the *kharif* rice crop is due to salinity build-up during the post-rainy season and unavailability of good quality irrigation water. To improve the productivity and income from these fertile but marginally productive lands, improving the cropping intensity by cultivating *rabi* crops is essential. However, it requires special management approaches, especially for salt-sensitive crops like groundnut. A study was conducted with the objective of groundnut yield enhancement using endophytic bacteria under saline stress conditions. Five endophytic bacteria were applied as a seed treatment to the groundnut (TAG-24, a locally popular variety) seed while control received no application. The experiment was vitiated due to multiple stresses that occurred during the crop growth and none of the endophyte bacteria made the crop grow successfully. The electrical conductivity ($EC_{1:2}$) at the time of sowing was 2.86 dS m^{-1}(EC_e10.0 dS m^{-1}) which eventually increased throughout the growing season to 21.22 dS m^{-1}(EC_e56.4 dS m^{-1}) till the 105 days after sowing. The salinity stress throughout the crop growing season adversely affected the germination and survival rate. The survival rate of the endophytic bacterial treatments was higher by 32-65% compared to the control. Further, a downpour of 302.5 mm rainfall from 16-18 May 2021 (after 105 DAS) resulted in water stagnation and thereby rotting of the plants and subsequently, the plants couldn't

reach maturity. Though the experiment failed, it envisages important aspects to be corrected or managed for further refinements. Strategic sowing to skip salt stress during the initial period of crop growth, making embankments to restrict the intrusion of saline water and reducing excess moisture buildup by proper drainage for early sowing is required to be made for the cultivation of salt-sensitive crops like groundnut.

Poor crop growth and mortality of groundnut crop due to dual stress by salinity during initial growth period and excessive soil moisture at a later stage



Salinity ($EC_{1:2}$) and soil pH during the growing period of the groundnut crop



Rainfall during the growth period of the groundnut crop

Project: AICRP on Pigs

Amiya Ranjan Sahu

The performance of crossbred pigs in fifth generation has achieved a birth weight of 1.072±0.03 kg, weaning weight of 8.25±0.35 kg and eight months weight at marketing of 77.22±2.09 kg. The application has been submitted for registration of the crossbred pigs as a variety "GOYA" to the ICAR-National Bureau of Animal Genetics and Resources (ICAR-NBAGR), Karnal, Haryana**.**

The crossbred pigs with 75% exotic Large White Yorkshire (LWY) and 25% local Agonda Goan inheritance were produced and maintained to study their growth as well as reproductive performance. A total 30 breeding females and 10 breeding males were selected as per approved guidelines. Generation-wise growth data has been recorded till fifth generation. The least-square mean of all the growth traits up to 10 months of age has been calculated and compared among the generations showing the best results for fifth-generation body weights. Selective breeding along with artificial insemination (A.I) was followed for all the experimental groups. The AI technology was also transferred to the farmers' demonstration unit. Under Tribal Sub Plan (TSP) and Schedule Caste Sub Plan (SCSP) programme training was conducted on scientific pig rearing along with distribution of germplasm, medicinal supplements and concentrate feed mixture to the progressive pig farmers in the west coastal region. The centre maintains pure AgondaGoan, pure Large White Yorkshire and their Crossbreeds.

Crossbred sow

Crossbred boar

Grower flock

Recording body measurements

Project: Hyperspectral remote sensing of the foliar nutrients in crops (funded by DST)

GR Mahajan

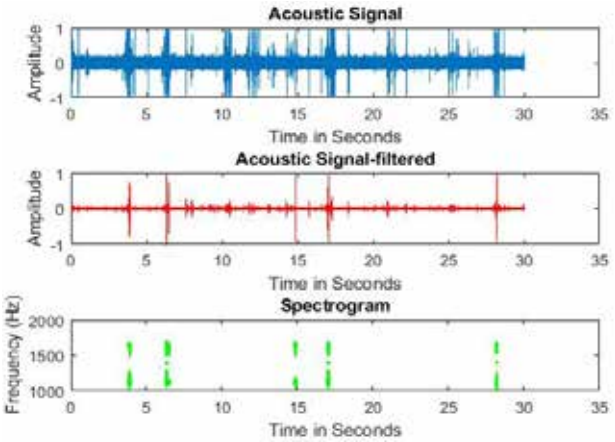
Currently, nutrient management in fruit crops like mango and cashew is based on soil test-based results. In these crops, leaf tissue-based nutrient management is promising from point of view of improving plant growth and yield. But traditional methods for the determination of nutrient in plant leaf samples requires extensive chemical analysis, it is time-consuming and labour intensive. Development of an alternate, rapid and reliable method for determining plant leaf nutrient estimation is the need of the hour and remote sensing techniques can be explored. In the present study, use of the visible near-infrared spectroscopy to predict nutrient status in leaves of mango and cashew was evaluated. Among the different approaches tested, a partial least square regression combined with different machine learning models was observed to be robust. In case of mango crop, the best performing PLSR-combined models were cubist for nitrogen, phosphorus, potassium, and zinc ($R^2 \geq 0.91$, the ratio of performance to deviation (RPD) ≥ 3.3, and the ratio of performance to interquartile distance (RPIQ) ≥ 3.71), SVR for calcium, iron, copper, boron ($R^2 \geq 0.88$, RPD ≥ 2.73, RPIQ ≥ 3.31) for and elastic net for magnesium and sulfur ($R^2 \geq 0.95$, RPD ≥ 4.47, RPIQ ≥ 6.11). For the cashew crop, the best performing PLSR-combined models were with cubist for nitrogen, phosphorus, zinc and copper (R^2 = 0.46-0.72, RPD = 1.30-1.71, and RPIQ = 0.83-2.28), SVR for calcium, magnesium and iron (R^2 = 0.51-0.84, RPD = 1.42-2.45, RPIQ = 1.56-2.65) and elastic net for sulphur, manganese and boron (R^2 = 0.48-0.80, RPD = 0.80-1.32, RPIQ = 0.68-1.71). The results of the current study revealed that the lab-based hyperspectral spectroscopy of mango and cashew leaves has the potential of determining the presence of macro- and micro-nutrients. Such information could be useful for site-specific nutrient management practices required for mango and cashew orchards.

Project: Design and development of acoustic methods for early detection of stem and root borer Plocaederus spp infestation in cashew (funded by DST)

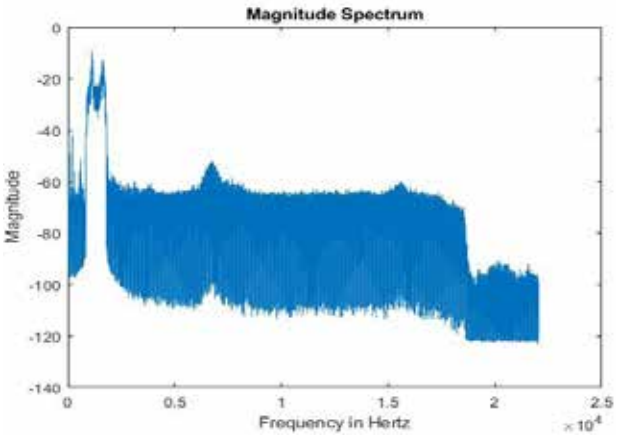
R Maruthadurai and T Veerakumar

The project's main objective was to investigate the acoustic behaviour of stem and root borers in cashew and standardize the methodology for early detection of cashew stem and root borer infestation. We have successfully detected the feeding sounds of cashew stem and root borer infestation with an accelerometer-based sensor and have standardized and developed an acoustic-based novel process for early detection of stem and root borer (*Plocaederus* spp) infestation in cashew. Acoustic signals were recorded from empty wood and various bio-stages of stem borer *viz*., first, second, third, fourth and fifth instars. After analyzing the power spectrum of empty wood, 1st instar, 2nd instar, 3rd instar, 4th instar, and 5th instar, the root borer signal frequency falls in the range of 10 Hz to 200Hz. The proposed approach consists of four stages - in the first stage, acoustic signal acquisition from the cashew tree by using acoustic sensor setup and the acquired acoustic signal is passed through the empirical mode decomposition to extract intrinsic mode functions (IMFs) in the second stage. The intrinsic mode features are computed from the IMFs in the third stage. Finally, the machine learning approach is

used for the identification of whether the root borer exists or not from the intrinsic mode features. Further, we have field evaluated the early detection performance of device with and without infestation of cashew stem borer. Under field conditions, the acoustic device accurately detected 91% of the trees as infested one having stem borer symptoms. Trees without symptoms, 85% of the trees were correctly detected as un-infested one.



A) Waveform and spectrogram of second instar larvae



B) Magnitude Spectrum

Project: Empowerment of farmers through adoption of sustainable and Eco-friendly Integrated Pest and Disease Management technologies in major vegetable crops in Goa (funded by NABARD)

R Maruthadurai and R Ramesh

The aim of this project is to popularize and promote the use of eco-friendly integrated pest and disease management (IPDM) technologies in major vegetable crops. Front line demonstration on integrated pest and disease management technologies for chilli was undertaken at six *taluks* viz., Canacona, Sanguem, Quepeum, Tiswadi, Bicholim and Mapusa. Plant protection inputs like Goa Bio 1, Goa Bio II, spinosad, chitosan and sticky traps were distributed to 300 farmers. Field training on identification and diagnosis of insect pests and diseases of chilli was organised. Hands-on training was provided to the farmers on nursery drenching of bio-control agents, main field application, installment of sticky traps and its preparation, grafting techniques and spraying of bio-pesticides. Demonstration plots were monitored from transplanting till harvest of the crop. Observations on insect pest incidence and disease scoring were recorded after every spray. Relatively, lesser incidence of thrips, whiteflies, aphids and diseases were recorded in IPDM demonstration plots as compared to control. Higher yields of chilli were recorded in plots which received IPDM technologies as compared to control. Wilt-resistant Goa Brinjal-1, 2, 3 and 4 were also distributed to the farmers under this project.

Demonstration plots for integrated pest and disease management in chilli

Project: Network Project on Functional Genomics & Genetically Modification (NPFGGM) in Corps (funded by ICAR)

Manohara KK

Advancement of mapping populations

The objectives of the project are to map QTLs/ genes governing tolerance to salinity stress at seedling stage in paddy. In order to study the mechanism of tolerance for salinity tolerance at seedling stage in Korgut and derived line Goa Dhan 2, crosses were developed using Korgut and Goa Dhan 2 as donor parents. Three populations, namely, Jaya × Goa Dhan 2, Jyothi × Goa Dhan 2 and Jyothi × *Korgut* were advanced to subsequent generations during *kharif* and *rabi* season. F_2 generations were raised during *kharif* and F_3 generation was raised during *rabi* season. Single panicles were harvested from each of the three populations to advance it to Recombinant Inbred Line populations.

Project: Production and formulation technology refinement of bacterial bio-agents for soil borne plant disease management under coastal ecosystems- Phase II (funded by ICAR)

R Ramesh and Maruthadura R

Evaluation of various carrier-based and liquid formulations of B. methylotrophicus (RCh6-2b and STC-4) for its viability

Conclusions from the studies on various carrier-based and liquid formulations of *B. methylotrophicus* (RCh6-2b and STC-4) indicated that the population of bacterium in the formulation was 8.0-9.0 Log CFU g^{-1} or mL^{-1} for at least 24 months. The population is same in case of talc formulations with different amendments (press mud and seaweed) and other value additions. In case of capsule and tablet formulations, the population was 9.0-10.0 Log CFU g^{-1} for at least 24 months.

Studies on the release of bacteria from talc and capsule formulation to the black pepper rhizosphere soil

Studies on the population of RCh6-2b and STC-4 in the rhizosphere soil applied with talc and capsule formulation over a period was 12 months indicated that the bacteria released to the rhizosphere and the population of the applied bacteria was 6 Log CFU g^{-1} of rhizosphere soil. Total soil bacterial population was 7-8 Log CFU g^{-1} of soil. These results indicate that the introduced bacteria from talc and capsule formulations survive well in the rhizosphere soil and hence would provide better growth benefits and protection to the crop.

Evaluation of capsule formulation of bio-agents for the management of foot rot in black pepper

Based on the experiments during the previous seasons and failed field trails due to cyclone, another field experiment was initiated in October 2021 at farmer's field in Narve village. The treatments include talc and capsule formulations of RCh6-2b and STC-4. Black pepper cuttings were treated either in nursery or while planting. Initial observations indicated that there is no mortality of cuttings treated with bioagent. Plant height was significantly higher in the treatments compared to untreated control after four months of treatments. The experiment is in progress. A field demonstration on the effect of capsule formulation of RCh6-2b on black pepper foot rot incidence was started in March 2022 at farmer's field in Sanguem village and the trial is being monitored.

Observations on four-year-old field experiment on the effect of bio-formulation on black pepper foot rot incidence at the farmer's field indicated that the plants treated with talc formulation of RCh6-2b showed vigorous growth and higher berry-bearing. The next best treatment was STC-4. Untreated control plants showed mortality and were less vigorous.

Disease management and growth promotion in vegetables using bacterial bio-agents agents

Talc-based bio-formulations (STC-4 and RCh6-2b as Goa Bio-1 and Goa Bio-2) were mass produced and distributed to farmers of Goa in more than 50 disease management field demonstrations on chilli. There was no incidence of wilt or other soil-borne diseases in the bio-agent treated fields. Results from 56 field demonstrations indicated that application of Goa Bio-1 and Goa Bio-2 along with spraying of chitosan/ spinosad reduced the leaf curl virus disease (27-38% and 23-38% disease reduction, respectively) compared to control. Increase in dry chilli yield in Goa Bio-1 and Goa Bio-2 applied plots (46-60% and 28-35% respectively) was recorded.

Project: District Agro-Met Unit (DAMU), North Goa

GR Mahajan and Bappa Das

Weather varies spatiotemporally and it has a profound influence on agricultural production. Timely information on the weather forecast and the advisories issued accordingly could be a viable approach to avoid crop losses and improve crop yields and ultimately the farmer's income. To provide real-time weather forecasts and agro-advisories at a block/*taluka* level to the farming community of North Goa district, District Agro-Met Unit (DAMU) was set up at ICAR-CCARI, Old Goa. The advisories were compiled in the form of weather-based agro-advisory bulletins issued twice a week (every Tuesday and Friday). Wider and effective dissemination was achieved through bilingual bulletins published in English and Konkani (the local language of the region) languages. In 2021, a total of 105 advisory bulletins were prepared and disseminated. About 130 WhatsApp groups were created to disseminate the AAS bulletins to farmers that covered farmers of 195 villages in the North Goa district. The agro-advisories were disseminated to 7000 farmers twice every week. A framework of reaching out of advisories to farmers at the village and block level was also achieved by hosting it on different departmental websites of Goa state. Awareness and capacity-building programmes were also conducted to enhance the outreach of weather information and advisories to farmers. In this context, 4 awareness programmes were conducted, which included farmers from different blocks of North Goa. Weekly feedback was collected from the farmers about the usefulness of the Agro-Advisories. Based on the feedback collection and impact assessment, an additional income of Rs. 9.0 crore was estimated by enabling farmers to save the crops from aberrant weather and plan timely agricultural

operations. For obtaining accurate observations of weather, an Automatic weather station has been installed at the ICAR-CCARI campus by IMD New Delhi. This AWS can measure, record & communicate weather data every 15 minutes with high accuracy. Further, this weather information is utilized for the preparation of more weather-specific agromet advisories. Crop weather calendar (CWC) was also prepared for *kharif* paddy (Variety –Jyoti). This can provide comprehensive information on weekly average weather, sowing and harvesting periods of locally cultivated crops. Further, favourable weather conditions and stage-wise pest disease infestation information were also added. This tool can help farmers in taking decisions on sowing period of crops and also their management. Thus, the agro-advisory bulletin based on current and forecast weather is a useful tool for enhancing the production and income of coastal farmers.

An automatic weather station installed at the Institute

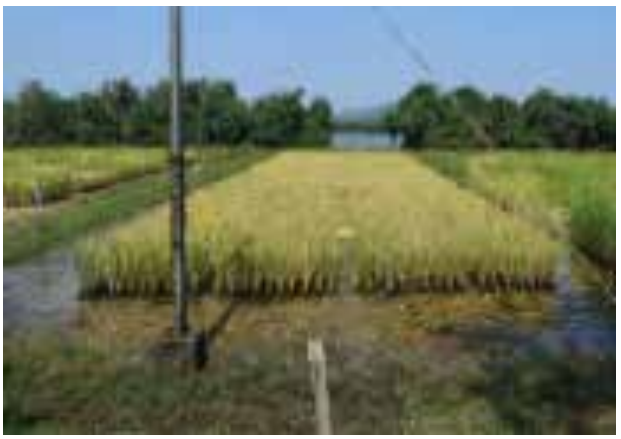
Capacity building of the extension officers and the farmers for the weather forecast based agro-advisories and its use.

a. Seed production in field crops

Manohara K K

Quality seed production for major field crops of Goa State was undertaken at the Institute farm during *kharif* and *rabi* seasons. The following quantity of breeder seed (BS) and truthfully labelled seed (TLS) was produced during 2021-22. Breeder seed production was taken up in paddy varieties Goa Dhan 1, Goa Dhan 2, Goa Dhan 3 and Goa Dhan 4 and cowpea variety Goa Cowpea 3. TL seed production was taken up in paddy varieties viz., Jaya, Jyothi, Karjat 3 and Sahbhagi Dhan and green gram varieties TM 96-2 and IPM 2-14 in small quantities to meet the demand from the Department of Agriculture, Govt of Goa.

Seed production during *kharif* 2021 (Institute farm)



Seed production during *kharif* 2021 (Rice research farm, Chorao Island)

Participatory seed production in farmers field

Quantity of seed produced at the Institute farm

Crop	Varieties	Class of seed	Qty (Quintal)
Paddy	Goa Dhan 1	BS	5.0
	Goa Dhan 2	BS	1.0
	Goa Dhan 3	BS	5.0
	Goa Dhan 4	BS	5.0
	Jaya	TLS	1.0
	Jyothi	TLS	0.5
	Sahbhagi Dhan	TLS	1.5
	Karjat 3	TLS	0.5
Cowpea	Goa Cowpea 3	BS	2.0
Green gram	TM 96-2	TLS	0.5
	IPM 2-14	TLS	0.5
Total quality seed produced at the Institute farm during kharif and rabi season (2021-22)		22.5	

Front line demonstration on paddy variety Sahbhagi Dhan & participatory seed production in farmers field

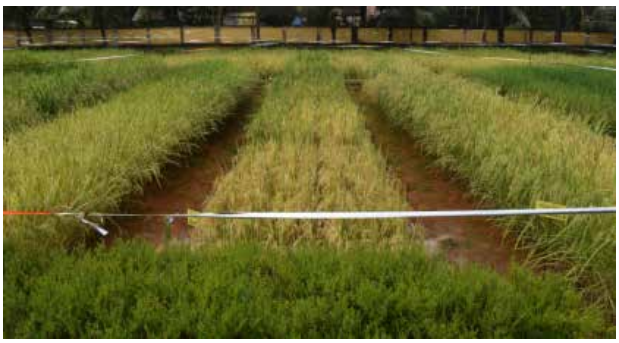
Truthfully Labelled Seed of paddy variety Sahbhagi Dhan was taken up in Gaodongrim and Cotigao villages of Canacona block through participatory seed production mode for multiplication and re-distribution among the farmers. Farmers were trained on quality seed production, plant protection measures and other package of practices for increasing their livelihood.

Maintenance breeding in released salt-tolerant rice varieties

Four salt-tolerant rice varieties, namely- Goa Dhan 1, Goa Dhan 2, Goa Dhan 3, and Goa Dhan 4 were planted in panicle to progeny rows in 25 rows of 8 m length to produced nucleus seeds. About 30 kg seed nucleus seed were produced and panicles were collected for producing the next cycle of nucleus seeds.

Capacity building / technology dissemination

As part of the capacity building under ICAR seed project, trainings were imparted to farmers in Gaodongrim and Cotigao villages about quality seed production. Farmers were given training on seed treatment, identification of important insect pests and disease symptoms in the field and to take appropriate control measures. Two trainings and one field day were organized during *kharif* 2021.



