নাইক সমিবির্বে Annual Report 2018-19



ICAR-Central Coastal Agricultural Research Institute भाकृअनुप - केंद्रीय तटीय कृषि अनुसंधान संस्थान



(Indian Council of Agricultural Research) Old Goa - 403 402, Goa, India







Establishment of FLD on improved cashew varieties of the Institute at Ziltawadi, Canacona in the presence of Dr. Trilochan Mohapatra, Secretary (DARE) and DG, ICAR, New Delhi



Shri. Deepak Narvekar, Sr. Manager (Public relations and marketing), GTDC throwing open the Agroeco tourism unit for the public

वार्षिक प्रतिवेद्न Annual Report 2018-19





भाकृअनुप-केन्द्रीय तटीय कृषि अनुसंधान संस्थान

(भारतीय कृषि अनुसंधान परिषद)

ओल्ड गोवा- ४०३ ४०२, गोवा, भारत

ICAR-CENTRAL COASTAL AGRICULTURAL RESEARCH INSTITUTE

(Indian Council of Agricultural Research) Old Goa - 403 402, India

ICAR-CCARI, Goa Annual Report 2018-2019

Publisher : Dr. Eaknath B Chakurkar

Director (A) ICAR - Central Coastal Agricultural Research Institute Old Goa-403 402, Goa, India

Tel : 0832-2285381, 2284677/678/679

Fax : 0832-2285649

E-mail : director.ccari@icar.gov.in

Website : www.ccari.res.in

Correct Citation : ICAR-CCARI Annual Report 2018-19

ICAR - Central Coastal Agricultural Research Institute Old Goa-403 402, Goa, India

Chief Editor : Dr. Eaknath B Chakurkar

Editors : Dr. S Priya Devi Dr. MJ Gupta Dr. Manohara KK Dr. Chethan Kumar HB Dr. GR Mahajan Dr. Sreekanth GB

> Compilation & Technical Assistance : Mr. Sidharth K Marathe

© All rights reserved

Cover page photos:



- 1. DG, ICAR, inaugurating Coastal Agri Expo 2019
- 2. Goa dhan 4
- 3. Goa brinjal 1
- 4. Goa bhendi 1
- 5. Goa dhan 3
- 6. Goa brinjal 4



PREFACE

The ICAR - Central Coastal Agricultural Research Institute (CCARI) is one of the leading research Institutes under Natural Resource Management (NRM) Division of Indian Council of Agricultural Research (ICAR), New Delhi. The Institute is mandated to carry out research and extension work on natural resources, field and horticultural crops, livestock, fisheries and Agroecotourism. Research activities are being undertaken through various research themes, *viz.*, conservation, utilization and management of natural resources, crop, livestock and fisheries; development of production technologies, post harvest management and agri-entrepreneurship. This is executed through five functional sections - Natural Resource Management, Crop Science, Horticulture Science, Animal Science and Fisheries. The annual report of the ICAR-CCARI documents the progress made in research and extension during the year 2018-19.

During the period, Institute has released two high yielding salt tolerant rice varieties *viz.*, Goa dhan 3 and Goa dhan 4 for cultivation in coastal saline soils , four bacterial

wilt resistant brinjal varieties *viz.*, Goa brinjal 1, Goa brinjal 2, Goa brinjal 3 and Goa brinjal 4 and one high yielding seven ridged okra variety, Goa bhendi 1 suitable for coastal states. As a part of conservation and registration of local germplasm, *Shwet Kapila*, cattle stock is being maintained in the Institute farm for evaluation of production traits and suitability in climate change scenario.

The Institute is a regular centre for AICRPs on cashew, integrated farming system, vegetable crops, palms, pig and animal disease monitoring and surveillance and voluntary centre for AICRP on rice and arid legumes. In addition to Institute projects, research projects are also funded by ICAR through various network platforms and collaborations (AMAAS, NPTC and ICAR Seed project), Department of Science, Technology & Environment and Department of Biotechnology, STRASA, PPV&FRA, GRA etc to undertake research in coastal agriculture. Extension and development projects are channelled through various development programmes like Tribal Sub Plan, Scheduled Caste Sub Plan, NABARD, National Horticultural Mission, Rashtriya Krishi Vikas Yojana, NFDB, DASD and also through other developmental agencies.

To provide advisories in the field of agro-ecotourism, Institute has established an Agro-ecotourism centre. Six Automatic Weather Stations were established across Goa to monitor nine weather variables recorded at every three minutes. An exclusive web portal on agricultural information of Goa (www.agrigoaexpert.res.in) was hosted during March, 2019 for the benefit of farmers and other stakeholders.

A new infrastructure facility, Dr. A.R. Bhattacharyya Farmers Exhibition hall, was inaugurated. Envisaging the need to foster the information on recent developments in the field of agriculture and allied sciences to the farming community, Coastal Agri Expo-2019 was organised. New technologies like high yielding varieties, best performing breeds, advanced production technologies and other inputs developed for the benefit of the farmers were disseminated during the event. Farmers, officials of State agricultural universities, ICAR institutes, KVKs and other organisations from mainland and UT Lakshadweep participated in the event. One brooder cum grower unit, that can house nearly 3000 chicks and a range of 1300-1500 birds of different ages, and one parent stock unit with a capacity to accommodate 750 adult birds were established. A multi-disciplinary team of scientists of the Institute visited the flood impacted areas of Ernakulam district, Kerala to study the damage caused by flood to the agriculture and livestock sector. Animal health camps were conducted for the affected animals and recommendations were provided to the line departments to combat the situation.

As an output of these activities, a total of 23 research articles, 24 conference papers, four popular articles, four book chapters, five technical bulletins, 13 extension folders and two extension leaflets were published. The Institute was awarded second prize for outstanding work in official language in West Zone 'C' category, for the year 2016-17, by the Department of official language, Ministry of Home Affairs, Govt of India and Rajarshi Tandon Rajbhasha award from ICAR, New Delhi, for securing second place under'C' category. The staff of the Institute was graced with several honours for their research, administrative and extracurricular excellence.

I place on record my gratitude to Dr. Trilochan Mohapatra, Secretary, DARE and DG, ICAR, New Delhi, Dr. K. Alagusundaram DDG (NRM), ICAR New Delhi, Dr S. K. Chaudhary ADG (SWM) and Dr. S. Bhaskar, ADG (A,AF&CC) for the support, encouragement and guidance extended. I appreciate all the scientists and staff members of the Institute who contributed to the significant development of the Institute. I sincerely acknowledge the efforts made by the editorial committee of the Annual Report for compilation and publication. As Director of the Institute, it gives me pleasure to present the Institute's Annual Report 2018-19 and I hope the report will be useful to researchers, policy makers, planners and extension personnel.

with

(Eaknath B. Chakurkar) DIRECTOR (A)

Place : Old Goa Date : 05-07-2019

Major Achievements

The Institute has released two high yielding salt tolerant rice varieties *viz.*, Goa dhan 3 and Goa dhan 4 for cultivation in coastal saline soils, four bacterial wilt resistant brinjal varieties *viz.*, Goa brinjal 1, Goa brinjal 2, Goa brinjal 3 and Goa brinjal 4 and one high yielding seven ridged okra variety, Goa bhendi 1.

As a part of conservation and registration of local germplasm, *Shwet Kapila*, cattle stock is being maintained in the Institute farm for evaluation of production traits.

To provide advisories in the field of agro-ecotourism, Institute has newly established an Agro-ecotourism centre. Six Automatic Weather Stations were established across Goa to monitor 9 weather variables recorded at every three minutes. An exclusive web portal on agricultural information of Goa (www. agrigoaexpert.res.in) was hosted.

Envisaging the need to foster the information on recent developments in the field of agriculture and allied sciences to the farming community, Coastal Agri Expo-2019 was organised in the new Exhibition Hall.



A new infrastructure facility, Dr. A.R. Bhattacharyya Farmers' Exhibition Hall, was inaugurated.

CONTENT

Executive Summary / 1 कार्यकारी सारांश / 5 Introduction / 9 Weather Report / 10

Research Achievements

Conservation and management of natural resources of coastal region / 13 Conservation and utilization of genetic resources of coastal region / 19 Development and validation of production technologies of crops of coastal region / 27 Development and validation of production technologies of livestock and fisheries / 33 Improving livelihood security through post- harvest technologies and other agri- enterprises / 38

All India Co-ordinated Research Projects / 43 Externally Funded Projects / 48

Significant Scientific Accomplishments

Varieties released / 59 Intellectual Property Rights / 60 Technology Evaluation / 61 Ongoing Research Projects / 62 Awards and Recognitions / 65 Publications / 66

Education and Training / 72

Human Resource Development / 75

Transfer of Technology

ICAR-Krishi Vigyan Kendra / 79 Technology Dissemination / 80 Flood Impact Studies in Kerala State / 84

Glimpses of Institute

Coastal Agri Expo and Workshop / 86 Swachha Bharat Abhiyan / 87 संस्थान के राजभाषा प्रकोष्ठ की गतिविधियां / 89 Events / 90 Distinguished Visitors / 94 Committees and Meetings / 95 Personnel / 99 Budget / 102

ICAR-CCARI, GOA

Introduction and improvement of all potential crops and various species/breeds of livestock and scientific exploitation of various aquatic resources for improving fish production



MISSION

Executive Summary

he research projects in ICAR- Central Coastal Agricultural Research Institute are conducted under five themes of conservation, management and utilization of natural and genetic resources, development of production technologies for crops, animals and fisheries, post-harvest technologies and agro ecotourism. The salient research achievements for the year 2018-2019 are presented below.

Conservation and management of natural resources of coastal region

- Highest hydraulic conductivity (8.43 cm h⁻¹), available nitrogen (104.4 mg kg⁻¹), available potassium (83.74 mg kg⁻¹) and organic carbon (2.02%) were found under Continuous Contour Trenching + Vegetative Barrier treatment at 0-30 cm depth as compared to control.
- Circular trenching and circular terracing reduced run off to 12.2 m³ ha⁻¹ and 12.7 m³ ha⁻¹ in coconut with turmeric as intercrop, as compared to 13.1 m³ ha⁻¹ and 15.7 m³ ha⁻¹ without intercrop.
- With three different combinations of organic and inorganic sources of nitrogen in three different cropping systems, rice-rice, rice-cowpea and ricemoong, highest GHG emission (total global warming potential of 26528 kg CO₂e ha⁻¹) was observed from 100% N through farmyard manure and least GHG emission was observed from control plots with RDF (9562 kg CO²e ha⁻¹) under rice-rice cropping system.
- Transplanting 35-days old Goa Bio 1 treated rice seedlings and soil test based fertilizer recommendations (75% STFR) recorded grain yield advantage of 24.5% (BCR 2.04) and 53.7% (BCR 1.98), respectively, when compared to broadcasting Goa Bio 1 treated seeds with no fertilizers
- The soil properties like soil pH, salinity (electrical conductivity), bulk density, soil available nitrogen, exchangeable magnesium, soil available zinc and boron were estimated using hyperspectral remote sensing of salt-affected soils (number of soil samples 372) with fair to excellent predictions (ratio of performance to deviation 1.48 to 2.06).
- Pedotransfer function was developed to predict the soil water retention properties of the salt-

affected soils of coastal region using the soil organic carbon, bulk density and soil texture. The prediction accuracy for these predictions was 0.57, 0.60 and 0.62 (p<0.001) for predicting the field capacity, permanent wilting point and available water capacity, respectively.

- Through linear correlation analysis, wavelengths and wavebands in visible and NIR responsive to the cashew and mango leaf nutrients were identified as 494, 673, 800, 1415, 1748, 1915, 2207 and 2385 nm.
- Weather-based statistical crop yield forecasting model for rice and coconut was developed for six coastal districts of Andhra Pradesh. The performances of the calibration models were found to be good to very good ($R^2 = 0.46$ to 0.97 for rice and 0.37 to 0.99 for coconut).
- Partial least square regression (PLSR) based spectral algorithm was developed for characterization of rice genotypes grown under salinity stress, with correlation coefficient ranging from 0.52 to 0.89.

Conservation and utilization of genetic resources in the coastal region

- Two salt tolerant rice varieties *viz.*, Goa dhan-3 (GRS-1) and Goa dhan-4 (JK-238) were released for the coastal saline soils of Goa through State Variety Release Committee (SVRC).
- Goa dhan-3 is a white kernelled rice variety from IRRI, Philippines, with yield ranging from 3.0 - 3.5 t/ ha under stress condition and up to 6.0 t/ha under normal condition.
- Goa dhan-4, developed from the cross Jyothi X Korgut, is a red kernelled rice variety, with yield ranging from 3.0 3.5 t/ha under stress condition and up to 5.5 t/ha under normal condition.
- Thirty two landraces of rice were collected from coastal Karnataka and added to the institute germplasm collection.
- Among the 71 rice genotypes evaluated for salinity stress tolerance at seedling stage under micro-plot with electrical conductivity of 12 dS/m, none were highly tolerant, but 11 of the genotypes were found to be tolerant (T) with SES scoring of 3 to 4 similar to that of standard tolerant check varieties Pokkali and FL 478.

- When all the 71 rice genotypes were subjected to genotyping using saltol linked markers, SSR marker RM10871 was found to be highly polymorphic with a PIC value of 0.90 and exhibited 14 different alleles followed by RM10793 (0.84) and RM3412 (0.80) with 8 and 7 alleles, respectively.
- Under STRASA project, 82 rice cultures (75 test entries + 7 check varieties) developed for salinity and alkalinity conditions by different NARS partners were evaluated under coastal salinity situation during the Kharif season. Significantly higher grain yield was recorded by RAU1397-18-3-7-9-4-7 (1464.58 kg ha⁻¹) and CSR11-192 (1445.83 kg ha⁻¹), when compared to the best check variety CSR 10 (1252.08 kg ha⁻¹).
- In AICRP on rice, the AVT-I trial conducted in farmers field with 18 entries revealed best three entries with respect to grain yield *viz.*, IET 2210 (2098.95 kg ha⁻¹) followed by IET 2202 (1970.33 kg ha⁻¹) and IET 2203 (1787.5 kg ha⁻¹), as against local check Goa dhan-2 (1490.62 kg ha⁻¹).
- In AICRP on arid legumes, IVT with 23 genotypes showed that three entries *viz.*, CP-12 (2204.22 kg ha⁻¹), CP-7 (2119.44 kg ha⁻¹) and CP-18 (2036.23 kg ha⁻¹) were promising for grain yield, as against local check variety Goa cowpea-3 (1443.46 kg ha⁻¹).
- A total of 104 cashew germplasm accessions were maintained in field germplasm bank. Five new accessions viz., Durga-1/18, Barsem-1/18, Barsem-3/18, Karvem-1/18 and Karvem-2/18 were identified for bold nut (7.68-11.86 g) and higher shelling (28.62-32.23%) and two accessions viz. Arla Keri-1/8 and Barsem-2/18 were identified for their cluster bearing habit.
- Albeit smaller nut size, HB-13/05 continued to record higher nut yield, followed by HB-21/05 with promising performance in terms of nut yield, nut size and kernel out turn.
- Four new accessions of Mankurad mango variants and three accessions of Hilario mango variants were collected besides maintaining the existing mango germplasm bank consisting of 158 collections.
- Four bacterial wilt resistant brinjal varieties *viz*. Goa Brinjal-1, Goa Brinjal-2, Goa Brinjal-3 and Goa Brinjal-4 were developed and released for the state of Goa by State seed sub-committee for agriculture and horticultural crops, Govt. of Goa.
- Goa Bhendi-1, a pure line selection from a promising local accession was released for the state of Goa. It is a high yielder (seven ridged with 252 g/ plant) and highly preferred by local people.
- Four promising amaranth germplasm (Amar New-1, Amar New-6, Amar-17 and Amar-21) for leaf yield were identified and forwarded for further evaluation.
- · A total of 46 germplasm accessions of nutmeg,

comprising of two age groups was maintained. The nutmeg accession NMF2 yielded the highest no. of fruits (738) followed by NMD1 (586), NMD2 (438) and NMF6 (400). NMI1, an accession of 4 years showed precocity with good fruit set.

- One FLD on improved cashew varieties of the Institute was established at Ziltawadi village, Canacona Taluka in an area of five ha jointly owned by a SHG of 35 Tribal Farmers. The farmers were also provided with irrigation infrastructures, papaya seedlings for intercropping and other farm inputs.
- Five Front line demonstration units of high density planting of bush pepper grafts were established under the sponsorship by the Directorate of Arecanut and Spices Development, Calicut (under MIDH programme).
- In total 62737, 55401, 50928 and 54689 fishes were collected from Zuari (176 taxa), Mandovi (154 taxa), Terekhol (131 taxa) and Kali (133 taxa) estuaries, respectively belonging to 229 species.
- Using underwater visual census (UVC), a total of 28 species were counted on the AFHs (RCC made Artificial Fish Habitats deployed) in Grande and 19 species at Zuari and species diversity and abundance were comparatively higher at Grande with various communities like oysters, sponges and ascidia.
- Two Ecopath models of the Zuari estuary using Ecosim one each for 2016 and 2025 (under the assumption that the fishing regulations were implemented in the Zuari estuary from 2017 onwards to test the possible effects of fishing regulations) were constructed to visualize the status of the ecosystem at these two different periods. The results showed that the fishing regulations would benefit the ecosystem protection, if implemented with a ban on illegal fishing fleets.
- Under RKVY funded project, six Automatic Weather Stations (AWS) were established across Goa to monitor in which 9 weather variables are recorded every three minutes and stored at Central Server being maintained at the Institute. An exclusive web portal on agricultural information of Goa (www.agrigoaexpert.res.in) was hosted during March, 2019 for the benefit of farmers and other stakeholders.

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

- Various symptoms associated with viral disease complex in chilli were studied, by testing the plant samples using PCR and qPCR, which showed that the major virus associated was Chili leaf curl virus.
- In a field experiment on the management of chilli leaf curl complex, the crop was severely infested with whitefly initially and leaf curl virus symptoms were very prominent. During the mid stage of the crop, leaf curl symptoms reduced and moderate potyvirus

symptoms/aphid infestation and abundant Tospovirus symptoms/thrips infestation were also observed. During the later stage of the crop, plants showed prominent leaf curl virus symptoms and reduced level of potyvirus and Tospovirus symptoms. However, insecticides, bio-formulation and barrier crops reduced the insect infestation and improved the crop growth and yield.

- Evaluation of talc, alginate and liquid formulations of RCh6-2b and STC-4 prepared from the bacteria grown in synthetic medium and standard semisynthetic medium indicated that the population is above 8 log CFU/g in talc and alginate formulations and above 8 log CFU/ml in liquid formulations till 24 months in both RCh6-2b and in STC-4.
- Novel delivery modes like capsule and tablet formulations of bacterial bio-agents were standardized. The population was above 8 log CFU/g and 9 log CFU/g in capsule and tablet, respectively till 270 days. It was also seen that bacteria was released to the soil within 7 days of application and the population of the applied bacteria was 6-7 log CFU/g of soil till 180 days.
- Field application of talc formulation of the promising bacterial strains *viz.* RCh6-2b and STC-4 besides reducing the incidence of soil borne diseases of chilli and foot rot in black pepper, also improved plant growth and yield.
- *Bacillus* strains Rch6-2b and STC-4 expressed good compatibility with Integrated Nutrient mixture. The population of *Bacillus* strain Rch 6-2b was 7.39, 7.30 and 7.89 log cfu/g and STC-4 was 8.11, 8.79 and 8.62 log cfu/g at 2, 5 and 10% concentration 180 days after inoculation.
- Study revealed that around 5-10% of cashew trees in Goa were affected by cashew stem and root borers (CSRB). The major stem borer species found in cashew plantations were *Plocaederus ferrugineus*, *P. obesus* and *Batocera rufomaculata*. An average of 17 and 7.1 number of grubs of *Plocaederus spp* and *Batocera rufomaculata* respectively was recorded per cashew tree.
- The increasing incidence of mango stem borer was recorded in cashew plantations. The buprestid *Belionota prasina* was found in almost all the affected trees with an average of 6.3 grubs/tree. The grubs of cerambycid *Plocaederus* spp, *B. rufomaculata* and buprestid grub were found from root region up to 3m in height. Mostly cocoons and adults of cerambycid species were found in the root and 1m above the ground region.
- Management studies on CSRB showed that maximum recovery of 90% was recorded using Fipronil (0.09%), Dichlorvos (0.7%) and Chlorphyriphos (0.2%).
- Evaluation of roosting plants with food baited trap

for the management of cucurbit fruit fly *Zeugodacus cucurbitae* showed that castor + food bait attracted maximum number of fruit flies (8.68 adult flies/trap/ week), whereas control treatment without roosting plant could attract only 0.9 flies/trap/week. Cue lure pheromone attracted an average of 33.78 fruit flies/ trap/week in cucumber.

- Field experiment on integrated management of cowpea aphid with border crops and seed treatment indicated that the least number of aphids (10.48/ leaf/shoot) was recorded in ground nut border crop, followed by 12.22 no. in maize border crop compared to control (183.11/leaf/shoot).
- Efficacy of different methyl eugenol traps for the management of mango fruit fly showed that empty water bottle + 4×1×1 cm lure attracted a maximum number of 30.57 flies/week/trap.
- Among the different methods evaluated for extraction of kokum butter, the fermentation method showed highest butter recovery (39.66%), least acid value (0.82%) and iodine value (18.05).
 Fatty acid profiling of butter samples showed presence of palmitic (2.24%), stearic (54.11%), oleic (42.75%) and linolenic acids (0.89%), indicating the presence of both unsaturated and saturated fatty acids in the butter.
- Effect of thermal treatment on physical and mechanical properties of kokum seed was studied for designing a decorticator for kokum seed butter extraction. It indicated that dry roasting of the seeds for 20 minutes weakened the seed coat (force required to rupture seed coat: 2.86±0.72x10⁵ kgf / m²⁻¹) as compared to other treatments.
- A rice based farming system model has been standardized in 0.5 ha area for typical lowland situations with enterprises like rice followed by cowpea/moong/vegetables/baby corn/sweet corn in 0.4 ha, forage grown bunds in 0.032 ha, dairy with two crossbreed cows and FYM unit of 10 m². The system produced 19 q of rice, 385 kg of baby corn, 72 kg of sweet corn, 72 kg of moong and 95 kg of cowpea with 1250 litre of milk. A gross return of Rs. 2.35 lakh had the highest contribution from crops (59%) followed by dairy (29%).
- In a five-year-old horticulture based integrated farming model, the gross return per annum, was around Rs. 1,72,850 and the net profit was Rs.1,18,320. The highest contribution to net profit was from the piggery unit (42%) followed by cashew-pineapple system (25%).
- A gross income of Rs. 119058.20 was obtained from the demonstration model of Coconut based multiple-species farming system. Coconut contributed 25.4 % to the gross income; banana 11.98% while the highest contribution of 46.08% was obtained from nutmeg component.

3

Development and validation of production technologies of livestock and fisheries

- Different protocols for cryo-preservation of boar semen was standardized with indigenous semen extender. Among the three protocols tried, mean post-thaw semen motility were 5.5%, 23.0% and 35% for protocol I, II and III, respectively. The mean percentage of live sperms in post-freezing samples were 17.7%, 51.0% and 55.0% for protocol I, II and III, respectively. Using frozen-thawed samples of protocol III, in vivo fertility in breeding sows recorded conception rate of 30.77%.
- Under AICRP on pigs, third generation crossbred pigs of 75% exotic blood i.e. Large White Yorkshire and 25 % Agonda Goan were produced and studied for their performance. Litter size and litter weight at birth of crossbred pigs was 8.25±0.89 nos. and 8.83±187.12 kg, respectively. On an average individual male grew at 181.75±5.137 g/day till weaning with average individual weight being 8.33±210.0 kg, whereas it was 8.16±230.79 kg for female piglets with growth rate of 177.43±5.981 g/day. Crossbred pigs reached weight of 78.91 ±10.16 kg in eight months i.e. at slaughter age with overall average growth rate of 324.36±92.47 g/day under optimum growing conditions.
- Prevalence of major parasites of pigs of Karnataka and Goa were studied. A total of 78 fecal samples, 479 serum samples and 78 diaphragm samples were collected and analyzed. The prevalence of gastrointestinal parasites was found to be 39.74% (31/78). Coccidia spp was the most prevalent parasite (35.89%), followed by Ascaris suum (10.25%) and Strongyle spp. (5.1%).
- Different imaging parameters and ultrasound attributes for Real-time B-mode ultrasound (RTU) and Colour Flow Mapping (CFM) modes were standardized in dairy buffaloes. Transrectal ultrasonography imaging sessions were performed using battery operated multi-mode ultrasound scanner equipped with multifrequency linear-array transducer and major attributes of standardization were transducer frequency (6-10 MHz), doppler angle (20-60°), colour gain under CFM (55-90%) and dynamic range (60-95 dB).
- The production and reproduction performance of poultry breed Srinidhi parent stock (total number: 725) was evaluated in coastal climate condition. The body weight for male and female varied from 3.0-3.3 kg and 1.6-1.8 kg, respectively. Egg production at 28 weeks was 1211 and Hen day egg production (HDEP) was 37.93%. Highest hatchability and fertility was 78% and 93%, respectively on total egg set (TES) basis.

Improving livelihood security through post-harvest technologies and other agri- enterprises

- Foliar glucose content of dwarf arecanut variety was 7.2 to 24.5 % higher than that of tall variety. The foliar glucose content increase over three months was 16 % in dwarf whereas it it was very meager (<0.0001) in tall arecanut. Similarly, petiole to lamina length ratio (<0.24) was also found useful to discriminate dwarf and tall plants in early vegetative stage.
- Physical, mechanical and biochemical properties of banana leaves were studied to assess their suitability to be used for cup making. Heating over direct flame was found to improve the penetration strength of the 4 ply of leaves (2.25x10⁻⁵ kgf/m²).
- A study on use of banana biomass for growing oyster mushroom showed that, highest productivity was observed in the substrate containing 100 % paddy straw (28.75 %) and its combination with banana pseudostem and banana leaves in equal proportion (30.65%), with corresponding values of 94.17% and 86.22% biological efficiency, respectively.
- In fan ventilated double span polyhouse, the introduction of insect nets decreased the air exchange rates (by 31.25 %) and consistently the average temperatures inside the polyhouse were found slightly higher or equal to ambient condition, during most part of the year.
- The day time relative humidity except during rains was controlled (<60 %) by the fan ventilation but the night time humidity, when fans were not operated, was very high (>60% to 100%).
- Under fan ventilated double-span greenhouse for tomato (Golden Seeds 600, F1 Hybrid), two Fertigation rates F1 -(N:P:K -159:257:400, Ca- 77, Mg- 33, S- 42, B-4.6) & F2-(N:P:K -106:171:266.7, Ca- 51.3, Mg- 22, S-28, B-3.1); two growing media: Soil and Coco-pith; planting material : seedlings and grafted plants were assessed. Tomato grafts made on Solanum torvum were least affected by bacterial wilt (23 to 39%), whereas the tomato seedlings were severely affected (63-97%) after 70 days of planting under the poly house conditions. The yield per plant varied from 1429.25±888.04 to 68±29.80 g.
- The single span greenhouse under naturally ventilated conditions with insect nets over vents, could not maintain the optimum required temperature and humidity. Under stressed condition cucumber (Kian (F1Hybrid) of Nunhems co.) production with two growing media of soil and coco-pith and two fertigation rates F1 – N:P:K -50:91.5:130, Ca-20.7, Mg-10.6, S-13.2 B-1.6 , kg/ ha, and F2 – N:P:K -67.9:122:173, Ca-27.6, Mg-14.1, S-17.6 B-2.1, kg/ha was taken up. The yield per plant varied from 0.71 ± 0.48 to 0.81 ± 0.49 kg.

भा.कृ.अ.नु.प. – केन्द्रीय तटीय कृषि अनुसंधान संस्थान (ICAR - CCARI), गोवा द्वारा पांच विषयों यथा संरक्षण; प्राकृतिक एवं आनुवांशिक संसाधनों का संरक्षण, प्रबंधन एवं उपयोग; फसलों, पशुओं व मात्स्यिकी के लिए उत्पादन प्रौद्योगिकियों का विकास; फसलोत्तर प्रौद्योगिकियां एवं कृषि इकोटूरिज़म के अंतर्गत अनुसंधान किया जाता है। वर्ष 2018–19 के लिए संस्थान की प्रमुख अनुसंधान उपलब्धियों को नीचे प्रस्तुत किया गया है :–

तटीय क्षेत्र के प्राकृतिक संसाधनों का संरक्षण एवं प्रबंधन

- कंट्रोल की तुलना में 0 से 30 से.मी. की गहराई पर निरन्तर समोच्च ट्रेन्चिंग + शाकीय अवरोध (VB) उपचार के अंतर्गत अधिकतम हाइड्रोलिक चालकता (8.43 से.मी./घंटा), उपलब्ध नत्रजन (104.4 मि.ग्रा./कि.ग्रा.), उपलब्ध पोटेशियम (83.74 मि. ग्रा./कि.ग्रा.) और जैविक कार्बन (2.02 प्रतिशत) पाए गए।
- नारियल में बिना किसी अंतर—फसल के 13.1 घन मीटर / हेक्टेयर और 15.7 घन मीटर / हेक्टेयर की तुलना में अंतर फसल के रूप में हल्दी को अपनाकर वृताकार ट्रेन्चिंग और वर्ताकार सीढ़ीनुमा उपाय से अपवाह में कमशः 12.2 घन मीटर / हेक्टेयर एवं 12.7 घन मीटर / हेक्टेयर तक की कमी देखने को मिली।
- तीन विभिन्न फसलचक प्रणालियों यथा चावल—चावल, चावल—लोबिया तथा चावल—मूंग में नत्रजन के जैविक तथा अजै. विक स्रोत वाले तीन भिन्न संयोजनों के साथ गोबर की खाद के माध्यम से 100 प्रतिशत नत्रजन से अधिकतम ग्रीनहाउस गैस उत्सर्जन (26528 कि.ग्रा. CO₂e/ हेक्टेयर की कुल ग्लोबल उष्मायन क्षमता) पाया गया और चावल—चावल फसलचक प्रणाली के तहत आर.डी.एफ. के साथ कंट्रोल प्लॉटों में सबसे कम ग्रीनहाउस गैस उत्सर्जन (9562 कि.ग्रा. CO₂e / हेक्टेयर) पाया गया।
- गोवा बायो 1 से उपचारित पैंतीस दिन पुरानी धान के पौधों का पौधारोपण करने और मृदा की जांच पर आधारित उर्वरक संस्तुति (75 प्रतिशत एस.टी.एफ.आर.) को अपनाने पर बिना किसी उर्वरकों के गोवा बायो 1 से उपचारित बीजों को छिड़काव द्वारा बुवाई करने के मुकाबले में कमशः 24.5 प्रतिशत (बी.सी.आर. : 2.04) और 53.7 प्रतिशत (बी.सी.आर. : 1.98) की दाना उपज अग्रता दर्ज की गई।
- हाइपरस्पेक्ट्रल रिमोट सेन्सिंग तकनीक का उपयोग (मृदा नमूनों की संख्या–372) करते हुए लवण प्रभावित मृदाओं में मृदा की विशेषताओं यथा मृदा का pH मान, लवणता (विद्युत चालकता), बल्क सघनता, उपलब्ध नत्रजन, विनिमय योग्य मैग्नीशियम, उपलब्ध जिंक एवं बोरोन आदि अच्छे से उत्कृष्ट पूर्वानुमान (विचलन प्रदर्शन दर : 1.48 से 2.06) लगाया गया।
- मृदा जैविक कार्बन, बल्क सघनता तथा मृदा की बनावट का उपयोग करते हुए तटवर्ती क्षेत्रों की लवण प्रभावित मृदाओं में जल को बनाये रखने की विशेषताओं का पूर्वानुमान लगाने के लिए पिडोट्रांसफर फंक्शन विकसित किया गया। क्षेत्र क्षमता, स्थाई मुरझान स्तर तथा उपलब्ध जल क्षमता का पूर्वानुमान लगाने के लिए इसकी सटीकता क्रमशः 0.57, 0.60 तथा 0.62 (p<0.001) थी।
- रेखीय सह—संबंध विश्लेषण के माध्यम से काजू तथा आम के पत्तियों के पोषक तत्वों में दृश्य तथा एन.आई.आर. प्रतिक्रिया में

तरंगदैर्ध्य एवं तरंगपट्टी की पहचान 494, 673, 800, 1415, 1748, 1915, 2207 तथा 2385 nm की गई।

- आन्ध्र प्रदेश के छः तटवर्ती जिलों के चावल व नारियल की फसल के लिए मौसम आधारित सांख्यिकीय फसल उपज पूर्वानुमान मॉडल विकसित किए गये। इन का प्रदर्शन अच्छे से बहुत अच्छा (चावल के लिए R² = 0.46 से 0.97 एवं नारियल के लिए R² = 0.37 से 0.99) पाया गया।
- लवणीय दबाव के अंतर्गत उगाये गए चावल जीनप्रारूपों के लक्षणवर्णन के लिए 0.52 से 0.89 की सीमा में सह-संबंध गुणांक के साथ आंशिक न्यूनतम वर्गाकार समाश्रयण (PLSR) आधारित स्पेक्ट्रल कलन–विधि का विकास किया गया।

तटीय क्षेत्र में आनुवंषिक संसाधनों का संरक्षण एवं उपयोगिता

- राज्य किस्मीय निर्मुक्ति समिति (SVRC) द्वारा गोवा की तटवर्ती लवणीय मृदाओं के लिए चावल की दो लवण सहिष्णु किस्मों यथा गोवा धान 3 (जी.आर.एस. 1) और गोवा धान 4 (जे.के. 238) को जारी किया गया।
- गोवा धान 3 एक सफेद दाने वाली आई.आर.आर.आई., फिलीपाइन्स की चावल किस्म है जिसकी दबाव परिस्थिति एवं सामान्य परिस्थिति में उपज क्षमता क्रमशः 3.0 से 3.5 टन/हेक्टेयर और 6.0 टन/ हेक्टेयर तक है।
- ज्योति एवं कोरगुट के क्रॉस से तैयार की गई एक लाल दाने वाली चावल किस्म, गोवा धान–4 की उपज क्षमता दबाव परिस्थिति के अंतर्गत (3.0 से 3.5 टन / हेक्टेयर) एवं सामान्य परिस्थिति के अंतर्गत (5.5 टन / हेक्टेयर तक) है।
- तटीय कर्नाटक से चावल की कुल 32 लैण्डरेस को संस्थान के जननद्रव्य संकलन में शामिल किया गया।
- माइको प्लॉट (12 dS/m की विद्युत चालकता) के अंतर्गत, पौद अवस्था में लवणीय दबाव सहिष्णुता के लिए कुल 71 चावल जीनप्रारूपों का मूल्यांकन किया गया जिनमें से कोई भी जीनप्रारूप अत्यधिक सहिष्णु नहीं पाया गया लेकिन 11 जीनप्रारूप 3 से 4 की एस.ई.एस. स्कोरिंग के साथ सहिष्णु तुलनीय किस्मों पोक्काली एवं एफ.एल. 478 के समान सहिष्णु (T) पाए गए।
- सॉल्टोल लिंक्ड मार्करों का उपयोग करते हुए 71 चावल जीनप्रारूपों की जीनोटाइपिंग की गई जिनमें 0.90 के पी.आई.सी. मान के साथ एस.एस.आर. मार्कर आर.एम. 10871 अत्यधिक बहुरूपीय पाया गया और उसमें 14 विभिन्न युग्मविकल्पी प्रदर्शित हुए और तदुपरान्त आर.एम. 10793 (0.84) एवं आर.एम. 3412 (0.80) में क्रमशः 8 एवं 7 युग्मविकल्पी प्रदर्शित हुए।
- STRASA परियोजना के अंतर्गत, विभिन्न एन.ए.आर.एस. भागीदारों द्वारा लवणीय एवं क्षारीय परिस्थितियों के लिए विकसित 82 चावल संवर्धनों (75 जांच प्रविष्टियां + 7 तुलनीय किस्मों) का मूल्यांकन खरीफ मौसम के दौरान तटीय लवणता

>>> 5

परिस्थिति के अंतर्गत किया गया। सर्वश्रेष्ठ तूलनीय किस्म .सी.एस.आर. 10 (1252.08 कि.ग्रा. / हेक्टेयर) के मुकाबले में आर.ए.य. 1397—18—3—7—9—4—7 (1464.58 कि.ग्रा. / हेक्टेयर) तथा सी.एस.आर. 11–192 (1445.83 कि.ग्रा. / हेक्टेयर) द्वारा उल्लेखनीय रूप से कहीं उच्चतर दाना उपज दर्ज की गई।

- चावल पर अखिल भारतीय समन्वित अनसंधान परियोजना के तहत, कुल 18 प्रविष्टियों के साथ किसानों के खेतों में आयोजित किए गए ए.वी.टी.—1 परीक्षण में दाना उपज के संबंध में सर्वश्रेष्ठ तीन प्रविष्टियों का पता चला। स्थानीय तुलनीय किस्म गोवा धान – 2 (1490.62 कि.ग्रा. / हेक्टेयर) के मुकाबले में आईईटी 2210 (2098.95 कि.ग्रा. / हेक्टेयर) एवं तदुपरान्त आई.ई.टी. 2202 (1970.33 कि.ग्रा. / हेक्टेयर) और आई.ई.टी. 2203 (1787.5 कि. ग्रा. / हेक्टेयर) की दाना उपज दर्ज की गई।
- शुष्क फलियों पर अखिल भारतीय समन्वित अनुसंधान परियोजना के तहत, आई.वी.टी. में 23 जीनप्रारूपों में प्रदर्शित हआ कि तीन प्रविष्टियां यथा सी.पी. 12 (2204.22 कि.ग्रा. / हेक्टेयर), सी.पी. 7 (2119.44 कि.ग्रा. / हेक्टेयर) और सी.पी. 18 (2036.23 कि.ग्रा. / हेक्टेयर), स्थानीय तुलनीय किस्म गोवा लोबिया 3 (1443.46 कि. ग्रा. / हेक्टेयर) के मुकाबले में दाना उपज के संबंध में आशाजनक पाई गईं।
- कुल 104 काजू जननद्रव्य प्राप्तियों का रख–रखाव संस्थान के क्षेत्र जननद्रव्य बैंक में किया गया। पांच नई प्राप्तियों यथा दुर्गा -1/18, बारसेम -1/18, बारसेम -3/18, कारवेम -1/18 तथा कारवेम –2 / 18 की पहचान बड़ी नट (7.68 से 11.86 ग्राम) और उच्चतर छिलन (28.62 से 32.23 प्रतिशत) के लिए और दो प्राप्तियों यथा अर्ला केरी -1/18 एवं बारसेम -2/18 की पहचान उनकी बेहतर गुच्छ धारण प्रवृति के लिए की गई।
- छोटे नट आकार के बावजूद किस्म एच.बी. –13/05 में उच्चतर नट उपज जारी रहा एवं तद्परान्त, नट उपज, नट आकार एवं दाना उत्पाद में एच.बी −21⁄05 का प्रदर्शन आशाजनक पाया गया ।
- मानकूराद आम परिवर्त की चार नई प्राप्तियों और हिलेरियो आम परिवर्त की तीन प्राप्तियों को संस्थान के 158 संकलनों वाले जननद्रव्य बैंक में संकलित किया गया।
- बैंगन की चार जीवाण्विक मुरझान प्रतिरोधी किस्मों यथा गोवा ब्रिंजल – 1, गोवा ब्रिंजल 2, गोवा ब्रिंजल 3 और गोवा ब्रिंजल 4 का विकास किया गया और उन्हें कृषि एवं बागवानी फसलों के लिए राज्य बीज उप–समिति, गोवा सरकार द्वारा गोवा राज्य के लिए जारी किया गया।
- एक आशाजनक स्थानीय प्राप्ति का परिशृद्ध वंशकम सेलेक्शन, गोवा भिण्डी–1 को गोवा राज्य के लिए जारी किया गया। यह एक उच्च उपजशील (252 ग्राम⁄पौधा के साथ सात मेंडवाला) वंशकम है, जो गोवा मे लोकप्रिय है।
- पत्ती उपज के लिए चौलाई के चार आशाजनक जननद्रव्य (अमर न्यू-1, अमर न्यू-6, अमर-17 तथा अमर-21) की पहचान की गई और उन्हें पुनः मूल्यांकन प्रयोजन के लिए आगे बढ़ाया गया।
- दो आय् वर्गों वाली जायफल की कुल 47 जननद्रव्य प्राप्तियों का रख–रखाव किया गया। फलों की सबसे अधिक संख्या जायफल प्राप्ति एन.एम.एफ.२ (७३८) में एवं तदुपरान्त एन.एम.डी.१ (५८६), एन.एम.डी.2 (438) तथा एन.एम.एफ.6 (400) में पाई गई। चार वर्षीय प्राप्ति एन.एम.आई.१ में अच्छे फल उत्पाद के साथ अकाल प्रौढता प्रदर्शित हुई।

- संस्थान की उन्नत काजू किस्मों पर एक अग्रिम पंक्ति प्रदर्शन (FLD) को जिल्टावाडी गांव, कानकोना तालुका के 35 जनजातीय किसानों के स्वयं सहायक समूह की सामूहिक स्वामित्व वाले पांच हेक्टेयर कृषि क्षेत्रफल में लगाया गया। किसानों को सिंचाई की बुनियादी सुविधाएं, अंतर फसलचक के लिए पपीते की पौद और अन्य फार्म आदान संस्थान के जनजातीय सहयोजना के अंतर्गत उपलब्ध किए गए।
- सपारी एवं मसाला विकास निदेशालय, कालीकट (एम.आई.डी.एच. कार्यक्रम के अंतर्गत) द्वारा वित्त पोषित परियोजना के तहत बुश पेपर कलमों के उच्च सघनता रोपण की पांच अग्रिम पंक्ति प्रदर्शन इकाइयां स्थापित की गईं।
- जुआरी (176 वर्ग), मान्डोवी (154 वर्ग), तेरेखोल (131 वर्ग) तथा काली (133 वर्ग) नदीमुख से दो सौ उनतीस (229) प्रजातियों से जुडे कमशः 62737, 55401, 50928 तथा 54689 मत्स्य का संकलन किया गया।
- जलमग्न विश्वअल गणना (UVC) का उपयोग करके आर.सी. सी. के कृत्रिम मत्स्यावास (AFHs) पर ग्रैन्ड द्वीप में कूल 28 प्रजातियों और जुआरी में 19 प्रजातियों की गणना की गई। ओयस्टर, स्पोंज तथा असीडिया जैसे विभिन्न समुदाय के साथ ग्रैन्ड द्वीप में तुलनात्मक रूप से प्रजाति विविधता और प्रचुरता कहीं अधिक पाई गई।
- मछली पकडने के नियमों के संभावित प्रभावों की जांच करने के लिए वर्ष 2016 तथा 2025 के लिए (इस कल्पना के तहत कि वर्ष 2017 के बाद से जुआरी नदीमुख में मछली पकडने वाले नियमों को लागू किया गया) इकोसिम का उपयोग करके जुआरी नदीमुख के दो इकोपाथ मॉडलों का निर्माण किया गया, ताकि इन दो भिन्न अवधियों में इकोसिस्टम की स्थिति को देखा जा सके। परिणामों में प्रदर्शित हुआ कि यदि अवैध तरीके से मछली पकडने वाले जहाजों पर प्रतिबंध को लागू किया जाता है तो इकोसिस्टम का संरक्षण हो सकता है।
- राष्ट्रीय कृषि विकास योजना व्दारा वित्त पोषित परियोजना के अंतर्गत, गोवा में छः स्वचालित मौसम स्टेशन (AWS) स्थापित किए गए ताकि प्रत्येक तीन मिनट में 9 मौसम परिवर्त की निगरानी की जा सके और संस्थान में रख रखाव किए जा रहे केन्द्रीय सर्वर में इन्हें भण्डारित किया जाए। किसानों व अन्य साझेदारों के लिए मार्च, 2019 के दौरान गोवा की कृषि जानकारी पर एक पूर्णतः समर्पित वेब पोर्टल (www.agrigoaexpert.res. in) बनाया गया है ।

तटीय क्षेत्र की प्रमुख फसलों की उत्पादन प्रौद्योगिकियों का विकास एवं प्रमाणन

- पी.सी.आर. तथा क्यू पी.सी.आर. का उपयोग करते हुए पौधा नमूनों की जांच करके मिर्च में वायरल रोग कॉम्पलेक्स से जुड़े विभिन्न लक्षणों का अध्ययन किया गया जिसमें प्रदर्शित हुआ कि सम्बद्ध प्रमुख वायरस कारक चिली लीफ कर्ल वायरस है।
- चिली लीफ कर्ल कॉम्पलेक्स की रोकथाम पर किए गए एक क्षेत्र प्रयोग में, फसल प्रारंभ में सफेद मक्खी से गंभीर रूप से संक्रमित थी और पत्ती कुंचन वायरस लक्षण बहुत प्रधान थे। फसल की मध्य अवस्था के दौरान, पत्ती कुंचन लक्षणों में कमी आई और संतुलित पॉटीवायरस लक्षण⁄एफिड़ संक्रमण तथा प्रचुर टॉस्पोवायरस लक्षण⁄थ्रिप्स संक्रमण पाया गया। फसल की आगे की अवस्था के दौरान, पौधों में पत्ती कुंचन वायरस लक्षण प्रमुखता से प्रदर्शित हुए और पॉटीवायरस लक्षणों का स्तर

घटा तथा साथ ही टॉस्पोवायरस लक्षण का स्तर भी कम हुआ। हालांकि, कीटनाशकों, जैव फार्मुलेशन और अवरोधी फसलों द्वारा कीट संक्रमण को कम किया गया और फसल की बढ़वार और उपज में सुधार किया गया।

- कृत्रिम मीडियम और मानक अर्ध—कृत्रिम मीडियम में उगे जीवाणु से तैयार RCh6-2b एवं STC-4 के पाउडर, एल्जीनेट एवं तरल फार्मुलेशन का मूल्यांकन किया गया जिससे पता चला कि RCh6-2b तथा STC-4 दोनों में 24 माह तक पाउडर तथा एल्जीनेट फार्मुलेशन में संख्या 8 log CFU/g से अधिक तथा तरल फार्मुलेशन में 8 log CFU/ml से अधिक है। इन पाउडर फार्मुलेशन के मूल्यांकन से मिर्च में फसल बढ़वार में सुधार हुआ।
- जैविक एजंटो के कैप्सुल तथा गुटिका फार्मुलेशन जैसे नवीन वितरण विधियों का भी मानकीकरण किया गया। कैप्सुल और गुटिका अथवा गोली में जीवाणु की संख्या 270 दिनों क्रमशः 8 log CFU/g से अधिक और 9 log CFU/g थी। अनुप्रयोग के सात दिनों के अंदर मृदा में जीवाणु का संरोपण हुआ और असकी संख्या 180 दिनों मे 6.7 log CFU/g पाया गया।
- आशाजनक जैविक स्ट्रेन यथा RCh6-2b तथा STC-4 के पाउडर फार्मुलेशन का खेत में प्रयोग करने पर मिर्च के बीज जनित रोगों तथा काली मिर्च में पाद गलन के प्रकोप में कमी आई और साथ ही पौद बढ़वार और उपज में सुधार हुआ।
- बैसिलस स्ट्रेन Rch6-2b एवं STC-4 द्वारा एकीकृत पोषक तत्व मिश्रण के साथ अच्छी अनुकूलनता अथवा सुसंगतता प्रदर्शित हुई। संरोपण के 180 दिन बाद 2, 5 तथा 10 प्रतिशत सान्द्रता पर बैसिलस स्ट्रेन Rch 6-2b की संख्या कमशः 7.39, 7.30 तथा 7.89 log cfu/g और STC – 4 की संख्या कमशः 8.11, 8.79 एवं 8.62 log cfu/g पाई गई।
- अध्ययन से पता चला कि गोवा राज्य में लगभग 5 से 10 प्रतिशत काजू वृक्ष काजू तना एवं जड़ वेधकों (CSRB) से प्रभावित थे। काजू फलोद्यानों में पाई गईं प्रमुख तना वेधक प्रजातियां : प्लोसीडेरस फेरूजीनियस, पी. ओबेसस तथा बेटोसेरा रूफोमैकुलैटा थी। काजू में प्लोसीडेरस प्रजातियों तथा बेटोसेरा रूफोमैकुलैटा की औसतन क्रमशः 17 एवं 7.1 ग्रब संख्या प्रति वृक्ष दर्ज की गई।
- काजू फलोद्यानों में आम तना वेधक के बढ़ रहे प्रकोप को दर्ज किया गया। लगभग सभी प्रभावित वृक्षों में औसतन 6.3 ग्रब प्रति वृक्ष बुप्रेस्टिड बेलियोनोटा प्रैसिना पाया गया। सेरमबायसिड प्लोसीडेरस प्रजातियां, बी. रूफोमैकुलैटा और बुप्रेस्टिड ग्रबों को जड़ क्षेत्र से तीन मीटर ऊंचाई तक में पाया गया। सेरमबायसिड प्रजातियों के अधिकांश कैकून्स व वयस्क जड़ में और भूतल क्षेत्र से एक मीटर ऊपर पाए गए।
- सी.एस.आर.बी. पर किए गए प्रबंधन अध्ययनों में प्रदर्शित हुआ कि फिप्रोनिल (0.09 प्रतिशत), डाइक्लोरवॉस (0.7 प्रतिशत) और क्लोरफायरीफॉस (0.2 प्रतिशत) का उपयोग करके 90 प्रतिशत तक नियंत्रण हो सकता हैं।
- खीरावर्गीय सब्जियों में फल मक्खी, ज्यूगोडेकस कुकुरबिटे की रोकथाम के लिए खाद्य प्रलोभन ट्रैप के साथ रूस्टिंग पौधों का मूल्यांकन करने पर प्रदर्शित हुआ कि अरण्डी + खाद्य प्रलोभन चारा द्वारा फल मक्खी की अधिकतम संख्या (8.68 वयस्क मक्खी / ट्रैप / सप्ताह) को आकर्षित किया गया जबकि रूस्टिंग

पौधों के बिना कंट्रोल उपचार द्वारा प्रति सप्ताह प्रति ट्रैप केवल 0.9 मक्खियों को ही आकर्षित किया जा सका। खीरा में क्यू ल्यूर फिरोमॉन द्वारा प्रति सप्ताह प्रति ट्रैप औसतन 33.78 फल मक्खियों को आकर्षित किया गया।

- सीमावर्ती फसलों और बीज उपचार के साथ लोबिया एफिड़ के एकीकृत प्रबंधन पर किए गए क्षेत्र प्रयोग में पता चला कि एफिड की सबसे कम संख्या (10.48/पत्ती/प्ररोह) मूंगफली सीमावर्ती फसल में एवं तदुपरान्त मक्का सीमावर्ती फसल (12.22) में पाई गई जबकि इसकी तुलना में कट्रोल में एफिड की संख्या (183. 11/पत्ती/प्ररोह) अधिक पाई गई।
- आम के फल मक्खी की रोकथाम के लिए विभिन्न मिथाइल यूगेनॉल ट्रैप की प्रभावशीलता में प्रदर्शित हुआ कि पानी की खाली बोतल + 4 x 1 x 1 सेमी. प्रलोभन द्वारा प्रति ट्रैप प्रति सप्ताह फल मक्खियों की अधिकतम संख्या (30.57) आकर्षिक की गई।
- कोकम के बीज से मक्खन का निष्कर्षण करने के लिए विभिन्न विधियों का मूल्यांकन किया गया जिसमें किणवन विधि में उच्चतम बटर वसूली (39.66 प्रतिशत), सबसे कम अम्ल मान (0.82 प्रतिशत) तथा आयोडिन मान (18.05 प्रतिशत) प्रदर्शित हुए। बटर नमूनों की वसा अम्ल प्रोफाइलिंग से पॉमीटिक (2.24 प्रतिशत), स्टीयरिक (54.11 प्रतिशत), ओलिक (42.75 प्रतिशत) तथा लिनोलेनिक अम्ल (0.89 प्रतिशत) की मौजूदगी का पता चला जिससे कि बटर अथवा मक्खन में असंतृप्त तथा संतृप्त वसा अम्लों दोनों की मौजूदगी का पता चलता है।
- कोकम बीज को छिलने का मशीन डिजाइन के लिए कोकम बीज की भौतिक और मैकेनिकल विशेषताओं पर तापीय उपचार के प्रभाव का अध्ययन किया गया। इसमें यह पता चला कि 20 मिनट के लिए बीजों को सूखा भूनने पर अन्य उपचारों की तुलना में बीज आवरण ज्यादा कमजोर हुआ (बीज आवरण को तोड़ने के लिए वांछित बल : 2.86±0.72 x 10⁵ kgf/m²)
- चावल जैसे उद्यमों के साथ विशिष्ट निचली भूमि परिस्थितियों के लिए 0.5 हेक्टेयर कृषि रकबे में चावल आधारित कृषि प्रणाली मॉडल का मानकीकरण किया गया जिसमें 0.4 हेक्टेयर रकबे में लोबिया/मूंग/सब्जी/बेबीकॉर्न/स्वीटकॉर्न; 0.032 हेक्टेयर में चारा उगाए गए मेंड; दो संकर नस्ल वाली गायों के साथ डेयरी पालन; तथा 10 वर्ग मीटर की एफ.वाई.एम. इकाई को अपनाया गया। प्रणाली में 19 क्विंटल चावल, 385 कि.ग्रा. बेबीकॉर्न, 72 कि.ग्रा. स्वीटकॉर्न, 72 कि.ग्रा. मूंग, 95 कि.ग्रा. लोबिया और 1250 लिटर दूध का उत्पादन किया गया। कुल 2.35 लाख रूपये का समग्र लाभ हासिल किया गया जिसमें सबसे अधिक योगदान फसलों (59 प्रतिशत) का एवं तदुपरान्त डेयरी पालन (29 प्रतिशत) का रहा।
- एक पांच वर्षीय बागवानी आधारित एकीकृत कृषि प्रणाली मॉडल में रू. 1,18,320 / – के शुद्ध लाभ के साथ प्रति वर्ष समग्र लाभ लगभग रू. 1,72,850 / – था। शुद्ध लाभ में सबसे अधिक योगदान शूकर पालन इकाई (42 प्रतिशत) एवं तदुपरान्त काजू–अनानास फसलचक प्रणाली (25 प्रतिशत) का था।
- नारियल आधारित बहु प्रजाति कृषि प्रणाली के प्रदर्शन मॉडल से रू. 1,19,058.20 की समग्र आय हासिल की गई। समग्र आय में नारियल की खेती का योगदान 25.4 प्रतिशत, केला खेती का 11.98 प्रतिशत था जबकि सबसे अधिक योगदान जायफल घटक (46.08 प्रतिशत) का रहा।

>>> 7

पषुधन एवं मात्स्यिकी की उत्पादन प्रौद्योगिकियों का विकास एवं प्रमाणन

- स्वदेशी सीमेन विस्तारक की मदद से शूकर के सीमेन अथवा वीर्य के हिम परिस्क्षण के लिए विभिन्न प्रोटोकॉल का मानकीकरण किया गया। आजमाये गए तीन प्रोटोकॉल में, प्रोटोकाल – I, II तथा III के लिए औसत पोस्ट थॉ सीमेन मृत्युदर क्रमशः 5.5 प्रतिशत, 23.0 प्रतिशत तथा 35 प्रतिशत पाई गई। प्रोटो. काल – I, II तथा III के लिए पोस्ट – फ्रीजिंग नमूनों में सजीव स्पर्म का औसत प्रतिशत क्रमशः 17.7 प्रतिशत, 51.0 प्रतिशत तथा 55.0 प्रतिशत पाया गया। प्रजनक मादाओं में प्रोटोकॉल III के पोस्ट थॉ सीमेन द्वारा स्वः जीव उर्वरता की गर्भधारण दर 30.77 प्रतिशत पाई गई।
- शूकर पर अखिल भारतीय समन्वित अनुसंधान परियोजना के अंतर्गत, 75 प्रतिशत विदेशी यथा लार्ज व्हाइट यॉर्कशायर तथा 25 प्रतिशत अगोण्डा गोवन की तीसरी पीढ़ी के संकर नस्ल वाले शूकरों को उत्पन्न किया गया और उनके प्रदर्शन का अध्ययन किया गया। संकर नस्ल वाले शूकरों के जन्म में एक ब्यांत अथवा लिटॄर का संख्या और भार क्रमशः 8.25 ± 0.89 संख्या एवं 8.83 ± 187.12 कि.ग्रा. पाया गया। नवजात शूकरों का दूध पीना बंद करने तक औसतन वैयक्तिक भार बढ़वार दर नर शूकरों ($8.33 \pm$ 210.0 कि.ग्रा.) के लिए 181.75 ± 5.137 ग्राम/दिन एवं मादा शूकरों (8.16 ± 230.79 कि.ग्रा.) था। आठ महीनों (वधशाला आयु) में संकर नस्ल के शूकर 78.91 ± 10.16 कि.ग्रा. की भार यथा अनुकूल बढ़वार परिस्थितियों के तहत 324.36 ± 92.47 ग्राम/दिन की समग्र औसत बढ़वार दर दर्ज किए।
- कर्नाटक और गोवा राज्य में शूकरों के प्रमुख परजीवियों की विद्यमानता का अध्ययन किया गया। कुल 78 मल नमूनों, 479 सीरम नमूनों तथा 78 डायाफ्राम नमूनों को संकलित करके उनका विश्लेषण किया गया। गैस्ट्रो आंत परजीवियों की विद्यमानता 39. 74 प्रतिशत (31 / 78) पाई गई। सबसे अधिक विद्यमान परजीवी कॉक्सीडिया प्रजातियां (35.89 प्रतिशत) और इसके उपरान्त अस्केरिस सूवम (10.25 प्रतिशत) तथा स्ट्रोन्गैल प्रजातियां (5.1 प्रतिशत) थीं।
- दुधारू भैंस में यथार्थ समय B मोड अल्ट्रासाउण्ड (RTU) तथा कलर फ्लो मैपिंग (CFM) मोड के लिए विभिन्न इमेजिंग पैरामीटरों और अल्ट्रासाउण्ड विशेषताओं का मानकीकरण किया गया। बहु आवर्ती लिनियर एरे ट्रांसडयूसर से सुसज्जित बैटरी चालित मल्टी मोड अल्ट्रासाउण्ड स्कैनर का उपयोग करके ट्रांस – रेक्टल अल्ट्रासोनोग्राफी इमेजिंग की गई। मानकीकरण के प्रमुख गुणों में ट्रांसड्यूसर आवर्ती (6-10 MHz), डॉपलर कोण (20-60), CFM के तहत हासिल रंग (55-90%) तथा गतिशील क्षमता (60-95 dB) शामिल थी।
- पोल्ट्री नस्ल श्रीनिधि के पैतृक स्टॉक (कुल संख्या : 725) के उत्पादन एवं पुनः उत्पादन प्रदर्शन का मूल्यांकन तटीय जलवायु परिस्थिति के लिए किया गया। नर तथा मादा के शरीर भार में कमशः 3.0 से 3.3 कि.ग्रा. और 1.6 से 1.8 कि.ग्रा. की भिन्नता पाई गई। अट्ठाईस सप्ताह की आयु अवस्था में अण्डा उत्पादन 1211 था जबकि वास्तविक मुर्गी संख्या के आधार पर अण्डा उत्पादन (HDEP) 37.93 प्रतिशत था। कुल अण्डा स्थापना (TES) आधार पर अधिक अण्डा सेने की क्षमता और उर्वरता कमशः 78 प्रतिशत एवं 93 प्रतिशत पाई गई।

फसलोत्तर प्रौद्योगिकियों तथा अन्य कृशि उद्यमों के माध्यम से आजीविका सुरक्षा में सुधार

- ऊंची अथवा लंबी किस्म की तुलना में बौनी सुपारी किस्म की पर्णीय ग्लूकोज मात्रा 7.2 से 24.5 प्रतिशत अधिक पाई गई। बौनी किस्म में तीन महीनों में पर्णीय ग्लूकोज मात्रा में वृद्धि 16 प्रतिशत थी जबकि ऊंची अथवा लंबी सुपारी किस्म में यह बहुत मामूली (<0.0001) थी। इसी प्रकार, डंटल अथवा पर्णवृन्त से लैमिना लंबाई अनुपात (<0.24) भी उपयोगी पाया गया जो कि प्रारंभिक शाकीय अवस्था में बौने तथा लंबे पौधों में भेद करने में सहायक हो सकता है।
- कप बनाने में उपयोग हेतु केले के पत्तियों की भौतिक, मैकेनिकल और जैव–रासायनिक विशेषताओं का अध्ययन किया गया। आग पर सेंकने से पत्तियों की 4 प्लाई (2.25 x 10⁻⁵ kgf/m²) की वेधन सुदृढ़ता में सुधार पाया गया।
- ओयस्टर मशरूम के लिए केला बायोमास के उपयोग पर अध्ययन किया गया जिसमें प्रदर्शित हुआ कि सबसे अधिक उत्पादकता (28.75 प्रतिशत) 100 प्रतिशत धान पुआल वाले पोषाधार में और पुआल, केले के स्यूडोस्टेम एवं केले की पत्तीयों के बराबर अनुपात (1:1:1) वाले संयोजन में पाई गई जिनमें क्रमशः 94.17 और 86.22 प्रतिशत की जैविक प्रभावशीलता पाई गई।
- द्विविस्तार वाले संवहित पॉलीहाउस में, कीटरोधी नेट का इस्तेमाल करने पर वायु की विनिमय दर में शेडनेट के तुलना मे कमी आई (31.25 प्रतिशत) और वर्ष के अधिकांश भाग के दौरान, पॉलीहाउस के अन्दर लगातार औसत तापमान आंशिक रूप से परिवेशी परिस्थिति के समान अधिक पाया गया।
- केवल वर्षाकाल को छोड़कर दिवस समय की आपेक्षिक आर्द्रता को पंखा वायु संचरण (<60%) द्वारा नियंत्रित किया गया लेकिन रात्रि के समय जब पंखों को नहीं चलाया गया तब आर्द्रता बहुत अधिक (> 60 से 100 प्रतिशत) पाई गई।
- टमाटर (गोल्डन बीज 600, F 1 संकर) के लिए पंखे की मदद से हवादार द्विविस्तार वाले ग्रीनहाउस में उर्वरीकरण की दो दर यथा F1 -(N : P : K -159 : 257 : 400, Ca- 77, Mg- 33, S- 42, B-4.6) & F2-(N : P : K -106 : 171 : 266.7, Ca- 51.3, Mg- 22, S-28, B-3.1; दो मीडिया : मृदा एवं कोकोपिथ; रोपण सामग्री: पौद एवं कलम पौधों का मूल्यांकन किया गया। सोलेनम टॉर्वम पर तैयार की गईं टमाटर कलम जहां जीवाण्विक मुरझान से सबसे कम (23 से 39 प्रतिशत) प्रभावित थीं जबकि पॉलीहाउस परिस्थितियों के तहत रोपण के 70 दिनों बाद साधारण टमाटर की पौद गंभीर रूप से प्रभावित (63 से 97 प्रतिशत) पाई गईं। प्रति पौद उपज में 1429.25 ± 888.04 से 68 ± 29.80 ग्राम की भिन्नता देखने को मिली।
- शेड नेट की तुलना में कीटरोधी नेट के साथ प्राकृतिक रूप से संवातित एकल विस्तार वाले ग्रीनहाउस में इष्टतम वांछित तापमान एवं आर्द्रता का रखरखाव नहीं किया जा सका। दबावग्रस्त परिस्थितियों में, मृदा एवं कोकोपिथ की दो बढ़वार मीडिया और दो उर्वरीकरण दरों यथा F1 – N : P : K – 50 : 91.5 : 130, Ca-20.7, Mg-10.6, S-13.2 B-1.6, कि.ग्रा. / हेक्टेयर तथा F2 – N : P : K - 67.9 : 122 : 173, Ca-27.6, Mg-14.1, S-17.6 B-2.1 कि.ग्रा. / हेक्टेयर के साथ खीरावर्गीय (कियान F1 संकर) की फसल को लिया गया। प्रति पौद उपज में 0.71±0.48 से 0.81± 0.49 कि.ग्रा. की भिन्नता देखने को मिली।

8 《

Introduction

The Indian Council of Agricultural Research, New Delhi, established the ICAR Research Complex for Goa in April, 1976. After a short spell under the 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. In order to intensify the transfer of technology and to impart grass-root level vocational training, a Krishi Vigyan Kendra was also established at the Research Complex in 1983. 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.

In India, the coastal ecosystem covers an area of 10.78 million ha along 7516 km long coastline. This coastline covers 33 districts under 9 peninsular coastal states, with an area of 3.85 lakh square km to form the coastal ecosystem of the country, with an estimated population of about 17.10 crores accounting for about 14.20% of the total population of the country. The major activities in the coastal region include agriculture and allied sectors, tourism, mining, industries, shipping transport, etc. The research activities of the Institute was earlier confined to the agriculture needs of Goa, but later Institute was further upgraded to ICAR-Central Coastal Agricultural Research Institute since 2014 to address the sustainable agricultural and allied activities in the fragile coastal ecosystem of the country. The Institute is poised to carry out the research and extension work on field and horticultural crops, livestock, and fisheries relevant

to natural resource base for sustainable productivity, to develop climate resilient land use and farming systems and agro-ecotourism.

The Institute is headed by the Director, who is supported by 21 Scientists, 18 Technical, 21 Administrative and 26 Skilled Support staff, making the total staff strength to 86.

The important areas of research of the Institute are identification of promising crop varieties/accessions of field and horticultural crops; development of suitable soil and water conservation measures in horticultural crops; development of integrated farming system models; development of ecofriendly management practices of major insect pests and diseases in plantation, field crops and vegetable crops; development and standardization of production and post harvest technologies for field and horticultural crops of Goa; standardization of low cost protected structures for vegetable and flower crop production; standardization of packages for rearing cattle, goat, buffalo, pig and poultry; standardization of hydroponics green fodder production, bypass fat production and feed block production; 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 transfer of technology through FLDs, trainings, workshops etc. The research accomplishments made by the scientists, the technologies transferred to farmer's fields, other events conducted by Institute and awards and recognitions conferred upon the staff are presented in the report.



In the scenario of climate change, information on weather is very important for agricultural production. Observations of weather parameters are being continuously recorded by the Institute. Observations made from April 2018 to March 2019 are discussed here.

Air temperature

Mean maximum temperature during April 2018 to March 2019 varied from 29.1 °C (August 2018) to 35.3 °C (November 2018), whereas mean minimum temperature varied from 17.6 °C (January 2019) to 25.7 °C (May 2018).



Rainfall and rainy days

The total rainfall received from April 2018 to March 2019 was 2773.0 mm. Total of 2524.8 mm was received during kharif (June 2017 to September 2017). The annual rainfall for this year was 204.0 mm lower than that of 2017-18 (2977.0 mm). Total number of rainy days observed was 103 which was lower compared to last year (131 days).



Soil temperature

The ranges of mean monthly soil temperature recorded in morning hours at 5, 10 and 20 cm depths were 24.3-30.3 °C, 25.1-33.9 °C and 26.4-39.9 °C, respectively, whereas the corresponding ranges for afternoon observation were 28.1-45.9 °C, 27.9-40.5 °C and 27.2-36.5 °C.



Evaporation and relative humidity

Daily evaporation was measured using USWB-Class A open pan evaporimeter. The total water evaporated from April 2018 to March 2019 was 1635 mm. The highest morning and afternoon relative humidity was



observed during June and July 2018, respectively, whereas the corresponding lowest was recorded during December 2018 and January 2019, respectively.

Wind speed

Mean monthly wind speed ranged from 3.9 km/h (October 2018) to 7.2 km/h (August 2018). Mean monthly wind speed started decreasing from August



Mean monthly wind speed and evaporation

2018 to October 2018 and it increased thereon till March 2019.

Sunshine hours

The mean monthly sunshine hour recorded ranged from 0.7 hours (July 2018) to 9.6 (February 2019). As expected, mean monthly sunshine hours were lower during the rainy season compared to the rest of the year.



Daramotor	Months											
Farameter	Apr	May	Jun	July	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar
Mean max temp (°C)	35.2	34.8	30.4	29.5	29.1	31.0	34.2	35.3	33.7	33.8	34.5	33.6
Mean min temp (ºC)	25.2	25.7	23.3	23.2	22.0	21.1	21.0	18.7	19.1	17.6	18.7	20.7
Mean morning R.H. (%)	85.1	85.1	92.0	91.7	91.0	91.9	87.5	82.0	76.9	77.4	89.3	91.9
Mean afternoon R.H. (%)	54.5	57.5	80.9	84.7	80.3	68.1	54.8	43.4	39.1	30.1	40.4	52.6
Mean wind speed (km/hr)	5.8	6.6	6.1	7.1	7.2	4.4	3.9	4.0	4.5	4.7	5.3	5.6
Sunshine (hrs/day)	8.2	6.1	2.7	0.7	1.2	6.2	7.3	8.4	8.6	9.3	9.6	7.8
Total rain (mm)	1.1	91.3	1100.6	898.6	461.9	63.7	145.4	10.4	0.0	0.0	0.0	0.0
Total rainy days	0	6	25	27	31	6	7	1	0	0	0	0
Evaporation (mm/day)	6.1	5.4	4.8	3.9	3.1	4.1	4.1	4.0	4.4	4.7	5.2	5.1
Coludiness morning (hrs)	2.7	4.2	4.9	5.0	4.9	3.8	2.5	2.1	2.6	2.4	1.7	2.7
Cloudiness afternoon (hrs)	1.0	3.0	5.0	4.5	4.4	3.6	0.8	1.8	1.3	0.4	0.0	0.5

Mean monthly weather parameters recorded at ICAR-CCARI from April, 2018 to March, 2019

Important dates of observations from April 2018 to March 2019 with the highest and lowest values of weather parameter

Weather parameter	Value	Date	
Highest maximum temperature	37.0 °C	13/02/2019	
Lowest minimum temperature	14 °C	12/12/2018	
Highest rainfall	184.8 mm	06/07/2018	
Highest evaporation	9.6 mm	10/05/2018	
Highest wind speed	11.9 km/h	26/05/2018	
Maximum sunshine hours	10.7 h	18/02/2019	

E

Meteorological Observatory at ICAR-CCARI Photo Courtesy: Bappa Das TATE Y

11

Research Achievements

- Conservation and management of natural resources
- Conservation and utilization of genetic resources
- Development and validation of production technologies of crops
- Development and validation of production technologies of livestock and fisheries
- Improving livelihood security through post- harvest technologies and other agri- enterprises

Paddy transplanting Photo Courtesy: Manohara KK

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

Project: Development and evaluation of soil and water conservation measures and land use systems for sustainable production of major horticultural crops in Goa Sujeet Desai

Soil and water conservation studies in mango

Soil moisture conservation

Soil moisture content was found highest under Continuous contour trenching + vegetative barrier (*Vetiveria zizaniodes*) (CCT+VB) treatment at 15-30 cm depth in the month of December (23.73%) and at 30-60 cm during January (24.8%) and February (22.5%) over the other measures studied.

Soil physical, chemical and biological properties

Conservation measures had a significant effect on available water in soil. The maximum available soil water was found under CCT+VB at 0-30 cm (12.2%). Higher hydraulic conductivity at 0-30 cm (8.43 cm h⁻¹) and 30-60 cm (9.73 cm h⁻¹) was found under CCT+VB treatment. Highest available nitrogen, available potassium and organic carbon of 104.4 mg kg⁻¹, 83.74 mg kg⁻¹ and 2.02%, respectively were found under CCT+VB treatment at 0-30 cm depth. Whereas at 30-60 cm depth, highest available nitrogen of 72.72 mg kg⁻¹ was found under Vegetative Barrier (VB) treatment and highest potassium and organic carbon of 67.08 mg kg⁻¹ and 1.39% respectively were found under CCT+VB. The dehydrogenase activity under CCT+VB and staggered contour trenching + vegetative barrier (SCT+VB) were 26.71 and 48.19 μ g TPF g⁻¹ soil day⁻¹ whereas phosphatase activity of 615.23 and 494.21 µg p-PNP g⁻¹ soil day⁻¹ was found under CCT+VB and SCT+VB respectively at 0-30 cm depth. Dehydrogenase activity under CCT+VB and SCT+VB were 12.57 and 21.93 µg TPF g⁻¹ soil day⁻¹ and phosphatase activity under CCT+VB was 466.87 µg p-PNP g⁻¹ soil day⁻¹ at 30-60 cm depth. Physical, chemical and biological properties of the soils improved at 0-30 cm and 30-60 cm depths under the long term influence of soil and water conservation measures. Order of soil and water conservation measures in improving the soil properties was CCT+VB > SCT+VB > VB > Control.

Effect on the physico-chemical properties of fruits and plant growth parameters

The effect of different soil and water conservation measures on physico-chemical properties of mango fruits was also studied. The physico-chemical properties such as average fruit weight (g), ascorbic acid (mg 100 ml⁻¹), total soluble solids (°Brix), total acidity (%) and pulp (%) were analyzed. It was observed that conservation measures had significant effect on number of primary branches (3.6) and TSS (20.2 %) of mango fruits with maximum under CCT+VB treatment.

Growth parameters of Vetiveria zizaniodes

The analysis showed that effect of SWC measures on weight of vetivaria grass was significant with maximum under CCT+VB (727 g) followed by SCT+VB (586 g).

Soil and water conservation studies in coconut

In order to evaluate the effect of intercrop on runoff and soil loss, turmeric (Var. Pragathi) was introduced in the interspace of coconut along with the soil and water conservation measures viz. circular trenching and circular terracing and control treatments. The runoff and soil loss data from coconut plots under three treatments was recorded along with intercrop and compared with previous year data without intercrop. It was observed that runoff under circular trenching, circular terracing and control treatment reduced to 12.2 m³ ha⁻¹, 12.7 m³ ha⁻¹ and 15 m³ ha⁻¹ in 2018 as compared to 13.1 m³ ha⁻¹, 15.7 m³ ha⁻¹ and 20.1 m³ ha⁻¹ in 2017. Similarly, soil loss under circular trenching, circular terracing and control treatment reduced to 53 kg ha⁻¹, 56 kg ha⁻¹ and 82 kg ha⁻¹ in 2018 as compared to 74 kg ha-1, 88 kg ha-1 and 116 kg ha-1 in 2017. Introduction of intercrop in coconut along with conservation measures significantly reduced the runoff and soil loss from sloping land.