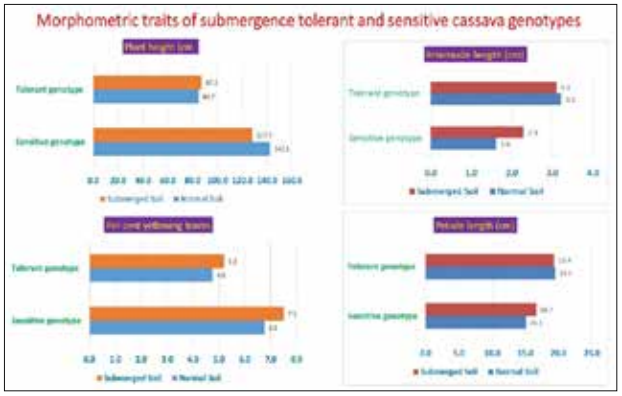
Field view of nucleus seed production plot at the Institute farm

Training and field day conducted in Gaodongrim and Cotigao villages in South Goa

b. Seed Production in Horticultural Crops

V Arunchalam

Submergence tolerant cassava germplasm was obtained from Kerala during the visit during 3rd to 5th Sept. 2018 to flood-affected Ernakulam district which had received heavy rainfall and winds during 9th to 15th August 2018. The survey was conducted in Karumallor, Erumathala, Thottumugham, Chengamauadu, Angumaly, Parapavam villages in Ernakulam district The period of water logging in different villages varied between 3-15 days and the depth of flowing water ranged from 1 m to 10 m. Tapioca (Cassava) crop is affected badly due to submergence since the root system is damaged because of submergence and root rot occurred. However, few plants have survived this submergence. Stem cuttings from surviving plants were collected and multiplied. The submergence genotype was tested in waterlogged soils. A trial was laid out during Oct 2021 in adult Arecanut cv. Mangala garden in a submergence area adjacent to normal soil. About a total of 48 plants were planted with four treatments (submergence tolerant accession in normal soil, submergence tolerant accession submerged soil, submergence susceptible accession in normal soil, and submergence susceptible accession in submerged soil). After 60 days of planting, data on the number of total leaves, number of yellow leaves, length and breadth of leaf and leaflet, plant height were recorded. Submergence tolerant cassava genotype was shorter in height, had lower percentage of yellowing leaves, with long petioles and long internodes than sensitive genotype.



Foliar potassium content in coconut and banana was quantified using sodium cobalt nitrate reagent-assisted colorimetric, ion-specific electrode, and smartphone app-based techniques. Scions of four mango accessions of Goa (St Thomas (San Thome), Raia Mangurad, Fatorda, Mussarat) were obtained and grafting was attempted. About 15 grafts each of four promising mango germplasm were made available. Mr Thomas Antonio da Costa from Novangully, Varca (South Goa) the owner of St Thomas type of unique mangurad with large fruits each weighing 400 to 500 g has spared scions for establishing the mother blocks for conservation of the genotype.

Two mutants of black pepper (bold fruit (AT-01), double-leaf tip) are spotted and characterized for morphometric traits and piperine content. The bold fruit mutant (AT01) recorded a higher berry weight of 7.04±0.27 g and a longer lateral branch (62.4±9.9 cm) than wild type (AT03) with small berry (5.95±0.3 g) and short lateral branch (37.1±5.1 cm).

AT03 Normal pepper AT01 Mutant pepper with bold fruits

Coconut seedlings of dwarf varieties - Chowghat Orange Dwarf, Gangabondom Green Dwarf and the progenies of big fruited Green Dwarf palm D6 were planted in the new plot for seed production. Arecanut seedlings of Hirehalli Dwarf were also planted in the new plot for generating planting material. Quality planting material numbering 5548 from 8 major horticultural crops and others were generated. A revenue of Rs. 4,18,233/- was generated during the year (Jan to Dec 2021) from the project, by the sale of the above planting materials and farm produce.

Planting material sold and revenue earned

Crop	Number of plants
Arecanut	2357
Coconut	799
Banana	95
Black Pepper	1257
Cashew	161
Mango	328
Passion fruit	120
Clove	94
Others	337
Total	5548

c. Seed Production in Ornamental Fisheries

Sreekanth G B

During this year, a total of 5000 ornamental fish seeds (Guppy, molly, platy, sword tail, gourami, goldfish and koi carp), 100 kg of fish feed, 40 kg of freshwater fish brooders, 300 posters on fisheries resources, 1000 seedlings of aquatic plants were produced and sold to the farming community.

Item	Particulars	No.'s	Rate (Rs.)	Total (Rs.)
Fish seeds	Guppy, molly, platy, koi carp, sword tail, gouramies, tilapia, Amur carp	5000	15	75000
Fish feed	Ornamental fish feed (kg)	100	1000	100000
Freshwater fish	Catla, Rohu and Common carp (kg)	40	200	8000
Fish posters	Posters on fisheries resources	300	100	30000
Aquatic plants	Aquatic plants	1000	15	15000
Aquariums	Tank set-0.45×0.3×0.3 m	1500	13	19500
		Total		247500

Project: Poultry Seed Project (ICAR)

Nibedita Nayak

Backyard poultry varieties - *Vanaraja, Krishibro, Grampriya, Debendra, Nirveek* and indigenous birds were reared in the institute during the reporting year. Presently *Gramapriya* parent stock day-old chicks (319 nos.) were in grower phase @13weeks. The average weekly body weights of *Gramapriya* birds at hatching, 1st, 2nd, 3rd, 4th and 7th week for were 36.72 g, 71.72 g, 183.53 g, 343.25 g, 494.47 g and 1008.86 g for males, whereas 32.35 g, 46.10 g, 96.83 g, 167.35 g, 213.35 g and 401.90 g for females. The average daily egg production was 43.18% at culling time and mean egg weight was 55.20±0.35g. The overall hatchability on fertile egg set (FES) basis varied from 75-82%.

Brooding unit of *Gramapriya*

***Krishibro* adult**

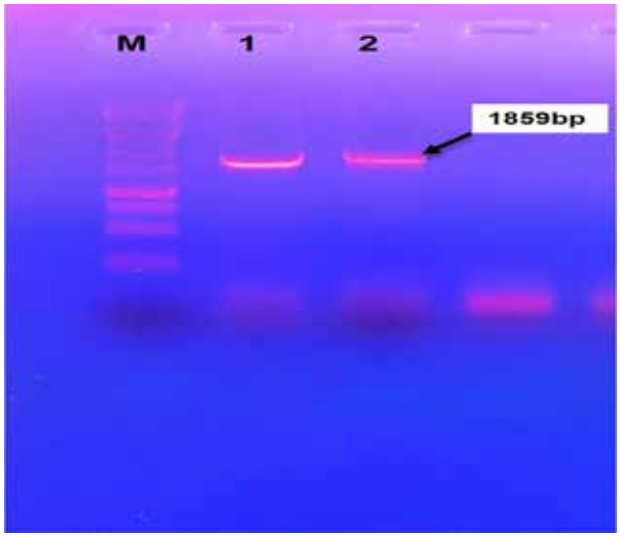
***Gramapriya* adult**

Susitha Rajkumar

Livestock disease outbreak investigations, monthly outbreak reporting and sample collection from Goa, as part of nationwide prevalence study are the main objectives of this project. Disease outbreak investigations were carried out in both the districts of Goa.

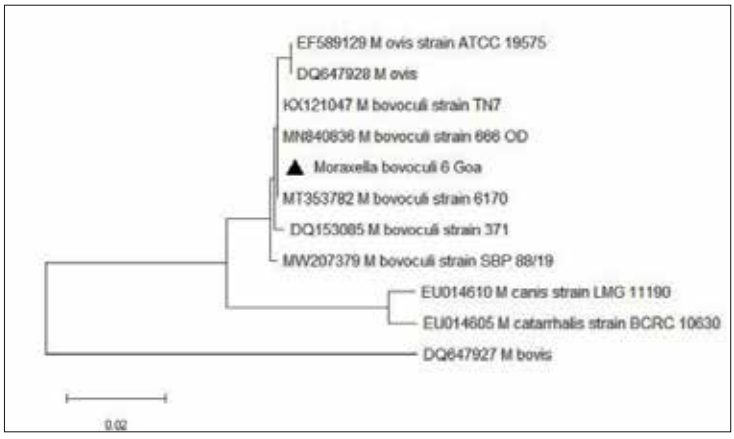
An outbreak of kerato-conjunctivitis was reported in a dairy farm in North Goa district, where a herd of more than 60 bulls were showing conjunctivitis, lachrymal discharge, corneal opacity in single or both eyes and animals were emaciated due to blindness. Isolation and identification of the pathogen from the ocular swab revealed the presence of *Moraxella* spp. and multiplex PCR identified the causative agent as *M. bovoculi*. The isolate was confirmed as *M. bovoculi* by sequence analysis of the *16srRNA* gene. Treatment using Streptomycin and Penicillin antibiotics and dexamethasone was taken up in affected animals, which yielded good results and led to complete recovery. Phylogenetic analysis using MEGA-X showed clustering of the Goan isolate with other isolates from India and United States.

An outbreak of Bovine tuberculosis (TB) was investigated in a dairy farm with around 600 susceptible cattle population and TB was confirmed in samples from 4 animals by microbiological and histo-pathological examination. Two outbreaks of Brucellosis were diagnosed in 2 dairy farms in North Goa. *Babesia bovis* (6 cases) and *B. bigemina* (2 cases) were detected by PCR in whole blood DNA from animals with high fever.



Agarose gel image showing amplification of 16rRNA gene (1850bp) of *Moraxella bovoculi.*

Kerato-conjunctivitis in affected bull



Phylogenetic analysis in MEGA X program showing clustering of Goan *M. bovoculi* isolate with other Indian isolates

Project: Centrally sponsored MIDH scheme through DASD, Kozhikode

A R Desai

Planting material of spice crops namely, Black pepper (4 varieties: Paniyur-1, 5, Thevam, Shakti, and local betel leaf), seed rhizomes of 5 varieties (Pratibha, Pragati, Sudarshan, Alleppey Supreme, Salem), Turmeric portray seedlings, Nutmeg grafts, Cinnamon, curry leaf, etc., was produced and supplied to farmers and development department.

Field level demonstration (FLD) on high-density planting (HDP) of grafted Bush pepper

The FLD units (160 m2 area each) on grafted bush pepper started flowering and production of pepper in all four units. Dry pepper yield of 16.9 kg, 11.6 kg and 14.2 kg was harvested from FLD Units at CCARI, Old Goa, Kurzuvem, Bardez (North Goa) and Raia, Salcette (South Goa) respectively. Flowering is being continuously observed in all the units. Of the bush pepper grafts of 4 different varieties viz. Paniyur-1, Paniyur-5, Karimunda and Kottayam local planted in FLD Unit-1 at CCARI, both Paniyur -1 and Paniyur-5 were observed to yield 9.1 kg and 7.8 kg of dry pepper, respectively, indicating their better performance and suitability for HDP under 50% shade net. In the unit at CCARI Farm, an attempt was made to utilize the aerial space for cultivation of oyster mushroom and orchid flower production. Two batches of oyster mushroom cultivation were taken up successfully in the aerial space above the bush pepper grafts under shade net structure. Fresh mushroom yield of 2.34 kg and 7.83 kg were harvested from 10 and 19 inoculated bags (18" × 12" size) of 1st and 2nd batch respectively, within a period of 20-30 days, with a mean yield of 234 g and 411g per bag from the respective batches. Orchids of commercial varieties also produced flower spikes in the first batch. Thus, the FLD units started production right from the first year of their establishment. FLD Unit-1 at CCARI, Old Goa and FLD unit -5 at Poinguinim are completely maintained under organic practices.

Production of oyster mushroom and orchids above grafted bush pepper under shade net


Growth of grafts of high-density planting (HDP) of grafted Bush pepper Var. Paniyur-1 at Kurjuvem in a field-level demonstration


Growth of high-density planting (HDP) of grafted Bush pepper Var. Paniyur-1 at Raia, Salcette in a field-level demonstration

Project: NAIF Component II (Agri-Business Incubator)

(Mathala Juliet Gupta, R.S. Rajkumar and Shripad Bhat)

- A Business Centre for ABI-AGNI of ICAR-CCARI has been created.
- A governance body and a system of governance and operation for the ABI has been formulated.
- External mentors for guidance on financial and business planning have been chosen and inducted in the ABI.
- A total of 12 Start-ups have been registered as incubates
- A Webpage for the ABI has been designed and developed.
- A sensitization workshop has been conducted for the potential incubates and based on this the final incubates registered.

Application Procedure: (through online google form):

Potential incubates apply through online google form. These forms are submitted before


advisory committee and based on the decision, incubates are assigned fees and mentors.

Services being offered to incubatees:

Some services being offered to incubatees are:

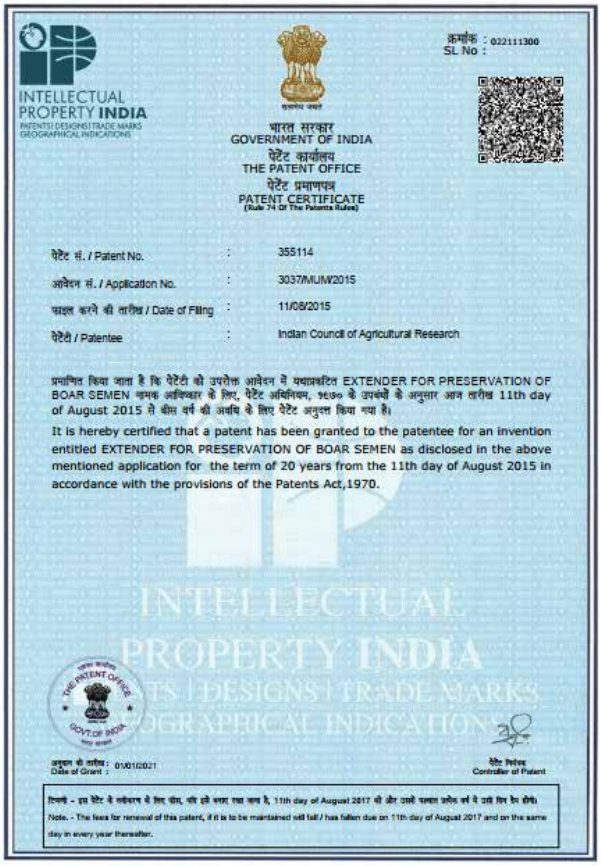
- In house processing and value addition – Custom hiring facility for turmeric, coconut, jackfruit, aonla and other fruits
- Innovative technology in processing for commercialization
- Preparation of Detailed Project Report (DPR) for new startups
- Hand-holding for startups up to 6 months (extendable as per requirement)

Significant Accomplishments

IPR Cell /ITMU Activities

Patent applications granted/processed/filed

- A patent was granted to "Extender for the preservation of boar semen" (Patent No.: 355114) invented by ICAR-CCARI, Goa, on 1st January 2021 for patent application No. 3037/MUM/2015 dated 11th August 2015.
- FER response was filed in the patent application entitled "Process for preparing nutmeg toffy and resultant food product thereof" (PA# 201621012414) at the Indian Patent Office through Institute IPR Attorney - M/s Krishna & Saurastri Associates LLP, Mumbai, on 2nd July 2021
- FER response was filed in the patent application entitled "Process for preparing cashew apple crunch and resultant food product thereof" (PA# 201621012413) at the Indian Patent Office through Institute IPR Attorney - M/s Krishna &Saurastri Associates LLP, Mumbai, on 22nd September 2021
- Complete Specification was jointly filed at the Indian Patent Office in the patent application entitled "Device and Method for Unmanned Harvesting of Nut & Fruit"(PA#202021042421) by ICAR-CCARI, Goa and Goa University, on 30th September 2021
- Process for filing a provisional patent application "Method and system for detection of stem and root borer infestation" through Institute IPR Attorney - M/S Krishna & Saurastri Associates LLP, Mumbai, was initiated as recommended by Committee (ITMC)



INTELLECTUAL PROPERTY INDIA

भारत सरकार
GOVERNMENT OF INDIA
पेटेंट कार्यालय
THE PATENT OFFICE
पेटेंट प्रमाणपत्र
PATENT CERTIFICATE

पेटेंट सं. / Patent No. : 355114
आवेदन सं. / Application No. : 3037/MUM/2015
फाइल करने की तारीख / Date of Filing : 11/08/2015
पेटेंटी / Patentee : Indian Council of Agricultural Research

It is hereby certified that a patent has been granted to the patentee for an invention entitled EXTENDER FOR PRESERVATION OF BOAR SEMEN as disclosed in the above mentioned application for the term of 20 years from the 11th day of August 2015 in accordance with the provisions of the Patents Act,1970.

Patent granted to "Extender for the preservation of boar semen"

Technology Commercialization / MoA/MoU Signed

- A Memorandum of Agreement (MoA) was signed between ICAR-CCARI, Goa and Goa State Biodiversity Board (GSBB), Goa, for commercialization of ICAR-CCARI's technology "Process for manufacturing of Nutmeg Pericarp Toffy" at ICAR-CCARI, Old Goa, on 19th February 2021. The licence fee was Rs. 3,54,000/- (Rs. 3,00,000 + 18% GST), and this non-exclusive licensing agreement is valid for a period of five years.
- A Memorandum of Understanding (MoU) was signed between ICAR-CCARI, Goa

and ICAR-CPRI, Shimla to popularize and develop a modified model unit of VEGFAST technology for the coastal region on 18th August 2021.

MTA Signed

- Material Transfer Agreement for transfer of seed material and promotion of cultivation of *Curcuma longa* (var. CIM-Pitamber) was signed with CSIR-CIMAP, Lucknow, on 19th April 2021.
- Material Transfer Agreement was signed for sharing salt-tolerant brinjal rootstocks, germplasm seeds with ICAR-IIVR, Varanasi on 24th December 2021 as per the recommendations in the '26th meeting of ICAR Regional Committee No.VII'.

Variety Release

- Brinjal varieties (Goa brinjal-5 and Goa brinjal-6) were released for the state of Goa by the State Variety Release Committee on 6th January 2021.

Webinar Organized

- The ITMU, ICAR - CCARI, Goa, organized a Webinar on "Importance of Intellectual Property Rights in Agricultural Research" on 26th April 2021 on the occasion of World Intellectual Property Day. Ms Uma Baskaran, Institute IPR Attorney & Senior Consultant, Krishna & Saurastri Associates LLP, Mumbai delivered a lecture on patentability of agricultural technologies. This Webinar was aimed at creating awareness about IPR issues in agricultural research, and a total of 26 participants attended the Webinar virtually.

Workshops/ Meetings attended

- Participated and delivered a presentation on the achievements of ITMU of the Institute in the Brainstorming Session of ITMUs under NRM SMD, organized by ZTMC - ICAR RC NEH Region, Umiam – Meghalaya, on 3rd February 2021.
- Participated in the virtual "National Dialogue on Innovative Food for Hospitality Industry" a Programme organized by IP&TM Unit, under the Chairmanship of Secretary (DARE) & Director General (ICAR), on 22nd June 2021.
- Presented progress report (2020-21 & 2021 and till October 2021) of ITMU and PME during ZTMU/ITMU Sensitization Virtual Workshop organized by IP&TM Unit on 5th October 2021.
- Presented a lecture on 'Commercialization of ICAR-CCARI Technologies' in the 'Sensitization Workshop on Agri-Business Incubation' organized by Agri-Business Incubation Centre (AGNI) at the Institute on 10th November 2021.

ITMC/other Meetings conducted/attended

Sl . No	Type of Meeting and Details	Venue/ Mode	Date	No of Participants
1	Institute Technology Management Committee (ITMC) Meeting	Virtual	18-02-2021	07
2	Institute Technology Management Committee (ITMC) Meeting	Virtual	10-03-2021	09
3	Institute Technology Management Committee (ITMC) Meeting	Virtual	17-04-2021	08
4	Discussion between the team from ICAR-CCARI & Goa University at the Institute for preparing the Complete Specification for Fly–Cocobot	Institute	12-06-2021	07
5	ITMC meeting of ICAR-CPRI Shimla to finalize modalities for designing MoU between ICAR- CPRI, Shimla & ICAR-CCARI, Goa	Virtual	08-07-2021	17
6	Meeting with Goa University for preparing Form 2 in the joint patent application (PA# 202021042421) at the Institute	Institute	25-09-2021	04
7	Institute Technology Management Committee (ITMC) Meeting	Institute	22-10-2021	09
8	Meeting with Goa University to discuss/clarify points to proceed with the process of MOU at Goa University	Institute	30-11-2021	09
9	Institute Technology Management Committee (ITMC) Meeting	Institute	03-12-2021	10
10	Institute Technology Management Committee (ITMC) Meeting	Institute	09-12-2021	13

Technology Evaluation

Performance evaluation of process machinery

Four process machinery *viz* 1) Cashew Apple Crusher and 2) juice extractor – of Omkar Krushi Yantra, Brahmakarmali 3) Motocart 125 and 4) Motocart 350 - of M/s Easy Life Enterprises, Udupi, Karnataka, manufactured by M/s Hegde Agro Impex Pvt.Ltd., Sagar, was evaluated and performance evaluation reports were given to the manufacturers. These machines will be useful in horticulture-based cropping systems of the coastal region. All four machines performed well and were certified as 'Good'.