Turmeric as intercrop in coconut





Runoff and soil loss studies in groundnut and maize crops using experimental runoff plots

The experiment consisted of six runoff plots in which three plots were used to cultivate groundnut (TAG-24) and three for maize (NAH-2049). Multi-slot divisors were used to measure the runoff and soil loss from individual plots. Mean runoff recorded from the groundnut and maize plots were 600 mm and 720 mm respectively. The mean soil loss recorded from groundnut and maize



Experimental runoff plots

Economics for excavation and lining of the farm pond

The economics for excavation and lining of large

farm pond (1400 m³ with 2.5 m depth) in laterite soils was worked out. The excavation cost for 1400 m³ as per standard rates was Rs. 2.52 lakhs @ Rs.180 per m³. Cost of 30 m³ garden soil required for smoothing of sides and bottom of the pond was Rs. 27000 @ Rs. 900/m³. Cost of silpaulin film (300 GSM) with 45 m × 35 m size required to line the pond was Rs. 1.57 lakhs. Cost of labour involved works like smoothing of side slopes and bottom, laying of the paddy straw, excavation of trench around the pond, lining of the pond with silpaulin film and minor cement works and back filling worked out to be Rs. 35,000 @ Rs. 350 per day for 98 man days. Thus, the total cost involved in construction of farm pond including all the works was Rs. 4.7 Lakhs, which could harvest and store 14 Lakhs liters of rain



Rain water harvesting pond

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 Gopal Mahajan

Crop establishment and nutrient management practices

A study was undertaken to evaluate the effect of the crop establishment methods and nutrient management in the salt-tolerant rice varieties (Goa Dhan 1 and Goa Dhan 2) and experiments were laid out in the split-split-plot design. The varieties performed at par when tested under different establishment methods and nutrient management strategies. The effects of the establishment method and nutrient management were significant on the grain yield, straw yield and profitability. Significantly higher grain (2.13 t ha⁻¹) and straw yield (3.34 t ha⁻¹) were achieved with the transplanting 35-days-old Goa Bio-1 nursery treated seedling than the broadcasting (1.71 t ha⁻¹ and 2.96 t ha⁻¹). A nutrient management strategy of soil test based fertilizer recommendation or modified blanket recommendation (120-30-00 kg N:P₂O₅:K₂O ha⁻¹) recorded the significantly higher grain and straw yield compared to the control and blanket fertilizer application. The grain yield advantage using the transplanting 35-days nursery Goa Bio 1 treated seedlings and soil test based



Growth of rice variety Goa Dhan 1 under the control (left) and improved crop establishement method and nutrient management (right)

14 《

fertilizer recommendations was 24.5% and 53.7%, in comparison with the broadcasting Goa Bio 1 treated seed and no application of the fertilizer nutrients. The grain yield advantage was 15.8% with the soil test based fertilizer recommendations over the blanket fertilizer recommendation. The benefit-cost ratio of 2.04 and 1.98 were observed when transplanting of the 32-days-old nursery treated seedling and a balanced nutrient application of 125-25-00-10 kg N:P₂:O₅:K₂O:Zn ha⁻¹, respectively. Such cost-effective crop establishment and nutrient management practices have great potential to enhance and sustain the rice crop yield and income in the salinity-prone coastal areas.

Seed treatment with Goa Bio 1 and broadcasting method of rice cultivation

An improved crop establishment method (seed treatment with Goa Bio 1 and broadcasting) with 75% of the soil test based fertilizer recommendation was evaluated against the farmers' practice of broadcasting and blanket fertilizer application for enhancement of the grain yield of the rice varieties under normal and salt-stress soil conditions. The effect of the improved crop establishment practice was insignificant for the grain yield in the variety Karjat-3 and Jyothi under normal soil condition. The grain yield with the improved crop establishment method and farmers practice was 4.6 and 4.5 t ha-1 for Karjat-3 and 4.3 and 4.2 t ha⁻¹ for Jyothi respectively. Interestingly, the results were significant for the salt-tolerant variety Goa Dhan 1. There was grain and straw yield advantage with the improved practice besides saving of 25% of the fertilizer inputs.



Microbial and enzyme activities of the salt- affected soils of the West Coast region of India

Based on the electrical conductivity (EC) of the soils, the samples were categorized in to five classes as: 1) Non-saline (NS, $< 2 \text{ dS m}^{-1}$, EC 0.62 dS m⁻¹), 2) Slightly saline (SS, 2-4 dS m⁻¹, 3.42 dS m⁻¹), 3) Moderately saline (MS, 4-8 dS m⁻¹, 5.78 dS m⁻¹), 4) Strongly saline (STS, 8-16 dS m⁻¹, 11.72 dS m⁻¹) and 5) Very strongly saline (VSTS, >16 dS m⁻¹, 20.12 dS m⁻¹). These soils exhibit a



Field view of the demonstration on use of salinity tolerant bioformulation and nutrient management

unique feature of varying salinity coupled with acidic soil reaction (low soil pH). Exchangeable Na was the dominant cation in all the salinity classes. The soil salinity did not have any impact on the soil organic carbon (SOC) content. The soil microbial activity microbial biomass carbon (MBC), microbial biomass nitrogen (MBN), basal soil respiration (BSR), MBC as a fraction of SOC (MBCOC) and enzyme activities dehydrogenase (DH), phosphatase (PH) and urease (UR) decreased significantly (p<0.05) with increasing salinity. The increase in the metabolic quotient (qCO2) with increasing salinity indicated stress on the microbial population. Significantly (p<0.05) negative correlation of EC with MBC (r=-0.83), MBN (r=-0.83), BSR (r=-0.92), DH (r=-0.78) and PH (r=-0.90) confirmed the depressive effect of salinity on the soil microbial and enzyme activity in salt affected soils of coastal region.

Determining minimum data set and soil quality indexing method for salt-affected soils of the west coast region of India

The aim of the present study was to evaluate soil quality (SQ) of the salt-affected soils (SAS) in the coastal region of India using different SQIs like additive and weighted. The indices were developed using the minimum data set (MDS) and two scoring functions (linear and non-linear). Soil samples were collected from study sites from salt-affected and nonsalt affected areas. Based on the results of PCA and correlation, an MDS comprised of basal soil respiration, urease enzyme activity, EC, soil available copper, zinc, boron, soil pH and soil available iron was identified. The overall performance of the non-linear SQIs was better than that of the linear. The weighted SQI developed using non-linear scoring (SQI_{NLW}) could identify four different categories of the soil salinity classes in order as NS < MS = SS < STS < VSTS. Based on the SQI_{NLW} values, the class NS had the best SQ and the VSTS had the lowest. Among eight soil indicators of the MDS, the contribution of urease enzyme activity (35.1%-66.6%) and EC (10.1%-40.6%) to the SQI_{NIW} was highest and this emphasized the importance to study those while assessing the SQ of SAS.

15

Monitoring the soil physical and chemical properties of the salt-affected soils of coastal region using the hyperspectral remote sensing

The objective of the study was to assess the properties of the salt affected soils of the coastal region of India using hyperspectral remote sensing. The spectral reflectance of processed soil samples was recorded in 350-2500 nm using Fieldspec®3 ASD-Spectroradiometer. The whole data set (n=372) was split in to two as 70% for calibration data set (n=260) to develop the calibration model and 30% for validation data set (n=112), an independent data set to assess the performance of the model for different multivariate analysis techniques. In general, the spectral reflectance from the soils decreased with increasing levels of salinity. The wavelengths; 494, 673, 800, 1415, 1748, 1915, 2207 and 2385 nm showed potential absorption characteristic to estimate the soil properties. The significant achievement of the research is that the soil properties like soil pH, salinity (electrical conductivity), bulk density, soil available nitrogen, exchangeable magnesium, soil available zinc and boron were estimated using hyperspectral remote sensing with fair to excellent predictions (ratio of performance to deviation - 1.48 to 2.06). The multivariate analysis techniques like support vector regression, partial least square regression and principal component regression were found more robust. The soil salinity was effectively predicted using the support vector regression method. The methods developed are rapid, repeatable, reliable, less time-consuming and cost-effective.

Pedotransfer function to predict the soil water retention properties of the salt-affected soils of coastal region

Owing to the importance of the determination of available soil water for the uptake by the plants under the salt-stress environment, a rapid and reliable method needs to be developed for its determination.



The present study was undertaken to estimate the Field Capacity (FC), Permanent Wilting Point (PWP) and Available Water Capacity (AWC) using the soil organic carbon (SOC), bulk density (BD) and concentrations of sand, silt and clay. Based on the results of the multiple linear regression analysis, the variation of 57.0%, 60.2% and 62.2 % in the FC, PWP and AWC could be explained by the SOC, BD and silt and clay. The coefficients of the determination for the prediction were significant at 0.0001 level. The MLR models developed in the study are as follows,

- 1. FC = $28.270 + (2.522 \times \text{SOC}) (12.757 \times \text{BD}) + (0.176 \times \text{Silt}) + (0.265 \times \text{Clay}), \quad (R^2 = 0.57, p < 0.0001)$
- 2. PWP = 19.136 + (0.340*×SOC) (9.935**×BD) + (0.11**×Silt) + (0.202**×Clay), (R² = 0.60, p<0.0001)
- 3. AWC = $8.028 + (1.837*\times SOC) (0.247**\times BD) + (0.072**\times Silt) + (0.069**\times Clay), (R² = 0.62, p<0.0001)$

* (significant at 5%) and ** (significant at 1%) The models developed in the present study could be used as pedotransfer functions to predict the FC, PWP and AWC of the salt-affected soils of the coastal region.

Project: Calibration and validation of simulation and statistical crop yield model for major field crops of West Coastal Plains and Ghats Bappa Das

Rice

Using the dataset obtained from India Meteorological Department, Pune for 6 weather stations of Andhra Pradesh, statistical crop weather model was developed for rice and coconut. For development of district-level rice yield forecast models, weather indices were generated using weekly cumulative value for rainfall and weekly average value for other parameters like maximum and minimum temperature, morning, evening relative humidity, bright sunshine hours etc. Long period rice yield data for those 6 stations was collected from the Directorate of Economics and Statistics, Department of Agriculture and Cooperation and State Department of Agriculture. The performance of the calibration models was found

16 《



The relationship between predicted and observed values of (a) rice (kg ha⁻¹) and (b) coconut (Nuts ha⁻¹) for preharvest yield forecast using stepwise multiple linear regression models. Dashed lines indicate 95% confidence interval of the regression; outermost lines indicate 95% confidence interval of prediction.

ICAR-CCARI Annual Report 2018-2019

17

(a)

(b)

to be very good to excellent with R² and RMSE ranging between 0.46-0.97 and 56.05-426.94 kg ha⁻¹ for rice. The developed models were validated using the data of 2012-2015. The RMSE and nRMSE during validation of the developed model for rice varied between 166.83-1054.06 kg ha⁻¹ and 4.59-28%.

Coconut

In case of coconut, the weather indices were generated using monthly as well as seasonal cumulative value for rainfall and average value for other parameters like maximum and minimum temperature, morning, evening relative humidity, bright sunshine hours etc. Long period coconut yield data for those 6 stations are collected from the website of Coconut Development Board. The performance of the calibration models was found to be good to excellent with R² and RMSE ranged between 0.37-0.99 and 114-3202 nuts/ha respectively, during calibration using monthly weather data. The validation of the models was carried out for the year 2015 and calculated percentage error varied between -23.6 to 24.76.

Project: Study of nutrient management and cropping system on greenhouse gas emission through infoRCT model in West coast of India Paramesha V

Different combinations of organic and inorganic sources of nitrogen in three different cropping systems such as rice-rice, rice-cowpea and rice-moong were evaluated. Among the different nutrient management tested in rice-rice system, higher grain yield of 5.22 t ha-1 was obtained in 100% N through neem coated urea and the lower values were observed under controlled plots. The similar treatments has produced higher growth and yield parameters in moong and cowpea. The results revealed that higher GHG emission was observed from 100% N through farmyard manure with a total global warming potential of 26528 kg CO₂e/ha followed by 50% N neem coated urea + 25% N-FYM +25% N- rice residue incorporation with a GWP of 13921 kg CO₂e/ha. The least GHG emission was observed from control plots (9562 kg CO₂e/ha) under rice-rice cropping system. The study indicated that the integrated nitrogen management will be the better option to curtail the GHG emission from different

cropping systems under lowland situations of Goa.

The study was undertaken in different ecosystems to know the effect of biomass turnover on the soil quality. The soil sample was collected from different cropping systems such as arecanut, coconut, cashew, rice-rice, rice-cowpea, rice-moong, pasture, forest and pasture system. The ex situ and in situ biomass turnover was measured through field surveys and through questionnaire. The soil samples were analyzed for different soil physical, chemical and biological properties and soil quality index was determined. The results indicated that in continuous pasture, forest ecosystem, cashew and arecanut based cropping systems the biomass turnover was found significantly higher, thereby higher carbon stock in the systems. The soil quality index is also found higher in the above ecosystems due to higher biomass turnover and better soil quality in terms of higher soil organic carbon, reduced bulk density and microbial activity.



General view of N managment practices in rice based systems

Cowpea under different N managment practises

18 《

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

Project : Breeding high yielding salt tolerant rice varieties for coastal saline soils Manohara KK

Evaluation of promising advanced breeding lines under coastal salinity condition

Fifty three promising rice genotypes comprising of advanced breeding lines from Jyothi X Korgut cross, pure line derivatives of Korgut, standard salinity tolerant and sensitive varieties, and few landrace collections of Goa and Kerala were evaluated under the natural coastal salinity conditions at farmers' field in Chorao Island in an augmented design. The trial was exposed to moderate submergence during the initial establishment period and high level of salinity stress during the flowering / reproductive stage because of which in most of the genotypes proper grain filling was a problem.



Field view of the trial after the submergence effect

Collection of rice germplasm

During the Kharif season 2018, survey was undertaken in Uttara Kannada, Udupi and Mangalore district of Karnataka for collecting the land races of rice. About 32 landraces of rice were collected and added to the existing germplasm collection.

In the same season, all the earlier collections



Field view of germplasm evaluation

were phenotyped for 25 agro-morphological and 12 vield and its attributing traits to assess the extent of variability in the germplasm. Days to 50% flowering ranged from 85 to 154 days, days to maturity ranged from 119 to 179 days, number of productive tillers ranged from 4.70 to 14.30 per hill, panicle length ranged from 21.70 cm to 33.10 cm, grains per panicle ranged from 48.30 to as high as 340.70 and grain yield per plant 0.10 to 28.50 g. PCA revealed six principal components (eigen value >1) which cumulatively accounted for 82.99% of the total phenotypic variance. PC1 explained 31.81% of the total variance; PC2 explained 15.04%, PC3, PC4, PC5 and PC6 explained 11.76, 8.46, 8.27 and 7.63% of variance, respectively. The traits with high positive loadings are straw yield per plant, total biomass, grain yield per plant, harvest index, plant height, flag leaf length, panicle length and number of productive tiller per hill among the traits studied.

The collections were further characterized at molecular level with the help of SSR markers. 28 SSR markers distributed in 12 chromosomes were selected and utilized to assess the diversity among the



Diversity in grain type in the collected germplasm



	Principal Component					
	PC1	PC2	PC3	PC4	PC5	PC6
Eigenvalues	4.772	2.256	1.765	1.27	1.241	1.145
% Variance	31.815	15.04	11.768	8.464	8.275	7.631
Cumulative variance (%)	31.815	46.855	58.623	67.087	75.361	82.993
Characters		Eiger	vectors/coe	fficient of ve	ctors	
Days to 50% flowering	0.71	-0.259	0.159	0.151	0.386	-0.353
Days to maturity	0.705	-0.272	0.124	0.166	0.387	-0.351
Plant height (cm)	0.339	-0.179	0.805	0.056	-0.003	0.026
Productive tillers per hill	0.026	-0.142	-0.082	-0.03	0.088	0.835
Flag leaf length (cm)	0.193	0.106	0.754	-0.104	-0.247	-0.04
Flag leaf width (cm)	0.007	0.493	0.203	-0.014	0.12	0.432
Panicle length (cm)	0.022	0.031	0.734	0.351	0.216	-0.041
Grains per panicle	-0.037	0.468	0.189	-0.189	0.736	0.084
Per cent fertility	-0.254	0.237	-0.044	-0.91	0.128	0.069
Test weight (g)	-0.144	0.145	0.215	-0.202	-0.824	-0.117
Grain yield per plant (g)	0.092	0.941	-0.049	-0.061	-0.018	-0.105
Straw yield per plant (g)	0.895	-0.056	0.228	0.221	-0.064	0.173
Total biomass (g)	0.877	0.307	0.196	0.185	-0.068	0.122
Harvest Index	-0.5	0.708	-0.185	-0.231	-0.035	-0.188

Principal Component Analysis for yield and its attributing characters

Hybridization and generation advancement

In the hybridization and generation advancement programme, segregants from eight F_6 population, three each from F_3 and F_2 populations were advanced to next generation for their stabilization. Hence, together 14 different populations are being maintained with number of segregants maintained ranging from 168 to 1254.

No.	Crosses	Generation	Number of segregants
1	Karjat-3 X KS-19-2	F ₂	285
2	Jaya X KS-19-2	F ₂	300
3	GRS-1 X Jaddubatta	F ₂	296
1	Karjat-3 X KS-19-2	F ₃	1254
2	Jaya X KS-19-2	F ₃	964
3	GRS-1 X Jaddubatta	F ₃	888
1	Karjat-3 X KS-17	F ₆	214
2	Pusa 44 X KS-17	F ₆	168
3	Karjat-3 X KS-17	F ₆	196
4	Karjat-3 X KS-19-2	F ₆	204
5	MTU 1010 X KS-16-1	F ₆	188
6	Chandan X KS-17	F ₆	269
7	Naveen X KS-19-2	F ₆	354
8	Naveen X KS-16-1	F ₆	256



Maintenance breeding

As part of the maintenance breeding programme, 30 kg nucleus seeds of each of the four varieties developed by the institute were produced at the Institute farm during the Kharif season. Panicles were collected to form the base seeds.

Development and release of rice varieties for coastal saline soils

Two salt tolerant rice varieties *viz.*, Goa dhan-3 and Goa dhan-4 were released for the coastal saline soils of Goa. The state seed-sub committee recommended these two varieties for release on 13th January 2019 for cultivation in the coastal saline soils of Goa state.

Goa dhan-3 (GRS-1)

Goa dhan-3 is a saltol QTL introgressed rice line from IRRI, Philippines. It is a white kernelled rice variety. The average yield of the variety is 3.0 - 3.5 t ha⁻¹ under stress condition and in normal condition it gives yield up to 6.0 t ha⁻¹.

Goa dhan-4 (JK-238)

Goa dhan-4 is developed from the cross Jyothi X Korgut for the salt affected coastal saline soils of Goa. The variety does very well under normal rainfed shallow lowland conditions also. It is a red kernelled rice variety. The average yield of the variety is 3.0 - 3.5 t ha⁻¹ under stress condition and in normal conditions it yields up to 5.5 t ha⁻¹.

20 《

Detailed agro-morphological	characteristics of Goa dha	an-3 and Goa dhan-4
-----------------------------	----------------------------	---------------------

No.	Character	Goa dhan-3 (GRS-1)	Goa dhan-4 (JK-238)
1	Plant height (cm)	108	112
2	Seedling vigour	vigorous	vigorous
3	Lodging tolerance	Yes	Yes
4	Plant type	Semi tall	Semi tall
5	Basal leaf sheath colour	Green	Green
6	Tillering ability	Moderate	Moderate
7	Position of flag leaf	Erect	Erect
8	Photosensitivity	Photo insensitive	Photo insensitive
9	Panicle length (cm)	23.14	27.16
10	Threshability	Easy	Easy
11	Paddy grain color	Straw	Straw
12	Maturity in days (seed to seed)	127	128
13	No. of grains/panicle	110	146
14	1000 grain weight (g)	35.40	28.66
15	Kernel shape	Long bold	Long slender
16	Length (mm)	7.53	7.35
17	Breadth (mm)	2.56	2.38
18	Kernel length to breadth ratio	2.93	3.08



DNA fingerprinting of the released rice varieties

Carried out DNA fingerprinting of the four released rice varieties with 38 different SSR markers distributed across the 12 chromosomes of rice.

IC no. for the released rice varieties

Obtained IC numbers from ICAR-National Bureau of Plant Genetic Resources (NBPGR), New Delhi for

the four released paddy varieties from the Institute. Following national identity numbers were allotted to the four rice varieties.

Goa dhan-1: (IC 629221) Goa dhan-2: (IC 629222) Goa dhan-3: (IC 629223) Goa dhan-4: (IC 629224)



Project: Collection, evaluation of genetic resources and management of fruits and spices **AR Desai**

New collection of Mankurad and Hilario accessions of mango

Four new accessions of Mankurad namely, MKD Chorao-1/1-18, MKD Neura-1/3-18, MKD Pilar-1/4-18, MKD Khetode-1/5-18, were clonally collected for further evaluation. In these variants fruit size varied from 171.33 g to 244.28 g with pulp content, total soluble solids, total acids and vit. C contents in the range of 70.2-75.46%, 18-22 OB, 0.17-0.38% and 42-82 mg 100g⁻¹, respectively.



MKD Chorao 1/1-18

Similarly, three new accessions of Hilario, namely, Hilario Raia-1/6-18, Hilario Mandrem-2/18 and Hilario Maulinge -3/18 with fruit size, pulp contents, total soluble solids, total acids and vitamin C in the range of 268-340g, 75-76.80%, 18.93-24.2 OB, 0.26-0.64% and 26.66-30.66 mg100g⁻¹ respectively were identified. Clonal propagation of Mandrem Hilario-2/18 was done.



Conservation of mango in field germplasm bank

With a new addition of 7 collections (Mankurad 4 Nos. and Hilario 3 Nos.), total gerplasm was increased to 165 accessions representing the following respective groups.

Local varieties including Mankurad and

Hilario variants	:	136
Local pickling mango accessions	:	18
Mango hybrids from IARI, Pusa, New Delhi	:	04
Mango varieties of CISH, Lucknow	:	02
Exotic mango varieties	:	05

Evaluation of Mankurad accessions

The height, girth and canopy spread of the Mankurad accessions varied from 1.76 to 4.27 m, 30 to 67 cm and 2.73 to 12.87 m², respectively.

Fruit size in all Mankurad genotypes was observed to be small to medium (179.5-288.33g) with pulp contents, Total Soluble Solids, Total Acids and Vitamin C in the range of 59.24-72.49%, 18-20.03 OB, 0.256-0.384% and 47-82.2 mg 100g⁻¹, respectively.

Maintenance of Nutmeg germplasm collection

A total of 46 germplasm accessions comprising of two age groups was maintained. First group (20 years old) has 28 accessions including 2 male genotypes and high yielding types, while second (4-7 years old) has 18 accessions including 1 promising precocious genotype. The accession NMF2 recorded highest number of fruits (738) followed by NMD1 (586), NMD2 (438) and NMF6 (400).



High yielding accessions of nutmeg: NMD1 and NMD2

Coconut based multi species integrated farming system

A model of coconut based multi species integrated farming system is being maintained as a demonstration unit in 0.5 ha area in the Institute farm. The model has as many as 15 plant species which are key economic drivers of the unit. Poultry component (Breed- CARI-Nirbhik) was added to the model unit during the current period of report. These components together impart economic sustainability to the unit besides providing employment opportunities and nutritional security to one farm family.

In a gross income of Rs. 1,19,058.20 was obtained from the above demonstration model during 2018-19, coconut contributed 25.4 % to the gross income; banana 11.98%, while the highest contribution of 46.08% was obtained from Nutmeg component. The Poultry component, which was added to the unit from November 2018 recorded the share of 6.02% through egg production during the period of three months from January to March 2019.

No	Component	Total Qty (kg)	Rate (Rs. per kg)	Total amount (Rs.)	% Share in income
1	Banana	400.5	30.00	12015.00	10.09
2	Рарауа	152.5	20.00	3050.00	2.56
3	Nutmeg seed	33.075	600.00	19845.00	16.66
4	Nutmeg mace	6.923	800.00	5538.40	4.65
	Nutmeg Pericarp Taffy	58.26	500.00	29130.00	24.46
5	Black Pepper	2.35	500.00	1175.00	0.98
6	Tarvati chilli	4.887	400.00	1954.80	1.64
7	Drumstick	32	20.00	640.00	0.53
8	Coconut (Nos.) : Grade I Grade II Grade III Grade IV Deaf coconut	100 195 70 2000 760	20.00 15.00 12.00 10.00 4.00	2000.00 2925.00 840.00 20000.00 3040.00 28805.00	24.19
9	Elephant Foot Yam	113	50.00	5650.00	4.74
10	Eggs (Nos.)	717	10.00	7170.00	6.02
	Total			1,14,973.20	
	Planting Material	Nos.		Rate (Rs.)	
11	Banana Suckers (Nos.)	113		2260.00	1.89
12	Nutmeg Grafts (Nos.)	5		375.00	0.31
13	Coconut Seedling (Nos.)	29		1450.00	1.21
	Total			4085.00	
	Grand Total			1,19,058.20	99.93



Poultry component in the system



CARI-Nirbheek birds

Project: Augmentation, Morphological and Molecular Characterization and Evaluation of Okra and Amaranth genetic resources of West Coast India for sustainable utilization **M** Thangam

Evaluation of Red Amaranthus germplasm during rabi season-2018-19

Red amaranthus are valued for leafiness as well as colour. The colour development and its intensity are highly influenced by season. Hence an evaluation study was undertaken to evaluate the amaranthus germplasm during Rabi season for growth, yield and colour traits.



Field view of amaranthus evaluation during rabi season

Among the 35 amaranthus accessions evaluated for different morphological traits, Amar New-1 recorded the highest plant biomass (21.14 g) followed by Amar New-6 (18.82 g) and Amar-17 (17.22 g) and Amar-21 (15.90 g). These four accessions were promising during Kharif season also.



Amar New-

Amar New-6





Amar-17 Amar-21 Promising accessions of Amaranth

Goa Bhendi-1: A promising selection from local germplasm

It is derived through pure line selection from local bhendi collection (Okra-10-108) from Karvem, Canacona Taluk, South Goa District, Goa state. Fruit yield is high (252.25 g per plant), which is higher than the released check variety Salkeerthi (245.50 g per plant) and the proposed variety is highly preferred by local people.



Field view of bhendi evaluation during rabi season

Leaves are deeply lobed, and leaf petiole is pink in colour. Fruits are seven ridged, hairy and long (20-22 cm) with less fiber and tender. Fruits are highly palatable for any vegetable cuisine preparation and highly preferred by the local people. Plant produces first fruit at 45 cm height from ground level with a intermodal length of 9 cm and each plant produces around 9-11 fruits per plant in 75 days of duration with an average yield of 7-8 tonnes ha-1. It is observed to be susceptible to Yellow Vein Mosaic (YVM) during rabi season and slightly susceptible during kharif season.



View of Bhendi variety 10-108 in field

24 《
Project : Assessment, management and designing improvement options for fisheries in selected low impacted estuaries along west coast of India Sreekanth GB

Assessment of fisheries status estuaries in west coast of India

The fish assemblage structure was analysed and the functional and ecological status established in four tropical monsoonal estuaries; Zuari, Mandovi, Terekhol, and Kali along the West coast of India. The sampling was conducted seasonally monsoon (June to September); post-monsoon (October to January); pre-monsoon (February to May) and spatially (upper, middle and lower estuarine gradient) between September 2017 to August 2018 using gillnets. A total of 72 sampling events (for 6 stations for 12 months) were carried out for each estuary from September 2017 to August 2018 and the monthly data were pooled for all the three seasons and three spatial zones. A total of 229 species were collected from Zuari (176 taxa), Mandovi (154 taxa), Terekhol (131 taxa) and Kali (133 taxa) estuaries. The overall fish diversity and species richness were high in Zuari estuary and low in Terekhol estuary. Cluster analysis using the species abundance data from seasons and spatial locations from all the estuaries showed two clusters, one composed of Zuari and Mandovi, and the other cluster of Terekhol and Kali estuaries. The results indicated that the fish community structure (composition) was similar between estuaries,





and however, all the estuarine systems showed spatial and seasonal variations in diversity indices, ecological and feeding guilds. The study has also underlined that the tropical monsoonal estuaries offer temporary habitats in terms of shelter and feeding grounds to juveniles of marine species.

Design, construction and evaluation of artificial fish habitats for fish communities

To rejuvenate and replenish the fish communities in Zuari, dome shaped Artificial Fish Habitats (AFHs) made of RCC were deployed at two sites (1. Zuari estuary, 2. Grande Island). Using underwater visual census (UVC), a total of 28 species were counted on the AFHs in Grande and 19 species at Zuari and species diversity and abundance were comparatively higher at Grande. The attachment of various communities like oysters, sponges and ascidia was highest on the Grande. This design is assumed to have a better shelter compared to rectangular AFHs. The major species observed were Heniochus intermedius, H. acuminatus, H. nigrescens, Chromis chromis, Acanthurus blochii, Lutjanus indicus, L. fulvus, L. russelli, Pomadasys furcatus, P. guoraca, Plectorhinchus chubbi, Cephalopholis formosa, Chaetodon collare, C. decussatus and Caranx ignobilis.

Time dynamic simulation model for prediction of fish biomass and fish catch for tropical estuarine system

The developed time dynamic simulation model measured the impact of an effective fishing regulation on the sustainability of fisheries in Zuari estuary through an ecosystem approach. Ecopath models of the Zuari estuary: 2016 model and 2025 model (for each Ecosim scenario) were constructed to visualize the status of the ecosystem at these two different periods. Four different fishing patterns were simulated to explore better options for the implementation of fishing regulations in Zuari. The Ecopath models for 2025 were



> 25

constructed using Ecosim under the assumption that the fishing regulations were implemented in the Zuari estuary from 2017 onwards. The ecosystem indices of 2025 models were compared with 2016 ecosystem to test the possible effects of fishing regulations. The results indicated that the fishing regulations did benefit the ecosystem protection, when it was implemented with a ban on illegal fishing fleets. The different scenarios indicated that most of the functional groups will deplete without the presence of fishing regulation. Moreover, the immediate implementation of ban on illegal fishing yielded better recovery of stocks than the direct reductions in all the fishing fleets.





The relative biomass of groups in 2025 to various fishing scenarios (S1-S4)





Deployment of AFHs and underwater visual census

Trophic modeling of low land IFS system using mass-balance models

mass-balance trophic model has Δ been constructed for a low land integrated farming system to understand the trophic flows, to measure the ecosystem indices and flow characteristics, and to understand the stage of the ecosystem development, maturity, and stability. Thirteen functional groups were identified in the ecosystem model starting from detritus (trophic level=1) to large ruminants (trophic level=3). The trophic network has moderate total system throughput (1134.9 kg N ha⁻¹ year⁻¹), and higher dimensions for recycling capacity (Finn's cycling index: 12.7%), system omnivory index (0.36), and relative ascendency (44.6%). This trophic model is the first agro-ecosystem model for integrated farming systems along Indian coast. This Ecopath model would be also useful for simulating the variations in trophic flows and biomass for functional groups under the variations in the ecological compartments on the ecosystem.



IFS food web and network flow diagram



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

Project : Study and the management of major diseases of vegetable crops in coastal regions R Ramesh

Development and release of bacterial wilt resistant brinjal varieties

Four bacterial wilt resistant brinjal varieties *viz*. Goa Brinjal-1, Goa Brinjal-2, Goa Brinjal-3 and Goa Brinjal-4 were developed and evaluated in multiple locations in Goa. The variety release proposal was submitted to Goa Government for the release of the above varieties in the state of Goa. State seed sub-committee for agriculture and horticultural crops, Govt. of Goa approved these varieties for the state of Goa vide letter No. 3/CIN/Crops/62/SSSC for Agri. & Hort. Crops/2018-19/D.Agridt. July 12, 2018.

Field evaluation of bacterial wilt resistant lines and identification of promising bacterial wilt resistant line (Batch 2)

Seventeen promising lines of brinjal were evaluated in the field. Lines 27-7-2, 42-7-3, 42-7-1, 41-7-1, 56-11-8 and 27-2-2 were promising among the purple types based on two years data on bacterial wilt incidence (0 to 3%), yield (0.59 to 0.80 kg per plant) and consumer preference (very high). Among the green types, line 94-3-1 was found to be the promising one.

S. No.	S. No. Lines		% wilt		No. of fruits/ plant			Yield (Kg/plant)		
		2017-18	2018-19	Mean	2017-18	2018-19	Mean	2017-18	2018-19	Mean
1	27-2 -2	0.00	2.38	1.19	6.38	7.83	7.10	0.49	0.69	0.59
2	27-7 -2	0.00	0.00	0.00	7.85	8.60	8.22	0.55	1.13	0.84
3	34 - 4 - 6	6.67	21.43	14.05	4.67	6.43	5.55	0.44	0.58	0.51
4	41-7-1	0.00	2.56	1.28	6.97	7.13	7.05	0.77	0.66	0.72
5	42-7 -1	1.67	0.00	0.83	7.55	8.24	7.89	0.77	0.76	0.76
6	42-7 -3	0.00	2.38	1.19	5.48	8.57	7.03	0.71	0.89	0.80
7	56 -11 -8	1.67	0.00	0.83	5.17	7.12	6.14	0.57	0.80	0.69
8	93 -8 -4	8.88	0.00	4.44	5.27	7.86	6.56	0.53	0.68	0.61
9	94 -3 -1	0.00	0.00	0.00	6.61	10.52	8.57	0.60	0.77	0.68
10	94 -3 -3	3.70	4.76	4.23	6.02	8.86	7.44	0.56	0.68	0.62
11	112 -9 -9	0.00	47.62	23.81	4.88	5.87	5.37	0.54	0.58	0.56
12	119 -2 -4	10.09	0.00	5.04	5.69	6.08	5.88	0.69	0.54	0.61
13	125-9-8	35.00	4.76	19.88	2.73	7.80	5.26	0.27	0.84	0.55
14	126-4-10	17.50	0.00	8.75	4.03	7.26	5.64	0.40	0.65	0.53
15	127 -9 -10	5.00	0.00	2.50	6.73	8.79	7.76	0.57	0.75	0.66
16	127-10-6	15.00	0.00	7.50	3.85	6.13	4.99	0.38	0.63	0.50
17	126 -4 -6	1.75	0.00	0.88	5.60	4.35	4.98	0.57	0.39	0.48
18	Agassaim	95.00	61.90	78.45	0.38	1.14	0.76	0.09	0.22	0.16
19	Surya	8.33	0.00	4.17	6.78	10.95	8.87	0.48	0.74	0.61
	CV	54.760	116.00		21.321	18.37		21.686	34.02	
	CD (0.05)	9.515	16.94		1.861	2.235		0.183	0.385	
	CD (0.01)	12.750	22.72		2.493	2.996		0.245		

Field evaluation of promising bacterial wilt resistant lines of brinjal (2017-18 and 2018-19)

>>> 27

Particulars	Goa Brinjal-1	Goa Brinjal-2	Goa Brinjal-3	Goa Brinjal-4
Wilt (%)	0.0	0.0	3.33	3.33
Yield (t /ha)	27.5	20.5	15	25
Fruit Colour	Purple	Light purple	Purple	Purple
Fruit Shape	Oval	Oblong	Oval	Long
Fruit Size (length x breadth in cm)	8 x 5	7.7 x 5.4	6.4 x 5.2	10.7 x 4.2
Fruit Weight (g)	0.150	0.136	0.079	0.100
No. of fruits/ plant	9-10	10-11	7-8	12-13
Consumer preference	High	High	High	High

Characteristic features of bactrial wilt resistant brinial varieties



Field evaluation of soil amendments and biocontrol agents on the incidence of bacterial wilt in brinjal

Evaluation of soil amendment with different quantities of lime (4, 6, 8 and 10 t ha⁻¹) and biocontrol agent indicated that there was no significant reduction in the wilt incidence. All the treatments were at par with control.

Viral disease complex in chilli

Symptoms associated with viral disease complex in chilli were studied during kharif 2018 in glass house and during rabi 2018 in the open field condition. Observations in the entire crop period on four varieties (G-4, VNR, Aldona local and Nisha) indicated various types of symptoms viz., curling of leaves, reduced leaf size, mosaic, leaf distortion, puckering, yellowing, bronzing of leaves, vein necrosis, and malformation of flower buds etc. Insect vectors viz., whitefly, aphids and thrips were also present in different time periods. Samples from plants exhibiting different symptoms were taken for further diagnosis using PCR and gPCR analysis. Results suggested the major virus associated is Chilli leaf curl virus.







Field evaluation of different methods for the management of chilli viral disease complex

A field experiment was conducted on chilli hybrid (VNR) with different treatments including seed treatment, nursery treatment, insecticide sprays (15, 30, 45 and 60 DAP), bio-formulation and neem based insecticide sprays (15, 30, 45 and 60 DAP) and barrier crop in the borders. In another experiment conducted on hybrid VNR and var. G-4, biocontrol formulations were applied in nursery and during planting. Spraying of insecticides was done twice (30 DAP and 45 DAP).

30-45 DAP: Observations indicated that the crop was severely infested with whitefly initially (30-45 DAP) and leaf curl virus symptoms were very prominent. Presence of aphids (moderate) and thrips (few) was also noticed on VNR and G4 of experiment 2.

60-70 DAP: It was noted that the population of whiteflies reduced in both the experiments after 70 days of planting. In experiment 1, few thrips population and no aphid population was observed. However, in experiment 2, moderate number of aphids and abundant thrips population was observed. The plants in both the experiments exhibited leaf curl symptoms



Evaluation of wilt resistant lines

(though there is a reduction), moderate potyvirus symptoms and abundant Tospo virus symptoms.

90 DAP: In the later stage of the crop (90 DAP), increased whitefly population was recorded in both the experiments. Aphid and thrips population was nil to very few. Plants showed prominent leaf curl virus symptoms and reduced level of poty virus symptoms and Tospo virus symptoms.

Initial leads indicated that insecticides, bioformulation and barrier crops reduced the insect infestation and improved the crop growth and yield.



Demonstration of bacterial wilt resistant variety Production of talc formulation of biocontrol agents for various experiments and field trials

Talc based formulation of *Trichoderma* (220 kg) was produced and was sold to farmers, and also used in various experiments and field trials on black pepper foot rot, papaya evaluation, plants in protected cultivation, chilli root rot/wilt etc in Institute. Bacterial antagonists (150 kg of RCh6-2b & STC-4) was produced and given to farmer's demonstration plots to treat black pepper plants for management of foot rot and plant growth experiments of paddy.



Field evaluation of integrated methods for the management of chilli viral disease complex



Bio-formulation - RCh6-2b



Bio-formulation - STC-4



Project: Bio-ecology and management of economically important insect pests under coastal ecosystem Maruthadurai R

Diversity and density of stem borers in cashew plantations

Stem and root borer is a major and very serious insect pest in cashew. Field studies were carried out to record the diversity in stem borers present in cashew plantations. Samples were collected from the borer affected trees. The major stem borer species found in cashew plantations were Plocaederus ferrugineus, P. obesus and Batocera rufomaculata. An average of 17 grubs of *Plocaederus* spp were found feeding in a tree. The species Batocera rufomaculata was found at an average of 7.1 grubs per tree. The increasing incidence of mango stem borer was recorded in cashew plantations. The buprestid Belionotaprasina was found in almost all the affected trees with an average of 6.3 grubs per tree. Beside these, Coptopsae dificator of cerambycids and ambrosia beetle Euplatypus parallelus, Platypodidae were also recorded on the infested trees. The occurrence of the secondary borers was mostly found on stressed trees or stem borer affected trees. Within a tree distribution of stem borers revealed that the grubs of cerambycid *Plocaederus* spp, B. rufomaculata and buprestid grub were found from root region to up to 3 m in height. Mostly cocoons and adults of cerambycid species were found in the root and 1m above the ground region. Maximum grub population of cerambycids and buprestid were found in 1 and 2 m region of the tree.



Grub of Plocaederus spp

Grub of Batocera rufomaculata

Management of cashew stem and root borers

Management of cashew stem and root borers was undertaken with six treatments *viz.*, T1- Imidacloprid (0.03%), T2- Thiamethoxam (0.05%), T3- Fipronil (0.09%), T4- Dichlorvos (0.7%), T5- Chlorphyriphos (0.2%) and T6- Untreated check with four replications. Borer affected trees were identified and the grubs were mechanically extracted. The desired concentration was prepared and drenched on the stem up to 1m height and root region. The results revealed that maximum recovery of 90% was recorded in T3- Fipronil (0.09%), T4- Dichlorvos (0.7%), T5- Chlorphyriphos (0.2%). None of the trees were recovered in untreated check where the grubs only were removed.

Evaluation of roosting plants with food baited traps for the management of cucurbit fruit fly *Zeugodacus cucurbitae*

Adult melon flies have a special behaviour of sheltering and roosting in non-host plants bordering host crops. The aim of this study was to evaluate the roosting plants with food baited traps for the management of cucurbit fruit fly Zeugodacus cucurbitae in cucumber. The roosting plants viz., maize, sorghum, castor, red gram, amaranth, tulsi, and tapioca were raised in plastic pots and kept on all the borders of cucumber. Banana and jaggary based food baited traps were prepared and kept at the centre of the each roosting plant. Attracted fruit flies were collected at weekly interval. Similarly food baits were changed weekly once. Among the treatments, castor + food bait attracted maximum of number of fruit flies @ 8.68 adult flies per trap in a week, where as control treatment without roosting plant could attract only 0.9 adult flies per trap in aweek. In all the treatments more females were attracted when compared to the males.



Roosting plants with food bait traps





Integrated management of cowpea aphid with border crops and seed treatment

A field trail was undertaken to evaluate the influence of border crops with seed treatment for managing cowpea aphid *Aphis craccivora*. Cowpea seed, variety Goa cowpea-3 was treated with imidacloprid @ 4 ml kg⁻¹ of seed. The border crops like maize, sorghum, red gram, ground nut, brinjal and gingelly were planted along the border of each plot. The results showed that the least no of aphids (10.48 per leaf per shoot) was recorded in ground nut border crop + seed treatment followed by (12.22 aphids per leaf per shoot) in maize border crop + seed treatment whereas highest no of aphids (183.11 per leaf per shoot) was recorded in control.





Maize as border crop

Management of mango fruit fly with different shape of methyl eugenol traps

A field trail was undertaken to evaluate the attraction potential of different shapes of methyl eugenol traps for management of mango fruit fly *Bactrocera dorsalis*. The treatments were T1- cylindrical white jar + 4×1×1 cm lure, T2 - spherical jar + 4×1×1 cm lure, T3 - transparent tub + 4×1×1 cm lure, T4- empty water bottle + 4×1×1 cm lure and T5 - transparent jar + 4×1×1 cm lure with four replication. Efficacy of different size and shape of methyl eugenol traps for mango fruit fly showed that the treatment T4 - empty water bottle



 $+ 4 \times 1 \times 1$ cm lure, has attracted maximum number of fruit flies (30.57 per week per trap).



Project : Development of Good Agricultural Practices through integrated nutrient management for sustainable fruit crop production in coastal regions of India Maneesha SR

Compatibility of microbial consortia (*Bacillus* strains Rch62b and STC-4) were tested in Integrated Nutrient (IN) mixture at different concentration levels. The IN mixture had organic, inorganic components and large quantity of native microbial colonies. The results showed that, both microbial consortia were able to maintain populations at 2%, 5% and 10% concentrations up to 180 days after inoculation.

The performance of bacteria enriched IN mixture was not as expected as the plant growth attributes of both papaya and tomato were inferior, when tested in pot culture. The composition of IN mixture was revised and tested in tomato and brinjal. In tomato variety '*Arka Rakshak*' and brinjal variety '*Agassim*', the application of IN mixture-poultry manure (10%) had the highest vegetative growth parameters.

Standardization of bio-fortified INM mixtures and their evaluation

Talc formulations of bio-agent (RCh6-2b and STC-4) were mixed @ 2, 5 and 10% (w/w) with INM mixture. INM mix was used in the experiment to evaluate the population of total bacteria and the specific bacteria (RCh6-2b/ STC-4 as the case may be) in the INM

Growth of *Bacillus* sp. strains Rch6-2b and STC-4 in IN mixture at different concentrations

Treatments	No. of specific colonies (log cfu g ⁻¹)						
ireatments	0 days	30 days	60 days	120 days	180 days		
INM mix + 2% Rch6-2b	7.54	7.54	7.54	8.04	7.39		
INM mix + 5%Rch6-2b	7.54	7.15	7.30	7.30	7.30		
INM mix + 10%Rch6-2b	7.91	7.80	7.66	7.81	7.89		
INM mix + 2%STC-4	8.32	8.95	9.02	8.15	8.11		
INM mix + 5%STC-4	8.74	8.74	8.97	8.64	8.79		
INM mix + 10%STC-4	9.10	8.82	8.93	8.84	8.62		
INM mix (Control)	0.00	0.00	0.00	0.00	0.00		



Compatibility of Rch 62 b and STC-4 after 180 days of inoculation



mixture during 6 months period. Population of RCh6-2b and STC-4 is above 7 log CFU g⁻¹ and 8 log CFU g⁻¹ of INM mix respectively till six months. Since there is no significant difference in the population at different degrees of amendments, 2-5% can be used in the INM

mix. This indicated that the addition of RCh6-2b and STC-4 to the INM mix makes it bio-fortified and can be used for any crop to improve the plant growth and disease control.

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

Standardization of extraction of butter from kokum seeds

Kokum is a good source of butter with industrial application. In this experiment, butter was extracted from dried seeds of Garcinia indica using different treatments (T1-T11), and a commercially available product from the market (extracted during October, 2017) was used to compare the quality characters of butter extracted. Out of the treatments, T5 (fermentation) gave the highest percentage of fat (39.66%) followed by T3, i.e., boiling of dried seeds (33.66%). Quality of butter was studied by estimation of acid value, iodine value and saponification value. Butter extracted from treatments T5 and T11 (wet grinding of sprouted seeds) had the least acid and iodine value showing that the quality of butter was good whereas butter sample purchased from market, had the highest value indicating rancidity. Butter extracted through T1 had the least saponification value (124.5), whereas that from market sample had the highest saponification value (294.5) showing the degree of deterioration cum adulteration. The samples obtained from different extraction methods showed melting point values in the range of 34-39 °C. The colour of butter extracted by different treatments varied from cream and yellowish. Fatty acid profiling of butter samples showed presence of palmitic (2.24), stearic (54.11), oleic (42.75) and linolenic acids (0.89), indicating the presence of both unsaturated and saturated fatty acids in the butter.

Properties of kokum seeds

Usually fat is extracted from dried kokum seeds and the process of decorticating or removal of adhering dried pulp is a tedious process. Hence, the physical and mechanical properties of dried seed as affected by

Kokum butter by fermentation method



Jackfruit bulbs stored in 20% brine solution

thermal treatment was studied to design a decorticator for kokum butter extraction.

The mean seed length was 16.8 ± 1.43 mm; width 9.8 ± 0.86 mm and thickness 5.27 ± 0.29 mm. These seeds were dried in hot air oven at 40 °C and 50 °C for 600 seconds and 1200 seconds. They were also subjected to dry roasting for 600 and 1200 seconds. After subjecting to these treatments, the force required to puncture the seed coat was measured, that ranged from $(2.86\pm0.72\times10^{-5} \text{ kgf m}^{-2})$ in 1200 seconds dry roasted seeds to $(6.07\pm0.30\times10^{-5} \text{ kgf m}^{-2})$ in oven dried samples (40 °C for 1200 seconds). The angle of repose was calculated to be 41.98°. Based on these findings, a decorticator is being designed.

Storage of mature jack fruit bulbs in brine solution

Mature jackfruit bulbs were stored in brine solution of varying concentrations, *viz.*, 10, 15, 20, 25, 30 and 40%. The bulbs were also stored in glass and porcelain jars in layers with dry salt as practiced by local folk. Organoleptic and microbial tests were conducted once in 3 months. The results showed that, the bulbs stored well for 9 months, in 20, 25 and 30% brine solution under ambient conditions. The salt crystal used for dry salting acted as a source of microbes in dry salting treatments.

Estimation of losses in jackfruit

All the jackfruit trees in the Institute were considered for the study. The yield data was recorded and the bio-waste after removal bulbs and seeds was also calculated. Out of the 19 trees, nine were firm type and ten were soft fleshed type. The total no. of fruits were 617 (101 in firm, 516 in soft type). The percentage of bulbs was 21-30 (without seeds), of seeds was 10-19 and of waste (skin, inner core, rags etc) almost 50.

Economics was calculated based on the Institute and market rates. The gross income when sold in form of fresh fruit is Rs. 87,000 (ripe fruits) and Rs. 30,000 (for unripe vegetable type). If the ripe fruits are converted in to leather, the net income would be Rs. 66,000 (@ Rs. 200/ kg). When converted into chips, the net income would be Rs. 2,35,000 (@ Rs. 800 /kg). All rate were calculated after considering labour charges and other required inputs.

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

Project: Standardization of protocols for cryopreservation of boar semen EB Chakurkar

Semen cryopreservation in liquid nitrogen (–196°C) is an ultra-low temperature freezing technique that allows for long-term storage of spermatozoa. Programmable freezing or controlled-rate freezing allows one to customize and control each temperature holding or lowering phase in accordance with sample requirements.

This project was designed to standardize and evaluate suitable cryopreservation protocols for prolonged storage of pig semen at ultra-low temperature. During the period, cryopreservation efficiency of pig semen using indigenously prepared semen extender and selected controlled-rate freezing protocols was evaluated.

Three protocols for controlled-rate freezing using programmable automatic freezer (Planer Kryo®560) were tested for post-thaw quality and viability. Cryopreservation extenders containing reduced levels of egg yolk and modified concentrations of glycerol as cryoprotectant were evaluated under selected controlled-rate freezing protocols. Pre-freezing and post-thaw sperm viability were assessed using Eosin Nigrosin staining and acrosome integrity at different time intervals were evaluated with modified EosinNigrosin Giemsa staining. Progressive motility of the frozen thawed semen sample of boar semen protocol -3 was found to be 50 % i.e acceptable for storage and AI.



Controlled-rate freezer system for programmable freezing



33

Mean progressive sperm motility, live and dead percentage and acrosomal integrity of the semen samples in liquid form before freezing and post-thaw states at different time intervals were recorded and compared. There were significant differences (p < 0.05) in post-freezing semen quality parameters associated with different cryopreservation protocols evaluated; major parameters showing higher values of sperm viability and sperm motility in boar cryo protocol-III. Mean post-thaw semen motility were 5.5%, 23.0% and 35% for protocol I, II and III, respectively. The mean percentage of live sperms in post-freezing samples were 17.7%, 51.0% and 55.0% for protocol I, II and III respectively. Selected frozen-thawed samples were also evaluated for in-vivo fertility status in breeding sows and conception rate of 30.77% was recorded in the initial trials for protocol III.

SI No Pr	Protocol	Pre-fi	reeze semen ar	nalysis	Post-thaw semen analysis		
		Progressive motility %	Live sperm %	Acrosomal Integrity %	Progressive motility %	Live sperm %	Acrosomal Integrity %
1	Boar cryo Protocol-l	65.60	95.00	72.50	5.50	17.75	11.00
2	Boar cryo Protocol-II	71.98	94.20	83.80	23.00	51.00	29.60
3	Boar cryo Protocol-III	71.85	94.00	83.50	35.00	55.00	27.00
	Mean	69.64	94.45	79.64	18.81	41.00	22.36
	± SEM	2.00	0.93	2.23	3.53	6.25	3.67

Semen quality assessment at different stages of processing in selected protocols

Project: Epidemiological surveillance of economically important diseases of Dairy animals in the West coast Susitha Rajkumar

Screening of dairy animals for subclinical mastitis

Prevalence study of subclinical mastitis was carried out in small and large dairy units in Goa. The important bacterial pathogens associated with subclinical mastitis in dairy animals in Goa *viz. Staphylococcus aureus,* coagulase negative Staphylococci (CoNS), *E.coli, Bacillus* spp. Identified the antibiotic susceptibility patterns of pathogens isolated from subclinical mastitis. The CoNS isolates showed 100% susceptibility to Enrofloxacin followed by Ceftriaxone and amoxicillin clavulanate (97.5%) for both. *E. coli* isolates showed 100% susceptibility to Quinolone antibiotics *viz.*, Enrofloxacin, Ciprofloxacin, Norfloxacin and Levofloxacin. Screening of *S. aureus* and CoNS isolates associated subclinical mastitis for slime production revealed that 10% of the isolates were positive. Biofim producing ability of CoNS isolates were confirmed by PCR. Screened the serum samples collected from dairy farms of selected districts

descent the second second second second second

Percentage of E. Coll	i isolates found resista	ant, intermediate and	a sensitive to differe	ent antibiotics
-				

Antibiotic	Resistant (%)	Intermediate (%)	Sensitive (%)
Gentamicin	18.18	4.55	77.27
Aztreonam	9.09	13.64	77.27
Ciprofloxacin	0	4.55	95.45
Amikacin	0	4.55	95.45
Ceftizoxime	4.55	27.27	68.18
Ceftriaxone	9.09	0	90.90
Imipenem	4.55	22.73	72.73
Norfloxacin	0	0	100
Levofloxacin	0	0	100
Nalidixic acid	0	0	100
Enrofloxacin	0	0	100



of Kerala, Karnataka and Goa for brucellosis by RBPT and ELISA and confirmed the presence of brucellosis in herds showing abortions. Prevalence study of parasites in dairy animals in Goa was also carried out.



Important protozoan parasites were *Buxtonella* spp. and *Eimeria* spp. Common helminth parasites were *Trichuris* spp., *Paramphistomum* spp., Strongyle worms and *Schistosoma* spp.



Black colonies of slime producing isolates of CoNS in Congo Red Agar

Project : Prevalence of swine associated zoonotic parasitic diseases in Indian West coast Chethan Kumar HB

During the year 2018-19, prevalence of major parasites of pigs of Karnataka and Goa were studied. A total of 78 fecal samples, 479 serum samples, 78 diaphragm samples were collected and analyzed. The prevalence of gastrointestinal parasites was found to be 39.74%. Coccidia spp was the most prevalent parasite (35.89%), followed by *Ascaris suum* (10.25%) and Strongyle spp (5.1%).

No cysticercosis positive carcass was found during the study. Pig diaphragm samples were examined for the presence of *Trichinella* using artificial digestion assay and found negative. The serum samples of pigs will be subjected to ELISA to find out the seroprevalence of trichinellosis which will give an idea to what extent the *Trichinella* infection is prevalent in Goan pigs.



Ascaris spp. ovum in pig feces

Pig diaphragm samples for *Trichinella* detection

Project : Seasonal modulation of reproductive performance in dairy buffaloes with special reference to west coast region Gokuldas PP

Calf Crop

In the first phase, effects of extended photoperiod on overall reproductive performance in buffaloes were studied during different seasons. Two year data on different reproductive variables of buffaloes exposed to extended photoperiod were recorded and compared between seasons viz. summer and winter seasons. Monitoring and evaluation of different biometeorological factors were also undertaken. During the period, average relative humidity (RH) during the summer and winter seasons were 78.92 and 62.29%, respectively. Active photoperiod with bright sunshine hours (n) averaged 4.61 \pm 0.84 h day⁻¹ and 8.73 \pm 0.14 h day⁻¹ while maximum photoperiods (N) were 12.43±0.033 h day⁻¹ and 11.4±0.018 h day⁻¹ during summer and winter seasons, respectively. Temperaturehumidity index values in the region were also recorded during the period and THI values averaged 78.10±1.19 in summer and 72.13±0.71 in winter.

Under extended photoperiod, except for the repeat breeding incidence, there existed a significant difference (p<0.05) in major reproductive variables between the seasons with apparently favourable reproductive performance observed during winter months. Submission rate in a breeding herd is the proportion of eligible buffaloes which are served in a given period and the rate was found to be significantly higher (p<0.05) in buffaloes bred during winter as compared to summer season (52.38 vs 86.36%). Correspondingly, significantly higher conception rate was recorded in winter than summer period. Overall calving rate in buffaloes reared under coastal climate was also significantly higher (p<0.05) in winter as compared to summer. In contrast, incidence of repeat breeding did not differ significantly (p>0.05) between seasons. Calf crop percentage is the proportion of calves born to total animals bred in a given period and this proportion was found to be significantly higher during winter months than in other seasons (27.27% vs. 68.42%, p<0.05).

Buffaloes calving in mid and late summer had apparently lower reproductive efficiency compared to those calving during winter months in coastal climate. Buffaloes calving during winter season had significantly shorter service period than during other seasons. Significantly shorter (p<0.05) calving to estrus intervals were also recorded for those buffaloes calved in winter (10.4 \pm 1.04 weeks) than in summer (28.8 \pm 3.71 weeks). Similarly, significantly shorter inter-calving intervals were recorded for those buffaloes calved in winter months (56.7 \pm 1.6 weeks) in comparison with hot humid summer months (82.8 \pm 6.4 weeks).

Reproductive variables in Summer Winter P- value phase-I (%) Submission Rate 0.022 52.38 86.36 Conception rate 54.55 78.95 0.035 Non-Return Rate 0.021 54.55 84.21 Repeat breeding incidence 0.082 42.86 23.52 Calving rate 36.36 68.42 0.048

27 27

0.027

68 4 2

Seasonal variation in reproductive response of dairy buffaloes reared under coastal climate



Mean (±SEM) Inter-calving period and calving to estrus interval in buffaloes during different seasons (S-summer, W-winter) in phase-1. Bars marked with an asterisk differ significantly (p<0.05)

Different imaging parameters and ultrasound attributes for trans-rectal Real-time B-mode ultrasound (RTU) and colour flow mapping (CFM) modes were standardized in buffaloes. Important imaging attributes include transducer frequency, doppler angle, colour gain and dynamic range. Ovarian perfusion and luteal dynamics using digital colour doppler ultrasound imaging system in experimental buffaloes were also monitored and recorded during the winter period. Trans-rectal ultrasonography was performed using a battery operated multi-mode ultrasound scanner equipped with multi-frequency (6-10 MHz) linear-array transducer (LOGIQ® Book XP device, GE Healthcare, Germany) for assessing luteal dynamics and ovarian perfusion in buffaloes reared under coastal climate. Optimal scan and CFM images were recorded for analysis and interpretation. A total of fifty one scanning sessions were carried out during the period.

36



Colour doppler ultrasound imaging system



Representative ultrasonogram under CFM mode

Project: Augmentation of backyard poultry production through technological interventions in breeding, feeding and management aspects In Indian West Coast. Nibedita Nayak

In this project, different activities like survey and documentation of indigenous poultry breeds of Goa, development of feed formulations using locally available ingredients, collection and testing of clinical samples from field for disease surveillance were carried out.

Survey and documentation of indigenous poultry birds of Goa

Questionnaire was used for surveying the socioeconomic characteristics, backyard poultry farming practices, phenotypic characteristics of the bird, gender wise dynamics of backyard poultry activities and institutional support system. About 100 numbers of local eggs were collected and incubated in Institute hatchery and further evaluated. Feeding of the improved poultry germplasm was found to be a constraint among farming community owing to the escalating feed cost. Hence, feed formulation using locally available, cheap sources of feed and fodder were advised to the farmers. Unconventional feed-sources such as black soldier fly larvae and other herbal plants were common among feedstuffs in this region. Hence these larvaes were collected to rear it scientifically by



Backyard poultry farm

utilizing waste and to evaluate its efficacy as protein source in Institute farm.

Sample collection and analysis for antimicrobial resistance

A total of 70 cloacal swabs were collected from healthy Kuttanad duck (n=50) and duck associated environment (n=20) from well-organized duckery in Goa. Isolation, characterization and resistogram pattern was carried out as per standard protocol with suitable modifications. Multiplex-PCR assay was performed to detect ESBL gene (blaCTX-M, blaTEM, blaSHV). A total of 50 multi-resistant ESBL E. coli isolates were retrieved from 35 cloacal swabs (40/50) and associated environment (15/20) with total prevalence of 78.57%. Based on phenotypic antibiogram, isolates represented 05 different phenotypes. All isolates were susceptible to Carbapenem class of antibiotics. Multiplex-PCR detected blaCTX-M (100%), blaSHV (7.40%), blaTEM (14.28%) genes in the isolates. Similarity of resistogram pattern in isolates from duck cloacae and associated environment revealed circulation of ESBL gene in duck and environment. This showed evidence of emergence of ESBL producing E. coli which harbour blaCTX-M in apparently healthy ducks.



Multiplex PCR for detection of ESBL gene

ICAR-CCARI Annual Report 2018-2019

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

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

Visit to different agro-ecotourism centers scattered in coastal region of India and data collection from these centers were undertaken. Field visit was made to observe the activities of agro-ecotourism center at RFRS, Vengurla, Dr. BSKKV, Dapoli. Establishment of the organic waste recycling unit at agro-ecotourism unit was also completed. Establishment of the medicinal and aromatic plants block and preparation of the name plates, display or information boards for different components in agro-ecotourism unit were carried out. Apiculture units have been established in the agroecotourism unit.

Blocks of red amaranth and local Okra were established. Planting of exotic fruit trees was undertaken and fish aquarium units were established. Ornamental poultry unit and Rabbit unit were established. A total of 817 public visited the Agro eco tourism unit and the income generated was Rs. 56, 435 through the sale of tickets and products.



Visitors at Agro-Eco Tourism centre

Addition of speciality fruits in Agro-ecotourism block

The Institute agro-ecotourism block was already sporting few speciality fruit species like, soursop, wax apple, Malayan apple, Indian Hog plum, custard apple, bullock's heart carambola, bilimbi, canistel, litchi, and jamun. In addition to these, few more fruit plants *viz.*, peanut butter fruit, yellow mangosteen, avacado graft, avacado seedling, loquat seedling, mangosteen, velvette apple and kokum grafts were added to the unit.

Addition of new species in Dhanvantari Vatika

Five new species of plants were included in the medicinal and aromatic plants collection *viz.*, Citronella grass (*Cymbopogon citrates*), Pacholi (*Pogostemon cablin*), Latakasthuri (*Abelmoschus mostachus*), Garden cress (*Lepidium sativum*) and Barleria (*Barleria priontis*). Annato seeds, Aswagandha seeds and roots, Vetiver roots and Alpinia roots were harvested and processed. These were packed and distributed for sales in the farm section.

Aloe vera leaves harvest

From a single aloe vera plant, 9 leaves were harvested with an average leaf length of 59.52 cm, leaf weight of 352 g and gel weight of 227.05 g. The gel recovery 65.44 % and moisture content was 98.82 %. Gel was solidified with gelatin and found that it can be kept in room temperature for 7 days without spoilage. Refrigerated samples can be stored up to two months.



Inauguration of Agro-Eco Tourism centre at the hands of Hon. DG, ICAR

38 《

Project : Enhancing the utilization of pseudostem and leaves of banana V Arunachalam

The project was initiated with the objectives to maximise the utilization of banana pseudostem and leaf. Banana leaf industry in the country despite contributing 12% of value of the banana industry little research work is taken up. Diploid wild relative *M. balbisiana* (BB) is a good source of leaf used as plates. A total of 137 half sib sexual seedlings of cultivar Rupa with BB genome of six months age are transplanted in the main field and evaluated for sucker and leaf production abilities at periodic intervals. Three promising single plants with potential for leaf industry after 8,14 and 22 months of transplanting respectively at August 2017, February 2018 and October 2018 are identified.

Leaf ionic content in ratoon crop of banana intercropped in Arecanut

Leaf quality was assessed by vein distance, solutes in leaf sap, content and ratio of foliar sodium and potassium ions in seven banana varieties grown as intercrop in the interspaces of areca. Diploid *M. balbisiana* Rupa (BB) variety recorded high vein distances as well as total soluble solids. Rasbali variety with AAB genome also known as Rasthali showed significantly high content of potassium and sodium ions Molar ratio of Na to K ions were found to be very low (0.01) in the banana leaves under study. Portable ion meters Horiba Aquatwin were used to measure the ionic contents. Ion meter values of leaf potassium and sodium content showed high correlation coefficient of 0.83 and 0.46, respectively with standard laboratory procedures.

Leaf properties of local cultivars of banana

The physical, mechanical and biochemical properties of banana leaves (four cultivars *viz.*, Red banana, Amti, Velchi and Raspali) were studied to assess the possible uses. Red banana recorded the highest leaf length (190 cm) whereas cv. amti recorded the maximum thickness (0.026 cm). Moisture content varied from $80.37 \pm 1.92\%$ in raspali to $80.29 \pm 5.54\%$ in red banana. Cultivar red banana recorded the highest ash content ($10.7 \pm 3.79\%$) and the highest crude fibre

of 60.1 \pm 8.6%. TSS was found maximum (0.2 \pm 0.14° Bx) in Velchi. Other parameters like K⁺, NO₃⁻, Na⁺, TSS & crude fat showed variations among all four cultivars.

The leaf samples of all four cultivars were subjected to immersion in boiling water (for 1 & 2 mins), hot iron press and heating on flame to see the effect of heat treatment methods on improvement of leaf strength. Hot iron pressed leaves recorded low range of penetration strength (1.4×10^{-5} to 1.9×10^{-5}), whereas immersion in boiling water for one minute recorded a range of 9.9×10^{-6} to 1.9×10^{-5} , the highest was found in flame treatment ($2.25 \times 10^{-5} \text{ kgf m}^{-2}$).

Use of Banana biomass for cultivation of oyster mushroom

Studies showed that banana biomass, either alone or in combination with paddy straw, could be effectively utilized for cultivation of oyster mushroom. Banana leaf biomass required longer period of incubation (35.5 days), while 100% Banana pseudo stem required the shortest period of only 18 days as compared to 22.75 days of incubation in paddy straw substrate. The highest fresh mushroom yield (613.25g per bag) was obtained from the substrate having the combination of paddy straw, Banana pseudo stem and banana leaves in equal proportion (1:1:1), which was on a par with that of paddy straw substrate (583.75g per bag) followed by 100% banana pseudo stem substrate (447.0g per bag).

The duration of harvest was found to be longest (39 days) when 100% banana pseudo stem was used as substrate, however with least number of harvests (7.0). Maximum number of harvests (11.75) was recorded when banana pseudo stem and banana leaves were used in 1:1 ratio.

The highest productivity (28.75% & 30.65%) of oyster mushroom was observed in the substrate containing 100% paddy straw and its combination with Banana pseudo stem and banana leaves in equal proportion, with corresponding values of 94.17 % and 86.22% biological efficiency, respectively. The study showed that banana biomass could be effectively used for growing oyster mushroom.



ICAR-CCARI Annual Report 2018-2019



Project : Design of protected cultivation structures for year round utilization in Western region MJ Gupta

The main objective of the project is to develop management practices for profitable and sustainable production under protected cultivation structures in the west coast region. Experiments on tomato, papaya, pineapple raised under a double span and cucumber under single span greenhouse, fertigation trials, different planting materials, growing media as well as the effect of microclimate on the growth and production year round were undertaken.

Studies on double Span Greenhouse

The introduction of insect nets decreased the air exchange rates (31.25%) and consistently the average temperatures in the greenhouse were found slightly higher or equal to ambient during most part of the year. The day time relative humidity except during rains was controlled by the fan ventilation but the night time humidity when fans were not operated, was very high. There was significant variation in microclimate across the width and length of the greenhouse with the introduction of the insect net. Two Fertigation rates F1 (N:P:K-159:257:400), Ca-77, Mg-33, S-42, B-4.6) & F2 (N:P:K -106:171:266.7), Ca-51.3, Mg-22, S-28, B-3.1, two growing media: Soil, Cocopith, planting material: seedlings, vs grafted plants were assessed. The use of grafted tomato seedlings significantly reduced the mortality due to bacterial wilt. The per plant yield varied from 1429.25±888.04 (grafted plants in soil media with fertigation F2) to 68±29.80g (transplanted seedlings in cocopith media with fertigation F1).

Management of bacterial wilt in tomato using grafting technology

Tomato Hybrid (GsDVs;j600) grafts made on wild brinjal were evaluated in the polyhouse. Evaluation of tomato grafts made on *Solanum torvum* in the poly house indicated that tomato grafts were least affected by bacterial wilt whereas the seedlings were severely affected. Wilt incidence in grafts ranged between 3 and 14% (10 DAP), 19 and 33% (40 DAP), 23 and 39% (70 DAP) and 26 and 44% (100 DAP). However, wilt incidence in the seedlings was 0 (10 DAP), 22-73% (40 DAP), and 63-97% (70 and 100 DAP).



Performance of tomato grafts

Wilt in tomato seedlings

Effect of flower induction chemicals in pineapple cultivated under polyhouse conditions

Suckers of pineapple variety 'Giant Kew' were planted inside the polyhouse and 100% RDN were applied through fertigation. Vegetative parameters were observed periodically. Flower induction treatments were applied to the pineapple plants, when it attained 40 leaf stages. T1: Ethephon 25 ppm+ Urea 2%+ Sodium Carbonate (0.04%) has the least number of days taken for flowering inside the polyhouse conditions. There was an advancement of 15 days by the application of this flower induction treatment over the control. The treatments had non-significant effect on the fruit weight, which ranged from 1.37-1.80 kg.



Flowering and fruiting in 'Giant Kew' pineapple inside poly house Performance of papaya under polyhouse

To improve air movement in polyhouse with indeterminate tomato hybrids, papaya var. C0-8 and Pusa Nanha were directly sown on beds (one bed after every three beds of tomato). At the same time, seeds were also sown outside the polyhouses. But there was 90% mortality in the initial stage due to viral diseases. The crop survived in polyhouse and subsequently came to flowering and fruiting. Variety Co-8 could bear upto 52 fruits per tree. But as it is a tall type, it could not be maintained after one crop. As there was lodging problem, the crop was removed and replaced withvar



Fruiting in papaya variety Co-8 in polyhouse

40 <</



Pusa Nanha, a dwarf type, which flowered and fruited upto 38 fruits per tree. After 18 months of sowing, there was incidence of leaf curl virus and mealy bugs. Therefore, it was removed, to safeguard the main crop tomato, which is also an alternate host to these pests.

Studies on Single Span Greenhouse

The effect of introduction of insect net on the microclimate of a single span naturally ventilated greenhouse with cucumber crop was also studied.

Under naturally ventilated conditions with insect

Day SSGH Air Ambient Air 50 40 30 20 10 120 100 % 80 Humidity, 60 40 20 35 **Dew Point Temperature** 30 25 ວ²⁰ 10 5 April July August Septem October November May June Decemt Februi Janus

nets over vents, the single span greenhouse could not maintain the optimum required temperature and humidity for a Cucumber crop i.e. $32-15^{\circ}$ C and 45-60%respectively. Under stressed condition experiments on cucumber (Kian (F1Hybrid) of Nunhems co. with two growing media of soil and coco-pith and two fertigation rates F1– N:P:K -50:91.5:130, Ca-20.7, Mg-10.6, S-13.2 B-1.6, kg ha⁻¹, F2 – N:P:K -67.9:122:173, Ca-27.6, Mg-14.1, S-17.6 B-2.1, kg ha⁻¹ were taken up. The yield per plant varied from 0.81±0.49 (Growbag with fertigation F1) to 0.71±0.48 (Growbag with fertigation F2)



Microclimate parameters(Year round) in single span greenhouse

≫ 41

Research Achievements

- All India Co-ordinated Research Projects (AICRP)
- **Externally Funded Projects**

Srinidhi chicks in brooding stage Photo Courtesy: Nibedita Nayak

42 // ICAR-CCARI Annual Report 2018-2019

Project : All India Co-ordinated Research Project on Integrated Farming Systems (IFS) Paramesha V

Standardization of integrated farming system model for lowland situations of Goa

A rice based farming system model (crop-dairyfisherv) has been standardized on 0.5 ha area for typical lowland situations of Goa. Different enterprises of the model are crops (rice followed by cowpea/green gram /vegetables/babycorn/sweetcorn-0.4 ha), forage grown on bunds (Hybrid Napier - 0.032 ha), Dairy (24 m²- two cross bred cows, one female calf- 24 m²), FYM unit (10 m²) and kitchen garden (80 m²). The system produced 19 q of rice, 385 kg of baby corn, 72 kg of sweet corn, 72 kg of green gram and 95 kg of cowpea with 1250 litre of milk. In terms of gross return (Rs. 2.35 lakh) the highest % contribution was from crops (59%) followed by dairy (29%). With regards to net return (Rs. 1.39 lakh) the highest contribution were recorded from crops (56%) followed by dairy (32%), and fishery component (12%). The total quantity of crop straw/ stover, green fodder and crop residue produced from cropping system (8336, 4012 and 161 kg, respectively) was recycled within the farm. In the same manner, 5828 kg and 3055 litre of cow dung and urine were also incorporated in farm.

Employment generation

An employment of nearly 339 man days worth Rs. 50870 generated from the IFS model. The value of farm employment generated and value of products recycled within farm was Rs. 1.21 lakh and Rs. 0.48 lakh, respectively.

Evaluation of the plantation crop based upland integrated farming system

An upland model of area 0.8 ha comprising of enterprises such as cashew (Bhaskara) + pineapple (Giant Kew), coconut (Benaulim)+ Pineapple (Giant Kew) + noni + tapioca, arecanut (Mangala) + Banana (Grand Naine), piggery, poultry, vermicompost unit, compost unit was evaluated for upland situations of Goa. After fifth year of start of the IFS model, the gross return of the system was around Rs. 1,72,850/- and the net profit was Rs. 1,18,320/- . The highest contribution to net profit was from the piggery unit (42%) followed by cashew-pineapple system (25%).



General View of low land IFS system



Plantation crop based IFS model

Project : All India Co-ordinated Research Project on Palms V Arunachalam

Evaluation of coconut based cropping system models

Various horticultural crops are being evaluated for intercropping under adult coconut palms. The average nut yield of coconut per year per palm has improved from 47 (2014-15) to 65 (2018-19) after taking up intercropping.

Soil analysis showed low level of potassium. The pH was acidic from 6.0 throughout the field and organic carbon was higher (1.91 %) in coconut = black pepper = Annona. Higher N (271.75 kg ha⁻¹) and K₂O (383.16 kg/ha) was observed in coconut = black pepper = banana = lemon, where P₂O₅ (59.63 kg ha⁻¹) was higher in coconut + black pepper + Heliconia.

Treatment	Crop and part harvested	Yield (ha-1)
T1	Papaya fruit	633 kg
T2	Heliconia flower	96000 stems
Т3	Banana fruit	1650 kg
	Lemon fruit	160 kg
T4	Pineapple fruit	3840 kg
	Passion fruit	160 kg
T6	Crossandra flower	60.45 kg

Yields of intercrops in the system

Establishment of mother blocks and production of guality planting material in arecanut

Nucleus seed garden of Hirehalli Dwarf was established in different phases and being maintained with currently 281 surviving palms of which 82 are at reproductive stage. Only about 62.86 % of the open pollinated progenies of Hirehalli Dwarf bred true as dwarf seedlings. Foliar glucose content was measured

during two seasons in the 55 Mangala tall and 64 Hirehalli dwarf progenies to associate the plant habit with biochemical assay of glucose content. Progeny test was performed for eight dwarf habit mother palms using six vegetative DUS traits and six indices derived from the six traits on 20 randomly chosen open pollinated seedlings from each of three plant habits (dwarf, medium and tall stature). Progeny test was performed for five dwarf (Hirehalli dwarf) mother palms and eight tall (Mangala) using six vegetative DUS traits and six indices derived from the eight traits on the available open pollinated seedlings of all habits together. Mode, shannon diversity, modal score, one tail and two tail p values for the binomial distribution were worked out for the scores for six indices. Among the indices, ratio of length of petiole to lamina had a uniform mode score of 1 in dwarf progenies with highly significant one and two tail P values of binomial distribution at 0.1 %. Most dwarf seedlings of dwarf mother palms possessed a short petiole to lamina ratio (<0.24) which helps to identify them.