Name : **Horivacao Manned Arecanut Tree Climber (Standing Type)**
Function : Climbing Arecanut trees for harvesting raw, mature & dry bunches & for tree management
Capacity : 9 trees /h, without applying the fatigue factor
Material : Body – Powder coated MS(Pedal and handles) & SS 202
Rope- Galvanized Carbon Steel
Grip used to hold the plant –Vulcanized Rubber with 3 reinforced Nylon strips
Power Source : None
Dimension in mm(L × W × H) : Height - 110 cm, Width - 40 cm, Rubber Grip – 17.8 cm
SS Rope Length (6 mm dia.)– 110 cm
Weight of machine : 6.78 kg

Manned Arecanut Tree Climber (Standing Type)

Name : **Horivacao Manned Coconut Tree Climber (Standing Type)**
Function : Climbing Coconut Trees for harvesting raw, mature & dry Coconuts & tree management
Capacity : 10 trees/h without applying fatigue factor
Material : Body – Powder coated MS(Pedal and handles) & SS 202
Rope- Galvanized Carbon Steel
Grip used to hold the plant –Vulcanized Rubber with 3 reinforced Nylon strips
Power Source : Manual
Overall Dimension : Height - 110 cm m; Width - 40 cm, Rubber Grip - 30 cm,
SS Rope Length (6 mm dia.)– 140 c
Weight of machine : 6.78 kg

Manned Coconut Tree Climber (Standing Type)

Name : **Horizontal Chaff cutter**
Function : Cutting of green and dry fodder
Capacity : 396.3±90.1 kg/h for green fodder grass (M.C.= 87.4 ± 0.5% W.B.),
Size of cut pieces : 18.5±1.1 mm (with cutting efficiency > 95% 223.1±20.7 kg/h for dry fodder grass (M.C.= 18.2 ± 0.5% W.B.),
Size of cut pieces : 21.5±1.4 mm with cutting efficiency > 95%
Material : Mild Steel except cutter which is made of high carbon steel
Power Source : 2 Hp Electric Motor, Single Phase, 230 V, 1440 RPM
Overall Dimension : 770 mm × 650 mm × 1120 mm (length × width × height)
Weight of machine : 135 kg

Horizontal Chaff cutter

Name : **Maharaja Arecanut Gorbal Polisher**
Function : Areca nut cleaning machine (For removal of residual husk from de-husked areca nuts)
Capacity : 52.5±14.3 kg/h of Mixed Grade unpolished areca nut (M.C.= 14.3± 0.1% D.B.) with polishing efficiency > 80% or 21.5±6.6 kg/h of Polished Arecanut (M.C.= 14.2± 0.3% D.B.) with polishing efficiency> 80%
Material : Mild Steel
Power Source : 2.0Hp, Single Phase Motor, 230 V
Overall Dimension : 640 × 549 × 1128 cm (length × width × height)
Weight of machine : 80 kg

Arecanut Gorbal Polisher

Name : **Agricultural Waste Shredder**

Function : Agricultural Waste Shredder (For shredding of Agricultural Waste)

Material	Capacity (kg/h)	MC & WB	Shredding efficiency
Dry coconut leaves	315.1±1.1	45.1±1.6%	> 40±0.6%
Green coconut leaves	255.5±0.6	61.5±0.6%	> 57.1±0.01%
Dry Coconut Husk	409.9±12.8	16.3±0.3%	75.5±0.02%
Wet Coconut Husk	619.9±14.9	63.9±1.4%	91.6±0.01%
Arecanut leaves	289.2±9.09	59.2±1.7%	45.0±0.2%
Coconut leaf petioles*	-	--	-

* could not shred

Material : Mild Steel
Power Source : 5.0 hp, Three Phase Motor, 1440 RPM
Overall Dimension : 95 × 122 × 120 cm (length × width × height)
Weight of machine : 115 Kg

Agricultural Waste Shredder

On-going Research Projects

Institute Funded Project

Sl. No.	Project Title	PI	Co-PI	Duration
NATURAL RESOURCE MANAGEMENT				
1.	Genesis of soils and associated evaporates for sustainable land use options and carbon management in the coastal region of India.	SK Singh	GR Mahajan, Bappa Das Sujeet Desai Sreekanth GB	2020–22
2.	Assessment of the properties of the coastal saline soils and development of integrated nutrient management practices and crop establishment methods for improving its productivity	GR Mahajan	R Ramesh	2017–22
3.	Study of conservation tillage practices for sustainability of rice based cropping systems in west coast of India	Paramesha V	GR Mahajan Parveen Kumar	2019–24
4.	Evaluation of potential rice based cropping systems under salt affected coastal saline soils for enhancing cropping intensity, sustainability and livelihood security	Paramesha V	Parveen Kumar Manohara KK Sukanata K Sarangi Shripad Bhat	2021–25
5.	Assessment of climate change vulnerability in coastal districts of India	Bappa Das	VK Sehgal	2019–22
6.	Assessment and mapping of trends in hydro-climatic variables over west and east coast regions of India	Sujeet Desai	Bappa Das Sreekanth GB	2019–22
7.	Assessment and development of agro-forestry systems for improved livelihood and climate change mitigation in coastal regions of India	Uthappa AR	Desai AR Shripad Bhat GR Mahajan Paramesha V Sujeet Desai Bappa Das RS Rajkumar	2021–25
HORTICULTURE SCIENCES				
8.	Harnessing palms for sustainable livelihoods of coastal India	V Arunachalam	SK Singh V Paramesha	2020–25
9.	Agro-biodiversity, nursery techniques, and post-harvest technology of ornamental crops for livelihood diversification in coastal India.	V Arunachalam	Maneesha SR	2021–25

10.	Collection, evaluation of genetic resources and management of fruit and spices	AR Desai	SK Singh Sujeet Desai Paramesha V Maneesha SR Nibedita Nayak	2011–23
11.	Integrated strategies for crop improvement and organic production in cashew for coastal climate resilience	AR Desai	Manohara KK Paramesha V	2020–25
12.	Assessment and development of cropping systems based harvest and postharvest management technologies for coastal India	MJ Gupta	AR Desai R Ramesh Maneesha SR Shripad Bhat Monica Singh	2020–25
13.	Production and postharvest management of fruit crops kokum, jackfruit and breadfruit of west coast region of India	Maneesha SR	MJ Gupta R Ramesh	2018–22
14.	Response of mango (*Mangifera indica* L.) to edaphic and climatefactors in Indian coastal region	Maneesha SR	AR Desai SK Singh Bappa Das	2020–25
15.	Assessment and strengthening of vegetable production in coastal region through acquisition, utilization of local germplasm and strategic introduction of commercial vegetables.	Chaudhari GV	AR Desai R Ramesh Maruthadurai R Shripad Bhat	2021–25
16.	Impact analysis of ICAR-CCARI technologies	Shripad Bhat	AR Desai Manohara KK GR Mahajan Paramesha V Amiya Ranjan Sahoo Monica Singh	2021–24
17.	Assessing research needs of stakeholders of ICAR-CCARI, Goa	Shripad Bhat	Monica Singh	2021–22
CROP SCIENCE				
18..	Study and the management of major diseases of vegetable crops in coastal region	R Ramesh	R Maruthadurai Ganesh Chaudhari	2017–22
19.	Development of detection methods/ diagnostics for important and emerging plant and animal pathogens of coastal region	R Ramesh	Shivasharanappa N Susitha Rajkumar	2020–25
20.	Genetic improvement of rice for coastal agro-ecosystem	Manohara KK	Paramesha V	2020–25
21.	Studies on emerging insect pests (white flies and fall army worm) and their management in coastal region of India	R Maruthadurai	R Ramesh	2019–22

ANIMAL SCIENCE AND FISHERY SCIENCE				
22.	Prevalence and impact study of the economically important diseases of dairy animals in coastal India	Susitha Rajkumar	Shivasharanappa N	2019–24
23.	Conservation of major farm animal resources in the coastal region through evaluation of seminal traits, semen processing and preservation	Gokuldas PP	Amiya Ranjan Sahu	2020–25
24.	Genetic variability of thermo tolerance in selected breeds of livestock under coastal environment	Amiya Ranjan Sahu	Gokuldas PP	2020–25
25.	Augmenting backyard poultry production through technological interventions in breeding, feeding and management aspects pertaining to Indian West coast	Nibedita Nayak	Gokuldas PP Susitha Rajkumar Amiya Ranjan Sahu Monica Singh	2019–22
26.	Development of ready-to-eat (RTE) animal and fish based traditional foods of coastal India by retort processing	RS Rajkumar	CO Mohan MJ Gupta Sunetra Talaulikar	2021–24
27.	Assessment, management and designing improvement options for fisheries in selected low impacted estuaries along southwest coast of India	Sreekanth GB	Trivesh Mayekar	2017–22
28.	Assessing status of coastal aquaculture practices and improvement through technology intervention for promoting livelihood of fish farmers in west coast of India.	Trivesh S Mayekar	Sreekanth GB GR Mahajan Manohara KK RS Rajkumar Paramesha V	2020–23
AGRO-ECO-TOURISM				
29.	Prospects and promotion of agro ecotourism in coastal region of India	Parveen Kumar	RS Rajkumar AR Desai V Arunachalam MJ Gupta GR Mahajan Maneesha SR Sujeet Desai R Ramesh R Maruthadurai Shripad Bhat Uthappa AR Trivesh Mayekar Chaudhari GV Nibedita Nayak Sreekanth GB Paramesha V	2017–25

AICRP CENTRES

Sr. No	Project Title	PI	Co-PI (s)
1.	All India Co-ordinated Research Project on Integrated Farming Systems	Paramesha V	Parveen Kumar A R Desai Manohara KK GR Mahajan Sreekanth GB Gokuldas PP Uthappa AR RS Rajkumar Trivesh Mayekar
2.	All India Co-ordinated Rice Improvement Project	Manohara KK	
3.	All India Co-ordinated Research Project on Palms	V Arunachalam	
4.	All India Co-ordinated Research Project on Vegetables	Chaudhari G V	R Ramesh
5.	All India Co-ordinated Research Project on Groundnut	GR Mahajan	
6.	All India Co-ordinated Research Project on Pig	Amiya Ranjan Sahu	

EXTERNALY FUNDED PROJECTS

Sr. No	Project Title	PI	Co-PI (s)
DST			
1.	Hyperspectral remote sensing of the foliar nutrients in crops	GR Mahajan	
2.	Design and development of acoustic methods for early detection of stem and root borer *Plocaederusspp* infestation in cashew	R Maruthadurai	T Veerakumar
NABARD			
3.	Empowerment of farmers through adoption of sustainable and eco-friendly integrated pest and disease management technologies in major vegetable crops in Goa	R Maruthadurai	R Ramesh
ICAR			
4.	Network Project on Transgenic Crops (Functional genomics): Genetic Mapping of Salinity Tolerant Genes in Rice	Manohara KK	
5.	Production and formulation technology refinement of bacterial bio- agents for soil borne plant disease management under coastal ecosystem Phase II	R Ramesh	Maruthadurai R
6.	District Agrimet Unit, North Goa	GR Mahajan	Bappa Das
7.	Seed production in agricultural, horticultural crops and fisheries	Manohara KK	V Arunachalam Sreekanth GB
8.	Poultry seed project	Nibedita Nayak Amiya Ranjan Sahu	
9.	National Animal Disease Epidemiology Network	Susitha Rajkumar	
10.	Centrally sponsored MIDH scheme through DASD, Kozhikode	AR Desai	
11.	Agri-Business Incubator	MJ Gupta	S Rajkumar Shripad Bhat
12.	National Agriculture Innovation Fund (NAIF), Component - I (ITMU)	Shripad Bhat	

Awards and Recognitions

Dr. R. Ramesh

- Awarded a Certificate of Appreciation for the Development and release of bacterial wilt resistant brinjal varieties during the foundation day celebrations of ICAR- CCARI on 01-4-2021.
- Chairman of the committee to conduct the assessment of JRF to SRF in CSIR-NIO.

Dr. G.R. Mahajan

- Received the Fulbright-Nehru Academic and Professional Excellence (FNAPE) Fellowship 2021-22 by United States - India Education Foundation, New Delhi, India to visit University of California, Riverside, California for nine months as a Fulbright Visiting Scholar.
- Received the Best Poster Presentation Award for the paper – Assessment of long-term trends in stream flow of river basins flowing in the West Coast of India by Desai S, Das B, Sreekanth GB, Mahajan GR (2021), which was presented in the International Symposium on Coastal Agriculture (ISCA Webinar): "Transforming Coastal Zone for Sustainable Food and Income Security" organized in virtual mode during March 16-19, 2021.
- Chairman of the committee to conduct the assessment of JRF to SRF in CSIR-NIO

Dr Gokuldas P.P.

- Received the Best Poster Presentation Award in the International Conference on Smart Agriculture for Resource Conservation and Ecological Stability held virtually during 29-30thOctober, 2021.
- Invited as a lead speaker to deliver presentation in the session of Small Ruminant and Swine Reproduction, in the International Symposium on "Novel knowledge, Innovative practices and Research in Theriogenology" organized by ISSAR and CVAS, Thrissur, held during 27-29th December 2021.
- Invited as Expert Speaker and Resource Person for the webinar organized by Guru Angad Dev Veterinary & Animal Sciences University, Ludhiana under the programme-"Strengthening and Development to Higher Agricultural Education in India" for UG and PG Students and held on 15th November 2021.
- Awarded Elsevier Reviewer Recognition Certificate from the International peer-reviewed Journal of Animal Reproduction-Theriogenology, Society for Theriogenology, USA

Dr. Sreekanth G. B.

- Received the Young Scientist Award by the College of Fisheries, Panangad Alumni Association of the Kerala University of Fisheries and Ocean Studies, Kochi, Kerala for the year 2021.
- Recognition by the Biodiversity Conservation Award-2021 for fisheries research and germplasm conservation by Goa State Biodiversity Board for the year 2021.

Dr. Maneesha SR

- Qualified as Master Trainer of 'Fruit and Vegetable processing' by MoFPI, Govt. of India.

Dr. Sujeet Desai

- Received the Sumer Memorial Award for contribution in the field of hydrological modelling, soil conservation and rainwater management from the Soil Conservation Society of India (SCSI), New Delhi during the 30th National Web Conference of SCSI held from 14-16th Dec, 2021.
- Received the Best Poster award in the ISCA Webinar "International symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security" held during 16-19th March 2021.

Dr. Uthappa AR

- Received the AWSAR award 2020 for best stories in Ph.D. category awarded by DST, New Delhi.

Publications

Research Articles

International

Ansari, M.A., Saha, S., Das, A., Lal, R., Das, B., Choudhury, B.U., Roy, S.S., Sharma, S.K., Singh, I.M., Meitei, C.B., Changloi, K.L., Singh, L.S., Singh, N.A., Saraswat, P.K., Ramakrishna, Y., Singh, D., Hazarika, S., Punitha, P., Sandhu, S.K., Prakash, N., 2021. Energy and carbon budgeting of traditional land use change with groundnut based cropping system for environmental quality, resilient soil health and farmers income in eastern Indian Himalayas. *J. Environ. Manage. 293*, 112892. https://doi.org/10.1016/j.jenvman.2021.112892 (NAAS Rating: 12.79)

Jinger D, Dhar S, Dass A, Sharma V K, Paramesh V, Parihar M, Joshi E, Singhal V Gupta, G, Prasad D, Vijayakumar S. 2021. Co-fertilization of Silicon and Phosphorus Influences the Dry Matter Accumulation, Grain Yield, Nutrient Uptake, and Nutrient-Use Efficiencies of Aerobic Rice. *Silicon*. doi:10.1007/s12633-021-01239-5. (NAAS Rating – 8.67)

Krishnamurthy S L, Sharma P C, Sharma D K, Singh Y P, Mishra V K, Burman D, Maji B, Mandal S, Sarangi S K, Gautam R K, Singh P K, Manohara K K, Marandi B C, Chattopadhyay K., Padmavathi G, Vanve P B, Patil K D, Thirumeni S., Verma O P, Khan A H, Tiwari S, Geetha S, Gill R, Yadav V K, Roy B, Prakash M, Anandan A, Bonifacio J, Ismail A M, Singh R K. 2021. Additive main effects and multiplicative interaction analyses of yield performance in rice genotypes for general and specific adaptation to salt stress in locations in India. *Euphytica*, 217(2):1-15. (NAAS Rating: 7.89)

Kumar B, Dhar S, Paul S, Paramesh V, Dass A, Upadhyay P K, Kumar A, Abdelmohsen S A M, Alkallas F H., El-Abedin T K Z, Elansary H O, Abdelbacki A M M, 2021. Microbial Biomass Carbon, Activity of Soil Enzymes, Nutrient Availability, Root Growth, and Total Biomass Production in Wheat Cultivars under Variable Irrigation and Nutrient Management. *Agronomy* 11, 669. doi:10.3390/agronomy11040669. (NAAS Rating – 9.42)

Kumari, S., Krishnan, N., Dubey, V., Das, B., Pandey, K.K., Singh, J., 2021. Investigations on annual spreading of viruses infecting cucurbit crops in Uttar Pradesh State, India. *Sci. Rep. 11*, 17883. https://doi.org/10.1038/s41598-021-97232-4 (NAAS Rating: 10.38)

Loganathan M, Thangavelu, R, Pushpakanth P, Muthubharathi K, Ramesh R., Selvarajan, R and Uma, S. 2021. First report of rhizome rot of banana caused by *Klebsiella variicola* in India. *Plant Disease.* doi.org/10.1094/PDIS-10-20-2316-PDN (NAAS Rating : 10.44)

Mahajan, G.R., Das, B., Gaikwad, B., Murgaonkar, D., Desai, A., Morajkar, S., Patel, K.P., Kulkarni, R.M., 2021. Monitoring properties of the salt-affected soils by multivariate analysis of the visible and near-infrared hyperspectral data. *Catena 198*, 105041. https://doi.org/10.1016/j.catena.2020.105041 (NAAS Rating: 11.20)

Mahajan, G.R., Das, B., Morajkar, S., Desai, A., Murgaokar, D., Patel, K.P., Kulkarni, R.M., 2021. Comparison of soil quality indexing methods for salt-affected soils of Indian coastal region. *Environ. Earth Sci. 80*, 725. https://doi.org/10.1007/s12665-021-09922-x (NAAS Rating: 8.78)

Mahajan, G.R., Das, B., Murgaokar, D., Herrmann, I., Berger, K., Sahoo, R.N., Patel, K., Desai, A., Morajkar, S., Kulkarni, R.M., 2021. Monitoring the Foliar Nutrients Status of Mango Using Spectroscopy-Based Spectral Indices and PLSR-Combined Machine Learning Models. *Remote Sens. 13*, 641. https://doi.org/10.3390/rs13040641 (NAAS Rating: 10.85)

Mahajan, G.R., Manjunath, B.L., Morajkar, S., Desai, A., Das, B., Paramesh, V., 2021. Long-Term Effect of Various Organic and Inorganic Nutrient Sources on Rice Yield and Soil Quality in West Coast India Using Suitable Indexing Techniques. *Commun. Soil Sci. Plant Anal. 52*, 1819–1833. https://doi.org/10.1080/00103624.2021.1900221 (NAAS Rating: 7.33)

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Paramesh, V., Ravisankar, N., Behera, U., Arunachalam, V., Kumar, P., Solomon Rajkumar, R., Dhar Misra, S., Mohan Kumar, R., Prusty, A.K., Jacob, D., Panwar, A.S., Mayekar, T.S., Reddy, V.K., and Rajkumar, S., 2021. Integrated farming system approaches to achieve food and nutritional security for enhancing profitability, employment, and climate resilience in India. *Food and Energy Security*, p.321. (NAAS Rating: 10.11)

Paramesha V, Singh SK, Mohekar DS, Arunachalama V, Misra SD, Jat SL, Kumar P, Nath AJ, Kumar N, Mahajan GR, Bhagat T. 2021 Impact of sustainable land-use management practices on soil carbon storage and soil quality in the Goa state of India. *Land Degradation and Development,* doi: 10.1002/ldr.4124. (NAAS Rating: 10.98).

Pothiraj G, Hussain Z, Singh A K, Solanke A U, Aggarwal R, Ramesh R and Shanmugam V. 2021. Characterization of *Fusarium* spp. inciting vascular wilt of tomato and its management by a *Chaetomium*-based biocontrol consortium. *Frontiers in Plant Science*. 12: 748013. doi: 10.3389/fpls.2021.748013, (NAAS Rating: 11.75)

Pradeep, H. K., Balasangameshwara, J., Sheshshayee, M. S., Desai, S., & Archana, B. K. 2021. Cognitive Computing Models for Estimation of Reference Evapotranspiration: A Review. *Cognitive Systems Research*. 70, 109-116. (Impact Factor: 3.52)

Prasad, P., Loveson, V.J., Das, B., Kotha, M., 2021. Novel ensemble machine learning models in flood susceptibility mapping. *Geocarto Int. 1–23*. https://doi.org/10.1080/10106049.2021.1892209 (NAAS Rating: 10.89)

Rajkumar, S., Nayar, R, Rajagopal, K, Chakurkar, E B, Venkatesh, V S., Nambiar, P, Paramesh, V. 2021. Socio-demographic influences on various consumer food safety indices: an empirical study of ethnic Goan pork sausage consumers. *Br. Food J*. 123, 2670–2692. doi:10.1108/BFJ-10-2020-0986. (NAAS Rating – 8.52)

Rajkumar, S., Nayar, R., Rajagopal, K., Chakurkar, E.B., Venkatesh, V.S., Nambiar, P. and Paramesh, V.2021, Socio-demographic influences on various consumer food safety indices: an empirical study of ethnic Goan pork sausage consumers. *British Food Journal*, Vol. 123 No. 8, pp. 2670-2692. (NAAS Rating: 8.52).

Rajkumar, S., Nayar, R., Rajagopal, K., Valsalan, N., Chinnasamy, S., Vasudevan, V.N., Thankachan, S. and Manjunath, N. 2021. Product characterization of a traditional sausage aiming at geographical indication certification and entrepreneurship prospects: an empirical study of Goan "choris". *Br. Food J.* https://doi.org/10.1108/BFJ-06-2021-0619 (NAAS Rating: 8.52).