Project : All India Co-ordinated Research Project on Cashew AR Desai

New germplasm accessions identified

During the year, five new accessions viz., Durga-1/18, Barsem-1/18, Barsem-3/18, Karvem-1/18 and Karvem-2/18 were identified for bold nut in the range of 7.68-11.86g, shelling % in the range of 28.62-32.23% and two accessions viz., Arla Keri-1/8 and Barsem-2/18 were identified for their cluster bearing habit.

Germplasm collection and maintenance

Presently a total 104 germplasm accessions of cashew representing the following groups is being maintained at Goa Centre.

- Jumbo nut types
- : 17 accessions Bold nut types (40+5)
 - : 45 accessions : 13 accessions
- Medium nut and high yielders • High yielders/ cluster bearers irrespective of nut size (23+2)
- : 25 accessions
- Dwarf canopy types
- : 3 accessions
- : 1 accession
- Total germplasm collection (97 + 7) : 104 accessions

Hybridization and Selection

• Very compact canopy type

Crossing and raising of hybrid seedlings: Out of 403 hybrid seed nuts produced in the previous season, a total of 301 hybrid seedlings were raised for evaluating in the field. During the current flowering season (January-March 2019) a total of 3170 crosses were made and >400 hybrid seed nuts were collected.





Hybrid Seedlings of cashew produced during 2018

Evaluation of hybrids

- Among 1st set of hybrids, raw nut yield varied from 0.3 kg/tree (HB-13/05) to 18.22 kg/tree (HB-31/05) with mean nut weight of 7.4g and shelling percentage of 28% in the former, and 4.99g nut weight and 35.95% of shelling in the latter, respectively.
- Seven hybrid seedlings of 2nd set started flowering and fruiting of which hybrid genotypes namely HB- N2/07, HB-27/07, HB-28/07 and HB-29/07 recorded nut yield in the range of 1-2 kg/ tree with mean nut weight ranging from 7.01 to 9.33 g. Two hybrids (HB-30/07 and HB-N1/07) had the mean nut weight of 10g each.

Project : All India Co-ordinated Research Project on Vegetable Crops M Thangam

ICAR-CCARI, Goa is one of the voluntary centres under AICRP on Vegetable crops, IIVR, Varanasi since 2005-06. Under this national programme, multilocation trails are being carried out in brinjal (varietal and resistant trial) and chilli (varietal trial) at Goa centre.

In varietal trial, the observations on days to first flowering, number of fruits per plant, yield per plant, individual fruit weight etc are being recorded and the trial is under progress.



Monitoring team visit in AICRP field during 2019

Brinjal (Long) IET (2017-18)

Nine lines in brinjal IET were evaluated for yield and yield contributing traits during 2018-19. The individual fruit weight ranged from 69.78



2017/BRLVAR-7

g (2017/BRLVAR-9) to 210.56 g (Local check) The highest fruit yield of 257.63 q ha⁻¹ was recorded in 2017/BRLVAR-7 followed by 247.18 q ha⁻¹ in 2017/ BRLVAR-2.

Brinjal (Round) AVT-I (2017-18)

Nine varieties along with one local check were evaluated for different traits under Goa condition. The highest fruit yield of 270.45 q ha⁻¹ was recorded in 2016/ BRRVAR-4 followed by 255.38q ha⁻¹ in 2016/BRRVAR-9. The lowest yield of 202.16q ha⁻¹ was recorded in 2016/ BRRVAR-8.



2016/BRRVAR-4

Brinjal Bacterial Wilt AVT-1 (2017-18)

Eight test varieties along with one local check were evaluated for incidence of bacterial wilt and other yield traits under Goa condition. There was incidence of bacterial wilt from moderate to high. The highest wilt incidence of 92.87% wa recorded in 2016/BRBWRES-4 followed by 2016/BRBW-7 (77.08%). The local check recorded wilt incidence of 39.17% during the evaluation. The highest fruit yield was recorded in 2016/BRBW-2 & 8 (55.33 q ha⁻¹) with a bacterial wilt incidence of 54.58% followed by 2016/BRBW-1 (48.77q ha⁻¹)

45

Tomato Hybrid Det. AVT-I (2017-18)

Seven entries of tomato were evaluated for different morphological traits. The individual fruit weight ranged from 53.33g in 2016/TODHYB-7 to 75.25g in 2016/ TODHYB-3. The highest fruit yield of 335.25 q ha⁻¹ was recorded in 2016/TODHYB-6 followed by 314.68 q in 2016/TODHYB-7.



Tomato hybrid-2016/TODHYB-6

Pumpkin AVT-I (2017-18)

Six entries of pumpkin were evaluated during rabi season for yield and yield contributing traits. The individual fruit weight ranged from 1.27 kg in 2016/ PUMPVAR-4 to 1.53 kg in 2016/PUMPVAR-7. The highest yield of 155.25 q ha⁻¹ was recorded in 2016/PUMPVAR-1 followed by 144.25 q ha⁻¹ in 2016/PUMPVAR-4.



Project : All India Co-ordinated Research Project on Pigs EB Chakurkar

As per the technical program of the AICRP on pigs, crossbred pigs of 75% exotic blood i.e. Large White Yorkshire and 25 % Agonda Goan were produced and studied for their performance. Thirty breeding females and 10 breeding males were selected for the trials. Generation wise data of three generation is being recorded and accordingly genetic gain selection differential was calculated. As per technical program 75% (exotic blood) crossbred are under study for performances viz., litter performance, growth performance, mortality etc. During 2018-19, litter size and litter weight at birth of crossbred pigs was 8.25±0.89 and 8.83±187.12 kg, respectively. Average individual weight at birth of male piglets was 1.061±25.57 kg and that of female piglets was 1.063±22.41 kg. There was no significant difference in birth weight between male and female piglets. Similarly weaning size after 40 days was 7.28±0.49 nos with 53.88±36.20 kg was the weaning weight. On an average individual male grew at 181.75±5.137 g day ⁻¹ till weaning with average individual weight being 8.33±210.0 kg whereas it was 8.16±230.79 kg for female piglets with growth rate of 177.43±5.981 g day⁻¹. Preweaning and Post-weaning mortality rate was 6.27% and 4.17%, respectively which was within the standard accepted rate of 10% and 5% as approved by AICRP on Pig. Crossbreed pigs (75% exotic blood) reached weight of 78.91 ±10.16 kg in eight months i.e. at slaughter age with overall average growth rate of 324.36±92.47 g/day under optimum growing conditions. Artificial Insemination was the only breeding method followed for all the experimental groups. This AI technology is

also transferred in the farmer's demonstration unit. Deworming pregnant sows on 105 days of gestation has been initiated to prevent transplacental and or transcolostrol transmission of strongyliode parasites from sow to piglets as well as it reduces worm egg passed in faeces of sows after pregnancy which prevents postnatal exposure of these parasites to piglets. Administration of deworming has improved post natal survivability of piglets by preventing piglet diarrhoea. Livestock maintained in the institute farm is fed concentrate feed mixture prepared in the farm with separate formulation for Pregnant, Growers and Piglet /Creeper. Regular vaccination against classical swine fever, foot and mouth disease and porcine circo virus is administered to entire herd. High pedigree crossbreed piglets were sold to the progressive pig farmers and government agencies across Goa, Kerala, Maharashtra and Karnataka for breeding thereby improving their livestock. Total of 150 piglets and 25 Adults pigs were sold during 2018-19 benefitting around 70 pig farmers.



Crossbred sow with litter

Project : All India Co-ordinated Research Project on animal disease monitoring and surveillance (ADMAS) Susitha Rajkumar

The seroprevalence of important diseases of goats were studied. Pig serum samples were collected from Goa state according to the sampling plan and dispatched to ICAR-NIVEDI. Monthly disease outbreak report was submitted to ICAR-NIVEDI for epidemiology information. Important live stock diseases reported in Goa were swine pox in pigs, Babesiosis, Brucellosis and gastrointestinal parasite infections in cattle, fowl pox and Coccidiosis in poultry and Ehrlichiosis and rabies in dogs.

Seroprevalence of Blue tongue and PPR in Goat nonulation in Goa

District	Block	No. of Samples	Prevalence of BTV (%)	Prevalence of PPR (%)
North	Bardez	35	45.71	48.57
Goa	Ponda	42	92.85	11.90
	Pernem	31	86.66	32.25
	Bicholim	11	45.45	63.63
	Tiswadi	26	57.59	19.23
South Goa	Salcete	62	77.41	3.22
	Cancona	40	60	40
	Qupem	04	100	00
	Margao	11	90.90	00
	Average	258	69.38	24.03

Project. All India Co-ordinated Research Project on Rice Manohara KK

AVT-I trial was conducted in farmers field under the coastal saline conditions. 18 entries were evaluated in RBD design with two replications. Top three entries with respect to grain yield are IET 2210 (2098.95 kg ha⁻¹) followed by IET 2202 (1970.33 kg ha⁻¹) and IET 2203 (1787.5 kg ha⁻¹). Local check Goa dhan-2 recorded grain yield of 1490.62 kg ha⁻¹.

Performance of entries in the AICRP on rice

Two of our developed salinity tolerant rice cultures viz., KS-12 (IET 25055) and GRS-1 (IET 25051) were promoted to 3rd year of testing (AVT-II) during the Kharif season of 2018.



Planting of CSTVT trial during Kharif 2018-19

Project. All India Co-ordinated Research Project on Arid Legumes Manohara KK

Initial Variety Trial comprising 23 genotypes of cowpea including one local check variety was undertaken for yield and its attributing characters under the rice fallow situation during the Rabi season. Top five entries with respect to grain yield are CP-12 (2204.22 kg ha⁻¹) followed by CP-7 (2119.44 kg ha⁻¹), CP-18 (2036.23 kg ha⁻¹), CP-1 (1917.41 kg ha⁻¹) and CP-8 (1747.92 kg ha⁻¹). Local check variety Goa cowpea-3 recorded grain yield of 1443.46 kg ha⁻¹.



Field view of IVT trial during Rabi 2018-19



Project : Stress Tolerant Rice for Poor Farmers of Asia and South Asia (STRASA) Manohara KK

82 rice cultures (75 test entries + 7 check varieties) developed for salinity and alkalinity conditions by different NARS partners were evaluated during Kharif 2018 under coastal salinity situation in farmers' field at Chorao Island of North Goa district. Highest grain yield was recorded by RAU1397-18-3-7-9-4-7 (1464.58 kg ha⁻¹) followed by CSR11-192 (1445.83 kg/ha), CSR-2748-4441-193 (1397.82 kg ha⁻¹), CSR11-143 (1308.33) and CSR-2748-4441-195 (1302.08 kg ha⁻¹). Only two entries RAU1397-18-3-7-9-4-7 and CSR11-192 could record significantly higher yield compared to the best check variety CSR 10 (1252.08 kg ha⁻¹).



Project: Hyperspectral remote sensing of the foliar nutrients in crops (SERB, DST) GR Mahajan

Variability of the soil chemical properties in cashew orchards

A study was undertaken to understand the soil fertility status and variability of soil properties under cashew orchards in the West coast region of India. The soils of the orchards were slightly acidic (soil pH 4.95-6.90), non-saline (electrical conductivity 0.10 dS m⁻¹, 0.01-0.59) and very high in soil organic carbon (1.53%). The soil fertility status of the orchards was medium with respect to soil available nitrogen and potassium and very high with respect to the soil phosphorus. The soil available sulfur was found in a deficient category. Among the micronutrients, soil available zinc and copper were found sufficient whereas soil available iron, manganese and boron were sufficient.

Variability of the soil chemical properties in mango orchards

The soils of the mango orchards were slightly acidic (soil pH 5.55, 5.05-7.04), non-saline (electrical conductivity 0.10 dS m⁻¹, 0.04-0.50) and very high in soil organic carbon (1.76%). The soil fertility status of the orchards was medium with respect to soil available nitrogen, potassium and phosphorus. The soil available sulfur was found in a deficient category (13.22 ppm). Among the micronutrients, soil available zinc and copper were found sufficient whereas soil available iron, manganese and boron were sufficient.

Variability in the foliar nutrient status of the cashew and mango varieties

The variability of the foliar nutrients (macroand micronutrients in different varieties of the cashew (Bali-2, Vengurla-4, 7 and Bhaskara; n=420) and mango (Mankurad and Amrapali, n=360) in farmers orchard in the West coast region of India was assessed. Adequate variability with a coefficient of variation from 23.7% to 174% and 28.7% to 145% was recorded for the foliar nutrients of cashew and mango, respectively. The lowest and highest variability was recorded for the phosphorus and sulfur content in cashew and zinc and copper content in mango, respectively. The results revealed that the variability existed among the foliar nutrient content was sufficient to carry out the spectroscopic analysis and studies. Most of the nutrients studied, ranged from deficient to sufficient levels.

Identification of the wavelengths or wavebands in responsive to the cashew and mango leaf nutrients

The hyperspectral reflectance data of leaves of cashew (Bali-2, Vengurla-4, Bhaskara) and mango (Mankurad, Amrapali) was collected for 420 and 360 samples, respectively from different orchards. The linear correlation coefficient between the leaf nutrients and the spectral data revealed presence of wavelengths or wavebands having significant value of correlation coefficient. These could be useful to develop the nutrient specific spectral algorithms to predict their content in the leaves of cashew and mango. The figure shows the presence of significant correlation of calcium and magnesium content with the wavelengths and wavebands in visible near infrared, mid-infrared, thermal infrared region, respectively.





spectral absorbance at mid infrared and thermal infrared (650-4000 cm⁻¹).

Project : Amelioration and management of coastal saline soils of Goa for rice production (DST&E, Goa) GR Mahajan

Effect of the organic and chemical amendment on the growth and yield of salt tolerant rice under coastal saline soils

Based on the results of the two years of experimentation, the yield of CSR-27 was higher than that of Korgut in all the treatments. The application of the organic manure (5 t ha⁻¹) with the liming material , dolomite (2.5 t ha⁻¹) recorded significantly highest grain and straw yield. The grain yield of CSR-27 and Korgut was 32.1% and 58.2% higher than their respective controls. The application and farmyard

manure (5 t ha⁻¹) and green leaf manure (10 t ha⁻¹ *Glyricidia maculata*) could increase the grain yield by 42.8% and 43.1% in Korgut and 23.7% and 26.4% in CSR-27, respectively. The increase in the grain yield was lesser in CSR-27 compared to Korgut. The lowest grain yield of 1.28 t ha⁻¹ in Korgut and 3.22 t ha⁻¹ in CSR-27 was recorded in untreated control. The use of foliar spraying of potassium nitrate and boron was ineffective to improve the yield. The study revealed that the application of organic and chemical amendment enhances the rice growth and yield in varieties CSR-27 and Korgut under coastal saline soils.

Project : Management of economically important insect pests with the use of pheromone technology through trainings and demonstrations (NABARD) Maruthadurai R

Pheromone technology was popularized for the management of fruit flies in cucurbits and mango. Performance of pheromone traps for the management of red palm weevil and rhinocerous beetle in coconut was studied. Trainings and field demonstrations were conducted at various locations *viz.*, Goa-Velha and Old Goa in Tiswadi Taluka, Cuncolim and Mardol in Ponda Taluka and Quepem Taluka on use of pheromone traps for managing these insect pest. Technical details like trap placement, lure replacement, food attractants,



Distribution of Cue lure traps

trap servicing and insect observation has been demonstrated to the farmers. All the information in the form of extension folder has been prepared and distributed to the farmers. In addition to farmers were also provided with the pheromone traps.

Management of red palm weevil and rhinocerous beetle in coconut using pheromone traps

The performance of aggregation pheromone traps for mass trapping of red palm weevil and rhinocerous beetle in coconut was evaluated. The pheromone traps were serviced at 15 days interval and weekly observations were recorded. Experiment results showed that maximum of 14.4 adults of red palm weevil was recorded in the month of November. In case of rhinocerous beetles maximum of 3.25 adults was observed in the month of October. An average of 7 adults of red palm weevils and 1.15 adults of rhinocerous beetles were attracted per trap per month. More number of females were attracted to the traps compared to the males in both the species.

>>> 49

Management of cucurbit fruit fly using pheromone traps

Cuelure pheromone traps in cucurbits attracted an average of 33.78 fruit flies per trap per week and reduced the infestation to10-15% against 30% in control. Maximum of 104.4 fruit flies per trap per week was recorded during 4th week of July reduced towards the end of season.



Project: Augmenting rural goat farming in Goa for sustainable income through advanced technological interventions in reproductive, nutrition and health management (DBT) EB Chakurkar

Artificial Insemination in goats was standardized and kidding has started in institute goat unit with AI.

Under this project, semen of goat breed Konkan Kanyal was characterized. Semen samples were collected from six selected bucks maintained at the Goat unit of the Institute. Semen samples were analysed immediately for parameters like volume, concentration of ejaculate, motility and abnormality. The cold storage of semen using different buffers was also studied. A total of 200 semen doses each diluted to get approximate final sperm cell concentration of 45 million/ml were preserved in Goat extender from ICAR-NDRI, Eastern Regional Station, Kalyani Campus, West Bengal. The stored semen samples were evaluated for sperm cell motility at every 24 hr interval during storage until the motility reduced to below 30%.

Artificial insemination technique in goats was also standardised using stored semen. Al was carried

out in 14 female goats using the preserved semen samples. Semen was deposited at the cervical os of the does exhibiting estrous signs. Pregnancy in artificially inseminated goats was confirmed by ultrasound scanning after 30 days of AI, showing 46.15% of does to be pregnant.



Artificial insemination of goat

Project : Development of Descriptors for Kokum (Garcinia indica) S Priya Devi

The project was continued during this year also. As decided in the meeting held between the main centre and our centre, places like Thrissur and Calicut in Kerala were visited and the accessions available in their germplasm bank was also studied. The fruit and leaf samples were brought to Goa and observations were recorded.

Thus, variation in fruit and leaf characters were estimated in more than 100 naturally existing trees of *Garcinia indica* from different populations geographically distributed in Goa and Kerala by assessing the phenotypical variations of fruit during April to June, 2018.

Among the leaves characters, leaf shape varied from oblong to lanceolate, shape of apex is acute, leaf margin entire type, nature of midrib include both pigmented and non-pigmented and petiole length 3.0 -15.00 mm.

External fruit colour varied from red to yellow, fruit shape spheroid to bell like hanging type, fruit surface smooth, fruit apex shape blunt to pointed, fruit length 21-46.4 mm, fruit diameter 21-59 mm, fruit weight 10.00–90.00 g, rind thickness 1.12-5.16 mm, Pulp TSS (%) 15-20, Rind TSS (%) 14.5-24.0, number of seeds per fruit 2-10, Seed weight per fruit 3.0-11.21 g.

Later on, in July-August 2018, we were involved in clonal propagation of promising trees identified from the previous project and also the running DUS project. After planting in the existing germplasm bank, the remaining grafts are being maintained in the nursery currently. Thereby, promising accessions are being exsitu conserved and evaluated at Institute.

50 《

Project : Network Project on Transgenic in Crops (NPTC)–Genetic Mapping of Salinity Tolerant Genes in Rice (ICAR) Manohara KK

Phenotyping for salinity tolerance at seedling stage

Phenotyping of 71 rice genotypes for salinity stress tolerance at seedling stage was carried out under microplot with electrical conductivity of 12 dS M⁻¹. None of the genotypes were highly tolerant to salinity but 11 of the genotypes were found to be tolerant (T) with SES scoring of 3 to 4 similar to that of standard tolerant check varieties Pokkali and FL478. 16 genotypes were found to be moderately tolerant, 29 genotypes were susceptible and 15 were found to be highly sensitive to salinity at seedling stage.

Genotyping using Saltol linked markers

Fourteen Saltol linked SSR markers were used to study the Saltol allelic diversity among the 71 rice genotypes. SSR marker RM10871 was found to be highly polymorphic with a PIC value of 0.90 and exhibited 14 different alleles followed by RM10793 (0.84) and RM3412 (0.80) with 8 and 7 alleles, respectively. RM10720 and RM7075 also exhibited 8 and 7 alleles, respectively but had a low PIC value. RM10713 with only two alleles exhibited the lowest PIC value of 0.08.



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

Evaluation of carrier (talc and sodium alginate) and liquid formulation of *B. methylotrophicus* (RCh6-2b &STC-4) for its viability

Talc, alginate and liquid formulations of RCh6-2b and STC-4 were prepared from the bacteria grown in synthetic medium and standard semi-synthetic medium. Results indicated that the population is above 8 log CFU/g in talc and alginate formulations and above 8 log CFU/ml in liquid formulations till 24 months in both RCh6-2b and in STC-4. When sodium alginate formulation was prepared using alginate and sago at different proportions, bacterial population of RCh6-2b in the formulation was 10.0 log CFU g⁻¹ till 270 days and over 9.0 log CFU g⁻¹ till 300 days, indicating that the low cost materials like sago can be used along with sodium alginate to prepare granular formulation without compromising the quality.

There is no difference between the population from the standard semi-synthetic medium and the new standardized medium. Evaluation of these talc formulations on growth of chilli indicated that higher shoot length and root length were recorded in treatments applied with the formulations compared with control. STC-4 formulation (Synthetic medium) and RCh6-2b formulation (semi-synthetic medium) performed better in improving shoot and root length of chilli. A similar observation was recorded in brinjal crop during 2017-18 with the same formulations.

Development of value added formulations of *B. methylotrophicus* (RCh6-2b and STC-4) and their evaluation

Formulations of *B. methylotrophicus* (RCh6-2b & STC-4) were prepared as per the standardized method with addition of amendments like agro byproducts (AP1) and other nutrient supplements (NS1, 2, 3, 4, C). The bacterial population in the various formulations of RCh6-2b and STC-4 was above 9.0 log CFU g⁻¹ till 12-15 months and there is no difference in the population between standard talc formulation and the value added formulations. Further, it was observed that the population of bacteria increased after six months of shelf life. Results indicate that agro byproducts could

>> 51

be added up to 10% (w/w) to the formulation and the other nutrient supplements could add value to the formulation without any adverse effects. These value added formulations resulted in increased growth of chilli when compared to untreated control.

Evaluation of liquid formulation of *B. methylotrophicus* RCh6-2b and STC-4 with nutrient amendments

Results of shelf life studies of liquid formulations indicated that the population of RCh6-2b and STC-4 was above 8 log CFU ml⁻¹ till 180 days and the population in the synthetic medium formulation was also the same. Hence, the value added liquid formulation can be prepared without compromising the shelf life and the population. It would be an added advantage to the formulation to improve the plant growth by providing additional nutrients.

Development of novel formulations of bacterial bio-agents

Capsule and tablet formulations of bacterial bioagents was standardized and evaluated for shelf life and released into the soil. Results indicated that the population was above 8 log CFU g⁻¹ and 9 log CFU g⁻¹ in capsule and tablet respectively till 270 days. Studies on the population of RCh6-2b soil applied with tablet and capsule formulations over a period of six months indicated that the bacteria released to the soil within 7 days of application was 6-7 log CFU g⁻¹ of soil till 180 days. These results indicate that the introduced bacteria from tablet and capsule formulation survive well in the soil and hence would provide better growth benefits and protection to the crop.

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

Field evaluation of talc and alginate formulations of bacterial bio-agents (RCh6-2b, STC-4 and RP-7) on chilli disease management was carried out. Two experiments were taken one each at ICAR-CCARI and farmer's field. Application of talc formulation of the above two promising bacterial strains reduced the incidence of soil borne diseases (wilt) in chilli; improved plant growth and yield in the field evaluation at ICAR-CCARI. The experiment in the farmer's field failed due to the severe insect damage and viral disease incidence.

Field evaluation of bacterial bio-agent formulations (RCh6-2b and STC-4) for the management of foot rot in black pepper

Field evaluation of talc and alginate formulations of bacterial bio-agents (RCh6-2b and STC-4) on black pepper foot rot disease management was carried out in three field trials at Narve and Chorao. Application of talc formulation of the above two promising bacterial strains reduced the incidence foot rot in black pepper in one of the experiments.



Establishment of black pepper in biocontrol treated plots (Chorao, Narve)

Project: Phenotyping for salinity stress of crop plants through thermal hyperspectral remote sensing (SERB, DST) Bappa Das

Leaf samples from 59 rice genotypes comprising salinity stress tolerant and sensitive were collected at flowering stage. The spectral signature of the fresh leaves was taken using Fourier-transform infrared (FTIR) spectrometer. Then the leaf samples were analyzed for K, Na, Ca, Mg, Fe, Mn, Zn and Cu using atomic absorption spectrophotometer, enough variations present in the data for quantitative modelling. The spectral response pattern revealed sufficient variations as affected by salinity stress which may help in quantification of macro and micronutrients. All the parameters measured at flowering stage were positively skewed. The data collected was used for partial least square regression (PLSR) model development. The performance of PLSR model was found good for K, Ca, Na, Zn and Cu with r value > 0.70 and d-index more than 0.80 while it was moderate for Mg (r = 0.60 and d-index = 0.72) during calibration. The models developed for Fe and Mn were not reliable. During validation the performance of the developed models were slightly reduced with r value and d-index of > 0.60 and > 0.70, respectively for K, Ca, Na, Zn and Cu. The correlation coefficient (r) and d-index of PLSR model developed for Mg during validation was 0.52 and 0.66, respectively.





Project: DASD sponsored Programme (MIDH) AR Desai

A new project of budget Rs. 12.4 lakhs was initiated with the financial support from Directorate of Arecanut and Spices Development, Kochi, in order to promote the High Density Planting (HDP) of Bush pepper grafts under shade net structures and, production of turmeric seed rhizomes and quality planting material of improved Black pepper varieties during 2018-19.

Establishment of FLDs on HDP of bush pepper grafts

Under the said programme, one unit of Paniyur-1, Paniyur-5 and Karimunda varieties

was established in the Institute's farm which has started yielding from very first year itself. Similarly, four units are being established in farmers field in villages Paigeunim and Raia of South Goa, and Korjuem and Mangeshi of North Goa.

Turmeric Seed rhizome production

Seed rhizome production of improved varieties of turmeric namely Pratibha and Pragati was taken up as intercrop in Coconut and Cashew plantations.



Bush pepper grafts under shade net structures



Bush pepper in bearing



Project : ICAR - Seed Project a. Seed Production in Field Crops Manohara KK

A quantity of 26.50 q quality seeds of three crops *viz.*, rice, cowpea and moong (green gram) was produced in *Kharif* and *Rabi* season of which 10.50 q was of breeder seed, 16.0 q of truthfully labelled seeds. Apart from this, about 35 q seeds of truthfully labelled

seeds of rice variety Sahbhagi dhan, 25 q of Goa dhan-1 and 20 q seeds of Goa dhan-2 were produced in the farmers field at Gaodongrim and Cotigao villages through participatory seed production mode.



Field view of seed production in Moong varieties (TM 96-2 and IPM 2-14) during rabi 2018



Field view of Seed production in rice during kharif 2018

Visit of ICAR-Seed project monitoring

Training cum distribution of seeds of Sahbhagi dhan in Cotigao, South Goa

b. Seed Production in Horticultural Crops V Arunchalam

Development of infrastructure

Establishment of new shade-net structure of 200 m² is under progress.

Development of mother blocks

Bund planting of 15 additional dwarf coconut plants (8 Green Dwarf and 7 Yellow Dwarf) was done towards developing seed gardens in low lying area. Further expansion of seed garden by developing additional bunds in the low lying area is under progress.

Development of nursery area

Two new nursery blocks of area 70 m^2 and 50 m^2 were developed for raising coconut seedlings.

Generation and sale of planting materials

Quality planting materials numbering 3189 coomprising eight horticultural crops were produced leading to revenue of Rs 2,16,599.

Planting material produced and sold

Plant	Number
Areca	1915
Coconut	530
Banana	67
Pepper	195
Mango	216
Lemon	61
Wax apple	90
Drumstick	115
Total	3189

c. Seed Production in Ornamental Fisheries Sreekanth GB

Ornamental fish seeds (Guppy, molly, platy, sword tail, gourami, goldfish and koi carp), fish feed, brood stock of freshwater fish (Rohu, Catla and Common carp) and seedlings of

aquatic plants were produced and distributed to the farming community under this project. The sale proceeds of the project is given in the following table.

ltem	Particulars	Nos	Rate	Total (Rs.)
Fish seeds	Guppy, molly, platy, koi carp, sword tail, gouramies, tilapia, Amur carp	5000	15	75000
Fish feed	Ornamental fish feed (kg)	30	600	18000
Freshwater fish	Catla, Rohu and Common carp (kg)	150	130	19500
Fish posters	Posters on fisheries resources	80	100	8000
Aquatic plants	Aquatic plants	220	15	3300
Total				123800



Planted aquarium tank with swordtail fish



Community aquarium tank

Project : Development of Comprehensive e-Agriculture Portal for Information and Knowledge Sharing In Goa (RKVY) M Thangam

Six Automatic Weather Stations (AWS) at Pernem, Old Goa, Codar, Kalay, Sulcorna and Margao were established during November, 2018 and weather parameters *viz.*, air temperature, relative humidity, rainfall, wind speed and



direction, soil temperature and moisture at 5, 20 and 50cm depth and solar radiation are continuously recorded at every 3rd minute and data are being transferred to Central server at ICAR-CCARI, Old Goa since December 2018.



AWS located at ICAR-CCARI, Old Goa



Project : Poultry Seed Project (ICAR) Nibedita Nayak

Day old chicks of Srinidhi and parent stock (Male-135, Female-590) were procured from ICAR-DPR, Hyderabad. The chicks were brooded on floor and reared under intensive system with strict biosecurity and best managemental practices. The production and reproduction performances were evaluated. The construction of one brooder cum grower unit and one parent stock unit each of 1600 of sq ft (Deep litter houses) sanctioned by Directorate of Poultry research was completed.



Growth Rate of Srinidhi Parents Stock

Project : Popularizing Good Post Harvest Management Practices for Field Crops of Goa through research, trainings and demonstrations (NABARD) **Mathala Juliet Gupta**

A new project funded by NABARD "Popularizing Good Post Harvest Management Practices for Field Crops of Goa through research, trainings & demonstrations" has been initiated in October 2018 with Dr. MJ Gupta as Project Leader and Dr. Maruthadurai R, as Co- Project Investigator. The project was proposed to disseminate the research findings of an institute funded project "Estimating Post-harvest Losses of Goa" to the stakeholders viz., the farmers and Directorate of Agriculture. As part of the project a series of training programs were planned for sensitization of farmers at various stages viz., pre-harvest to harvest, threshing, winnowing, drying, parboiling, milling and storage regarding the extent and causes for losses and to introduce modern

technologies and good management practices to reduce post-harvest losses. The project started with two sensitization training programs on Octoner 26th 2018 innaugurated by Dr. EB Chakurakar and 19 January 2019, inaugurated by Shri. Vijai Sardesai, Hon. Minister of Agriculture, T&CP, Archives & Archeology; Factories & Boilers, Govt. of Goa. The farmers were sensitised on GAP for field crops, choice of suitable varieties, pest and disease managment, nutrient managment and use of machineries and advanced technologies to reduce post-harvest losses in field crops. Training programs were also conducted on farmers' field in 15 villages during different stages from harvest, drying, storage, parboiling etc. for 225 paddy farmers.







Field level training programmes

The germplasm collected and conserved at the Institute

Type of germplasm	Crop/ livestock/ fish	Total
	Rice	154
Field crops	Cowpea	5
	Green gram	2
	Cashew	104
Discontrations	Coconut	б
Plantation crops	Arecanut	3
	Mango	165
	Kokum	28
	Banana	25
Fundte	Рарауа	8
Fruits	Pineapple	7
	Aonla	5
	Amaranthus	42
	Chilli	52
	Brinjal	50
	Vegetable cowpea	16
Vegetables	Bhendi	18
	Cucurbits	40
	Sweet Potato	2
	Cluster bean	2
	KnolKhol	1
	Nutmeg	46
Enicoc	Black pepper	8
spices	Turmeric	7
	Ginger	3
	Heliconia	45
Flowers	Jasmine	17
	Crossandra	8
Medicinal and	Medicinal plants	80
Aromatic plants	Noni	19
	Cattle	1
Livester	Pig	1
LIVESLOCK	Rabbit	4
	Poultry	3
	Goat	1
Fish	Fish	45
	R. solanacearum	300
Microbes	Endophytic and rhzobacteria	800



Cashew: Barsem - 3/18



Rice: Jeerige sanna



Nutmeg: NMD-1



Kokum: Kurcherium-9







Poultry: Black Belgian milliefleur

Fish: Indigo barb





Significant Accomplishments

- Varieties Released
- Intellectual Property Rights (IPR) Cell
- Technology Evaluation
- Ongoing Research Projects
- Awards and Recognitions
- Publications

White belgian millefleur Photo Courtesy: Nibedita Navak ICAR-CCARI Annual Report 2018-2019

Varieties Released

Variety release proposals for the release of one bhendi variety, two rice varieties and four brinjal varieties were submitted to the State Variety Release Committee, Directorate of Agriculture, Govt. of Goa. The same were accepted and released for the state of Goa. The characteristic features of the varieties are as follows:





Particulars	Goa Brinjal-1	Goa Brinjal-2	Goa Brinjal-3	Goa Brinjal-4
Wilt (%)	0.0	0.0	3.33	3.33
Yield (t /ha)	27.5	20.5	15	25
Fruit Colour	Purple	Light purple	Purple	Purple
Fruit Shape	Oval	Oblong	Oval	Long
Fruit Size (length x breadth in cm)	8 x 5	7.7 x 5.4	6.4 x 5.2	10.7 x 4.2
Fruit Weight (g)	0.150	0.136	0.079	0.100
No. of fruits/ plant	9-10	10-11	7-8	12-13
Consumer preference	High	High	High	High



Goa bhendi-1

It is derived through pure line selection from local accession (Okra-10-108) from South Goa. Fruits are seven ridged, hairy and long (20-22 cm), with less fibre and tender. Each plant produces around 9-11 fruits in 75 days of duration with yield of 7-8 tonnes ha-1. It is observed to be susceptible to Yellow Vein Mosaic (YVM) during rabi season and slightly susceptible during kharif season. The fruit is highly palatable and preferred by consumers.

Patent applications filed / processed

Request for examination for the patent application for technology entitled "Extender for preservation of boar semen" with application serial No. 3037/ MUM/2015 was submitted to the Indian Patent office on 4th April, 2018 by patent attorney Inventillect Consultancy Services Pvt. Ltd., Pune.

As directed by IP &TM Unit, New Delhi, a meeting of the Institute Technology Management Unit was held on 15th June, 2018 in order to facilitate filing procedures for the Patent filed by Goa University and ICAR entitled "Unmanned Remote Controlled Palm tree Harvesting Robot" under ICAR extramural project vide application No. 201721022813 filed on 29th June 2017.

Germplasm Registration

The following IC numbers were obtained for 4 released rice varieties *viz*. Goa Dhan-1 (KS12/MK 021)–IC 629221, Goa Dhan-2 (KS17/MK 023) – IC 629222, Goa Dhan-3 (GRS 1/MK 025) –IC 629223, and Goa Dhan-4 (JK 238/MK 027) –IC 629224 from ICAR-National Bureau of Plant Genetic Resources, New Delhi.

Material Transfer Agreement (MTA) Signed

Provisional Material Transfer Agreement (MTA) was signed and sent to National Biodiversity Authority (NBA), Chennai as a part of the procedure for getting permission for the transfer of microbial culture for research purpose. MTA was related to the request received from National Plant Protection Organization (NPPO), under Ministry of Economic Affairs, Netherlands through National Biodiversity Authority, Chennai.

Geographical Indication

Institute also facilitated the application process for registration of Khola Chilli for Geographical Indication through Dept. of Science and Technology, Goa and the item was listed as new application in the GI Journal No.110 dated 14th August, 2018. IPR Cell facilitated the process by providing relevant information on Khola Chilli and required linkage with farmer's society Khola/Canacona Chilli Cultivators Group, South Goa.

Meetings / Programmes Attended

Mrs. Anuradha Naik, R.A-IPR/NAIF Scheme participated in "Training Programme on Intellectual Property Rights (IPR) Protection and Traditional Knowledge documentation" organized by Goa State Biodiversity Board (GSBB), Saligao, Goa on 20th September 2018.

Mrs. Anuradha Naik, RA-IPR Cell participated in the "Training programme to understand negotiations skills and economic valuation of bio-resources" organized by Goa State Biodiversity Board on 5th February, 2019 at Goa International Centre, Dona Paula, Goa.

Participation in Outreach Activities

Technologies developed by this Institute were showcased in the India International Science Festival-2018 (IISF Goa) on 25th September, 2018 at CSIR-National Institute of Oceanography, (NIO), Dona Paula, Goa organised by Vidnyan Parishad Goa, and Department of Education and Department of Science & Technology, Govt. of Goa.

Technologies developed by the Institute was showcased and demonstrated by Goa Innovation Council at India International Science Festival 2018. The event was organized by Ministry of Science and Technology, Ministry of Earth Sciences in association with Vijnana Bharati at Indira Gandhi Pratishthan, Lucknow during 5-8th October, 2018.

Awards & Recognitions

Ms. Anuradha Naik, Research Associate working in IPR/NAIF Project of the Institute was conferred with prestigious Nari Shakti Puraskar at the hands of Shri Ram Nath Kovind, Hon'ble President of India on 8th March, 2019 at Rashtrapati Bhawan. The Award was presented by Ministry of Women and Child Development, New Delhi for her exceptional and pioneering work done towards empowerment of tribal women in Khola village, South Goa especially registration of Khola Chilli through IPR Cell.