Ram, H., Hedau, N.K., Chaudhari, G.V. and Kant, L., 2021. Peas with zero shelling edible pods: A review. Scientia Horticulturae, 288, p.110333. https://doi.org/10.1016/j.scienta.2021.110333 (NAAS Rating: 9.46)

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Roshni K, Renjith Kumar C R, Sreekanth G B, Raghavan R, Ranjeet K, Harikrishnan M and Kurup B M. 2021. Trophic interactions between native and exotic cichlids in a shallow tropical estuary (Lake Vembanad, India). *Marine and Freshwater Research*, 73(3) 411-416. (NAAS Rating: 8.07)

Sah, S., Singh, R., Chaturvedi, G., Das, B., 2021. Trends, variability, and teleconnections of long-term rainfall in the Terai region of India. *Theor. Appl. Climatol.* 143, 291–307. https://doi.org/10.1007/s00704-020-03421-y (NAAS Rating: 9.18)

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Arunachalam V 2021. Palms in an 'Omics' Era. In: *The Coconut Genome* (pp. 103-118). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-76649-8_7

Arunachalam V 2021. *Nypa fruticans* (Thunb.) Wurmb. In: Waman, A.A. and Bohra, P. Eds *Perennial under utilized horticultural species of India* (pp 245-252). ISBN: 978-93-90611-38-6 (HB) 978-93-90611-30-0 (PB). Jaya Publishing house, Rohini, Delhi India.

Arunachalam V, Ramesh S V, Rajesh M K and Muralikrishna K S 2021. Aroma and Fragrance: A Case Study for Trait-Related Gene Evolution in Coconut. In: *The Coconut Genome* (pp. 159-164). Springer, Cham. https://link.springer.com/chapter/10.1007/978-3-030-76649-8_11

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Nayak N 2021. Multiple choice questions in Poultry science. In: *The book of Hidden Treasure: MCQ Animal Sciences* Brillion Publishing, Pp: 201-234. (ISBN: 978-93-90757-23-7).

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INSTITUTE PUBLICATIONS

Publications	Authors/ Editors/ Publishers
Reports	
Annual Report (2020) pp.1-100	Parveen Kumar, M J Gupta, Maruthadura R, Susitha Rajkumar, Trivesh Mayekar, Maneesha S R, Paramesha V and Sujeet Desai
Technical Bulletins	
Fresh water ornamental fish culture and management Technical Bulletin No 69 pp 1-39	Sreekanth GB., E B. Chakurkar, Trivesh Mayekar, Poorva, Tincy Varghesse, Sikhendar Kumar and Sudhir Kumar
Insect pests of vegetables in Coastal regions and their management Technical Bulletin No 70 pp 1-36	Maruthadurai R and R Ramesh
A field guide on identification and management of cashew insect pests. Technical Bulletin No 71 pp 1-36	Maruthadurai R, A R Desai and R Ramesh
Extension Folders	
Incubation and Hatching: Problems and prevention. Extension Folder No. 98	Nibedita Nayak, Amiya Ranjan Sahu and Ashita K
Poultry: Accomplishment in agro-eco-tourism Extension Folder No.99	Nibedita Nayak, EB Chakurkar and Amiya Ranjan Sahu
Common infertility disorders & their management in dairy animals. Extension Folder No 100.	Gokuldas P P, Susitha R, Rajkumar R S, Sahu A R and Shivasharanappa N
Bhat va tandul malacher santhovan davarpa khatir sudarit padyati ani tantraginyan (in Konkani) Extension Folder No 101	M J Gupta and Maruthadurai R
Mango Production Technology Extension Folder No 102	A R Desai, Maneesha S R, Chidananda Prabhu and Shripad Bhat
Promoting Indigenous ornamental fish of Goa: Breeding and seed production of *Haludaria pradhani* for conservation and management Extension Folder No 103	Trivesh Mayekar, Sreekanth G B, Amit Patil and Sajiya Mujjawar
Extension Leaflets	
Method of application of Goa Bio -1 Extension Leaflet 09	GR Mahajan and R Ramesh
News Letters	
Vol. XXII. No 2, May- August, 2020 Pp 1-15	Manohara KK, Susitha Rajkumar, Bappa Das and Sujeet Desai
Vol. XXII. No 3, September - November, 2020 Pp 1-24	Manohara KK, Susitha Rajkumar, Bappa Das and Sujeet Desai
Vol. XXIII. No 1, January - April, 2022 Pp 1-13	Manohara KK, Susitha Rajkumar, Bappa Das and Sujeet Desai

Education And Training

EDUCATION

A R Desai

- Dissertation project coordinator of 3rd year B.Tech.(Biotechnology) student, Ms. Nikita Dhanava, of Banasthali Vidyapeeth, Rajasthan, "Molecular Diversity Studies in Nutmeg Using SSR Markers", during June –November 2021

Shripad Bhat

- Evaluated a M.Sc. (Agri.) thesis Impact of COVID-19 pandemic on farm income of vegetable producers in Terai region of Nepal from UAS, GKVK, Bengaluru.

Sreekanth G B

- Member of the advisory committee of Ms. Dhanya M Lal, FRM PA6-02, FRM Division of ICAR-CIFE, Mumbai for PhD thesis entitled "A study on the trophic structure of Ulhas river estuary, Maharashtra".
- Member of the advisory committee of Mr. Sudhan C, FRM PA8-07, FRM Division of ICAR-CIFE, Mumbai for PhD thesis entitled "Assessment of health and valuation of ecosystem services derived from Gorai creek, Mumbai, India".
- Member of the advisory committee of Ms. Ashwini Gopi Kumar, FRM, KUFOS, Kochi for PhD thesis entitled "Ecosystem assessment of Kavvayi estuarine wetland in terms of fish community, plankton and benthos ".
- Member of the advisory committee of Ms. Keerthana TA, FRM, KUFOS, Kochi for the PhD thesis entitled "Assessment of Molluscan diversity, community structure and fisheries status of Kavvayi backwaters."
- Member of the advisory committee of Mr. Rinchen Nopu Bhutia, FRM PA7-06, ICAR-CIFE, Mumbai for the PhD thesis entitled "Fish trophic guild and food web structure of Matla estuary, North-eastern coast of India".

Uthappa AR

- Experiential Learning Programme (ELP) from 11th October, 2021 to 1st November, 2021 for Miss M Poornima, B.Sc. (Hons) a student of College of Horticulture and Forestry, Rani Lakshmi Bai Central Agricultural University, Jhansi, Uttar Pradesh.

Lectures delivered by Scientists

Date	Lecture Topic/Programme	Participants	Venue
V Arunachalam			
23-06-2021	Single Nucleotide polymorphisms tiny changes but huge consequences- a step towards business opportunity in bioinformatics	Delegate trainees	Virtual platform organised by Periyar Maniammai Institute of Science and Technology Thanjavur Tamil Nadu
R Ramesh			
12-03-2021	Diagnosis and management of diseases in vegetables	Agricultural officers	KVK, North Goa
18-12-2021	Bacterial wilt of solanaceous vegetables: Pathogen diversity and management strategies in IPS Delhi Zone	Scientists and professors	Virtual Symposium on "Plant Disease: Impact on Food Security)
Mathala J Gupta			
16-11-2021	Selection, procurement and supply chain management of spices and plantation crops for the processing industry	Trainees	KVK, North Goa
20-11-2021	Weights and measures, regulations	Trainees	KVK, North Goa
22-11-2021	Overview of PMFME scheme, guidelines, objectives, capacity building framework and its implementation, Packaging of Spices and Plantation Crops, Food safety regulations & certification.	Trainees	KVK, North Goa
25-11-2021	Overview of PMFME scheme, guidelines, objectives, capacity building framework and its implementation, Hands-on training on Plant Layout and Maintenance and Hygiene, FSSAI standards, Weights & Measures, Case and/or Success stories in Fruits & Vegetables Processing Industry.	Trainees	KVK, North Goa
29-11-2021	Processing of Jackfruit -into leather & Wine-Processes-SOPs-Packaging -Storage.	Trainees	KVK, North Goa
30-11-2021	Packaging hands-on training	Trainees	KVK, North Goa
01-12-2021	Advances in the storage of fruits and vegetables including low temperature, CA and MA storage and Food safety regulations & certification	Trainees	KVK, North Goa
GR Mahajan			
05-03-2021	Competitive Examination: AIEEA (PG) JRF, AICE-JRF/SRF (Ph.D.) and ICAR-NET/ARS	Students	Virtual platform College of Agriculture, Kolhapur
09-03-2021	Competitive Soil Science –Introduction and Preparation	Students	Virtual platform Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior
11-03-2021	Science Fiction Movie 'The Core'	Students	Pre-Sci-FFI, , Goa
12-03-2021	How to read books to get ready for competitive soil sciences exams - Part I and Part II	Students	Virtual platform Rajmata Vijayaraje Scindia Krishi Vishwa Vidyalaya, Gwalior,
15-03-2021	Competitive Soil Sciences Examination – Introduction and Preparation	Students	Virtual platform College of Agriculture, Dhule,

23-03-2021	Competitive Soil Sciences Examination – Introduction and Preparation	Students	Virtual platform Dr. BSKKV, Dapoli,
28-03-2021	Soil water energy relationship and Problematic soils and waterlogged soils	Students	Virtual platform College of Agriculture, Pune
18-06-2021	Balanced use of fertilizers	Farmers and extension officers	Virtual paltform KVK, North Goa
30-06-2021	Balanced use of fertilizers	Farmers	Cumbharjua, Tiswadi, Goa
30-06-2021	Balanced use of fertilizers	Farmers	Corlim, Tiswadi, Goa
16-07-2021	Organic farming practices for different crops	Farmers	Virtual paltform KVK, North Goa
14-08-2021	ICAR – Central Coastal Agricultural Research Institute, Old Goa and Agro-ecotoursim'	Students	Virtual platform College of Agriculture, Bidar,
21-08-2021	Professional Service Functions (Training, Consultancy, Contract Research and Contract Service): An introduction, Rules and Guidelines	Scientists	Virtual platform Central Island Agricultural Research Institute, Port Blair, Andaman and Nicobar
20-09-2021	Technologies by Natural Resource Management by IACR-CCARI, Goa	Officers of the Government of Goa	KVK, North Goa,
28-09-2021	Climate Resilient Varieties, Technologies & Practices	Farmers	KVK, North Goa,
R S. Rajkumar			
09-11-2021	Agro-Ecotourism as a Sustainable Agriculture"	Scientists	ICAR-Directorate of Poultry Research, Hyderabad.
Susitha Rajkumar			
19-02-2021	Feeding and watering practices of livestock	Skilled Support Staff	ICAR-CCARI, Goa
Sreekanth GB			
20-09-2021	Technologies in Fisheries Science.	Officers	KVK, North Goa, Goa.
24/09/2021	Molluscan Fisheries Resources of Estuaries: Assessment and Management	Farmers	Village Panchayat Curti-Khandepar
Gokuldas PP			
19-02-2021	Scientific dairy farming	Trainees	ICAR-CCARI, Goa
27-02-2021	Modern techniques in pig reproduction and practical demonstration on A.I in pigs	Farmers	ICAR-CCARI, Goa
Maneesha SR			
17-11-2021	Curry leaf value addition and Value addition in turmeric	Trainees	KVK, North Goa
Sujeet Desai			
19-01-2021	Traditional methods of water conservation in agriculture and their refinement	Farmers and Line department officials	Ravindra Bhawan, Sanquelim, Goa
22-03-2021	Valuing water and its Conservation	Farmers	ICAR-KVK, North Goa
07-05-2021	Water conservation techniques	Farmers	ICAR-KVK, North Goa
23-08-2021	Water Conservation	Students	Virtual platform by VVSK Higher Secondary School,Old Goa

Bappa Das

18-05-2021	Remote sensing and GIS Application in Agriculture	Students	Virtual platform by Vellore Institute of Technology, Vellore, Tamil Nadu

Amiya Ranjan Sahu

18-02-2021	Importance of cleaning and sanitization of livestock and poultry yards	Skilled Support Staff	ICAR – CCARI, Goa
26-02-2021	Introduction to scientific pig farming, its importance, breeds and basic managemental practices and Practical demonstration on Castration in pigs, microchip tagging, vaccination and deworming	Farmers	ICAR – CCARI, Goa
27-08-2021	Introduction to scientific pig farming, breeds reared, routine farm operations, feeding and managemental practices	Farmers	ICAR – CCARI, Goa

Ganesh Choudhary

28-02-2021	ARS and NET in Vegetable Science	Students	Dr. PDKV, Akola,

Shripad Bhat

19-01-2021	Watershed Principles and Concept	Delegates	Workshop on Water Conservation at Ravindra Bhawan, Sanquelim, Goa
12-10-2021	Role of Human Resource Development in Agricultural Entrepreneurship in Goa	Participants	Virtual platform on webinar on Human Resource Development in Goa for building Atmanirbhar Bharat (Self Reliant India)
10-11-2021	ommercialization of ICAR-CCARI Technologies	Participants	Sensitization Workshop on Agri-Business Incubation

Trivesh Mayekar

30-06-2021	Fish genetics, Biotechnology and Reproductive behavior of fishes.	Students	College of Fisheries, Ratnagiri.
12-10-2021	Ornamental Fisheries: Turning hobby into a professional career	Students and Farmers	Fisheries Training Centre, Ela Dhauji, Goa.

Human Resource Development

Training and Capacity Development programs attended by Scientists

Date	Name	Programme	Venue
04-01-2021 to 08-01-2021	**Nibedita Nayak**	Training programme on Science and technology for rural societies for women scientists	Virtual platform by Indian institute and Public Administration, New Delhi
01-03-2021 to 05-03-2021	**GR Mahajan**	Geo-informatics in agriculture using open-source data and analysis platforms	Virtual platform by ICAR – Indian Agricultural Research Institute, New Delhi
22-04-2021 to 23-04-2021	**Gokuldas PP**	International e-workshop on recent trends in Quality Control of Bovine Semen	Virtual Platform by CFSP&TI, Bengaluru
06-04-2021 to 10-04-2021	**Mathala J Gupta**	Master Trainers on EDP	NIFTEM, Noida
23-07-2021 to 27-07-2021	**Mathala J Gupta**	Master Trainers on Spices and Plantation Crops Processing	ICAR-CPCRI, Mysore
03-08-2021 to 06-08-2021	**Mathala J Gupta**	Master Trainers on Grain Processing	CFTRI, Mysore,
16-08-2021 to 18-08-2021	**R Ramesh**	Training workshop for Vigilance Officers of ICAR Institutes	Virtual platfporm by ICAR-NAARM, Hyderabad
27/09/2021 to 28/09/2021	**Ganesh Choudhary**	VEGFASTTM	ICAR-CPRS, Jalandhar
28-09-2021 to 30-09-2021	**Susitha Rajkumar**	Training program on Transcriptomic Data Analysis	Virtual platform by ICAR – IASRI, New Delhi
25-10-2021 to 30-10-2021	**Mathala J Gupta**	Management Development Programme	Virtual platfporm by ICAR-NAARM, Hyderabad
06-11-2021 to 12-11-2021	**V. Arunachalam**	UAV	Virtual platform by NMICPS TiHAN Foundation, IIT Hyderabad
10-11-2021 to 30-11-2021	**Susitha Rajkumar**	21 Days Advanced National Training Course (ANTC 2021) On"Recent Advances in Veterinary Pathology for Intensive Livestock Development"	Virtual platform s by WBUAFS, Kolkata,
27-11-2021	**Gokuldas PP**	Orientation Workshop for Nodal Officers of DRIVE Dashboard and DST	Virtual Platform by ICAR-NAARM, Hyderabad
08-12-2021 to 17-12-2021	**Uthappa A R & Amiya Ranjan Sahu**	Training Programme on Statistical Designs and Analytical Methods for Multifactor Experiments	Virtual Platform by ICAR-CMFRI, Kochi, India.
16-12-2021 to 21-12-2021	**V Arunachalam**	SNP Mining, GWAS and Genomic Selection	Virtual platform by ICAR-IASRI, New Delhi

Participation in Conference/ Seminar/ Symposia/ Workshops/ Meetings

Date	Name	Programme	Venue
09-01-2021	**Maruthadurai R**	National webinar on ESI	Virtual platform by ESI, New Delhi Online
18-01-2021	**Shripad Bhat**	Webinar on Role of ICAR-NAARM in Promoting Agri Startups in BIRAC BIG Grant	Virtual platform by ICAR-NAARM, Hyderabad
19-01-2021	**Sujeet Desai**	National Hydrology ProjectWorkshop on Water Conservation	Ravindra Bhawan, Sanquelim, Goa
29-01-2021	**Shripad Bhat**	Webinar on Entrepreneurship opportunities in Post-Harvest Technologies	Virtual platform by ICAR-NIVEDI, Bengaluru
01-02-2021 to 03-02-2022	**R. Ramesh**	National webinar on Statistical methods in plant pathology	Virtual platform by Assam Agricultural University, Jorhat
02-02-2021 to 05-03-2021	**V Arunachalam**	Geo-informatics in agriculture using open-source data and analysis	Virtual platform by ICAR-IARI New Delhi
03-02-2021	**Shripad Bhat**	Brainstorming Session of ITMU's Under NRM SMD	Virtual platform by ZTMC - ICAR RC NEH Region, Umiam – Meghalaya
04-02-2021 to 05-02-2021	**R. Ramesh**	Webinar on next generation sequencing for deciphering host-pathogen interactions	Virtual platform by Indian Phytopathological Society, New Delhi
12-02-2021	**Shripad Bhat**	Webinar for ICAR Labs- Innovation Excellence Indicators for Public Funded R&D Organizations,	Virtual platform by Confederation of Indian Industry
16-02-2021	**Amiya Ranjan Sahu**	Annual Review Meeting of AICRP on Pig	Virtual platform by ICAR-AICRP on Pigs
26-02-2021 to 27-02-2021	**Shripad Bhat**	National Conference on Cashew Development in India – Challenges and Opportunities	Directorate of Cashewnut and Cocoa Development, Panaji Goa
16-03-2021 to -19-03-2021	**GR Mahajan** **Susitha Rajkumar** **Sujeet Desai**	International Symposium on Coastal Agriculture: Transforming Coastal Zone for Sustainable Food and Income Security	Virtual platform by Indian Society of Coastal Agricultural Research Canning Town, West Bengal
07-04-2021	**Amiya Ranjan Sahu**	in Annual Review Meeting of Poultry Seed Project	Virtual platform by ICAR-PDP, Hyderabad
24-04-2021	**Gokuldas PP**	International Webinar on One Health Approach During Pandemics	Virtual Platform by RIVER, Puducherry
17-05-2021	**Shripad Bhat**	Launch of Agri Udaan 4.0	Virtual platform by ICAR-NAARM, Hyderabad
01-06-2021	**Gokuldas PP**	National Webinar on Organic Animal Production: Opportunities and Strategies in India	Virtual Platform by MPUAT, Udaipur
22-06-2021	**Shripad Bhat**	National Dialogue on Innovative Foods for Hospitality Industry,	Virtual platform by Indian Council of Agricultural Research (ICAR), New Delhi

01-07-2021	**Gokuldas PP**	International webinar on Impact of oxidative stress on male and female reproduction	Virtual Platform by ICAR-NDRI, Karnal
05-07-2021 to 09-07-2021	**R Ramesh**	Online sensitization programme for agricultural scientists on "Entrepreneurship Development & Start-Up Ecosystem"	Virtual platform by ICAR-NAARM, Hyderabad
07-07-2021	**Gokuldas PP**	Symposium on Sustainable Buffalo Production Through Integration of Reproduction, Nutrition, Health and Knowledge Dissemination	Virtual Platform by ISBD, CIRB, Hisar
18-07-2021 to 21-07-2021	**R. Solomon Rajkumar**	Annual Meeting of International Association for Food Protection	Virtual platform by Phoenix, Arizona, USA
19-07-2021 to 21-07-2021	**TriveshMayekar**	National seminar on 'Life and life processes: Interdisciplinary approach for sustainable development.	Goa University, Goa.
19-07-2021 to 20-07-2021	**Gokuldas PP**	International Symposium on Harnessing the potentials of genome editing tools to augment the productivity and health of farm animals	Virtual Platform by ICAR-NDRI, Karnal
26-08- 2021	**GR Mahajan**	Orientation Programme on "Preparation and dissemination of Agromet Advisories at Block level	Virtual platform by India Meteorological Department, Pune
26-08-2021 to 27-08- 2021	**Trivesh Mayekar**	Virtual international conference and exhibition 'Seaweed India, 2021'.	Virtual mode
01-09-2021	**Trivesh Mayekar**	Webinar on 'Integrating Agri-aquaculture systems for promoting blue economy in coastal region through productivity, income and livelihood enhancement'.	Virtual mode
09-09-2021	**Susitha Rajkumar**	Lecture on "The One Health Paradigm: Challenges and Opportunities for preparedness against emerging and exotic Diseases of India"	Virtual platform by ICAR-National Institute of High Security Animal Diseases (NIHSAD), Bhopal
18-09-2021 to 19-09-2021	**Uthappa A R**	Workshop on Bamboo for Sustainable Livelihood Strategies & Way Forward	Virtual platform by College of Forestry, University of Agriculture & Technology, Banda
23-09-2021	**V Arunachalam** **Sujeet Desai**	Workshop on Coastal Ecosystems: Sustainable Livelihoods and Protection from Climate Change	Virtual platform by The Energy and Resources Institute (TERI).
07-09-2021 to 09-09-2021	**Ganesh Choudhary**	Annual meeting on AICRP-Vegetable Crops	Virtual platform
23-09-2021	**Gokuldas PP**	National Webinar on Coastal Ecosystems: sustainable livelihoods and protection from climate change	Virtual Platform by TERI in collaboration with MoEFCC
29-09-2021 to 01-10-2021	**Uthappa A R**	International Webinar Conference on "Alternate Cropping Systems for Climate Change and Resource Conservation".	Virtual platform

05-10-2021 to 07-10-2021.	**TriveshMayekar**	National conference on 'Integrated Farming Systems: A tool for enhancing Income and Nutritional Security'	ICAR- Research Complex for Eastern Region, Patna.
19-10-2021	**TriveshMayekar**	Webinar on 'Diversity and conservation concerns of Marine Mammals'	Zoology Dept., Carmel College of Women, Goa.
26-10-2021	**Maruthadurai R**	International Webinar on Fighting the hunger using smart technology, Andra Pradesh	Virtual platform by ICAR-IIOPR, Pedavegi
26-10-2021	**Shripad Bhat**	National webinar on crop diversification: A way towards Nutritional Security	Virtual platform by ICAR-ICAR-Research Complex for Eastern Region, Patna
29-10-2021 to 30-10-2021	**Gokuldas PP**	International Conference on Smart Agriculture for Resource Conservation and Ecological Stability	Virtual Platform by ANRCM, Lucknow
01-11-2021	**Shripad Bhat**	Webinar on Patent & Patent Design and its drafting, filing and processing	Virtual platform by ICAR-CIRG, Mathura
16-11-2021 to 19-11-2021-	**G R Mahajan**	85th Annual Convention of Indian Society of Soil Science	Virtual platform by Palli Siksha Bhavana, Institute of Agriculture, Visva Bharati, Sriniketan–West Bengal
22-11-2021 to 26-11-2021	**Maneesha SR**	National Training programme on conservation, management and utilization of horticultural genetic resources for livelihood and nutritional security	ICAR-IIHR, Bengaluru
23-11- 2021	**GR Mahajan**	Fifth International Agronomy Congress	Virtual platform by Indian Society of Agronomy at PJTSAU, Hyderabad
23-11-2021 to 25-11-2021	**Mathala J Gupta**	55th Annual Convention of ISAE and International Symposium on "Emerging Trends in Agricultural Engineering Education, Research and Extension"	Virtual platform by Patna
23-11-2021 to -27-11-2021	**Sujeet Desai**	5thInternational Agronomy Congress on Agri Innovations to Combat Food and Nutrition Challenges	Virtual platform by PJTSAU, Hyderabad
24-11-2021	**Susitha Rajkumar**	29th Annual Review Meeting of AICRP-ADMAS	Virtual platform by ICAR-NIVEDI, Bengaluru
23-11-2021 to 27-11-2021	**Paramesha V**	5thInternational Agronomy Congress	Professor JayashankarTelangana State Agricultural University, Hyderabad
29-11-2021	**Shripad Bhat**	National Workshop on Farmers' Income and Research Impact Assessment	ICAR- NIAP, New Delhi
9-11- 2021	**GR Mahajan**	A Brainstorming Session on 'Road map to rehabilitate 26 million ha degraded lands in India by 2030'	Virtual platform by The National Academy of Agricultural Sciences, New Delhi

14-12-2021 to 16-12-2021	**Ganesh Choudhary**	International Conference on Vegetable Research and Innovations for Nutrition, Entrepreneurship and Environment	Virtual platform by ICAR-IIVR, Varanasi
14-12-2021 to 16-12-2021	**Sujeet Desai**	30th National Web conference on Soil and Water Management Technologies for ClimateResilience, Agricultural and Environmental Sustainability	Virtual platform by ICAR-IIWM, Bhubaneswar
15-12-2021	**Shripad Bhat**	Webinar on E-Commerce Marketing for Agri Enterprises	Virtual platform by ICAR-NIVEDI, Bengaluru
18-12-2021 to 20-12-2021	**Paramesha V**	Annual Group AICRP-IFS	ICAR- Indian Instittute of Farming System Research, Modipuram

ICAR Krishi Vigyan Kendra

ICAR-Krishi Vigyan Kendra was established at the Institute in 1983 for carrying out technology assessment, refinement, demonstration under local agro-climatic conditions and capacity-building programme in agriculture and allied sectors. The major activities carried out are given below:

Trainings

Training programmes were conducted to impart knowledge and skill to farmers, farm women and extension functionaries on advanced agricultural technologies and technical know-how. During 2021, 63 training programmes were conducted involving 1478 participants. The major training programmes were on production and management technology, resource conservation technology, vermicomposting, organic input production, integrated pest management, integrated disease management, beekeeping, value addition of major fruit crops, entrepreneurship development, scientific management of dairy, poultry and goatery, design and development of low/minimum cost diet, women empowerment etc.,

Participation of KVK in different forums

The KVK is actively involved in conducting 648 different types of extension activities such as demonstrations, field days, exposure visits, exhibitions, *sammelan,* agro-advisories, webinars, soil health camps, etc. In addition to this, the KVK also uses different social media such as WhatsApp groups, Facebook, Youtube and Twitter to disseminate information to a large number of stakeholders spread out over the state and adjoining coastal regions. It is also actively involved in celebrating important days such as World Food Day, *Mahila Kisan Diwas,* World Soil Day, World Environment Day, *Kisan Diwas, Swachhata Pakhwada* etc., and organizing various other activities.

S.No.	Programme	Particulars
A	**On-farm trial**	**No. of trials**
1	Assessment of Salt Tolerant varieties of Paddy	05
2	Assessment of Tomato varieties/hybrids resistant to bacterial wilt	05
3	Assessment of high yielding finger millet varieties	05
4	Assessment of Various Poultry varieties	05
5	Assessment of ready-to-cook tender / manure Jackfruit	05
6	Development of low-cost supplementary diet for infants and children using locally available food ingredients	05
	Total	30
B	**Frontline demonstration**	**No of Demonstrations**
1	Popularization of cowpea var. Goa Cowpea-03	10
2	Popularization of High yielding salt tolerant rice variety	8
3	Management of Stem & Root Borer	10
4	Popularization of High yielding yard long bean var. *Arka Mangala*	10
5	Popularization of Sweet corn var. Golden *COB F1*	10
6	Popularization of high yielding variety *Arka Manik*	10
7	Popularization of cowpea var. *Goa Cowpea-03*	10
8	Improved Par-boiling unit	10
9	Nutrition garden	10
	Total	88

Revenue generation

Particulars	Quantity	Revenue generated (Rs.)
Planting material	5980	3,00,065
Virgin Coconut Oil	88.1 litre	88,100
Vermi-compost	4098.5 kg	81,970
Earthworm	3.0 kg	1,500
Vegetable seeds	519.55 kg	3,40,025
Poultry	Eggs: 8119 (CARI Nirbheek) & 7149 (Grampriya) Chicks:1486 (CARI Nirbheek) & 389 (Grampriya)and birds	2,43,354
Total		**10,55,014/-**

Shri Shripad Naik, MoS, GOI during celebration of World Soil Day

Dr. Pramod Sawant, Hon'ble CM, Goa during Orientation programme for *Swayampurna Mitras*

Dr. V. P. Chahal, ADG, ICAR – New Delhi during State Level Review cum Sensitization Workshop on CFLD – Oilseed and Pulses

Celebration of International year of Millets 2023 campaign on Nutri-Garden and Tree Plantation

Demonstrations and Front-Line Demonstrations

Front line demonstrations on integrated pest and disease management technologies in chilli

Front line demonstrations on Integrated Pest and Disease Management (IPDM) technologies on chilli were undertaken at six *taluks viz*., Canacona, Sanguem, Quepeum, Tiswadi, Bicholim and Mapusa. A total of 12 front-line demonstrations were undertaken at the above places. Plant protection inputs like Goa Bio 1 and Goa Bio II (200 kg) spinosad, chitosan and yellow and blue sticky traps (200) were distributed to 200 farmers. Hands-on training was provided to the farmers on nursery drenching of bio-control agents, main field application, instalment of sticky traps and its preparation, and spraying of bio-pesticides. Percent disease index was less in demonstration plots compared to control. Relatively, lesser incidences of whiteflies, aphids and diseases were recorded in IPDM demonstration plots compared to control. Higher yields were recorded in plots which received integrated pest and disease management technologies as compared with control.

IPDM demonstration in chilli plots

Production and Supply of quality planting material

Quality planting material of elite varieties of Mango (1500 grafts), Guava (600 grafts), Papaya, cashew (5500 grafts), Black pepper (Var. Paniyur-1, Paniyur-5 and Thevam), Nutmeg (Var. Konkan Swad), Cinnamon (5000 grafts and rooted cuttings); 4.5 tons of turmeric (Pratibha, Salem, Sudarshan, Suguna, Suvarna, Alleppey and 2 tons of ginger (Var. Himachal) were produced and supplied to the farmers

Water harvesting cum gravity-based drip irrigation and nutrient management in coconut

Water harvesting cum gravity-based drip irrigation and nutrient management interventions under STC were implemented through farmers participatory approach at Bhupar village in South Goa, to a group of 30 farmers practicing coconut farming with 500 plants over 2.45 ha. A water harvesting pond (capacity 400 cu m) was established where run-off water during the monsoons and water of perennial spring during post-monsoon season is being harvested. The harvested water was regularly utilized to irrigate 500 coconut plants through gravity-based drip irrigation and fertigation system. The pond could harvest 4 lakh litres of rainwater. The natural slope was utilized by connecting a gravity-based drip irrigation system with the pond for irrigating the coconut trees, which saved 100%

energy on electricity consumption and reduced the cost of production. The drip irrigation system led to water saving upto 90%. Nutrient management interventions included soil test-based application of organic and inorganic fertilizers through drip fertigation and soil application. The interventions have increased the yield and income of the group of farmers from 17500 nuts/year to 43500 nuts/year (2.5 times higher) and Rs. 2.97 lakhs to 8.45 lakhs (2.8 times higher) with a benefit cost ratio of 4.48.

Water harvesting pond with gravity based drip system.

Artificial insemination of pigs in farmers' field

Artificial insemination (AI) technology in pigs holds enormous promise for rapid genetic improvement and in order to improve productivity of pig farming, Institute has carried out standardized AI technology in farmer's field. AI using liquid semen is being performed when farmers inform about female pigs in estrus and, controlled breeding involving standardized technique of estrus induction and synchronization combined with AI were also undertaken. During the period, total of 178 piglets were born through AI out of 21 farrowings with success rate of 79% in the farmers' herds. In addition, farmers were trained to perform AI and also received technical advice on estrus detection, pregnancy and neonatal care, scientific feeding and health management practices. Institute has also distributed superior quality pig germplasm including improved crossbred pig variety to the farming community with an aim to improve pig husbandry in the region.

Field adoption of reproductive technologies for successful piggery enterprise

Institute had encouraged and supported farmers and agri-entrepreneurs to adopt beneficial technologies like AI and estrus synchronization in enhancing productivity in pig farming. One such aspiring entrepreneur, Shri Ramesh Vaidu hailing from Belagavi, had opted for self-employment through pig farming but initially struggled due to problems like low submission rate, conception rate and sub-optimal productivity. With technical knowledge received through training on reproductive technologies and scientific pig farming organized by the Institute, he got encouraged to adopt modern technologies and expanded his farming activities. Institute extended much-needed support including setting-up of an on-farm lab with facilities for semen evaluation and processing, technical advice on AI, controlled breeding using estrus induction, synchronization and use of innovative audio-

On farm lab **Farmer performing AI in his pig farm**

visual aids to stimulate breeding females. After these interventions, herd productivity improved and his piggery enterprise became profitable with annual income increasing by more than three times and fetching enhanced monthly income of Rs. 80,000. With success in adopting and moving viable technology from lab to farm, this entrepreneur also wishes to get enrolled as an incubatee in the Institute ABI for getting technical consultancy, value-added business support in terms of diversification of business and marketing.

Training

Internship Training Programme for BVSc students

ICAR-CCARI organized Internship Training Programme for BVSc. students of Mumbai Veterinary College, MAFSU, Mumbai during January to April, 2021. A total of 36 veterinary scholars participated in the programme. Dr. Shivasharanappa N., Dr. Gokuldas PP, Dr. Susitha Rajkumar and Dr. Amiya Sahu acted as training coordinators. Programme comprised of lectures, hands-on sessions like animal health, reproductive management and treatment procedures, insemination, pregnancy diagnosis, disease diagnosis, castration, RFID microchip tagging, livestock units and farmers' field visits, as well as evaluation and feedback sessions.

Farmers-Scientists interaction on 'Advances in Production and Processing of Turmeric and Ginger'

A Farmers-Scientists interaction on "Advances in Production and Processing of Turmeric and Ginger" was jointly organized by Agriculture Technology Management Agency (ATMA-North Goa) and ICAR-CCARI, Goa on 16th February 2021 at ICAR-CCARI, Goa.Forty-nine farmers participated in this field demonstration oriented training programme. In this programme, farmers were imparted practical training and demonstration on various aspects of organic and inorganic cultivation of turmeric and ginger in Goa, crop management practices, appropriate harvesting stage.

Training programme on improved production technology for turmeric, ginger and black pepper

A training programme on "Improved production technology for turmeric, ginger and black pepper" was organized during 30-31, March'21 at ICAR-CCARI, Goa under the sponsorship by Mission for Integrated Development of Horticulture. Thirty-five farmers were imparted training through talks by expert resource persons and practical demonstrations in field and nursery practices for turmeric, ginger and black pepper.

Hands on Training

One week hands on training for the stake holders of Goa State Biodiversity Board for transfer of Nutmeg pericarp toffy technology was imparted during 9-14th, August,'21.

Training programme on 'Management of canopy architecture'

ICAR-Central Coastal Agricultural Research Institute has organized a virtual training programme on management of canopy architecture with special emphasis on mango on 7th August 2021. About 60 farmers/officials of the agriculture department of Goa participated virtually and interacted with experts in this virtual training programme

Training and demonstration programme on ornamental fish culture

A one-day training and demonstration programme on "Ornamental Fisheries and Fabrication of Aquarium tanks" was organized on 12th October 2021 in collaboration with the Directorate of Fisheries, Govt. of Goa. A total of 20 participants attended the programme.

Farmers-Scientist Interaction on 'Improving productivity of Coastal Saline Soils'

A Field Day cum Farmers-Scientists Interaction on 'Improving productivity of coastal saline soils was organized by ICAR-CCARI, Goa on 14th October 2021 at a typical salt-affected farmer's fields (locally called *khazan* lands) at Merces, Tiswadi, Goa. The programme was organized to demonstrate how uncultivated salt-affected lands can be made productive and profitable through scientific paddy cultivation and other technological interventions. Around 30 paddy growers with *khazan* lands attended the programme.

Training programmes for new and existing beneficiaries on plantation and spices crops processing

Two concurrent training programmes, funded by Pradhan Mantri Formalization of Micro Food Processing Enterprises for New and Existing Beneficiaries on Plantation and Spices Crops, were organized between November 16-23, 2021 at ICAR-CCARI, Goa. Thirteen new beneficiaries were trained on various aspects of processing of coconut.

Scheduled Tribe Component (STC) and Schedule Caste Sub Plan (SCSP)

Two numbers of Coconut climbing devices, one areca peeling machine and many planting materials-Areca, Black pepper were distributed to Schedule caste farmers of Sirsi taluk, Uttar Kannada District Karnataka. About three farmers of Schedule caste at Kudal Sindudurg District Maharashtra state were trained in nursery raising of arecanut by providing 500 seed nuts and required nursery bags and compost. About five farmers of Schedule caste at the location were supported by five coconut climbing devices. About 72 farmers/padelis/farm workers were trained and free coconut climbing devices were provided. Six schedule tribe farmers were also provided with brush/grass cutting machines. Many planting materials of coconut and intercrops were given to Schedule Tribe farmers free of cost. On 17.02.2021 at two villages the demonstration of the devices and distribution was done to 18 persons belonging to Schedule Tribe community. On the morning of 17.02.2021 about 6 beneficiaries native to Rivona village Sanguem Taluk South Goa District received the training and one each free coconut climbing device at Rivona. During afternoon session the 12 beneficiaries from Morpirla village Quepem Taluk South Goa District were trained and were given coconut climbing devices one each free of cost at Morpirla village. Tribal people of Canacona Taluk South Goa District were demonstrated on 12.02.2021 to popularise the simple coconut climbing devices and to provide the devices free of cost on 12.02.2021 at two villages the demonstration of the devices and distribution was done to 49 persons belonging to Schedule Tribe community. On the morning of 12.02.2021 about 19 beneficiaries native to Shrishtal panchayat received the training and one each free coconut climbing device at Shrishtal. During afternoon session the 30 beneficiaries from Cotigao and Gaodongrim villages were trained and were given coconut climbing devices one each free of cost at Gaodongrim village. A total of 49 beneficiaries were demonstrated the use of coconut climbing devices during the day. On 07.04.2021 at ICAR CCARI Old Goa, the demonstration of the devices and distribution was done to 5 persons (four belonging to Goa Velha village and one from Chimbel village, Tiswadi Taluk North Goa District) belonging to Schedule Tribe community.



Field level Demonstration (FLD) on cashew varieties and coconut based cropping system in Ziltwadi wada of Gaondongruim village

Progress of the FLD on cashew varieties and coconut-based cropping system in Ziltwadi wada of Gaondongruim village was monitored for the second year. Farmers of the Ziltwadi Farmers' SHG were provided with planting material (Black pepper, Var. Paniyur-1) and farm inputs (Fertilizers and agro-chemicals) for the management of cashew plantation established under STC programme. On-farm practical demonstrations were imparted to farmers under this programme about potential intercrops like Chilli, Sweet Corn, Hybrid Maize, besides their local tuber crops.

Field view of FLD on improved cashew varieties in Ziltawadi Vaddo in Goadongruim village

Laying out the plot for new FLD on improved cashew varieties

A new FLD on cashew varieties and coconut-based cropping system in Satorlim wada of Gaondongrim village of Cancona zone in South Goa was also initiated for the benefit of Satorlim Farmers' SHG of Gaodongrim village. Farmers were facilitated in clearing and laying out the land selected for FLD of cashew varieties and vegetables as intercrops.

- A team of scientists comprising Dr. A. R. Desai (Principal Scientist & Section-in-charge, Horticulture), Dr. Sujeet Desai (Scientist, Land and Water Management Engineering), Dr. Uthappa A. R. (Scientist, Agroforestry), Dr. Shripad Bhat (Scientist, Agril. Economics), Dr. Ganesh Vasudeo Chaudhari (Scientist, Vegetable Science) and Dr. Paramesha V. (Scientist, Agronomy & STC Coordinator), visited FLD plots at Ziltawadi and Satorlim in Gaondongrim Panchayat, Canacona and organised a Field Day on 30-06-2021 for an active Farmers-Scientists Interaction under the Scheduled Tribe Component (STC).
- Under SCSP Programme, quality planting materials of arecanut, black pepper, clove, allspice, nutmeg, kokum, vanilla and vegetable seeds and honeybee boxes were distributed to beneficiary farmers of Kumta and Honavar taluks of Uttara Kannada on 25th August 2021.
- A Training Programme on "Strategies for Improving Farm Income" at Kadatoka, Honavar, was organized under SCSP Programme on 25th August 2021.

Training programme on Scientific pig farming

Two-days training programme on Scientific pig farming was held during 26-27 February 2021 at ICAR-CCARI, Goa. Total seven participants from Palghar district (Maharashtra) attended the training. Six pig farmers of Schedule Tribe community from Maharashtra and seven farmers of Schedule Caste community from Goa were supplied with piglets (75% CB), feed mixture and medicinal supplement. Seven farmers from Goa were distributed with piglets (30 nos.), feed, mineral mixture and medicinal supplements under SCSP of AICRP on Pig.

SCSP distribution programme

A programme on Distribution of fishing gears and aquaculture inputs was organized by the institute at Jaigad village on 7th March 2021. Fishing gear (different types of gillnets) materials and aquaculture inputs like feed, probiotics and medicines were distributed among the fishermen (members of Saksham Self Help Group) of Jaigad. Traditional fishermen of the village welcomed the great initiative and ensured complete co-operation in research, training and extension activities of the institute.

Training and agricultural inputs distribution to the farmers of Maharashtra

On 9th March 2021 under the Schedule caste sub-plan (SCSP) scheme a training and agricultural inputs distribution program for the beneficiary farmers of Ganvale village of Kudal taluka, Sindhadurga, Maharashtra was organized. Fertilizer (1500 kg) and sprayers (12 no.) were distributed to the paddy, coconut, and cashew growers (35 farmers).