Ms Anuradha Naik receiving Nari Shakti Puraskar from Hon. President of India

60 《
Technology Evaluation

Performance Evaluation of Process Machinery Developed for West coast

Four process machineries *viz.,* 1) Cashew Apple Crusher –Sree Agro Engineering, Valpoi 2) Compost chipper shredder – Ferds Engineering, Mumbai 3) Arecanut dehusking machine – Omkar Krushi Yantra, Brahmakarmali, 4) Agricultural Waste Shredder -Omkar Krushi Yantra, Brahmakarmali were evaluated and performance evaluation reports given to the farmer innovators. These machineries would be useful for horticulture based cropping systems of the coastal region. All four machines performed well and were certified as good.

Name Function Capacity (kg/h) Material Power Source Dimension	 : Cashew Apple Crusher : Crushing of Cashew Apples : 280 kg hr⁻¹ for Cashew Apples with Crushing efficiency > 95% : Stainless Steel Grade 3014 : 2 HP, Single Phase Motor 1440 RPM : 24 X 23 X 44 inch (length X width X height) 	
Name Function	 Compost Chipper Shredder Suitable for shredding kitchen waste (mixed with sawdust, coco peat, dried and branches up to 35 mm, coconut husk, coconut shell, paper, cardboard tree branches up to 50 mm 	d leaves etc.), leaves, shrubs d, chipping coconut palm &
Material Power Source Capacity Dimension	 Heavy duty epoxy painted steel sheets of 5mm.thickness Blades – Hardenee 10 HP, Three Phase Motor (Crompton Greaves) Starter – Siemens Star Delta Coconut Fronds - 197.79 kg h⁻¹ (M.C.= 10.35% W.B.) with PE > 95% Coconut Frond ends - 138.23 kg h⁻¹ (M.C.= 30.61% W.B.) with PE> 95% Coconut Husk - 80.39 kg h⁻¹ (M.C. = 25.33%, W.B.) with PE > 95% Dry Leaves - 71.74 kg h⁻¹ (M.C. = 3.9% W.B.) with PE > 95% G1150 X 980 X 1000 mm (length X width X height) Top Hopper : 450 mm x 570m Side honner : 400 mm x 400 mm Pace frame : 020 mm x 750 mm 	ed Alloy Steel
Weight * PE - Pulverizing	: 22 kg efficiency	
Name Function Capacity	 Agricultural Waste Shredder Suitable for shredding all kinds of agricultural waste Green Fodder 120.94 kg h⁻¹ (M.C.=57.62% W.B.) with PE > 95% Fresh Plant waste - 132.09 kg h⁻¹ (M.C.= 69.85 % W.B.) with PE > 95% Coconut Petioles only - 323.23 kg h⁻¹ (M.C.= 40.83%, W.B.) with PE > 95% Arecanut Petioles only - 115.69 kg h⁻¹ (M.C.= 62.20% W.B.) with PE > 95% Arecanut leaf Sheath - 43.99 kg h⁻¹ (M.C.= 5.39% W.B.) with PE > 95% 	
Material Power Source Dimension * PE - Pulverizing	 Blades – EN 24 Blades, Supporting blades – EN 8, Triangular Blades – EN 24, Frame – 1.5 inch MS Angle, Upper funnel (14 G), lower funnel & cylindrical part (12 G) MS sheet, Polish Rod -10 mm MS, 220 mm MS Flange 2 HP, Single Phase Motor (1440 RPM) 1400 X 600 X 1100 mm (length X width X height) efficiency 	
Name	: Arecanut Dehusking Machine	







Ongoing Research Projects

Institute projects

No.	Project Title	PI	Co – Pl	Duration
Mega Project I : Conservation and management of natural resources of coastal region Project Leader : GR Mahajan				
1.	Development and evaluation of soil and water conservation measures for sustainable crop production of major horticultural crops in Goa.	Sujeet Desai	V Arunachalam AR Desai	2008 – 19
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 - 20
3.	Study of nutrient management and cropping system on greenhouse gas emission through infoRCT model in west coast of India	Paramesha V	Bappa Das	2016 - 19
4.	Calibration and validation of simulation and statistical crop yield model for major field crops of west coast of India	Bappa Das	Paramesh V	2016 - 19
Meg Proje	a project 2: Conservation and utilization of genetic ect Leader: AR Desai	c resources in the coas	stal region	
5.	Breeding high yielding salt tolerant rice varieties for coastal saline soils	Manohara KK		2010 – 20
6.	Collection, evaluation of genetic resources and management of fruit and spices	AR Desai	S Priya Devi Nibedita Nayak Sujeet Desai	2011 – 19
7.	Augmentation, morphological and molecular characterization and evaluation of okra and amaranth genetic resources of West Coast India for sustainable utilization	M Thangam	V Arunachalam	2017-20
8.	Assessment, management and designing improvement options for fisheries in selected low impacted estuaries along southwest coast of India	Sreekanth GB		2017-20
Mega Proje	a project 3: Development and validation of production act Leader: R Ramesh	on technologies of maj	or crops of coastal region	
9.	Study and the management of major diseases of vegetable crops in coastal region	R Ramesh	Maruthadurai R	2017 -20
10.	Bio-ecology and management of economically important insect pests under coastal ecosystem	Maruthadurai R		2016-19
11.	Development of good agricultural practices through integrated nutrient management for sustainable fruit production in coastal regions of India	Maneesha SR	R Ramesh GR Mahajan	2015-19
12.	Production and postharvest management of fruit crops kokum, jackfruit and breadfruit of west coast region of India	S Priya Devi	MJ Gupta	2018-20



Mega project 4: Development and validation of production technologies of livestock and fisheries Project Leader: EB Chakurkar

TTOJC				
13.	Standardization of protocols for cryopreservation of boar semen	EB Chakurkar	Gokuldas PP	2017-20
14.	Epidemiological surveillance of economically important disease of dairy animals in west coast	Susitha Rajkumar		2015-19
15.	Prevalence of swine associated zoonotic parasitic diseases in Indian west coast	Chethan Kumar HB		2015-19
16.	Seasonal modulation of reproductive performance in dairy buffaloes with special reference to west coast region	Gokuldas PP	Bappa Das	2016 - 19
17.	Augmentation of backyard poultry production through technological interventions in breeding, feeding and management aspects In Indian West Coast	Nibedita Nayak	Gokuldas PP Susitha Rajkumar	2018 - 22
Mega project 5: Improving livelihood security through post-harvest technologies and other agri- enterprises Project Leader: V Arunachalam				5
18.	Prospects and promotion of agro ecotourism in coastal region of India	EB Chakurkar	AR Desai V Arunachalam M Thangam MJ Gupta GR Mahajan Mannesha SR S Priya Devi Sreekanth GB	2017 - 20
19.	Enhanced utilization of pseudo-stem and leaves of banana species identification	V Arunachalam	AR Desai MJ Gupta	2017 – 20
20.	Development of production technologies for successful management and semi-automation under suitable protected cultivation structures designed or adopted for west coastal ecosystem of India	MJ Gupta	AR Desai M Thangam R Ramesh S Priya Devi R Maruthadurai Maneesha SR Sujeet Desai	2017 - 19

AICRP CENTRES

No.	Project Title	PI	Co-PI (s)
1.	All India Co-ordinated Research Project on Integrated Farming Systems	Paramesha V	AR Desai Manohara KK GR Mahajan Sreekanth GB Gokuldas PP Chethan Kumar HB
2.	All India Co-ordinated Research Project on Palms	V Arunachalam	
3.	All India Co-ordinated Research Project on Cashew	AR Desai	
4.	All India Co-ordinated Research Project on Vegetables	M Thangam	
5.	All India Co-ordinated Research Project on Pig	EB Chakurkar	
6.	All India Co-ordinated Research Project on Animal Disease Monitoring and Surveillance (ADMAS)	Sushita Rajkumar	Shivasharanappa N Chethan Kumar HB

63

AICRP VOLUNTARY CENTRES

No	Project Title	PI	Co-PI (s)
1.	All India Co-ordinated Rice Improvement Project	Manohara KK	
2.	All India Co-ordinated Research Project on Arid Legumes	Manohara KK	

EXTERNAL FUNDED PROJECTS

S. No.	Project Title	PI	Co-PI (s)		
Foreig	Foreign Aided				
1.	Stress Tolerant Rice for Africa and South Asia (STRASA)	Manohara KK			
DST, S	ERB,				
2.	Phenotyping for salinity stress of crop plants through thermal hyperspectral remote sensing	Bappa Das	Manohara KK		
3.	Hyperspectral remote sensing of the foliar nutrients in crops	GR Mahajan			
DSTE,	Goa				
4.	Amelioration and management of coastal saline soils of Goa for rice production	GR Mahajan			
NABAF	RD				
5.	Management of economically important insect pests with the use of pheromone technology through trainings and demonstrations	Maruthadurai R	R Ramesh		
б.	Popularizing Good Post Harvest Management Practices for Field Crops of Goa through research, trainings and demonstrations	MJ Gupta	Maruthadurai R		
DBT					
7.	Augmentation of rural pig production for socio economic upliftment of rural poor in Goa through artificial insemination	EB Chakurkar	Susitha Rajkumar		
PPV &	FRA				
8.	Development of DUS guidelines for kokum (Garcinia indica)	S Priya Devi			
ICAR					
9.	Network Project on Transgenic Crops (Functional genomics): Genetic Mapping of Salinity Tolerant Genes in Rice	Manohara KK			
10.	Production and formulation technology refinement of bacterial bio- agents for soil borne plant disease management under coastal ecosystem	R Ramesh			
11.	Seed production in agricultural, horticultural crops and fisheries	Manohara KK	V Arunachalam Sreekanth GB		
12.	Poultry seed project	Nibedita Nayak			
RKVY					
13.	Establishment of protected structures for high value flower and vegetable crops for training and demonstration	M Thangam	S Priya Devi		
14.	Conservation of traditional varieties of vegetable crops and entrepreneurship development for its seed production	M Thangam	S Priya Devi V Arunachalam		
15.	Development of comprehensive e-agriculture portal for information and knowledge sharing in Goa	M Thangam	S Priya Devi		
16.	Demonstration of Precision Farming Technologies (PFT) in banana, pineapple and papaya in farmers' fields of Goa	S Priya Devi			



Awards and Recognition

Dr. Maruthadurai R - Best poster presentation award was bestowed in "First International Conference on Biological Control approaches and applications" by ICAR-NBAIR at Bengaluru held during 27-29th September 2018.

- Elected as Fellow of Entomological Society of India (FESI) by the President, ESI to honour the significant contributions in the field of Agricultural Entomology in the year 2018.

Dr. Bappa Das - ICAR Jawaharlal Nehru Award for P.G. Outstanding Doctoral Thesis Research in Agricultural and Allied Sciences 2017 by Indian Council of Agricultural Research, New Delhi.

Dr. Gokuldas PP - Recognition as an active reviewer by PLOS ONE, a scholarly peer-reviewed journal published by the Public Library of Science, CA, US.

Dr. Sreekanth GB - Associate Editor for the Journal "Fisheries and Life Sciences".

- Board member for the state level approval and monitoring committee (SLAMC) for fisheries projects under blue revolution schemes, Govt. of Goa.

Dr. S Priya Devi - Secured first place in oral presentation in International Conference on Rural Livelihood Improvement by Enhancing Farmers' Income through Sustainable Innovative Agri and Allied Enterprises, held at Patna, during 30th October to 1st Nov 2018.

Dr. Nibedita Nayak - Received Best oral presentation award for "Detection of partial promoter of ACACB gene" in IPSACON-2018 held at ICAR-CIARI, Port Blair, during 15th-17th November, 2018.

IARI Innovative Farmer Award 2019 - Shri. Sanjiv Balaji Kunkalienkar a progressive farmer resident of Mangeshi, Ponda Taluka, Goa received prestigious IARI Innovative Farmers Award 2019 at ICAR - IARI, New Delhi on 7th March 2019. Shri.Sanjiv Balaji Kunkalienkar was nominated by ICAR- Central Coastal Agricultural Research Institute, Goa.



Shri. Sanjiv Balaji Kunkalienkar receiving IARI Innovative Farmers Award 2019 from Dr. Ramesh Chand, Member, NITI Ayog, New Delhi.

> 65

Publications

Aslokar T and Ramesh R (2018) Development of T3SS mutants (hrpB- and hrcV-) of Ralstonia Research solanacearum, evaluation of virulence attenuation in brinjal and tomato- A pre-requisite to **Articles** validate T3Es of R. solanacearum. Indian Journal of Microbiology, doi.10.1007/s12088-018-0736-y. Arunachalam V (2018) Morinda citrifolia L.(Rubiaceae): a multi-purpose tree for coastal ecosystems and its variability in Konkan region of India. Genetic Resources and Crop Evolution 65(6): 1751-765. Barman K, Konwar D, Banik S, Girish Patil S, Gokuldas PP, Thomas R and Rajkhowa S (2018) Effect of supplementation of Azolla (Azolla carolini) meal on performance of crossbred (Hampshire X Ghungroo) pigs, Indian Journal of Animal Nutrition, 35(4): 469-472. Das Bappa, Nair B, Reddy KV and Paramesha V (2018) Evaluation of multiple linear, neural network and penalised regression models for prediction of rice yield based on weather parameters for west coast of India. International Journal of Biometeorology, 62: 1809–1822. Dhanze H, Bhilegaonkar KN, Kumar C, Suman Kumar M, Singh P and Kumar A (2019) Development and evaluation of lateral flow assay for sero-diagnosis of Japanese encephalitis in Swine. Animal Biotechnology, doi: 10.1080/10495398.2019.1602539. Fernandes Danielle, Safeena SA, Manju Lekshmi N, Chaki S, Sreekanth GB and Singh NP (2018) Evaluation of Natural Carotenoid sources from Rosa hybrida varieties on Growth and Pigmentation of Goldfish (Carassius auratus L.). National Academy Science Letters, doi: 10.1007/s40009-018-0738-7. Gupta M, Pitre A, Pandurang S and Vanjari S (2019) Impact analysis of Mechanization program for tribal paddy farmers of Goa. Journal of AgriSearch, 6(1): 55-59. John KJ, Nair RA, Suma A, Unnikrishnan M and Arunachalam V (2018) Agro-biodiversity and ethnobotany of Lakshadweep Islands of India. Genetic Resources and Crop Evolution, 65(8): 2083-2094. Karuppasamy K, Bhanja SK, Mehra M, Aswathi PB, Nayak N and Goel A (2018) Evaluation of economic traits of White Leghorn layers under normal and controlled heat stress conditions. Indian Journal of Poultry Science, 53(1): 21-27. Maneesha SR, Deepika S and Preety L (2019) Preparation and properties of herbal extract blended pineapple ready to serve. Journal of AgriSearch, 6(1): 34-37. Manohara KK, Bhosle SP and Singh NP (2019) Phenotypic Diversity of Rice Landraces Collected from Goa State for Salinity and Agro-morphological traits. Agricultural Research, 8(1): 1-8. Maruthadurai R (2019) A scientific note on occurrence and infestation of Jewel beetle Belionota prasina (Coleoptera: Buprestidae) on Cashew (Anacardium occidentale). National Academy Science Letters, 42(2): 91-94. Manjunath BL, Paramesh V, Mahajan GR, Reddy KV, Das B, Singh NP (2018). A five years study on the selection of rice based cropping systems in Goa for west coast region of India. Journal of *Environmental Biology*, 39(3): 393-399. Nayak N, Rajini RA, Kirubaharan JJ, Ezhilvalavan S and Sahu AR (2018) Effect of In Ovo Feeding of Tryptophan on Post-Hatch Production Performance and Immune Response in Commercial Broilers. Animal Nutrition and Feed Technology, 18: 355-366. Paramesha V, Arunachalam V, Nikkhah A, Das Bappa and Ghnimi S (2018) Optimization of energy consumption and environmental impacts of arecanut production through coupled data envelopment analysis and life cycle assessment. Journal of Cleaner Production, 203: 674-684. Paul NC, Sahoo PM, Sahoo RN, Das Bappa, Biswas A, Krishna G, Rai A, Ahmad T (2018) Comparative evaluation between multispectral and hyperspectral data for discrimination of fruit crops using statistical techniques. Journal of the Indian Society of Agricultural Statistics, 72: 187-191. Rajkumar S, Reddy MR and Somvanshi R (2018) Molecular typing of Indian Mycoplasma



gallisepticum isolates. Indian Journal of Animal Research, doi: 10.18805/ijar.B-3715.

- Sandeep KP, Kumaraguru Vasangam KP, Kumararaja P, Syama Dayal J, Sreekanth GB, Ambasankar K and Vijayan KK (2018) Microalgal diversity of a tropical estuary in south India with special reference to isolation of potential species for aquaculture. *Journal of Coastal Conservation*, 23(1): 253-267.
- Sreekanth GB, Manju Lekshmi N and Ajey Patil (2018) Performance of a shipwreck as an artificial fish habitat along Goa, west coast of India. *Journal of Environmental Biology*, 40: 170-176.
- Sreekanth GB, Chakraborty SK, Jaiswar AK, Das Bappa, Chakurkar EB (2019) Application of deterministic and stochastic geo-statistical tools for analysing spatial patterns of fish density in a tropical monsoonal estuary. *Aquatic Ecology*, 53: 49-60.
- Sreekanth GB, Jaiswar AK, Zacharia PU, Pazhayamadom DG and Chakraborty SK (2019) Effect of environment on spatio-temporal structuring of fish assemblages in a monsoon influenced tropical estuary. *Environmental Monitoring and Assessment*, doi: 0.1007/s10661-019-7436-x.
- Sri Hari M, Jaiswar AK and Sreekanth GB (2018) Length-weight relationship of seven finfish species from Mandovi-Zuari estuarine system, Goa, India. *Journal of Applied Ichthyology*, doi: 10.1111/jai.13816.
- Sri Hari M, Bhutia RN, Kathirvelpandian A, Sreekanth GB, Ramteke K, Sajina AM, Gangan SS and Abidi ZJ (2019) Deciphering the stock structure of *Chanos chanos* (Forsskål, 1775) in Indian waters by truss network and otolith shape analysis. *Turkish journal of Fisheries and Aquatic Sciences*, doi: 10.4194/1303-2712-v20_2_03.
- Susitha Rajkumar and Chakurkar EB (2018) A rare case of Spontaneous Uterine Rupture and Peritonitis in a Sow. *Global Journal of Bio-Science and Biotechnology*, 6(4): 715-716.
- Nandkishore T, Mishra S, Siddiqui MZ, Jha U, Deodhari S and Mahajan GR (2018) Design and development of guar gum based novel, superabsorbent and moisture retaining hydrogels for agricultural applications. *Carbohydrate Polymers*, 185: 169-178.

Papers and abstracts in Conferences/ Workshops

- Chakurkar EB and Desai S (2019) Importance of Livestock in the Watersheds. 28th National Conference on Farmers' Friendly Soil and Water Conservation Technologies for Mitigating Climate Change Impact, Udhagamandalam, Tamil Nadu from 31st January to 2nd February 2019.
- Chakurkar EB, Chethan Kumar HB, Shiavasharanappa N, Susitha R, Gokuldas PP and Sajan Naik (2018) Karad grass feed block: An economical feed resource for dairy cows. 12th National Symposium of ISCAR at Dapoli, Maharashtra from 28th September to 1st October, 2018.
 - Chethan Kumar HB, Suhani SN, Shivasharanappa, N, Rajkumar RS, Susitha R and Chakurkar EB (2018) Prevalence of Trichinella in pork and pork products in Goa. International symposium on Microbiological Food Safety Sampling and Testing in Food Safety Management at New Delhi from 9th to 10th October, 2018.
 - Das Bappa, Nair B, Reddy KV, Paramesh V (2018) Comparison of different multivariate regression models for rice yield prediction using long-term weather information in12th National Symposium of ISCAR at Dapoli, Maharashtra from 28th September to 1st October, 2018.

Das Bappa, Nair B, Reddy KV and Paramesha V (2018) Evaluation of multiple linear, neural network and sparse regression models for pre-harvest forecasting of rice yield based on weather parameters for west coast of India. 12th National Symposium of ISCAR at Dapoli, Maharashtra, India from 28th September to 1st October 2018.

Desai S, Singh DK, Adlul Islam and Sarangi A (2018) Calibration and validation of SWAT model to assess the hydrologic response of Betwa river basin (India) to climate change. Global Water Security Conference for Agriculture and Natural Resources, Hyderabad from 4th to 7th October, 2018.

Gupta MJ (2018) Samudra aadharit arthavyavashtaa mein prasanskaran evam moolyavardhan ke unnant praudyogikiyom ka yogdaan. Sanghosthi on Samudra adhaarit arthvyavastha at NIO, Dona Paula on 24th September 2018.

67

- Gupta MJ, Thangam M, Das B, Ramesh R, Maruthadurai M and Arunachalam V (2018) The microclimate in a mono-span greenhouse under coastal condition of western India and its effect on biotic stress in cucumber. 3rd International Symposium on Innovation and New Technologies in Protected Cultivation at Istanbul from 12th to 16th August 2018.
- Gupta MJ, Thangam M and Arunachalam V (2018) Microclimatic Studies in a Double-span Greenhouse under Wind Driven and Fan Ventilated Conditions in West Coast of India. 3rd International Symposium on Innovation and New Technologies in Protected Cultivation, at Istanbul from 12th to 16th August 2018.
- Gupta MJ, Sayli SP and Kharat KB (2019) Studies on the physical and biochemical properties of Cashew Apple Pomace/Bagase to assess its use for paper making. 53rd annual convention of ISAE and International symposium on "Engineering Technologies for Precision and Climate Smart Agriculture at Varanasi from 28th to 30th January 2019.
- Kumar A, Dhanze H and Kumar C (2018) Japanese encephalitis: A zoonotic threat and our preparedness. International conference of virology, Global viral epidemics: A challenging threat at Chandigarh from 12th to 14th November 2018.
- Mahajan GR, Das B, Patel K, Kulkarni A, Morajkar S, Kulkarni R, Bhaskar Gaikwad (2019) Monitoring properties of the salt affected soil of coastal region of India using hyperspectral remote sensing. Resilient Agriculture in Saline Environments under Changing Climate: Challenges & Opportunities (RAISE-II) at Karnal, Haryana from 21st to 23rd February, 2019.
- Mahajan GR, Das B, Desai A, Murgaonkar D, Kulkarni MR (2018) Microbial and enzyme activities of the salt affected soils of West Coast region of India. 12th National Symposium of ISCAR at Dapoli, Maharashtra from 28th September to 1st October 2018.
- Maruthadurai R and Desai AR (2018) Diversity, abundance and predation potential of major aphidophagous predators of Aphis odinae (Van der Goot) (Hemiptera: Aphididae) in cashew. First International Conference on Biological Control approaches and applications at Bengaluru from 27th to 29th September 2018.
- Maruthadurai R and Ramesh R (2018) Mass trapping of red palm weevil in coconut plantations of Goa using aggregation pheromone traps. ESA, ESC, and ESBC Joint Annual Meeting at Vancouver, BC Canada from 11th to 14th November 2018.
- Nayak N, Bhattacharya TK, Shukla R, Chakurkar EB, Prasad R and Chatterjee RN (2018) Detection of partial promoter of ACACB gene. XXXV Annual Conference of Indian Poultry Science Association on Rural Poultry Production: Challenges for Sustainable Entrepreneurship Development held at ICAR-CIARI, Port Blair from 15th to 17th November 2018.
- Paramesha V, Chakurkar EB, Sreekanth GB, Chetan Kumar HB, Gokuldas PP, Mahajan GR and Manohara KK (2018) Rice based integrated farming system for lowland agroecosystem of Goa, West coast of India. National symposium on integrated farming system from 24th to 28th December 2018.
- Priya Devi S, Gupta MJ and Travasso T (2018) Effect of fruit type and drying methods on quantity and quality of jack fruit leather. International Conference on Rural Livelihood Improvement by Enhancing Farmers' Income through Sustainable Innovative Agri and Allied Enterprises at Patna from 30th October to 1st November 2018.
- Rajkumar S, Shivasharanappa N, Chethan Kumar HB and Rajkumar RS (2018) Prevalence of subclinical mastitis and antibiotic sensitivity screening of major associated pathogens in dairy farms of west coast. 12th National Symposium of ISCAR at Dapoli, Maharashtra from 28th September to 1st October 2018.
- Ramesh R (2018) Pathogenesis of plant pathogenic bacterium, *Ralstonia solanacearum*. CAFT on Recent Trends in Plant–Microbe Interactions at TNAU, Coimbatore from 27th November to 17th December 2018.
- Sreekanth GB and Chakurkar EB (2019) Linking the complexity of an artificial fish habitat and associated fish trophic guilds from Goa, southwest coast of India. International Conference on Challenges and opportunities for sustainable fisheries and aquaculture development at Ratnagiri, Maharashtra from 17th to 20th January 2019.



I	Sreekanth GB and Chakurkar EB (2019) Fish trophic stru west coast of India: A functional trophic guild app	icture in three macrotidal estuaries from proach. World Brackishwater Aquaculture
	Conference at Chennai from 22 nd to 25 th January 20)19.
	Sreekanth GB (2019) Ecosystem based fisheries manage Rivers and wetlands at KUFOS, Kochi from 28 th to 2	ement for estuaries. National Seminar on 9 th March 2019.
	Sivasharanappa N, Desai D, Chethan Kumar HB and S of Blue Tongue Virus (BTV) and Pest Des Petit Ru National Symposium of ISCAR at Dapoli, Maharasl 2018.	usitha Rajkumar (2018). Seroprevalence minants among goats in Goa State. 12 th htra from 28 th September to 1 st October
	Shivasharanappa N, Desai D, Silpa.MV and Chethan Kum of β-lactamase producer No-shigatoxigenic Escher coastal region of India. 12 th National Symposium o September to 1 st October 2018.	ar HB (2018). Emergence and prevalence richia coli in healthy livestock from west of ISCAR at Dapoli, Maharashtra from 28 th
Popular / Technical Articles	Chinnadurai S, Sreekanth GB, Renjith RK and Madhu VF efficiency of Off-Bottom Trawl System (OBTS): 3 A Tech Reporter, 4(1): 3-6.	R (2018) Demonstration and operational new initiative in Goa by ICAR-CIFT. Fish
	Rajanna GA, Dass A and Paramesha V (2018) Excess Wa Mitigation Strategies. Popular Kheti, 6(3): 49-53.	ter Stress: Effects on Crop and Soil, and
	Udharwar SV, Chethan Kumar HB and EB Chakurkar Janavaranchya Aharmadhe Bypass fat Mishrana 2019: 66-69.	(2019) Swatch Dudh Nirithi va Dudhal nche Mahatv. Baliraja Magazine, March
	Udharwar SV, Chethan Kumar HB and EB Chakurkar (20 Mrugdhara magazine, January 2019: 54-57.	19) Swatch Dudh Nirmithi–Kalachi Garaj.
Book Chapters/ Books/ Compendia	Bourdeix, R, Arunachalam,V and Hamelin C (2018) Local <u>c</u> 2. Where we are today. In: Bourdeix R & Prades A (Ed and Use of Coconut Genetic Resources 2018-2028. (International.	genebank management systems-Chapter s.), A Global Strategy for the Conservation pp. 68-69). Montpellier, France. Bioversity
compendia	Das Bappa, Mahajan GR and Singh R (2019) Hyperspe Abiotic Stresses in Agriculture. In: Advances in Crop Springer, Singapore.	ctral Remote Sensing: Use in Detecting DEnvironment Interaction. (pp. 317-335).
	Sahoo RN, Bajpai V, Paul N, Krishna G, Das Bappa, Patr	ra H and Mridha N (2018) Orchard crop
	discrimination. In: Spectrum of India. (pp. 4-5). ISRO Sreekanth GB and Chakurkar EB (2019). Importance of Souvenir of the World Brackishwater Aquaculture (ICAR-CIBA, Chennai.	publication, ISBN No. 978-93-82760-29-0. fisheries sector in coastal agriculture. In: Conference (BRAQCON-2019) (pp. 50-56).
Institute as	Publications	Authors/Editors/Publishers
Publisher	Reports	

•	
Annual Report (2017-2018) pp.1-114	EB Chakurkar, S Priya Devi, MJ Gupta, Manohara KK, N Shivasharanappa, GR Mahajan and Sreekanth GB
Technologies of ICAR- CCARI pp. 1- 19	Gokuldas PP, EB Chakurkar, GR Mahajan, Shivashranappa N
Souvenir of the workshop on "Coastal agriculture for sustainable production vis-à-vis doubling farmer's income", Coastal Agri Expo, pp: 1-81.	EB Chakurkar, M Thangam, Maruthadurai R and Nibedita Nayak

69

Training Manual on Modern techniques in pig semen processing and Artificial Insemination. pp: 1-60.	Gokuldas PP, Susitha Rajkumar, Chethan Kumar HB, Sajan Naik and EB Chakurkar.	
E-book on Modern techniques in pig semen processing and Artificial Insemination. Accessible at https://cbp.icar.gov.in/ CBP portal. pp: 1-60.	EB Chakurkar, Gokuldas PP and Susitha Rajkumar	
Technical Bulletins		
Red Amaranthus – Potential Leafy Vegetable of Goa- Genetic Resources, Characterization and Utilization, Technical Bulletin No. 65, pp 1- 52	M Thangam and Safeena SA	
Extension Folders		
Aloe Vera	Maneesha SR	
Chekkurmanis	Maneesha SR	
Andrographis	Maneesha SR	
Lemon Grass	Maneesha SR	
Stevia	Maneesha SR	
Scientific goat farming packages for coastal India	Shivasharanappa N, EB Chakurkar and Sanjay Udharwar	
Konkan Kanyal goat: A pride breed of West Coastal India	Shivasharanappa N and EB Chakurkar	
Pheromone technology for the management of cucurbit fruit fly <i>Bactrocera cucurbitae</i>	Maruthadurai R and R Ramesh	
Wide area management of red palm weevil and rhinoceros beetle in coconut using pheromone technology	Maruthadurai R and R Ramesh	
Mud crab pen culture	Sreekanth GB and Sudhir Kumar S	
Kyasanur Forest Disease (Monkey Fever)	Chethan Kumar HB, Shivasharanappa N, Sushitha Rajkumar and Sanjay Udharwar	
Ketosis in Dairy animals and its management	Susitha Rajkumar, Chethan Kumar HB, Sanjay Kumar Udharwar and Chakurkar EB	
Extension Leaflet		
Goa Bio-1: Bio formulation for plant growth promotion of paddy under salt affected soils for Coastal regions.	Ramesh R and Mahajan GR	
Goa Bio-2: Bio formulation for plant health management of field, vegetable crops and black pepper in Coastal regions.	of Ramesh R	
News Letter		
Vol. IX. No.2, September - December, 2017 pp. 1-18	GR Mahajan, Sreekanth GB and EB Chakurkar	
Vol. XX. No.1, January – April, 2018 pp. 1-18	S Priya Devi, Manohara K. K., Susitha Rajkumar and Bappa Das	

Education and Training Human Resource Development

Surgeon fish in reef Photo Courtesy: Sreekanth GB

Education and Training

Education

M Thangam	 Member of FRC for Mr. Anup Deshpande, PhD Scholar (Botany) as Vice Chancellor nominee at Dept. of Botany, Goa University. External examiner for Ph.D viva on 4th September, 2018 at HC&RI, TNAU, Coimbatore. External Examiner to evaluate the M.Sc. thesis on Evaluation of Okra Hybrids for Yield and Quality (Abelmoschus esculentus (L.) Moench) 		
	External Examiner to evaluate the M.Sc. thesis Stability analysis in yard long bean (Vigna unguiculata subsp. sesquipedalis L. Vercourt) under different population densities.		
	External Examiner to evaluate the Ph.D. thesis on Heterosis and combining ability studies in pumpkin (<i>Cucurbita moschata</i> Duch)		
	External Examiner for M.Sc. qualifying viva at PAJANCO, Karaikal (9.4.2018) and UHS, Bagalkot (14.3.2019), Arabhavi (15.3.2019) and Bengaluru (16.3.2019).		
R Ramesh	External Examiner to evaluate the M.Sc. thesis on Identification of compatible antagonistic fungus and bacteria; evaluation of their growth promoting activity in brinjal. External Examiner to evaluate the M.Sc. thesis on Antimicrobial activity of plant extracts of Garcinia indica, Tamirindus indica and <i>Murraya koenigii</i> .		
Sreekanth GB	Advisory committee member for Ms. Dhanya MLal, PhD Scholar (Fisheries Resource Management) at ICAR-Central Institute of Fisheries Education (Deemed Univ.), Mumbai, Maharashtra		

Lectures delivered by the Scientists

Date	Lecture Topic/Programme	Participants	Venue
EB Chakurkar		-	
08-05-2018	Agro Techniques for sustainable integrated farming production with livestock	Delegates	Vengurla, Maharashtra
22-05-2018	Role of Biodiversity Management Committees in conservation of Local Species- Case study of Agonda Pig	Delegates	Panaji, Goa
30-05-2018	Coastal Agriculture-An overview of research	Trainees	Goa University
30-06-2018	An overview of reproduction in Goat	Trainees	KVK, North Goa
29-09-2018	Role of livestock in coastal agriculture	Delegates	Dr BSKKV, Dapoli, Maharashtra
08-10-2018	Coastal Agriculture-An overview of research	Trainees	Goa University
	Role of livestock in watershed development programme	Delegates	Ooty, Tamil Nadu
24-01-2019	Livestock production and health in coastal India: An SWOT analysis	Delegates	Thrissur, Kerala
V Arunachalam			
04-09-2017	Coconut varieties and mother palm selection	Farmers	ICAR-CCARI, Old Goa
06-02-2018	Maturity indices of fruit crops	Students	Goa University
08-02-2018	Coconut arecanut and pepper cultivation: problems and solutions	Farmers	Pirna, Goa
06-03-2018	Coconut cultivation	Farmers	KVK, North Goa
M Thangam			
02-05-2018	Vegetable cultivation for Doubling the Farmers Income by 2022	Farmers	Pernem, Goa
R Ramesh			
24-10-2018	Brinjal grafting and disease management in vegetable crops	Farmers	Dhulape, Goa
25-10-2018	Brinjal grafting and disease management in vegetable crops	Farmers	Cumbharjua, Goa



26-10-2018	Good Management Practices to reduce Fungi/ Pathogen related losses in Field Crops of West Coastal Ecosystem	Farmers	ICAR-CCARI, Old Goa
19-01-2019	Good Management Practices to reduce Fungi/ Pathogen related losses in Field Crops of West Coastal Ecosystem	Farmers	ICAR-CCARI, Old Goa
29-01-2019	Diseases of coconut and arecanut; Diseases of black pepper; Diseases of vegetables; Diseases of ginger and turmeric; Diseases of fruit crops	Agricultural officers, extension personnel	ICAR-CCARI, Old Goa
S Priya Devi			
03-05-2018	Value addition in jackfruit and kokum as an enterprise for farm women of Goa on at	Farmers	Dongri, Goa
06-06-2018	Value addition in jackfruit – a potential enterprise	Students	College of Agriculture, Sulcorna, Goa
15-06-2018	Promoting Value Addition in Jackfruit as an enterprise	Delegates	Goa Chamber of Commerce and Industries, Panjim, Goa
10-07-2018	Status and Prospects Of Jackfruit In Goa on at	Trainees	KVK, North Goa
14-08-2018	Biodiversity in important crops of Goa	Students	PES College, Ponda, Goa
Manohara KK			
19-02-2019	Choosing Varieties Suitable for West Coast Ecosystem to reduce post-harvest losses in Field Crops in the Sensitization	Trainees	ICAR- CCARI, Old Goa
Mathala J Gupta			
26-10-2018 and	Machineries and Technologies for reducing Post harvest losses in Field crops of West Coastal	Trainees	ICAR- CCARI, Old Goa
19-01-2019	Ecosystem.		
12-03-2019	Methods of Storage of Fruit Crops	Students	Goa University
Maruthadurai R		-	
24-09-2018	Wet waste management by Black soldier fly Larvae	Farmers, Students and other stakeholders	Navelim, Goa
26-10-2018	Pest management for reducing post- harvest losses in field crops	Farmers	ICAR-KVK, North Goa
19-01-2019	Pest management for reducing post- harvest losses in field crops	Farmers	ICAR-KVK, North Goa
29-01-2019	Integrated pest management for major crops of Goa	Agricultural officers, ATM & BTM	ICAR -CCARI, Old Goa
GR Mahajan			
15-06-2018	Technologies by ICAR CCARI	Trainees	Goa University
26-10-2018	Nutrient Management in Field Crops in West Coastal Ecosystem for reducing Post -harvest losses	Farmers	ICAR-CCARI, Old Goa
04-12-2018	Agricultural Education: Introduction and Opportunities	Students	ICAR-CCARI, Old Goa
05-12-2018	Nutrient management in different crops, Nutrient deficiency: Identification and Management in different crops and Soil Health Card: Importance and use	Farmers	Sal, Goa
19-01-2019	Nutrient Management in Field Crops in West Coastal Ecosystem for reducing Post -harvest losses	Farmers	ICAR-CCARI, Old Goa
Susitha Raikumai	r		
25-10-2018	Importance of Standard Hygienic practices in and Prevention of disease transmission through Artificial insemination in pigs.	Faculty	ICAR-CCARI, Old Goa