Tribal empowerment by usage of improved coconut elite seedlings and coconut climbing devices

On 1st June 2021 ICAR-CCARI, Old Goa organized a demonstration of the seedlings of Benaulim variety of tall coconut and distribution was carried out. A total of 15 beneficiaries belonging to Schedule Tribe community of Divar village island of Tiswadi *taluka* were provided with coconut climbing devices and coconut seedlings during the day.

Field Day and Farmers-Scientist interaction

Field Day and Farmers-Scientist interaction was organized on 19th July 2021. During the event, all the scientists and the ST farmers of SHG's went around FLD plots on vegetable production technology and productivity enhancement of local vegetables like bitter gourd, cucumber, snake gourd, pumpkin, etc., reviewed the progress of the activities and discussed further action plans. Discussions were also held on deciding the interventions on these farms for the upcoming *kharif* and *rabi* seasons. After taking into account the prevailing conditions and the problems faced by the farmers, the scientists' team designed the interventions and a future action plan.

Capacity building cum distribution programme on ornamental fish culture

ICAR-CCARI, Old Goa, Goa organized a capacity building cum training programme on ornamental fish culture at Kerala University of Fisheries and Ocean Studies (KUFOS), Kochi on 16th August 2021. A group of ten farmers participated in the programme and benefitted with the knowledge of various ornamental fish culture systems and their management. The farmers were given a full day training and exposure to the ornamental fish hatchery of KUFOS.

Training and distribution of agricultural inputs to the farmers of Uttara Kannada

ICAR- CCARI, Old Goa organized a training programme on Strategies for Improving Farm Income at Kadatoka, Honavar, under SCSP Programme on 25th August 2021. Quality planting materials of arecanut, black pepper, clove, allspice, nutmeg, kokum, vanilla and vegetable seeds and honeybee boxes were distributed to beneficiary farmers of Kumta and Honavar taluks of Uttara Kannada. Honeybee boxes were also provided to these farmers for generating additional income.

Training programme conducted on Scientific Practices of Pig Rearing

A one-day training programme on Scientific Practices of Pig Rearing was successfully completed at ICAR-Central Coastal Agricultural Research Institute, Goa under the Institute Schedule Caste Sub Plan (SCSP) programme on 27th August 2021. Total of seven participants from different parts of Goa had attended the training.

Training and distribution of agricultural inputs to the farmers of coastal Maharashtra

A one-day training programme under SCSP on Site-specific nutrient management for improving the productivity and income of coastal farmers was organized by ICAR-CCARI, Goa at Ghavanale village of Kudal taluka of Sindhudurg district of Maharashtra on 8th Oct. 2021. The training included technical sessions on site-specific nutrient management in important crops, preparations of the organics and its use of important crops for improving productivity and income and water harvesting structures suitable for the west coast region.

Goat distribution

A goat distribution program was conducted at ICAR-CCARI on 8th November 2021 under STC Program. Scheduled Tribe farmers (5 numbers) were selected who were having experience of goat farming and they were provided goats. The director and scientists interacted with farmers regarding farming plan and their constraints in farming. A pair of adult male and female goats were distributed to each farmer.

Organization of *Swachhta Pakhwada* at ICAR-CCARI during 16th -31st December 2021

The institute sucessfully organised the Swachhta Pakhwada during the fortnight. A number of events were organised with the active participation of all employees and village communities. The list of activities carried out is given below:

Date	Activities as per the theme
16-12-2021	Display of Banner at prominent places
	Taking *Swachatta* Pledge
	Stock taking & briefing of the activities to be organized during the *Pakhwada*
	Plantation of trees
17-12-2021	Basic maintenance: Stock taking on digitization of Office records/e-office implementation.
	Cleanliness drive including cleaning of Offices, corridors/premises.
	Review of progress on wedding out old records, disposing of old and obsolete furniture's and junk materials.
	White washing/painting.
18-12-2021	Sanitization and SWM.
	Cleanliness and sanitation drive in the villages adopted under the *Mera Gaon - Mera Gaurav* programme and/or other schemes by ICAR Institutes/KVKs involving villages community. Reviewing the progress of ongoing *Swachhta* activities including implementation of SAP & providing at the spot solutions.
19-12-2021	Sanitation and SWM
	Cleanliness and sanitation drive within campuses and surroundings including residential colonies, common market places. Stock taking of bio-degradable and non-biodegradable waste disposal status and providing on the spot solutions.
20-12-2021	Stock taking waste management & other activities including utilization of organic wastes/ generation of wealth from waste, polythene free status, composting of kitchen and home waste materials. Promoting clean & green technologies and organic farming practices in kitchen gardens of residential colonies and at least one nearby village and proving on the spot technology solution.
21-12-2021	Campaign on cleaning of sewerage & water lines. Awareness on recycling of waste, water harvesting for agriculture/horticulture application/kitchen gardens in residential colonies/ 1-2 nearby villages.
22-12-2021	Organizing Workshops, Exhibitions, technology demonstrations on agricultural technologies for conversion of waste to wealth, safe disposal of all kinds of wastes.
	Debate on *Swachhta* at the DARE/ICAR establishments, seminars, awareness camps, rallies, street plays and expert talks
23-12-2021	Celebration of Special Day- *Kisan Diwas* (Farmer's Day) -23rd December inviting farmers, experience sharing on *Swachhta* initiatives by farmers and civil society officials. Felicitating farmers/civil society officials for exemplary initiatives on *Swachhta*.

24-12-2021	*Swachhta* Awareness at local level (organizing sanitation campaigns involving and with the help of the farmers, farm women and village youths in view villages not adopted under any scheme by Institutes/ Establishments.
25-12-2021	Cleaning of public places, community market places and/or nearby tourist/selected spots.
26-12-2021	Fostering healthy competition: Organizing competition and rewarding the best offices/residential areas/ campuses on cleanliness. Quiz, essay & drawing competitions for school children and village youth.
27-12-2021	Awareness on waste management and other activities including utilization of organic waste/generation of wealth from waste, polythene-free status. Composting of kitchen and home waste materials, promoting clean and green technologies and organic farming practices in new area.
28-12-2021	Campaign on cleaning of sewerage and water lines, awareness on recycling of waste water, water harvesting for agriculture/ horticulture application/kitchen gardens in residential colonies. Outside campus/nearby villages with the involvement local village communities.
29-12-2021	Visits of community waste disposal sites/compost pits, cleaning and creating awareness on treatment & safe disposal of bio-degradable waste by involving civil/ farming community.
30-12-2021	Involvement of VIP/VVIPS in the *Swachhta* activities, Involvement of print and electronic media may be ensured so that adequate publicity is given to the *Swachhta Pakhwada.*
31-12-2021	Organization of press conference for highlighting the activities of *Swachh Bharat Pakhwada* by involving all stakeholders including farmers/VIPs press and electronic media.

Views of the different activities undertaken during the *Swachhta Pakhwada* at ICAR-CCARI.

संस्थान के राजभाषा प्रकोष्ठ की गतिविधियां

संस्थान की राजभाषा प्रकोष्ठ, संस्थान के कार्यान्वयन में राजभाषा के उपयोग के प्रोत्साहन तथा भारत सरकार की राजभाषा नीतियों का अनुकरण व प्रसार में अहं भूमिका निभाती है। हिन्दी के प्रयोग तथा प्रधानता के आधार पर राजभाषा विभाग, भारत सरकार द्वारा विभक्त किए गए तीन भौगोलिक क्षेत्रों में, हमारा संस्थान 'ग' क्षेत्र में स्थित है। राजभाषा अधिनियम व राजभाषा नियम के अनुसार संस्थान में राजभाषा - संबंधी कार्योंकी समीक्षा तथा राजभाषा के प्रयोग को गति प्रदान करने हेतु संस्थान के निदेशक की अध्यक्षता में राजभाषा कार्यान्वयन समिति गठित की गयी है, जिसमे विभिन्न अनुभागों के वैज्ञानिकों तकनीकी कर्मचारियों तथा प्रशासनिक कर्मचारियों को शामिल किया गया है। संस्थान के राजभाषा कार्यान्वयन समिति निम्न प्रकार से है :

डॉ प्रवीण कुमार, निदेशक	- अध्यक्ष
डॉ मथाला जूलियट गुप्ता, वरिष्ठ वैज्ञानिक	- सदस्य
डॉ आरमरुथदुराईएम, वैज्ञानिक व पुस्तकालय समन्वयक	- सदस्य
श्रीमति मोंटीया रीता डीसिल्वा, प्रशासनिक अधिकारी	- सदस्य
श्री शशि विश्वकर्मा, तकनीकी अधिकारी	- सदस्य
श्री विश्वास शर्मा, सहायक	- सदस्य
श्रीमति श्रेयाबर्वे,आशुलिपिक	- सदस्य
श्री हिरेन व्यास, अवर श्रेणी लिपिक	- सदस्य
श्रीमति तारिका उसपकर, निजी सचिव	- सदस्य
श्री राहुल कुलकर्णी, सहायक मुख्य तकनीकी आधिकारी	- सचिव एवं राजभाषा अधिकारी

वर्ष 2021 में राजभाषा कार्यान्वयन समिति की 04 त्रैमासिक बैठक 13-08-2021, 08-09-2021, 17-12-2021, 17-03-2022 तिथियों को सम्पन्न हुई है । इन में राजभाषा संबंधी कार्य -कलापों की समीक्षा की गई तथा राजभाषा कार्यान्वयन में आने वाली बाधाएँ एवं उनके निदान के उपायों पर चर्चा एवं सुझाव किये गए । राजभाषा कार्यान्वयन समिति भारत सरकार केराजभाषा विभाग द्वारा निर्धारित वार्षिक कार्यक्रम के लक्ष्यों की प्राप्ति हेतु समुचित योजना को सुनिश्चित करती है तथा समय -समय पर किए गए प्रयासों की समीक्षा एवं मार्ग दर्शन भी करती है।

हिंदी पखवाड़े 2021

14 सितंबर 2021 को भाकृअनुप - केन्द्रीय तटीय कृषि अनुसंधान संस्थान, एला, ओल्ड गोवा में हिंदी पखवाड़े का उद्घाटन समारोह संपन्न हुआ। संस्थान के माननीय निदेशक महोदय डॉ. प्रवीण कुमार ने इस कार्यक्रम का उद्घाटन दीप प्रजव्लन से कियातथा सभा को संभोधित करते हुए उपस्थित कर्मचारियों को कार्यालय का अधिकतम काम-काज हिंदी में करने के लिए प्रेरित किया। प्रधान वैज्ञानिक डॉ एस.के.सिंह ने हिंदी भाषा के विषय में अपने मौलिक विचार सभा में रखे। इस संस्थान के पूर्व निदेशक एंवएमिरेटस वैज्ञानिक डॉ. नरेंद्र प्रताप सिंह ने हिंदी भाषा के सहजता एंव सरलता पर रोशनी डाली।

राजभाषा अधिकारी श्री राहुल कुलकर्णी ने सभा में उपस्थित सभी को हिंदी पखवाड़े के दौरान आयोजित होने वाले विभिन्न कार्यक्रमों की रुपरेखा के बारे में सभी कर्मियों को अवगत कराया। पखवाड़े में आयोजित किये गए विभिन्न कार्यक्रम निम्नलिखित है:

क्र.	प्रतियोगिता का नाम	दिनांक
1.	आशुभाषण प्रतियोगिता - सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	14.09.2021
2.	हिंदी टिप्पण एवं प्रारूप लेखन प्रतियोगिता - सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	15.09.2021
3.	सुलेख प्रतियोगिता-सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	16.09.2021

4.	कम्प्यूटर पर यूनिकोड में टाइपिंग - सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	17.09.2021
5.	हिन्दी निबंध प्रतियोगिता - सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	18.09.2021
6.	सामान्य ज्ञान प्रश्नोत्तरी - सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए।	22.09.2021
7.	संस्थान के कार्मिकों के बच्चों के लिए विभिन्न प्रतियोगिताएं	27.09.2021
8.	हिंदी काव्य पाठ प्रतियोगिता	28.09.2021

हिंदी पखवाड़े के समापन समारोह

पखवाड़े के समापन समारोह में गोवा से राज्यसभा के माननीय सांसद श्री विनय दिनुतेंडुलकर ने मुख्य अतिथि के रूप में, एंव विद्या प्रबोधिनी वाणिज्य महाविद्यालय, पणजी के प्राचार्य डॉ भूषण भावेएवं श्री कपिल कुमार वरिष्ठ परिवहन अधिकारी जछ्छ्ड, विशेष अतिथि के रूप में मंच पर उपस्थित रहे। इनके अलावा इस संस्थान के पूर्व निदेशक एंवएमेरिटस वैज्ञानिक, डॉ नरेंद्र प्रताप सिंह भी कार्यक्रम में उपस्थित रहे । पखवाड़े के समापन समारोह के दौरान श्री मनोज कुमार, मुख्य तकनीकी अधिकारी, हिंदी राजभाषा विभाग, भाकृअनुप नई दिल्ली, ने आभासीपध्दति से कार्यशाला ली, जिसमे कार्यालय पत्र, टिप्पण, आदेश पत्र, इत्यादि कार्यालय कामकाज में हिंदी का उचित उपयोग करने के बारे में अवगत कराया।मुख्य अतिथि श्री विनय दिनुतेंडुलकर ने हिन्दी भाषा की सरलता के बारे में अवगत कराया। डॉ भूषण भावे ने हिन्दी भाषा एंव गोवा में हिंदी के प्रचलन पर प्रकाश डाला। पखवाड़े के दौरान आयोजित विभिन्न प्रतियोगिताओं के विजेताओं को मान्यवरों के करकमलों द्वारा पुरस्कृत किया गया। श्रीमति श्रेयाबर्वे, आशुलिपिक ने आभार प्रर्दशन किया औरराष्ट्रगीतके साथ कार्यक्रम का समापन किया गया। कोरोना महामारी से बचाव

के लिए सभी निर्देशों का पालन करते हुए हिन्दी पखवाड़ा अत्यंत उत्साह के साथ संपन्न हुआ।

भाकृअनुप-केन्द्रीय तटीय कृषि अनुसंधान संस्थान, गोवा को राजभाषा पुरस्कार:

भाकृअनुप-केन्द्रीय तटीय कृषि अनुसंधान संस्थान,गोवा को क्षेत्रीय कार्यान्वयन कार्यालय(पश्चिम) क्षेत्र के अंतर्गत गीं क्षेत्र में स्थित केंद्रीय सरकार के कार्यालयों में (50 से अधिककर्मचारी वाले केन्द्रीय कार्यालयों में) वर्ष2017-18के दौरान राजभाषा नीति केकार्यान्वयन के क्षेत्र में उत्कृष्ट योगदान के लिए भारत सरकार, गृह मंत्रालय,राजभाषा विभाग केओर से प्रथम पुरस्कार प्रदान किया गया,तथा वर्ष 2018-19 के लिए द्वितीय पुरस्कार प्रदान किया गया ।

केंद्रीय गृहमंत्रालय के राजभाषा विभाग के ओर से मडगाव (गोवा) में पश्चिम और मध्य क्षेत्र संयुक्त प्रादेशिक राजभाषा सम्मेलन का आयोजन दिनांक22/10/2021को किया गया था। इसकार्यक्रम में मुख्य अतिथि माननीय गृह राजमंत्री श्री अजय कुमारमिश्रा और विशेष अतिथि के रूप में केंद्रीय पर्यटन, बंदरगाहे, नौकावहन और जलमार्ग राजमंत्री, श्री श्रीपादयेसोनाईक उपस्थित थे। माननीय अतिथियोंके कर-कमलों द्वारा संस्थान के निदेशक डॉ प्रवीण कुमार,राजभाषा अधिकारी श्री राहुल कुलकर्णी एवं आशुलिपिक श्रीमति

श्रेयाबर्वे को यह पुरस्कार राजभाषा विभागद्वारा प्रदान किए गए। इस अवसर पर केंद्र सरकार की राजभाषा सचिव श्रीमति अंशुली आर्या और राजभाषा विभाग की संयुक्त सचिव डॉ मीनाक्षीजॉली उपस्थित थी।

भाकृअनुप - केन्द्रीय तटीय कृषि अनुसंधान संस्थान में राष्ट्रीयस्तर पर हिन्दी कार्यशाला का आयोजन :

भाकृअनुप-केन्द्रीय तटीय कृषि अनुसंधान संस्थान में दिनांक 15.12.2021 को हिन्दी कार्यशाला का आयोजन ऑनलाइनम ाध्यम द्वारा किया गया था,इस कार्यशाला का विषयवैज्ञानिक संस्थानो में हिन्दी को बढ़ावा कैसे दिया जाएऔर इस विषय के मार्गदर्शक वक्ता, श्री राजीव रंजन,हरियाणा पावर यूटिलिटीस हरियाणा सरकार के मुख्य जनसम्पर्क अधिकारी थे।

इस संस्थान के राजभाषा अधिकारी श्री राहुल कुलकर्णी ने मुख्य वक्ता का परिचय उपस्थित मान्यवरों को कराया। म ाननीय निदेशक महोदय डॉ. प्रवीण कुमार ने इस कार्यशाला के विषय के महत्व के बारे मे सभी गणमान्यों को अवगत कराया। श्री राजीव रंजन ने वैज्ञानिक संस्थानो में हिन्दी को बढ़ावा देने हेतु महत्वपूर्ण मुद्दों से उपस्थित गणमान्योंकों अवगत कराया तथा हिन्दी एवं क्षेत्रीय भाषाओं की सहजताएवं सरलता पर रोशनी डाली तथा मातृभाषा एवं समझाया कि क्षेत्रीय भाषा में सिखाये गए विषय हमेशा याद रहते है, यदि कोई वैज्ञानिक उपलब्धि क्षेत्रीय या हिन्दी में सामने वाले को समझायी जाती है तो वह बात सामने वालों को तुरंत समझ आती है।

श्रीमति सीमा चोपड़ा - निदेशक महोदया,राजभाषा विभाग नई दिल्ली से इस कार्यशाला में ऑनलाइनमाध्यम से जुड़ी उन्होंने भी अपने मौलिक विचार प्रकट किए। इस कार्यशाला में देश के विभिन्न क्षेत्र के 22 संस्थानो के 66 अधिकारियों/ कर्मचारियों ने भाग लिया था।कार्यशाला के अंत में संस्थान के माननीय निदेशक महोदय डॉ. प्रवीण कुमार और उप राजभाषा अधिकारी श्री शशि विश्वकर्मा,तकनीकी अधिकारी, मृदा विज्ञान, कृषि विज्ञान केंद्र उत्तर गोवा ने सभी को आभार एवं धन्यवाद प्रकट किया।

भाकृअनुप- केन्द्रीय तटीय कृषि अनुसंधान संस्थान में हिंदी कार्यशाला का आयोजन:

भाकृअनुप - केन्द्रीय तटीय कृषि अनुसंधान संस्थान में दिनांक 24.02.2022 को हिंदी कार्यशाला का आयोजन किया गया था, इस कार्यशाला का विषयडिजिटल प्लैटफार्म पर राजभाषा हिंदीऔर इस विषय के मार्गदर्शक वक्ता थे,डॉ राकेश शर्मा, वरिष्ठ राजभाषा अधिकारी, राष्ट्रीय समुद्र विज्ञान संस्थान गोवा।

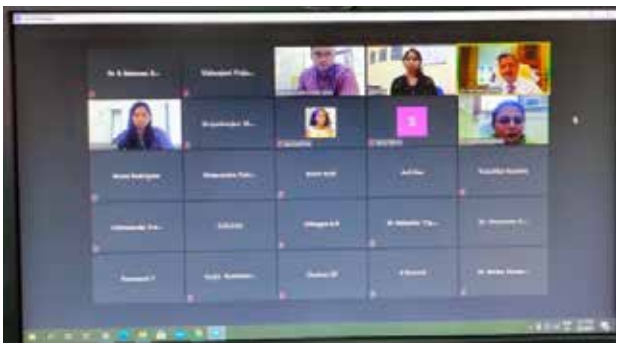
संस्थान के उप राजभाषा अधिकारी श्री. शशि विश्वकर्मा ने मुख्य वक्ता का परिचय उपस्थित मान्यवरों को कराया। माननीय निदेशक महोदय डॉ प्रवीण कुमार ने पुष्पगुच्छ देकर मुख्य वक्ता डॉ राकेश शर्मा का स्वागत किया और विषय के महत्व के बारे मे अपने विचार प्रस्तुत कर सभी गणमान्यों को अवगत कराया। डॉ राकेश शर्मा ने'डिजिटल प्लैटफार्म पर राजभाषा हिंदी'यह विषय सभागृह में उपस्थित सभी स्तर के कर्मचारियों को परीचित कराया और हिंदी को आसान तरीके से कैसे प्रस्तुत किया जाए उसपर विस्तार रुप से सभी को अवगत कराया। उन्होने हिंदी की सबसे आसान टंकण विधि के बारे मे जानकारी दी ताकि हिंदी के कार्यों मे कोई बाधा न आए।

उक्त कार्यशाला में संस्थान के सभी स्तर के कुल 45 वैज्ञानिको/अधिकारियों/कर्मचारियों ने भाग लिया था। कार्यशाला के अंत में संस्थान के माननीय निदेशक महोदय डॉ प्रवीण कुमार और राजभाषा अधिकारी श्री राहुल कुलकर्णी ने सभी को आभार एंव धन्यवाद प्रकट किया।

Events organized at ICAR –CCARI, Goa

Seminars, Webinars and Workshops organized

Webinar under '*Bharat Ka Amrut Mahotsav*' on the theme "Animal Health & Productivity"



ICAR-CCARI, Goa conducted a webinar on "Animal Health and productivity" on 5th June 2021 in a virtual mode. The topic of the webinar was 'Small scale dairy processing for doubling farmer's income' which was presented by Dr. Archana Chandran, (Assistant Professor), College of Dairy Science and Technology, KVASU, Pookode, Kerala. The programme was attended by 54 participants from Odisha, Kerala, West Bengal and Goa and which included farmers, women entrepreneurs, scientists, subject matter specialists, technical staff.

Webinar on "VEGFASTTM technology to increase the vegetable production in coastal regions

ICAR-CCARI, Goa conducted a webinar on "VEGFASTTM technology to increase vegetable production in the coastal regions" on 15th June'21, which was inaugurated by the Chief Guest of the webinar, Shri Kuldeep Singh Gangar, IAS, Secretary (Agriculture), Govt. of Goa. He lauded the efforts of ICAR-CCARI, Goa in sensing the urgent need of Goa regarding shortage of vegetable production and emphasized for close collaboration of ICAR-CCARI, Goa and Directorate of Agriculture, Govt. of Goa to boost vegetable production in the state. The programme was attended online by 100 stakeholders (Officials from the Agric. Dept., Goa, vegetable growers from Goa and other coastal districts, resident welfare association executives, ICAR institute scientists, scientific and technical staff of CCARI & KVK, Goa etc.) on the Zoom platform (maximum capacity) and about 50 participants on Facebook Live from various states of the country.

Webinar on 'Balanced use of Fertilizers and Vermi-composting'

ICAR – Central Coastal Agricultural Research Institute, Goa and ICAR – Krishi Vigyan Kendra, North Goa organized a webinar as a Farmers Awareness campaign on 'Balanced use of Fertilizers and Vermi-composting' on 18th June 2021 in a virtual mode. Hon'ble Shri Shripad Naik, Union Minister of State, Ministry of AYUSH and Minister of State for Defence, Government of India graced the occasion as Chief Guest. Almost 75 participants comprising of farmers, scientists, staff of KVK and other stakeholders attended the programme.

Webinar series on Agro-ecotourism

ICAR-CCARI, Old Goa organised a webinar series on agro ecotourism (AET) on 18th August 2021 under *Bharat Ka Amrut Mahotsav*. The webinar series included topics on "Sustainable development planning for farms with Agro-ecotourism model in Goa: Experiences and Future strategies" delivered by Shri Mahesh Patil, Chairman (Agriculture & Food Processing Committee), Goa Chamber of Commerce and Industry, which emphasized the development of AET models with diversified activities for mine-affected areas in coastal region. The webinar series was attended by 30 persons including scientists and stakeholders.

Vision document to make Goa self reliant in agriculture released

A vision document 'Vision for Development of Agricultural and Allied Sectors: A Way Towards Making Goa Self Reliant (*Swayampurna* Goa)' was released during the 26th Meeting of ICAR Regional Committee No. VII by Shri Purushottam Rupala, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying, Government of India on 25th August 2021 through the virtual mode. The vision document was prepared by ICAR-CCARI under the guidance of Hon'ble Chief Minister, Government of Goa, Secretary (Agriculture), and in consultation with the state line departments. The document is also available on the official website of ICAR-CCARI, Old Goa.

Webinar on "Integrating Agri-aquaculture systems for promoting blue economy in coastal region through productivity, income and livelihood enhancement"

ICAR-Central Coastal Agricultural Research Institute, Goa organised a webinar on "Integrating Agri-aquaculture systems for promoting blue economy in coastal region through productivity, income and livelihood enhancement" on 1st September 2021. The webinar was organised as a part of the National Campaign on "System Diversification in Aquaculture". The programme was attended by 50 participants including scientists, department officials, farmers, entrepreneurs, students, researchers and other stakeholders.

Orientation programme on Agriculture for *Swayampurna Mitras* to make Goa Self reliant

An orientation program on Agriculture for *Swayampurna Mitras* was organized by Directorate of Planning, Statistics & Evaluation, Govt of Goa in collaboration with ICAR-Krishi Vigyan Kendra, North Goa and ICAR-Central Coastal Agricultural Research Institute, Old Goa during 20-21st September 2021. In this programme, 104 *Swayampurna Mitras* from North Goa participated on 20/09/2021 and 95 *Swayampurna Mitras* from South Goa on 21/09/2021. The valedictory function of the Orientation programme was graced by Dr. Pramod Sawant, Hon'ble Chief Minister, Govt. of Goa. In his address, he appreciated the efforts of ICAR-CCARI in developing technologies for the farmers of Goa. He also urged the *Swayampurna Mitras* to visit ICAR-CCARI regularly and help in disseminating ICAR technologies to the farming community to increase their income by increasing productivity of different crops.

Webinar on Organic farming

ICAR-Central Coastal Agricultural Research Institute, Goa organized a webinar on "Organic farming; Indian perceptive of research and technology" on 27th Sept.'21. The programme was attended by 90 participants including scientists, PI's of the AICRP-IFS project, department officials, farmers, entrepreneurs, students, researchers and other stakeholders.

Hon'ble Shri Narendra Modi, Prime Minister, Government of India interacted with a woman farmer Smt. Darshana Pednekar from Goa

Hon'ble Shri Narendra Modi, Prime Minister, Government of India, interacted with Mrs. Darshana Pednekar, a woman farmer from a village Parra of Bardez taluk, North Goa, Goa on 28th September 2021 during a programme on 'Climate Resilient Agriculture and inauguration of ICAR-NIBSM' through a virtual programme platform. During the interaction, she spoke about technologies and trainings provided by ICAR – Central Coastal Agricultural Research Institute and Krishi Vigyan Kendra, North Goa, Goa.

Technical seminar on 'Recent advances in mango production, processing and marketing opportunities'

A Seminar on 'Recent advances in mango production, processing and marketing opportunities' was organized at ICAR-CCARI, Old Goa on 5th Oct. 2022. This programme was jointly organized with Goa State Council for Science & Technology (GSCS &T) catalyzed and supported by National Bank for Agriculture and Rural Development(NABARD) under *Gramya Vikas Nidhi*. The major focus of the programme was to give impetus for seeking Geographical indication (GI) registration for 'Mankurad' mango.

Sensitization Workshop on Agri-Business Incubation

Agri-based Growth opportunities for Nurturing start-ups through Incubation (AGNI), the ABI Centre of ICAR-Central Coastal Agricultural Research Institute organized "Sensitization Workshop on Agri-Business Incubation" for aspiring entrepreneurs on 10th Nov.2021.

Days Celebrated

World Environment Day

ICAR-CCARI, Goa celebrated World Environment day on 5th June 2021 by establishing a *Nakshatra* Garden. The Director, scientific, administrative and technical staff attended the program. In his address Director, Dr. Parveen Kumar highlighted the significance of celebrating the World Environment day by showing respect to Mother Earth.

World Yoga Day

An online awareness program on "Yoga for Respiratory & Immunity" was organized on 19th June 2021. Dr. Parveen Kumar, Director, ICAR – CCARI in his address spoke on the science of yoga and its role in increasing immunity of our body to fight the pandemic and also fitness of mind. Shri. Dikar Pagui, Yoga Veera from Isha Foundation, spoke on Sadguru Yoga and its benefits in boosting immunity. He also demonstrated *Simhakriya, Shrashtanga* and *Makarasna* to enhance lung capacity and improve immunity.

National Fish Farmers' Day

ICAR-CCARI, Goa organised a National Campaign on "Ecosystem management for sustainable fisheries" with the fishermen and farmers of Zuari estuary at Cacra fishing village to discuss various challenges for fisheries sustainability on 10th July 2021. A total of 40 participants from different fishing villages such as Cacra, Odxel, Nauxim, Bambolim, and Siridao participated in the event.

93rd ICAR Foundation Day

ICAR-Central Coastal Agricultural Research Institute, Old Goa organised a 'Tree planting campaign' on 16th July 2021 at 10:30 am on the occasion of 93rd ICAR Foundation Day under *Bharat Ka Amrut Mahotsav* as 75th year of Independence of India. Dr. Parveen Kumar, Director, ICAR-CCARI, Goa greeted all the participants of programme on ICAR foundation Day. He highlighted the importance of planting trees from environmental and ecological sustainability point of view and for improving farmer's livelihood. On this occasion, tree planting was done and a drive was initiated to plant 200 trees of different species including teak on the bunds of the C Block of the Institute.

World Coconut day

On 2nd September 2021 world coconut day was celebrated at ICAR-CCARI Old Goa. Nineteen participants received one coconut climbing device during the event. A demonstration on the use of coconut climbing device was also organised.

Mahila Kisan Diwas

ICAR-CCARI, Old Goa celebrated *Mahila Kisan Diwas* at Parra village of Bardez taluka of State of Goa on 15th October 2021. Processing and value addition to locally available fruits like jackfruit, kokum and coconut for employment generation and increasing income were demonstrated to the participants. Around 60 farm women and farmers attended the programme.

World Food Day

ICAR-CCARI, Old Goa, celebrated World Food Day on 16th October 2021 at Diwar Island of Tiswadi *taluka* in Goa. On the occasion, coins released since 1970 by Government of India to Commemorate World Food Day were also displayed. To promote healthy and nutritious food items, a cooking competition using millets, pulses and vegetables was also arranged, where 24 farm women participated and prizes were awarded. The programme was attended by 52 farmers and farm women.

Rice Field Day

ICAR-CCARI, Old Goa organized a field day on rice at Sadeti Wada of Chorao Island in North Goa district, Goa on 25th October 2021 to showcase the varietal performance of the salt-tolerant rice varieties of the Institute. About 30 farmers from the Island village attended the field day.

Vigilance Awareness Week celebrated

Vigilance Awareness Week' was celebrated at ICAR- CCARI, Old Goa from 26th October to 1st November 2021. This year the main focus of Vigilance Awareness Week was Independent India @75: Self Reliance with Integrity; "**स्वतंत्र भारत @:75 सत्यनिषठा से आत्मनिर्भरता।**"

World Fisheries Day Celebrated

ICAR- CCARI, Old Goa celebrated World Fisheries Day by organising a campaign on "Conservation and Management of Small Indigenous Fishes of Goa" at Mangueshi temple, Mardol, Goa on 21st November 2021. A total of 500 individuals of seven indigenous fish species were released into the temple pond, which is considered as a method of *in-situ* conservation.

World Soil Day

ICAR – Central Coastal Agricultural Research Institute (CCARI), Old Goa celebrated 'World Soil Day' on 5th December 2021. The theme of World Soil Day for the year 2021 is 'Halt Soil Salinization - Boost Soil Productivity'. Shri Shripad Yesso Naik, Hon'ble Minister of State, Ministry of Tourism and Port, Shipping and Waterways, Government of India, graced the occasion as chief guest.

Kisan Diwas

ICAR-Central Coastal Agricultural Research Institute, Old Goa celebrated 'Kisan Diwas' on 23rd December 2021 on the birthday of the 5th Prime Minister of India, Shri Choudhary Charan Singh, a farmer's leader, who introduced many policies to improve the lives of the Indian farmers.

Memorandum of Understanding (MoU) signed

Memorandum of Understanding (MoU) signed between ICAR-CCARI, Goa & ICAR-CPRI, Shimla to popularize VEGFAST.

A Memorandum of Understanding (MoU) was signed between ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI), Goa and ICAR-Central Potato Research Institute (ICAR-CPRI), Shimla, on 18th August 2021, to undertake collaborative research on rooftop vegetable cultivation in the form of VEGFAST Technology and to develop a modified model of this technology suitable for prevailing agronomic conditions of the coastal region.

ICAR – CCARI, Goa inks MoU with Montfort Academy, Goa

A Memorandum of Understanding (MoU) was signed between ICAR - Central Coastal Agricultural Research Institute (ICAR-CCARI), Goa and Montfort Academy, Industrial Training Institute, Corlim, Goa on 14th Oct. 2021, at ICAR-CCAR. The MoU aims to strengthen the activities on scientific farm mechanization on small and marginal landholding and for capacity building of the students on different aspects of agriculture.

Participations in exhibitions/ Programmes

Outreach Programme of India International Science Festival-2021

ICAR-Central Coastal Agricultural Research Institute (CCARI), Goa under the banner of 'India International Science Festival-2021' (IISF-2021) organized an outreach programme on 29th Nov. 2021, at V.D. & S.V. Wagle High School, Mangeshi, Mardol, Goa. The programme was conducted to create awareness and sensitize the importance of science education among high school students. Around 150 students of classes VIII, IX and X and school staff actively participated in this event.

India International Science Festival -2021

ICAR- CCARI, Goa participated in the 7th India International Science Festival-2021 (IISF-2021) held at Panaji, Goa during 10-13th Dec. 2021. The theme of the IISF-2021 was "Celebrating Creativity, Science, Technology and Innovation for a prosperous India". This mega event was inaugurated by Dr. Jitendra Singh, Hon'ble Union Minister of State Science & Technology; Minister of State (Independent Charge) Earth Sciences; MoS, PMO, Personnel, Public Grievances, Pensions, Atomic Energy and Space.

Distinguished Visitors

Parliamentary standing committee on Agriculture visited ICAR-CCARI Goa

A team of nine honourable Members of Parliament Chaired by Shri Parvatagouda Gaddigoudar, visited ICAR-CCARI Goa on 6th September 2021 to study agriculture, animal husbandry and fisheries research and development. The team visited experimental fields including coconut-based cropping systems, coconut-heliconia, mango germplasm block. The team also visited the exhibition stalls arranged in the campus and was acquainted with various technologies of the institute and the extension activities of Krishi Vigyan Kendra of North Goa. The members interacted with the scientists and few progressive farmers during the visit.

Shri Kailash Choudhary, Hon'ble Union Minister of State for Agriculture and Farmers' Welfare visited ICAR-CCARI, Goa

Hon'ble Union Minister of State for Agriculture and Farmers' Welfare, Shri Kailash Choudhary visited ICAR-Central Coastal Agricultural Research Institute, Goa on 24 September 2021. On the occasion, Shri Chandrakant Babu Kavalekar, Hon'ble Deputy Chief Minister, Govt. of Goa was also present. Hon'ble Union Minister of State appreciated the achievements and innovations of the Institute and complimented the team for addressing challenges of such a vast operating environment of the coastal region spread in 9 states and 2 UTs covering 75 districts.

Sushri Shobha Karandlaje, Hon'ble Union Minister of State for Agriculture and Farmers' Welfare, Government of India visited ICAR-CCARI, Goa

Hon'ble Union Minister of State for Agriculture and Farmers' Welfare, Sushri Shobha Karandlaje visited ICAR-Central Coastal Agricultural Research Institute, Goa on 29th September 2021. Hon'ble Minister was welcomed by ICAR staff at the exhibition where all the innovative technologies of the Institute and KVK were showcased. During the exhibition, agricultural inputs like coconut climbing machines, vegetable seeds of improved varieties, etc.

were distributed to the women farmers at the hands of the Hon'ble Minister. On the occasion, she appreciated the achievements and innovations of the Institute and complimented the team of ICAR-CCARI and KVK for addressing the challenges of the operating environment spread over 9 coastal states and 2 UTs covering 75 districts

Visit of Shri Parshottam Rupala, Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying, Government of India

Shri Parshottam Rupala, Union Minister for Fisheries, Animal Husbandry and Dairying, Government of India visited the Institute on 11th Dec. 2021. He was accompanied by Dr. Pramod Sawant, Hon'ble Chief Minister of Goa, Shri Filipe Neri Rodrigues, Minister for Fisheries and Water Resources Department, Govt. of Goa, Shri J.N. Swain, Secretary, Department of Fisheries, Dr O. P. Chaudhary, Joint Secretary (NLM/PC) and Shri J. Balaji, Joint Secretary (Marine Fisheries).

Date	Name of Visitor	Designation/ Institute/ Place
19-02-2021	Dr. Pradip Sarmokadam,	Member Secretary, Goa State Biodiversity Board, Goa
03-06-2021 29-09-2021	Shri. Nevil Alphonso,	Director, Directorate of Agriculture, Government of Goa
26-08-2021	Dr. Adlul Islam,	Assistant Director General (SWM), Division of Natural Resource Management, ICAR, New Delhi
06-09-2021	Visit of nine honourable Members of Parliament Chaired by Shri Parvatagouda Gaddigoudar,	Parliamentary Standing Committee on agriculture
20-09-2021	Dr. Durga Prasad	Director, Directorate of Planning, Statistics & Evaluation, Govt of Goa
21-09-2021 11/12/2021	Dr. Pramod Sawant	Honourable Chief Minister, Government of Goa
24-09-2021	Shri Kailash Choudhary	Hon'ble Union Minister of State for Agriculture and Farmers' Welfare, Government of India
29-09-2021	Sushri Shobha Karandlaje	Hon'ble Union Minister of State for Agriculture and Farmers' Welfare, Government of India
29-09-2021	Shri. Kuldeep Singh Gangar	Secretary (Agriculture.), Govt. of Goa
30-09-2021	Shri Vinay Tendulkar	Honourable member of Parliament (Rajya Sabha) Goa
05-10-2021	Dr. Tariq Thomas	Secretary, DST& WM, Govt. of Goa
05-10-2021	Smt. Usha Ramesh,	General Manager, NABARD, Regional Office, Goa
05-12-2021	Shri Shripad Yesso Naik,	Hon'ble Minister of State, Ministry of Tourism and Port, Shipping and Waterways, Government of India
11-12-2021	Shri Parshottam Rupala,	Hon'ble Union Minister of Fisheries, Animal Husbandry and Dairying, Government of India,
11/12/2021	Shri Filipe Neri Rodrigues,	Minister for Fisheries and Water Resources Department, Govt. of Goa,

Committees and Meetings

Research Advisory Committee

The IX Research Advisory Committee (RAC) for ICAR- Central Coastal Agricultural Research Institute was constituted for a period of three years from 14/08/2020 to 13/08/2023. The composition of RAC is given below.

Name and address	Role
Dr. Tapas Bhattacharya Ex- Vice Chancellor, Dr BSKKV, Dapoli, Bunglow No 11, Jayanti Nagari 2, BESA Nagpur – 4440031, Maharashtra	Chairman
Dr. MA Shankar Ex- Director of Research, UAS, Bengaluru, 1st Main Road, HGH layout, Ganganagar, Bengaluru- 560032, Karnataka	Member
Dr. V. L. Deopurkar Ex- Director of Research, MAFSU Om Bangla, Plot No-88, Sangam Society, Bibvewadi, Pune – 411037, Maharashtra	Member
Dr. Dilip Dora Ex. Professor, Horticulture & Ex Dean (PG), OUAT, Bhubaneshwar Tala Sahi, P.O- Khordha – 752055, Orissa	Member
Dr. Baban Ingole Visiting Scientist ESSO-National Centre for Polar & Ocean Research, Vasco, Goa	Member
Dr. Anupam Mishra Vice-Chancellor, CAU, Imphal	Member
Shri. Dattaprasad P Kholkar, H. No 245-A/9, Ganeshpuri, Housing Board Colony, Mapusa Goa	Member (Management (Committee Representative)
Shri. Prabhakar Gaonkar H. No. 21, Bendurden, Balli via Cuncolim, Salcette Goa - 403703	Member (Management Committee Representative)
Dr. Adlul Islam Assistant Director General (SWM) NRM, ICAR, KAB-II, Pusa, New Delhi - 110012	Member
Dr. Parveen Kumar Director, ICAR-CCARI, Old Goa	Member
Dr. Shivasharanappa N. Senior Scientist (Veterinary Pathology) ICAR- CCARI, Old Goa	Member Secretary

Institute Research Council Meeting

The 32nd Annual Institute Research Council meeting of the Institute was held during 9th to 13th August 2021. The meeting was chaired by Dr. Parveen Kumar, Director of the Institute. He welcomed all the scientists and highlighted about the importance of this meeting. He suggested to incorporate the RAC recommendations in the existing ongoing projects or new project proposals, if any. He also requested the scientists to take up need-based research projects as per the requirements of the coastal ecosystem. The scientists made their deliberations on the actions taken on recommendations of last IRC meeting and research activities carried out during last one year. The chairman reviewed all the projects thoroughly and made critical comments for the further improvement of projects.