18-03-2019	Metabolic diseases in dairy cattle and importance of Vaccination and deworming in dairy cattle	Farmer	KVK, North Goa
Sreekanth GB			
17-04-2018	Coastal fisheries resources of Goa: conservation and management approaches	Fishermen, members of BMC	Terekhol, Goa
10-08-2018 13-08-2018	Ornamental fisheries and its scope in Goa Methods employed in evaluation of Fish biodiversity	Students Students	ICAR-CCARI, Old Goa Dept. of Marine Biology, KU, Karwar, Karnataka
02-09-2018	Aquarium fabrication and management	Students	ICAR-CCARI, Old Goa
08-09-2018	Disease treatment and management in ornamental fish culture	Students	ICAR-CCARI, Old Goa
17-08-2018	Ornamental fish culture: Scope and Challenges	Field functionaries	ICAR-CCARI, Old Goa
09-10- 2018	Integrated fish farming	Students	KVK, South Goa
10-10-2018	Ornamental fish culture: a potential sector for livelihood improvement	Farmers and entrepreneurs	ICAR-CCARI, Old Goa
11-10-2018	Indigenous freshwater fishes of Goa: Scope in ornamental fish culture and Aquarium fabrication and disease management in fish culture	Farmers and entrepreneurs	ICAR-CCARI, Old Goa
28-03-2019	Ecosystem based fisheries management for estuaries	Students and Staff	KUFOS, Kochi, Kerala
Gokuldas PP			
22-10-2018	Present status and research developments of AI and Boar semen evaluation and processing	Trainees	ICAR-CCARI, Old Goa
23-10-2018	Methods of estrus detection, Induction and Synchronization of estrus	Trainees	ICAR-CCARI, Old Goa
24-10-2018	Screening of boar semen for fertility markers	Trainees	ICAR-CCARI, Old Goa
25-10-2018	Present status and research developments of Al in pigs	Trainees	ICAR-CCARI, Old Goa
14-12-2018	IPR cell activities and potential Institute technologies for transfer and commercialization	Delegates	Don Bosco Engineering College, Fatorda, Goa
15-03-2019	Reproductive management of dairy animals and Hormonal therapy and use of Colour Doppler ultrasonography in reproductive management	Trainees	KVK, North Goa
28-06-2018	Optimization of reproductive efficiency in Goats	Trainees	KVK, North Goa
Chethan Kumar H	B		
29-06-2018	Housing of Goats	Goat farmers	KVK, North Goa
23-08-2018	Diseases of pigs	Farmers	KVK, North Goa
27-11-2018	Importance of Deworming in Dairy Cattle	Farmers	Mopa, Goa
07-03-2019	Scientific Housing of dairy animals	Farmers	KVK, North Goa
Paramesha V		- .	
25-05-2018	Integrated farming systems of Goa	Irainees	Dir. of Agriculture, Panaji, Goa
26-10-2018	West Coast Ecosystem to reduce Post-harvest losses	Irainees	KVK, North Goa
Maneesha SR			
05-11-2018	Nutritional importance of Fruits	Students	Govt. college of Arts, Science and Commerce, Khandola, Goa
Nibedita Nayak			
28-06-2018	Nutrition and feeding management on goats	Trainees	KVK, North Goa
24-09-2018	Managing wet waste by black-soldier fly larvae as alternate feed for backyard poultry	Trainees	Navelim, Goa

Human Resource Development

Training and Capacity Development

1

Date	Name	Programme	Venue
April 17-18, 2018	M Thangam Paramesha V	Training on Integrated Farming systems for Goa	SAMETI, Directorate of Agriculture, Govt. of Goa, Old Goa
June 26-29, 2018	Paramesha V	GHG emission/Carbon Sequestration estimation in IFS models using ß-version of excel tool	ICAR-IIFSR, Modipuram, Meerut
September 4-24, 2018	GR Mahajan	21 days Winter School training programme 'Advances in Salinity and Sodicity Management under Different Agro-climatic Regions for enhancing Farmers' Income	ICAR-CSSRI, Karnal, Haryana

Participation in Conference / Seminar/ Symposia / Workshops / Meetings

Date	Name	Programme	Venue
May 8-10, 2018	EB Chakurkar S Priya Devi Maneesha SR	International Mango Symposium	Regional Fruit Research Station, Vengurla, Dr.BSKKV, Maharashtra
May 18-21, 2018	M Thangam	36 th Workshop on AICRP on Vegetable Crops	RARI, Jaipur, Rajasthan
May 24-26, 2018	V Arunachalam	27 th Annual Group Meeting of AICRP (Palms)	ICAR-IIOPR, Pedavegi, Andhra Pradesh
July 16-18, 2018	EB Chakurkar	ICAR Institute Directors Conference	NASC Complex, New Delhi
July 18, 2018	EB Chakurkar	Cadre Strength Review meeting	ICAR, New Delhi
August 9, 2018	Gokuldas PP	3 rd meeting of expert committee on Gene Bank	Goa State Biodiversity Board, Saligao, Goa
August 12-16, 2018	Mathala J Gupta	3 rd International Symposium on Innovation and New Technologies in Protected Cultivation, International Horticultural Congress 2018.	Istanbul, Turkey
August 23 -24, 2018	EB Chakurkar	Symposium on Current & Emerging Trends in Plant Health management	Colva, Goa
September 24, 2018	Mathala J Gupta Sreekanth GB Bappa Das	Samudra adhaarit arthvyavastha	CSIR-NIO, Dona Paula, Goa
September 27-29, 2018	Maruthadurai R	First International Conference on Biological Control approaches and applications	Bengaluru, Karnataka
September 28 - October 1, 2018	EB Chakurkar V Arunachalam GR Mahajan Susitha Rajkumar Paramesha V Bappa Das Manohara KK AR Desai	12 th National Symposium on "Coastal agriculture: Boosting Production Potential under Stressed Environment"	Dr. BSKKV, Dapoli, Maharashtra

75

October 3-6, 2018	Sujeet Desai	Global Water Security Conference for Agriculture and Natural Resources	Hyderabad, Telangana
October 4, 2018	S Priya Devi	Pre-rabi Workshop cum review meeting of Kokum DUS project	NASC Complex, New Delhi
October 8, 2018	Chethan Kumar HB	Hands on Training on Microbiological Food Safety Sampling and Testing in Food Safety Management	FDA Bhavan, New Delhi
October 9-10, 2018	Chethan Kumar HB	International symposium on Microbiological Food Safety Sampling and Testing in Food Safety Management	New Delhi
October 10-12, 2018	V Arunachalam	ICGEB Workshop on plant response to light and stress: Emerging issues in climate change	International Centre for Genetic Engineering and Biotechnology, New Delhi
October 30 – November 1, 2018	S Priya Devi	International Conference on Rural Livelihood Improvement by Enhancing Farmers' Income through Sustainable Innovative Agri and Allied Enterprises	Birla Institute of Technology, Patna, Bihar
November 10-11, 2018	Susitha Rajkumar	10 th Kerala Veterinary Science Congress	Kannur, Kerala
November 15-17, 2018.	Nibedita Nayak	IPSACON-2018	ICAR-CIARI, Port Blair
November 16-17, 2018	Susitha Rajkumar	26 th Annual Review Meeting of AICRP- ADMAS	ICAR-NIVEDI, Bengaluru, Karnataka
November 23-24, 2018	EB Chakurkar	Annual Review meet of AICRP on Pig	NRC on Pig, Guwahati, Assam
November 26, 2018	EB Chakurkar	IMC meeting	ICAR- NIASM, Baramati, Maharashtra
November 29, 2018	EB Chakurkar	Two days workshop on Pig Reproduction and Health management	Post Graduate Institute of Veterinary and Animal Sciences, Krishi Nagar, Akola, Maharashtra
December 03, 2018	R Ramesh	Training (CAFT) on Recent Trends in Plant – Microbe Interactions	TNAU, Coimbatore, Tamil Nadu
December 20-22, 2018	Paramesha V	33 rd Biennial Workshop of AICRP-IFS	UAS, Bengaluru, Karnataka
December 23-24, 2018	Paramesha V	National symposium on integrated farming system	UAS, Bengaluru, Karnataka
Janauary 3, 2019	Gokuldas PP	One day technical seminar BIRAC	BITS Pilani, Zuarinagar, Goa
January 10-12, 2019	Paramesha V	QRT meeting of AICRP IFS of South region	Karamana, Trivandrum, Kerala
January 17-20, 2019	Sreekanth GB	International Conference on Challenges and opportunities for sustainable fisheries and aquaculture development	College of Fisheries, Ratnagiri, Maharashtra
January 22-25, 2019	Sreekanth GB	World Brackishwater Conference, BRAQCON-2019	ICAR-CIBA, Chennai, Tamil Nadu
January 23-25, 2019	EB Chakurkar Rajkumar RS	National Conference on Innovations in Animal Production for Sustainability and Doubling Farmers Income	Thrissur, Kerala
January 28-30, 2019	Mathala J Gupta	International symposium on Engineering Technologies for Precision and Climate Smart Agriculture	College of Agriculture, BHU, Varanasi, Uttar Pradesh

January 29-30, 2019 Gokuldas PP		Regional Workshop on Biological Diversity Laws	College of Law, Panaji, Goa	
January 31-February 1, 2019	EB Chakurkar	ICAR Institute Directors Conference	NASC Complex, New Delhi	
February 2, 2019	EB Chakurkar	28 th National Conference on "Farmers' Friendly Soil and Water Conservation Technologies for Mitigating Climate Change impact	Ooty, Tamil Nadu	
February 7- 8, 2019	Susitha Rajkumar	1 st Steering Committee Meeting on Biotechnology based program for Societal Development	DBT, New Delhi	
February 9 -11, 2019	Gokuldas PP	National Agri-Business Entrepreneurship Conclave (NABEC)-2019	ICAR RC for NEH Region, Umiam, Meghalaya	
February 9 -11, 2019	Paramesha V	Krishi Kumbh Mela-2019	Motihari, Patna, Bihar	
February 21-23, 2019	GR Mahajan	International Salinity Conference 2019 on Resilient Agriculture in Saline Environments under Changing Climate: Challenges & Opportunities	ICAR-CSSRI, Karnal, Haryana	
February 25, 2019	EB Chakurkar	IMC meeting	ICAR- NIASM, Baramati	
March 8, 2019	EB Chakurkar	Assessment meeting of Scientists	ICAR- NIASM, Baramati	
March 28-29, 2019	Sreekanth GB	National Seminar on Rivers and wetlands	KUFOS, Kochi, Kerala	



Transfer of Technology

- ICAR-Krishi Vigyan Kendra
- Technology Dissemination
- Flood-impact studies in Kerala State



ICAR- KRISHI VIGYAN KENDRA, North Goa

In order to intensify the transfer of technology and to impart grass root level vocational training, Krishi Vigyan Kendra was established at the Institute in 1983, The major extension activities carried out are given below.

Trainings

To impart knowledge on advanced technologies in different fields to farmers, several training programmes were conducted. The training programmes were on plant protection, vermi compost, home science and animal science. A total of 71 training were conducted which benefitted 1546 farmers.

Income generation

Income generated from Vemicompost, Nursery, dairy, poultry and post harvest is Rs.10,89,226/-.

Participation of KVK in different forums

KVK, North Goa participated in Coastal Agri Expo 2019, Goa Krishi Kranti Exhibition, Rabi meeting, *Kisan Kalyan Karyashala, Swachhata Pakhwada* and other events. During the period, *mahila kisan diwas*, World soil day and National milk day were celebrated. Live streaming of webcast of Hon. Prime Minister was organized for farmers.

Visit of dignitaries to KVK, North Goa

Shri. Vijay Sardesai, Agriculture Minister, Govt. of Goa visited the KVK and interacted with Director, ICAR-CCARI and technical staff of KVK regarding different on going activities for the benefit of the farmers. Shri. Sripad Y Naik, Hon. Union Minister of State, Ministry of AYUSH visited KVK and reviewed the activities.

Α	On Farm Trials	No. of trials
1	Assessment of improved poultry varieties Grampriya and CARI – Nirbheek	05
2	Assessment of Hybrid Napier fodder varieties CO-4 and CO-5	03
	Total	08
В	Front Line Demonstrations	No. of demonstrations
1	Popularization of high yielding salt tolerant rice variety	04
2	Popularization of high yielding multiple cashew varieties	02
3	Demonstration on management of cashew stem and root borer	10
4	Demonstration on management of bud rot in coconut	10
5	Popularization of virgin coconut oil production technology at home scale level	02
6	Popularization of post harvesting technologies for jackfruit	04
7	Demonstration on clean milk production in dairy animals	10
8	Popularization of Konkan Kanyal goat	03
9	Demonstration of feeding of bypass fat in dairy cattle	10
10	Popularization of Srinidhi - A dual purpose poultry bird	05
	Total	60
C	Extension activities	
1	Soil testing and soil health card distribution	975



Training on goat farming

Soil health campaign

Mahila kisan diwas



Technology Dissemination

Front Line Demonstrations and field Days

Demonstration on nursery inoculation of the salinity tolerant bioformulation and nutrient management in paddy

A field demonstration was carried out at a farmer's field affected with the coastal soil salinity to exhibit the use of the nursery inoculation of the salinity tolerant bioformulation and nutrient management practice in salt tolerant rice variety (Korgut). Practices resulted in improved growth and yield. The yield advantage in the demonstration was 17.6% over the farmers practice. Besides, the grain yield advantage there was a saving of 25% of fertilizer inputs with the improved nutrient management practice.



Demonstration of high-yielding rice varieties at the Institute farm

Demonstrated the high yielding rice varieties *viz.*, Goa dhan-1, 2, 3 & 4 at the institute farm which were developed/identified for the state of Goa. The other varieties included for demonstrations are Jaya, Karjat-3 and Sahbhagi dhan. Demonstration plots were also taken up in the farmers field at Chorao Island on salt tolerant rice varieties. During rabi season, cowpea variety Goa cowpea-3 and Moong varieties TM 96-2 and IPM 2-14 were demonstrated in the institute farm.

FLD on salt tolerant rice varieties in St. Estavam village, North Goa

Front Line Demonstration on high yielding new salt tolerant rice varieties Goa Dhan 1 (KS-12) and Goa Dhan 3 (GRS-1) were taken up during Kharif 2018 in St estevam village of North Goa district. Group of farmers from this small island village came forward to take up FLD on the newly developed varieties in 50 ha of land which was left fallow for almost 30 years. Series of meetings were conducted by to apprise the farmers regarding new varieties of paddy and their advantages over their traditional varieties like Korgut. Periodical visits were made to the FLD plots during the critical stages and suggestions were given accordingly. Overall, Goa Dhan 1 and Goa Dhan 3 recorded 3.6 and 4.1 t/ha of grain yield compared to the local Korgut

Rice field day organised at Ulga village, Karwar

ICAR-Central Coastal Agricultural Research Institute, Goa, in an effort to test salt tolerant rice varieties, taken up demonstration in the farmers' field at Karwar in Karnataka. Representatives of social organization 'Community Organization of Rural Educe, Karwar',



with 1.6 t/ha. Farmers group was very much happy with the performance of salt tolerant varieties under the salinity condition and they have decided to expand their cultivation area to 100 ha in the coming Kharif 2019 season.



Shri. Yeshwanth Rane and Shri. Ramesh Kadam and progressive farmer Shri. Narayana Gaonkar approached ICAR-CCARI, Goa, for suggesting them with the suitable technologies to bring back cultivation of paddy in the coastal low lying areas which are often affected with salinity and water stagnation. Accordingly, seeds of the

80 《

new salt tolerant rice varieties developed at the institute was provided to farmers and demonstration plots were laid out at three villages viz., Ulga, Hankon and in Gopshitta. All the package of practices were suggested during the course of discussion and necessary guidance was given during the visit to the farmers field. Field Day was organized at Ulga village, in Karwar district of Karnataka on 7th October 2018. During the field day, farmers were apprised about the newly introduced salt tolerant rice varieties viz., Goa dhan-1, Goa dhan-2 and GRS-1. Later a formal interaction meeting with the farmers was organized at the auditorium of the local college. Speaking on the occasion as chief guest director ICAR-CCARI Dr. E. B. Chakurkar, emphasised on the integration of agriculture, animal husbandry and fisheries to increase the income of the farmers. He informed the farmers that the new varieties of paddy are boon to farmers in the low lying coastal saline area and are capable of meeting the demands as per the local farmers. As farmers are producing the paddy with least use of chemical fertilizers in the salt affected soils, the rice produced will have huge demand among the consumers, he said. Dr. Jagadeesh Rane, Principal scientist and Head at ICAR-National Institute of Abiotic Stress Management, Baramati, emphasised on retaining youths in agriculture and highlighted

FLD on new salt tolerant rice varieties in the Karwar district in Karnataka

Front line demonstration on high yielding drought tolerant rice variety, sahbhagi dhan suitable for rainfed upland areas was undertaken at Yedda wada in Cotigao village of South Goa district during Kharif season 2018. 13 Quintal of seeds were distributed to the farmers of the village and were briefed about the advantages of growing Sahbhagi dhan over the traditionally grown varieties like Jaya, Karjat-3 and Jyothi in terms of yield, taste and its suitability for milling. More than 26 ha of area distributed among 86 farmers was covered under FLD. Most of the farmers are small and marginal land holders with 0.1 to 0.2 ha area. The peformance was



that community farming along with other subsidiary agriculture help in retaining them in the villages. He also emphasized on use of machinery to bring back a vast area of fallow land into agriculture. Dr. Manohara, K. K., Scientist in Plant Breeding, ICAR CCARI, apprised the farmers about the new varieties of paddy. He said that new varieties are tolerant to salinity and water stagnation, and are capable of giving higher yield compared to the local varieties. The varieties are best suited for parboiled rice and for making poha, he said. He also emphasized that farmers should involve in seed production to earn additional income than just producing them as grains. The Goa dhan-3 recorded average yield of 3.2 t/ha where as Goa dhan-1 recorded average yield of 2.7 t/ha.

recorded. Sahbhagi dhan recorded average grain yield of 5.0 t/ha compared to the locally cultivated varieties *viz.*, Karjat-3, Jyothi and Jaya which recorded 4.2, 3.2 and 4.0 t/ha respectively.



Trainings

ICAR sponsored short course on Modern techniques in pig semen processing and artificial insemination

A 10-days Short Course on "Modern techniques in pig semen processing and Al", organised from 22nd to 31st October 2018, was inaugurated by Dr. MB Chetti, Hon. Vice-Chancellor, UAS, Dharwad. Dr. EB Chakurkar, was the course Director and Dr. Gokuldas PP and Dr. Susitha Rajkumar, were the course Coordinators. The participants were exposed to theoretical and practical hands-on sessions on modern techniques in semen evaluation, processing and Al in pigs. The course also covered standard hygienic practices for boar semen processing and screening of semen for fertility markers. A total of 14 participants from 11 states attended the course.



A Refresher course on Administration & Finance Management

A Refresher course on Administration & Finance Management for Section Officers, AAOs, AFAOs and Assistants of ICAR Headquarters & Institutes was conducted by ICAR-NAARM, Hyderabad, Telangana at ICAR-CCARI, Goa from 5th to 10th July 2018. The Training was inaugurated by Dr.Ch. Srinavasa Rao, Director, NAARM, Hyderabad along with Dr EB Chakurkar, Director of the Institute. A total of 41 participants representing 19 ICAR Institutes from 14 States and ICAR HQ, New Delhi attended the training programme.

Ornamental fish breeding and culture

A short term skill development training programme on "Ornamental fish breeding and culture" was conducted during 10th August and 2nd and 8th September 2018. The training programme was attended by about a total of 25 participants (23 students (BSc. Zoology) and 2 faculty) from Govt. College, Sanquelim-Goa (affiliated to Goa University). The training covered lectures on ornamental fisheries, breeding and culture, aquarium fabrication and disease management in ornamental fish culture.

Training-cum-workshop on horticulture statistics

Training-cum-workshop was organized by DASD, Calicut, Kerala, for Nodal Officers of State Horticulture Statistics Authority (SHOSA) of Horticulture Statistics Division, DAC & FW, Govt. of India, on 25th September 2018 at the institute. The objective of the program was to review the Horticulture statistics generated previously and refine the methodologies and techniques for enhancing the precision of the horticulture statistics.

Livelihood improvement through ornamental fish culture

Two days training programme on "Livelihood improvement through ornamental fish culture" was conducted from 10th to 11th October 2018. The training programme was attended by about a total of 20 participants from Dharbandora village, South Goa. The training covered lectures on ornamental fisheries, breeding and culture, aquarium fabrication and disease management in ornamental fish culture.

Brinjal grafting and other aspects of pest and disease management in vegetable crops

Two one-day training programmes on "Brinjal grafting and other aspects of pest and disease management in vegetable crops" to the farmers on 24th October 2018 (Dhulape) and 25th October 2018 (Cumbharjua). Diagnosis of insect pests and diseases of horticultural crops of Coastal region and their management Training programme on "Diagnosis of insect pests and diseases of horticultural crops of Coastal region and their management" was conducted by ICAR-CCARI, Goa from 29th to 30th January, 2019. A total of 35 people participated in the training programme. The participants include zonal agricultural officers, agricultural officers from Directorate of agriculture, ATMA, extension personnel from NGOs, Private companies and progressive farmers from Goa.

Diagnosis of insect pests and diseases of horticultural crops of Coastal region and their management

A training programme on "Diagnosis of insect pests and diseases of horticultural crops of Coastal region and their management" was conducted by ICAR-CCARI, Goa on 29-30 January, 2019. Over 35 participants (Zonal agricultural officers, agricultural officers from Directorate of agriculture, ATMA, extension personnel from NGOs, Private companies and progressive farmers from Goa) attended the programme. The training was inaugurated by Dr. E.B. Chakurkar, Director, ICAR-CCARI. He emphasized the need of frequent refresher training programmes to the agricultural extension personnel involving in diagnosis of insect pest and disease problems. Detailed presentation and deliberations were conducted during the training by Dr. R. Ramesh, Principal Scientist (Plant Pathology) and Dr. R. Maruthadurai, Scientist (Agricultural Entomology), the course coordinators. All the pest and disease diagnosis and management aspects were discussed in detail and queries were answered. The participants were also taken to field units of ICAR-CCARI for field diagnosis of insect pest and disease problems.

Microbiological Analysis of meat

Training was provided to Dr. Pramod L Shirodkar, Veterinary Officer, Goa Meat Complex on Microbiological Analysis of meat, water and environmental swabs between 6-11th August 2018. During the training collection, transportation, storage and analysis of meat, water, surface swabs for microbiological analysis was demonstrated along with hands on training. Isolation and identification of major food borne pathogens, colony counting and interpretation of culture results were also taught.

Training on use of pheromone traps for the management of Red palm weevil and Rhinocerous beetle in coconut and fruit fly in mango

A training cum distribution on use of pheromone traps for the management of Red palm weevil and Rhinocerous beetle in coconut and fruit fly in mango was organised at ICAR- CCARI, Old Goa on 31/1/19. The project "Management of economically important insect pests with the use of pheromone technology through trainings and demonstrations" was funded by NABARD. More than 40 farmers from different taluks of Goa actively participated in the training programme. Detailed presentation on various insect Pests of Coconut, mango and their management was delivered by Dr. Maruthadurai.R Scientist (Agril. Entomology) the Principal Investigator of the project. Trap placement, lure replacement, food attractants, trap servicing and insect observations were demonstrated to the farmers. Mango fruit fly traps 60 number and 160 traps and lures of red palm weevil and Rhinocerous beetle were distributed to the farmers.

Tribal Sub Plan (TSP)

Distribution of bypass fat and Jackfruit processing machineries

Programme on Distribution of bypass fat and Jackfruit processing machineries was held at the Institute on 5th May, 2018. The programme was inaugurated by Shri Narendra Sawaikar, Hon. Member of Parliament, South Goa along with Shri Govind Gawade, Honourable Minister for Tribal Welfare, Government of Goa. Dr. E. B. Chakurkar, Director (A), ICAR-CCARI welcomed the gathering and briefed about the research and extension activities of the institute.

Value addition in jackfruit

Training programmes were organized to self-help groups of tribal beneficiaries on 14th May 2018, 6th June 2018, 19th June 2018 and 10th July 2018 on Value addition in jackfruit for 60 farmers.

Distribution of processing machinery for Jack fruit & Kokum, Fertilizers and Goa Bio 1

Programme on distribution of inputs was organized by at the Institute on 19th June, 2018. The programme was inaugurated by Shri Govind Gawade, Hon. Minister for Tribal Welfare, Government of Goa. Dr. E. B. Chakurkar, Director (A), ICAR-CCARI welcomed the gathering and briefed about the research and extension activities of the institute. Process machinery for Jack & Kokum, Fertilizers and Goa Bio 1 were distributed to tribal farmers.

Demonstration cum distribution of cue lure pheromone traps

Programme on demonstration cum distribution on use of cue lure pheromone traps for management of cucurbit fruit flies was organised by at the Institute at Cuncolim Goa on 19 July, 2018. More than 30 farmers actively participated in the programme and 200 cue lure traps were distributed to the farmers.

Distribution of ornamental fish culture inputs

Programme on Distribution of ornamental fish culture inputs and artificial fish habitats to tribal fishers under STCwas held at the Institute on 4th December, 2018. Shri. Narendra K. Sawaikar, Hon. Member of Parliament (South Goa), was the chief guest of the function.

Distribution of coconut climbing devices, bypass fat and agrochemicals and fertilizers

Programme on Distribution of coconut climbing devices, by-pass fat and agrochemicals and fertilizers was held at Shantadurga Mandap Cuncoliem Village, Mardol on 29th December, 2018. Shri Govind Gaude, Minister for Arts, culture, Tribal welfare, civil supplies & Price control, Govt. of Goa was the chief guest of the function.

83

Flood-impact studies on agriculture, horticulture and animal husbandry in Kerala State

The state of Kerala faced severe floods due to heavy rainfall and landslides during August, 2018, leading to a major disaster. Due to heavy downpour, Periyar, the state's second largest river swelled and entered the densely populated low-lying areas of Kochi along the banks of the river. The period of waterlogging in villages varied between 3-15 days and the height of flowing water ranged from 1 m to 10 m. A team of scientiest from the Institute visited flood impacted areas to study its effects on agriculture, horticulture and animal husbandry.

Institute Team

Chair	:	EB Chakurkar
Team Leader	:	V Arunachalam
Members	:	Gokuldas PP, Paramesha V, Bappa Das, Chethan Kumar HB, Udharwar SK
Collaborators	:	ICAR-KVK, ICAR-CMFRI, Ernakulum Department of Animal husbandry, Ernakulam District, Govt. of Kerala

Flood impact on field and horticultural crops

According to the preliminary assessment, standing crops of rice, tapioca, vegetables, nutmeg, black pepper and banana were affected severely. Among these crops, the worst affected was paddy because the flood occurred during the panicle initiation stage of the crop and so the crop recovery was not possible at that stage. Tapioca was also affected badly due to submergence of the root system, resulting in root rot disease. With loss of both rice and tapioca, the major staple foods of Kerala, the state's food sufficiency was heavily impacted. The team also observed that, coconut, bamboo, areca plants and some of the banana cv. Njalipoovan survived the flood in some locations.

This silt deposition reduced water infiltration and root aeration which lead to drying of nutmeg, black pepper, pineapple, vegetable plants, teak etc. The crops those submerged for 9 days up to 8 m height had maximum damage, the lesser the height of the crop the maximum the damage. In most multispecies cropping systems, nutmeg plant was most affected by flooding follwed by banana plants especially cv. Nendran.

Flood impact on Livestock and animal husbandry

In the post-flood scenario, health care for surviving livestock is of utmost importance. Devastating floods had brought a wide range of animal health and management problems, from feed and fodder shortage to infection, drop in milk yield and loss of hygienic condition. With possibility of many infectious agents thriving and multiplying in moist and contaminated environment, Pneumonia, bloat, haemorrhagic enteritis and diarrhoea were also observed in flood-affected animals of the region. Mastitis was also observed in many milking animals as they were stressed and not milked during the initial days of disaster. The team visited major flood-affected areas like North Paravur, Aluva, Kaladi, South Vellarappilly, Chowara, Kodanad and Cheranalloor during the period. Total of 15 animal health camps benefitting around 650 farmers and 20 house visits were taken up to treat severely affected animals. Around 220 animals were also treated during the health camps organized in active collaboration with Ernakulam District animal husbandry department. Important medicines worth rupees one lakh were also distributed to the farmers. A radio talk on important aspects of post-flood livestock management was also delivered. Dr. EB Chakurkar, Director ICAR-CCARI held a meeting with the officials of ICAR-KVK, Ernakulam and district animal husbandry department officials from Ernakulam at ICAR-CMFRI, Kochi. Dr. Shinoj Subramannian, Head of KVK, Ernakulam and Dr. Mary James, District Animal husbandry officer I/C also participated in the meeting. Based on the observations, interview and impact assessment, a set of recommendations were made to be incorporated as part of post-flood management strategies.

84 《

Glimpses of Institute

- Coastal Agri Expo and Workshop
- Swachha Bharat Abhiyan
- संस्थान के राजभाषा प्रकोष्ठ की गतिविधियां
- Events
- Distinguished Visitors
- Committees and Meetings
- Personnel
- Budget

Coastal Agri Expo and Workshop

Coastal Agri Expo 2019

Coastal Agri Expo 2019 was organized by ICAR-CCARI at ICAR – CCARI, Old Goa during 2-4 March, 2019. Dr. Trilochan Mohapatra, Secretary (DARE) and Director General, ICAR, New Delhi, inaugurated the Coastal Agri Expo 2019 and Dr. A. R. Bhattacharya Farmers Exhibition Hall on 2nd March 2019 along with other dignitaries, Dr. M. B. Chetti, Vice Chancellor, University of Agricultural Sciences, Dharwad, Dr. S. K. Chaudhari, ADG (Soil and Water Management), ICAR, New Delhi, Dr. N. P. Singh, Director, ICAR - NIASM, Baramati, Maharashtra, Shri. Madhav Kelkar, Director, Directorate of Agriculture, Government of Goa. Dr. Trilochan Mohapatra highlighted the challenges to be faced in the future in agriculture and other sectors and how we can be prepared in that direction. He stressed upon Krishi Melas, Agri Expos, etc. to disseminate the technologies through as one important ways to create awareness among farmers and other stakeholders'. He underlined various research achievements of ICAR to achieve national food and nutritional security and bring prosperity and economic security to our farming communities. The Expo was organized with a central focus on agriculture, livestock and fisheries in the coastal region of the country. Dr. E B Chakurkar, Director and Dr. M Thangam, Principal Scientist and Secretary, Association for Coastal Agricultural Research (ACAR), ICAR-CCARI, Goa represented as the organizers of the event.

The farmers and officers from the Lakshadweep UT were felicitated during the occasion. On the occasion, publications of the event and Institute were released by the chief guest and guests of honor. The participants for the expo were Institutes of ICAR and others, state agricultural universities, Krishi Vigyan Kendras, central and state government organizations, cooperative societies, agro-based private companies and industries, self-help groups, NGOs and farmers of the state of Goa, adjoining states and Lakshadweep UT and press and media. A total number of the exhibition stall during the expo was around 70 and 4000 people visited the expo. The exhibition stalls displayed technologies and products by various organizations for the benefit of farmers.

Workshop on coastal agriculture

A three-day workshop on "Coastal agriculture for sustainable production vis-à-vis doubling farmer's income" was organized by ACAR and ICAR-CCARI, Old Goa during the Expo for the benefit of the farmers. During the workshop, the farmer-Scientist interaction provided the farmers with an opportunity to discuss the farming related problems with the scientists.

The valedictory function of the three day 'Coastal Agri Expo 2019' was held at ICAR- Central Coastal Agricultural Research Institute, Old Goa, Goa on 4th March 2019. The programme was graced by Dr. Trilochan Mohapatra, Secretary (DARE) and Director General, ICAR, New Delhi as the chief guest. The chief guest congratulated ICAR-CCARI and ACAR, Old Goa for successfully organizing the first 'Coastal Agri Expo 2019' and urged to continue to organize such event in future for the benefit of farmers and other stakeholders. Dr. N. P. Singh appreciated the efforts and greeted for successful organization of the event. The participants of the Expo, farmers, students of the schools and colleges and volunteers were felicitated during the occasion.

Swachha Bharat Abhiyan

Under Swachh Bharat Abhiyan or Clean India Mission, Govt. of India, the Institute organized a series of events to emphasize the importance of the cleanliness.

The scientists, administrative, technical, supporting, SRFs, RAs and contractual staff of the Institute and Krishi Vigyan Kendra have actively participated in the cleanliness drives organized.

The following events were organized in two phases as part of Swachha Bharat Abhiyan.

Date	Programme
15-09-2018	Pledge taking ceremony and launching of Swachhta Hi Seva 2018 (SHS) Monitoring System at the Institute. Display of Banners " <i>Swachhta Hi Seva</i> " at Main Entrance, Office Entrance and KVK Entrance.
17-09-2018	All employees devoted 2 hrs in cleaning and sweeping their respective sections, laboratories, corridors and the entire campus.
18-09-2018	Housekeeping activities in laboratories, corridors and office premises.
18-09-2018	Awareness campaign for all the Staff Members on segregation of solid waste into non-biodegradable and biodegradable waste, for better sanitation practices like using a toilet, hand-washing, health and hygiene awareness
19-09-2018	Beautification of Children's Park.
20-09-2018	Cleaning of streets, drains and surrounding areas outside through awareness drive, conducted vllage or school-level rallies to generate awareness about sanitation.
22-09-2018	Conducted door-to-door meetings to bringout change in sanitation behaviours in the ICAR Quarters, segregation of solid waste into non-biodegradable and biodegradable waste.
24-09-2018	Waste collection drive, mobilized community to build compost pits.
25-09-2018	Conducted rally for generating awareness about cleanliness in Old Goa Village, street play based on cleanliness at the Gandhi Circle , Old Goa, and distribution of pamphlets.
26-09-2018	Planting of trees in the campus.
27-09-2018	Organised waste-collection drives in households and common or shared spaces.
28-09-2018	Cleaning the surrounding areas of the main office building.
29-08-2018	Toilet construction activities including pit making.
01-10-2018	Cleaning the areas surrounding KVK campus.
03-10-2018	Award Ceremony to recognize the contributions of the outstanding performers.

Pledge taking ceremony

Institute cleaning activities

Phase-II

Date	Activities
16-12-2018	Taking Swachhta pledge, display of banner at prominent places, stock taking and briefing of the activities to be organized during the plantation of trees
17-12-2012	Basic maintenance: stock taking on digitization of office records/e-office implementation, cleanliness drive including cleaning of offices, corridors and premises, review of progress on weeding out old records, disposing of old and obsolete furniture, junk materials, white washing/painting.
18-12-2018	Cleanliness and sanitation drive within campus and surroundings including residential colonies, common market places. Stock taking of biodegradable and non-biodegradable waste disposal status and providing on the spot solutions.
19-12-2018	Cleanliness and sanitation drive in the villages adopted under the Mera Gaon Mera Gaurav programme or other schemes by ICAR Institutes/KVKs involving village community.
20-12-2018	Stock taking of 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/one nearby village and proving on the spot technology solution.
21-12-2018	Campaign on cleaning of sewerage & water lines,
	awareness on recycling of waste water, water harvesting for agriculture/horticulture application/ kitchen gardens in residential colonies/1-2 nearby villages.
22-12-2018	Organizing Workshops, Exhibitions, technology demonstrations on agricultural technologies for conversion of waste to wealth, safe disposal of all kinds of wastes.
	Debate on cleanliness at the DARE/ICAR establishments, seminars, awareness camps, rallies, street plays and expert talks.
23-12-2018	Farmer's Day - Inviting farmers, experience sharing on swachhta initiatives by farmers and civil society officials. Felicitating farmers/civil society officials for exemplary initiatives on cleanliness.
24-12-2018	Sanitation Campaigns for farmers, farm women and village youth in villages.
25-12-2018	Cleaning of public places, community market places and/or nearby tourist spots.
26-12-2018	Organizing competition and rewarding best offices/residential areas/ campuses on cleanliness. Quiz, Essay & drawing competitions for school children, village youth.
27-12-2018	Promoting clean and green technologies and organic farming practices in community places and on the spot redressal of issues.
28-12-2018	Awareness on recycling of waste water, water harvesting for agriculture/horticulture application/ kitchen gardens in residential colonies outside campuses/nearby villages with the involvement of local/village communities.
29-12-2018	Visits of community waste disposal sites/compost pits, cleaning and creating awareness on treatment & safe disposal of bio-degradable/non-biodegradable wastes by involving civil/farming community.
30-12-2018	Involvement of VIP/VVIPs, print and electronic media to ensure adequate publicity on <i>Swachhta Pakhwada</i> .
31-12-2018	Organisation of press conference for highlighting the activities of Swachh Bharat Pakhwada by involving all stake holders including farmers/VIPs press and electronic media.

संस्थान के राजभाषा प्रकोष्ठ की गतिविधियां

संस्थान में राजभाषा के प्रचार – प्रसार तथा भारत सरकार की राजभाषा नीति का अनुकरण व प्रसार करने हेतु राजभाषा प्रकोष्ठ की स्थापना की गई है । हिन्दी के प्रयोग तथा प्रधानता के आधार पर राजभाषा विभाग, भारत सरकार द्वारा विभक्त किए गए तीन भौगोलिक क्षेत्रों में से हमारा संस्थान 'ग' क्षेत्र में स्थित है तथा इसे राजभाषा अधिनियम की धारा 10 (4) के अंतर्गत केंद्रीय गजट में अधिसूचित किया जा चुका है।

राजभाषा अधिनियम व राजभाषा नियम के अनुसार संस्थान में राजभाषा—संबधी कार्यों की समीक्षा तथा राजभाषा के प्रयोग को गति प्रदान करने हेतु संस्थान के निदेशक की अध्यक्षता में राजभाषा कार्यान्वयन समिति गठित की गई है, जिसमे विभिन्न अनुभागों के वैज्ञानिकों, तकनीकी कर्मचारियों तथा प्रशासनिक कर्मचारियों को शामिल किया गया है । राजभाषा कार्यान्वयन समिति की त्रैमासिक बैठक आहुत की जाती है, जिसमे राजभाषा—संबंधी कार्य—कलापों की समीक्षा की जाती है तथा राजभाषा कार्यान्वयन में आने वाली बाधाएँ एवं उनके निदान के उपायों पर चर्चा की जाती है । राजभाषा कार्यान्वयन समिति राजभाषा विभाग, भारत सरकार के वार्षिक कार्यक्रम में निर्धारित लक्ष्यों की प्राप्ति हेतु समुचित प्रयास सुनिश्चित करती है तथा समय—समय पर किए गए प्रयासों की समीक्षा भी करती है।

पुरस्कार

 भा.कृ.अनु.प. – केन्द्रीय तटीय कृषि अनुसंधान संस्थान, गोवा को क्षेत्रीय कार्यान्वयन कार्यालय (पश्चिम) गृह मंत्रालय, राजभाषा विभाग, भारत सरकार द्वारा क्षेत्रीय राजभाषा पुरस्कार के प्रथम पुरस्कार से सम्मानित किया गया।

2) भा.कृ.अनु.प. मुख्यालय द्वारा वर्ष 2016–17 के राजर्षि टंडन राजभाषा पुरस्कार, 'ग' क्षेत्र में स्थित संस्थानों मे द्वितीय पुरस्कार से सम्मानित किया गया।

हिन्दी पखवाड़ा

संस्थान द्वारा हिन्दी पखवाड़े का आयोजन दिनांक 12.09.2018

से 29.09.2018 तक किया गया। हिन्दी पखवाड़े का शुभारंभ दिनांक 12.09.2018 को शाम 03:30 बजे संस्थान के सम्मेलन कक्ष में किया गया। तत्पश्चात संस्थान के राजभाषा कार्यान्वयन समिति की बैठक आहूत की गयी।

राजभाषा कार्यान्वयन समिति की बैठक में राजभाषा के प्रचार – प्रसार तथा कार्यालय में राजभाषा के अधिकाधिक प्रयोग पर चर्चा की गयी। साथ ही हिन्दी पखवाड़े के दौरान आयोजित विभिन्न प्रतियोगिताओं तथा कार्यक्रम की रूपरेखा निर्धारित की गयी।

संस्थान द्वारा आयोजित हिन्दी पखवाड़े का समापन समारोह दिनांक 29.09.2018 को मध्यान्ह 02:30 बजे से संस्थान के सम्मेलन कक्ष में किया गया । समापन समारोह मे मुख्य अथिति श्री राकेश शर्मा, हिन्दी अधिकारी, राष्ट्रीय समुद्र विज्ञान संस्थान उपस्थित थे। इस अवसर पर पखवाड़े में विभिन्न प्रतियोगिताएँ जैसे की सुलेख, गायन, वाद विवाद, निबंध लेखन आदि मे विजयी प्रतिभागियों को पुरस्कृत किया गया ।

हिन्दी पखवाड़े के दौरान दिनांक 18.09.2018 से 29.09.2018 को आयोजित किए गये कार्यक्रम इस प्रकार हैं:

दिनांक 18.09.2018 गायन–संस्वर कविता–पाठन प्रतियोगिता – सभी कर्मचारियों तथा संविदा कर्मचारियों के लिए

दिनांक 19.09.2018 सामान्य ज्ञान प्रश्नोत्तरी का प्रथम दौर–राउंड

दिनांक 20.09.2018 सुलेख प्रतियोगिता

दिनांक 22.09.2018 बच्चों के लिए विभिन्न प्रतियोगिताएँ

दिनांक 24.09.2018 हिन्दी में कार्य करने हेतु कार्यशाला

दिनांक 25.09.2018 निबंध-लेखन प्रतियोगिता

दिनांक 26.09.2018 सामान्य ज्ञान प्रश्नोत्तरी का अंतिम दौर –राउंड – प्रथम दौर में अहर्ता प्राप्त कर्मचारियों के लिए

दिनांक 27.09.2018 आशुभाषण प्रतियोगिता

दिनांक 28.09.2018 हिन्दी टिप्पण एवं प्रारूप लेखन प्रतियोगिता

दिनांक 29.09.2018 हिन्दी पखवाड़े का समापन तथा पुरस्कार वितरण

निदेशक महोदय राजर्षि टंडन राजभाषा पुरस्कार 2016–17 स्विकृत करते हुए।

हिन्दी पखवाड़े का शुभारंभ

Events

Days celebrated

Foundation Day

Foundation Day was celebrated at the Institute on 7th April 2018. Dr. Promod Sawant, Honorable Speaker-Goa Legislative Assembly was the chief guest. An exhibition was organized to showcase the significant technologies developed and research work carried out by the Institute. Dr. EB Chakurkar, Director, ICAR-CCARI, welcomed the chief guest and participants and gave a brief presentation about the Institute, its activities and output. Shri Nelson Figueiredo, Director, Department of Agriculture, Govt. of Goa and Dr. Santosh V Desai, Director, Department of AH&VS, Govt. of Goa were also present during the celebration. Progressive farmers were felicitated during the programme. On

the occasion, the staff of the Institute were awarded with various annual awards and ex-staff of the Institute were also felicitated.

Seed Day

Institute organised 'Seed Day' at Cotigao village in South Goa on 16th June 2018 and distributed the seeds of Sahbhagi dhan, an upland rice variety for the tribal farmers. Shri Narendra Sawaikar, Hon. Member of Parliament, South Goa, graced the programme along with Dr EB Chakurkar, Director (A), ICAR- CCARI, Old Goa. Thirteen quintal seeds of Sahbhagi dhan was distributed to 80 tribal farmers along with other inputs like fertilizers and plant protection chemicals so as to cover 30-35 hectare under front line demonstration

International Yoga Day

ICAR–CCARI celebrated Fourth International Day of Yoga on 21st June 2018. Shri. Shailendra Gupta, certified Yoga Instructor was chief guest for the function. He gave a speech on Yoga and its health benefits. He along with staff members also performed many asanas.

Sadbhavana Diwas

In order to promote National Integration and Communal Harmony among people of all religions, languages and regions *Sadbhavana Diwas* was observed on 20th August, 2018. The *Sadbhavana Pledge* was taken by staff along with Director of the institute.

Agriculture Education Day

Agriculture Education Day was celebrated at Institute, on 4th December, 2018. Shri. Narendra Sawaikar, Hon. Member of Parliament (South Goa) was the chief guest of the function Dr. EB Chakurkar, Director, ICAR - CCARI briefed about the programme and initiatives taken by ICAR - CCARI to inculcate the importance agricultural education among the students.. An essay competition was organized on the topic of 'Importance of agriculture in India' among schools in Old Goa. The event received an overwhelming response from students. The scientific and technical staff of ICAR- CCARI and KVK, North Goa and teachers and students of Old Goa Educational

Institute, Old Goa and Madkaikar Navchaitanya High School, Corlim Goa participated in the event.

90 《

World Coconut day

World Coconut day celebrations were held from 30th August to 2nd Sep 2018. An exhibition of coconut varieties, climbing machine, products was displayed. Training program on Virgin coconut oil was also organized.

Vigilance Awareness Week

Vigilance Awareness Week was observed at the Institute from 29th October to 3rd November, 2018 on the theme Eradicate corruption: Build a new India. Dr. EB Chakurkar, Director gave pledge to all staff members to eradicate corruption. As part of vigilance awareness week, an essay writing competition was organized on 31 October, 2018. A silent rally to create vigilance awareness by distributing handouts in Hindi and English on slogans to tourists at Heritage site of Old Goa Church at Old Goa was held.

World Soil Day

World Soil Day was celebrated at Sal village on 5th December 2018. Shri. Meghyam, Sarpanch, Sal village, Shri . Bhave, ZAO Bicholim, Mrs. Anuja, Branch Manager, SBI, Sal and Dr. EB Chakurkar, Director, ICAR-CCARI graced the occasion. About 300 Soil health cards were distributed to the farmers from village Sal.

International Women's Day

International Women's Day was celebrated at the Institute on 8th March, 2019. On this occasion, all the Staff Members witnessed the Hon'ble Prime Minister's live address. Dr. Leena Naik, MD Pathologist was the chief guest for the function. She delivered a talk on *Health and Diet*.

Inaugurations

Inauguration of Agro-ecotourism Unit and Poultry parent and brooder shed

Dr. Trilochan Mohapatra, Secretary, DARE, Govt. of India and Director General, ICAR, New Delhi visited ICAR-CCARI, Old Goa on 28th July 2018 along with Dr. S K Chaudhari, ADG (SWM), ICAR and Dr. RN Chatterjee, Director, ICAR-DPR, Hyderabad. Hon. Director General inaugurated the Agroecotourism Unit and Poultry parent and brooder shed. Foundation stone for the establishement of '*Central Instrumentation Facility'* was also laid by him. Dr EB Chakurkar, Director coordinated the field visit and explained all the ongoing research activities.

The Agro-Ecotourism unit was opened to the public at the hands of Mr. Deepak Narvekar, Senior Manager

Dr. AR Bhattacharyya Farmers Exhibition Hall

Dr. Trilochan Mohapatra, Secretary (DARE) and Director General, ICAR, New Delhi inaugurated the Dr. AR Bhattacharyya Farmers' Exhibition Hall on 2nd March at the institute along with Dr. SK Chaudhari, ADG (SWM), ICAR, Dr. MB Chetti, Vice Chancellor, UAS, Dharwad and Dr. NP Singh, Director ICAR-NIASM, Baramati, Maharashtra.

(Public Relations and Marketing), GTDC Ltd, Panaji, Goa on 16th August 2018. The other dignitaries present for this function were Mr. Suyash Asthana, DGM, SBI, Panaji and Dr. EB Chakurkar, Director of the institute.

Participation in exhibitions

International Day for Biological Diversity

Institute participated in the exhibition for celebrating International Day for Biological Diversity at Parisram Damodar Raikar Hall, Margao from 22nd to 23rd May 2018. Dr. EB Chakurkar, Director of the institute gave a lecture on Artificial Insemination in pigs and also distributed certificates to all participants. Institute showcased the bioresources such as germplasm of rice, cashew, mango, kokum, fish, cattle and pig in Goa.

International Science Festival-2018

Konkan Fruit Fest-2018

Institute participated in Konkan Fruit Fest-2018, organized by Botanical Society of Goa at Ravindra Bhavan, Margao, during 20th to 22nd April 2018. During the exhibition, the technologies developed by the institute were on displayed for the benefit of farmers. Quality planting materials, vermicompost and post harvest products like virgin coconut oil, kokum squash, rose apple squash, jackfruit pickle, nutmeg pericarp taffy and cashew apple crunch were sold to public.

State Level Kisan Mela

Institute participated in State Level Kisan Mela and Farmer's Innovation Meet held at ICAR- CAZRI, Jodhpur from 13th to 15th September 2018. Shri. Gajendra Singh Shekhawat, Minister of State for Agriculture and Farmers Welfare, Govt. of India inaugurated event. Various posters on the technologies and germplam, and products developed by the institute were displayed at the exhibilition stall. During the programme more then 10,000 farmers and farm women visited Kisan Mela.

Information and prototypes of potential commercializable technologies developed by this Institute were showcased and demonstrated at International Science Festival-2018 (IISF), Goa held at CSIR- National Institute of Oceanography, (NIO), Dona Paula, Goa on 25th September 2018. Shri. Shripad Naik, Hon. Union Minister of State for Ayush inaugurated the Festival.

Goa Krishi Kranti exhibition

Institute participated in the Goa Krishi Kranti exhibition held at Dhuler Farm, Mapusa from 18th to 20th December 2018. The exhibition was inaugurated by Shri. Shripad Naik Hon. Union Minister for State for Ayush, along with other dignitaries, Shri. Vijay Sardesai, Hon. Agricultural Minister, Govt. of Goa, Shri. Michael Lobo, Hon. Deputy Speaker, Govt. of Goa and Shri .Vinoda Palienkar, Hon. WRD Minister, Govt. of Goa. Dr. E. B. Chakurkar, Director, briefed the dignitaries about the technologies and other activities of the Institute.

Other events

Annual Games

As a part of the recreation club activities, the 2nd Annual Games of ICAR-CCARI, Goa were held from 1st July to 14th August 2018 at the Institute. Dr. E.B. Chakurkar, Director (A), inaugurated the games on 1st July, 2018 and wished all the participants and asked them to show their talents and excel in the sports events. The various games included were Chess, carroms, and table tennis and the winners are as follows:

Blood donation camp

Second Blood donation camp was organised in collaboration with Goa Medical College on 3rd Janauary 2019. Around 50 staff (both permanent and contractual) and their family members participated in the noble cause conducted under the supervision of Dr. EB Chakurkar (A), Director, ICAR-CCARI. Doctors and staff from Goa Medical College participated in the

Events		l place	ll place	III place
Commons	Men	Dilkush Velip	Shripad Shirodkar	Agostinho Fernandes
Carrom	Women	Pratibha Sawant	Montia Rita D'silva	Madina Solapuri
Table	Men	Ravi Kadam	Agostinho Fernandes	Manohara KK
Tennis	Women	Priya Narvekar	Rubina Naik	Mathala Juliet Gupta
Chess	Men	Payak Padkar	Satin Velip	Yogesh Bhomkar
	Women	Maneesha SR	Shreya Barve	Sobin Gupta

Participation in ICAR – Zonal & Interzonal Sports Meet

The ICAR Zonal sports meet 2018 (West zone) was held at ICAR-IGFRI, Jhansi, between 5th and 8th October 2018. The group of 14 members from ICAR-CCARI participated in the events such as football, volleyball, carrom, chess and athletics. Shri. Agostinho Fernandes secured II place in Carroms and Shri. Anil Khandeparkar secured II place in 1500 m race and the institute team secured first place in football and qualified for the ICAR-Inter Zonal finals. Institute team has also received the *Fair Play Award*.

The Inter zonal sports tournament 2018 was held at ICAR-IVRI, Izatnagar from 25th to 28th February 2019. The group of 14 members participated in football, carroms and 1500 m race. Shri. Edward Crasta was the Cheif de Mission and Shri. Agostinho Fernendes was the manger for the Institute sports team.

»» 93

Distinguished Visitors

Dr. Trilochan Mohapatra, Secretary, DARE, Govt. of India and DG, ICAR, New Delhi visited the institute on 28th July 2018 and inaugurated the Agro-Eco Tourism centre in presence of Dr. SK Chaudhari, ADG (SWM), ICAR and Dr. RN Chatterjee, Director, ICAR-DPR, Hyderabad.

Dr. Trilochan Mohapatra, Secretary, DARE, Govt. of India and DG, ICAR visited the Institute from 2nd to 4th March 2019 and inaugurated the Coastal Agri Expo and Dr. AR Bhattacharyya Farmers Exhibition Hall.

Hon. DG, iCAR inaugurates the Agro-eco tourism unit

Shri. Chhabilendra Roul, Special Secretary, DARE, Govt. of India and Secretary, ICAR, New Delhi visited the Institute on 17th October 2018. He visited the Agroecotourism Unit developed by the Institute at the 'Block A'. Shri Chhabilendra Roul addressed the staff of the Institute and elaborated various initiatives taken by the council to expedite the administrative processes and make it more transparent.

Visit of Special Secretary, DARE to the Institute

Date	Name of Visitor	Designation/Institute/Place
07-04-2018	Dr. Promod Sawant	Hon Speaker Goal egislative Assembly
07-04-2018	Shri Nelson	Director Department of Agriculture Govt of Goa
07 04 2010	Figueiredo	Director, Department of Agriculture, Govt. of Gou
07-04-2018	Dr. Santosh V Desai	Director, Department of AH and VS, Govt. of Goa
05-05-2018	Shri. Govind Gawade	Hon. Minister for Tribal Welfare, Government of Goa
19-06-2018		
05-05-2018	Shri. Narendra	Hon. Member of Parliament South Goa
04-12-2018	Sawaikar	
05-07-2018	Dr. CH Srinavasa Rao	Director, ICAR- NAARM, Hyderabad
28-07-2018	Dr. SK Chaudhari	Assistant Director General (SWM), ICAR, New Delhi
16-11-2018		
04-03-2019		
16-08-2018	Mr Deepak Narvekar	Senior Manager (Public Relations and Marketing), GTDC Ltd, Panaji, Goa
16-08-2018	Mr. Suyash Asthana,	Deputy General Manager, State Bank of India, Panaji, Goa
22-10-2018	Dr. MB Chetti	Vice Chancellor, University of Agricultural Sciences, Dharwad,
04-03-2019		Karnataka
04-03-2019	Dr. NP Singh	Director, ICAR–National Institute of Abiotic Stress Management, Baramati, Maharashtra
04-03-2019	Shri. Madhav Kelkar	Director, Directorate of Agriculture, Government of Goa.

Committees and Meetings

Quinquennial Review Team

Director General, ICAR constituted the 5th Quinquennial Review Team (QRT) in respect of ICAR – Central Coastal Agricultural Research Institute, Goa vide Office order no. NRM/7-2/2018-IA-II dated 31 May, 2018 to review the work done by the Institute from 1/04/2013 to 31/03/2018. The constitution of the QRT is as under.

Dr. Tapas Bhattacharya	Former Vice Chancellor, Dr. BSKKV, Dapoli, Ratnagiri District – 415712 Maharashtra	Chairman
Dr. SR Das	Honorary Professor, Department of Plant Breeding & Genetics, Orissa University of Agriculture & Technology, Bhubaneshwar - 751003	Member
Dr. M Anandraj	Ex- Director ICAR- IISR, Calicat, 48A "Madhoovan" 2nd Main Railway Men Layout Thanisandra Bangalore - 560077	Member
Dr. SMK Naqvi	Ex Director, ICAR- Central Sheep & Wool Research Institute, Avikanagar, Via Jaipur – 304501, Rajasthan	Member
Dr. Sreenath Dixit	Dy. Head & Principal Scientist, International Crops Research Institute for the Semi – Arid Tropics (ICRISAT), Patancheru, Hyderabad, Telangana - 502324	Member
Dr. Z Abraham	Ex- OIC, NBPGR Centre, B-104, Gardenia Jasminoides, 2 nd Cross, Lakshmaiah Layout, Opposite Agara Lake, Horamavu, Bengaluru, 560113	Member
Dr. M Thangam	Principal Scientist (Horticulture), ICAR – CCARI, Old Goa	Member Secretary

The first meeting of 5th Quinquennial Review Team (QRT) was held from 29th to 30th July 2018 at the institute. The meeting was attended by Dr. SR Das, Dr. M Anandraj, Dr. SMK Naqvi, Dr. Sreenath Dixit and Dr. Z Abraham. Dr. E. B. Chakurkar, Director of the institute briefed the house about the Institute, status of Coastal agriculture, ongoing research projects and the research achievements.

The second meeting was held on 4th October 2018 under the chairmanship of Dr. Tapas Bhattacharya, Vice Chancellor, Dr.BSKKV, Dapoli. The following members attended the meeting Dr. SR Das, Dr. SMK Naqvi and Dr. Z Abraham. As per the suggestions of chairman, special invitees *viz.*, Dr. PM Haldankar, Director of Research, Dr. BSKKV, Dapoli and Dr. PC Haldavanekar, Associate Dean, College of Horticulture, Mulde, Maharashtra also attended the meeting to discuss the possibilities of collaboration with the institute in various research, academic, development and extension activities.

QRT meeting held at ICAR-CCARI

> 95

Research Advisory Committee

The VIII Research Advisory Committee (RAC) for ICAR- Central Coastal Agricultural Research Institute was constituted for a period of three years from 11/08/2017 to 10/08/2020. The composition of RAC is given below.

1.	Dr. SS Magar	Ex- Vice Chancellor, Dr BSKKV, Dapoli, Runabandh Housing Society, Near Kotibagi Hospital, Aundh, Pune – 411008, Maharashtra	Chairman
2.	Dr. BB Deshpande	Ex- Dean, College of Veterinary & Animal Sciences, Parbhani Flat No 2, Raviraj Apartment, Umaji Colony, Bansilal Nagar, Aurangabad - Maharashtra	Member
3.	Dr. PN Jagdev	Dean of Research, Orissa University of Agriculture & Technology, Plot No. MIG-141, Phase -1, Khandagiri Housing Board Colony, Kolathia, Bhubaneshwar - 751030, Odisha	Member
4.	Dr. AM Gosawami	Former Head, Division of Horticulture, IARI, 40/7 (Pocket 40, House No 07), C R Park, New Delhi - 110019	Member
5.	Dr. SD Singh	Former ADG (Inland Fisheries), ICAR 5/85, Viram Khand, Gomti Nagar, Lucknow- 226010, Uttar Pradesh	Member
6.	Shri. Babu Narhari Komarpant	Near Dhavlikar Hospital, Devbag, Palolem, Cancona, Goa- 403702	Member
7.	Shri. Shrirang Venktesh Jamble	Sawai, P.O. Verem Ponda - 403401	Member
8.	Dr. S Bhaskar	Assistant Director General (Agronomy/ Agroforestry) NRM, ICAR, KAB-II, Pusa, New Delhi	Member
8.	Dr. EB Chakurkar	Director (A), ICAR-CCARI, Old Goa	Member
9.	Dr. R Ramesh	Principal Scientist, ICAR-CCARI, Old Goa	Member Secretary

The second meeting of the VIII RAC was held from 16th to 17th November 2018 at ICAR–CCARI, Old Goa. The meeting was chaired by Dr. SS Magar, Chairman, and attended by members, Dr. AM Goswami, Dr. SD Singh, Dr. PN Jagdev, Dr. SK Chaudhary, Shri. Shriranga Venkatesh Jamble, Shri. Babu Narahari Komarpant, Dr. EB Chakurkar and Dr. R Ramesh, Member Secretary, along with scientists of the Institute and subject matter specialists from KVK, North Goa.

At the outset, Dr. EB Chakurkar, Director of the Institute gave welcome address and highlighted the research achievements of the Institute. Then, Dr. SS Magar, Chairman, addressed the gathering. A presentation of action taken report on recommendations of last RAC meeting was made by R. Ramesh, Member Secretary. Presentations were made by all the scientists and Programme Co-ordinator, KVK on transfer of technology, highlighting the research and extension activities carried out by them during the last year. A field trip was also organised to Regional Fruit Research Station, Vengurla, Dr. BSKKV, Dapoli to interact with the scientists on germplasm conservation, mass propagation and value addition. The Agro-eco tourism centre maintained by the research station was also visited by the RAC members.
The approved RAC recommendations are as follows

- 1. Technologies may be developed keeping in view of optimum use of resources like water, energy, inputs and labour to maximize the system productivity and farmer's income.
- 2. Participatory approach with local bodies may be encouraged to preserve biodiversity of crops, livestock and fisheries. Promising germplasm may be registered with PPV& FRA and other concerned National Bureaus.
- 3. IFS for different farm holding sizes and the proportion of integration of different components may be studied. Agro-eco tourism with processing facility may be included as a part of IFS to improve the output of IFS/ farm income.



The 29th Annual Institute Research Council meeting of the Institute was held from 24th to 25th April 2018 at the Institute. The meeting was chaired by Dr. EB Chakurkar, Director of the Institute. He welcomed all the scientists and highlighted about the importance of this meeting. He emphasized upon transfer of technology to the farmer's field and publication of research findings in peer reviewed journals.

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 2017-18 and finalized the technical programmes of the ongoing research projects for the year 2018-19. The details of IRC are as follows



4. Soil, water and nutrient loss in the coastal areas may be studied in relation to slope and land use.

Dr. EB Chakurkar Director (A), CAR - CCARI, Old Goa	-	Chairman
All Project Leaders	-	Members
Dr. GR Mahajan Scientist (Soil Science) CAR–CCARI, Old Goa	-	Member Secretary

Mid- Institute Research Council Meeting was held during 1-2nd November, 2018 in the conference hall of the Institute. Dr. EB Chakurkar, Director (A) and Chairman, IRC chaired all the technical sessions. All the Scientists and members, IRC participated in the meeting and presented brief about the progress made in the research project in brief and the further work to be accomplished.





Institute Management Committee

The Institute Management Committee is constituted for financial and administrative guidance to the Institute by the council for a period of three years from 20/03/2017 to 19/03/ 2020. The 48th meeting of the IMC was held at the Institute on 6th October, 2018. The composition of IMC is as follows:

Dr. EB Chakurkar	Director, ICAR-CCARI, Old Goa	Chairman
Dr. Nelson Figueiredo	Director of Agriculture Directorate of Agriculture, Government of Goa, Krishi Bhawan, Tonca, Carnzzalem, Goa.	Member
Dr. PC Haldavanekar	Associate Director of Research, Dr. BS KKV, Dapoli Regional Fruit Research Station, Vengurle- 416 516, Maharahtra	Member
Dr. H Basavaraj	Prof. of Economics & Controller, University of Agricultural Sciences, Krishinagar, Dharwad. Karnataka	Member
Dr. Jagdish Rane	Head, School of Drought Strees Management, ICAR-NIASM, Baramati	Member
Dr. Pradip Dey	Project Coordinator, ICAR-Indian Institute of Soil Science, Nabi Bagh, Berasia Road, Bhopal – 462038, Madhya Pradesh	Member
Dr. SK Mishra	Principal Scientist, ICAR-CARI, Regional Centre, P.O. Baramunda, Bhubaneswar-751003, Odisha.	Member
Dr. TK Behera	Principal Scientist (Horticulture), Division of Vegetable Science, ICAR- Indian Agricultural Research Institute, New Delhi -110 0012	Member
Shri. SV Jambhale	Savai (Ghano), Verem, Ponda, Goa-403401	Member
Shri. BN Komarpant	Near Dhavalikar Hospital, Devabag Palolem, Canacona, Goa-403702	Member
ADG (AG & AF)	ICAR, KAB-II, New Delhi -12	Member
The Finance & Accounts Officer	ICAR-NIASM, Baramati, Maharshtra	Member
Shri. Somnath	Administrative Officer, ICAR-CCARI, Goa	Member Secretary

Scientist Farmers Interactive Meeting

Training and Education Center, of ICAR – IVRI, Pune in collaboration with ICAR-CCARI, Goa has organised Interface meeting of scientists with Veterinary Officers of Department of Animal Husbandry and Veterinary Services, Goa, Veterinary Officers of Goa state cooperative milk producers Union, Ponda and progressive farmers at ICAR-CCARI from 30th to 31st August, 2018.

During the meeting technologies developed by ICAR-IVRI, were described followed by animal nutrition related technologies were briefed and surgical management of fractures were demonstrated. The participants were also sensitised regarding organic



livestock farming. The officials also visited goshalas' in Valpoi and Sekeri and distributed deworming agents and other animal health suppliments for the benifit of animals housed in goshalas.

Personnel

No.	Name	Designation	Additional Charge			
Resear	Research Management					
1.	Dr. EB Chakurkar	Director (Acting)	Animal and Fishery Science			
Scient	ific Staff					
2.	Dr. V Arunachalam	Principal Scientist (Horticulture)	Vigilance officer			
3.	Dr. AR Desai	Principal Scientist (Horticulture)	Horticultural Science			
4.	Dr. M Thangam	Principal Scientist (Horticulture)	ORT			
5.	Dr. R Ramesh	Principal Scientist (Plant Pathology)	Crop Science AKMU Cell, RAC			
6.	Dr. S Priva Devi	Principal Scientist (Horticulture)	RKVY			
7.	Dr. Manohara KK	Senior Scientist (Plant Breeding)				
8.	Dr. Mathala Juliet Gupta	Scientist (Agricultural Structures and Process Engineering)	TSP, SCSP			
9.	Dr. Maruthadurai R	Scientist (Agricultural Entomology)	Library			
10	Dr. R Soloman Rajkumar	Scientist (LPT)				
11.	Dr. Susitha Raikumar	Scientist (Veterinary Pathology)				
12.	Dr. Shiyasharanappa N	Scientist (Veterinary Pathology)				
13.	Dr. Mahajan GR	Scientist (Soil Science)	NRM Section, IRC, PMF/ PIMS			
14	Dr. Gokuldas PP	Scientist (Animal Reproduction and Gynaecology)	IPR			
15	Dr. Sreekanth GB	Scientist (Fisheries Resource Management)				
16	Ms Maneesha SR	Scientist (Fruit Science)				
17	Dr Chethan Kumar HB	Scientist (Veterinary Public Health)				
18	Dr. Banna Das	Scientist (Agricultural Meteorology)				
10.	Dr. Paramesha V	Scientist (Agronomy)				
20	Dr. Suieet Desai	Scientist (Land and Water Management Engineering)				
20.	Dr. Nibedita Navak	Scientist (Poultry Science)				
Techni		Science,				
1	Ms Madina Sollanuri	Senior Technical Officer (Estate)				
2	Mr. Vinod Ubarhande	Farm Superintendent				
3	Mr. Rahul Kulkarni	Senior Technical Officer (Agronomy)				
۶. ۵	Mr. Sidharth K Marathe	Senior Technical Officer (PME Cell)	PRO			
5	Mr. Edward Crasta	Technical Officer (Stockman)				
5. 6	Ms. Praniali Wadekar	Technical Officer (AKMU)				
7	Mr. Voganand Gaude	Technical Officer (Electrical)				
7. 8	Mr. Suresh M Gomes	Senior Technical Assistant (Tractor Driver)				
9.	Mr. Omar Illroy Francisco De Ursula	Technical Assistant				
10.	Mr. Prakash Parwar	Technician				
11.	Mr. Gokuldas Gawas	Technician				
12	Mr. Data Velip	Technician				
13.	Mr. Laxman Naik	Technician				
Admin	istrative & Accounts Staff					
1.	Mr. Somnath	Administrative Officer				
2.	Mr. Saurabh Muni	Finance & Accounts Officer				
3.	Ms. Lizette Maria Carmel Noronha	Private Secretary				
4.	Ms. Montia Rita D'Silva	Assistant Administrative Officer	Estt./ Bills			
5.	Mr. Agostinho Fernandes	Assistant Administrative Officer	Store/ DDO/Vehicle			
6.	Ms. Sneha Arlekar	Assistant Administrative Officer	Works			
7.	Ms. Pratibha Sawant	Assistant				
8.	Ms. Sohini Sawant	Assistant				
9.	Ms. Tarika Ussapkar	Personal Assistant				
10.	Mr. Vinod Pagi	UDC				



11	Ms Bushra Sayed	Stenographer Grade.III		
12.	Ms Chitra Kankonkar	LDC		
13.	Mr. Vyas Hiren Kumar	LDC		
14.	Ms Sujata S Kamble	LDC		
Skilled	d Supporting Staff			
1.	Mr. Subhash Melekar		13.	Ms. Rekha U Naik,
2.	Mr. Dhaku Kankonkar		14.	Ms. Lalita Naik
3.	Mr. Dugu Khandeparkar		15.	Ms. Pratibha Folkar
4	Mr. Ashok Gadekar		16.	Mr. Vilas P Gaonkar
5.	Mr. Ravi S Kadam		17.	Mr. Prabhakar Goankar
6.	Mr. Chimmnu Tivrekar		18.	Mr. Sitaram Kuncolikar
7.	Mr. Anil Khandeparkar		19.	Ms. Janika S Shirodkar
8.	Ms. Maria S Dias		20.	Mr. Shanu G Velip
9.	Mr. Giri Madkaikar		21.	Mr. Nitin J Naik
10.	Mr. Gokuldas Kasker		22.	Mr. Mayur N Mandrekar
11.	Mr. Umesh Marcelkar		23.	Ms. Swati R Khandeparkar
12.	Ms. Prafulla Khandeparkar		24.	Mr. Pralhad H Zambaulikar

ICAR-KRISHI VIGYAN KENDRA

No.	Name	Designation	Additional Charge
Technical Staff			
1	Mr. HRC Prabhu	Subject Matter Specialist T-9 (Plant Protection)	Programme Co-ordinator
2.	Ms. Sunetra Talaulikar	Subject Matter Specialist T-9 (Home Science)	
3.	Dr. Sanjay Kumar Udharwar	Subject Matter Specialist T-6 (Animal Science)	
4.	Dr. Monica Singh	Subject Matter Specialist T-6 (Agricultural Extension)	
5.	Mr. Shashi Vishwakarma	Technical Officer	
б.	Mr. Vishwjeet Prajapati	Technical Officer	
7.	Mr. Irappa M Chalawadi	Driver-cum-Mechanic T-5	
8.	Mr. Dilkush Velip	Driver T-2	
Admi	nistrative Staff		
1.	Mr. Vishwas Sharma	Assistant	
2.	Ms. Shreya C Barve	Stenographer Grade. III	
Skilled Supporting Staff			
1.	Mr. Payak J Padkar		
2.	Ms. Sarita Kedo Shelko		

STAFF ACTIVITIES

Foreign Deputation

Dr. Shivasharanappa N, Scientist (Veterinary Pathology) deputed for Fulbright Post-Doctoral Fellowship-2018 for a period of 12 months from 01-09-2018 to 31-08-2019 at North Carolina State University, Raleigh, USA.

Dr. Mathala Juliet Gupta, Scientist (AS&PE) of this Institute participated in the "XXX International Horticultural Congress (IHC2018,)" held at Istanbul, Turkey during 12th August, 2018 to 16th August, 2018.

Appointments / Joining

Name	Post	Date of Joining
Mr. Mahendra Pandit Sonawane	Technician	01-01-2019
Dr. Monica Singh	Subject Matter Specialist (Agri Ext.)	18-03-2019



Promotions

Name/designation of the Officials	Granted higher Grade Pay in the Pay band / level	Date of promotion
Dr. Manohara KK, Sr. Scientist (Plant Breeding)	Level 12	21-04-2018
Smt. Lizette Noronha, Private Secretary	Level 8 (MACPS)	14-02-2019
Shri Irappa M Chalwadi, Driver-cum Mechanic T-3	Level 05	07-11-2013
Shri Prakash Parwar, Technician	Level 04	11-01-2018
Shri Gokuldas Gawas, Technician	Level 04	11-01-2018
Shri Datta Velip , Technician	Level 04	14-01-2018
Shri Laxman Naik, Technician	Level 04	11-02-2018
Shri Umesh Marcelkar, SSS	Level 4 (MACPS)	21-06-2018
Smt. Prafulla Khandeparkar, SSS	Level 4 (MACPS)	24-06-2018
Smt. Rekha V Naik, SSS	Level 4 (MACPS)	24-06-2018
Smt. Lalitha Naik, SSS	Level 4 (MACPS)	24-06-2018
Smt. Pratibha Folkar, SSS	Level 4 (MACPS)	24-06-2018
Shri Ashok Gadekar, SSS	Level 4 (MACPS)	28-06-2018

Transfer

Name	Post held	Transfered to	Date of transfer
Shri Upendra Kumar	Technician	ICAR-IISR, Lucknow	31-08-2018

Superannuation

Name	Post held	Date of Retirement
Shri Vithal Parwar	Skilled Support Staff	31-05-2018

Resignation

Name	Post held	Date of Resignation
Mr. Mahendra Pandit Sonawane	Technician	11-01-2019



Budget 2018-19 (lakh)

	_	TOTAL	Expenditure (Govt.Grant) 2018-19		Expenditure (Revenue	TOTAL	
No.	Head	ALLOCATION 2018-19	TSP	SCSP	Other than NEH & TSP	Generation) 2018-19	EXPENDITURE 2018-19
1	Works	0.00	0.00	0.00	0.00	0.00	0.00
2	Equipments	33.07	4.99	7.30	20.54	0.00	32.83
3	Livestock	0.25	0.00	0.00	0.24	0.00	0.24
4	Furniture & fixtures	1.25	0.00	0.00	1.18	0.00	1.18
5	Capital	34.57	4.99	7.30	21.77	0.00	34.07
6	Establishment Expenses(Salaries)	757.18	0.00	0.00	744.25	5.54	749.79
7	Pension & Other Retirement Benefits	40.00	0.00	0.00	31.29	0.00	31.29
8	Traveling Allowance	19.00	0.00	0.00	18.97	0.00	18.97
9	Research & Operatinal Expen	ses					
	A. Research Expenses	89.00	0.00	0.00	85.98	2.82	88.80
	B. Operational Expenses	167.00			149.96	16.13	166.09
	Total - Research & Operational Expenses	256.00	0.00	0.00	235.94	189.95	254.89
10	Administrative Expenses						
	A. Infrastructure	105.50	0.00	0.00	98.48	6.11	104.59
	B. Communication	2.50	0.00	0.00	2.39	0.00	2.39
	i. Equipments,Vehicles & Others	22.50	0.00	0.00	19.45	1.90	21.36
	ii. Minor Works	31.50	0.00	0.00	31.45	0.00	31.45
	C. Others (excluding TA)	61.00	0.00	0.00	57.97	2.68	60.65
	Total - Administrative Expenses	22300	0.00	0.00	209.75	10.70	220.45
11	Miscellaneous Expenses						
	A. HRD	5.50	0.00	0.00	5.18	0.00	5.18
	B. Publicity & Exhibitions	2.00	0.00	0.00	1.99	0.00	1.99
	C. Guest House – Maintenance	14.00	0.00	0.00	11.90	1.02	12.90
	D. Other Miscellaneous	47.42	4.71	41.20	0.49	0.00	46.41
	Total - Miscellaneous Expenses	68.92	4.71	41.20	19.57	1.02	66.50
	TotalGrants in Aid - General	606.92	4.71	41.20	515.52	30.66	592.09
	Grand Total (Capital + Establishment+General)	1398.67	9.69	48.52	1281.54	36.21	1375.96







NM -I1





Tamsuli-2



42-7-3



Kurcherium-9



42-7-1

Ó









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

Agr#search with a Buman touch

CT V