The IRC reviewed the progress made under various research projects for the year 2020-21 and finalized the technical programmes of the ongoing research projects for the year 2021-22. The details of IRC are as follows

Name and address	Role
Dr. Parveen Kumar Director, ICAR - CCARI, Old Goa-403 402	Chairman
All Project Leaders	Members
Dr. Manohara K K Senior Scientist (Genetics & Plant Breeding) ICAR - CCARI, Old Goa-403 402	Member Secretary

Institute Management Committee

The Institute Management Committee has been constituted for financial and administrative guidance of Institute by the Council for a period of three years from 22/06/2020 to 21/06/ 2023. Following is the composition of IMC:

Name	Address	Designation
Dr. Parveen Kumar	Director, ICAR – CCARI, Old Goa	Chairman
Shri Nevil Alfanso	Director of Agriculture Directorate of Agriculture, Government of Goa, Krishi Bhavan, Tonca, Caranzalem, Goa.	Member
Dr. B N Sawant,	Associate Director of Research, RFRS, Vengurla, 416516	Member
Dr. P C Haldvanekar	Associate Dean, College of Horticulture, Dr.BSKKV, Dapoli	Member
Dr. Jagdish Rane	In-charge, Head School of Drought Stress Management ICAR-NIASM, Malegaon, Baramati -413 115 Maharshtra	Member
Dr. J Loka	Principal Scientist & I/c. Karwar Research Centre of CMFRI, Karwar, Karnataka	Member
Dr. Ravi Bhat	Acting Head, Division of Crop production ICAR-CPCRI, Kudlu P.O Kasargod	Member
Dr. K N Bhilegaonkar	I/c IVRI regional Station, Agriculture College Campus, Shivajinagar, Pune	Member
Dr. Adlul Islam	ADG (S&WM), NRM Division, ICAR, New Delhi	Member
Shri Saurabh Muni	Sr. Finance & Accounts Officer, IARI, New Delhi	Member
Smt. Montia Rita D'Silva	Administrative Officer, ICAR- CCARI, Old Goa	Member Secretary

Interface meeting with line departments of Goa State

The ICAR - Central Coastal Agricultural Research Institute (ICAR - CCARI), organized State level Interface meeting with Directorate of Agriculture, Government of Goa on 3rd June 2021 and with Directorate of Animal Husbandry & Veterinary Services and Directorate of Fisheries on 4th June 2021. Dr. Parveen Kumar, Director, ICAR-CCARI Chaired the meeting and highlighted the

significant achievements of the Institute. He also emphasized on collaboration with line departments to popularise Institute technologies among the farmers of Goa State to increase their income and livelihood security. The meeting was attended by Scientists of ICAR-CCARI, Subject Matter Specialists of Krishi Vigyan Kendra, North Goa and officials of all the three development departments.

Stakeholders Consultation Meeting

ICAR-Central Coastal Agricultural Research Institute, Goa organized a Stakeholders Consultation Meeting on enhancing effectiveness of research and seeking opinion on future directions of research on 31st July 2021 through virtual mode under the Chairmanship of Dr. Parveen Kumar, Director, ICAR-CCARI, Goa. An interaction was held with the stakeholders to assess the research needs, to identify issues faced by the farmers, fisher folk, entrepreneurs and other stakeholders from the coastal region and feedbacks were received. A total of 60 participants involving progressive farmers, entrepreneurs, processors, representatives from KVKs of coastal districts, state government officials, Agricultural Research Stations and other stakeholders from Maharashtra, Goa, Karnataka, Kerala, West Bengal and other coastal states along with scientists of the Institute participated in this meeting.

Interface meeting between ICAR-CCARI and Directorate of Agriculture, Govt. of Goa

ICAR-Central Coastal Agricultural Research Institute (ICAR-CCARI), organized an interface meeting with officers of Directorate of Agriculture, Government of Goa on 30th November 2021 at ICAR-CCARI, Old Goa under the chairmanship of Dr. Parveen Kumar, Director, ICAR-CCARI. The meeting was attended by all the Scientists of ICAR CCARI and 12 officers from Department of Agriculture, Govt. of Goa and Krishi Vigyan Kendra, North Goa and Krishi Vigyan Kendra, South Goa. During the meeting, action points pertaining to decisions of the pre-*kharif* meeting were discussed. About 25 new agenda points received for the current meeting were discussed in length and action points were formulated to address the same.

Personnel

Institute

Sr. No.	Name	Designation	Additional Charge
Research Management			
1.	Dr. EB Chakurkar (Up to 30/04/2021) Dr. Parveen Kumar (From 01/05/2021)	Director (A) Director	
Scientific Staff			
2.	Dr. SK Singh	Principal Scientist (Soil Science)	
3.	Dr. V Arunachalam	Principal Scientist (Horticulture)	
4.	Dr. AR Desai	Principal Scientist (Horticulture)	Horticultural Science
5.	Dr. R Ramesh	Principal Scientist (Plant Pathology)	Crop Science AKMU Cell, RAC
6.	Dr. Manohara KK	Senior Scientist (Plant Breeding)	IRC
7.	Dr. Mathala Juliet Gupta	Senior Scientist (Agricultural Structures and Process Engineering)	PME/ PIMS
8.	Dr. Shivasharanappa N (Uptill 8/10/2021)	Senior Scientist (Veterinary Pathology)	
9.	Dr. R Solomon Rajkumar	Scientist (Livestock Products Technology)	Animal and Fishery Science
10.	Dr. R Maruthadurai	Scientist (Agricultural Entomology)	Library
11.	Dr.Gokuldas PP	Scientist (Animal Reproduction and Gynaecology)	
12.	Dr. Mahajan GR	Scientist (Soil Science)	NRM Section,
13.	Dr. Shripad Bhat,	Scientist (Agricultural Economics)	IPR
14.	Dr. Susitha Rajkumar	Scientist (Veterinary Pathology)	
15.	Dr. Sreekanth GB	Scientist (Fisheries Resource Management)	
16.	Dr.Uthappa AR	Scientist (Agroforestry)	
17.	Dr. Chaudhari Ganesh Vasudeo	Scientist (Vegetable Science)	
18.	Shri. Trivesh S Mayekar	Scientist (Fish Genetics and Breeding)	
19.	Dr. Maneesha SR	Scientist (Fruit Science)	
20.	Dr. Paramesha V	Scientist (Agronomy)	TSP
21.	Dr.Bappa Das	Scientist (Agricultural Meteorology)	
22	Dr. Sujeet Desai	Scientist (Land and Water Management Engineering)	HRD, ISO

23.	Dr. NibeditaNayak	Scientist (Poultry Science)	
24.	Dr. Amiya Ranjan Sahu	Scientist (Animal Genetics and Breeding)	
Technical Staff			
1.	Ms. MadinaSollapuri	Assistant Chief Technical Officer (Estate)	
2.	Mr. VinodUbarhande	Farm Superintendent	
3.	Mr. Rahul Kulkarni	Senior Technical Officer (Agronomy)	
4.	Mr. Sidharth K. Marathe	Senior Technical Officer (PME Cell)	PRO -I
5.	Mr. Edward Crasto	Technical Officer (Stockman)	PRO -II
6.	Ms. PranjaliWadekar	Technical Officer (AKMU)	
7.	Mr.YoganandGaude	TechnicalOfficer (Electrical)	
8.	Mr. Suresh M Gomes	Senior Technical Assistant (Tractor Driver)	
9.	Mr. Omar Illroy Francisco De Ursula	Sr. Technical Assistant	
10.	Mr. PrakashParwar	Sr. Technician	
11.	Mr. Gokuldas Gawas	Sr. Technician	
12	Mr. Datta Velip	Sr. Technician	
13.	Mr. Laxman Naik	Sr. Technician	
Administrative & Accounts Staff			
1.	Shri. Somnath (Uptill 27/10/2021)	Administrative Officer	
2.	Ms. Lizette Maria Carmel Noronha	Private Secretary	
3.	Ms. Montia Rita D'Silva	Assistant Administrative Officer	Estt./ Bills
4.	Ms. Sneha Arlekar	Assistant Administrative Officer	Works
5.	Ms. Pratibha Sawant	Assistant Administrative Officer	
6.	Ms. Sohini Sawant	Assistant	
7.	Ms. Tarika Ussapkar	Personal Assistant	
8.	Mr. Vinod Pagi	Assistant	
9.	Ms. Bushra Ansari	Stenographer Grade.III	
10.	Ms. Chitra Kankonkar	UDC	
13.	Mr. Vyas Hiren Kumar	UDC	
14.	Ms. Sujatha S. Kamble	LDC	
15.	Ms. Swati Khandeparkar	LDC	
16.	Ms. Kushmala Chalawadi	LDC	
17.	Smt. Sarita Shelko	LDC	

Skilled Supporting Staff			
1.	Mr. Subhash Melekar		
2.	Mr. Dhaku Kankonkar		
3	Mr. Ashok Gadekar		
4.	Mr. ChimmnuTivrekar		
5.	Mr. Anil Khandeparkar		
6.	Ms. Maria S Dias		
7.	Mr. Giri Madkaikar		
8.	Mr. Umesh Marcelkar		
9.	Ms. Prafulla Khandeparkar		
10.	Ms. Rekha U Naik		
11.	Ms. Lalitha Naik		
12.	Ms. Partibha Folkar		
13.	Mr. Ravi S Kadam		
14.	Mr.Vilas P Gaonkar		
15.	Mr. Prabhakar Goankar		
16.	Mr. Sitaram Kuncolikar		
17.	Ms. Janika S Shirodkar		
18.	Mr. Shanu G Velip		
19.	Mr. Nitin J Naik		
20.	Mr. Prallhad Zambaulikar		

KVK

Sr. No.	Name	Designation	Additional Charge
Technical Staff			
1.	Mr. HRC Prabhu	Subject Matter Specialist T-9 (Plant Protection)	Programme Co-ordinator
2.	Ms. SunetraTalaulikar	Subject Matter Specialist T-9 (Home Science)	
3.	Dr. Sanjay Kumar Udharwar	Subject Matter Specialist T-6 (Animal Science)	Study Leave
4.	Dr. Monica Singh	Subject Matter Specialist T-6 (Agricultural Extension)	
5.	Mr. Shashi Vishwakarma	Technical Officer	
6.	Mr. Vishwajeet Prajapati	Technical Officer	
7.	Mr. DilkushVelip	Driver T-2	
Administrative Staff			
1.	Mr. Vishwas Sharma	Assistant	
2.	Ms. Shreya C. Barve	Stenographer Grade. III	
Skilled Supporting Staff			
1.	Mr. Payak J Padkar		

Staff activities

Study Leave:

- Dr. Bappa Das, Scientist (Agricultural Meteorology) has been granted study leave for a period of 12 months from 12-10-2020 to 11-10-2021 for availing the ICAR-Postdoctoral Research Fellowship for 2020-21 at ICAR-IARI, New Delhi.
- Dr. Sanjay Kumar Udharwar, Subject Matter Specialist (Animal Science), North KVK has been granted study leave for a period of 1 year from 31-12-2020 to 30-12-2021 for attending the course work at Kerala Veterinary and Animal Science University, Wayanad, Kerala for pursuing Ph.D. in Veterinary Surgery and Radiology.

Appointments

Name	Post	Date of Joining
Dr. Parveen Kumar	Director	01-05-2021
Smt. Montia Rita D'Silva	Administrative Officer	10-11-2021

Promotions

Name/designation of the Officials	Promoted/ Granted higher Grade Pay in the Pay band/level	Date of promotion
Dr. Mathala J. Gupta, Sr. Scientist (Agril. Structures & Process Engineering)	Placed in PB- Rs. 37400-67000 +RGP Rs. 9000/-	14-04-2014
Dr. Shripad Bhatt, Scientist (Agri. Economics)	Pay Matrix Level -11	15-09-2016
Smt. Pranjali N. Wadekar, Technical Officer (T-5) (Computer)	Senior Technical Officer (T-6) (Computer) in Pay Level 10	24-12-2018
Dr. Uthappa A.R., Scientist (Agroforestry)	Pay Matrix Level -11	01-01-2019
Shri Vinod A. Ubarhande, Senior Technical Officer (Farm Superintendent)	Assistant Chief Technical Officer (T-7/8) (Farm Superintendent)	24-11-2019
Shri Rahul M. Kulkarni, Senior Technical Officer (Agronomy)	Assistant Chief Technical Officer (T-7/8) (Agronomy)	01-01-2020
Shri Somnath Administrative Officer	Senior Administrative Officer	27-01-2021
Dr. Udharwar Sanjaykumar V., Subject Matter Specialist (T-6)	Assistant Chief Technical Officer (T-7/8) (Animal Science)	02-09-2019
Smt. Tarika S.Ussapkar, Personal Assistant	Private Secretary	19-07-2021
Shri Ravi S. Kadam, Skilled Support Staff	Financial Upgradation under MACPS	20-07-2021
Smt. Sohini S. Sawant, Assistant	Assistant Administrative Officer	18-11-2021
Shri Payak Padkar, Skilled Support Staff	Technician	22-12-2021

Transfer

Name	Post held	Transfer to	Date of transfer
Dr. Eaknath B. Chakurkar	Director (A)	ICAR-Central Island Agricultural Research Institute, Port Blair.	28-04-2021
Dr. Shivasharnappa N.	Senior Scientist (Veterinary Pathology)	ICAR-NIVEDI, Bengaluru.	08-10-2021
Shri Somnath	Senior Administrative Officer	ICAR- New Delhi	27-10-202

Joining

Name	Post at which joined	Transfer from	Date of transfer
Dr. Chaudhari Ganesh Vasudeo	Scientist (Vegetable Science)	ICAR-VPKAS, Almora	15-02-2021.

Supperannuation

Name	Post held	Date of Retirement
Dr. B.L. Kasinath	Principal Scientist and Head, KVK North Goa	31-05-2021.
Shri Dhaku Nuno Kankonkar	Skilled Support Staff	31-05-2021

Annexure-B

ICAR- CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE, GOA

ANNUAL ACCOUNT 2021-22

Details of Institute Govt. Grant expenditure for the year 2021-22

(Amount in Rupees)

Sl. No.	Head	Total allocation 2021-22	Expenditure (Govt. Grant) 2021-22				Expenditure Revenue Generation 2021-22	Total expenditure 2021-22
			NEH	TSP	SCSP	Other than NEH & TSP		
1	Works	70.95	0.00			70.95	0.00	70.95
2	Equipments	51.66	0.00	20.85		30.81	0.00	51.66
3	Information Technology	8.14	0.00			8.14	0.00	8.14
4	Library Books and Journals	1.09	0.00			1.09	0.00	1.09
5	Vehicles & Vessels		0.00			0.00	0.00	0.00
6	Livestock	2.87	0.00			2.87	0.00	2.87
7	Furniture & fixtures	5.96	0.00			5.96	0.00	5.96
8	Others	0.00	0.00				0.00	0.00
	Total – Capital (Grants for creation of Capital Assets)	**140.67**	**0.00**	**20.85**	**0.00**	**119.82**	**0.00**	**140.67**
1	**Establishment Expenses (Salaries)**							
	i. Establishment Charges	937.73	0.00			916.62	0.00	916.62
	ii. Wages	0.00	0.00				0.00	0.00
	iii. Overtime Allowance	0.00	0.00				0.00	0.00
	Total – Establishment Expenses (Grant in Aid - Salaries)	**937.73**	**0.00**	**0.00**	**0.00**	**916.62**	**0.00**	**916.62**
1	**Pension & Other Retirement Benefits**	**63.79**	**0.00**			**63.79**	**0.00**	**63.79**
2	**T.A.**							
	A. Domestic TA / Transfer TA	**7.66**	**0.00**			**7.66**	**0.00**	**7.66**
	B. Foreign TA	**0.00**	**0.00**				**0.00**	**0.00**
	Total – Traveling Allowance	***7.66***	***0.00***	***0.00***	***0.00***	***7.66***	***0.00***	***7.66***
3	**Research & Operational Expenses**							
	A. Research Expenses	**92.18**	**0.00**			**108.05**	**1.33**	**109.38**
	B. Operational Expenses	**259.69**	**0.00**			**223.62**	**18.63**	**242.25**
	Total - Research & Operational Expenses	**351.87**	**0.00**	**0.00**	**0.00**	**331.67**	**19.96**	**351.63**
4	**Administrative Expenses**							
	A. Infrastructure	**82.91**	**0.00**			**82.91**	**0.00**	**82.91**
	B. Communication	**0.98**	**0.00**			**0.98**	**0.00**	**0.98**
	C. Repair & Maintenance		**0.00**					**0.00**

	i. Equipments, Vehicles & Others	**18.70**	**0.00**			**18.70**	**0.00**	**18.70**
	ii. Office building		**0.00**			**0.00**	**0.00**	**0.00**
	iii. Residential building		**0.00**			**0.00**	**0.00**	**0.00**
	iv. Minor Works	**54.04**	**0.00**			**54.04**	**0.00**	**54.04**
	D. Others (excluding TA)	**56.25**	**0.00**			**56.44**	**0.03**	**56.47**
	Total - Administrative Expenses	**212.88**	**0.00**	**0.00**	**0.00**	**213.07**	**0.03**	**213.10**
5	**Miscellaneous Expenses**							
	A. HRD	**1.16**	**0.00**			**1.16**	**0.00**	**1.16**
	B. Other Items (Fellowships, Scholarships etc.)		**0.00**				**0.00**	**0.00**
	C. Publicity & Exhibitions		**0.00**				**0.00**	**0.00**
	D. Guest House – Maintenance	**16.44**	**0.00**			**16.44**	**0.00**	**16.44**
	E. Other Miscellaneous	**31.29**	**0.00**	31.29			**0.00**	**31.29**
	Total - Miscellaneous Expenses	**48.89**	**0.00**	**31.29**	**0.00**	**17.60**	**0.00**	**48.89**
	Total --Grants in Aid - General	**685.09**	**0.00**	**31.29**	**0.00**	**633.79**	**19.99**	**685.07**
	Grand Total (Capital + Establishment + General)	**1763.49**	**0.00**	**52.14**	**0.00**	**1670.23**	**19.99**	**1742.36**
6	**Loans and Advances**	**0.00**	**0.00**				**0.00**	**0.00**

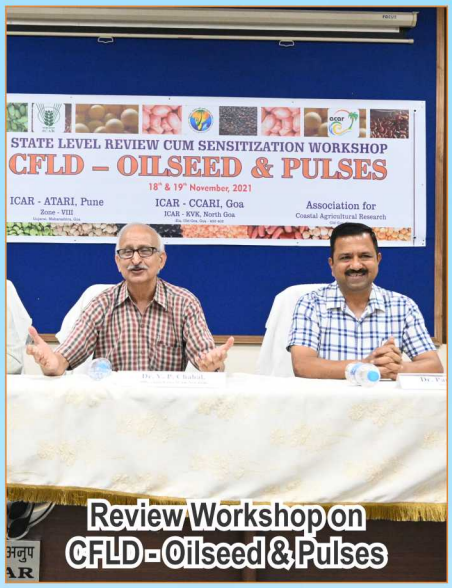
(Rs. In Lakhs)

	Swachh Bharat Mission							

Finance & Accounts Officer

NOTES

Distribution under Schedule Caste Sub Plan & Tribal Sub Plan

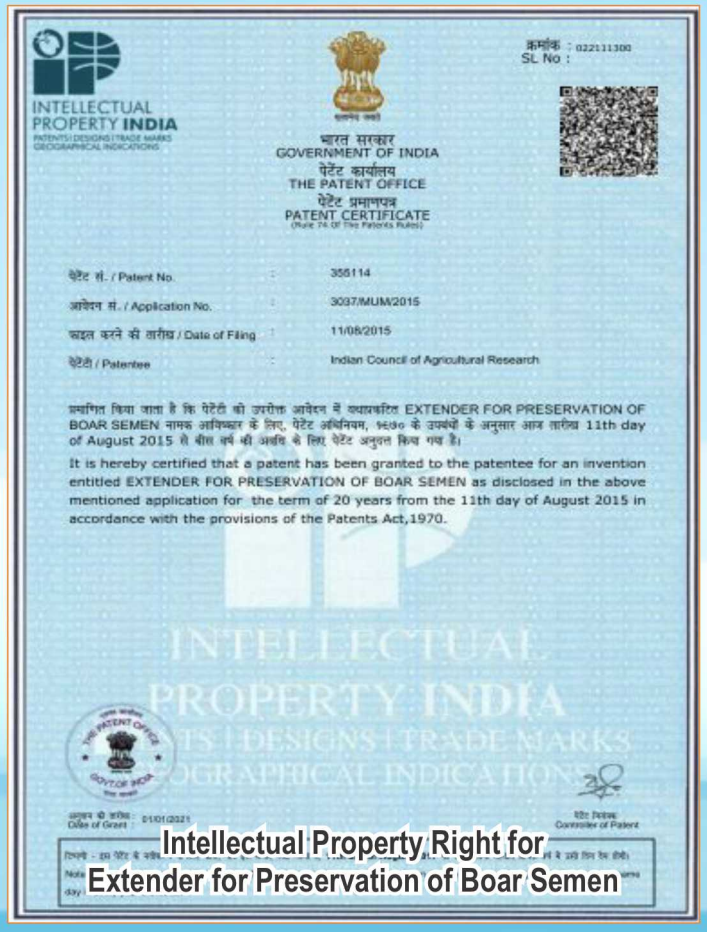


Review Workshop on CFLD - Oilseed & Pulses

Special National Swachhta Campaign on Waste to Wealth

Poshan Vatika Campaign & Tree Plantation

National Campaign on Ecosystem Management for Sustainable Fisheries



Intellectual Property Right for Extender for Preservation of Boar Semen

Annual Report 2021

Scan Me

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch