2018-19
ANNUAL REPORT

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ICAR-CENTRAL ISLAND AGRICULTURAL RESEARCH INSTITUTE

(Indian Council of Agricultural Research)
Port Blair – 744 101,
Andaman & Nicobar Islands, India

भाकृअनुप
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PREFACE

I am happy to present the Annual Report of ICAR- Central Island Agricultural Research Institute, Port Blair for year 2018-2019 with appreciative research outcome in agriculture and allied fields for the benefit of the farmers, youths, policy makers and other stakeholders of the Island and mainland.

With an aim to increase the productivity, production and quality of Field, Agri- Horticulture-Fish and livestock specific and time bound R&D activities were undertaken during the period. A joint exploration and collection mission targeting horticulturally important crop wild relatives from Great Nicobar, Little Nicobar and Nancowrie group of Islands was undertaken, wherein 213 important wild/cultivated horticulturally important plant species were collected. Preliminary analysis indicated presence of more than 24 new records of these plants. Technology for open field cultivation of *Arachnis flosaeris*(Spider Orchid) for year round production was standardized .Five unique rice land races (Black Burma, Khushbayya, White Burma, Mushley and Nyaw-in) grown by Karen community of North & Middle Andaman got registered as farmers' varieties by PPVFRA, New Delhi. Hay, haylage and silage production technology for rice fodder from C-14-8 variety was developed. Under NICRA-CGP project, performance of coconut + banana and other arable crops in tsunami affected lands were evaluated under different land shaping methods. Phenotypic and molecular characterization of Andaman local duck is the first report from India and also the genetic root of Trinket cattle beside whole mitochondrial DNA of Andaman Buffalo has been sequenced and characterized. A new species of snake head *Channa royi* was reported which is the first description, since 1935 of a new freshwater fish species from the Islands with integrated taxonomy. Further new records of Snapper, *Lutjanus xanthopinnis* and marine goby *Amblygobius phaleana* was also first report for the Islands and India respectively. One Patent on methods of determining sex of non-ratite birds has been filed during the period. Case study revealed that Noni cultivation across Andaman & Nicobar Islands for avocation in challenged areas after *T*sunami 2004 has increased from 18 ha to 97 ha under single firm, fetching a BC ratio of 1.39. Under Mera Gaon Mera Gaurav 57 villages across all the three districts of Andaman & Nicobar Islands were adopted.

One hundred four agromet advisory bulletins in English and Hindi were issued through print and electronic media. Six hundred and nine SMS based agro-advisories were sent on every Tuesday and Friday both in Hindi and English. Policy Brief's on the development of open sea cage culture, marine fisheries sector of the Island and EDP on coconut was prepared and shared with the stakeholders.

Umbrella memorandum of understanding was signed between ICAR-CIARI and West Bengal University of Agriculture & Fisheries Science, Kolkata, Bidhan Chandra Krishi Viswa Vidyalaya, Nadia, Tamil Nadu Jayalalitha Fisheries University, Chennai and OUAT, Bhubaneshwar for the purpose of conducting research related to the thesis requirement of the students who are pursing MVSC/MFSC/PhD programme from the Island and Mainland.

In order to strengthen our R,D & Extension activities various events were conducted like Awareness building and sensitization on health, nutrition and environment of Nicobari tribals from 20th and 21st April, 2018 with NASI, ICAR 3rd Interactive meet of Nodal Officers of SAUs/ CUs/DUs on 4th and 5th May, 2018, World coconut day and EDP on coconut on 3rd September, 2018, Mahila kisan diwas on 15th October, 2018, Vigilance awareness week from 29th October, to 3rd November, IPSACON on 15th to 17th November, 2018, National Minicoy festival on 12th & 13th January, 2019 at Minicoy, Recent advances in orchidology with special emphasis on biology, climate change, conservation and commercialization of floriculturally and therapeutically important taxa and Orchid show on 15th to 17th February, 2019 with TOSI, District kisan mela on 25th February, 2019 with A & N Administration, 41st Foundation day of the Institute, Swachh Bharat Abhiyan Pakhwara, Hindi Workshop. Half Yearly Meeting of TOLIC, awareness/ health camp, exposure visit to student and official etc. To accomplish the extended mandate of serving the Island ecosystem research needs in agriculture and allied sectors of India, CIARI has spread its activities into Lakshadweep Islands.

Further, an Inter Coordination Committee between ICAR-CIARI and A & N Administration to address to the issues at field level related to agriculture and allied activities and also to provide technological backstopping to A&N Administration was conducted.

The most important event for our Institute was the visit of Hon'ble Vice President of India Shri M. Venkaiah Naidu along with Lieutenant Governor (ANI), Member of Parliament (LS-ANI), Adhyaksha and Zilla Parishad South Andaman and Chief Secretary (A & N Administration) on 5th July, 2018 to attend scientists-farmers interaction.

I take this opportunity to express my deep sense of gratitude to Dr. Trilochan Mohapatra, Secretary, DARE and Director General, ICAR for his visionary leadership, unstinted support and guidance to meet the emerging challenges. I am grateful to Dr. A.K. Singh, Deputy Director General (Horticultural Science) who has been our source of inspiration and advising us constantly on future course of action to address the emergent issues related to research and programmes of the institute. I am honoured by Professor S.K. Sharma, Chairman (RAC) and the esteemed members for their constructive suggestion in redefining the research activities as per the need of the farmers and the policy makers. I am thankful to Dr. Wasaka Singh Dhillon and Dr. T.Janakiram, ADGs and all the officers & staff of SMD (Horticultural Science) for rendering support on various issues related to the Institute.

I am thankful to the Former Hon'ble Lt. Governor, A.K. Singh and present Lt. Governor, A & N Islands, Admiral Devendra Kumar Joshi, PVSM, AVSM, YSM, NM, VSM, ADC (Retd.), Shri Bishnu Pada Ray, Hon'ble MP, Andaman and Nicobar Islands, Smt. Baby Fareeda Adyaksha Zilla Parishad, South Andaman, Chief Secretary, Andaman & Nicobar Administration, Secretary (Agriculture, Animal husbandry & Fisheries), A&N Administration, Deputy Commissioner, South, North & Middle and Nicobar District, Directors, Officers of A & N Administration, Chairman & members of Tribal Council, PRI's Lead Bank and NABARD for their continued support and active collaboration.

At the end, I feel privilege to express my gratitude and compliment every staff of this Institute for working together and taking forward deliverable outcomes in research, development and extension activities for enabling doubling farmers income by 2022 on mission mode.

(Anandamoy Kundu)
Director (Acting)
ICAR-CIARI

Dated: 2nd May, 2019

EXECUTIVE SUMMARY

Horticulture & Forestry

- Fruit component studies were carried out in 35 coconut accessions which includes 24 Pacific Ocean collections, six Nicobar collections, three Andaman Dwarf types and two Andaman tall types to evaluate the performance for VCO recovery levels. Among the tall accessions from Pacific Ocean collections, Acc 17 recorded highest VCO recovery of 38% followed by Acc 4 (36.1%) and Acc 13 (34.7%). Higher recovery of VCO was also recorded in the accessions 1, 2 and 28. Among all the dwarf accessions, Acc 18 has recorded the highest VCO recovery of 34.7%. The evaluation revealed wide variation for fruit component traits and the VCO recovery.
- Based on intra-population variability for palm morphology, fruit component traits and VCO recovery among the palms, fruit samples among 49 palms, 12 palms of NLGD (Niu Leka Green Dwarf) were selected for further observations, crossing programme and *inter se* mating.
- A total of 1152 female flowers were pollinated in 18 different Dwarf x Tall cross combinations (involving eight dwarf parents *viz.*, Chandan, Surya, Omkar, Annapurna, AGD, AOD, AYD as female parent and three talls *viz*., CCNT, SNRT and AOT as male parents) of coconut and recorded the overall setting percentage of 35.1 %.
- Based on the palm morphology, yield of fruits, regular bearing, tender nut water volume and taste, Andaman Green Dwarf was identified as potential coconut accession for further exploitation to be developed and released as a variety. The palms of AGD were observed as more vigoruous than the Yellow and Orange dwarfs, regular bearers, bearing dark green attractive bunches, shorter drooping leaves.
- In order to evaluate the coconut types for product diversification, soap making technique using Virgin Coconut Oil was standardized with locally available natural aromatic plant materials such as mango ginger, turmeric, khoonphal, annatto and rose petals.
- Characterization of Andaman Arecanut Dwarf for palm morphological traits and floral traits confirmed the dwarf nature of the accession having potential for use as a genetic stock in arecanut breeding.
- Two years long arecanut based cropping system experiments suggested that banana, elephant foot yam and ginger could be profitably grown as intercrops under island conditions.
- High density planting of eleven black pepper varieties on glyricidia standards was initiated to improve the productivity of coconut orchards.
- In mango, seven elite mangoes were identified and the grafted collections with accession numbers NM1, NM 2, NM 3, NM 4, NM 5, NM 6 and NM 7 are conserved in the germplasm block.
- Four germplasm accessions of Dragon fruit (*Hylocereus sp)* were characterized based on the DUS descriptors and molecular analysis. Comparative phytochemical characterization of dragon fruit accessions revealed that the total phenolic content, flavanoid and β carotene were maximum in the dragon fruit accession DGF 4, whereas the carotenoid and xanthophylls content were highest in the accession DGF 2. The antioxidant activity by DPPH and ABTS were maximum in the accession DGF 4.
- Four local banana varieties namely *Katta Champa*, *Mitta Champa*, *Cheena Kela*, *Kornagi* and two wild banana are conserved. Seven banana varieties Grand Naine, Hill Banana, Populu, Poovan, Ney Poovan, Red Banana, Udhayam and Monthan were collected from National Research Centre for Banana (NRCB), Tiruchirapalli and conserved in the field gene bank for further evaluation.
- *Garcinia dhanikhariensis* was identified as a novel source of anthocyanins while *G. kydia* and *G. cowa* were found to be source of carotenoids. *Garcinia dhanikhariensis* was processed into syrup and sweetened rind, while dehydrated rind of *G. kydia* and *G. cowa* were observed to be potential acidulants.
- Fatty acid methyl ester profiling was carried out in six *Garcinia* species, which suggested dominance of Methyl oleate and Metyl stearate. These native species could be alternative sources for industrial purpose.

- Flowering was observed in three varieties of rambutan. Analysis of fruits of variety N-18 weighed 43 g and had 41.3% pulp and 18 °B TSS .
- Natural fruit set was observed in Annona hybrid Árka Sahan with average fruit weight of 233 g, TSS of 25 °B and 74% pulp recovery.
- Seed germination was standardized in *Garcinia kydia* and 0.1% potassium nitrate treatment for 24 hours was found to be optimum.
- In banana variety Cheena Kela, no effect of carbon source was observed during initial stages and multiplication rate of 2.8-3.4 shoots per inoculum was observed. Macro propagation studies in Cheena Kela revealed that coir pith as substrate and BAP treatment induced higher shoots during first multiplication cycle.
- Comparative evaluation of tissue culture raised plants and suckers indicated that sucker derived plants recorded higher plant height after 8 months of planting.
- For *in vitro* multiplication of *Musa indandamanensis*, seedlings were found to be novel source of explants. Use of Thidiazuron (0.2-0.5 mg/L) could induce 4.74-6.13 microshoots per inoculum during initial multiplication cycle.
- Vermicompost was found to be better substrate for seed germination in *Musa paramjitiana* with 90.7% success and 1703.3 seedling vigour index.
- Germplasm conservation block of endemic wild *Musa* species *viz. M. indandamanensis* and *M. paramjitiana* was established.
- Variations were observed in fruit and seed morphological and physico-chemical parameters in three blood fruit collections from Andaman islands and one from Tripura.
- Anthocyanin profiling of blood fruit pulp was carried out for the first time in the world and pelargonidin and cyanidin were found to be the dominant anthocyanins. Solvent solute ratio of 15:1 was found to be optimum for maximum extraction of anthocyanins.
- Among the five commercial varieties of banana planted in three planting seasons November, 2017 (S3); March 2018 (S1) and July, 2018 (S2) under rainfed system with only organic inputs, fruiting was observed in the varietiy Ney Poovan (501.6 days after planting) and Monthan (548.5 days after planting).
- To augment the genetic resources of vegetable crops for varietal improvement, eleven endemic vegetable crops (used by the local communities) from South Andaman and Nicobar District were collected and conserved at vegetable block of the Institute.
- Seventy diverse accessions of chilli collected from Andaman & Nicobar Island are under conservation, characterization and evaluation for quantitative and qualitative traits.
- Tuber crop exploration were made at Rutland, Jirkatang, Baratang of South Andaman, Rangat, Maya bunder of Middle & North Andaman, Great Nicobar and Nancowrie group of Islands and 33 accessions of different tuber crops were collected and added to the germplasm holding at the Institute. IC numbers for 10 greater yam (IC-0623824 to 0623833) and 5 colocasia accessions (IC- 0623834 to 0623838) were obtained from NBPGR, New Delhi.A total of 135 accessions are under conservation in the gene bank.
- Exploratory survey was conducted in North and Middle Andaman and 10 species of orchids were collected and conserved in the Orchidarium. Among the species collected, *Eria andamanica* is an endemic orchid of the Island and is a threatened species.One accession each of *Dendrobium anceps, Rhyncostylis retusa, Eria* spp*, Agrostophyllum* spp*, Spathoglottis* spp*, Vanilla* spp*, Dendrobium crumenatum, Cymbidium* spp, *Pholidota* spp, *Eulophia* spp*, Bulbophyllum* spp*, Dendrobium aphyllum and Papilionanthe* spp were collected from Nicobar District and conserved for further multiplication.
- Technology was standardized for open field cultivation of *Arachnis flosaeris*(Spider Orchid) for year round production.

- Seed germination and propagation was standardized for *Rhopaloblaste augusta,* an endemic palm having ornamental value.
- Vaselife studies conducted in different flower crops using 21 different treatments has revealed that Hi foliar solution @ 0.5% recorded maximum shelf life in Spider Orchid (7.5 days) and *Alpinia* (7 days). Silver Nitrate @ 20 ppm gave maximum (6 days) shelf life in *Etlingera*.
- Three released varieties of marigold from IARI, New Delhi were evaluated for performance under Andaman condition. Early flowering (26.5 days after transplanting) was recorded in Pusa Deep followed by 31.3 days in Pusa Arpita.
- Evaluation of entries of china aster Arka Aadhya, Arka Archana, Arka Kamini, Arka Poornima with check varieties Local Pink and Local White indicated early flowering in the varieties Arka Kamini (30.3 days after planting) followed by Arka Archana (44.5 days).
- A new block of three varieties of noni was developed and maintained at Garacharma farm for its evaluation. Further, three new accessions of Noni were collected from Terassa, Katchal and Little Nicobar Islands and conserved at CIARI germplasm block.
- Identified 10 locations of woody pepper in Little, Middle and North Andaman through exploration. Phytochemical analysis as affected by stem thickness was carried out in woody pepper powder, which revealed that methanolic extract of thin sized stem pieces had maximum total phenolic content.
- Fatty acid profiling in wild nutmeg species revealed methyl myristate as dominant compound in *Myristica andamanica*, *Knema andamanica* and *Horsfieldia glabra*. Profile of Knema andamanica had similarity with that of cultivated nutmeg.
- Black pepper varietal evaluation during earlier stages suggested superiority of Panchami in terms of green yield.
- Studies in leaves of improved varieties of cinnamon suggested that Konkan Tej and Konkan Tejpat had highest leaf biomass and dry recovery percentage. Total phenolic content was higher in all five improved varieties than the local seedlings.
- Quality analysis of samples of clove suggested that sample collected from Katchal had highest oil content, oleoresin percentage and *p*-Eugenol than samples collected from Andaman group of islands.
- Quality analysis in nutmeg samples suggested that sample collected from Miletilak had highest oil content, whereas myristicin was highest in sample from Katchal.
- Clove leaf and pedicel were found to be potential sources of essential oil and the Eugenol content was in the order leaf > pedicel > bud. Fallen leaves of clove were found to have 3.2-3.6% essential oil content.
- Micropropagation protocol was standardized in mango ginger and dextrose (3%) as carbon source and meta-topolin (2mg/L) as cytokinin could induce 13.7 shoots per inoculum. Further, single step concurrent *ex vitro* rooting cum hardening was standardized.
- Dehydrated shreds of mango ginger were prepared using different drying methods. Sun drying and oven drying at 50 degree centigrade were rated superior for phytochemical and sensory parameters.
- To evaluate the biomass production potential of different multi purpose trees (MPT's) under coconut garden *Sesbania grandiflora, Leucaena leucocephala, Dendralobium undullatum, Pterocarpus dalbergioides, Bahuinia spp, Sterculia villosa, Casuarina equisetifolia, Morinda citrifolia, Sagaria elliptica, Diospyros marmorata, Callophyllum inophyllum and Pongamia pinnata* were planted.
- Padauk (*Pterocarpus dalbergioides* Roxb.) a principal timber tree endemic to the Andaman was used for regeneration and molecular characterization works under a new DBT project. Initial exploratory survey work for identification of plus trees was conducted from South Andaman District and identified seven plus trees. Seeds and stem cuttings collected from selected trees, pretreated and planted in nursery for further evaluation. First sprouting from stem cuttings were observed sixteenth day after planting.

- The planting material production was taken up during this period in plantation crops (coconut, arecanut), spices (Black Pepper, Nutmeg, Clove, Cinnamon, Ginger, Turmeric), fruits (Dragon fruit, West Indian cherry, Carambola, Bael, Garcinia, Acid lime), vegetables (Broad dhaniya, Poi, Amaranthus, Brinjal, Coccinea), tuber crops (Sweet potato, Greater yam, Tapioca), flowers/ ornamental plants (Marigold, tuberose, anthurium, orchids, foliage plants etc) and forestry/industrial crops (Noni, multi-purpose tress etc). About 9250 units of elite planting material of horticulturally, important crop/tree as listed of above and about 950 kg of seed tubers/ rhizomes of Elephant Foot yam, ginger and turmeric were produced and supplied to the farmers. Multiplied and produced the quality planting materials of Black pepper (45000), clove (5000), Cinnamon (6000), Ginger (1200 kg) and Turmeric (2000 Kg).
- A joint exploration and collection mission targeting horticulturally important crop wild relatives from Great Nicobar, Little Nicobar and Nancowrie group of Islands was undertaken. Through this collection mission, a total of 213 important wild/cultivated horticulturally important plant species comprising several accessions of *Mangifera* spp, *Piper* spp, *Artocarpus* spp, *Garcinia* spp, wild *Musa* spp, different wild cucurbits, a rare ash gourd, ginger, turmeric, *Alocasia* spp, *Colocasia* spp, greater yam, sweet potato, *Bixa* sp, different endemic leafy vegetable plants, orchidaceous plants, edible fern species, *Casuarina* spp, *Cardia* sp, *Myristica* spp, *Rhopaloblaste* sp, *Bentickia nicobarica*, wild/ cultivated *Areca* spp, *Syzigium* sp, *Alpinia* sp, *Amorphophalu s*sp, wild *Jasminum* spp, *Citrus* spp, *Vigna Marina,* diverse *Etilingera* spp, *Eclipta alba*, *Knema andamanica*, *Moringa* sp, *Morinda citrifolia* and *Horsfeldiairya.* Preliminary analysis indicated presence of more than 24 new records of these plants.

Field Crops Improvement & Protection

- Five unique rice land races (Black Burma, Khushbayya, White Burma, Mushley and Nyaw-in) grown by Karen community of North & Middle Andaman registered as farmers' varieties by PPVFRA, New Delhi.
- Under salinity rice trials conducted, the genotypes *viz*. CSR2016 IR18-1 and KS-12 were found significantly better (3.17 t/ha) than the best check, CST 7-1 (2.13 t/ha) in terms of grain yield.
- A total of 26 kg of Nucleus Seed and 157 kg of Breeder Seed of improved rice varieties were produced at Bloomsdale Research Farm, ICAR-CIARI, Port Blair during *Kharif* 2018-19.
- Under farmers participatory seed production 59.42 quintal Truthfully Labelled (TFL) seeds of rice was produced during *Kharif* 2018. Besides, 4.01 quintal TFL seed of Mungbean and Urdbean were produced during *Rabi* 2018-19.
- Leaf samples of 15 Beachpea genotypes were collected across Andaman Islands. Among seven primers used for salinity tolerance gene, only two primers (CEDG087 and CEDG007) showed polymorphism among 20 *Vigna* genotypes including checks.
- Among 16 hybrid oyster mushroom strains tested for yield and bio-efficacy under island conditions, P-1808 showed better performance followed by P1802, P1804 and P18106.
- The genus and species identity of multi-potential bacillus species were confirmed through *rpoB* gene confirmation and PCR screening for the presence of three polyketide biosynthesis genes in 12 multi-potential *bacilli* . Revealed four bacilli to possess all three genes studied.
- Farmer field evaluation on application of CIARI Bio-consortia in brinjal fields of North and South Andaman was found effective in suppression of bacterial wilt disease (85-99%) and increased the yield from three to four times.
- Out of 12 bacilli isolates subjected to temperature and salt stress tolerance assays *in vitro* condition, all the *Bacillus* colonies could be revived in dilutions above 10^{-5} under 55ºC and 60ºC, whereas, five isolates showed regular growth pattern at 10% salt stress.
- Survey conducted in 15 locations of South Andaman revealed 35-68% leaf curl disease incidence under natural conditions. Leaf samples from fourteen symptomatic and three asymptomatic plants were first tested for begomo-virus infection with Squash leaf curl virus (SLCV) antiserum (DSMZ, Germany) through dot immune binding assay (DIBA) with help of ICAR-IIVR, Varanasi.

- Totally, 15 quintal TFL seed of HYVs of rice, 1.27 quintal seeds of HYVs of pulses and 0.5 Kg seeds of brinjal were distributed to tribal farmers of Little Andaman, Campbell Bay and Car Nicobar.

Natural Resource Management

- Hay, haylage and silage production technology for rice fodder from C-14-8 variety was developed.
- During the year (January-December 2018), rains were normal in both Andaman & Nicobar Islands (ANI) and Lakshadweep islands (LDI). However, S-W monsoon rain (553.2 mm) was deficit by 45% (998.5 mm mean) in LDI and North-East (NE) monsoon (856.9 mm) was 23% excess (mean: 695.9 mm) in ANI.
- Evaluation of 4 IET lines of rice along with 3 checks indicated superior grain yields of hybrid check 'KRH-4' over all other entries and checks. It has 8 and 28% higher yield than the next best (IET-26263) and least performer (CARI Dhan-6).
- Polythene mulching and chopped arecanut leaf mulching for effective weed management in areca nut was developed.
- Utility of weeds as goat feed (*Mimosa pudica*) and vermicompost raw material (*Parthenium, Limnochara, Cyperus*) established.
- Under NICRA-CGP project, performance of coconut + banana and other arable crops in tsunami affected lands were evaluated under different land shaping methods. Six piggery, one each of duckery and goatery unit established. Raft cultivation technology for leafy vegetables from waterlogged areas were demonstrated. Direct wet seeding technology of rice demonstrated with two farmers.
- Growth media for soil less cultivation of vegetables standardised. For soil less culture of tomato and cucumber, recommended dose of fertilizers were necessary. In nutrient film technique (NFT) hydroponic system, performance of lettuce and spinach was assessed.
- Organic farming study on coconut based cropping system was initiated at Garacharma farm.
- During 2018-19, 104 agromet bulletins and 609 SMS based agro-advisories were issued. Forecasted weather was compared with actual data with varying accuracies ranging between 60 to 65%.
- Through microbial consortia rapid decomposition of organic residues into nutrient dense vermicompost was demonstrated to 10 farmers.
- Vulnerability assessment of Andaman Islands based on land form, elevation, land use and salinity hazard in a GIS framework has shown 18 and 14% of area under very high and high vulnerability category. Soil salinization and waterlogging are the major processes of land degradation.
- Green house gases emission and carbon sequestration was theoretically assessed for low land and coconut based farming system.
- During the year, 495 vegetable samples were collected for analysis of pesticide residues.
- Bio-accessibility of total phenolic content, flavonoid content and antioxidant capacity of noni (powder and juice) through *In-vitro* gastro-intestinal digestion was studied.
- Through a survey on 58 families from 10 villages, consumption pattern and level of post harvest losses in fruits and vegetables were assessed.
- Two training-cum-demonstration programme on value addition of mango, pine apple, bael, coconut and noni were conducted during the year benefiting 75 participants.
- Under STC, six lined dug out ponds were developed in tribal areas.

Animal Science

- Breeding and growing performance of Vanaraja breeders were assessed to evaluate the performance under island ecosystem. Result showed that, age at sexual maturity was 178 days with an average egg weight of 35.16 ± 11.8 gm. The flock attained 5% egg production at the age of 157 days. The average body weight of the birds during the period of 24-45 weeks of age ranged from 3.35 ± 0.095 to 4.10 ± 0.057 kg for males and 2.35 ± 0.044 to 3.20 ± 0.076 kg for females. Growing performance of Vanaraja breeders were assessed from 0 to 20 weeks. At 20th week of age both male and female attained more than 10 kg of body weight.

- Production and reproduction performances of Gramapriya breeders were assessed on the basis of hen-day-egg production (HDEP) and hatchability percentage. HDEP was highest in 48th week and lowest in 24th week. Whereas hatchability percentage of Gramapriya breeder was maximum in 36th week and lowest in 24th week.
- Production and distribution of Vanaraja and Gramapriya germplasm benefitted 107 beneficiaries of Andaman and Nicobar Islands and Rs.97250.00 was earned as revenue.
- Economics of Vanaraja poultry rearing was assessed in farmer's field and cost benefit ratio was 1:2.5.
- Backward and forward linkage was established for sustainable duck production in North and Middle Andaman by producing hatchable duck eggs, its inhouse production and finally distribution of ducklings to other farmers. A total of 14 hatches were completed with mean hatchability percentage of 14.9%. Further analysis revealed that, percentage hatchability calculated on the basis of fertility was 57.8% which is comparable to hatchability percentage of rural poultry eggs in incubator.
- Phenotypic and molecular characterization of Andaman local duck is the 1st report from India. Phenotypic characterization of the duck were done on the basis of colour of plumage, feather, bill and shank as well as economic traits of birds.
- Genotypic characterization on the basis of partial D-loop sequences revealed that Andaman local duck were close to local ducks of the Indonesia. The result of the study will be helpful in future for development of breeding strategy of Andaman local duck for their future conservation.
- Through intervention of AICRP on goat improvement, there was overall increases in goat population through scientific breeding strategy and disease management. Kidding percentage on the basis of does kidded was 155.97% in 2018-19 compared to 155.77% in 2017-18. Litter size also increased to 1.56 in 2018-19 compared to 1.54 in the 2017-18.
- Hatchability and correlated study of Andaman local goat were carried out using animal model by Wombat software, high genetic (0.778± 0.14) and phenotypic (0.64±0.05) correlation was found between the body weights attained during 6 month and 9 month of age which indicated the suitability of selection based on the 6 month body weight.
- Soil and fodder across the wet and dry seasons in South Andaman were deficient in copper (Cu), zinc (Zn) and iron (Fe), which indirectly indicated that such pictures of soil wave system may affect the health of animal and human as well.
- Foot and mouth disease (FMD) outbreak in South Andaman in cattle was seen during the year 2018 with morbidity of 85-90%. However, mortality was less than 2%. Analysis of clinical samples revealed that infection was due to O serotype of virus which was confirmed by ELISA and multiplex PCR.
- Result of DIVA ELISA indicated that 11.12% sera samples of cattle were positive. The high titre of DIVA ELISA might be due to the recent outbreak of FMD reported in South Andaman. The herd immunity during the year of outbreak of FMD was found to be only 41% (Type O), 38% (Type A) and 44% (Type Asia-1). The poor protective antibody titre indicated that the animals were susceptible to FMD virus infection.
- Pharmaco assessment of ethno veterinary medicine for controlling poultry diseases with 4 identified plants *viz*., kuyavu, chem-rev, to-ku-ro-tong and to-ki-ti-nyn were done on E.coli isolated from poultry birds on the basis of zone of inhibition through anti biogram of herbal methanolic extracts. All the four plants had antibacterial activity, out of them, to-ki-ti-nyn and kuvavu were identified as alternate to antibiotics.
- A total of four medicinal plants used by the tribal community for treatment of anthelminths and gastro intestinal helminths were identified which are commonly known as tokurotong, marvalu, hakonpookore and meiutaneuyo.

- With the aim of selection and conservation of native Nicobari fowl for immunity under different seasons, haem agglutination titre (HA) was assessed after inoculation of goat RBC. HA titre was more in short shank length Nicobari fowl after 1st week of inoculation compared to long shank length Nicobari fowl. However, from the 2nd week onwards, values of HA titres in both phenotypic were same. This observation indicated that immune response of short and long shank Nicobari fowl was same.
- Non major disease outbreaks were recorded in livestock during the year 2018-19 except clinical cases of contagious ecthyma (orf) disease in goat. During the year a total of 18521 cases of various parasitic, bacterial and viral disease were reported. Parasitic diseases (99%) were of major problems followed by bacterial, viral and protozoal diseases (1%).The main parasitic infestation reported were fasioliasis, amphistomiasis and ascariasis.
- Occurrence of parasitic diseases was comparatively more in South Andaman (53%) followed by North & Middle Andaman (30%) and Nicobar (17%), however, according to the proportion of livestock population density and distribution, number of total parasitic cases are more in Nicobar and lower in N&M Andaman particularly the prevalence of fasioliasis.
- During the year, a total of 2022 sera samples including cattle, goat and pig from South, N & M and Nicobar Islands were screened for presence of antibodies by ELISA and rapid test card against Brucellosis, Infectious bovine rhinotrachitis (IBR), bovine tuberculosis, *Peste des petits ruminants (PPR)*, blue tongue and classical swine fever (CSF). The sero-positivity of CSF was found to be 21.57 %. Moderate risk was recorded for blue tongue with sero positivity of 32.89 %. Low risk was recorded for infectious bovine rhinotrachitis in cattle with sero positivity of 13.61 %. Less risk for bovine tuberculosis was recorded with sero-positivity of 2.0 %. No risk for both cattle and goat brucellosis were reported as the sero-positivity was found to be nil.
- To identify the key role players in bull semen freezability and to reduce the cryo injury on bull spermatozoa" developed RNA extraction protocol from sperm with no DNA contamination and no DNase treatment needed. Intron spanning RPLP primer based real time PCR analysis was developed for the detection of genomic DNA contamination in RNA samples. Comparison of protein precipitation protocols showed that Acetone precipitation yield more compared to other similar approaches as assessed by Bradford assay and UV spectrometry and further confirmed by SDS PAGE. In staining of SDS PAGE, sensitivity of SNAP blue stain was better than commonly used CBB while silver staining was the most sensitive. Sperm proteins were extracted from samples after the RNA extraction using manufactures protocols with some modifications.
- Molecular characterization of Nicobari fowl on the basis of control region of mitochondrial gene revealed that, Nicobari chickens grouped with common haplogroups, E1 (known to be widely distributed maternal lineage), E2 (mainly distributed in domestic chicken of South Asia) and B (widely distributed throughout globe except Africa).
- Genetic root of Trinket cattle has been traced and it was found that it falls under *Bos indicus* haplogroup I2. Whole mitochondrial DNA of Andaman Buffalo has been sequenced and characterized.
- Preliminary study on Andaman local pig revealed that total semen volume, gel in semen and gel free semen volume was 220, 190 and 30 ml, respectively whereas seminal pH was observed to be 7.5. Objective assessment of total and progressive sperm motility was done which were 80 and 75%, respectively. Sperm concentration was $210x10^6$/ml which was counted using hemocytometer chamber. Morphometric measurements of pig spermatozoa with software enabled microscope were performed. Average head length, head width, tail length and full sperm length was observed to be 9.42, 5.24, 43.93 and 52.37 µm, respectively. Evaluation of semen quality parameters is the first report from India and is helpful observation to start with assisted reproductive technology for conservation and propagation of the species.
- External pelvimetric manual method was used to measure the pelvic area to select the suitable animal for breeding purpose as small or disproportioned pelvic area leads to dystocia (difficult in birth). The result of study revealed that as age advanced, the pelvic area has been increased. The optimum age is required to

reach optimum pelvic area was 3-4 years, however, it also depends upon the management and husbandry practices.

- Various reproductive pathological conditions were measured in wet and dry seasons in Andaman and Nicobar Islands. Percentage of incidence of the reproductive disorders was higher percentage in dry than rainy season. Blood, hormone, antioxidant and biochemical profiles were significantly deviated from the normal unaffected animals, clearly indicated that the affected animals were deficient or misbalance/imbalance among the hormone and bio-chemicals. Similarly the oxidative stress was significantly higher in affected animals than normal unaffected animals.
- Walking and dry season stress has significant effect on physiological, heamatological, hormonal, biochemical and oxidative profiles in cattle and goat. Antioxidant profiles are significantly reduced whereas oxidative stress profiles increased in the affected animals.

Fisheries Science

- Wild marine shrimp samples collected from the selected landing centers of North and Middle Andaman, South Andaman and Nicobar Districts gave positive result for Infectious Hypodermal and Hematopoietic Necrosis Virus (IHHNV) and White Spot Syndrome Virus (WSSV) by Polymerase Chain Reaction (PCR). Baseline data has been collected from a total of 307 freshwater fish farms located at 48 different villages of North and South Andaman and necessary advocacies on fish health management were provided to the fish farmers.
- A new species of snake head *Channa royi* was reported and published adding significant information to the aquatic sciences. Further 23 COI barcodes were generated for *C.royi* and submitted to NCBI Gene Bank. Since 1935, *C. royi* is the first description of a new freshwater fish species from the Islands with integrated taxonomy. Further new records of Snapper *Lutjanus xanthopinnis* and marine goby *Amblygobius phaleana* was also first report for the Islands and India respectively.
- A consolidated checklist of freshwater aquatic fauna was prepared through exploratory surveys in Andaman Islands and published during the period. An updated checklist of 57 freshwater aquatic fauna including fishes, crustaceans, and amphibians were reported which included an updated endemic fish checklist of 9 species to the islands.
- Impact analysis of the interventions undertaken at Car Nicobar islands under tribal sub plan was undertaken through structured interviews at Car Nicobar. A database on Tribal sub plan activities for the period of 2012-18 has been prepared and published.
- Policy Brief's on the development of open sea cage culture and marine fisheries sector of the Islands in collaboration with Andaman and Nicobar Administration and other scientific organizations in the islands was prepared.

Social Science

- As climate variability increases and related extreme weather events become more frequent and severe, Agroforestry is increasingly recognized as a sustainable land use in multi-functional landscapes owing to its diverse mitigation, adaptation and economic benefits. *Morinda citrifolia* L. commonly known as Noni, a small tree of varied therapeutic values shows extremely wide range of environmental tolerances making it an invaluable component in various agroforestry systems aimed at climate change adaptation. The case study conducted revealed that in 2006-07, CIARI promoted Noni cultivation across Andaman & Nicobar Islands for avocation in challenged areas after *T*sunami 2004. Since then, the acreage under the technology has increased from 18 ha to 97 ha under single firm. In 10 years, an organic Noni plantation of 14 ha with 10,000 trees amidst arecanut incurs a discounted expenditure and income of Rs.1.09 crore and Rs.1.52 crore respectively fetching a BC ratio of 1.39. As a low input-high value crop, Noni is found to be an ideal choice for alternate/additional source of income from marginal lands.

- Broad Bed & Furrow System of cultivation (BBFS) is being demonstrated across Andaman Islands to exhibit the technology's potential to increase the overall farm yield and ensure a sustainable income throughout the year under challenging conditions. While the establishment of 2 BBFS units, each at Kausalya Nagar and Dasratpurin Middle Andaman are under progress,in the established BBFS at Creekabad in South Andaman the farmer has harvested 2.5 t of brinjal from 656 m^2 bed area and earned a net income of Rs.58,000during 2018 which was hitherto uncultivable due to seawater intrusion after *T*sunami.
- Under the National Extension Programme of IARI, crop varieties of IARI are being evaluated involving KVKs. A total of 42 FLDs were conducted *viz.* 7 in cauliflower var. Pusa Megna, 16 in brinjal var. Pusa Uttam, 9 in mung var. Pusa Vishal and 10 in palak var. Pusa Bharti covering 1.7 ha in South and Middle Andaman; and Car Nicobar.
- Impact of 142 FLDs on promising rice varieties of CIARI covering 56.80 ha across North & Middle Andaman and South Andaman districts were conducted in collaboration with Division of FCI&P and KVKs during *Kharif* 2018. Through random survey among 30 adopter farmers revealed that CIARI rice varieties are performed better (55%) than the local varieties with regard to germination and number of productive tillers, while they show lodging tendency during flooding. CIARI 5, 7 and CSR 36 were preferred varieties along with Gayatri which was introduced earlier. 45% farmers expressed their willingness to increase the acreage under CIARI 5, 7 and CSR 36 owing to their higher yield of 20-25%.
- The policy outlook based on the survey conducted among participants of one-day EDP on coconut value addition has revealed that non-availability of labour for cultural operations as major constraint to farmers while lack of supportive policies/schemes, prospective markets and advanced machinery as the major hindrance to processing industry. As many of them wish to venture into the production of Virgin Coconut Oil, copra and neera & sugar products, they expect various institutional support *viz*. simplified credit procedures and supportive policies. From their suggestions, it has been inferred that location specific processing technologies has to be disseminated considering the resources, infrastructure and market opportunities, market intelligence and quality standards need to be strengthened, organic production of coconut should be projected to get higher price for coconut products of Andaman & Nicobar Islands, drudgery reducing and processing equipment should be introduced to strengthen on-farm and community level processing; and clusters should be formed at community level to strengthen product branding and marketing.
- Under Schedule Tribe component, an awareness building and sensitization programmme on "Health, Nutrition and Environment" for Nicobari tribal farmers has been organized in collaboration with National Academy of Sciences, Allahabad. Consequently, two projects *viz.* piggery and horticulture were sanctioned with the financial outlay of Rs.30 lakhs; for the first time a one-day workshop on "Role of Foldscope Microscopy in minimizing the risk of zoonotic diseases at field level, diagnosis of plant diseases and ensure the personal hygiene of tribal farmers" has been jointly organized by ICAR-NIBSM and ICAR-CIARI for Nicobarese tribal farmers at Harminder Bay; and a field level project has been initiated in collaboration with AAJVS to demonstrate "Homestead based nutritional Kitchen Garden" for Onge tribes. Besides, one Scientist-Farmer Interaction has been organized at the Regional Station in Minicoy, Lakshadweep wherein 300 vegetables kits were distributed to the trainees for growing under backyard to ensure nutritional security for the family. A total of 428 beneficiaries were targeted comprising of Nicobari, Onges & ST farmers of Minicoy through capacity building.
- Mera Gaon Mera Gaurav programme of the Institute was coordinated wherein 13 teams comprising Scientists and Technical Officers of CIARI; and Subject Matter Specialists of Krishi Vigyan Kendras regularly visited 57 villages across all the three districts of Andaman & Nicobar Islands and addressed specific problems through diagnostic services, conducted 32 interface meetings/*Goshthies*, organized 42 trainings, conducted 35 demonstrations, provided 400 mobile based advisories, distributed seeds, planting materials and veterinary medicines as critical inputs.
- Visit of Hon'ble Vice President of India Shri M. Venkaiah Naidu along with Lieutenant Governor (ANI), Member of Parliament (LS-ANI), Adhyaksha and Zilla Parishad South Andaman and Chief Secretary (A

& N Administration); and Minister of State for External Affairs were coordinated to facilitate Scientist-Farmers Interaction and KVK Interface Meeting. Besides, 12 exposure visits by 846 students from the schools located in and around Port Blair; and one exposure visit of 7 officials of HPSDP-JICA-ODA, Himachal Pradesh were coordinated for inculcating scientific temperament in agriculture and allied fields and giving exposure on the Island Farming System respectively.

Krishi Vigyan Kendra, South Andaman

- For the period under report a total of 33 training programmes (vocational and in-service) were conducted of which 12 were "On" and 21 "Off" campus. The target groups trained were practising farmers (441), rural youth/farm women (290), SHGs (210) and the extension functionaries (46), which totalled to (987) in numbers.

- Two 30 days skill development training under Rashtriya Krishi Vikas Yojana (RKVY) through Agriculture Skill Council of India (ASCI) for the job role "Coconut Grower" (200 hrs) and "Small Poultry Farmer" (240 hrs) was held at the ASCI affiliated training centre ICAR-KVK, Sippighat, South Andaman from 20th February to 27th March, 2019.

- Eight 'On Farm Trials' (OFTs) and 13 FLD's were conducted in agriculture and allied fields, beside five field days were conducted on different activities and a total of 164 numbers of beneficiaries got benefitted.

- Twenty five extension activities were performed, wherein 2255 farmers including extension personals from line departments like Agriculture, Animal Husbandry, Fisheries, Industries, ATMA, NCUI, students from Govt. Schools and Colleges of South Andaman District participated. 6 radio talks and 8 DDK programmes were delivered for the benefit of the farmers of the Islands.

- 108 diagnostic visits were made and the problems *viz*. Banana wilt disease, Phomopsis blight, Fruit rot disease in brinjal, Root rot in papaya, Bacterial wilt in brinjal, Leaf eating caterpillar, Pod borer in beans, Downy mildew in cucurbits, Wilt disease in arecanut in South Andaman district were identified and solved.

- A total of twenty two programmes were conducted at different villages in collaboration with CIARI, PRIs and villagers in South Andaman district under Swachh Bharat Programme.

Krishi Vigyan Kendra, Car Nicobar

- Thirteen trainings were conducted wherein a total of 429 farmers including 207 (48%) female got benefited.
- For assessment and refinement of technology relevant to Nicobar, a total of four On Farm Trial were successfully undertaken with participation of 4 tribal farmers. Further, 3 nos. of Front Line Demonstrations (FLDs) with the active participation of three tribal farmers in Okra (Arka Anamika), Intensive Pig Farming and Supplementation of mineral mixture in goats were undertaken. A total of 139 extension activities were carried-out benefiting more than 1465 tribal farmers, students and other stakeholders for agricultural development in Nicobar district.
- Dissemination of agricultural technology relevant to Nicobar was done through Kisan Kalyan Karyashala, celebration of Mahila Kisan Divas, Swachchta Hi Seva, celebration of World Soil Day (WSD), three Live Telecast of Address by Hon'ble Prime Minister of India, Soil Health Card distribution, demonstration on organic kitchen garden and activities under Mera Gaon Mera Gaurav etc. Several programmes were carried out with host Institute to enrich the tribal farmers with skill, knowledge and critical inputs for community development.
- Survey of Trinket cattle and collection of samples for survey of parasitic and livestock diseases were conducted.

Krishi Vigyan Kendra, North and Middle Andaman

- In the year 2018-19, for enrichment of farmers skills and knowledge a total of 35 trainings were conducted in different disciplines of Agriculture *viz.* Agronomy, Horticulture, Animal Science, Fisheries, Agriculture Engineering and Home Science. A total of 1091 farmers including 611 female got benefited from the trainings.
- Eight On Farm Trials (OFT) were conducted which are need based to address local problems of farmers and a total of nine Front Line demonstrations (FLD) were conducted in agriculture and allied aspects for the dissemination of latest technology and skills to the farmers. Beside 06 field days were organized on successful demonstration of technologies in farmers fields.
- A total of 6007 farmers were benefited from the different extension activities like Kisan Ghosthi, Film Shows, Method Demonstrations, Group Meetings, SHGs meeting and Swachh Bharat Abhiyan.
- For creating awareness amongst the farming community live telecast programme of Honble Prime Minister were organized on the topic like interaction with farmers SHGs & farm women and Pradhan Mantri Kisan Samman Nidhi.
- In order to overcome the farmers problems in plant protection, soil health, fish and animal diseases 1022 scientific/diagnostic visit to farmers were made.
- Important events like Seed Day, World Soil Day, Mahila Kisan Diwas, Vigilance Awareness Week, Kisan Diwas, International Women's Day, National Productivity Day, Swachhta Pakhwada and Swachhta Hi Sewa (SHS) were conducted which have established and fostered close liason, mutual trust and participation of farming communities in KVK programmes for acquiring knowledge on latest technologies.
- 1100 Kg of Paddy (CARI varieties) seeds were produced and supplied to the Institue.
- The Institute vegetable, paddy seeds, fish seeds, nursery plants and chicks were supplied to farmers.

INTRODUCTION

ICAR -Central Island Agricultural Research Institute (CIARI)

Central Island Agricultural Research Institute, Port Blair an ICAR unit for A & N Islands, is an unique Institute engaged in multidisciplinary research devoted to the cause of island agriculture and island ecosystem since its inception. It was established on 23rd June 1978 by merging different Regional Research Stations of the ICAR Institutes viz., Central Marine Fisheries Research Institute, Indian Veterinary Research Institute, Indian Agricultural Research Institute and Central Plantation Crops Research Institute.

CIARI caters to the specific needs of agricultural research and development and entrusted with the task of developing technologies for enhancing the productivity and production of crops, livestock and fishery through adoptive and basic research to bridge the gap between requirement and the local production. It has several accomplishments during the last four decades of its service despite various insurmountable constraints. The research activities are carried out under five divisions *viz.,* Natural Resource Management, Horticulture & Forestry, Field Crops Improvement & Protection, Fisheries Science, Animal Science and one Social Science Section. The Institute has its main campus located at Garacharma farm and is spread over 62 ha of land wherein research work related to field crops, horticulture, animal sciences and fresh water fisheries are being carried out. In addition, it has three Krishi Vigyan Kendras located one each at Sippighat, Car Nicobar and Nimbudera covering all the three districts of the Island. One Regional Station at Minicoy have also come into the fold of the Institute.

With the accumulated experience and expertise in Island agriculture, it is envisioned to make a major stride in coming years towards our cherished goal of emerging as the Institute of Excellence on Tropical Island Agriculture in the Asian countries.

Mission

To provide decent livelihood to farm youth from agriculture in a fragile Island ecosystem on sustainable basis.

Vision

The Institute envisages developing agri horticulture, livestock and fisheries sector in a sustainable way through technological innovation in the changing climatic scenario to ensure decent livelihood in the fragile Island ecosystem.

MANDATE

- To provide a research base to improve the productivity of agri-horticulture, livestock and fisheries of Andaman & Nicobar and Lakshadweep group of Islands through basic, applied and adaptive research
- Conservation, characterization and sustainable utilization of natural resources and harnessing through post harvest and value addition
- To standardize technologies for health coverage and bio security of plant, animal and fishery resources
- To standardize techniques for capture and culture fisheries including coastal aquaculture
- Vulnerability studies of Island ecosystem and adaptive strategies to develop climate resilient agriculture
- Transfer of technology, capacity building, policy support and market intelligence to stake holders

Thrust Areas

Broad research programmes are as under:

- Characterization and bio-prospecting of natural Island bio-resources
- Climate proofing Island agriculture for improving productivity
- Development of harvest - post-harvest management practices and value addition
- Policy support research for agriculture development in the Islands

Beside other programmes are:

- Flagship programme on Integrated agriculture system for eco-regions
- Schedule Tribe Component

ORGANISATIONAL SET UP

Administration of the institute rests with the Director, who receives support from both research divisions and administration. The Research Advisory Committee (RAC), Institute Management Committee (IMC) and Institute Research Council (IRC) reviews and monitor the research programmes and facilitates to identify new research thrust areas for the Institute.

STAFF POSITION

Sl. No.	Category	Sanctioned	Filled
1	Scientist	50+1	46
2	Technical	43	27
3	Administrative	25	20
4	Supporting	78	64
	Total	**196 + 1**	**157**

BUDGET UTILIZATION DURING 2018-2019

Head of Account	Annual Plan (in Lakhs)	
Particulars	**Sanction**	**Expenditure**
Establishment charges	1981.46	1964.65
Travelling allowances	31.00	31.00
Recurring contingencies	381.66	381.85
Works (Main)	5.00	5.00
Equipment, furniture & livestock	34.94	34.94
HRD/fellowships	8.89	8.69
Pension	275.35	191.05
TSP	23.00	22.99
SCSP	25.10	22.68
Total	**2766.40**	**2662.85**
P. Loans & Advances	15.00	7.45

ORGANOGRAM

- **Research Advisory Committee (RAC)** → **DIRECTOR**
- **Institute Research Council (IRC)** → **DIRECTOR**
- **Institute Management Committee (IMC)** → **DIRECTOR**

DIRECTOR

- **Research**
  - Divisions & Regional Station
    - Horticulture & Forestry
    - Field Crop Improvement & Protection
    - Natural Resource Management
    - Animal Science
    - Fisheries Science
    - Regional Station Minicoy
  - Section
    - Social Science
- **BUDGET PLAN 25.97 Crores**
- **Supporting Units**
  - Priority setting, Monitoring & Evaluation Cell
  - PG Cell
  - Rajbhasha Cell
  - HRD Cell
  - RTI Cell
  - Administration
  - Finance & Accounts
  - Estate & Workshop
  - Store
  - Security

Extension
- Krishi Vigyan Kendra South Andaman
- Krishi Vigyan Kendra Nicobar
- Krishi Vigyan Kendra Nimbudera
- Dweep Krishi Darpan
- ATIC

Research Farms
- Garacharma (62 ha) Hilly land
- Sippighat (32 ha) Hilly & Brackish water
- Bloomsdale (3.5 ha) Valley land
- Marine Hill Marine Fisheries Lab
- Minicoy, Lakshadweep (5.2 ha)

Central Facility
- Library
- AKMU
- Central Instrumentation Facility
- Sub-Distributed Information Centre
- ITMU
- Guest House

RESEARCH PROGRAMMES

DIVISION OF HORTICULTURE & FORESTRY

Conservation and Utilization of Coconut and Arecanut Genetic Resources of Andaman & Nicobar and Lakshadweep Islands for High Yield and Product Diversification

B. Augustine Jerard, V. Damodaran, I. Jaisankar and S.K. Zamir Ahmed

Evaluation of coconut accessions

Fruit component studies were carried out in 35 coconut accessions which includes 24 Pacific Ocean collections, six Nicobar collections, three Andaman Dwarf types and two Andaman tall types. The fruit component traits and VCO recovery levels are presented in table 1. The husked fruit weight without water was highest in ADGT (857g) followed by Acc.29 (691.8g). The kernel weight was also higher in in ADGT (703.9g) followed by Acc.29 (463g). Among all the dwarf accessions studied, Acc 5 has recorded higher fruit weight, husked fruit weight without water and kernel weight. VCO was recovered from milk extracted from good quality 11 to 12-month-old coconuts from all the accessions using fermentation method at room temperature. Fresh kernel was grated using coconut grater, pulverised using a mixer grinder and the milk was squeezed out using nylon cloth. Milk and water mix at 1:1 ratio was fermented exactly for 18 hours and the VCO was harvested using spoon manually. Among the tall accessions from Pacific Ocean collections Acc 17 recorded highest VCO recovery of 38% followed by Acc 4 (36.1%) and Acc 13 (34.7%). Higher recovery of VCO was also recorded in the accessions 1, 2 and 28. Among all the dwarf accessions, Acc 18 has recorded the highest VCO recovery of 34.7%. The evaluation revealed wide variation for fruit component traits and the VCO recovery. The traits such as dehusked fruit weight and kernel weight are contributing to the VCO yield. But the recovery varies with the level of maturity of nuts as well as the processing of milk. The experiment will be repeated to confirm the variation for VCO recovery. VCO samples from all the 35 coconut samples have been extracted for fatty acid profiling.

Table 1: Fruit component and VCO recovery traits among 35 conserved coconut accessions

Accession	Fruit weight (g)	Husked fruit weight (g)	Husked fruit weight without water (g)	Shell weight (g)	Kernal weight (g)	Milk weight (g)	VCO recovered (g)	Hot oil from curd (g)	VCO recovery (%)	Total oil recovery (%)
Acc 1	811.9	550.9	294.6	108.7	245.4	173.9	79.5	12.8	32.4	37.6
Acc 2	1153.6	750.5	563.3	189.0	372.8	151.0	111.3	54.7	29.9	44.5
Acc 3	880.5	0.0	490.0	146.0	245.1	146.1	59.6	29.8	24.3	36.5
Acc 4	498.9	271.0	218.1	111.3	151.5	135.1	54.7	18.6	36.1	48.4
Acc 5	1390.0	728.8	588.1	261.7	319.3	199.7	41.7	29.2	13.1	22.2
Acc 6	725.0	525.0	500.0	123.8	312.0	154.1	49.7	26.1	15.9	24.3
Acc 7	1182.6	738.8	551.1	186.9	354.1	274.1	29.8	19.9	8.4	14.0
Acc 8	309.4	189.6	173.6	77.3	94.5	22.5	7.5	5.0	7.9	13.1
Acc 9	1350.0	868.8	656.3	243.8	412.5	243.5	100.6	31.1	24.4	31.9
Acc 10	854.5	578.9	451.9	132.0	316.6	176.5	70.8	18.6	22.4	28.3
Acc 11	868.8	575.0	478.8	181.3	300.0	177.8	62.1	18.6	20.7	26.9
Acc 12	847.9	682.5	517.5	141.0	411.3	207.0	55.9	24.9	13.6	19.6
Acc 13	925.5	533.0	415.5	138.5	272.5	177.8	94.4	12.4	34.7	39.2
Acc 14	866.0	580.4	455.1	134.4	311.4	414.0	63.4	24.9	20.4	28.3

Accession	Fruit weight (g)	Husked fruit weight (g)	Husked fruit weight without water (g)	Shell weight (g)	Kernal weight (g)	Milk weight (g)	VCO recovered (g)	Hot oil from curd (g)	VCO recovery (%)	Total oil recovery (%)
Acc 15	1214.6	671.6	489.5	166.9	315.8	214.3	64.6	23.6	20.5	27.9
Acc 16	863.6	618.8	416.5	122.5	336.3	379.9	74.6	12.4	22.2	25.9
Acc 17	886.9	776.8	477.5	119.6	294.1	280.0	111.8	37.3	38.0	50.7
Acc 18	315.8	197.1	163.3	65.5	91.6	59.7	31.8	22.4	34.7	59.1
Acc 19	768.0	573.9	384.4	116.4	221.0	170.5	63.4	13.7	28.7	34.9
Acc 20	1003.8	631.3	481.9	146.3	307.5	304.4	44.7	27.3	14.5	23.4
Acc 21	1175.0	612.5	496.9	145.7	264.3	171.7	60.9	24.9	23.0	32.4
Acc 22	565.4	320.5	256.1	111.1	148.0	89.1	24.9	21.3	16.8	31.2
Acc 23	681.9	490.9	261.1	118.4	223.8	146.1	53.4	12.4	23.9	29.4
Acc 24	587.5	453.8	335.0	133.1	257.5	127.8	62.1	13.7	24.1	29.4
Acc 25	1323.1	694.3	570.5	175.3	442.4	235.4	69.6	36.8	15.7	24.0
Acc 26	745.1	458.6	375.5	127.8	242.9	211.8	48.5	21.7	20.0	28.9
Acc 27	880.0	647.5	568.3	169.1	381.3	233.3	99.4	16.2	26.1	30.3
Acc 28	1068.8	613.1	488.5	165.4	319.0	243.5	94.4	19.9	29.6	35.8
Acc 29	1783.8	916.6	691.8	218.7	463.1	284.1	34.8	19.9	7.5	11.8
Acc 30	1114.1	809.4	577.0	212.4	356.5	243.5	64.0	19.9	17.9	23.5
AGD	526.7	372.2	350.0	120.0	246.7	129.9	47.5	11.0	19.3	23.7
AOD	678.4	448.5	423.7	165.3	250.7	146.1	41.9	9.1	16.7	20.4
AYD	550.0	413.6	346.1	107.4	405.4	129.9	15.2	44.7	3.8	14.8
ADGT	2212.1	1487.7	857.3	390.4	703.9	344.1	87.2	92.8	12.4	25.6
ADOT	1283.3	700.5	484.2	222.7	327.3	215.9	61.3	17.1	18.7	23.9
Mean	939.8	585.2	452.8	157.0	306.2	200.4	61.1	24.1	21.1	29.2
CV (%)	41.33	43.23	32.31	38.28	36.63	41.69	41.8	64.9	40.3	35.8

Intra - population variability among Niu Leka Green Dwarf population

As there was wide intra population variability observed for palm morphology among the Niu Leka Dwarf palms, fruit samples from the 49 palms were assessed for the fruit component traits and VCO recovery. The one season mean, range and co-efficient of variation for the fruit characteristics and VCO traits among the unique Niu Leka Green Dwarf (Acc 5) are given in table 2. The results showed wide range of variation for important traits such as fruit weight, size, kernel weight, milk yield, oil yield and recovery per cent. The fruit weight ranged from 671g to 1895g, kernel weight ranged from 197g to 584g, VCO yield through fermentation method ranged from 9.1g to 103.3g per nut among the individual palms highlighting the need for selection of mother palms for further use. The results also highlight the need to develop uniform populations of Niu Leka Dwarf palms with higher yield and other desirable traits in order to utilize them in crop improvement. Based on the palm morphology, nut component traits and VCO recovery, twelve palms of NLGD were selected for further observations, crossing programme and *inter se* mating.

Table 2: Fruit component and VCO recovery traits among 49 Niu Leka Dwarf palms

Parameters	Mean	Minimum	Maximum	SD	CV%
Fruit weight (g)	1170.7	671.0	1894.5	266.8	22.8
Fruit length (cm)	20.8	15.5	26.5	2.2	10.5
Fruit width (cm)	15.8	13.0	19.1	1.6	10.2
Fruit polar circumfance (cm)	55.6	44.0	67.0	4.6	8.2
Frui equitorial circumference (cm)	49.7	33.0	59.0	5.2	10.4
Husk weight (g)	440.9	183.5	971.5	163.4	37.1
Husk thickness (mm)	22.7	16.9	32.0	3.9	17.3
Husked fruit weight (g) with water	704.8	384.5	1154.5	164.2	23.3
Husked fruit weight (g) without water	532.6	332.0	935.0	110.3	20.7
Kernal weight (g)	337.7	197.0	584.0	70.3	20.8
Shell weight (g)	191.5	101.5	342.0	47.2	24.7
Kernal thickness (mm)	13.8	6.7	17.4	2.1	15.4
Shell thickness (mm)	4.9	2.9	7.9	0.9	18.4
Milk volume (ml)	221.5	115.0	406.5	58.6	26.4
Milk weight (g)	209.8	45.0	296.0	49.4	23.5
Milk recovery (%) from kernel	62.6	13.5	76.1	8.3	13.3
VCO yield (g)	46.8	9.1	103.3	19.6	41.8
Hot oil yield (g)	25.6	11.4	82.3	13.3	51.7
Total oil (g)	71.8	25.1	128.0	20.6	28.7
VCO recovery (%) from kernel	16.8	12.6	25.2	3.2	19.1
VCO recovery from milk (%)	25.5	10.3	43.0	6.9	27.1
Total oil recovery (%) from milk	34.1	12.6	56.2	8.9	26.2

Observations on the intra - population variability for stem traits *Viz.,* girth of stem at different heights, and number of leaf scars (which are the main factors attributed to the dwarfness in coconut) among palms of Niu Leka Green Dwarf coconut population (Plate 1& 2) has revealed wide range of mean and higher co-efficient of variation (Table 3). Variation was also recorded for smoothness of stem, presence and arrangement of leaf scars over the stem. The palm height among the 32 year old palms of this population ranged from 4.11 m to 8.6 m, stem girth at 50 cm height ranged from 0.5 m to 1.9 m and the number of leaf scars in one meter of stem ranged from 15 to 42. The palm height which might be influenced by these stem traits showcase the importance of these traits in exploiting them in breeding for dwarfness in coconut. As the Niu Leka palms are considered as unique coconut dwarf coupled with nut characteristics similar to tall accessions, the study would help in identifying better group of individual palms among Niu Leka population based on the stem traits. Out of 40 palms of original introduction from Fiji and planted at World Coconut Germplasm Center (WCGC), Sipighat during 1986, twelve individual palms were selected based on the present observations on stem traits contributing to dwarfness. The possible outcrosses and non-typical palms in the population could be separated among the conserved palms. The selected palms are to be evaluated and observed for other nut and yield traits for strengthening mass selection of palms for further utilization in breeding programme. The selection could be useful in developing an improved population of Niu Leka Dwarf with desirable traits through *inter se* mating and evaluation. It is important to develop such improved Niu Leka Dwarf population which could be useful in developing compact dwarfs in coconut to address possibly the climbing issues and high density planting in coconut. Selection should also focus on the observations on floral and nut characters as very vast range of variability could be expected for those traits too. The variability for stem traits among NLGD palms are depicted in Fig. 1. The stem traits of NLGD and Andaman Yellow Dwarf (AYD) were compared to test the distinct nature of NLGD (Fig. 2). Generally, the NLGD palms recorded higher values for stem girth, and number of leaf scars per metre of stem indicating the robustness and dwarfness.

Table 3: Stem traits among the individual palms of Niu Leka Green Dwarf

Palm No.	Palm Height (m)	Girth at base (cm)	Girth at 50 cm height of stem (cm)	Girth at 1m height of stem	Number of Leaf scars in 1m of stem
5/3	6.12	198	198	100	26
5/4	4.8	96	90	86	32
5/11	6.12	125	107	107	20
5/94	7.05	126	110	96	20
5/16	5.35	103	113	96	31
5/17	6.33	167	119	102	22
5/18	5.86	113	95	85	20
5/19	6.81	150	127	114	28
5/21	5.13	137	113	105	16
5/22	7.7	114	92	98	19
5/24	5.66	125	109	96	25
5/27	6.74	111	112	109	27
5/78	6.3	111	103	94	16
5/32	7.25	129	93	99	17
5/33	6.97	130	105	96	19
5/38	6.5	119	112	100	24
5/92	8.15	103	91	87	20
5/39	6.75	155	124	107	18
5/41	5.09	150	128	94	18
5/42	5.02	91	94	90	15
5/44	4.64	57	58	56	19
5/45	5.93	168	127	108	18
5/95	8.4	100	50	93	20
5/77	7.09	118	97	97	31
5/47	6.39	120	79	71	22
5/49	5.14	128	85	91	42
5/52	5.75	95	75	84	25
5/54	7.4	135	92	89	18
5/88	5.54	123	118	115	22
5/89	8.6	116	91	92	15
5/61	7.63	118	98	103	27
5/63	7.9	124	116	110	20
5/86	6.86	154	125	86	27
5/80	8	129	117	111	20
5/68	4.11	120	91	88	19
5/70	5.94	113	102	101	17
5/71	8.38	136	113	104	24
5/73	8.5	167	123	108	15

Palm No.	Palm Height (m)	Girth at base (cm)	Girth at 50 cm height of stem (cm)	Girth at 1m height of stem	Number of Leaf scars in 1m of stem
5/96	8.1	91	88	120	15
5/93	6.67	139	120	121	21
Mean	6.57	125.10	105.00	97.73	21.75
CV	18.10	20.51	22.39	12.87	26.13

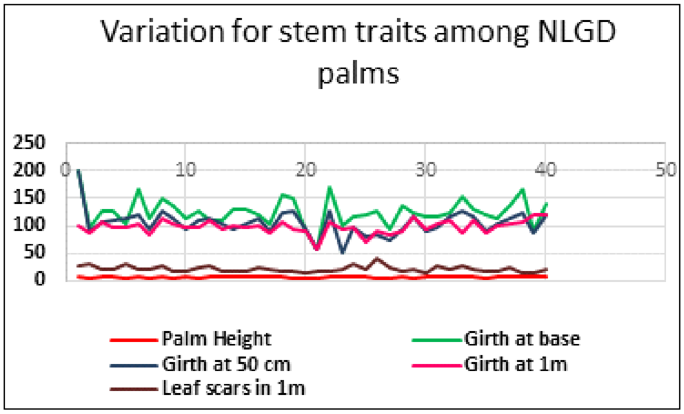

Fig.1: Variation for stem traits among NLGD palms

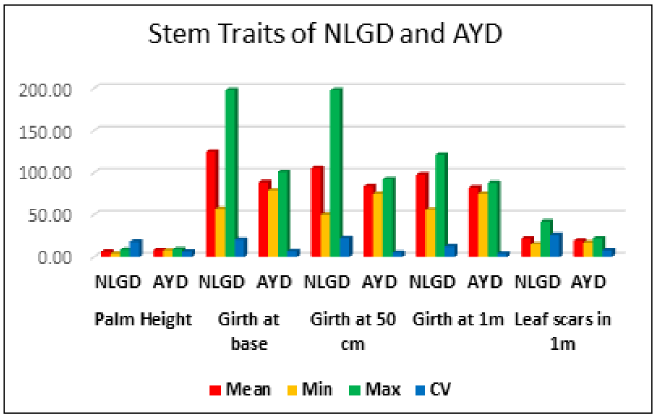

Fig. 2: Comparison of NLGD and AYD for stem traits

Plate 1: Niu Leka Dwarf population at World Coconut Germplasm Centre, ICAR-CIARI

Plate 2: Variation for number of leaf scars and smoothness of stem among NLGD palms

Pollination for development of coconut hybrids

During the year, a total of 1152 female flowers were pollinated in 18 different Dwarfx Tall cross combinations and recorded the overall setting percentage of 35.1%. Eight dwarf parents *viz.,* Chandan, Surya, Omkar, Annapurna, AGD, AOD, AYD were used as female parent and three talls *viz*., CCNT, SNRT and AOT were used as male parents. The pollen of CCNT and SNRT were obtained from ICAR-CPCRI for effecting crossing at ICAR-CIARI. The highest setting percentage of 58.5 was recorded in the cross between Annapurana x CCNT followed by Surya x SNRT and AGD x SNRT. The least setting percent (5.1) was observed in the cross between AYD x AOT (Fig.3). A total of 17 packets of pollen grains from selected Pacific Ocean collections *viz*. Rennel Tall, Niu Leka Green Dwarf and Hari Papua Orange Dwarf were sent to ICAR- CPCRI for crossing work at mainland for development of new hybrids and also for *inter se* mating.

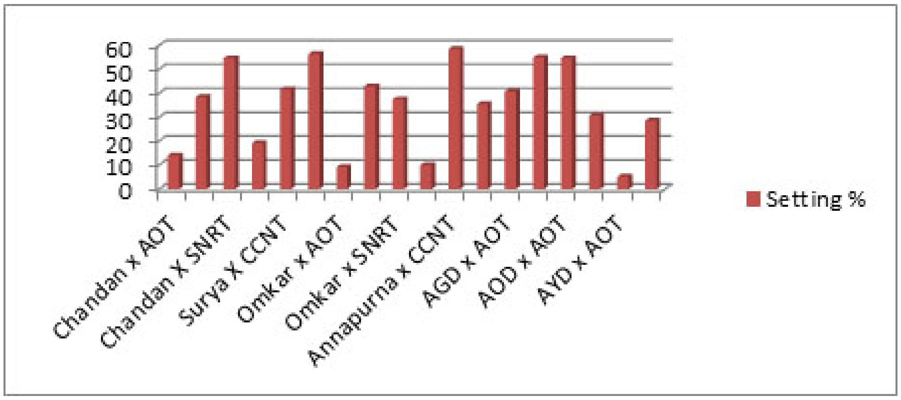

Fig.3: Setting % among D x T crosses

Seventeen F_1 seedlings have been transplanted and maintained in the field for further evaluation of growth and yield parameters. Initial evaluations of hybrids revealed that, AOD x CARI Annapurna recorded maximum girth of stem (122 cm), longest leaf (383 cm) and more number of leaflets on one side (100) followed by AGD x AYD (Table 4).

Table 4: Growth and morphology of coconut hybrids at South Andaman

Cross	Plant height (cm)	Stem Girth (cm)	No. of leaves	Petiole length (cm)	Length of leaf (cm)	No. of leaflets (one side)	Length of leaflet (cm)	Width of leaflet (cm)
Annapurnax AOT	356	60	11	134	167	46	67	4.8
AOD x AGD	244	39.3	7.5	87.5	148.5	47	49.5	3.2
AOD x Annapurna	586	122	13	173	383	96	100	4.6
AOD X AYD	165.7	21.3	6	66.3	102	36	43	2.8
AGD x AGD	146	26.0	7	65	112	36	52	3.0
AGD x AYD	651	125	12	175	321	95	99	3.4
AGD x AOD	165	17	5	79	130	34	43	2.2
AOD x AYD	254	28	6	105	131	44	50	3.2
AYD x AOD	184.7	27.6	7.3	61	111.6	38	49.6	2.9
AYD x AGD	293.6	17	8.6	77	173.3	54.3	56.6	3.3
Nicobar Dwarf	159	27	8	72	105	42	49	3.0
Local Tall	303	39	7	101	197	50	66	4.5

Identification of superior dwarf types in coconut

Palm morphology and fruit component studies initiated to explore the selection of better dwarf coconut varieties suitable for Andaman Islands. The four conserved and released dwarf varieties from the Institute accessions and the local dwarf selections AGD, AOD and AYD were subjected to observations. Based on the palm morphology, yield of fruits, regular bearing, tender nut water volume and taste, Andaman Green Dwarf was identified as potential for further exploitation. A total of over 50 palms of AGD palms available at the Institute are under further observations for tender nut characteristics. The palms of AGD were observed as more vigoruous than the Yellow and Orange dwarfs, regular bearers, bearing dark green attractive bunches, shorter drooping leaves. The AGD palms have been earlier provided to ICAR-CPCRI which are under evaluation at two locations in Kerala and one location at Karnataka.

Evaluation for product diversification

In order to evaluate the coconut types for product diversification, soap making using VCO (Plate 3) was standardized with locally available natural aromatic plant materials such as mango ginger, turmeric, khoon phal, annatto and rose petals.

Plate 3: VCO soaps with combinations of different natural aroma

Characterization of Andaman Arecanut Dwarf

Arecanut is the second most predominant crops grown in Andaman and Nicobar Islands next to coconut palm. Numerous diverse types of arecanut with wide variation for palm morphology and fruit component traits have been observed among the areca types of these Islands. Characterization of a dwarf arecanut which was collected and conserved at ICAR- CIARI for palm morphology was undertaken. The results revealed that the dwarf type has very short internodes, dense crown and short inflorescences (Plate 4 & 5). More than 80% of the progenies of these dwarf type are found to be uniform for seedling traits. The palm morphology, floral characteristics, nut component traits of this Andaman Arecanut Dwarf are documented in the background of utilizing the accession in breeding for dwarfness in arecanut and the possibility of exploiting the dwarf arecanut for ornamental purpose. Compact canopy with shorter leaves, shorter inflorescences, lesser fruit set and highly fragrant flowers are the typical characteristics of the dwarf palms. The dwarf arecanut is identified as potential for exploitation in cultivation and breeding purposes. The estimated chali yield of the dwarf arecanut palms ranged from 1.8 kg to 2.8 kg/palm/year. The characterization using 8 dwarf palms also revealed occurrence of highly fragrant male and female flowers in dwarf arecanut when compared to local tall highlighting the scope for exploiting them for perfumery purposes. Seedlings of few hybrid combinations involving Andaman Arecanut Dwarf as male parent made with released variety 'Samridhi' and 'Andaman Arecanut Local Tall' has revealed marked differences for seedling traits and number of leaves when compared to the parental progenies.


Plate 4: Comparison of stem traits of Andaman Arecanut Dwarf with Andaman Local Tall with arrangement, number of leaf scars and smoothness of stem


Plate 5: Comparison of crown and leaf traits of Andaman Arecanut Dwarf with Andaman Local Tall Arecanut

ALL INDIA COORDINATED RESEARCH PROJECT ON PALMS

Ajit Arun Waman

Arecanut based cropping system models

Intercropping experiments in arecanut revealed the scope of increasing profitablity by incorporating suitable crops. In arecanut monocropping, cumulative gross returns of Rs. 8,42,000/- were obtained over a period of two years (Table 5). Adoption of intercropping could increase cumulative gross returns (two years) to Rs. 12,16,400/- (arecanut + ginger), Rs. 12,33,000/- (arecanut + elephant foot yam) and Rs. 12,84,000/- (arecaut + banana). Depending upon input availability and market demand, these crops could be profitably cultivated in the Islands.

Table 5: Yield and gross income of arecanut and intercrops under Island condition

Treatment	Crops	Year I		Year II		Cumulative gross income (Rs.)
		Yield (t/ha)	Gross income (Rs.)	Yield (t/ha)	Gross income (Rs.)	
T_1	Arecanut	1.11	2,22,000/-	3.1	6,20,000/-	8,42,000/-
T_2	Arecanut	1.49	2,98,000/-	3.1	6,20,000/-	
	Banana	-	-	12.2	3,66,000/-	
	Total T_2		2,98,000/-		9,86,000/-	12,84,000/-

Treatment	Crops	Year I		Year II		Cumulative gross income (Rs.)
		Yield (t/ha)	Gross income (Rs.)	Yield (t/ha)	Gross income (Rs.)	
T_3	Arecanut	1.65	3,30,000/-	3.6	7,20,000/-	
	Ginger	0.95	76,000/-	1.13	90,400/-	
	Total T_3		4,06,000/-		8,10,400/-	12,16,400/-
T_4	Arecanut	1.31	2,62,000/-	4.3	8,60,000/-	
	EFY	2.70	54,000/-	2.85	57,000/-	
	Total T_4		3,16,000/-		9,17,000/-	12,33,000/-

Selling prices: arecanut *chali* @ Rs. 200 / kg; ginger @ Rs. 80/ kg; banana @ Rs. 30 /kg and EFY @ Rs. 20/ kg

The soil properties under different intercropping systems were recorded (Table 6). Irrespective of the treatment, pH values of the soil increased after the experiment was over. Reduction in organic carbon content was noticed after intercroppping. Available nitrogen content increased after cropping, which indicates the positive effect of organic matter recycling on N content. Decrease in available potassium content was noticed after cropping.

Table 6: Pre-experimental and post-experimental soil characteristics of arecanut based cropping system models

Treatment	pH		EC (dS/m)		Available N (kg/ha)		Available K_2O (kg/ha)	
	Pre	Post	Pre	Post	Pre	Post	Pre	Post
T^1	4.64	5.75	0.7	0.06	292	489	226	115
T^2		5.80		0.13		533		186
T^3		5.95		0.10		383		96
T^4		5.58		0.07		527		136

Coconut based cropping system models

New experiment was initiated during 2018 to evaluate performance of eleven black pepper varieties under close spacing (2 m × 2 m). Pepper was trained on glyricidia as a standard, which was planted in coconut interspaces. Growth parameters of pepper varieties were recorded after four months of planting, which are presented in table 7. Plant height varied between 55.1 cm (IISR- Subhakara) and 117.5 cm (IISR- Sreekara), number of leaves between 14.1 and 23.3 cm, while collar thickness varied between 4.4 and 5.5 mm.

Table 7: Growth parameters of black pepper varieties grown on glyricidia in coconut plantation as intercrop

Variety	Plant height (cm)	No. of leaves	Collar thickness (mm)
Panniyur 1	89.9 ± 16.64	16.3 ± 1.94	4.5 ± 0.45
Panniyur 2	80.2 ± 11.77	16.0 ± 1.93	5.3 ± 0.31
Panniyur 5	78.6 ± 13.23	21.1 ± 3.11	5.3 ± 0.25
Panniyur 6	94.2 ± 14.63	15.7 ± 2.07	4.4 ± 0.21
IISR- Girimunda	99.6 ± 9.06	22.6 ± 2.41	5.1 ± 0.26
IISR- Malabar Excel	80.7 ± 11.02	23.3 ± 3.95	5.5 ± 0.36
IISR- Panchami	81.7 ± 10.96	16.7 ± 2.08	4.7 ± 0.33
IISR- Sakthi	109.6 ± 10.24	20.6 ± 2.72	4.5 ± 0.29
IISR- Sreekara	117.5 ± 15.60	21.8 ± 1.44	4.7 ± 0.24
IISR- Subhakara	55.1 ± 9.29	14.1 ± 2.14	5.7 ± 0.60
IISR-Thevum	81.5 ± 10.68	16.4 ± 1.91	5.3 ± 0.54

Collection, Conservation and Evaluation of Commercial Fruit Crops of Andaman and Nicobar Islands

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Collection and conservation of commercial fruit crops

In mango, along with released varieties and exotic collections, seven elite mangoes were identified and the grafted collections with accession number NM1, NM 2, NM 3, NM 4, NM 5, NM 6 and NM 7 are conserved in the germplasm block for further field evaluation. The growth observations recorded in the varieties of guava under evaluation (Plate 6) revealed maximum vegetative growth in the variety Allahabad Safeda with height (186.9 cm), girth (15.5 cm) and number of branches (29) in the second year after planting. Early fruiting (48 months after planting) was recorded in the variety, Lucknow 47. A total of 25 varieties/accessions of wild mango, cultivated mango and guava are under conservation and evaluation at the Institute (Table 8).

Table 8: Fruit crops under conservation and evaluation

Fruit crop	Numbers	Particulars
Mangifera andamanica	1	Wild mango
Mangifera camptosperma	1	Wild mango
Mangifera griffithi	1	Wild mango
Mangifera indica collection	15	Varieties: Lalima, Surya, Himsagar, Gulabkhas, Baramasi, 3 Exotic collections. Local collections: NM -1 to NM -7
Guava	07	Allahabad Safeda, Lucknow 47, Exotic collection (EC1), Arka Mridula, Hisar Surkha, Arka Kiran and Arka Rashmi

Plate 6: Conservation and evaluation of guava varieties

Collection, conservation, evaluation and agro-technique standardization of Dragon fruit

Four germplasm accessions of Dragon fruit (*Hylocereus sp)* maintained at the Institute were characterized based on the DUS descriptors and their molecular characterization initiated. Comparative phytochemical characterization of all the four dragon fruit accessions were carried out and the results are given in table 9. The total phenolic content, flavanoid and β carotene were maximum in the dragon fruit accession DGF 4 whereas the carotenoid content and xanthophylls content were highest in the accession DGF 2. The antioxidant activity by DPPH and ABTS were maximum in the accession DGF 4.

Table 9: Phyto-constituents of dragon fruit accessions

Accessions	Total phenolic content (mg GAE/100 g)	Flavonoid content (mg RE/100g)	Carotenoids (µg/ g)	β-Carotene (µg/ 100g)	Xanthophyll (µg/g)	Antioxidant activity (DPPH (%))	Antioxidant activity (ABTS (%))
DGF 1	71.25	55.52	4.82	0.21	4.82	65.0	61.76
DGF 2	91.25	26.57	24.30	16.35	24.14	55.61	86.35
DGF 3	103.75	123.94	9.93	0.89	9.93	65.86	82.35
DGF 4	161.25	508.15	23.72	18.51	23.54	81.16	89.15

Collection, Characterization, Evaluation and Mass Multiplication of Unconventional Native and Exotic Fruit Crops for Bay Islands

Pooja Bohra, Ajit Arun Waman, T. Bharathimeena and S.K. Zamir Ahmed

Morphological and physicochemical studies in *Garcinia* species

Garcinia is an important genus with immense horticultural potential and is distributed naturally in these Islands. Intraspecific diversity in *Garcinia kydia* (three from Middle Andaman and two from South Andaman) was studied (Table 10). Fruit weight varied between 26.1 g and 50.7 g. Though fruits were small in a sample from South Andaman (GK/SA/AP), peel thickness (3.3 mm) and peel content (49.1%) was found to be highest in it. Three collections of *Garcinia cowa* were made from Middle Andaman. Fruits weighed between 46.2 to 48.5 g each. Collection GC/MA/SB-1 was found to have thickest peel (4.8 mm) with highest peel weight (29.2 g) and peel recovery (60.5%). *Garcinia dhanikhariensis* was collected from three locations in South Andaman. Collection GDH/SA/BS showed superiority in terms of fruit weight (41.2 g), peel thickness (3.4 mm) and peel weight (16.9 g). Studies also revealed that *G. kydia* and *G. cowa* were sources of carotenoids, while *G. dhanikhariensis* contained anthocyanins. The three species of *Garcinia* are shown in Plate 7.

Table 10: Fruit morphological parameters in collections of *Garcinia* species

Collection	Fruit weight (g)	Peel thickness (mm)	Peel weight (g)	Peel recovery (%)
Garcinia kydia				
GK/MA/AS	42.1 ± 2.16	2.4 ± 0.11	16.4 ± 0.58	39.4 ± 1.00
GK/MA/KT	50.7 ± 2.64	2.6 ± 0.14	19.7 ± 0.72	39.3 ± 1.01
GK/MA/JKR	39.4 ± 1.41	2.6 ± 0.12	17.5 ± 0.47	44.6 ± 0.59
GK/SA/AP	26.1 ± 1.86	3.3 ± 0.08	12.7 ± 0.71	49.1 ± 0.93
GK/SA/LP	37.1 ± 1.35	2.1 ± 0.07	16.6 ± 0.65	44.9 ± 0.72
Garcinia cowa				
GC/MA/YB	48.4 ± 3.85	2.6 ± 0.07	21.3 ± 1.37	44.6 ± 0.96
GC/MA/KT	46.2 ± 3.32	2.4 ± 0.11	18.5 ± 1.43	40.0 ± 0.83
GC/MA/SB-1	48.5 ± 4.03	4.8 ± 0.24	29.2 ± 2.33	60.5 ± 0.72
Garcinia dhanikhariensis				
GDH/SA/BS	41.2 ± 4.07	3.4 ± 0.11	16.9 ± 1.08	40.3 ± 1.31
GDH/SA/LP-1	14.3 ± 0.33	2.3 ± 0.08	7.6 ± 0.19	53.4 ± 0.42
GDH/SA/KAL	7.8 ± 0.61	2.4 ± 0.08	3.5 ± 0.32	48.6 ± 1.14

Plate 7: Developing fruits of *Garcinia kydia*, *Garcinia cowa* and *Garcinia dhanikhariensis*

Fatty acid profiling in native *Garcinia* species of the Islands

Seeds of some *Garcinia* species are utilized for extraction of seed butter, which is used in food and non-food industries in other parts of the country. To explore the industrial potential of native *Garcinia* species of these Islands, fatty acid profiling of seeds of six species was undertaken. Data (Table 11.) revealed that Methyl oleate, Methyl stearate, Methyl palmitate and Methyl linoleate were major compounds. Considering richness in fatty acids, these species could also be utilized for extraction of butter.

Table 11: Fatty acid methyl esters profiling of seeds of *Garcinia* species using GCMS

Species	Major fatty acids		
G. kydia	Me. oleate (43.92%)	Me. stearate (37.94%)	Me. palmitate (9.02)
G. andamanica	Me. oleate (44.35%)	Me. palmitate (31.38%)	Me. stearate (11.83%)
G. cowa	Me. oleate (44.24%)	Me. stearate (37.94%)	Me. palmitate (10.52%)
G. celebica	Me. stearate (41.34 %)	Me. oleate (23.27%)	Me. linoleate (19.12%)
G. dhanikhariensis	Me. stearate (43.62 %)	Me. oleate (42.40 %)	Me. palmitate (8.21%)
G. dulcis	Me. oleate (39.82%)	Me. palmitate (33.48%)	Me. stearate (9.00%)

Evaluation of native and exotic fruit crops under Island condition

Mangosteen

To evaluate performance of mangosteen under Island condition, two collections were planted in Garacharma farm. After three years, both collections grew 1.5 m tall (Table 12); however, number of leaves (246.6), collar thickness (3.6 cm) and number of branches (19.5) were higher in seedlings collected from local nursery.

Table 12: Growth parameters in mangosteen after three years of planting under Island conditions

Parameters	Homegrown K-100	Local nursery
Plant height (m)	1.5 ± 0.11	1.5 ± 0.07
Number of leaves	183.1 ± 28.96	246 .6 ± 35.51
Collar thickness (cm)	3.0 ± 0.12	3.6 ± 0.16
No. of branches	14.7 ± 1.70	19.5 ± 1.40

To know the quality of mangosteen produced in the Islands, physicochemical analysis was carried out using fruits collected from two mature trees in Haddo, Port Blair. Parameters such as fruit weight (69.9 g), fruit length (4.5 cm), fruit width (5.3 cm), total soluble solids (22.5 °B), number of seeds (1.3 per fruit), mean seed weight (0.6 g) and seed thickness (8.6 mm) were superior in fruits collected from Tree No. 3, while pH (4.0) and pulp content (32.6%) were marginally higher in fruits from Tree No. 1.

Rambutan

Five collections of rambutan were evaluated under Island conditions. At three years age, maximum plant height was observed in N-18 (399.4 cm) with highest canopy spread of 270.0 cm (Table 13). Collar thickness varied between 5.2 cm (E-35) and 8.4 cm (Sunrise). Flowering was noticed in Sunrise, N-18 and King. Fruits of N-18 (Plate 8) were evaluated for physicochemical parameters. Each fruit was 6.0 cm long, 3.9 cm wide and weighed about 43 g. Spines were 1.9 cm long with a density of 37.8 spines/ 4 cm^2. Fruits contained about 41.3% pulp with sweetness of 18.0 °B and pH of 3.9.

Table 13: Growth parameters in five collections of Rambutan after three years of planting under Island condition

Parameters	Plant height (cm)	Collar thickness (cm)	Mean Canopy spread (cm)	Flowering/ Fruiting
Sunrise	261.3 ± 21.25	8.4 ± 0.85	240.6 ± 3.13	Yes
N-18	399.4 ± 42.82	8.0 ± 0.55	270.0 ± 56.06	Yes
King	264.4 ± 24.74	6.8 ± 1.36	210.6 ± 14.80	Yes
E-35	276.0 ± 44.68	5.2 ± 0.94	210.5 ± 37.31	No
Bengaluru collection	252.1 ± 25.47	7.3 ± 1.15	199.0 ± 23.00	No

Plate 8: Fruits of rambutan variety 'N-18' developing in experimental block

Sweet Carambola

An experiment was initiated to study the performance of sweet carambola at closer spacing under Island condition. Growth observations recorded after three years revealed that the plants grown at wider spacing (3.5 m × 3.5 m) had more number of branches (22.0) and higher canopy spread (3.7 m) but were short in stature (3.2 m) than those grown at closer spacing (Table 14). Fruiting was recorded in few plants. Formative pruning has been taken up in all the plants during this year for providing appropriate framework to the plants.

Table 14: Growth parameters of Sweet Carambola at three spacing after three years of planting under Island condition

Spacing (m)	Plant Height (m)	No. of branches	Collar girth (cm)	Canopy spread (m)
3.5 × 1.5	3.8 ± 0.17	19.0 ± 1.53	41.7 ± 4.37	2.6 ± 0.23
3.5 × 2.5	3.8 ± 0.03	19.3 ± 1.67	41.8 ± 4.15	3.3 ± 0.32
3.5 × 3.5	3.2 ± 0.49	22.0 ± 3.51	38.7 ± 2.91	3.7 ± 0.26

Annona hybrid 'Arka Sahan'

Experiment on performance evaluation of Annona hybrid 'Arka Sahan' was initiated during 2015 at two spacing. Plants attained 1.6-1.8 m height with 5.9- 7.8 branches each. Collar thickness of 17.8 to 18.6 cm and spread of 2.1 to 2.3 m were recorded. Fruiting was observed in plants without manual pollination. Fruits were smaller (233.0 g) with less TSS (25.0 °B) than that reported earlier from crop grown in Bengaluru condition (285-296 g and 26-32 °B). Pulp content of 74.0 % with thicker skin (0.35 cm) was observed (Table 15). However, plants and fruits were found to be infested with unidentified pests, causing considerable damage. Further, stems in some plants exhibited dry rot symptoms, thereby causing mortality. Considering the pest and pathogen issues and poor growth and development, the trial was discontinued.

Table 15: Performance evaluation of Annona hybrid 'Arka Sahan' at closer spacing under Island condition (3 years old)

Spacing (m)	Plant height (m)	No. of branches	Collar girth (cm)	Canopy spread (m)
5.0 × 2.5	1.8 ± 0.08	5.9 ± 0.70	17.8 ± 0.35	2.3 ± 0.09
5.0 × 5.0	1.6 ± 0.21	7.8 ± 0.73	18.6 ± 1.20	2.1 ± 0.19

Seed germination studies in *Garcinia* species

In order to multiply seedlings in large number for carrying out further studies, seed germination studies were undertaken in a rare species *viz*. *Garcinia kydia*. Germination (%) varied amongst the treatments and 67.03% germination was recorded in seeds soaked in 0.1% potassium nitrate for 24 h (Fig. 4), when compared with 52.75% in water soaking treatment. The same treatment improved other growth parameters as well and the highest seedling vigour index of 1519.57 was recorded in it as against 1072.94 in water soaking. In case of *Garcinia andamanica* too, seed treatment with 0.1% potassium nitrate was found to be promising; however seedling emergence was slower compared to that in case of *Garcinia kydia*. Seedlings of both the species grew normally (Plate 9).

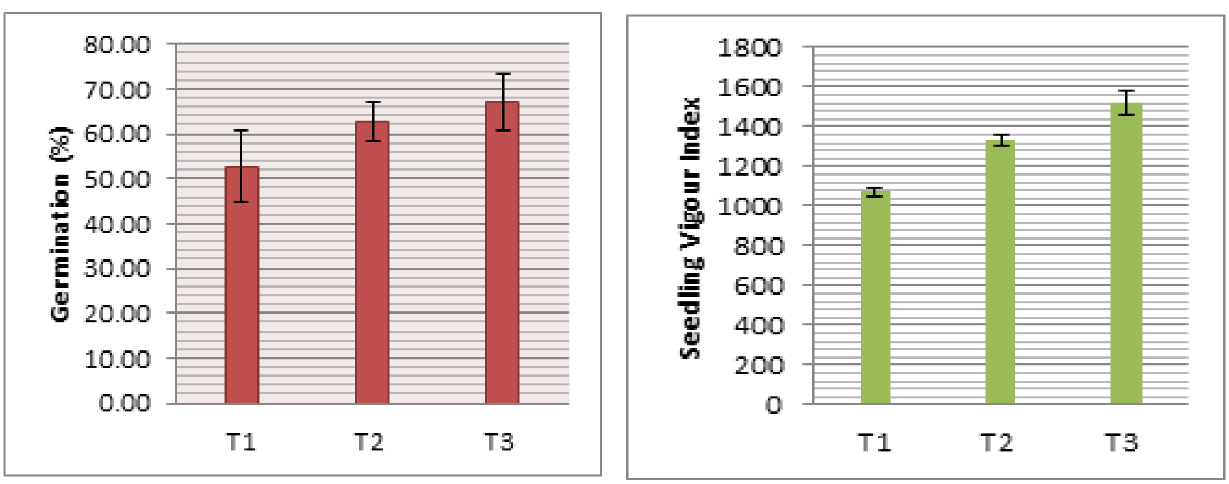


Fig. 4: Germination percentage and Seedling vigour index in *Garcinia kydia* as influenced by pre-treatments: Water soaking (T_1), thiourea (T_2) and KNO_3 (T_3)

Plate 9: Regenerated seedling of *Garcinia kydia* (a) and *Garcinia andamanica* (b)

Collection, conservation and distribution of underutilized fruits

Seedlings of *Garcinia kydia* and *Garcinia andamanica* were planted in the *Garcinia* conservation block of the institute. *Garcinia dhanikhariensis* was also planted in Chidiyatapu Biological Park for conservation. Planting material of West Indian cherry and bael was distributed/ sold to various stakeholders including women entrepreneurs, Onge tribal settlement area and other Island farmers.

Value addition in underutilized fruits

Considering anthocyanin richness in rind of *Garcinia dhanikhariensis* fruits, attempts were made to use its rind for preparation of syrup (Plate 10) and sweetened rind. Both products had good consumer acceptability. Rind of *Garcinia kydia* was dehydrated, which was found to be a local substitute for kokum and Malabar tamarind as an acidulant. Further, osmotically dehydrated products were also prepared from it, which were found to have good sensory properties.

Plate 10: Syrup and ready to serve beverage prepared from *Garcinia dhanikhariensis*

Development of Protocols for Micropropagation of Selected Fruit Crops for Bay Islands

Pooja Bohra, Ajit Arun Waman and L.B. Singh

Optimization of micropropagation protocol

Studies were initiated to optimize micropropagation protocols for locally popular banana varieties of Islands belonging to different genomic groups and subgroups. To produce large number of shoots for conducting further trials, varieties were cultured onto a common multiplication medium consisting of 4 mg/L BAP, 0.2 mg/L NAA and 70 mg/L AdS. Multiplication varied from 2.64 (Korangi) to 3.2 (Cheena Kela) microshoots per inoculum. Experiments in Cheena Kela suggested that kind of carbon source had no significant influence in shoot multiplication during initial stages of culture and multiplication ratio varied between 2.8 and 3.4 microshoots per inoculum (Fig. 5 and Plate 11).

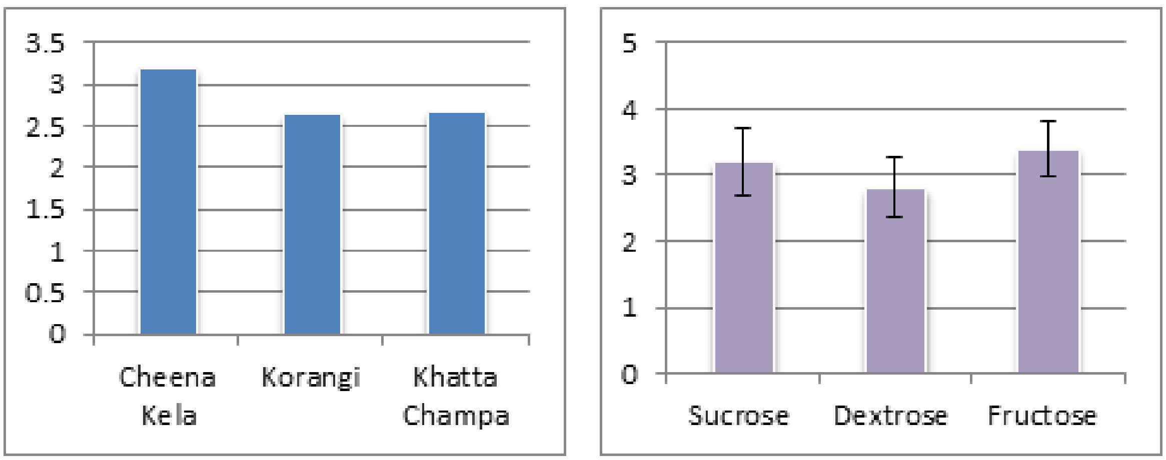


Fig. 5: (a) *In vitro* performance of banana varieties in multiplication medium (during multi-stage II) and (b) *In vitro* multiplication in Cheena Kela as influenced by carbon source during multi-stage II

Plate 11: Multiplying cultures of banana variety Cheena Kela on media supplemented with fructose (3%), sucrose (3%) and dextrose (3%)

Macropropagation studies

Macropropagation studies were undertaken in Cheena Kela to facilitate on farm production of planting material. Two substrates *viz*. coirpith compost and sand were studied along with two treatments *i.e.* BAP (100 mg/l) and coconut water (AOT). Results of first multiplication cycle are presented in Fig. 6. In general, coirpith was found to be more supportive substrate than sand for inducing multiplication. Highest mean multiplication rate of 3.43 per corm was obtained in coirpith + BAP combination, whereas maximum leaf production per plant was highest in sand+ BAP combination. Decortication and treatments were imparted for second cycle.

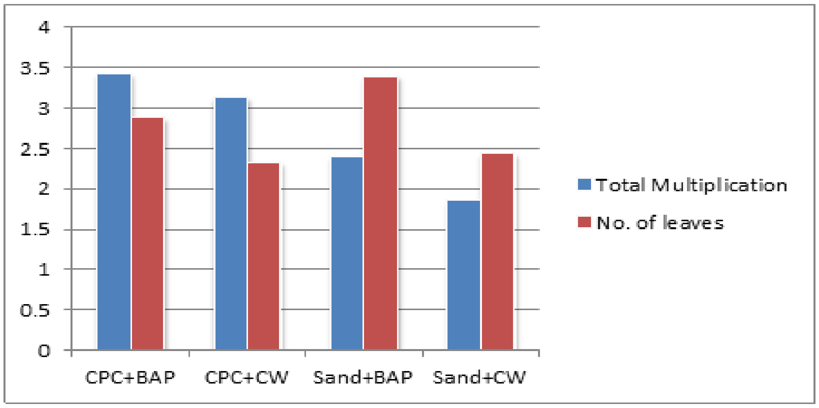


Fig.6: Effect of substrate and treatment on multiplication of Cheena Kela

Comparative evaluation of micropropagated and sucker derived plants

To test field performance of tissue cultured plants *vis-a-vis* sucker derived plants, experiment was conducted in variety Grande Naine. Data on plant height and plant girth of tissue cultured and sucker derived plants after 4 and 8 months of planting has been presented in Fig. 7. It was noticed that sucker derived plants were vigorous and had higher plant height and plant girth than micropropagated plants during both the durations studied. The evaluation is in progress.

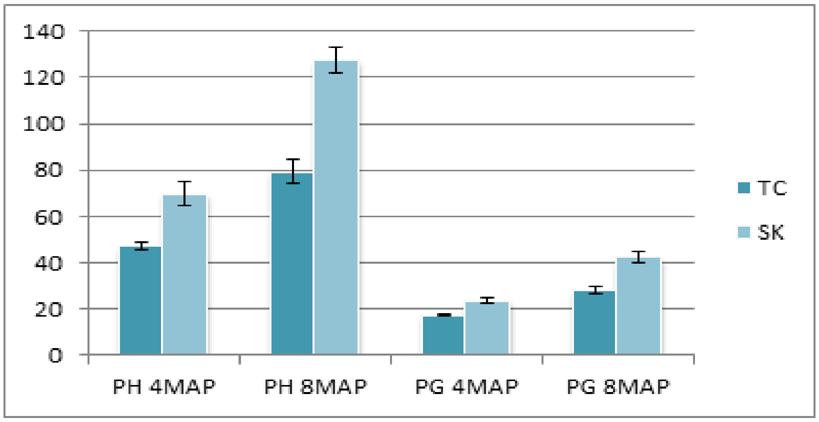


Fig.7: Plant height (PH) and plant girth (PG) of tissue cultured (TC) and sucker derived (SK) plants after four and eight months of planting

In vitro Mass Multiplication, Characterization and Habitat Enrichment of Two Horticulturally Important Underutilized Species from Andaman and Nicobar Islands

Pooja Bohra and Ajit Arun Waman

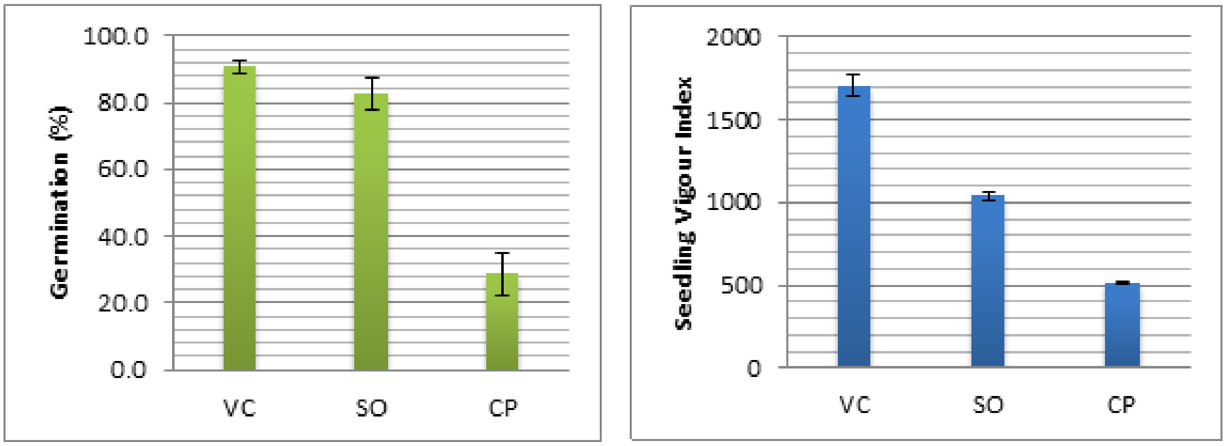
Micropropagation in *Musa indandamanensis*

Musa indandamanensis is an endemic crop wild relative of banana which requires dedicated efforts for its conservation. Micropropagation in this species would not only help in its conservation but would also help in germplasm exchange following the norms of international *Musa* germplasm transfer. A novel technique of culture initiation using seedling explants was developed for the species. Aseptic cultures were established using the protocol optimized by the research team. For culture multiplication, thidiazuron was found to be the best cytokinin for inducing multiple shoots, when compared with other cytokinins (BAP, *m*T). Elaborate studies on thidiazuron have indicated that 0.2 to 0.5 mg/L concentration could successfully promote shoot proliferation (4.74 to 6.13 microshoots/inoculum) in *in vitro* cultures (multistage 2) of *M. indandamanensis* (Plate 12).

Plate12: Multiplying cultures of *Musa indandamanensis* on MS Basal, TDZ (0.2 mg/L), TDZ (0.5 mg/L), TDZ (1.0 mg/L) and TDZ (2.0 mg/L) medium (left to right)

Standardization of substrate for seed germination in *Musa paramjitiana*

In continuation with previous studies, experiment was conducted with the best pretreatment (0.1% KNO_3) to identify most suitable substrate to further improve the seed germination process. Germination percentage was significantly improved from 28.7% in coir pith to 90.7% when seeds were sown in vermicompost. Further, seedling vigour index was also enhanced drastically from 513.73 to 1703.3 in vermicompost (Fig. 8).



(A) (B)

Fig. 8: Germination percentage (A) and Seedling Vigour Index (B) in *Musa paramjitiana* as influenced by different substrates *viz*. VC: Vermicompost; SO: Soil and CP: Coir pith

Conservation and characterization of wild banana germplasm

Regenerated seedlings of *Musa indandamanensis* and *Musa paramjitiana* from seed germination experiments were planted in the newly established wild banana conservation block of the institute (Plate 13). Further, one new collection of *Musa paramjitiana* was also collected from South Andaman during the year. Both the species are being characterized using *Musa* descriptors developed by IPGRI, Rome (Now *Bioversity International*). Comparative morphological and biochemical characterization of fruits of both the species was also carried out, which revealed that *Musa indandamanensis* could be used as a parent for breeding bananas rich in carotenoids.

Plate 13: Germplasm conservation block of endemic *Musa* species

Collection, Characterization and Conservation of Blood Fruit

Blood fruit germplasm was collected from four locations in Andaman Islands and one from Tripura. Comparative morphological and physicochemical analysis of fruits was carried out. Significant differences were recorded for fruit morphological parameters and pulp content (Table 16). Sample from Tripura had larger and heavier fruits than those from Andaman Islands; however, pulp content remained statistically similar to some collections from Andaman Islands.

For *ex situ* conservation of the species, 30 regenerated seedlings were transplanted in conservation block. All the seedlings established successfully and were trained on the live standards of wild tree species (Plate 14).

Plate 14: Blood fruit being trained on a wild tree in conservation block

Table 16: Variability in fruit parameters in different collections of blood fruit

Coll. code	Fruit Length (cm)	Fruit Width (cm)	Fruit Weight (g)	Pedicel length (cm)	Pulp (%)
ANIHV-1	3.60 ± 0.045	2.74 ± 0.029	12.68 ± 0.341	0.37 ± 0.021	23.52 ± 0.898
ANIHV-2	3.47 ± 0.036	2.79 ± 0.024	15.38 ± 0.291	0.35 ± 0.027	27.40 ± 0.689
ANIHV-3	3.84 ± 0.044	2.89 ± 0.060	17.42 ± 0.276	0.32 ± 0.020	24.28 ± 0.501
ANIHV-4	3.69 ± 0.071	2.57 ± 0.029	14.12 ± 0.262	0.37 ± 0.023	-
NERHV-1	4.32 ± 0.039	3.09 ± 0.036	21.17 ± 0.568	0.45 ± 0.029	26.28 ± 1.521

Anthocyanin profiling in *Haematocarpus validus*

Blood fruit is known to be rich in anthocyanin pigments, which impart blood red colour to its pulp. In a pioneering attempt, profiling was carried out in the pulp of blood fruit collection from Middle Andaman Island using Liquid Chromatography/Mass Spectrometry (LC/MS). Of the total anthocyanins (8.760 mg/g FW), Pelargonidin (4.997 mg/g FW) and Cyanidin (2.939 mg/g FW) were found to be dominant compounds in the pulp.

Optimization of solvent: solute ratio for extraction of anthocyanins

To identify the most appropriate ratio of solvent: solute for extraction of total anthocyanins from the pulp of blood fruit, four treatments were compared. The anthocyanin recovery increased with increase in solvent volume from 1:5 (229.6 mg/ 100g) to 1:15 (302.9 mg/ 100g), after which the recovery decreased. Hence, extraction of 1 g pulp using 15 parts of acidified methanol could be recommended for complete recovery of anthocyanins.

Creation of awareness amongst the stakeholders

For creation of awareness about conservation of native underutilized fruit species from the Islands, one day training programme was conducted for postgraduate students of Botany from JNRM, Port Blair while two awareness programmes were conducted at GSSS, Bamboo Flat and Crescent Public School, Nayapuram, respectively.

All India Coordinated Research Project (AICRP) on Fruits

K. Abirami

Four local banana varieties namely *Kattachampa*, *Mittachampa*, *Cheena Kela* and *Kornagi* and two wild banana are conserved. Seven banana varieties Grand Naine, Hill Banana, Populu, Poovan, Ney Poovan, Red Banana, Udhayam and Monthan were collected from National Research Centre for banana (NRCB), Tiruchirapalli and conserved in the field gene bank for further evaluation.

Plate 15: Fruiting in (a)Monthan and (b) Ney Poovan varieties of banana

Five commercial varieties of banana were planted in three planting seasons November, 2017 (S3); March 2018 (S1) and July, 2018 (S2) under rainfed system with only organic inputs. The growth parameters of all the varieties in all three planting seasons were recorded. Fruiting (Plate 15) observed in the varieties Ney Poovan (501.6 days after planting) and Monthan (548.5 days after planting). However, fruiting has not been initiated in the varieties planted in other planting seasons March 2018 (S1) and July 2018 (S2) and still at vegetative stage.

Improvement of Vegetable and Tuber Crops for Andaman and Nicobar Islands

B. Augustine Jerard, Soobedar Yadav, I. Jaisankar, V. Damodaran, S.K. Zamir Ahmed,
L. B. Singh and BL. Kasinath

Collection and evaluation of vegetable genetic resources

To augment the genetic resources of vegetable crops for varietal improvement, eleven endemic vegetable crops (used by the local communities) from South Andaman and Nicobar District (Table 17) were collected and conserved at vegetable block of the Institute. The collected material is planted for further multiplication for use in the trials. Fifteen tuber crop accessions were collected from Nicobar District (Table 18) and conserved at Sippighat Research farm for its multiplication and use in further evaluation. Few of the significant collections are shown in Plate 16.

Table 17: Endemic vegetable crops collected and conserved

Sl. No	Name of the crop	Place of collection
1	*Abelmoschus moschatus*	Terresa
2	Spiny Brinjal	Terresa
3	Primitive Brinjal	Terresa
4	Vegetable Cowpea	Terresa
5	Wild Ash Gourd	Terresa
6	*Solanum lasicorpus*	Terresa, Munak
7	Mitha Baji	Katchal, Kamorta
8	*Amaranthus dubius*	Katchal
9	Capsicum	Makachua
10	Edible fern	Campbell Bay
11	*Dryneria quircifolia*	Garacharma

Table 18: Tuber crops accessions collected from Nicobar district and conserved

Sl. No	Name of the crop	Place of collection
1	*Amorphopilus hirsutum*	Thiruvanchikulam
2	*Dioscorea bulbifera*	Galathea II, Munak
3	*Curcuma longa*	Makachua
4	*Zingiber* sp	Kondul Island
5	*Dioscorea glabra*	Bada Enaka
6	*Colocasia esculenta*- Purple	Bada Enaka
7	*Colocasia esculenta*- Green	Bada Enaka
8	*Xanthosoma sagitrifolium*	Bada Enaka
9	*Alocasia macrorhizos*- Purple	Champin Island
10	*Dioscorea piscatorum*	Katchal
11	*Xanthosoma sagiffolium*	Katchal

12	*Acorus calamus*	Katchal
13	*Dioscorea alata*- purple	Terassa
14	*Dioscorea alata*- Kuping	Terassa
15	Sweet potato	Terassa


(a) Spiny Brinjal


(b) Primitive Brinjal

(c) Wild Ash gourd


(d) *Tacca sp*


e) *Dioscorea piscatorum*


(f) Edible fern

Plate 16: Few endemic vegetable species collected from Nicobar District and conserved

Seeds of released varieties of tomato (Arka Vikas, Aka Meghali), brinjal (Arka Anand, Arka Nidhi), chilli (Arka Suphal, Arka Lohit), cowpea (Arka Suman, Arka Garima), amaranthus (Arka Samraksha, Arka Suguna), palak (Arka Anupama), leafy coriander (Arka Isha), french bean (Arka Arjun), bhendi (Arka Anamica, Arka Nikita) were procured from ICAR-IIHR for evaluation under Island conditions and use in identification of better lines. Two types of *Solanum torvum*from Andaman and Bengaluru respectively and one wild brinjal type from South Andaman were collected for use in screening trials and alsoproduction of grafts in brinjal and tomato.

Evaluation trials initiated in brinjal, chilli, amaranthus, palak and bhendi with the released varieties and local collections (Plate 17) available at the Institute. Observations on growth and yield were recorded. Selfing carried out in three local brinjal genotypes and seeds extracted for further use. Amaranthus trial with 14 types, palak trial with 3 types, brinjal trial with 4 types and coriander trial with 5 types are under progress. A cluster bearing open pollinated local brinjal type (Plate 18) was identified for further exploitation and subjected to selfing.

Plate 17: Amaranthus evaluation trial

Plate 18: A cluster bearing open pollinated local brinjal identified for evaluation

Seventy diverse accessions of chilli collected from Andaman & Nicobar Island and are under conservation, characterization and evaluation for quantitative and qualitative traits (Plate 19). Among them few genotypes exhibited unique characteristics such as AC-15 (Purple colour), AC-10 (Small conical shape), AC-17 (Blackish green and conical shape), AC-6 (Dark green conical shape), AC-6 (Dark purple), AC-25 (Cylindrical purple green), AC-1(Dark green round). Highest fruit length (75.34 mm) was observed in AC-32 followed by AC-34- 73 mm, while, lowest (11.26 mm) in AC-8 followed by AC-23 (17.41 mm).

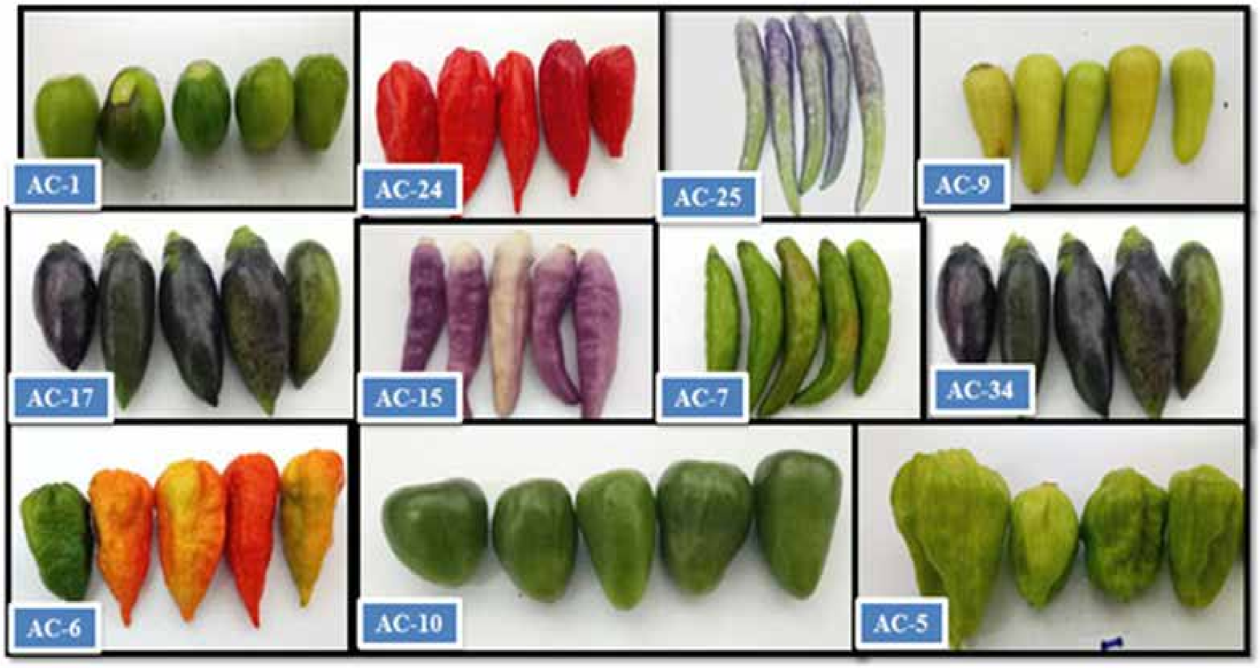


Plate 19: Part of chilli diversity of Andaman & Nicobar Islands conserved

All India Coordinated Research on Vegetable Crops

Soobedar Yadav

Evaluation was undertaken on three vegetable crops *viz*., Brinjal: Brinjal (Long) - AVT-I, Brinjal (Round) - AVT-I, Brinjal Small Round AVT-I Brinjal (Long) - AVT-II, Brinjal (Round) - AVT-II, Brinjal Bacterial Wilt - AVT-II, Brinjal Hybrid Long - IET, Brinjal Hybrid Round - IET and Brinjal Long - IET). Green Pea: Pea (Early) – AVT I, Pea (Mid) – AVT- I, Pea (Early) – AVT II and Pea (Mid) – AVT- II. In Tomato: Tomato Determinate AVT-I, Tomato hybrid Determinate- AVT-I, Tomato hybrid Determinate- AVT-II, Tomato Determinate- IET-I, Tomato Determinate- AVT-II Tomato Indeterminate- IET-I, , Cherry Tomato – AVT-II and Cherry Tomato – IET, were evaluated and reported during 2018-19.

Brinjal

Brinjal (Long) AVT-I : A total of nine entries were evaluated and the maximum projected fruit yield (218.64 q/ha) was recorded in 2017/BRLVAR-9 followed by 2017/BRLVAR-6 (179.123 q/ha) and the least projected fruit yield of 116.45 q/ha was recorded in 2017/BRLVAR-3 entry.

Brinjal (Round) AVT-I : Nine entries evaluated under the trial and the maximum projected fruit yield of 221.01 q/ha was recorded in 2017/BRRVAR-6 followed by 2017/BRRVAR-5 (188.62 q/ha).

Brinjal Small Round –AVT-I: A total of seven entries were evaluated among which 2017/BRSRVAR-4 hasrecorded the maximum projected fruit yield of 152.35 (q/ha) followed by 2017/BRSRVAR-5 (106.40 q/ha).

Brinjal (Long) AVT-II: A total of nine entries were evaluated and the maximum projected fruit yield (227.39 q/ha) was recorded in 2016/BRLVAR-9 followed by 2016/BRLVAR-7 (185.72 q/ha).

Brinjal (Long) IET:Nine entries were evaluated and the maximum projected fruit yield (182.74 q/ha) was recorded in 2018/BRLWAR-5 followed by 2018/BRLWAR-9 (137.36 q/ha)

Brinjal (Round) AVT-II: Among the nine entries evaluated under this trial, the maximum projected fruit yield of 212.64 q/ha was recorded in 2016/BRRVAR-6 followed by 2016/BRRVAR-8 (202.64 q/ha)

Brinjal Bacterial Wilt – AVT-II: A total of eight entries were evaluated. Among the entries, maximum bacterial wilt infection was recorded in 2016/ BRBW-4 (94.45 %), while minimum in 2016/ BRBW-1 (18.4) 2016/ BRBW-1. However, maximum projected fruit yield of 138.64 (q/ha) in 2016/ BRBW-2, while lowest in 2016/ BRBW-4 (17.54 q/ha).

Brinjal Hybrid (Long) IET : Total of eight entries were evaluated and the maximum projected fruit yield (225.63 q/ha) was recorded in 2018/BRLWAR-5 followed by 2018/BRLWAR-7 (212.48 q/ha).

Brinjal Hybrid (Round) IET: Eight entries were evaluated under this trial, wherein the maximum projected fruit yield of 196.76 q/ha was recorded in 2018/BRRVAR-8 followed by 2018/BRRVAR-5 (185.38 q/ha).

Pea: Total 24 line of garden pea of four groups are evaluated: Pea (Early) – AVT I, Pea (Mid) – AVT- I, Pea (Early) – AVT II and Pea (Mid) – AVT- II

Garden Pea (Early) – AVT I :Among the Six green pea entries in the Pea (Early) AVT-I trial, the highest projected green pea yield was recorded in 2017/PMVAR-1 (36.60 q/ha) followed by 2017/PMVAR-7 (28.65 q/ha)

Garden Pea (Mid) – AVT I: Among the five entries evaluated under GardenPea (Mid) – AVT-Itrial the maximum projected green pod yield of 32.36 q/ha were recorded in 2017/PMVAR-3followed by 2017/PMVAR-6(28.3 q/ha).

Garden Pea (Early) – AVT II: Among the eight green pea entries in the Pea (Early) AVT-II trial, the highest green pea yield was recorded in 2016/PEVAR-6 (27.62 q/ha) while lowest 8.45 (q/ha) recorded in 2016/PEVAR-7

Garden Pea (Mid) – AVT II: Among the five green pea entries in the Pea (Mid) AVT-II trial, the highest projected green pea yield was recorded in 2016/PMVAR-3 (29.78 q/ha) followed while lowest in 2016/PMVAR-5 (14.32) q/ha

Tomato

Tomato (Determinate) AVT-I: Among ten entries evaluated, 2017/TODVAR-7 recorded maximum projected fruit yield of 228.62 q/ha followed by 2017/TODVAR-5 (162.36 q/ha) and least projected yield was recorded in 2017/TODVAR-9 (106.26 q/ha) in Tomato Determinate AVT-I.

Tomato Hybrid Determinate AVT-I: Among the six entries evaluated under Tomato Hybrid Determinate AVT-I trial the maximum projected fruit yield of 216.36 was recorded in 2017/TODHYB-3 followed by 2017/TODHYB-1 (186.47 q/ha).

Tomato Hybrid Determinate AVT-II : Among the seven entries evaluated under Tomato Hybrid Determinate AVT-II trial the maximum projected fruit yield of 335.75q/ha was recorded in 2016/TODHYB-7 followed by 2016/TODHYB-6 (317.45 q/ha).

Tomato (Determinate) IET : Among six entries evaluated, 2018/TODVAR-4 recorded maximum projected fruit yield of 214.65 q/ha followed by 2018/TODVAR-6 (192.32 q/ha) and least projected yield was recorded in 2018/TODVAR-2 (98.26 q/ha) in Tomato Determinate IET

Tomato (Determinate) AVT-II :Among the 12 entries evaluated, 2016 /TODVAR-7 recorded maximum projected fruit yield of 218.34 q/ha followed by 2016/TODVAR-5 (185.66 q/ha) and least projected yield was recorded in 2016/TODVAR-10 (108.26 q/ha) in Tomato Determinate IET.

Tomato (Indeterminate) IET : Among the seven entries evaluated under Tomato Indeterminate IET trial the maximum projected fruit yield of 218.36 was recorded in 2018/TOINDVAR-5 followed by 2018/TOINDVAR-5 (196.73 q/ha).

Cherry Tomato AVT-II : The Cherry Tomato AVT-I trial included six entries. Among these, 2016/TOCVAR-6 recorded the maximum projected fruit yield of 127.87 q/ha followed by 2016/TOCVAR-3 (78.64 q/ha).

Cherry Tomato IET : Total Six entries were evaluated and the maximum projected fruit yield (115.63 q/ha) was recorded in 2018/TOCVAR-4 followed by 2018/TOCVAR-6 (105.48 q/ha) and the least projected fruit yield of 65.36 q/ha was recorded in 2018/TOCVAR-1 entry.

AICRP on Tuber Crops

V. Damodaran, B. Augustine Jerard and L.B. Singh

Collection, Conservation, Cataloguing and evaluation of Genetic resources of tuber crops

Tuber crop exploration trips were made in Rutland, Jirkatang, Baratang of South Andaman, Rangat, Maya bunder of Middle & North Andaman, Great Nicobar and Nancowrie group of Islands (along with NBPGR exploration team during January- February, 2019) and over 33 accessions of different tuber crops were collected and added to the germplasm holding at the Institute (Plate 20). Maximum of eight collections in colocasia followed by *Dioscorea alata* and *Dioscorea bulbifera* (3 each) was made. IC numbers for 10 greater yam (IC-0623824 to 0623833) and 5 colocasia accessions (IC- 0623834 to 0623838) has been obtained from NBPGR, New Delhi. A total of 135 accessions are being maintained in the gene bank.

Plate 20: Few of the diverse tuber crop germplasms accessions collected from Nicobar District

MLT on Colocasia (2nd year)

Six entries of colocasia were evaluated at three locations for growth and yield parameters under Island conditions. Among the entries, TTr 12-8 recorded maximum number of cormel per plant (10.2) and maximum weight of cormel/plant (314 g) followed by TTr 12-7. With regard to cormel yield, TTr 12-8 recorded higher yield (11.2 t/ha) followed TTr-7 while the lowest cormel yield (6.0 t/ha) was recorded in TTr 12-1. The entries TTr-12-7 and TTr 12-8 also recorded long keeping quality of tubers and exhibited better cooking quality and taste score as compared to the other entries. Pooled analysis revealed that, TTr 12-8 recorded higher cormel yield (12.2 t/ha) followed TTr-7.

Farming system studies in tribal areas

The Nicobari tribal communities mainly rely on coconut, tuber crops, pigs and marine fisheries for their livelihood. The tribal farmers clear the forest area cultivate crops in joint family system called Tuhet. They mainly grow only Nicobar Aloo (greater yam) along with banana mainly for food in the traditional tuhet garden. Considering the successful intervention of tuber crop based farming system, six farmers have adopted the tuber crop based farming system at Harminder Bay, Little Andaman during 2018-19. Each tuhet garden comprising of 0.2 ha model involving tuber crops integrated with piggery unit was demonstated. Farmers were distributed with planting materials of tuber crops (Elephant Foot Yam, Colocasia, Sweet potato), Ginger and Piglets. Regular trainings and field visits were organized to upgrade the farming skills of tribal farmers. Prior to interventions, the net income of each tuhet was Rs 42,200 with B: C ratio of 1.33. After intervention of tuber crops based farming system in 0.2 ha model, the net income of the tuhet increased to Rs 1, 32,820 with the B:C ratio of 2.08.The employment generation in the tuber crops based farming system was 510 man days/ha as compared to 295 man days/ha in their traditional system. With the success of this system, more tribal youths has come forward to adopt the tuber crops based farming system (Plate 21) as their livelihood options.

Plate 21: Tuber crop based farming system at Harminder Bay, Hut Bay

Popularization and Demonstration of Tuber Crops in Urban & Peri- Urban and Non-Traditional Areas for Food and Feed

Conducted 6 FLD on organic cultivation of elephant foot yam var. Gajendra in farmers field at Port Mout, Lal pahar, Rangachang, Ferrargunj and Guptaphara villages of South Andaman in an area of 0.05 – 0.2 ha and recorded the yield of 800- 3400 kg/farmer. Each farmer has earned net income of Rs. 12,000 – 51,200 from elephant foot yam cultivation with B:C ratio ranging from 2.8 to 3.3.

Collection, Characterization and Utilization of Natural Diversity of Important Spice Crops from Bay Islands and Evaluation of Their Improved Varieties

Ajit Arun Waman, Pooja Bohra, T. Sujatha, L.B. Singh and V. Damodaran

Collection and documentation studies in Woody Pepper

Woody pepper has been identified as a potential spice for commercial scale cultivation in these Islands. Explorations were conducted to identify farmers cultivating this species in their backyards and standards used for training were recorded. Six farmers were identified from Middle and North Andaman, while four were from Little Andaman. In all, 67 plants of different age groups were spotted (Table 19). Further, plants in a single backyard were vegetatively multiplied progeny of single mother plant in all the cases. Mango was found to be the most preferred standard for its cultivation. National identity was obtained for one collection (IC-0625887).

Table 19: Collection and documentation of Woody Pepper

Collection	Place	No. of plants	Standard used
WP/MA/LM	Middle Andaman	47	Mango, jackfruit, arecanut
WP/MA/AB	Middle Andaman	01	Mango
WP/MA/SR	Middle Andaman	01	Wild species
WP/MA/AS	Middle Andaman	01	House wall
WP/MA/KIR	Middle Andaman	01	Wild species
WP/NA/LD	North Andaman	01	Mango
WP/LA/KPM	Little Andaman	03	Mango, coconut and arecanut
WP/LA/BM	Little Andaman	02	Mango
WP/LA/DB	Little Andaman	08	Mango, jackfruit, wild species
WP/LA/CR	Little Andaman	02	Drumstick

Studies in dehydrated woody pepper powder

Dehydrated powder was prepared as a novel product (Plate 22) in woody pepper for extension of shelf life of produce and introducing new taste in the cuisines. Powdered samples of woody pepper (WP/MA/LM) were extracted using acetone and methanol and used for determination of oleoresins and total phenolic content. Stem pieces of thin, medium and thick sizes sold in the market were used for analysis, which revealed that oleoresin yield was independent of stem size and it varied between 3.5 to 3.7% (Table 20). Total phenolic content in acetone extract was found to be the highest (183.0 mg GAE/ 100g extract).

Plate 22: Woody pepper powder: A novel product from the Islands

Table 20: Oleoresin yield and total phenolic content in powdered samples of woody pepper as influenced by stem size and solvent

Sample code	Oleoresin content (%)	TPC (mg GAE/ 100g acetone extract)	TPC (mg GAE/ 100g methanol extract)
Thin	3.5 ± 0.13	183.0 ± 2.54	304.6 ± 12.50
Medium	3.7 ± 0.17	85. 9 ± 2.04	107.1 ± 11.08
Thick	3.7 ± 0.45	134.5 ± 5.34	77.9 ± 1.71

Conservation, characterization and utilization of wild nutmeg species

Three native wild nutmeg species were studied for various morphological and biochemical parameters (Table 21). Seeds of *Knema andamanica* and *Horsfieldia glabra* were smaller in dimensions than *Myristica andamanica*; however, they contained high amounts of fat (14.3 to 15.2%) and fibre (12.2 to13.2%). Fatty acid methyl esters analysis (Table 22) revealed Methyl myristate as the most dominant compound. Profile of *Knema andamanica* had more similarities with cultivated nutmeg. Considering these results, native species could be utilized as source of fat in industrial applications, wherein cultivated nutmeg is being used. Identification of such nontraditional uses could help in conservation of these species in the Islands besides providing source of livelihood to the Island farmers.

Table 21: Seed morphological characteristics and proximate composition of wild nutmeg species

Parameter	*Myristica andamanica*	*Knema andamanica*	*Horsfieldia glabra*
Morphological parameters			
Seed Length (mm)	46.6 ± 0.39	21.8 ± 0.58	27.4 ± 0.26
Seed Width (mm)	22.9 ± 0.30	14.7 ± 0.17	16.2 ± 0.15
Seed Weight (g)	14.4 ± 0.36	2.4 ± 0.16	3.7 ± 0.10
Proximate analysis			

Parameter	*Myristica andamanica*	*Knema andamanica*	*Horsfieldia glabra*
Protein (%)	12.3 ± 0.05	12.1 ± 0.10	13.2 ± 0.05
Fat (%)	10.2 ± 0.05	14.3 ± 0.05	15.2 ± 0.00
Ash (%)	6.5 ± 0.05	6.3 ± 0.05	5.2 ± 0.05
Fibre (%)	11.3 ± 0.15	12.2 ± 0.05	13.2 ± 0.05

Table 22: Fatty acid methyl esters analysis in wild nutmeg species using GCMS

Myristica fragrans	*Myristica andamanica*	*Knema andamanica*	*Horsfieldia glabra*
Methyl myristate (56.7 ± 1.71)	Methyl myristate (46.9 ± 0.57)	Methyl myristate (68.8 ± 3.40)	Methyl myristate (54.3 ± 1.70)
Methyl 9-octadecenoate (21.2 ± 0.44)	Methyl dodecanoate (27.0 ± 1.30)	Methyl 9-octadecenoate (17.5 ± 2.25)	Methyl erucate (17.0 ±1.11)
Methyl palmitate (11.7 ± 0.33)	Methyl 9-octadecenoate (11.7 ± 0.79)	Methyl palmitate (4.7 ± 0.30)	Methyl 9-octadecenoate (11.5 ± 0.18)

Black pepper varietal evaluation trial

Performance of twelve improved varieties / hybrids is being evaluated on glyricidia (as live support (Table 23 and Plate 23). Four varieties bore fruits and spike length varied between 8.9 cm to 12.6 cm amongst them. Highest mean green yield of 112.4 g per plant was observed in Panchami, while it was the lowest in Panniyur - 6 (36.6 g). Drying recovery varied from 39.0% to 41.2%.

Table 23: Performance of black pepper varieties under Island condition

Varieties	Spike length (cm)	Green yield (g/ vine)	Drying recovery (%)
Panniyur- 6	12.6	36.6	40.1
Malabar Excel	8.9	93.8	41.2
Girimunda	12.3	62.6	39.0
Panchami	8.9	112.4	39.3

Plate 23: View of experimental block of black pepper varietal evaluation trial

Cinnamon varietal evaluation trial

Five improved varieties were introduced and established successfully in the Garacharma farm. Plants of these varieties were multiplied through air layering for further evaluation. As leaves of cinnamon are also used in culinary preparations as spice, studies were conducted in these varieties as presented in Table 24. Varieties from Maharashtra had significantly higher biomass content and dry recovery (%) than other varieties and local check. Total chlorophyll content varied between 0.7 mg/g (IISR-Nithyasree) to 1.1 mg/g (IISR-Navasree). Total phenolic content values were significantly lower in local seedlings (18.7 mg GAE/ 100 g), when compared with the improved varieties studied.

Table 24: Leaf parameters in cinnamon varieties grown under Island condition

Variety	Biomass content (%)	Total chlorophyll(mg/g)	Dry recovery (%)	Total phenolic content (mg GAE/100g)
Local seedling	44.8 ± 0.27	0.9 ± 0.04	54.9 ± 3.29	18.7 ± 1.62
Konkan Tej	53.8 ± 0.03	0.9 ± 0.01	63.9 ± 3.55	27.6 ± 0.07
Konkan Tejpat	53.2 ± 0.17	0.9 ± 0.03	66.7 ± 1.86	21.6 ± 0.14
Yercaud- 1	45.6 ± 1.39	0.9 ± 0.01	52.4 ± 0.84	26.6 ± 0.35
Nithyasree	43.5 ± 0.34	0.7 ± 0.00	53.0 ± 1.15	27.9 ± 1.71
Navasree	41.4 ± 0.04	1.1 ± 0.01	46.5 ± 5.47	24.3 ± 0.24

Quality analysis of spices grown in Islands

Clove samples were collected from Sippighat, Little Andaman and Katchal Islands and used for extraction of oleoresins and essential oils (Table 25). Oil yield varied from 6.6% (Little Andaman) to 10.0% (Katchal); whereas oleoresins varied from 14.66% (Sippighat) to 18.37% (Katchal). GC/MS analysis of the samples revealed that *p*-Eugenol, which is the major active ingredient of clove oil, was found to be highest (76.059%) in samples from Katchal, whereas it was the lowest (59.895%) in oil from Sippighat. Reverse trend was noticed in case of Eugenyl acetate. *β*-Caryophyllene content was in the order: Little Andaman (24.856%) > Sippighat (21.073%) > Katchal (13.185%).

Table 25: Major volatile constituents of essential oil of clove from Andaman & Nicobar Islands analyzed using GC/MS

Compound	Concentration (area %)		
	Sippighat	Little Andaman	Katchal
p-Eugenol	59.895	61.058	76.059
β-Caryophyllene	21.073	24.856	13.185
Eugenyl acetate	4.058	3.659	3.772

Essential oils and oleoresins were extracted from nutmeg samples collected from Mile Tilak, Little Andaman and Katchal. Oil content varied between 5.1% (Little Andaman and Katchal) to 7.2% (Mile Tilak); whereas oleoresins content was found to be 7.10% (Katchal) to 8.06% (Little Andaman). GC/MS analysis revealed that Myristicin (the hallucinogenic compound) was found to be highest (20.331%) in sample collected from Katchal, followed by that in Little Andaman (Table 26). Sabinene was second dominant compound in both these collections. Interestingly, sample from Mile Tilak had mere 7.07% of Myristicin and 0.172% of Sabinene content. α-Thujene, (-)-4-Terpineol and α-Pinene were the other dominant compounds in the oils.

Table 26: Major volatile constituents of essential oil of nutmeg from Andaman & Nicobar Islands analyzed using GC/MS

Compound	Concentration (area %)		
	Mile Tilak	Little Andaman	Katchal
α-Thujene	16.874	4.549	12.050
α-Pinene	10.135	4.613	9.553
Sabinene	0.172	15.292	19.248
√-Terpinene	9.617	4.980	4.170
(-)-4-Terpineol	13.611	14.161	7.113
β-Isosafrole	1.644	3.587	1.457
Myristicin	7.070	19.729	20.331
Elemicin	3.609	1.129	3.958

Volatiles from clove leaf and pedicel

Besides conventionally used clove buds, leaves and pedicel of clove are aromatic and contain volatile oils. Samples of leaf, buds and pedicels were used for essential oil extraction and their GC/MS analysis resulted in identification of 15, 19 and 23 compounds, respectively. Eugenol content was found to be in the order: 86.525 % (leaf) > 71.648% (pedicel) > 69.236 (bud), whereas reverse trend was noticed in case of Caryophyllene content. Essential oil of pedicel additionally contained Methyl salicylate (1.485%) and other minor components which were not present in oils distilled from other parts. These resources could be exploited for essential oil extraction in the Islands.

Fallen leaves of clove: an alternative resource to be tapped

Clove leaf oil is a rich source of industrially important eugenol. Experiment was conducted to know if naturally senesced leaves could be used for oil extraction. Naturally fallen leaves were collected from tree basin during November- December and essential oil was extracted. For comparison, freshly harvested leaves were shade dried and used for essential oil extraction. Results revealed that oil content ranged from 2.4 to 2.8% in fresh leaves, whereas it was 3.2 to 3.6% in naturally fallen leaves. This result revealed the potential of farm waste utilization for generation of additional income.

Exploration, Characterization, Micropropagation and Agro-Technique Standardization of Important Rhizomatous Species-Mango Ginger from Bay Islands

Ajit Arun Waman, Pooja Bohra, I. Jaisankar, D. Basantia and V. Damodaran

Effect of carbon source and their concentration on micropropagation

Effect of three carbon sources (fructose, dextrose and sucrose) at two concentrations (1% and 3%) was studied on *in vitro* multiplication of mango ginger (Fig. 9). Shoot multiplication was significantly influenced by both kind and concentration of carbon source. Proliferation of 6.3 shoots per inoculum was observed in explants cultured on MS medium supplemented with dextrose (3%) as carbon source (Plate 24). It was rated far more superior than conventionally used sucrose (3%) in which 2.8 shoots per inoculum was observed. Other growth parameters were also improved in this treatment.

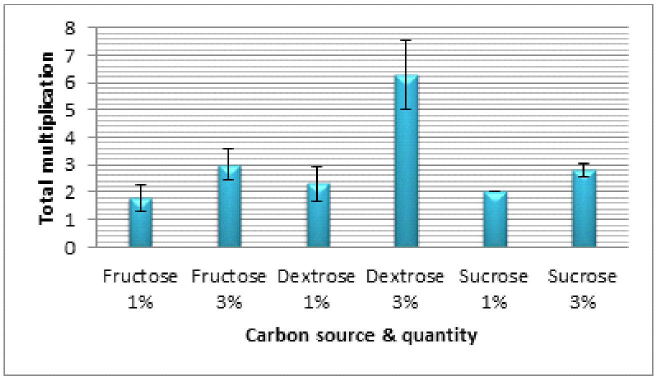


Fig. 9: Effect of carbon source and their concentration on shoot multiplication in *Curcuma mangga*

Plate 24: Profuse shoot multiplication in cultures of *Curcuma mangga* on dextrose (3%) supplemented medium

Effect of cytokinin source and concentration on shoot proliferation

To identify most suitable cytokinin for induction of multiple shoots, experiment was conducted (Fig. 10). Benzylamino purine, one of the most commonly used cytokinins for *in vitro* culture, did not improve shoot multiplication beyond 9.2 shoots/ inoculum (BAP 2 mg/l) and remained statistically similar with growth regulator free medium (8.2 shoots/ inoculum). Inclusion of *meta*- Topolin (*m*T) in the medium; however, could improve the multiplication to as high as 15.2 shoots/ inoculum. In subsequent subculture, same trend was continued as proliferation of 13.7 shoots/ inoculum was observed in 2 mg/l *m*T as against 7.69 proliferation/ inoculum in basal medium.Use of*m*T marginally reduced shoots length than control, indicating its apical dominance suppressing efficiency.

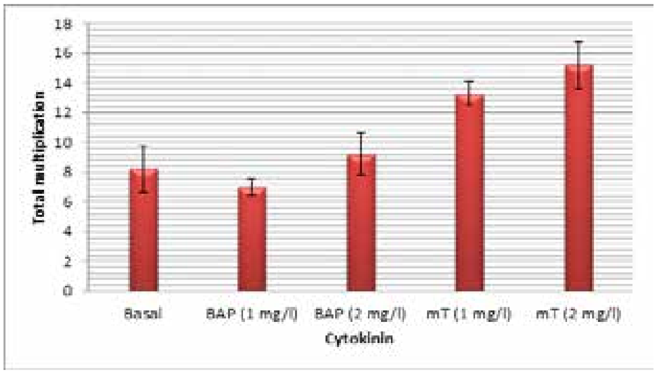


Fig.10: Effect of cytokinins on shoot multiplication in *Curcuma mangga*

Concurrent *ex vitro* rooting cum hardening

To reduce time and other inputs required for *in vitro* rooting and subsequent hardening, single step *ex vitro* rooting cum hardening procedure was developed. Microshoots were dipped in indole 3- butyric acid solutions at different concentrations and transferred into pots for hardening in polyhouse. Results suggested that adoption of concurrent *ex vitro* rooting cum hardening without use of auxin could help in 100% rooting and acclimatization of microshoots. This novel technique could be easily employed for production of large number of plants with reduced cost of production.

Performance of tissue culture raised plants was compared with rhizome derived plants in grow bags. All tissue cultured raised plants grew normal without any morphological variations. Produce is harvested and is being analysed for biochemical parameters.

Collection and conservation of germplasm

Nine collections of *Curcuma mangga* and *Curcuma amada* have been conserved in the germplasm block. They were evaluated for morphological and biochemical parameters with considerable variations and superior types have been identified.

Standardization of procedure for preparation of dehydrated mango ginger shreds

To explore the possibility of processing mango ginger into value added products, dehydrated shreds were prepared from fresh rhizomes. Three methods were compared for dehydration including sun drying as control (Table 27). Dry recovery varied between 16.4% and 17.2%. Total soluble solids remained same in all the treatments, while increment were noticed in pH and total phenolic content values with rise in oven drying temperature. The products had good organoleptic properties and retained its typical raw mango like aroma. Considering the advantages of oven drying, drying at 50 °C temperature could be used, however sun drying could be promoted for adoption by farmers.

Table 27: Effect of drying treatments on physicochemical parameters of dehydrated mango ginger shreds

Treatment	Dry recovery (%)	Total soluble solids (°B)	pH	TPC (mg GAE/100g)
Sun drying	17.1	10.0	4.54	3.56
Oven drying at 40 °C	16.4	10.0	5.68	5.55
Oven drying at 50 °C	17.2	10.0	6.10	8.36

Enhancing Production and Quality of Rhizomatous Spices Through Varietal, Biotic Stress and Processing Interventions in Plantation based Cropping System under Island Conditions

Soobedar Yadav, Ajit Arun Waman, V. Damodaran, K. Sakhtivel and S. Swain

Fourteen genotypes of ginger and12 genotype of turmeric were collected from Andaman Island and evaluated their performance for growth and yield parameters. In Ginger, genotype AG-7 (24.7 t ha-1) have registered highest fresh rhizome yields which was significantly different from AG-12 (20.65.23 t ha-1), while lowest yield of fresh rhizome yield was found with cultivar AG-10 (8.32 t ha-1). In Turmeric 12 genotype (AT-16, AT-17, AT18, AT-19, AT-20, AT-21, AT-22, AT-23, AT-24, AT-25, Narendra Haldi 3 and IISR Pargati) were collected from Andaman &Nicobar Islands and mainland India. In the present investigation, maximum plant height was observed in AT-18(95.65cm) which was at par (793.23 cm) with AT -21. However lowest plant height (42.34 cm) was observed in AT-21.

CSS-(MIDH) National Horticulture Mission Scheme on Spices

K. Abirami and V. Damodaran

Production of planting material of spices

Multiplied and produced the quality planting materials of Black pepper (45000), clove (5000), Cinnamon (6000), ginger (1200 kg) and turmeric (2000 Kg). Standards of Glyricidia are planted for establishment of new mother block of black pepper at Garacharma farm (Plate 25). For establishment of new spices block, grafted plants of Vishwashree variety of nutmeg was planted. The planting material of different spice crops were distributed to farmers during training programmes and field days conducted.

Plate 25: Planting material production of black pepper in modified planting system

Technology demonstration programmes

Front line demonstration programmes were taken up in farmers' field on organic production of ginger and turmeric in different parts of Islands. 10 FLDs on organic cultivation of ginger (Plate 26) and turmeric were conducted and on an average, a yield of about 8- 10 t/ha of ginger and 12-15 t/ha of turmeric were recorded.

Plate 26: Demonstration of ginger cultivation at farmers' fields in South Andaman

Effect of different planting material on growth and yield of turmeric

Mother rhizome (50 g, 30g), primary rhizome (50 g, 30g) and plug tray transplants were used as different planting material and their effect on growth and development of turmeric variety 'CO2' was studied. Maximum yield was recorded with the mother rhizome 50 g in traditional planting system (880.9 g per plant), whereas the mother rhizome 30 g gave highest per plant yield in modified planting system (546.8 g per plant).

Collection, Characterization and Evaluation of Selected Economically Important Aromatic Crops in Andaman & Nicobar Island

Soobedar Yadav, K. Abirami and R. K. Gautam

Six genotypes of lemongrass were collected from South Andaman, evaluated for the plant morphology. Maximum plant height, (161.33 cm) leaf length (98.67 cm) and number of tiller (28.33) were observed in AL-6. However, minimum plants height (80.0 cm) and leaf length (55.67) were observed in AL-3. Light red leaf sheath colours were observed in AL-1, AL-4 and AL-5 while AL-2 and AL-6 showed red and dark red respectively. Among the six genotypes, AL-1 and AL-6 performed better with respect to different growth parameters.

Twenty genotypes of *Ocimum* spp were collected from South and Little Andaman. Maximum plant height was observed in AO-7(109.10 cm) while minimum in AO-2 (46.7 cm). However, maximum leaf lamina length and width (5.8 cm) and (3.4 cm) were observed in AO-13, minimum (0.8 cm) and (0.7 cm) were observed in AO-9. Maximum inflorescence length (13.20 cm) was observed in AO-20 while, minimum (7.2 cm) in AO-6. Among all the twenty genotype AO-7.AO-11 and AO-20 performed best with respect to different quantitative and qualitative observation.

Exploiting Endemic and Promising Orchids of Andaman and Nicobar Islands for Crop Improvement

V. Baskaran, K. Abirami, B. A. Jerard and K. Venkatesan

Exploration, collection and conservation of endemic orchids

Exploratory survey was conducted in North and Middle Andaman and 10 species of orchids were collected and conserved in the Orchidarium. Among the species collected, *Eria andamanica* is an endemic orchid of the Island and is a threatened species. The other species collected includes *Rhyncostylis retusa, Cymbidium bicolor, Obenaria sp, Eria bractescens, Dendrobium anceps, Dendrobium secundum, Paphilionanthe teres, Dendrobium farmosum* and *Dendrobium aphyllum* (Plate 27).

Plate 27: Some of the Orchids collected and conserved

One accession each of *Dendrobium anceps, Rhyncostylis retusa, Eria* spp, *Agrostophyllum* spp, *Spathoglottis* spp, *Vanilla* spp, *Dendrobium crumenatum, Cymbidium* spp, *Pholidota* spp, *Eulophia* spp, *Bulbophyllum* spp, *Dendrobium aphyllum and Papilionanthe* spp were collected from Nicobar District and conserved for further multiplication. One accession each of *Dendrobium anceps* from South Andaman and Eulophia from Little Andaman were collected and conserved for multiplication. The accessions differed in flower size, colour and length of flower stalk. Flowering was observed in *Dendrobium anceps and Dendrobium aphyllum* during December to February.

Flowering and yield of *Arachnis flosaeris* (Spider Orchid) in open cultivation system for year round production

The low cost pandal type of support system was established with bamboo from forest and plastic wire for cultivation of Spider Orchid with cultivars Yellow Ribbon, Red Ribbon and Maroon Ribbon. When this particular orchid was grown in conventional method, flowering occurred once in a year. But open field cultivation using pandal system resulted in flowering (Plate 28) throughout the year in all three cultivars. The cultivar Maroon ribbon recorded early flowering (89.57 days). Yellow Ribbon recorded maximum floret size (10.5 cm). The maximum number of florets per spike (9.4), spike length (54.6cm) and intermodal length between two florets (6.5 cm) were recorded in Red Ribbon. the frequency of spike emergence was less in the cultivar Red Ribbon (12.4 days) (Table 28).

Table 28: Flowering and yield behaviour of spider orchid cultivars in pandal system

Variety	Days to Spike emergence	Days to bud initiation	Days to flower initiation	Days to flower harvest	Days to next flower spike emergence	No. of Florets per spike	Flower diameter (cm)	Internodal length of buds	Length of spike (cm)
Maroon	71.15	81.57	89.57	134.9	17.3	6.0	10.2	6.3	45.4
Yellow	93.85	99.23	104.85	132.7	16.2	8.2	10.5	5.4	42.3
Red	91.15	97.15	122.85	126.7	12.4	9.4	9.6	6.5	54.6
CV	9.15	5.07	2.6	1.8	15.9	8.5	4.8	4.4	5.5
CD (0.05)	9.10	5.46	3.2	2.8	2.8	0.8	0.6	0.3	3.0

Plate 28: Profuse flowering of *Arachnis* orchid in open field cultivation

Development of Production Technology for Ornamental Crops in Bay Islands

V. Baskaran, K. Abirami and A. Velmurugan

Propagation studies in endemic palms of the Island

Field experiment on seed germination, vigour and seedling growth behaviour of the palms were conducted for conservation and exploitation of palms for commercial use. *Rhopaloblaste augusta* showed minimum number of days taken for 50% seed germination (22 days) while maximum number of days taken for 50% seed germination (56 days) was recorded in *Bentinckia nicobarica*. Maximum height of seedling, number of leaves, plant spread, girth of seedling, and length of frond (73.2cm, 7.4, 56.2 cm, 4.5 cm and 59.8 cm respectively) were recorded in the palm species *Rhopaloblaste augusta* (Plate 29).

Plate 29: Seed germination and seedling growth in *Rhopaloblaste augusta*

Seed germination and seedling growth of the palm were studied in different organic media like T1 (Sand+ vermicompost + coircompost), T2 (Sand), T3 (vermicompost), T4 (Coir compost) and T5 (vermicompost and coircompost) and the results are in table 29. Media T3 was most suitable for early sprouting of seeds of *Rhopaloblaste augusta*. However, the seedling growth and vigour were maximum in the media T1 (Sand+ vermicompost + coircompost).

Table 29: Seed germination and seedling growth of the palm

Trts	Days to 50% sprouting	Days to 100% sprouting	Seedling Length (cm)	No of leaves per seed	Root Length (cm)	No of primary roots	Seedling girth (cm)	Seedling weight (g)	Leaf length (cm)	Leaf width (cm)	Thickness of primary root (cm)
T1	60.4	83.2	31.4	2.8	31.0	4.6	2.6	5.2	27.6	18.2	1.0
T2	74.0	89.4	31.2	1.4	13.7	3.6	1.7	2.2	27.0	13.0	0.8
T3	49.2	70.6	27.4	1.8	16.2	4.0	1.3	3.1	25.6	10.2	0.7
T4	56.8	80.2	25.8	1.0	18.0	3.6	1.4	2.1	23.2	11.8	0.7
T5	61.6	88.0	28.8	1.4	17.2	3.2	1.4	2.1	26.6	10.2	0.6
CV	7.4	3.2	9.3	23.8	24.2	17.7	13.5	22.1	8.19	13.9	23.5
CD (0.05)	6.1	3.5	3.6	0.5	6.3	0.9	0.3	0.9	2.9	2.4	0.2

Growth and development of gerbera varieties in different growing environments

Gerbera varieties, Arka Ashwa and Arka Nesara procured from IIHR, Bengaluru are grown in different growing environments like low cost shade house and polyhouse. The varieties of gerbera are planted in the two growing environments and the experiment is at initial stage

Growth and yield of *Alpinia* and tuberose in different shade levels

A new experiment was conducted in *Alpinia* and tuberose to study the growth and flowering in different shade levels. Early flowering was observed in open sunlight in both tuberose (62.8 days after planting) and *Alpinia* (71.3 days after planting) when compared to shaded conditions (Plate 30).

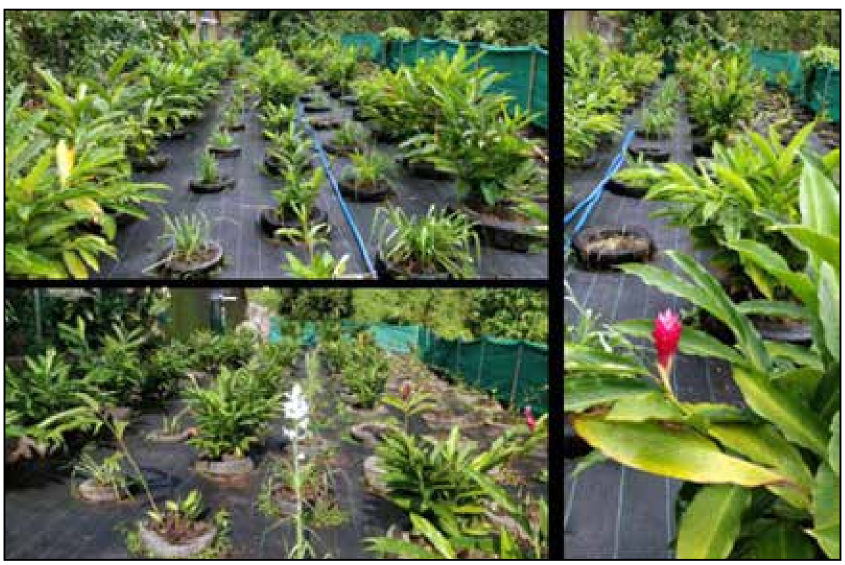


Plate 30: Early flowering in *Alpinia* and tuberose in open sunlight

Vaselife studies in Spider Orchid, Alpinia and *Etlingera*

Vaselife studies was conducted in different flower crops using 21 different treatments. It was observed that Hi foliar solution @ 0.5% recorded maximum shelf life in Spider Orchid (7.5 days) (Plate 31) and *Alpinia* (7 days). Silver Nitrate @ 20 ppm gave maximum (6 days) shelf life in *Etlingera*.

Plate 31: Vase life studies in spider orchid

Marigold collection and evaluation

Three marigold accessions were identified from farmer's field in which flowering was observed throughout the year. The seeds of four accessions are collected and are under evaluation in field. Three released varieties of marigold released from IARI, New Delhi namely Pusa Arpita, Pusa Bahar and Pusa Deep were procured for evaluating their performance under Andaman condition. Early flowering (26.5 days after transplanting) was recorded in Pusa Deep followed by 31.3 days in Pusa Arpita (Plate 32). Pusa Bahar did not perform well under our Island condition.

Plate 32: Early flowering in marigold varieties

All India Co-Ordinated Research Project (AICRP) on Flowers

V. Baskaran

Evaluation of new entries of china aster

The new entries of china aster, namely Arka Aadhya, Arka Archana, Arka Kamini, Arka Poornima were evaluated (Plate 33) with check varieties Local Pink and Local White for the third year experimental trial. Due to heavy rains, the crops did not perform well when sown in different month intervals till December, 2018. The seedlings transplanted in the month of February, 2019 are performing well and the flowering initiated in the tested varieties. Early flowering is observed in the varieties Arka Kamini (30.3 days after planting) followed byArka Archana (44.5 days).

Plate 33: Performance of China Aster varieties

Performance evaluation of *Jasminum nitidum*

Jasminum nitidum was collected from TNAU, Coimbatore and their performance was studied in the Island along with other species of jasmine collected from Local and Western Ghats. Early flowering was observed in *Jasminum nitidum*(54.6 days after transplanting) with profuse flowering. The different Jasminum species conserved at the Institute are shown in Plate 34.

Jasminum nitidum

Local *Jasminum*

J. malabaricum

J. acuminatissimum

Plate 34: Performance of *Jasminum* spp

Development and Standardization of Dus Characteristics Procedures for Noni (*Morinda citrifolia* **l.**)

I. Jaisankar

All the mother blocks of released noni reference varieties *viz.*, Samapada, Sanjivini, Rakshak and Sanjivini were maintained at Garacharma farm with implementing timely silvicultural activities like, weeding, earthing up, fertilizer application and pruning. A new block of three varieties of noni have been developed and maintained at Garacharma farm for its evaluation. Further, three new accessions of Noni were collected from Terassa, Katchal and Little Nicobar Islands and conserved. Growth observations of all reference varieties were recorded and the results revealed that highest height, DBH and number of branches recorded in CARI-Sampada (7m, 9.8cm and 21 respectively) followed by CARI Sanjivini. The monthly fruit yield observation revealed higher fruit yields in the month of July-2018 to October 2018 in CARI-Samridhi (31 kg/tree) followed by CIARI Sampada (30 kg/tree), CIARI Sanjivini (29 kg/tree) and the lower fruit yield was recorded in CIARI Rakshak (15 kg/tree).

Noni released variety (Samapada, Sanjivini and Sanjivini) seedlings were planted at Dollygunj, Chidiyatapu and Mithakari (around 15 acres) for evaluation of its growth and yield performance at private farming area. The planted seedlings were mulched with coconut husk and modified planting systems were also carried out for protecting the seedlings from drought. Under the modified ridges and furrow system planting of noni seedlings on the ridges protected the seedlings from water stagnation and the yield observation showed that the highest yield of 27 kg/tree/year compared to intercrop of noni under banana (22 kg/tree/year) (Plate 35).

Plate 35: Modified ridges and furrow system planting of noni

Enriching Coconut Plantations of Andaman and Nicobar Islands through Augmentation of Indigenous Multipurpose Tree Resources

I.Jaisankar, B. Augustine Jerard, T. P. Swarnam and V. Damodaran

To evaluate the biomass production potential of different multi purpose trees (MPT's) under coconut garden, an experiment was initiated with the following MPT's. *Sesbania grandiflora, Leucaena leucocephala, Dendralobium undullatum, Pterocarpus dalbergioides, Bahuinia spp, Sterculia villosa, Casuarina equisetifolia, Morinda citrifolia, Sagaria elliptica, Diospyros marmorata, Callophyllum inophyllum and Pongamia pinnata*. The experiment was initiated at Garacharma Research Farm of the Institute in the month of August 2018. The initial soil samples were collected and analysed for the NPK content so as to study the impact of multipurpose trees on soil properties. Germination percentage and gap filling of the MPT's have been carried out. The growth observations of MPT's were recorded at bimonthly interval. The observations showed that at the initial period of growth there was no significant difference among the MPT's growth. The results revealed that the soil available nitrogen ranged from 177 kg/ha to 190 kg/ha, phosphorous ranged from 15.0 kg/ha to 16.4 kg/ha and potassium ranged from 84.6 kg/ha to 96.5 kg/ha.

Regeneration and Molecular Characterization of Andaman Padauk (*P. dalbergioides*)

I.Jaisankar, B. Augustine Jerard and Nabanitha Ganguly

Padauk (*Pterocarpus dalbergioides* Roxb.) belonging to the family Fabaceae is the principal timber tree endemic to the Andaman not occurring even in the Nicobar group of Islands nor in the rest of the world. The wood, which is used for innumerable purposes, varies in colour. Trees with Burr formation and trees with less sap wood occur interspersed in the same habitat suggests that both the characters are under strong genetic control and needs to be identified and mass multiplied. The species has been over exploited during the fast systems of management coupled with unabated smuggling has led to the depletion of Padauk. It is essential for the conservation of *P. dalbergioides* to encourage the *ex situ* plantations, which require large-scale elite planting materials. The production of vigorous and healthy seedlings by vegetative means would enhance forest management through enrichment planting especially for species that are threatened and also in a short span of time, by *in vitro* propagation. To restore the species to its pristine position there is a need to standardize seed and vegetative propagation strategies for mass multiplication and *ex situ* conservation of superior quality phenotypes. Against this backdrop, the current study is proposed to mass multiplication through seed and vegetative propagation, molecular characterization and *ex situ* conservation of this species in the interest of current national importance. The project has been sanctioned by Department of Biotechnology, Ministry of Science and Technology, Government of India by December 2018 (DBT sanction order. No. BT/PR29179/FCB/125/7/2018. Dt. 21.12.2018). Initial exploratory survey work for identification of plus trees conducted from South Andaman District and identified seven plus trees. Seeds and stem cuttings were collected from selected trees pretreated and planted in nursery for further evaluation. First sprouting from stem cuttings were observed sixteenth day after planting (Plate 36).

Plate 36: Padauk propagation (a) Coppice of selected plus tree, (b) Pretreated Stem cuttings of Padauk tree under nursery for evaluation

Planting Material Production in Horticultural Crops

B. Augustine Jerard, V. Baskaran, K. Abirami, V. Damodaran, I. Jaisankar, Ajit Arun Waman, Pooja Bohra, Soobedar Yadav and S.K.Zamir Ahmed

This is a new project launched during 2018-19 focusing on strengthening the quality planting material in selected and targeted horticultural crops for the benefit of stakeholders. The planting material production was taken up during this period in plantation crops (coconut, arecanut), spices (Black Pepper, Nutmeg, clove, cinnamon, ginger, turmeric), fruits (dragon fruit, west Indian cherry, carambola, bael, Garcinia, acid lime), vegetables (broad dhaniya, poi, amaranthus, brinjal, coccinea), tuber crops (sweet potato, greater yam, tapioca), flowers/ ornamental plants (Marigold, tuberose, anthurium, orchids, foliage plants etc) and forestry/industrial crops (Noni, multi-purpose tress etc). The planting material of these targeted crops and plants were sold or distributed to the stakeholders including farmers.

The mother blocks of coconut, arecanut, Guava, sapota, dragon fruit, garcinia spp, carambola, tree spp, ornamental plots, spices and medicinal plant conservatory maintained under different ongoing projects were used for producing planting materials. New area has been cleared within the horticulture farm for establishment for selected mother plants in targeted trees and fruits. The planting material production in spices was also undertaken under the CSS-MIDH on spices which has been reported under the project. During the reporting period, about 9250 units of elite planting material of horticulturally, important crop/tree as listed of aboveand about 950 kg of seed tubers/ rhizomes of Elephant Foot yam, ginger and turmeric were produced and supplied to the needy farmers excluding the spices planting material produced under CSS-MIDH programme.Over 17500 planting materials of coconut, arecanut, noni, minor fruits and spices are in the nursery at various stages and being maintained for distribution in the coming season (Plate 37).

Plate 37: Noni (*Morinda citrifolia*) seedling production

One thousand six hundred (1600) cuttings of improved varieties of black pepper were multiplied through vine cuttings, of which 1,351 plants were sold to the farmers (Plate 38). About 500 air layers of superior types of cinnamon and tejpat were produced (Plate 39), of which 94 were distributed to the farmers, while remaining are under hardening. In case of underutilized fruits, 650 seedlings of *Garcinia* species, West Indian cherry, blood fruit and bael were produced, of which 42 were distributed to the stakeholders. To facilitate strengthening of the activity of planting material production of perennial horticultural crops, a polyhouse has been renovated with misting and sprinkler irrigation facilities at Garacharma farm and another polyhouse was renovated at Sipighat farm. As the availability of good soil mixture for polybags is becoming an issue in the Islands, a trial on coir pith composting using poultry manure has been initiated to promote and use of soilless media for plant propagation and distribution.

Plate 38: Planting material of black pepper being loaded for transportation to North Andaman

Plate 39: Air layering in tejpat for distribution to farmers

Germplasm Collection and Augmentation from Andaman and Nicobar Islands - joint Exploratory Survey with Teams from ICAR- NBPGR and ICAR-IISR

B. Augustine Jerard, I. Jaisankar (ICAR-CIARI) Joseph John, Pradheep, K (ICAR-NBPGR) and V.A. Mohammed Nissar (ICAR-IISR)

A joint exploration survey was conducted by scientists from ICAR-CIARI and ICAR- NBPGR during January 2018 in parts of Great Nicobar Biosphere Reserve from 11.01.2018 to 31.01.2018 and the team has collected 88 crop wild relatives. Some of the collections *viz*., Piper spp, Mangifera spp, *Knema* spp, *Dioscorea* spp., *Gingiber* spp.,wild edible fruit species, fodder species, *Jasminum* spp., wild banana, *Garcinia* spp., Arecanut and Mango-ginger were conserved at ICAR-CIARI, remaining accessions were deposited and conserved at ICAR- NBPGR, Thrissur and New Delhi. Among the collections made, twenty-eight well established accessions were allotted IC numbers from ICAR- NBPGR, New Delhi and the rest are under various stages of conservation and multiplication.

Subsequently, the full team as above has undertaken another joint exploration and collection mission targeting horticulturally important crop wild relatives from Great Nicobar, Little Nicobar and Noncowrie group of Islands w.e.f. 10.01.2019 to 10.02.2019. The work has assumed national importance as documentation and collection of the plant biodiversity from hitherto unexplored areas has been considered the key for strengthening the conservation and utilization of Island plant biodiversity. Through this collection mission, a total of 213 important wild/cultivated horticulturally important plant species comprising several accessions of *Mangifera* spp, *Piper* spp, *Artocarpus* spp, *Garcinia* spp, wild *Musa* spp, different wild cucurbits, a rare ash gourd, ginger, turmeric, *Alocasia* spp, *Colocasia* spp, greater yam, sweet potato, *Bixa* sp, different endemic leafy vegetable plants, orchidaceous plants, edible fern species, *Casuarina* spp, *Cardia* sp, *Myristica* spp, *Rhopaloblaste* sp, *Bentickia nicobarica*, wild/ cultivated *Areca* spp, *Syzigium* sp, *Alpinia* sp, *Amorphophalus* sp, wild *Jasminum* spp, *Citrus* spp, *Vigna marina, Etlingera* spp, *Eclipta alba*, *Knema andamanica*, *Moringa* sp, *Morinda citrifolia* and *Horsfeldia irya.* A set of all these collections were planted at ICAR-CIARI and at NBPGR, Thrissur for further conservation (Table 30, 31 and Plate 40).

Table 30: Number of collections made from Great Nicobar little Nicobar and Noncowrie group of Islands

Place	Number of collections
Galathea forest	6
Galathea forest to towards Indira point	10
Galathea II	8
Shompen Hut	5
Pillow Millow	10
Makachua	22

Place	Number of collections
Pilopancha and Thomas Tikry	9
Afra Bay and Kondul Island	13
Vijay nagar and Sastri nagar	9
Chingan forest	3
Bada Enaka, Vikas nagar and Pilpillow	22
Champin Island	10
Hitui	11
Katchal Island	33
Theresa Island	34
Trinket Island	6
Munak	2
Total	213

Table 31: List of accessions collected from Great Nicobar and Noncowrie group of Islands

Acc. No/ Collector No.	Name of the species	Acc.No/ Collecter No.	Name of the species
AJJPN/19/	**12.01.2019** (Galathea)	123	*Citrus reticulata*
90	*Dioscorea piscotorum*	124	*Citurs auritipolium*
91	*Eclipta alba*	125	*Pandanus amarillifolius*
92	*Dioscorea* sp	126	*Piper betle*
93	*Piper pedasallosum*	127	*Casuarina equisetifolia*
94	*Piper* sp	128	*Vigna marina*
95	*Tinospora cardifolia*		**18.01.2019** (Makachua)
	13.01.2019 (Towards Indira point)	129	*Cissus ripens*
96	*Horsfeldia glabra*	130	*Cerbera mangas*
97	*Knema malayana*	131	*Mangifera comptosperma*
98	*Zizupus horsfeldie*	132	*Jasminum elongatum*
99	*Piper clapiatum*	133	*Knema globularia*
100	*Piper betle*	134	*Garcinia nervosa*
101	*Piper betle*	135	*Alpinia congigera*
102	*Piper pedusallosum*	136	*Dioscorea* spp
103	*Cissus ripens*	137	*Piper* spp
104	Unidentified	138	*Piper pedesellasum*
105	*Myristica andamanica*	139	*Piper betle*
	14.01.2019 (Galathea II)	140	*Myristica andamanica*
106	*Garcinia nervosa*	141	*Myristica andamanica*
107	*Musa inandamanensis*	142	*Myristica andamanica*
108	*Amorphophalus*	143	Capsicum
109	Piper (wild)	144	*Curcuma longa*
110	*Dioscorea bulbifera*	145	*Musa* wild
111	*Pinnanka manii*	146	Etilingira

Acc. No/ Collector No.	Name of the species	Acc.No/ Collecter No.	Name of the species
112	*Dioscorea nimularia*	147	Citrus lemon
113	*Eclipta alba*	148	*Citrus medica*
	16.01.2019 (Shompen Hut)	149	*Osimum sanctum*
114	*Piper* spp	150	Vegetable cowpea
115	*Syzigium gratum*		**19.01.2019** (Pilopancha)
116	*Piper* spp	151	*Artocarpus pidangularis*
117	*Piper* wild	152	*Osimum sanctum*
118	*Tinospora cardifolia*	153	*Horsfeldia irya*
	17.01.2019 (Pillowmillow)	154	*Curcuma* spp
119	Leafy vegetable	155	Citrus
120	Garcinia	156	*Citrus aurantifolia*
121	*Alpinia congigera*	157	*Aristolochia tagala*
122	*Curcuma rubesense*	158	*Colubrina asiatica*
159	*Eclipta alba*	197	*Xanthosomasagitrifolium*
	20.01.2019 (Afra Bay)	198	*Bentinckia* sp
160	*Garcinia nervosa*	199	*Colocasia esculenta*
161	*Dracontomelon dao*	200	*Morinda citrifolia*
162	*Piper* spp	201	*Zingiber* sp
163	*Vigna marina*	202	*Abelmoschus moschatus*
164	*Alpinia* sp	203	*Dioscorea nummularia*
165	*Eclipta* alba	204	*Curcuma longa*
	21.01.2019 (Kondul Island)	205	*Etilingira fenzlii* – white colour
166	*Vigna marina*	206	*Gardenia* sp
167	*Knema laurina*	207	*Trichosanthes quinquangulata*
168	*Garcinia dubius*	208	*Myristica andamanica*
169	*Garcinia* sp	209	*Horsfeldii glabra*
170	*Mimosops* sp	210	Lemon grass
171	*Artocarpus chama*	211	*Garcinia hombroniana*
172	*Piper pedicellosum*		**28.01.2019** (Champin Island)
173	*Etlingera* sp	212	*Artocarpus* sp
174	*Artocarpus peduncularis*	213	*Alocasia macrorhizos*- Purple
175	*Piper* sp	214	*Syzygium* Clove relative
176	*Dioscorea* sp	215	*Areca triandra*
177	*Tacca laentopetaloides*	216	*Cucumis melo* sub sp. Agrestis
178	*Zingiber* sp	217	*Buchanania splendens*
	23.01.2019 (Vijay and Shastri Nagar)	218	*Horsfieldia irya*
179	*Musa inandamanensis*	219	Turmeric
180	*Musa inandamanensis*	220	*Syzygium* Jamun relative
181	*Cinnamomum verum*	221	*Cajanus scarabaeoides*
182	*Moringa oleifera*		**29.01.2019** (Munak and Hitui)
183	*Eclipta prostate*	222	*Syzygium jambos*

Acc. No/ Collector No.	Name of the species	Acc.No/ Collecter No.	Name of the species
184	*Carchorus aestuans*	223	*Solanum lasiocarpus*
185	*Tephrosia purpurea*	224	*Alpinia conchigera*
186	*Echinochloa acolona*	225	*Dioscorea bulbifera*
187	*Eclipta alba*	226	*Garcinia humbroniana*
	25.01.2019 (Chingan Forest)	227	*Alpinia conchigera*
188	*Myristica andamanica*	228	*Artocapus gomegianus*
189	*Knema malayana*	229	*Sterculia cordata*
190	*Diospyros undulate*	230	*Garcinia humbroniana*- sweet
JPJ/19/	**27.01.2019** (Bada Enaka)	231	*Cordia grandis*
191	Sida sp	232	Meeta Bhaji
192	*Dioscorea glabra*	233	*Garcinia hombroniana*- Sour
193	*Piper betle*	234	*Colocasia esculenta*
194	*Eclipta alba*	235	*Artocarpus peduncularis*
195	*Colocasia esculenta*- Purple	236	*Horsfieldia glabra*
196	*Colocasia esculenta*- Green	237	*Garcinia hombroniana*
238	*Parsiflora suberosa*		**02.02.2019** (Therassa)
	30.01.2019 (Katchal)	278	*Rhynchosia* sp
239	*Vigna* sp	279	*Indigofera* sp
240	*Dioscorea* sp	280	*Solanum lasiocarpus*
241	*Garcinia hombroniana*	281	Brinjal spiny
242	*Ziziphus horsfieldii*	282	*Bixa orellana*- White flower
243	*Artocarpus chama*	283	*Colocasia esculenta*
244	*Artocarpus gomezianus*	284	*Oropea katschallica*
245	*Artocarpus communis*	285	Vegetable cowpea
246	Ginger	286	*Dioscorea esculenta*
247	Turmeric	289	*Dioscorea bulbifera*
248	Mango ginger	290	*Colocasia esculenta*
249	*Zingiber* sp	291	*Dioscorea alata*- purple
250	Zingiber wild	292	*Dioscorea alata*- Kuping
251	*Tinospora cordifolia*	293	*Dioscorea alata*
252	*Madhuca butyraceoides*	294	Sweet potato
253	Meetha Baji	295	*Syzigium* sp (Clove relative)
254	*Mangifera nicobarica*	296	*Vigna* sp
255	*Mangifera camptosperma*	297	Ash gourd (Wild)
256	*Knema* spp	298	Primitive brinjal
257	*Dimocarpus longan*	299	*Solanum lasiocarpus*
258	*Dioscorea piscatorum*	300	*Artocarpus chama*
259	*Dioscorea glabra*	301	Piper wild
260	*Tricosanthus quinquangulata*	302	*Cordia subcordata*
261	*Alocasia macrorhizos*		**04.02.2019**
262	*Colocasia esculenta*	303	*Citrus aurentifolia*

Acc. No/ Collector No.	Name of the species	Acc.No/ Collecter No.	Name of the species
263	*Colocasia esculenta*	304	*Knema* sp
264	*Xanthosoma sagiffolium*	305	*Vernonia* sp
265	*Acorus calamus*		**06.02.2019**
266	*Amaranthus dubius*	306	*Eclipta alba*
267	*Trichosanthes tricuspidata*	307	Castor
268	*Knema* sp	308	Brinjal- Spiny
	01.02.2019 (Therassa)	309	*Triphasia trifoliate*
269	*Abelmoschus moschatus*	310	*Garcinia hombroniana*
270	*Cajanus scarabaeoides*	311	*Eugenia* sp
271	Cucurbit- red fruit		**06.02.2019** (Munak)
272	*Curcuma rubascens*	312	*Artocarpus peduncularis*
273	*Sesbanis javanica*	313	*Musa* sp
274	*Sesbania cannabina*		**07.02.2019** (Kamorta)
275	*Luffa aegyptiaca*	314	*Syzygium* sp
276	*Corchorus aestuans*	315	Meetha Baji
277	*Mucuna puriens*		

a) Piper clipiatum

(b) Myristica andamanica

c) Garcinia spp

(d) New wild Musa sp

(e) Mangifera nicobarica

(f) Mangifera camptosperma

Plate 40: Few new collections made from unexplored areas of Nicobar district

Organic Vegetable Production

V. Baskaran and K. Abirami

A pilot project was undertaken for production of vegetable crops organically using biowaste decomposer and other organic inputs. The entire vegetable production was done in modified planting system with organic media. Two varieties of Okra Arka namely Anamika and CO4 were evaluated for their growth and yield under modified planting system (Plate 41). The growth and yield of CO4 variety of bhendi was significantly higher with maximum plant height (140.6 cm), single fruit weight (34.5 g) and per plant yield (860.3 g) when compared to Arka Anamika (plant height (98.3 cm), single fruit weight (17.5 g) and per plant yield (480.3 g)).

CO2 variety of brinjal evaluated with the local accession collected in modified planting system under organic production. The fruit weight (129.2 g per fruit), and yield per plant were maximum in the local accession (3.16 Kg per plant) and the crop is still in the field. The plants were healthy in the local accession when compared to the CO2 variety. No pest and disease incidence noticed so far.

Plate 41: Field view of organic Okra production

DIVISION OF
FIELD CROP IMPROVEMENT AND PROTECTION

Augmenting Rice Productivity through Varietal Purification of Popular Land Races

R. K. Gautam, P. K. Singh, S. K. Zamir Ahmed, K. Sakthivel, S. Swain and Pooja Kapoor

PPVFRA Registration of Karen rice varieties

The traditional varieties of rice grown by Karen community in Middle Andaman as characterized and purified during previous years were facilitated for registration with the Protection of Plant Varieties and Farmers' Rights Authority (PPVFRA), Govt. of India, New Delhi. Consequently, following 5 unique rice land races have been registered as farmers' varieties by PPVFRA (Table 32). The registration certificates were given by Shri. Radha Mohan Singh, Hon'ble Union Minister of Agriculture & Farmers' Welfare to Saw Saytha, President Karen Welfare Association on February, 2018 during Regional Agriculture Fair in ICAR-CIARI, Port Blair (Plate 42).

Table 32: Details of registration of Karen rice varieties in favour of applicant Karen Welfare Association

SI. No	PPVFRA Registration No.	Application No.	Denomination of Traditional Varieties	Date of Registration
1	221 of 2017	F542 OS573 14 892	Black Burma	11-07-2017
2	222 of 2017	F543 OS594 14 893	Khushbayya	11-07-2017
3	219 of 2017	F544 OS575 14 894	White Burma	11-07-2017
4	308 of 2017	F545 OS576 14 895	Mushley	27-11-2017
5	220 of 2017	F546 OS577 14 896	Nyaw-in	11-07-2017

Plate 42: Felicitation by Hon'ble Minister of Agriculture & Farmers' Welfare during RAF at Port Blair

Evaluation of Black Burma and Khusbuyya lines in Karen village, Mayabunder (North & Middle Andaman)

Based upon previous years' performance of intra-varietal selections, 5 elite lines each of two Karen rice varieties Black Burma and Khushbuyya were evaluated along with local check variety, CARI Dhan 5 in three replication under RBD design following plot size of 8.4 m^2 without any fertilizer application at Webi village, Mayabunder. Though no significant differences for grain yield were recorded among selections of both traditional varieties, the best grain yield performance (t/ha) of the selection BB13-79 (2.26) followed by BB13-1 (2.18) and BB13-40 (2.10) was recorded in case of Black Burma. Similarly, among Khushbuyya lines, KU-65 line produced maximum grain yield (2.29 t/ha) ton/ha followed by KU13-10 and KU13-51 (1.85 t/ha).

Front line demonstrations and seed production of CIARI Dhan 8 and CIARI Dhan 9

Front line demonstrations (FLDs) were conducted for CIARI Dhan 8 and CIARI Dhan 9 rice varieties in the field of 15 farmers growing C14-8 rice variety in North & Middle Andaman. In general, farmers gave good feedback in terms of important characters of new varieties in comparison with C14-8 (Table 33). Though the exact grain yield could not be measured, the average estimates across farmers fields revealed that CIARI Dhan 8 gave grain yield of 3.2 t/ha against 2.0 t/ha of farmers' own C14-8. Similarly, CIARI Dhan 9 yielded about 2.6 t/ha in comparison with farmers' C14-8 (2.1 t/ha). A total of 91 kg and 165 kg Breeder Seed of CIARI Dhan 8 and CIARI Dhan 9 respectively have been produced during Kharif 2018-19 to meet seed demand.

Table 33: Performance of CIARI Dhan 8 and CIARI Dhan 9 varieties in FLDs

Attribute	CIARI Dhan 8 (9)	Farmers' C14-8 (8)	CIARI Dhan 9 (6)	Farmers' C14-8 (4)
Visual crop performance *	1.7±0.33	4.7±0.45	1.3±0.3	2±1.0
Disease/pest problem	3.9+0.35	5±0.53	3.3±0.3	4±0.6
Lodging	8.8+0.22	8.5±0.32	9.0±0.0	9± 0.0
Grain type	2.3+0.33	4.25+0.36	3.7±0.7	4.5±1.3
Estimated Grain Yield (t/ha)	3.2±0.4	2.0±0.3	2.6±0.3	2.1±0.3

Figures in parenthesis denote number of farmers grown this variety,

* SES: 1-9 scale, 1: Best, 9: Poorest.

Stress Tolerant Rice for Poor Farmers of Africa and South Asia (A & N Islands, India)

R. K. Gautam, P. K. Singh, S. K. Zamir Ahmed and A. Velumurugan

Salinity Tolerant Breeding Network Trial (STBN)

A total of 96 rice genotypes contributed by different salinity research centres in India were evaluated under STBN 2018-19 trial at Creekabad village, Port Blair, South Andaman district under salinity (ECe~3.8 dS/m and ECiw~5.22 dS/m) conditions in sandy loam soil near the sea shore area having frequent high tides. The latitude and longitude of the field was 11^{0}39.11" N and 92^{0}44.44" E, respectively with the elevation of 4 m from the mean sea level. The experiment was conducted with one local check variety, CARI Dhan 5 and 5 national checks *viz.* CST 7-1, CSR 27, NSICRC 222, CSR 10 and CSR 36 along with susceptible check, Pusa 44 in Augmented Block Design with 4 blocks. The gross plot size of 4 m^2 was followed by planting on 3rd July, 2018 with a row spacing of 20 cm and plant spacing of 15 cm. The recommended doses of fertilizers was applied @ 90 kg/ha N, 60 kg/ha P_2O_5 and 40 kg/ha K_2O during the crop growth period. The data were recorded for plant height, days to 50% flowering, tillers/plant, productive tillers/plant, panicle length, spikelet fertility, filled grains, grain yield (t/ha) and phenotypic acceptability scores. Significant variability was observed in the genotypes for all traits recorded except number of tillers. The grain yield data revealed that genotypes *viz*. CSR2016 IR18-1 and KS-12 were found to be significantly better (3.17 t/ha) than the best check, CST 7-1 (2.13 t/ha) under the tested salinity conditions of the Island agro-ecosystem. A compilation of results revealed the following promising rice genotypes as best under tested salinity conditions during last 5 years for Andaman & Nicobar Islands (Table 34).

Table 34: Promising salt tolerant rice varieties for Andaman and Nicobar Islands

Year	Salinity (ECiw~dS/m)	pH	Farmers' preferred salt tolerant varieties
2014	6.8	5.5	CARI Dhan 6, NDRK11-14
2015	4.0	5.5	IR84645-305-6-1-1-1, IR87938-1-1-2-1-3-B
2016	5.0	5.5	RP 4353-MSC-38-43-6-2-4-3 and CARI Dhan 5
2017	4.3	7.8	CSR2016 18-15 and CSR2016-IR18-2
2018	5.5	7.8	CSR2016 IR18-1 and KS-12

Seed production and dissemination of salt tolerant rice varieties

A total of 37.60 quintal truthfully labelled seed of salt tolerant rice varieties CARI Dhan 4 (8.00 q), CARI Dhan 5 (11.00 q) and CSR36 (18.60 q) as produced during last year was distributed in different Islands.

The Global Rice Array: India Partnership to Strengthen Global Phenomics Network

R. K. Gautam, P. K. Singh, K. Sakthivel & K. Venkatesan

International Rice Research Institute, Philippines is leading the CGIAR Research Program (CRP) on rice which has 5 flagship projects. The flagship project 4 (FP4) is on "Global Rice Array (GRA)" with 5 clusters of activities (CoA). GRA is a global network of field laboratories and trial sites, which aim to characterize and monitor the environments, conduct crop/ pathogen trials and develop models to quantify and map the impact of abiotic/biotic factors on yield. Its main goal is to establish a Global Rice Array to provide phenomics, genomics and environmental information to the rice breeders as well as target ideotypes for accelerating development of better adapted varieties worldwide especially in view of emerging climatic scenario.

A twice replicated GRA trial of "Antenna Panel" consisting of 58 genetically diverse genotypes originating from different countries was conducted at Bloomsdale Farm of ICAR-CIARI, Port Blair during 2018-19 in a plot size of 2.88 m^2 (12 plants /row, 6 rows/ plot and 20x20 cm spacing) without additional spacing after each plot. Significant differences were recorded among genotypes for the grain yield performance which is also shown in Fig. 11. Among all the genotypes, IRRI 154 produced the maximum grain yield (3.5 tons/ha) followed by Sahel 134 & N 22:IRGC 19379-1 and BR28 (3.3tons/ha). On the other hand, 2 genotypes, Manaw Thukha and OM4900 could not survive after the transplanting.

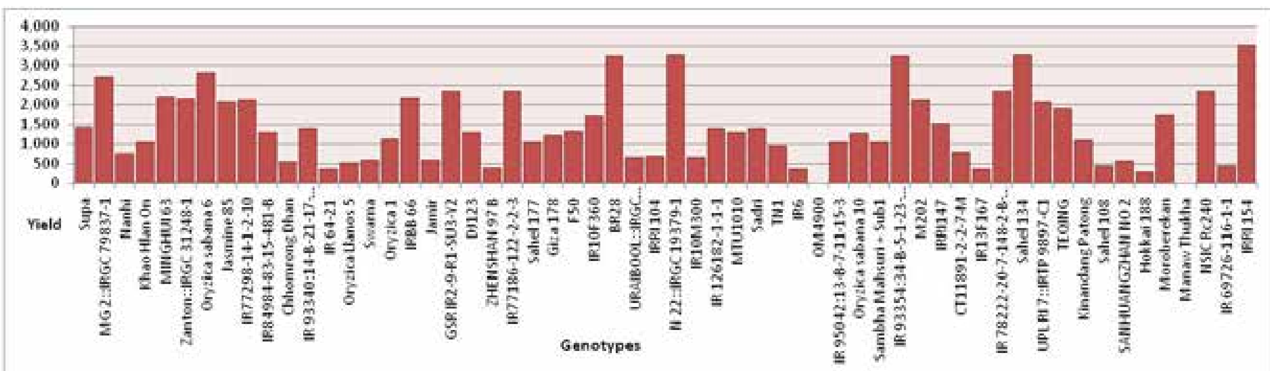


Fig. 11: Grain yield performance of Global Rice Array lines during Kharif 2018-19

ICAR Seed Project - Seed Production in Agricultural Crops

P. K. Singh and R. K. Gautam

Nucleus and breeder seed production

A total of 26 kg of Nucleus Seed of 9 rice varieties (CARI Dhan 1, CARI Dhan 2, CARI Dhan 3, CARI Dhan 4, CARI Dhan 5, CARI Dhan 6, CARI Dhan 7, CARI Dhan 8 and CARI Dhan 9) and 157 kg of Breeder Seed of 12 varieties were produced at Bloomsdale Research Farm, ICAR-CIARI, Port Blair during Kharif 2018. Moreover 0.5 Kg TFL seed of CARI Brinjal 1 and CARI Brinjal 2 were also produced during Rabi 2018-19 (Plate 43 a).

Farmer's participatory seed production

Under farmers participatory seed production 59.42 quintal Truthfully Labelled (TFL) Seed of 9 rice varieties (CARI Dhan 2, 4, 5, 6 7, 8, 9, CSR36 and Gayatri) was produced at Keralapuram, Madhupur, Pinakinagar and KVK-CIARI, Nimbuder, North Andaman during Kharif 2018 (Plate 43 b & c). Besides that 4.01 quintal TFL seed of 4 Mungbean varieties (CIARI Mung 1, 2, 3 and 4) and 2 varieties of Urdbean (CIARI Urd 1 & CIARI Urd 2) was produced at Diglipur during Rabi 2018-19.

Plate 43: Seed production of Rice a) Field view of Breeder seed of rice, b) Farmers participatory seed production of rice c) Farmers visit at CARI Dhan 6 rice variety field

Seed Day conducted

Seed day on Technology application of promising High Yielding Varieties of rice was conducted at Rangat, Sundergarh, North & Middle Andaman and KVK-CIARI, South Andaman during Kharif 2018. During the programmes total of 17 quintal seed of CIARI Rice Varieties CARI Dhan 4, 5, 6, 7, 8 and 9 were given to the 197 farmers under FLDs. This program was conducted with the collaboration of KVK, Nimbudera, North and Middle Andaman, KVK, Port Blair, South Andaman and Social Science Section, CIARI.

Similarly Seed day on Promoting high yielding varieties of pulses at North & Middle Andaman through FLDs were conducted at Long Island, North and Middle Andaman during Rabi, 2018-19. During the programme, 1.0 quintal seed of HYVs of pulses (CARI Mung 1, CARI Mung 2, CARI Mung 3, CARI Mung 4, CARI Urd 1 and CARI Urd 2) were given to the 62 farmers under FLDs.

Trainings and field day imparted

Two trainings and one Field Day were organised on various aspects of quality seed production and management of rice and pulses in North & Middle Andaman during 2018-19 (Plate 44). Altogether, 96 farmers were participated and benefited from the trainings.

Plate 44: Field day on farmer's participatory seed production (a), Seed day (b) and Rice seed distribution during seed day for FLDs (c).

Seed sale and distribution

A total of 0.80q Truthfully Labelled Seed of HYVs of Pulses were supplied to the Department of Agriculture. However, 18 quintal TFL seed of rice varieties (CARI Dhan 4, CARI Dhan 5, CARI Dhan 6, CARI Dhan 7, CARI Dhan 8, CARI Dhan 9 and CSR 36) and 1.0 quintal seeds of pulses (Green gram and black gram) were distributed to the farmers of North and Middle Andaman under FLDs during Kharif 2018-19. Moreover under Schedule Tribe Component (STC) programme, 15 quintal rice and 1.27 quintal pulses seed were given to the farmers of Hut bay, Campbell Bay and Car Nicobar farmers.

Genetic Improvement of Rice for Higher Productivity in Andaman and Nicobar Islands Conditions

P. K. Singh, R. K. Gautam, B. Gangaiah, K. Sakthivel, T. Bharathimeena, S. K. Zamir Ahmed and B. L. Meena

Evaluation of Multi-parental crosses

Eighty seven F_1 plants produced under eight-way crossing [GSR33/Gayatri/Khusbuyya/IRLON50 (Female) x CSR36/SPS26/IRBB60/IRLON25 (Male)] of parents having high yielding, wider adoptability, resistant to BLB were evaluated in space planting (25 x 25 cm) in field conditions during Kharif 2018. F_2 seeds of individual plants were harvested for growing F_2 generations. Likewise, F_2 generations of four-way crosses GSR33/Gayatri/Khusbuyya/IRLON 50 and CSR 36/SPS26/IRBB60/IRLON 25 were also evaluated in space planting under rainfed low land conditions. High genetic variability were observed for plant height, days to flowering, panicle length, tiller/plant & yield/plant. Single panicle of individual plants (500 each) of above four-way crosses were collected for growing F_3 generation (Plate 45).

Plate 45: Performance of progenies of multiple crosses in rice (a) F1 and (b) F2

Evaluation of elite rice lines under rainfed lowland conditions

Total of 18 improved lines of rice were evaluated under rainfed lowland conditions at Bloomsdale Research Farm, Port Blair during Kharif 2018 (Plate 46). The experiment was conducted in RBD design with two checks (CARI Dhan 6 and CARI Dhan 7) and planting was done at the spacing of 20 x 15 cm in the month of July. Observations were recorded for plant height, days to flowering (50%), panicle length (cm), tillers/plant, grain yield (t/ha). Disease scoring was also done for BLB through artificial inoculation under field conditions. The results revealed that all rice lines under study are medium duration and medium-statured, except ANR 41 (126cm). Panicle length of rice lines ranged from 22 to 27 cm and the average number of tillers/plant observed as 6.9. The highest grain yield (t/ha) was recorded for ANR 44 (5.58) followed by ANR 51(5.38) and ANR 49 (5.25) compared to best check CARI Dhan 7 (5.04). However, highest average (2017-18 and 2018-19) grain yield were recorded only for ANR 51 (5.16) over the best check (CARI Dhan 7) (5.11). While four lines *viz.* ANR 51 (5.16), ANR 43 (5.10), ANR 47 (5.09), ANR 53 (5.09) and ANR 44 (4.97) were found superior compared to check variety CARI Dhan 6 (4.91). However, ANR 43, ANR 47, ANR 48, ANR 46 and ANR 58 showed resistances for BLB (Table 35).

Table 35: The performance of elite rice lines under rainfed lowland conditions

S. No.	Genotype	DF	PH	NT	PL	GY		Av. GY	BB	PAccP
						2018-19	2017-18			
1	ANR 41	74	126	7	25	4.71	4.72	4.71	5	1
2	ANR 42	78	118	7	26	4.54	4.46	4.50	5	1
3	ANR 43	87	103	7	25	4.96	5.24	5.10	1	1
4	ANR 44	88	110	8	23	5.58	4.36	4.97	5	1
5	ANR 45	79	117	6	24	4.67	4.13	4.40	5	1
6	ANR 46	75	105	6	22	4.54	4.44	4.49	5	1
7	ANR 47	82	114	7	23	4.96	5.23	5.09	3	1
8	ANR 48	81	111	7	24	4.33	5.12	4.73	3	1
9	ANR 49	80	114	7	24	5.25	4.29	4.77	9	1
10	ANR 50	80	114	7	24	4.79	4.88	4.84	5	1
11	ANR 51	82	107	6	24	5.38	4.94	5.16	5	1
12	ANR 52	73	116	6	26	4.71	4.77	4.74	7	7
13	ANR 53	76	122	8	27	4.54	5.63	5.09	9	5
14	ANR 54	78	127	6	25	3.75	5.28	4.52	5	1
15	ANR 55	75	123	7	26	4.75	4.76	4.76	7	3
16	ANR 56	76	122	8	25	4.29	5.29	4.79	3	3
17	ANR 57	80	132	7	26	3.71	4.65	4.18	7	5
18	ANR 58	88	123	7	26	4.29	5.33	4.81	3	1
19	CARI Dhan 7	91	129	8	26	5.04	5.18	5.11	3	1
20	CARI Dhan 6	89	135	7	25	5.00	4.81	4.91	3	3
	Mean	**80.62**	**118.4**	**6.90**	**24.82**	**4.69**	**4.87**	**4.78**		
	C.D.	**2.99**	**10.28**	**1.04**	**2.14**	**0.714**	**0.82**			
	SE(m)	**1.47**	**5.06**	**0.51**	**1.05**	**0.35**	**0.42**			
	C.V.	**2.24**	**5.23**	**9.08**	**5.18**	**9.09**	**8.24**			

DF= Days to flowering (50%); PH= Plant height (cm); NT= Tillers/ plant; PL= Panicle length (cm); GY= Grain yield (t/ha); Av. Gy= Average grain yield; BB= Bacterial leaf blight; PAccP= Phenotypic acceptability

Plate 46: Field view of elite rice lines under rainfed lowland conditions during 2018-19

Enhancing Pulse Productivity of Andaman and Nicobar Islands through Development and Promotion of High Yielding and Stress Tolerant Varieties

K. Venkatesan, R.K. Gautam, K. Sakthivel, P.K. Singh, B. Gangaiah, and S.K. Zamir Ahmed

Exploration, Collection and molecular characterization of *V. marina*

The South, Middle and North Andaman areas were explored for Beachpea. Leaf samples and cuttings of 15 Beachpea genotypes were collected from South Andaman [Chidyatapu; Manjery; Wandoor; Baludera (Baratang); Harmindar bay (Little Andaman); Radhanagar and Kalapather (Havelock Island); Bharatpur, Lakshmanpur, Pearl park (Neil Island)] and North and Middle Andaman of Lamia bay (Diglipur) (Table 36 and Plate 47). This species was not found in the following areas such as Badabalu (Chidyatapu) and Corbyn's Cove of South Andaman, Hut bay area's (Hut bay jetty, 7th Km, 11th Km, 16th Km) of Little Andaman, Kalipur, Arialbay, Ramnagar areas of Diglipur (North Andaman) and Karmatang (Mayabandhar), Betapur and Long Island areas of Middle Andaman. DNA of 15 collected *V. marina* genotypes and 5 checks [3 Urdbean varieties (LBG 752, VBN 7 and IPU-02-43) and 2 Mungbean (LGG 544 and TARM 1)] were isolated for molecular characterization. Seven SSR primers (CEDG007, CEDG087, CEDG288, CEDG102, cp04220, cp02909 and cp06039) related to stage-specific salinity tolerance used for screening them. However, only two primers (CEDG087 and CEDG007) showed polymorphism among 20 *Vigna* genotypes. The details of SSR primers used, number of alleles deducted, PIC values and expected hetero-zygosity (He) were presented in Table 37. The SSR marker profiles of Beachpea genotype was presented in Fig. 2. The number of alleles detected per primer ranged from 1 to 3, whereas, the size of alleles ranged from 100 to 325bp. The PIC values ranged from 0.05 to 0.57 with an average of 0.33. The H_e values ranged from 0.375 to 0.612. Two SSR loci revealed PIC and H_e values higher than 0.40 and 0.50, respectively, and are CEDG087 and CEDG007.

Table 36: The passport information of *Vigna marina* genotypes collected from Andaman and Nicobar Islands and the varieties of other *Vigna* species

Accession	Site of collection		Latitude ^{0}N	Longitude ^{0}E	Altitude (m)
	Village	District			
Vm1	ChidyaTapu	South Andaman	11^0 29'431"	92^0 42'569"	-2
Vm2	Manjery	South Andaman	11^0 36'823"	92^0 42'972"	-
Vm3	Wandoor	South Andaman	11^0 31'016"	92^0 39'244"	-5
Vm4	Lamia bay (Diglipur)	N & M Andaman	13^0 12' 192"	93^0 02'433"	8
Vm5	Kalapather (Havelock)	South Andaman	-	-	-
Vm6	Kalapather (Havelock)	South Andaman	-	-	-
Vm7	Radhanagar (Havelock)	South Andaman	-	-	-
Vm8	Radhanagar (Havelock)	South Andaman	-	-	-
Vm9	Baludera (Baratang)	South Andaman	12^0 08'005"	92^0 48'021"	-
Vm10	Harmindar bay (Hut bay)	Little Andaman	10^0 33'617"	92^0 33'316"	-1
Vm11	Bharatapur (Neil)	South Andaman	-	-	-
Vm12	Bharatapur (Neil)	South Andaman	-	-	-
Vm13	Lakshmanpur (Neil)	South Andaman	-	-	-
Vm14	Pearl park (Neil)	South Andaman	-	-	-
Vm15	Pearl park (Neil)	South Andaman	-	-	-

Table 37: Details of the 4 SSR markers used for molecular characterization of 20 *Vigna* genotypes/ varieties

Sl. No.	Marker	Annealing Temperature (^{0}C)	Alleles detected	Allele size (bp)	PIC value	Expected heterozygosity (He)
1	CEDG007	52	3	125-175	0.424	0.503
2	CEDG087	53	3	140-180	0.537	0.612
3	CEDG102	50	1	180	-	-
4	cp04220	48	2	100-325	0.305	0.375

Plate 47 (A-F) : Vegetation of *V. marina* in natural condition across Andaman and Nicobar Islands A) ChidyaTapu, B) Manjery, C) Wandoor, D) Lamia bay of Diglipur, E) Harminder bay of Little Andaman and F) Radhanagar beach of Havelock Island

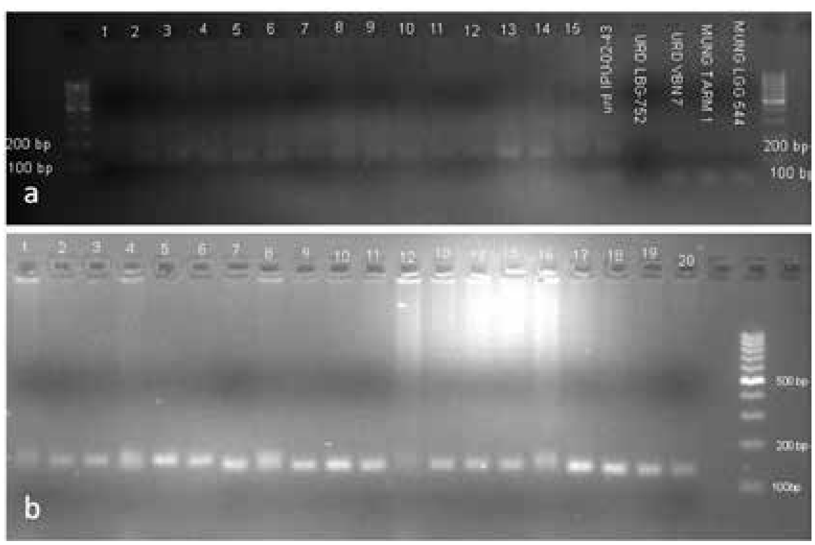


Fig. 12(a-b): SSR profiles of 20 *Vigna* genotypes/ varieties generated by selected polymorphic primers, CEDG007 and CEDG087 using individual DNA in which M denotes marker lane and 1-20 denotes genotypes lane

Evaluation of Mungbean and Urdbean genotypes

Totally, 45 pulse genotypes (24 Mungbean and 21 Urdbean) including checks were evaluated during Rabi season of 2018-19 at Garacharma field. The genotypes performing better than checks are listed in Table 38. The following genotypes such as ANM-14-10 (11.3) and ANM-11-63 (11.0) of mungbean and ANU-12-02 (12.0), ANU-11-29 (12.0) and ANU-11-09 (10.4) of urdbean performed over checks yielded over checks [TARM 1 (11.0) and IPU-02-43 (8.2), respectively] in terms of yield per plant (g/plant).

Table 38: Performance of Mungbean and Urdbean genotypes during 2018-19 at Garacharma field of ICAR - CIARI, Port Blair

Genotypes	DF	PH	NCl	NPd/Pt	PdL	NS/Pt	GY
Mungbean							
ANM-14-10	40	58.4	12.6	45.0	9.4	429.2	11.3
ANM-11-63	42	62.6	10.6	39.0	8.8	436.9	11.0
ANM-11-05	38	53.6	8.8	27.4	7.6	223.9	10.4
ANM-13-12	45	58.4	9.0	30.3	9.2	329.3	9.5
ANM-12-02	41	51.8	9.0	31.5	9.5	375.7	9.4
ANM-11-15	43	54.2	10.2	31.9	9.9	370.0	9.4
TARM-1	36	40.0	8.2	28.8	7.5	0.0	11.0
Urdbean							
ANU-12-02	41	44.2	21.8	49.2	4.9	346.2	12.0
ANU-11-29	39	34.0	15.4	42.5	4.5	354.6	12.0
ANU-11-09	40	34.2	14.4	36.7	5.3	258.2	10.4
ANU-11-34	39	25.2	10.8	30.8	4.7	218.0	8.0
IPU-02-43	37	27.6	14.2	39.2	4.6	271.9	8.2

Introduction, characterization and evaluation of Mungbean and Urdbean

Fifty accessions each of Mungbean and Urdbean received from NBPGR (Hyderabad) were introduced for evaluation of high yield and different abiotic and biotic stress tolerance. Sowing of pulses genotypes including checks (Mung-27; Urd-20) and NBPGR accessions (Mung-50; Urd-50) were done during Rabi season of 2018-19.

The characters to be observed are related to growth, yield, pest and diseases. Performance of Mungbean and Urdbean on germination varied from poor to very good and satisfactory.

Isolation of *Rhizobium* in pulses

Total of 11 *Rhizobium* strains isolated from black gram and green gram samples collected from Garacharma and Chouldhari fields and maintained for further analysis (Plate 48 a & b).

Plate 48: (a) Root nodules collected from Blackgram and (b) Isolated *Rhizobium* **colonies**

AICRP – Mushroom

K. Sakthivel, N.C. Choudhuri, V.K. Pandey, Pooja Kapoor, R.K. Gautam and S. Dam Roy

The hybrid oyster mushroom strains obtained from Directorate of Mushroom Research (DMR), Solan were evaluated for yield efficacy under Island conditions. Out of 16 hybrid strains tested, P-1808 showed better performance in case of yield and bio-efficacy which was followed by P1802, 1804 and P18106. A total of two training-cum-demonstration programs were conducted, in which around 90 farmers benefitted. In addition, around 225 spawns of CIARI Mushroom 1 (101), CIARI Mushroom 2 (75), CIARI Mushroom 3 (49) have been distributed to Island farmers and Department of Agriculture through Institute spawn production unit.

Exploring Antimicrobial Peptide Genes in Developing Bioformulation for the Management of Plant Disease of Andaman & Nicobar Islands (AMAAS)

K. Sakthivel, R.K. Gautam, V.K. Pandey, P.K. Singh and K. Venkatesan

Screening for the presence of polyketide biosynthesis genes

Twelve multi-potential *Bacilli* identified earlier from different soils of A& N Islands were subjected to amplifications and sequencing for the presence three polyketide biosynthesis genes to confirm/ understand its basic behind broad spectrum antagonism against plant pathogens.

Farmer field evaluations of CIARI Bio – Consortia

Field evaluations of CIARI Bio - Consortia on bacterial wilt disease management in brinjal were carried out in six different farmer fields of three districts in Andaman & Nicobar Islands. The fields were selected based on initial record of severe incidence (30-60%) of bacterial wilt disease and the CIARI Bio-consortia treatments were applied to notice the disease suppression and yield increase. The results from all the field experiments revealed that the application of CIARI Bio-consortia suppressed the bacterial wilt incidence in brinjal fields to 85-99% in all the fields throughout all the districts.

Characterization of Viral Diseases of Important Vegetable Crops of Andaman and Nicobar Islands and Development of Eco-Friendly Integrated Disease Management (IDM) Modules

K. Sakthivel, R.K. Gautam, P.K. Singh, K. Venkatesan, V.K. Pandey, V. Baskaran, T. Bharathimeena and Soobedar Yadav

The project aims to induce viral disease resistance in crop plants through *Bacillus*-mediated plant health management approaches.

Sequencing of *rpo*B genes for species confirmation

Twelve multi-potential bacilli identified earlier from different soils of A& N Islands were subjected to amplifications and sequencing of *rpo*B genes and confirmed at species level.

In-vitro temperature and salt stress tolerance assays

Also all the 12 bacilli were subjected to temperature and salt stress tolerance assays *in vitro*. In temperature tolerance tests, *Bacillus* isolates could be revived in all three dilutions (10^{-3}, 10^{-5} and 10^{-7}) up to 50ºC incubation whereas in case of 55ºC and 60ºC, all the *Bacillus* colonies could be revived in dilutions above 10^{-5}. In case of salt stress tolerance tests, the results showed that all the isolates grew up to 4% NaCl concentration. In addition, the results also revealed that 11 out of 12 isolates could tolerate 6% salt stress, whereas eight *Bacillus* isolates could tolerate 8% salt stress and the five isolates *viz.,* SM4, Bs_Ane, Bs_Adg, Cc_Ss and Wn_Ss showed regular growth pattern at 10% salt stress.

In- vitro nutrient mobilization assays

In addition, all the 12 potential isolates were subjected to *in-vitro* nutrient mobilization analysis. The results revealed Phosphorus (P) solubilization exhibited by 10 bacilli; Zinc solubilisation by 10 bacilli; Potassium (K) solubilisation by 5 bacilli; N fixation in Norris medium by 3 bacilli and in Jenson medium by 7 bacilli.

Survey and characterization of chilli viruses

Survey conducted in 15 locations of South Andaman revealed 35-68% leaf curl disease incidence under natural conditions. Symptomatic analysis revealed the presence of mild to severe curling of leaves, reduction of leaf size, stunting of plant growth, clearing of veins and veinlets, thickening of leaves, enations and chlorosis. Infection found on all crop growth stages starting from seedling to mature crop. As the crops were sheltering whiteflies, begomo-viruses were suspected on the symptomatic samples. Leaf samples from fourteen symptomatic and three asymptomatic plants were first tested for begomo-virus infection with Squash leaf curl virus (SLCV) antiserum (DSMZ, Germany) through dot immune binding assay (DIBA) with help of ICAR-IIVR, Varanasi.

All the symptomatic samples were showed positive reaction for begomo-virus infection. Since the SLCV antiserum can also react with other begomo-viruses, to confirm the identity of the virus, DNA was isolated from the symptomatic leaf samples and analyzed by PCR with two universal primer pairs, Rojas F/ Rojas R and Beta01 / Beta02 to amplify ~1200 bp on DNA-A and complete (~1350bp) beta satellite genome, respectively. BLAST analysis showed nucleotide highest identity (98%) with sequences of ToLCJoV isolates from Bangladesh and India and 92% identity with tomato leaf curl Joydebpur beta-satellites (ToLCJoB) from India.

SUCCESS STORIES

1. Farmer's participatory seed production: A success story

Shri. Subhash Das aged 42, is a progressive farmer of village Keralapuram, North Andaman district. He has about 1.0 ha of land and grows rice in *Kharif* and vegetables & pulses in the *Rabi* season. Since 2016 he is associated with Farmers Participatory Seed Production under ICAR Seed Project "Seed Production in Agricultural Crops". He has produced a total of 68.5 quintal of Truthfully Labelled Seed of high yielding varieties of rice, green gram and black gram and earned about Rs. 66,762/- from the seed alone during 2016-19. His rice crop productivity has increased from 2.8 t/ha to 4.0 t/ha and he has emerged as a seed grower ambassador among the farmers of that area. Similarly, 7 other farmers of 3 villages are also accompanying with Farmers Participatory Seed Production Programme. These farmers not only fetch good price from seed but also fulfill rice seed requirement of the neighboring farmers.

1	**Name of the farmer**	**Shri. Subhash Das**	
2	**Age**	43	
3	**Name of the village**	Keralapuram	
4	**Tehsil**	Diglipur	
5	**District**	North and Middle Andaman	
6	**State**	Andaman and Nicobar Islands	
7	**Land holding (ha)**	1.0	

8	Year	Name of the crop	Name of Variety	Area (ha)	Production (q)	Seed sold to CIARI (q)	Total income from seed sale (₹)
	2016	**Rice**	CARI Dhan 7	0.4	17.5	9.75	17,062.5
	2016	**Mung**	CARI Mung 1	0.2	0.10	0.08	800
	2017	**Rice**	CARI Dhan 7	0.4	19.0	6.80	13,600
	2017	**Urd**	CARI Urd 1	0.2	0.50	0.35	3,500
	2018	**Rice**	CSR 36	0.4	15.0	9.40	18,800
	2018	**Mung**	CARI Mug 4	0.2	0.35	0.30	3,000
	2019	**Rice**	CARI Dhan 7	0.4	16.0	5.00	10,000
	Total			**1.6**	68.45	31.68	**66,762**

(Contribution: ICAR-CIARI - P.K. Singh, R.K. Gautam, K. Sakthivel, K. Venkatesan, S. K. Zamir Ahmed, M. N. Das and Shyam Sunder Rao)

2. Mushroom culture as a venture after retirement - Mrs. Freeda George, Karen woman

Plate 50: Mushroom culture

ICAR- CIARI, Port Blair is regularly popularizing oyster mushroom cultivation among the Island farmers, youths, farm women through various trainings, demonstrations and through regular supply of mushroom spawn materials to needy farmers under AICRP- Mushroom scheme. During December 2018, CIARI- Scientists along with officials of Department of Agriculture, Maybundar have given practical demonstrations on oyster mushroom cultivation to 30 interested Karen community youths and farmers at Mayabunder. The required spawn materials being made available through Department of Agriculture. Among these trainees Mrs. Freeda, retired Principal nursing officer, Directorate of Health Services, A&N Administration started oyster mushroom cultivation as a venture. For this purpose, she utilized two rooms of her house, one for mushroom bed preparation and one for mushroom production unit. Now she is able to produce mushroom for family consumption and started giving to her relatives and neighbours. She is planning to sell the oyster mushroom in market due to demand. Moreover her mushroom unit has also been supported by ATMA scheme of Agricultural Department. She expressed her heart-felt thanks to scientists and Department officials for continuous guidance and support. Furthermore, she assured to create awareness and popularize oyster mushroom cultivation among Karen community

(Contribution: ICAR-CIARI - K. Sakthivel, R.K. Gautam, P.K. Singh, K. Venkatesan, B.L. Kasinath, Basantia, A. Kundu Dept. of Agriculture- Soundararajan, Chandan, Kanann)

3. Mrs. Nitu Sindhu, the first private mushroom spawn production entrepreneur in the Islands


Plate 51: Spawn production by entrepreneur

Through support from ICAR AICRP- Mushroom project, ICAR- CIARI, Port Blair has been imparting trainings on mushroom spawn production to the interested progressive farmers for mushroom spawn production to meet out the growing huge demand of mushroom spawn all over the Islands.

A well educated young couple namely Mr. Sainath Shenoy & Dr. Nitu Sindhu started mushroom cultivation from October 2016 after getting training from FCI&P Division, ICAR- CIARI, Port Blair. Initially, they started cultivation of oyster mushroom in small business mode by purchasing seed materials from ICAR- CIARI and Department of Agriculture in a small hut of area 120 sq ft with 100 mushroom bed holding capacity. They named their firm as “Mahalasa Agro Products” which produces oyster mushrooms with the brand name “Shrooms”. However by seeing huge demand of mushrooms in the Islands, Dr. Nitu Sindhu wished to initiate spawn production at her own unit and got practical training through AICRP- Mushroom scheme at FCI&P Division. She also received financial support of Rs. 4.5 lakhs from Department of Agriculture through HVADA (High Value Agriculture Development Agency) scheme. At present she is able to supply mushroom spawn to nearly 20 farmers of the Islands of which 10 farmers are regular mushroom growers. She further informed through this venture that she could earn Rs. 35,000-40,000/- per month. Accordingly their agro-farm “Mahalasa Agro products” has now been selected as model firm for promoting small scale commercial oyster mushroom production in Andaman & Nicobar Islands by Department of Agriculture, ICAR- CIARI, KVK and other line departments. Dr. Nitu Sindhu gratefully thanked ICAR-CIARI for providing technical support and guidance for this successful venture in the Islands.

(Contribution: ICAR-CIARI - K. Sakthivel, R.K. Gautam, P.K. Singh, V.K. Pandey, N.C. Choudhari, S. Dam Roy & A. Kundu)

4. CIARI Bio-consortia enhances brinjal bacterial wilt disease stresses areas

ICAR-CIARI has developed a talc based bioformulation namely CIARI Bio-consortia which consists of native *Bacillus* species conferring general plant growth promotion and soil borne plant disease management in vegetable crops. In December 2018, ICAR- CIARI gave training cum demonstrations on “Application of CIARI Bio-consortia for plant health management” through AMMAS project fund in various locations of A&N Islands. Few farmers were given with CIARI Bio-consortia along with technical know-how on application methodologies (MFYM-Microbe enriched farm yard manure soil application methodology standardized by ICAR-CIARI, Port Blair) through Assistant Director, and Department of Agriculture, Maybundar and informed about application methodologies. An organic vegetable grower from Mayabunder named **Mr. Saw Mayatwe from Webi village** informed that he was facing severe yield losses due to bacterial wilt disease in his organically grown brinjal crop of Muktakeshi variety and the wilt disease incidence about 70%. He was given CIARI Bio-consortia. Due to non-availability of FYM, the farmer used indigenous paddy straw compost for soil application of CIARI Bio-consortia. The farmer informed that out of 250 brinjal plants of Muktakeshi variety grown during 2018-19, only 3 plants died. Due to bumper crop, he could get four times more yield from the same organic field. He expressed his heartfelt thanks to CIARI and Department of Agriculture officials. Seeing his success story, many other farmers have now been started using CIARI Bio-consortia.

Acknowledgement: Funding support from AMAAS project, ICAR-NBAIM, Mau

Plate 52: Field view

Contribution: ICAR-CIARI - K. Sakthivel, R.K. Gautam, P.K. Singh, K. Venkatesan, A. Kundu Dept. of Agriculture- Soundararajan, Chandan and Kanann)

DIVISION OF NATURAL RESOURCE MANAGEMENT

Vulnerability Assessment and Adaptation Led Mitigation Strategies of Andaman and Nicobar Islands Farming to Climate Change

B. Gangaiah, T. Subramani, S. Swain, B.K. Nanda, V. Damodaran, M.S. Kundu and A. Velmurugan

Dual purpose rice cultivation (fodder cum grain) and hay, haylage and silage production from fodder

From 'C-14-8', dual harvest (fodder harvest followed by grain production from regrowth) was taken. Six fodder harvest schedules including no fodder harvest control (Table 39) as treatments were evaluated in RCBD with 4 replications. Rice fodder harvested was dried / ensiled and yields were recorded at 8 (hay), 50 (haylage) and 65% (silage) moisture content. Haylage and silage were prepared with 3 additives (2% jiggery additive, 10% subabul additive and no additive)from each harvest treatment wise (Plate 53 a,b &c), its quality was assessed along with hay and compared with straw.

The data (Table 39) reveals that on account of increased plant height, despite of a reduction in tiller number after 60 days after transplanting (DAT) fodder harvest treatments, green fodder and preserved forms (hay, haylage and silage) yield increased significantly up to 105 DAT (silage up to 120 DAT). Fodder harvest beyond 60 DAT significantly reduced the grain yields of rice (Table 40), but the system productivity (rice equivalent yield) was highest with 90-120 DAT on account of higher fodder production and net income was highest in 75 DAT fodder harvest. Per day productivity (kg/ha-day) of rice was enhanced with fodder harvest (2.2-3.8) on account of reduced lodging as compared to no fodder harvest (14.4).Dual harvest system was economical (Rs.3219-10,714) to grain production alone. Quality of rice fodder (crude protein, P, K concentration) in descending order was: silage>haylage>hay>straw (Table 41).

Table 39: Impact of stage of harvests on green fodder, hay and ensilage production of rice

Fodder harvest at	Plant height (cm) at harvest	Tiller /hill	Green fodder yield (t/ha)	Hay yield (t/ha)	Ensilage yields (t/ha)	
					Haylage	Silage
60 DAT	170.2	16.30	16.75	4.69	8.31	15.13
75 DAT	192.4	14.95	21.50	6.34	10.68	19.82
90 DAT	198.6	13.90	23.96	7.42	11.88	22.56
105 DAT	203.5	12.80	28.51	8.92	14.29	26.97
120 DAT	210.5	11.45	30.43	9.89	15.16	29.30
CD (P=0.05)	9.71	1.910	3.142	1.325	2.151	2.55

Table 40: Rice productivity and economics of dual harvest system as influenced by fodder harvest schedules

Fodder harvest at	Rice yield (t/ha)		System productivity (t/ha)*	Productivity/ day (kg/ ha-day)	Economics (Rs/ha): grain-fodder system	
	Grain	Straw			Cost C	Net income
60 DAT	2.69	10.65	3.36	16.9	56971	24839
75 DAT	2.47	10.39	3.54	17.7	58456	25714
90 DAT	2.25	9.58	3.70	18.1	59428	23997
105 DAT	2.01	8.52	3.71	17.8	60778	22857
120 DAT (flowering)	1.70	7.24	3.74	16.6	61651	18519
No Fodder Harvest	2.86	11.50	2.86	14.4	52000	15300
CD (P=0.05)	0.274	0.904	0.30	0.85	-	1806

*Rice equivalent yield

Table 41: Quality of different types of rice fodders as influenced by fodder harvest schedules

Fodder harvest at	Crude protein (%)				P concentration (%)				K concentration (%)			
	Silage (S)	Haylage (HL)	Hay (H)	Straw* (St)	S	HL	H	St	S	HL	H	St
60 DAT	12.58	12.32	11.00	4.32	0.27	0.28	0.28	0.103	2.88	2.84	2.85	1.66
75 DAT	11.74	11.51	10.28	4.34	0.24	0.24	0.25	0.105	2.62	2.65	2.66	1.63
90 DAT	10.91	10.74	9.56	4.37	0.22	0.23	0.24	0.104	2.58	2.55	2.57	1.68
105 DAT	10.03	9.84	8.63	4.51	0.20	0.22	0.21	0.110	2.32	2.35	2.38	1.63
120 DAT (flowering)	9.00	8.83	7.96	4.55	0.18	0.19	0.19	0.112	2.00	1.98	2.01	1.64
No Fodder Harvest	-	-	-	4.28	-	-	-	0.099	-	-	-	1.64
CD (P=0.05)	0.81	0.58	0.63	NS	0.029	0.031	0.035	NS	0.173	0.182	0.150	NS

*from grain crop

Plate 53a: Rice fodder harvest

Plate 53b: Chopping of fodder

Plate 53c: Silage with additives

South West and North-East Monsoon performance across Islands (January-December, 2018)

Annual rainfall (January-December) of ANI (2959.8 mm) was normal across the six weather stations (2767.3 mm mean). Station wise analysis shows that Long Island has recorded a deficit rainfall (34.64%), though rainy days were normal (+2.91%). Further, South-West (SW) monsoon rainfall (1569.2 mm) was 7% lower than the mean values (1682.3 mm), while North-East (NE) monsoon rain fall (856.9 mm) was 23% excess over the mean rainfall (695.9 mm). Lakshadweep Islands (LDI) received 10% less annual rainfall than the mean (1600.0 mm). S-W monsoons have shown -45% deficit rainfall i.e. 553.2 mm as against mean of 998.5 mm, however, N-E monsoons rainfall (282.9 mm) has 14% deficiency over the mean (333.6 mm). (Table 42).

Table 42: Rainfall (mm) and rainy days (January-December, 2018) across the Islands as compared to their mean values

Parameter	Andaman and Nicobar Islands						Lakshadweep Islands**
	Mayabunder	Long Island	Port Blair	Hutbay	Car Nicobar	Nancowry	
2018	3363.0	3697.8	3435.5	2779.4	2480.5	2002.5	1440.1
Mean (1967-2018)	3042.9	2746.4	3023.8	2753.2	2639.5	2443.9	1600.9**
% D (-) /E from mean*	-10.52	-34.64	-13.62	-0.95	6.02	18.06	-9.99
Mean rainy days /year (2008-18)	131.2	134.1	143.7	151.7	144.8	145.3	121[a]
Rainy days (2018)	134.0	138.0	143.0	141.0	124.0	135.0	
% D (-) / E over mean	2.13	2.91	-0.49	-7.05	-14.36	-7.09	

*D / E : Deficit / Excess; ** Mean of 1951-2018; [a]Minicoy

All India Coordinated Rice Improvement Project (AICRIP) – AVT-2 MS (Advanced Varietal Trail-2, Medium Slender)

B. Gangaiah

A field study was made at Bloomsdale farm during kharif -2018 season to assess the comparative performance of 4 IET (Initial Evaluation Trial) entries of rice along with a national hybrid (KRH-4), variety check (WGL 14) and a local check (CARI Dhan 6) in Randomised Complete Block Design with three replications. The crop was grown as irrigated crop with recommended production practices.

The data (Table 43) reveals that IET 26241 being at par with KRH 4 has produced significantly taller plants than IET 25793 and CARI Dhan 6. Rice hybrid check, KRH 4 out yielded all other entries and checks for grain yield. IET026263, IET 25795, IET 26241 and WGL 14 have statistically similar yields. CARI Dhan-6 being at par with IET-25793 has recorded the lowest grain and straw yields.

Table 43: AVT-2-MS entries and checks yield (t/ha) performance in Islands

Entry	Plant height (cm) at harvest	Grain yield (kg/ha)	Straw yield (kg/ha)
IET 26263	120.9	3819	6951
IET 25795	124.7	3573	7229
IET 25793	117.4	3155	6503
IET 26241	128.6	3689	7658
KRH 4	127.9	4150	7508
WGL 14	125.3	3761	7435
CARI Dhan-6	118.2	2987	6607
SEm±	2.54	83.0	101.9
CD (P=0.05)	9.12	298.0	365.8

All India Coordinated Rice Improvement Project (AICRP) on Weed Management

B. Gangaiah

A field study was made during October, 2018 - March, 2019 at Garacharma farm, Port Blair, on arecanut to assess the impact of seven mulching on arecanut in RCBD with five replications (Table 44). Tree is taken as a replication (0.75 m radius from tree bole= 1.77 m^2area). Results revealed that black polythene mulching (PM) by excluding light supply to weeds have completely controlled them within 6 weeks of time and thus have 100% weed control efficiency (WCE) as that of weed free check (maintained manually).Organic mulches WCE values ranged from 77.63 - 92.93% and chopped arecanut leaf and arecanut fruit husk mulches were promising to other organic mulch treatments. In weed free check treatment, weed biomass (259.1 g/tree in 6 monthly weed removals) has removed 82 kg (33.7- 5.18-38.9 kg/ha of N-P-K) nutrients. Soil moisture content differed significantly in surface layer (0-10 cm) due to mulching.

However, PM is preferred to manual weeding owing to its moisture (nutrient) conservation through evapo-transpiration (ET) regulation from controlled weeds, on the contrary weed free have removed weeds successfully but, weed free soil surface have enhanced evaporation losses (Plate 54 a,b & c). PM maintained high values due to minimized ET losses from weed control while weedy check has reached permanent wilting point (PWP) status quickly. Further, weed free treatment favouring E, has moisture loss as that of weedy check. High cost of polythene mulches (Rs. 41095) when spread over its 5 year life span becomes much cheaper to manual weeding (with recurring cost every year). Arecanut leaf mulching is cheapest option for farmers.

Table 44: Impact of different mulches on weed count, biomass, control efficiency and their costs

Mulch treatment	Based on 20 March, 2019 observation			Cost of treatment (Rs/ha)
	Total weed count (No/m^2)**	Weed biomass (g/m^2)	Weed control efficiency (%)	
Arecanut leaf mulch	3.521 (11.9)	8.649 (74.3)	77.63	2300
Arecanut chopped leaf mulch	2.757 (7.1)	6.333 (39.6)	92.93	4600
Arecanut husk mulch	2.627 (6.4)	6.083 (36.5)	89.01	4600
Silver oak leaf mulch	3.082 (9.0)	7.931 (60.4)	81.82	4600
Black polythene mulch	0.707 (0.0)	0.707 (0.0)	100.0	41095

Mulch treatment	Based on 20 March, 2019 observation			Cost of treatment (Rs/ha)
	Total weed count (No/ m^2)**	Weed biomass (g/ m^2)	Weed control efficiency (%)	
Weedy check	6.197 (37.9)	18.240 (332.2)	0.0	-
Weed free check (no mulch)*	0.707 (0.0)	0.707 (0.0)	100.0	13800
CD (p=0.05)	0.250	0.81	6.51	-

*Total weed count in weed free check at start of study in October, 2018: 38.0 ** Total count means: grasses and broadleaved weeds count


Plate 54 a: Weed free treatment (manual weeding)


Plate 54 b: Arecanut leaf mulch


Plate 54 c: Black polythene mulch

Weeds utilization as management strategy

As it is easy to use weed biomass than their management, attempts were made to use weeds for compost making and also as livestock feed. *Mimosa pudica* was successfully used as goat browse material land its powdered form is prepared for integration with goat feed (Plate 55a, b &c).


Plate55 a : *Mimosa* collection


Plate 55 b: Feeding *Mimosa* to goat

Plate 55 c: Feed making from Mimosa

Restoration of Agriculture in Tsunami Affected Lands of Andaman and Nicobar Islands

B. Gangaiah, M.S. Kundu, T. Subramani, S. Swain, L.B. Singh, S.K. Pandey and B.L. Meena

Raised Bed and Furrow and block plantation of coconut + Banana intervention

Coconut + banana plantations were done in July, 2018 on 0.4 ha in block plantation as well as on raised bed and furrow system (to contain sea water entry) and had 100% survival at Malabar Coconut Cooperative Society (MCCS).To tide over the weed menace, coconut husk and black polythene mulch were used (Plate56 a,b & c). Fish could not grow up successfully due to various constraints in furrows. Naturally growing fish has attained 200 g weight (July- December, 2018).



Plate 56 a : Established coconut + banana at MCCS site, Ograbraj

Plate 56 b : Mulched coconut

Plate 56 c: Banana with bunch

Broad Bed and Furrow (BBF) intervention and associated allied activities (Shri. Abdul Khader)

Two Broad bed and furrow units made were used for coconut + banana and vegetables planting on beds, fish in the pond and ducks too. Farmer has harvested seasonal vegetables (bhendi, cowpea, tapioca). All crops (coconut, banana, spices, arecanut) established successfully and banana yields were obtained.

The following animal husbandry based activities (poultry, duckery and goatery) were undertaken with great success.

Poultry: Vanaraja birds for broiler purpose (100 birds unit) was evaluated by releasing one day old chicks on 20th July, 2018 in to poultry shed constructed over tsunami water in February, 2018 under the project. Standard feed schedule and safe drinking water were provided. At the end of 7 weeks study (8thSeptember, 2018), bird shave attained a mean live body weight of 1.6 kg whose sale (Rs. 200/kg live bird) generated Rs. 31, 360 as gross income. From poultry manure (95 kg) produced gave Rs. 495 income (Rs 5/kg). After deducting the costs (birds, feed, labour), a net income of Rs. 7555 was left with the farmer. Feed conversion ratio (kg feed consumed / kg bird weight gain) of 2.17 was obtained (Plate 57 a,b c, & d)

Plate 57 a : Poultry shed over tsunami water

Plate 57 b : Vanaraja birds of week age

Plate 57 c: Birds at 3rd week age

Plate 57 d: Birds at end of 7th week

Duckery: A duckery unit (50 birds) were evaluated in tsunami lands from 1st September, 2018. There was 100% survival of ducks. Ducks have attained a mean weight of 2.0 kg with egg production since January, 2019 @ 100 eggs/ week. It is also most successful intervention with control of mosquito.

Plate 58 a: Duck shed

Plate 58 b: Day old ducklings

Plate 58 c: Foraging ducks

Plate 58 d: Egg laying ducks

Goatery: A teressa goat unit (1 male and 1 female) study was started from 17th September, 2018 and goats were weighing 10 kg. Native forbes browsing on tsunami land vegetation was supplemented with goat feed on which goats have attained a weight of 22 kg in March, 2019 (Plate 59 a & b).

Plate 59 a: Grown up goat unit of Shri Abdul Khader

Plate 59 b: Goat feed distribution to farmer

Fish pond intervention at Rampur

In pond based farming systems at Rampur, North & Middle Andaman district, Coconut + Banana + Vegetables were planted on the bunds of pond. Fish (*Pangasius* and Rupchanda) was introduced that gained 200 g weight (Plate 60 a,b &c).

Plate 60 a: Pond developed in March, 2018

Plate 60 b: Fish introduction into pond

Plate 60 c: Fish feed distribution

Raft cultivation of vegetables

In tsunami waterlogged areas, Ograbraj, raft technology was developed using local materials (bamboo) that is floated on tubes filled with air. Dhania (*Coriandrum sativum*) and Amaranthus leafy vegetables were grown successfully (Plate 61).

Plate 61: Raft cultivation of *Dhania* in waterlogged tsunami lands

Piggery intervention: On 5th October, 2018 feed were supplied and proper health care was given. The pigs have attained a mean weight of over 50 kg at end of March, 2019 (Plate 62 a, b &c). At Rs. 250/kg live weight, each unit is worth Rs. 37500 as on 31st March, 2019. It is continuing up to end of June for economics analysis. It is most successful intervention for *Tsunami* farmers.

Plate 62a: Pig distribution to identified farmers

Plate 62b: Feed supply and pig delivery at benficiary home

Plate 62c: Pigs as on 6th March, 2019 at one of beneficiary

Direct wet seeding of rice in *Tsunami* impacted soils

Direct wet seeding of rice (DWSR) was evaluated in *tsunami* waterlogged areas of Mithakhari with two farmers. In this farmers practice (FP) was improved through (1) gap filling (2) weeding (3) fertilizer N top dressing 50 kg /ha in 2 splits; (4) 1 & 2 (5) 1 & 3 (6) 2 & 3 (7) 1, 2 & 33 (Plate 63). The study was in RCBD with 3 replications. Farmers practice included simple sowing only. Results (Table 45) reveal that gap filling, weeding and N fertilization impacts are compounded when applied together and have improved C-14-8 rice productivity by 68% as compared to farmers practice (1.56 t/ha). Gap filling and weeding are most important interventions of DWSR and N top dressing alone failed to improve DWSR yield significantly over FP. Gap filling + weeding and Gap filling + weeding + N top dressing gave significant improvements in DWSR yields.

Table 45: Performance of direct wet seeded rice in tsunami waterlogged soils under different management options

Treatment	Mean grain yield (t/ha)
Gap filling	1.88
Weeding	1.79
N top dressing	1.64
Gap filling + Weeding	2.23
Gap filling + N top dressing	2.01
Weeding+ N top dressing	2.04
Gap filling + Weeding + N top dressing	2.52
Farmers practice	1.50
CD (p=0.05)	0.17

Plate 63a: Farmers field at land preparation

Plate 63 b: DWSR field at 30 days harvest

Plate 63c: Gaps after weeding

Plate 63 d: Paddy harvest

Crab fattening

A meeting was conducted with Pradhan, Wandoor Panchyayat on 19th January, 2019 and two beneficiaries were identified. Water crabs were distributed to one of the two farmers (Plate 64 a & b).

Plate 64 a: Meeting with Pradhan, Wandoor for crab fattening farmer selection

Plate 64 b: At selected farmers pond in New Wandoor

Development of Production Technologies for High Value Vegetables in Soilless Culture

T. Subramani, B. Gangaiah and V. Baskaran

Experiment on “Standardization of growth media for soilless culture” revealed that among different growth media, cocopeat + saw dust (1:1 v/v) being at par with cocopeat + vermiculite + saw dust (1:1:2) together have recorded higher number of fruits/plant (8.67) and fruit weight (51 g) that resulted in higher fruit (442 g/plant). Cocopeat + vermiculite + saw dust has proved to be the next best media for tomato cultivation. The lowest yield (236 g/plant and 5.3 t/ha) was recorded in control *i.e.* soil + FYM (3:1).

Among the growth media combinations, cocopeat + saw dust (1:1 v/v) and cocopeat + vermiculite + saw dust (1:1:2 v/v) proved the best (Plate 65). However, cocopeat + saw dust (1:1 v/v) was 1.87 times cheaper (Rs. 63) than cocopeat + vermiculite + saw dust (Rs.118). Tomato fruit quality measured by TSS was significantly higher (6.8 %) in cocopeat + saw dust than other media. In the confirmatory trial also, cocopeat + saw dust (1:1 v/v) recorded higher plant height (137 cm) and early flowering (56 days) as compared to soil +FYM (3:1).

Plate 65: Tomato under media culture

Among the nutrient levels 100 % nutrient concentration produced taller plants in tomato (136 cm) and in cucumber (182 cm)as compared to reduced nutrient levels. Irrigation frequencies (daily and alternate day) have no significant effect in both the crops.

Under nutrient film technique (NFT) hydroponic system, performance of lettuce and spinach was assessed (Plate 66). The data revealed that the biomass yield of 430 and 350 g/m^{2}were registered by lettuce and spinach.

Crop: Lettuce

Crop: Spinach

Plate 66: Leafy vegetables under NFT hydroponic system

Organic Farming Studies for Sustaining Productivity of Island Cropping Systems

K. R. Kiran, B. Gangaiah, A. Velmurugan and K. Shakthivel

The project was aimed at developing production package for organic farming in coconut based multitier cropping system. At Garacharma farm, work was initiated in the existing coconut plantation (Andaman ordinary tall) with 48 trees. Four trees were allotted per treatment and thus twelve plots were created and basins and crown was cleaned for experiment. Pepper cuttings were planted for trailing on coconut uniformly (Plate 67 & 68).

Plate 67: View of the experimental field

Plate 68: Establishment and trailing of pepper on coconut palm

Integrated Agromet Advisory Services (Gramin Krishi Mousam Seva)

A. Velmurugan, T. Subramani (Co-ordintor) Advisory team: T.P. Swarnam, A. Kundu, P.K. Singh, R. Kiruba Sankar, Nagesh Ram, S.K. Zamir Ahmed and S. Dam Roy

Integrated agromet advisory

During the period (2018-19) the Agro-Meteorological Field Unit (AMFU) at ICAR-CIARI, Port Blair has issued 104 agromet bulletins covering all the aspects of agriculture production based on the weather forecast received from IMD, Pune through print and electronic media. It aimed at minimizing the production losses and aid in timely decision making in farm operations. The agromet unit effectively utilized the services of All India Radio (AIR), Doordarshan, print media, KVK, VRC and other means to reach out to the farmers even in remote Islands.

mKISAN and SMS service

AMFU Port Blair has been activated in mKISAN portal on 24th June 2014 and registered farmers from South Andaman, North and Middle Andaman and Nicobar Islands. All the registered farmers have been regularly receiving agromet advisories through SMS on every Tuesday and Friday in Hindi and English from CIARI, Port Blair. AMFU, Port Blair has sent nearly 609 SMS covering all aspects of agriculture. At present AMFU, Port Blair stands second in the country after Delhi in terms of percentage of responsive farmers covered out of total farmhouse hold.

Dissemination through social media

AMFU, Port Blair has created Agromet user group in Whatsapp to utilize the social media to disseminate advisories and send video messages (Plate 69). During the period photos / videos on plant protection, moisture conservation, animal health management was sent for the benefit of all the stakeholders. Received feedback / queries from farmers and encouraged young farmers for active participation.

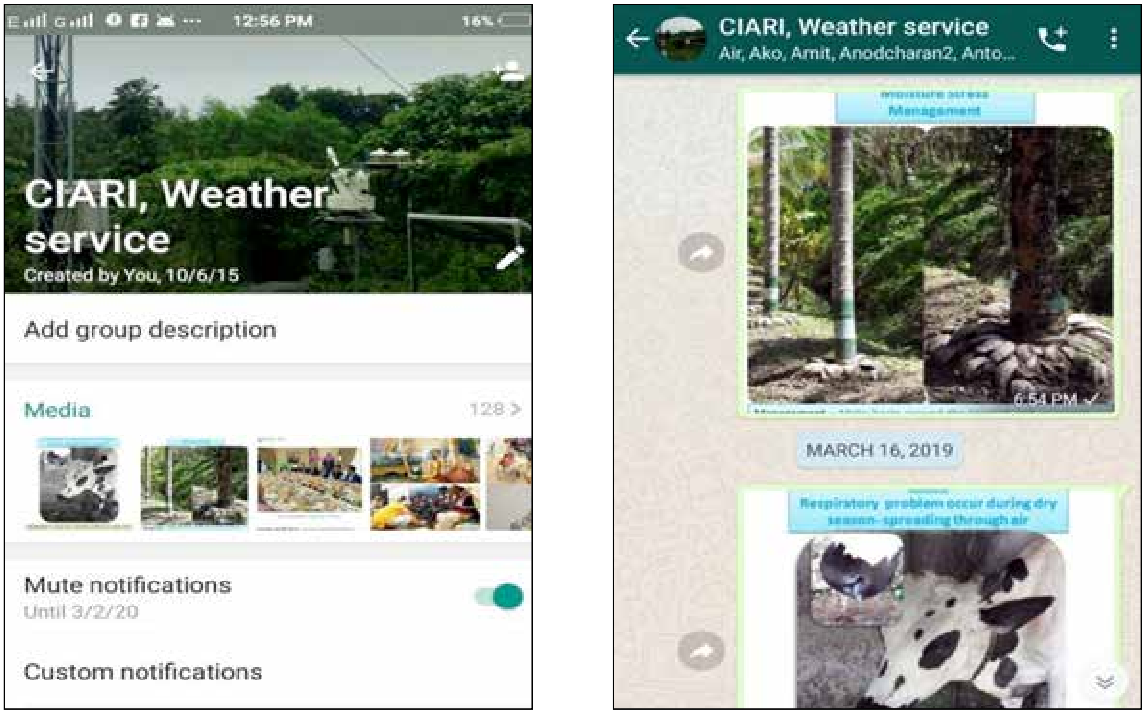


Plate 69: Weather service through Whatsapp group

Verification of forecast

Verification of forecasted and observed values of rainfall in the Islands was carried out for pre– monsoon, monsoon and post-monsoon period (2018-19). The results (Table 46) revealed that on an average forecasted and observed values of rainfall for the Islands were matching to the tune of 63.2% for pre monsoon, 65.6% for monsoon and 58.5% for post-monsoon period. Forecast for Andaman Islands was more accurate than Nicobar Islands whereas more deviation from the forecasted value was observed for post-monsoon period. Concurrently monsoon and post-monsoon seasonal forecast and advisories were also issued for long-term planning of agricultural and land improvement activities through mass media.

Table 46: Verification of weather forecast

Sl.No.	Particulars	State	Pre Monsoon (April to May 2018)	Monsoon (June to Nov 2018)	Post Monsoon (Dec 2018 to March 2019)
1	No. of day when rain was forecasted and also observed (YY)	Andaman	33	143	28
		Nicobar	21	91	25
2	No. of day when rain was observed but not forecasted (YN)	Andaman	0	0	0
		Nicobar	1	0	1
3	No. of day when rain was not observed but forecasted (NY)	Andaman	14	37	36
		Nicobar	30	89	64

Sl.No.	Particulars	State	Pre Monsoon (April to May 2018)	Monsoon (June to Nov 2018)	Post Monsoon (Dec 2018 to March 2019)
4	No. of day when rain was not observed and also not forecasted (NN)	Andaman	14	3	57
		Nicobar	9	3	31
5	No. of matching case (YY+NN)	Andaman	47	146	85
		Nicobar	30	94	56
6	Skill score or ratio score in rainfall	Andaman	77.1	79.8	70.2
		Nicobar	49.2	51.4	46.3
	Average	AN Islands	63.2	65.6	58.5

Evaluation and Popularization of Value Added Compost and other Organic Inputs in Neil Island

A. Velmurugan, I.Jaisankar, S.K.Zamir Ahmed and T.P.Swarnam

Preparation and use of compost and other organic inputs are very essential to sustain the agricultural production and conserve the Island ecosystem. During 2018-19 the ongoing project on organic input preparation at Neil Island was continued to demonstrate the potential of organic waste recycling through improved method of composting. Ten responsive farmers from Neil Island were selected after an awareness programme followed by construction of ten vermicompost tanks at farmers field (Plate 70). The tanks were filled with coconut and other organic wastes available at the farmer's field. The farmers were given microbial consortia for faster decomposition and nutrient mobilization after demonstration. Samples were collected after 105 days and analysed for quality parameters. In addition, light traps, neem oil, panchagavya, and other organic inputs for plant protection were distributed to the farmers.

Plate 70: Compost preparation at farmers field

Table 47: Quality assessment of compost prepared at farmers field

Quality Parameters	Name of the farmer				
	Ashini Das	Bimal Roy	Chinta Haran Biswas	Gyanmai Mondal	Shanti Ram Gain
Moisture (% DM)	18.2	16.7	18.3	15.7	19.4
pH	7.3	7.1	6.6	6.4	6.2
EC (dS/m)	0.97	1.31	1.28	1.10	1.02
Total organic carbon (%)	27.6	26.5	27.3	22.8	22.1
Total nitrogen (%)	0.98	1.22	1.09	1.12	1.15
Total phosphorus (%)	0.75	0.92	0.86	0.78	1.03
Total potassium (%)	0.81	0.95	0.98	1.10	1.07
C:N Ratio	28.16	21.72	25.05	20.35	19.22

In general, the results showed that the quality of vermicompost was of desired level and the parameters were well correlated (Table 47). The pH and EC varied from 6.2 to 7.3 and 0.97 to 1.31 (dSm^{-1}), respectively. Total N, P and K content has significantly increased in the final product at all the locations. A high substrate C:N ratio implies a low mineralization and humification which was attributed to the nature of organic materials. However, use of microbial consortia and animal manures has resulted in narrow C/N ratio. This was due to higher N content and easily decomposable carbon source from animal manure and the efficiency of microbial culture which resulted in mineralization and subsequent acceptable maturity standard of compost. By following the composting method and inputs as demonstrated, farmers can prepare enriched compost three times in a year.

AICRP on Management of Salt affected Soils and use of Saline Water in Agriculture

A. Velmurugan, T.P. Swarnam and T. Subramani

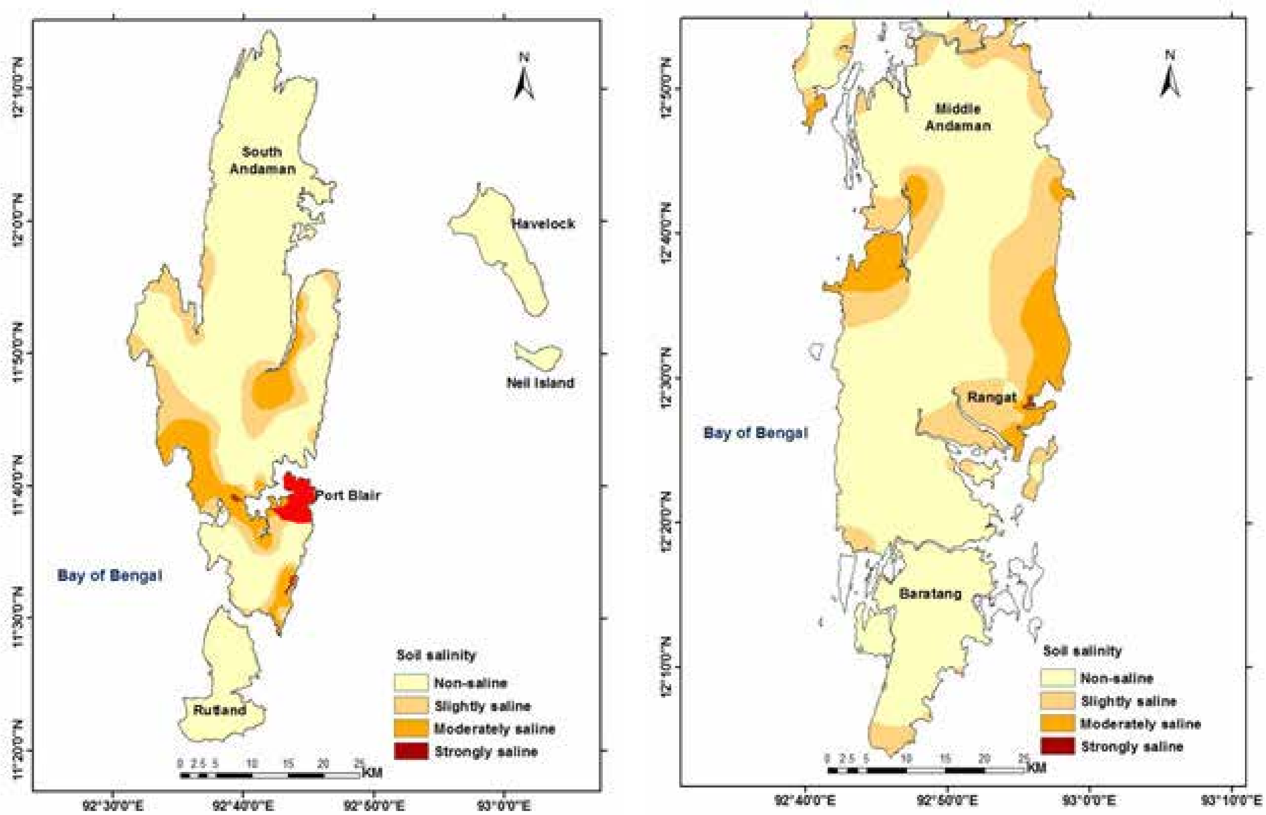
The coastal areas of Andaman and Nicobar Islands are affected by the twin problems of salinity and waterlogging. During 2018-19 the ongoing study was continued and the results are given below:

Soil salinity mapping

The analysis of soil samples collected from all the three districts of AN Island at different time intervals showed significant seasonal variations in salinity measured as ECe, sodium adsorption ratio (SAR) and residual sodium carbonate (RSC). The point data on soil salinity parameters were interpolated in a GIS environment to prepare the spatial salinity maps which showed significant variations in spatial distribution of salinity. In general, ECe varied from 0.1 to 10.1 (dS m^{-1}), SAR from 0.1 to 7.2 whereas there was no RSC in soil. The spatial distribution of soil salinity based on ECe showed that majority of the areas were non-saline followed by moderately saline, while strongly saline areas were observed around the creeks and back water areas (Fig. 13). Among the three districts, interestingly South Andaman had largest area under non-saline and moderately saline category. In general, the mountain ranges and hilly uplands were non-saline with ECe less than 2.0.

Vulnerability

Vulnerability assessment of Andaman Islands was carried out based on land form, elevation, land use and salinity hazard in a GIS framework. These vulnerable areas were grouped into very high vulnerability, high vulnerability, moderate vulnerability and low vulnerability. Due to the inherent weakness of remote sensing data to detect lower levels of salinity and cloud cover, salinity mapping of Andaman Islands was carriedout by ground survey, historical data and data interpolation. The vulnerability study showed that 18% of area is under very high vulnerability and 14% is high vulnerability category. Soil salinization and waterlogging have been identified as major processes of land degradation and loss of agricultural production in the very high vulnerable areas.



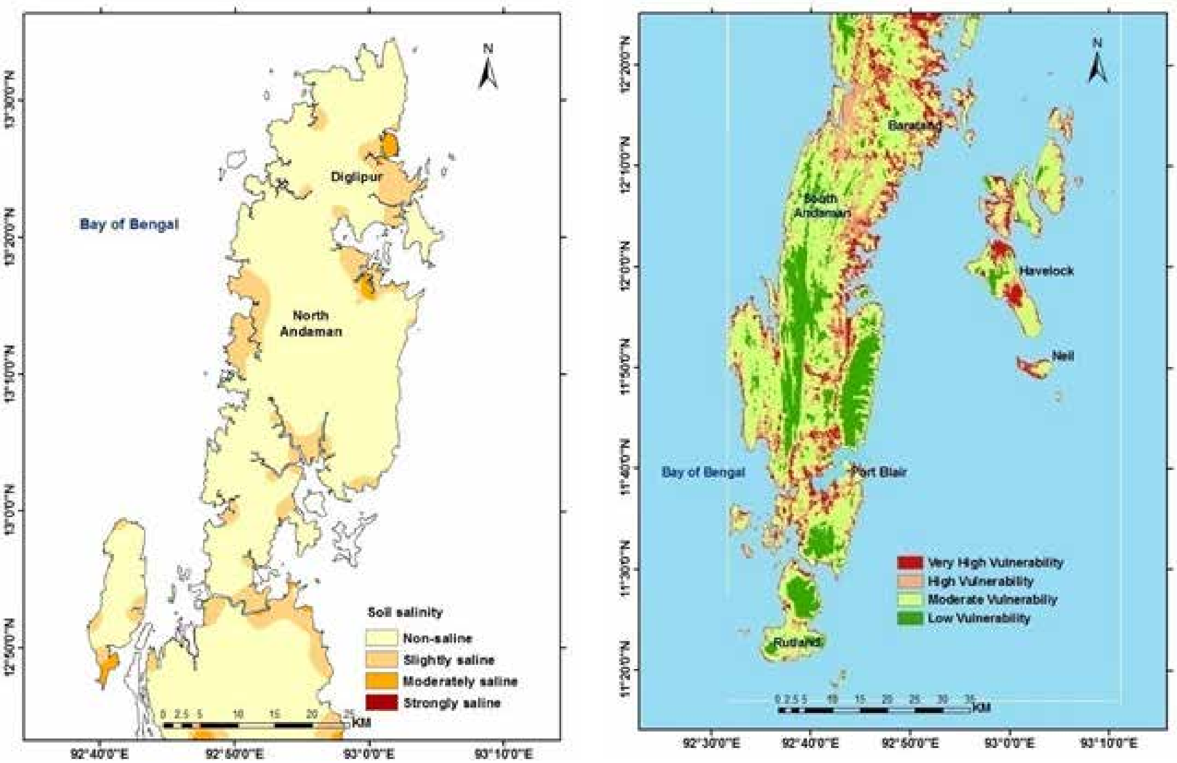


Fig. 13: Soil salinity and vulnerability of Andaman Islands

All India Coordinated Research Project on Integrated Farming Systems

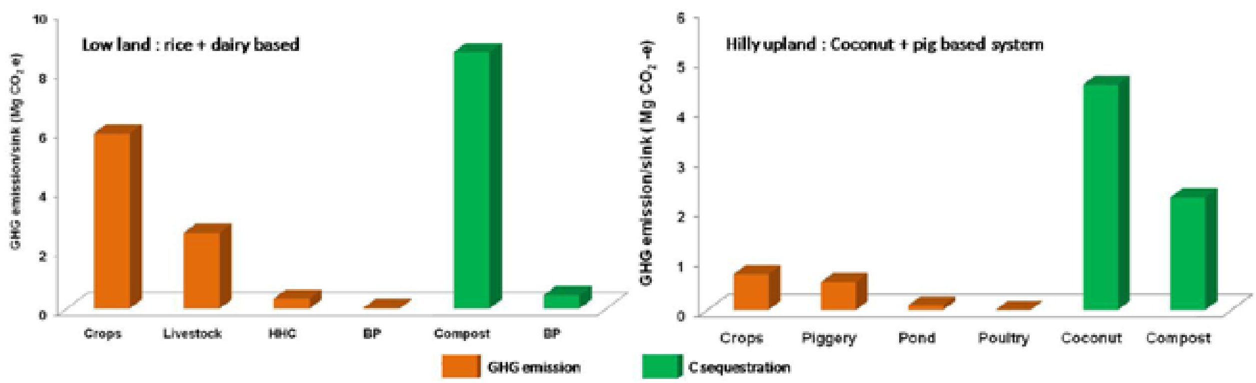
T.P. Swarnam , A. Velmurugan, T. Subramani, S. Swain, M.S. Kundu, R. Kiruba Sankar, I. Jaisankar, Ajit Arun Wamen, B.K. Nanda, S.K. Pandey and Zacharia George

During the year, the potential of IFS in mitigating green house gas (GHG) emissions was studied. The IIFSR-GHG Emission tool (V1.1) was used to estimate carbon credit and GHG emissions from different IFS models (It is not a measurement).

The results indicated that a total GHG emission from crop + dairy based system in lowland was 8.8 Mg CO_2eq yr^{-1} (Plate 71). In this system, crop contributed 67% and 28% by dairy unit. Off the total emission from crop component 75% was contributed by rice. On the other hand, the major sources of C sink were incorporation of manures and compost produced from the system into the soil and boundary plantations amounting to 9.1 Mg CO_2yr^{-1}. This resulted in a net C sequestration of 0.27 Mg CO_2yr^{-1}.

Similarly the total GHG emissions from coconut + pig based system was 1.38 Mg CO_2eq yr^{-1} ha^{-1} (Fig.14) with the maximum emission from crop component (52%) followed by livestock (41%). It was estimated that the C sequestration potential of the system was 6.8 Mg CO_2yr^{-1} ha^{-1}mainly due to the inclusion of tree components and addition of manures, compost and crop residues into the soil. This resulted in a net C sequestration of 5.4 Mg CO_2yr^{-1} ha^{-1} within the system.

Plate 71: GHG emission and C sequestration from lowland IFS



Monitoring of Pesticide Residue Analysis at National Level

T. P. Swarnam

During the year 495 samples (395: vegetables, 48 fruits, pulses, rice and 35 water) were collected from across the Islands (Plate 72) and sent to Regional Plant Quarantine Station, Chennai for analysis of pesticide residues. The samples were analyzed for the presence of residues of 126 compounds. Based on the analysis, the residues were monitored using CODEX guidelines for different commodities from April 2018 to March 2019. The results revealed that the percentage of samples with pesticide residues (15%) have significantly reduced.

Plate 72: Collection of vegetable samples from different farmers field

Development of Nutraceutical Beverages from Potential Underutilized Fruits and Medicinal Herbs of Andaman and Nicobar Islands

Sachidananda Swain, K.Abirami, Pooja Bohra and Pooja Kapoor

Bio-accessibility of total *phenolic* content, flavonoid content and antioxidant capacity of noni (powder and juice) through *in-vitro* gastro-intestinal digestion

The study was aimed to determine bioactive compounds and antioxidant capacity of noni subjected to *in-vitro* GI digestion.

Change in total phenolic and flavonoid contents

In fresh state, phenolic content of noni powder and juice was found to be 4.51 ± 0.65 and 6.49 ±0.89 mg GAE/g (Table 48). After gastric phase of *in vitro* digestion model, there was significant (P <0.001) change in total phenolic contents among two products. Noni powder had shown highest increase in phenolic content (96.2%) while noni juice exhibited increase of 59.7% compared to fresh state. In duodenal phase (pH=7.3), there was a marginal increase in phenolic content (1.06%) of noni juice, whereas noni powder had shown 21.2 % decrease in phenolic content. Total flavonoid content was highest in juice (208.11± 2.5 mg QE/g) before digestion. After gastric phase, there was a significant (P <0.001) change in flavonoid content in both sample. Noni powder and juice displayed 59.06% and 55.88% decrease in flavonoid content. In the duodenal phase, there was again decrease of 38.3 % and 78.06 %.

Table 48: Phytochemical constituents of noni (powder and juice) at fresh, gastric and duodenal phase of digestion

Noni	Total Phenolic Content (TPC) (mg GAE/g)			Flavonoid content (mg QE/g)		
	Fresh	Gastric phase	Duodenal phase	Fresh	Gastric phase	Duodenal phase
Powder	4.51±0.65	8.85±0.70	6.98±1.11	208.11±2.5	85.18±1.73	18.68±1.38
Juice	6.49±0.89	10.37±0.82	10.46±0.82	46.47±1.45	20.5±1.31	12.65±1.45
	DPPH activity (mg BHT/g)			ABTS activity (mM trolox/g)		
Powder	19.58±1.53	11±1.52	15.86±2.19	11.76±1.54	4.95±1.05	14.1±2.17
Juice	25.73±1.35	16.66±1.77	22.95±1.19	17.24±1.11	5.78±0.82	16.5±1.79
	Nitric oxide activity (NO) (mg Vit-C/g)			Metal Chelating Activity(MCA) (mg EDTA/g)		
Powder	87.84±1.49	36.2±2.15	48.00±1.51	57.62±2.85	20.42±0.8	18.67±1.55
Juice	99.04±1.96	46±1.90	45.4±0.95	45±1.04	15.89±0.52	16.98±1.75
	Super Oxide Dismutage Activity (SOD) (mg QE/g)			β-carotene bleaching activity (%)		
Powder	50.35±2.66	20.27±1.01	21.65±1.96	83.42±2.07	91.62±1.31	82.99±2.17
Juice	51.27±2.49	20.23±2.33	21.2±1.89	90.77±1.66	92.33±2.39	92.64±2.12

DPPH- 2,2- diphenyl-1-picrylhydrazyl; ABTS- 2,2'-azinobis-3-ethylbenzothiazoline-6-sulphonate (ABTS)

Change in antioxidant activities

Antioxidant activity measured using DPPH method was found to be 19.58 ±1.53 and 25.73 ±1.35 mg BHT/100 g in powder and juice, respectively. In the gastric phase, both powder and juice exhibited 43.8 % and 35.2% decrease in DPPH value. In duodenal phase, there was increase in DPPH value ranged between 44.1 % (powder) and 37.75% (juice). There was steady increase in free radical inhibition with concomitant increase in concentration of the extract establishing dose dependence of the extract in scavenging DPPH radicals. DPPH scavenging activity was 51.46 % and 56.98 % in fresh state for powder and juice, respectively. Powder exhibited 13.6 % to 17.7 % and juice exhibited 24.73 % and 19.2 % increase in scavenging activity compared to fresh and gastric phase respectively. This indicates the effectiveness of GI tract in extracting inhibition effect at two different pH resulting their bioaccessibility. Noni juice had 31.78% higher ABTS value than its powder form in fresh state. Interestingly there was a trend for ABTS activity gastric phase followed significant decrease (57.9 and 66.4 % in powder and juice) and duodenal phase followed sudden increase in ABTS value (2.85 times in both products). ABTS scavenging activity was also continuously increased from 48.2% in fresh state to 49.17 % and 84.57 % in gastric and duodenal phase in noni powder. Unlike, juice followed slightly decrease in scavenging activity (7.54 %) compared to fresh state (56.61%) and there was significant increase in scavenging activity (77.35%) in duodenal phase compared to gastric phase . In fresh state, NO value was found to be 87.84±1.49 and 99.04±1.96 mg Vit-C/g in powder and juice products. However, during gastric phase, 2.42 and 2.15 times lower NO values were obtained in powder and juice indicating the inhibiting effect of

NO in gastric phase. After duodenal phase of digestion, NO value was increased by 32.6% in powder and a non-significant decrease was observed in juice.

In fresh state, MCA of noni powder and juice was found to be 57.62 ± 2.85 and 45±1.04 mg EDTA/g. There were significant decrease (P<0.01) in MCA value by 64.5 % and 64.68 % in gastric phase for powder and juice, respectively whereas only a slight decrease in MCA activity (8.5% and 6.8 %) was observed in duodenal phase. SOD values ranged from 50.35 ± 2.66 QE mg/g (powder) to 51.27 ± 2.49 (juice) in fresh state. Following the gastric phase, there was 2.5 times decrease in SOD values in both products. After the duodenal phase of digestion, slight increase in SOD values (4.8-6.3 %) were observed. SOD inhibition activity increased from 78.94 (fresh) to 86.97% (duodenal phase) with non-significant decrease (1.03%) in gastric phase. Similar trend was also observed in juice. Juice had highest β-carotene bleaching activity (90.77±2.07 %) in fresh state. In the gastric phase, there were 2.0 to 9.82 % increase in bleaching activity in juice and powder. However, in the duodenal phase, juice retained its activity (92.64 %) but only 9.4% decrease in bleaching activity was observed in noni powder.

Change in antinutrients

The intake of tannins was found to lower the glucose levels in blood by delaying the intestinal glucose absorption and also acts as antioxidant. Tannin content in fresh state was found to be 6.09±0.73 and 4.64±0.59 mg tannic acid/g in powder and juice, respectively. In gastric phase, there were 48.4 and 33.6% reduction of tannin content in powder and juice. Consequent upon duodenal digestion, both samples had undergone significant increase in tannin content by 30.7 % (powder) and 85.7 % (juice). Compared to fresh state, there was 32.5 and 23.3 % reduction only. Similarly powder had higher saponin content (229.79±2.51) than juice (232.34±1.09 mg diosgenin/g). Following gastric and duodenal phase, there was 5.4 (juice) and 7.1 (powder) fold decrease in saponin content compared to fresh state. Nitrate content was found to be 32.33±1.57 and 9.7 ±0.4 mg KNO_3/g in podwer and juice. Following gastric phase, both samples exhibited different trend where powder gained 41.5 % and juice lossed 75.9 % of nitrate content. In duodenal phase, it followed opposite trend, where there was 79.23 % decrease and 7.45 fold increase in nitrate content in powder and juice samples.

Assessment of Post Harvest Losses in Fruits and Vegetables Produces and Strategy for their Reduction in Andaman and Nicobar Islands

Sachidananda Swain, S. K. Zamir Ahmed, L. B Singh, Chandrika Ram,Manoj Kumar, Tauqueer Ahmed and P. Misra Sahoo

Post-harvest losses in consumer level

A survey was conducted on 58 families at Calicut, Burmanalla, Chouldari, Wandoor, Guptapara, Manglutan, Ograbraj, Humphregunj, Memio and Chidiyatapu to assess the consumption pattern and level of post harvest losses.

These losses at home: includes foods consumed at home from purchases at retailer shops, farmers market, food outlets and their own production and *Away from home:* Includes food consumed from restaurants, school and company cafeterias, hospitals, nursing homes, catered events, and other foodservice outlets which was not considered as it is quite tedious and difficult to classify the vegetables coming from mainland for preparation of a particular dish.

The study revealed that 65.3 % of consumer purchase fruits and vegetables on weekly basis, while 12.8 % of the consumer purchased on daily basis and rest (21.9 %) purchase as per requirement. 20.6 % of the respondents always received physically injured fruits and vegetables from the market. Consumption level of fruits (mango, banana and pine apple) are almost seasonal and mostly depend on their own production. The analysis showed about 3.8- 6.2 % losses in vegetables such as pumpkin, brinjal, okra, chilly, bean, point gourd, banana, tomato, mango, pine apple, drumstick, taro, yam and other leafy vegetables and 0.4 - 0.9 % losses in fruits.

Food Processing Training Centre (FPTC)

Sachidananda Swain

Training and demonstration for the development of value added products from mango, pine apple, bael, coconut and noni

Two training-cum-demonstration programme on value addition of mango, pine apple, bael, coconut and noni were conducted during 1^{st} to 3^{rd} August, 2018 and 28^{th} to 30^{th} March, 2019. Seventy five participants (58 females) attended and learnt post harvest processing and development of value added products. Demonstration of RTS juice, squash, jam, jelly and candy from mango, bael and as well as free "hands-on" training on coconut milk, packaging of tender coconut water, grating of coconut and coconut chips were given (Plate 73).


Plate 73: Training and demonstration of value added products to the SHG's/rural women and youths

DIVISION OF
ANIMAL SCIENCE

Poultry Seed Project

A. Kundu and T. Sujatha

Breeding performance of Vanaraja breeders (fourth batch)

A total of 627 numbers of Vanaraja chicks including 565 female and 62 male were brought from Project Directorate on Poultry, Hyderabad. During the year 2018-19, a total of 360 female and 36 male vanaraja breeders (Parent stock) attained breeding stage. A total of 18550 numbers of hatchable eggs were produced during the period from 24 to 48 weeks of age. The age at sexual maturity (ASM) was 178 days with average egg weight of 35.16±11.8 g and the egg weight of 55 g was reached at 35 weeks of age. The age at 5% egg production was 187 days. During breeding period, average feed allowance was 145 g per bird per day. The body weight during the period of 24 to 45 weeks of age ranged from 3.35±69.55 to 4.10±57.6 kg males and 2.35±44.2 to 3.20±76.5kg for females (Fig.15).

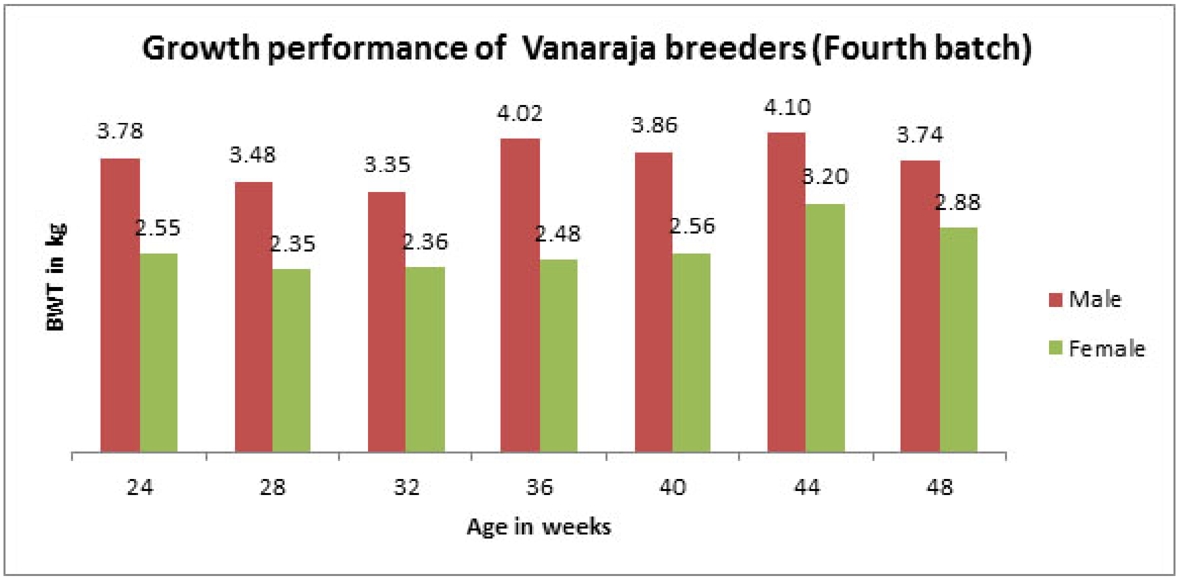


Fig.15: Growth performance of Vanaraja breeders (Fourth batch)

Growing performance of Vanraja breeders

A total of 627 numbers of vanaraja chicks including 565 female and 62 male were brought from Project Directorate on Poultry, Hyderabad. The standard managerial practices were followed for the parent stock. The sheds were cleaned, washed, flame gunned and fumigated with formaldehyde solution prior to the chicks and commencement of the experiment. The cemented brooding area was covered with paddy husk and standard brooding arrangement was made. All the chicks were provided with uniform brooding facilities using 60 W incandescent bulbs with floor space of 675 cm^2. Growth performance of Vanaraja breeders have been mentioned in Table 49.

Table 49: Growth performance of Vanaraja breeders (Fourth batch)

Age in weeks	Body Weight (g)	
	Male	Female
0 day	35.6 ± 1.37	34.9 ± 1.34
4	447.0±10.53	384.0±11.05
16	1822.9±81.13	1293.3±46.47
20	2951.1±147.9	2191.6±63.39

Production and reproduction performance of Vanaraja breeders

Production performance of Vanaraja breeders were assessed on the basis of hen-day egg production (HDEP) and hatchability percentage. HDEP was found highest (37.87%) in 40th week of age and lowest (1.46%) in 24th week. Hatchability percent was maximum in 36th week of age and lowest in 24th week (Table 50).

Table 50: Production and reproduction performance of Vanaraja breeders (Fourth batch)

Age in weeks	HDEP%	Hatchability%
24	1.46	32.22
28	13.71	33.42
32	26.54	35.31
36	31.22	53.63
40	37.87	43.1
44	30.18	45.12
48	27.74	46.23

Growing performance of Vanaraja breeders (Fifth batch)

A total of 627 numbers of Vanaraja chicks including 565 female and 62 male were brought on 21.09.2018 from Project Directorate on Poultry, Hyderabad. The standard managerial practices were followed for the parent stock. The shed was cleaned, washed, flame gunned and fumigated with formaldehyde solution prior to the arrival of chicks and commencement of the experiment. The cemented brooding area was covered with paddy husk and standard brooding arrangement was made. All the chicks were provided with uniform brooding facilities using 60 W incandescent bulbs. The floor space of 675 cm^2 was provided. Growth performance of Vanaraja breeders have been mentioned in Table-50.

Germplasm supply

Production and distribution of Vanaraja and Gramapriya germplasm

In a span of 6 months, a total of 16,284 germplasms of chicks and hatchable eggs were supplied. 170 benefkckarkes Rs. 97,250.00 was generated as revenue.

Economics of Vanaraja poultry rearing

A total of five farmers have successfully adopted poultry farming with Vanaraja birds. Flock size ranged from 30 to 150 birds per batch. Average body weight at marketing was 2.0 to 3.0 kg with a cost benefit ratio of 2.5.

Establishment of Duckling Resource Unit for Sustainable Duck Production in North and Middle Andaman

T.Sujatha, A.Kundu, Jai Sunder and Shardul Lal

The activities of duck farming were assemblage of converge by the concept of ‘’by farmers to farmers’’. Backward and forward linkage was established among the farmers by three different mode of actions: (a) producing hatchable duck eggs, (b) hither-to its in-house hatching, and (c) distribution of ducklings to other farmers. Through cluster approach, the slot was allotted to each farmer to hatch his own duck eggs at a time. In a span of one year, the mini incubator has been used for hatching of 1124 eggs which produced 482 chicks out of 596 fertile eggs. A total of 14 hatches have been completed with the mean hatchability per cent of 40.9%. The per cent hatchability was 57.8% based on fertility.

Impact of concept ‘’by farmers to farmers” and its horizontal dissemination

The duckling resource unit with the concept of “by farmers to farmers” has imparted knowledge and skill development on handling of mini incubator. In this way, self-sustained concept of ‘’by farmers to farmers” has been successful because chicks have been made available in N&M Andaman. Due to this intervention a total of four farmers have established mini incubator, started their own poultry farm and selling chicks. Evaluation of duckling production unit and impact of concept “ by farmers to farmers” in duckling production unit has been narrated in Table 51 & 52.

Table 51: Evaluation of duckling production unit

Evaluation of duckling production unit								
Batches (No.)	Eggs set (No.)	Chicks hatched (No.)	Infertility	Fertile eggs	Early embryonic death	Late embryonic death	Hatchability on total eggs set	Hatchability on fertile eggs basis
1	34	13	7	27	-	1	38.2	48.1
2	120	42	-	-	-	-	35.0	-
3	120	67	25	95	16	2	55.8	70.5
4	80	51	20	60	3	6	63.8	85.0
5	64	36	18	46	11	16	56.3	78.3
6	120	67	48	72	-	-	55.8	93.1
7	120	17	26	94	19	58	14.2	18.1
8	75	30	30	45	8	9	40.0	66.7
9	14	2	-	-	-	-	14.3	-
10	70	36					51.4	
11	70	27	13	57	16	9	38.6	47.4
12	60	20	1	59			33.3	33.9
13	120	59	-	-	-	-	49.2	-
14	57	15	16	41	15	11	26.3	36.6
Total	1124	482	204	596	88	112		
Mean	-	-	-	-	-	-	40.9	57.8

Table 52: Impact of concept of “by farmers to farmers” in duckling production unit

Impact of concept of "by farmers to farmers" in duckling production unit				
Sl.No.	Farmers	Before Mini incubator	After Mini incubator	Increase in chicks availability
1	ManobendraHalder			
	Unit size of farm	270	520	1.93 times
	Source of chicks	Govt. poultry farm	own	
	Cost of chicks (Rs.)	23/ chick	72/120 = 60%	
	Hatchability		Source of feed - market	
	Selling price		250 / kg	
	Total birds sold		250 nos.	
2	Krishna Chandrabachan			
	Unit size of farm	100	400	4 times

Impact of concept of "by farmers to farmers" in duckling production unit				
Sl.No.	Farmers	Before Mini incubator	After Mini incubator	Increase in chicks availability
	Source of chicks	Govt. poultry farm	own	
	Cost of chicks (Rs.)	23/ chick		
	Hatchability		240/300=80%	
	Selling price (Rs.)		42-50	
	Total birds sold		300 nos.	
3	Rajini kumari			
	Unit size of farm	50	200	4 times
	Source of chicks	Govt. poultry farm	own	
	Cost of chicks (Rs.)	23/ chick		
	Hatchability		80/120=66.66%	
	Selling price (Rs.)		Rs.250/kg	
	Total birds sold		80	
4	R.K. Nair			
	Unit size of farm	No farming	66	Started own farm
	Hatchability		59/120=49.17%	
	Selling price (Rs.)		own use	

Andaman Local duck: First report on phenotypic and molecular characterization

The population of Andaman Local Duck(ALD) is more in North and Middle Andaman. A study was taken up to characterise ALD for its phenotypic as well as genotypic characterisation.

Phenotypic characterisation: Female ducks are having matty brown coloured plumage and males are with dark brown plumage mixed with black patches on tip of feather with or without white ring type feathers on neck. The head and neck is covered with lustrous dark brown plumage. Males have brown coloured feather. The bill colour is dark brown or orange. The shank colour is either orange or dark brown for both males and females. These ducks are medium in size having egg production of 200 to 220 eggs per annum.

Genotypic Characterization: Partial mitochondrial D-loop sequences of the duck breed were analyzed. Eleven blood samples from ALD were collected from different parts of North and Middle Andaman. Mitochondrial D loop was amplified using the specific primers and sequence information was generated by dideoxy fingerprinting. Sequence information revealed that the estimated transition/transversion bias (R) was 1.01. Substitution pattern and rates were estimated under the Kimura (1980) 2 parameter model. The nucleotide frequencies were 25.00% (A), 25.00% (T), 25.00% (G) and 25.00% (C). The nucleotide diversity was 0.01069 and Tajima's Neutrality test exhibited the value of 1.996678. Among the sequences, three haplotypes were identified with haplotype diversity of 0.691.

By NJ method of phylogenetic analysis this has been found that, Andaman local ducks form a separate cluster and phylogenetically were close to local ducks of Indonesia (Fig. 16). The results of the study will be helpful for development of breeding strategy of the Andaman local duck for their future conservation.

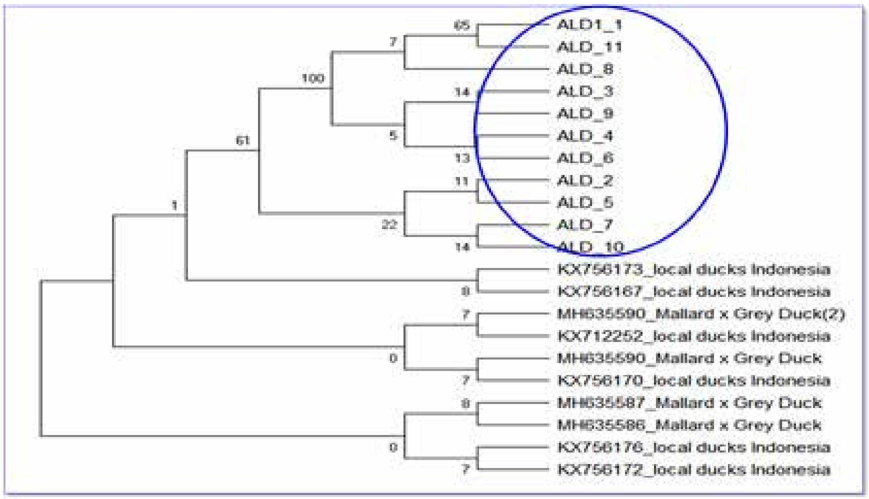


Fig. 16: Phylogenetic analysis of Andaman Local Duck with other ducks. ALD denotes Andaman Local Duck

AICRP on Goat Improvement- Andaman Local Goat

Jai Sunder, M.S.Kundu, A. Kundu and R. A. Alyethodi

The opening balance (goats) of all the three clusters *viz*. Port Blair, Baratang and Nimbudera were 1757, 1179 and 428, respectively. A total of 155 goats were added as new registration, 836 were added as new birth and 584 reductions were due to death and sale of goats in the overall clusters. The closing balance as on 31.03.19 was 1981, 1163 and 625 goats at Port Blair, Baratang and Nimbudera clusters, respectively which speaks about the overall increase in goat population through the intervention of the project (Table 53). During the period under recording, 836 kids were born out of 908 selected adult Andaman local goat does, so the overall population growth was 88.55%. The body weight at different ages has been presented in table 54. The overall least square means of body weights (kg) at birth, 3, 6, 9 and 12 months of age are 1.53±0.02, 5.80±0.08, 9.83±0.14, 13.63±0.23 and 16.40±1.09. In general single born kids were heavier than the multiple born kids. The biometric dimensions (in cm) of Andaman local goats at different ages and sex have been recorded. The overall heart girth (HG) at birth, 6, and 12 months was 26.15±2.1, 41.23±3.45 and 52.82±0.87 respectively. Measurements for body length (BL) at birth, 6, and 12 months were 27.01±2.04, 39.14±2.74 and 50.27±1.44 respectively. Measurements for body height (BH) at birth, 3, 6, and 12 months were 28.01±1.78, 40.12±2.91 and 53.37±2.94 respectively. Age at first mating, weight at first mating, age at first kidding, weight at first kidding, kidding interval, service period and gestation period was 251.89 ±2.98 days, 11.93 ± 0.88 kg, 407.86 ± 3.55 days, 16.40 ± 00.99 kg, 273.31 ± 3.42 days, 98.66 ±15.86 days and 146.35 ± 0.55 days respectively. The kidding percentage of 155.97 per cent on the basis of does kidded and the kidding rate of 1.56 was recorded in the present stock of Andaman local goats. The percentage of singles, twins, triplets were 44.37, 53.82 and 1.79 respectively in the present population under study during the period. During the year a total of 17 superior bucks of Andaman local goats were distributed to different villages of Nimbudera and Baratang clusters for genetic up-gradation of the Andaman local goats in the field

Heritability and correlations studies are carried out using Animal model in WOMBAT. Heritability value are after conditioning sex, birth type, and cluster effects which are found to have significant effect on the body weight measured at different age periods such as birth weight, weight at 3rd, 6th and 9th months. The heritability of body weight was higher at all stages of measurement. High genetic (0.778±0.14) and phenotypic (0.64±0.05). Correlations were found between 6th and 9th month body weight indicating the suitability of selection based on 6 month body weight.

During the year, no major disease outbreak was reported from the goats. A total of 2938 goats were given the mineral mixture, 2329 treated for different illness and 2829 dewormed. The overall mortality during the period was 4.52 %, however the highest mortality was observed in the age group of below 3 months. Among the main diseases/ symptoms, the morality is mainly due to the diarrhoea, blot and grass poisoning. A total of 9 training programmes/ health camps/field day were conducted during the year, of which 202 farmers were benefitted.

Since the start of this project, there has been a considerable increase in the overall body weight gain, reduction in mortality percentage and enhancement of income. The average body weight of doe at kidding increased to 16.40 ± 10.99 kg from 16.05±0.46 kg. Mineral mixtures were provided to the pregnant does in the last stages of pregnancy and there was reduction in the kid mortality and an improvement in the overall health of the kid and the doe (Plate 74&75). The mortality during the period was reduced to 4.52 % from 6.50 %. The new born kids were also given more care by providing the vitamin tonic and sufficient milk of the does. The weaning weight of the goat kids increased from 5.64 ±1.02 kg to 5.88±0.11 kg.

Table 53: Reproductive Performance in Andaman Local Goat

Particulars	2014	2015	2016	2017	2018
No. of available does for breeding (A)	1078	1043	543	843	979
Tupped does available at kidding (B)	-	-	345	677	536
Does Kidded	83	416	345	677	536
Single (C)	33	242	176	375	371
Twins (D)	98	324	324	648	450
Triplet (E)	3	27	21	18	15
More > 3 (F)	-	12	-		nil
No. of abortion (G)	22	14	9	22	Nil
No. of still Birth (H)	14	7	NIL	8	Nil
Breeding Efficiency/Fertility On the basis of does tupped (C+D+E+F+G*100)/B	-	-	153.62	157.02	155.97
Actual live birth (I)	134	605	521	1041	836
Kidding (%)(on the basis of does kidded) (I*100/B)	161.4	145.43	151.01	153.77	155.97
Kidding Rate (Litter Size) (I/B)	1.61	1.45	1.51	1.54	1.56

Table 54: Least Square Mean of Body Weight Growth (kg) in Andaman local goats

Factor	Weight				
	Birth	3 month	6 month	9 month	12 month
Overall mean (2018-19) (all clusters)	1.53±0.02 (n=836)	5.80±0.08 (n=764)	9.83±0.14 (n=742)	13.63±0.25 (n=544)	16.40±1.09 (n=686)
Year					
Cluster I (2018-19)	1.50±0.01 (n=337)	5.87±0.07 (n=330)	9.99±0.23 (n=321)	13.89±0.27 (n=230)	16.89±1.20 (n=160)
Cluster II (2018-19)	1.51±0.03 (n=282)	5.56±0.12 (n=225)	9.88±0.15 (n=201)	13.44±0.23 (n=137)	16.56±1.04 (n=78)
Cluster III (2018-19)	1.58±0.05 (n=217)	5.96±0.11 (n=209)	9.60±0.15 (n=220)	13.55±0.27 (n=177)	15.76±1.11 (n=106)

Factor	Weight				
	Birth	3 month	6 month	9 month	12 month
2016-17	1.42±0.54 (n=378)	5.59±0.10 (n=328)	9.63±0.04 (n=411)	13.24±0.19 (n=326)	16.10±0.12 (n=460)
2015-16	1.40±0.01 (n=106)	5.58±0.08 (n=307)	9.61±0.23 (n=280)	13.21±0.17 (n=303)	16.07±0.04 (n=217)
Season of Birth					
Cluster I (April – Sep.)	1.54±0.06 (n=200)	5.93±0.04 (n=150)	10.1±0.11 (n=170)	14.5±0.19 (n=100)	16.90±0.28 (n=60
Cluster II (April – Sep.)	1.53±0.01 (n=182)	5.46±0.03 (n=100)	9.9±0.12 (n=90)	13.52±0.23 (n=80)	16.59.±0.13 (n=30)
Cluster III (April – Sep.)	1.59±0.01 (n=110)	6.1±0.03 (n=110)	9.71±0.12 (n=150)	13.80±0.27 (n=95)	15.93.±0.13 (n=68)
Cluster I (Oct. - March)	1.46±0.01 (n=137)	5.80±0.03 (n=180)	9.88±0.06 (n=150)	13.3±0.07 (n=130)	16.80±0.07 (n=80)
Cluster II (Oct. - March)	1.51±0.01 (n=100)	5.68±0.07 (n=150)	9.72±0.09 (n=112)	13.35±0.05 (n=50)	16.50±0.07 (n=53)
Cluster III (Oct. - March)	1.56±0.01 (n=101)	5.80±0.07 (n=98)	9.62±0.09 (n=65)	13.10±0.05 (n=86)	15.61±0.07 (n=43)
Sex of Goats					
Male	1.56±0.09 (n=352)	5.92±0.11 (n=324)	10.81±0.24 (n=320)	13.87±0.93 (n=212)	16.80±1.42 (n=122)
Female	1.50±0.1 (n=484)	5.66±0.12 (n=440)	8.86±0.54 (n=422)	13.39±0.15 (n=332)	16.1±1.14 (n=222)
Type of Birth					
Single	1.52±0.01 (n=371)	5.88±0.02 (n=350)	10.9±0.43 (n=250)	14.3±0.02 (n=161)	16.60±1.04 (n=146)
Twin	1.54±0.01 (n=450)	5.80±0.02 (n=363)	10.1+0.02 (n=380)	13.8±0.03 (n=274)	16.35+0.05 (n=125)
Triplet	1.42±0.02 (n=15)	5.70±0.06 (n=15)	8.3±0.11 (n=15)	12.8±0.16 (n=15)	16.10±0.17 (n=15)

Data have been presented as mean±SEM , n=number

Plate 74: Awareness on goat farming and distribution of mineral mixtures at Nimbudera cluster

& Field day on deworming in goats at South Andaman

Plate 75: Distribution of superior bucks at Nimbudera cluster & South Andaman

Study on the Status of Minerals Profile in Cattle Sera, its Correlation with Infertility and Production and Development of Area Specific Mineral Mixture to Augment Productivity

Jai Sunder, M.S. Kundu, T. Sujatha, P.A. Bala and A. Kundu

The preliminary survey in different parts of the South Andaman, North & Middle Andaman was conducted and the status of the dairy animals was recorded. Majority of the livestock population belongs to non-descript or desi type. Only 10% of the cattle are crossbred. Percentage of lactating and non-lactating animals was found to be 38% and 30% respectively. The total milk yield was recorded to be 285 lit/day. The average milk yield / day / cow was 4 to 5 liter and the average milk yield / day / family was 9.5 liter. Survey revealed that very little emphasis is being given to the nutrition of the cattle, and that too depends on the economic status of the farmer and also the production performance of the animal. If the animal is a high yielder then its nutrition is taken care otherwise they are let loose for grazing in the open field. Most of the small and marginal farmers keep their animals solely on grazing. Farmers with better economic stability go for supplementation of animal's diet with one or more concentrate feed ingredients and other essential micro-nutrients. Though the productivity of animals depends on the genetic potential, it is always prudent to feed them with optimum quantities of different minerals to exploit the maximum productivity potential. Letting the animals loose during the daytime and offering dry roughages, mainly paddy straw along with some cultivated green grass or collected pasture grasses from the nearby jungles are the most prevalent feeding practice followed by the farmers in the surveyed areas. Feeding concentrate in the ration as per nutritional requirements was hardly practiced by the farmers. During the period, surveillance study was taken to quantify the availability of micro minerals to animals through forages according to status of production. The samples were collected during the rainy season and the dry season. A total of 396 soil samples and 604 fodder samples were collected from selected 40 villages of South, North and Middle Andaman. The observation of micronutrient content of soil and fodder were categorized into four groups *viz.,* lactation, pregnant, heifer and infertile cattle in accordance to status of production. The collected samples were processed for further analysis in the lab as per standard procedure for quantification of macro and micronutrients by atomic absorption flame emission spectrophotometer. In the study period, three micro minerals such as copper (Cu), zinc (Zn) and iron (Fe) were analysed.

Average soil moisture was maximum in wet season (26%) and then was low in the dry season (17%). Average pH ranged from 4.8 to 6.6. The result suggests that 22% of the villages have moderately acidic (4.5-5.5) soil types and 78 % have slightly acidic soil (5.5-6.5). Soil in this range is considered to be healthy soil for most food plants. The detail result of the micronutrients in soil and fodder in South, North& Middle Andaman districts is given in the table 55 & 56.

Table 55: Micronutrients Contents of Soil & Fodder in South Andaman (in ppm)

South Andaman - Soil samples				
	Lactation	**Pregnant**	**Heifer**	**Infertile**
Cu (Critical level: 1 – 1.8)				
Wet season	0.30±0.04	0.30±0.05	0.22±0.06	0.23±0.11
Dry season	0.28±0.08	0.19±0.02	0.12±0.04	0.21±0.04
Zn(Critical level: 1.5)				
Wet season	0.35±0.06	0.59±0.21	0.62±0.53	0.27±0.11
Dry season	0.84±0.15	0.45±0.01	0.49±0.03	0.55±0.02
Fe(Critical level: 20-30)				
Wet season	1.40±0.13	1.23±0.10	3.54±0.18	2.41±0.65
Dry season	24.65±3.90	4.19±0.19	3.46±0.38	3.72±0.28
South Andaman – Fodder samples				
Copper (Critical level: 5-20)				
Wet season	0.39±0.03	0.44±0.04	0.14±0.04	0.41±0.08
Dry season	0.48±0.03	0.55±0.06	0.23±0.05	0.23±0.04
Zinc (Critical level: 20-30)				
Wet season	1.28±0.27	1.64±0.20	0.59±0.04	1.45±0.28
Dry season	1.77±0.23	2.23±0.20	1.83±0.09	2.06±0.32
Fe (Critical level: 50-250)				
Wet season	3.27±0.28	3.38±0.27	7.05±0.75	2.45±0.68
Dry season	4.01±0.28	3.64±0.28	8.08±0.27	3.62±0.69

Table 56: Micronutrients contents of Soil & Fodder in N&M Andaman (in ppm)

North & Middle Andaman - Soil samples				
	Lactation	**Pregnant**	**Heifer**	**Infertile**
Cu (Critical level: 1 – 1.8)				
Wet season	1.09±0.09	1.23±0.14	1.04±0.13	1.15±0.24
Dry season	1.92±0.50	1.25±0.41	0.43±0.01	0.76±0.08
Zn (Critical level: 1.5)				
Wet season	3.03±0.27	4.20±0.32	2.97±0.42	4.37±0.59
Dry season	1.28±0.37	0.84±0.05	0.49±0.02	0.54±0.12
Fe (Critical level: 20-30)				
Wet season	19.84±1.38	21.89±1.61	19.59±2.01	24.59±3.99
Dry season	22.64±3.07	19.75±2.68	11.32±1.24	2.81±0.62
North & Middle Andaman – Fodder samples				
Copper (Critical level: 5-20)				
Wet season	0.42±0.03	0.45±0.08	0.38±0.04	0.54±0.07
Dry season	2.12±0.08	0.98±0.04	1.05±0.05	1.36±0.09

North & Middle Andaman - Soil samples				
	Lactation	Pregnant	Heifer	Infertile
Zinc (Critical level: 20-30)				
Wet season	0.46±0.06	0.47±0.16	0.48±0.26	0.25±0.06
Dry season	1.09±0.09	1.34±0.06	1.16±0.09	0.81±0.06
Fe (Critical level: 50-250)				
Wet season	8.52±1.92	5.62±1.39	8.47±1.80	1.88±0.75
Dry season	9.22±1.02	5.96±1.35	8.86±1.85	2.87±0.74

Micro-minerals in Soil & Fodder in South Andaman: All the three minerals *viz.*, Cu, Zn and Fe are below the critical levels in both the soil and fodder across wet and dry season in South Andaman. This study indicates that cattle are deficient in Cu, Zn and Fe during all production stages of growing, pregnancy and lactating. Moreover, this deficiency might be one of contributing factors for infertility.

Micro-minerals in Soil & Fodder in N&M Andaman: All the three minerals *viz.*, Cu, Zn and Fe are above the critical levels in soil during wet season in N&M Andaman. However, they are below critical levels in fodder in both the seasons. So, cattle in N& M Andaman are still deficient of these minerals to optimize the production and reproduction.

Correlation on influence of season and place on status of micro minerals (Table 57, 58, 59 & 60)

Table 57: Correlation of season vs minerals in soil (in ppm)

	Copper		Zinc		Iron	
	Dry season	wet season	Dry season	wet season	Dry season	wet season
N	56	303	56	303	56	298
Mean± SE	1.05±0.21	0.75±0.05	0.90±0.12	2.15±0.14	17.05±1.77	12.11±0.75
P value	0.0335(*)		0.0002 (***)		0.0094 (**)	

Inference: Based on correlation study on season versus minerals in soil irrespective of place, season is significant factor to influence the levels of minerals. During dry season, iron and copper is significantly higher in soil than wet season; whereas Zn level of soil is significantly higher during wet season.

Table 58: Correlation of season vs minerals in fodder (in ppm)

	Copper		Zinc		Iron	
	Dry season	wet season	Dry season	wet season	Dry season	wet season
N	293	302	281	303	303	303
Mean± SE	1.06±0.05	0.416±0.02	1.57±0.07	0.92±0.07	9.19±3.1	5.59±0.45
P value	< 0.0001(****)		< 0.0001 (****)		0.2524 (NS)	

Inference: Based on correlation study on season versus minerals in soil irrespective of place, season is significant factor to influence the levels of minerals in fodder. During dry season, copper and zinc are significantly higher in fodder than wet season; whereas level Fe in fodder is not significantly influenced by season.

Table 59: Correlation of place vs season vs micro-minerals in soil(in ppm)

	Wet Season						Dry Season					
	S- Cu	NM-Cu-	S- Zn	NM-Zn	S-Fe	NM-Fe	S- Cu	NM-Cu	S-Zn	NM-Zn	S-Fe	NM-Fe
N	133	170	133	170	133	165	36	57	36	57	36	57
Mean± SE	0.291± 0.36	1.12 ± 0.84	0.471 ± 1.22	3.46± 2.39	1.48± 1.03	20.65 ± 11.75	0.201 ± 0.15	1.15± 1.54	0.573 ± 0.25	0.833 ± 0.88	8.51 ± 10.16	16.32 ± 11.46
P value	P< 0.0001 (****)		P< 0.0001 (****)		P< 0.0001 (****)		P=0.0004 (***)		0.0891 (NS)		0.0012 (**)	

S= South Andaman, NM = North & Middle Andaman

Table 60: Correlation of place vs season vs micro-minerals in fodder (in ppm)

	Wet Season						Dry Season					
	S- Cu	NM-Cu-	S- Zn	NM-Zn	S-Fe	NM-Fe	S- Cu	NM-Cu	S-Zn	NM-Zn	S-Fe	NM-Fe
N	133	169	133	148	133	170	133	169	133	148	133	170
Mean± SE	0.398 ± 0.03	0.43 ± 0.02	1.51 ± 0.14	0.45 ± 0.38	3.48 ± 0.20	7.24 ± 0.77	0.498 ± 0.03	1.52 ± 0.06	1.99 ± 0.14	1.18 ± 0.03	4.04 ± 0.03	13.22 ± 5.5
P value	0.2918 (NS)		< 0.0001 (****)		< 0.0001 (****)		< 0.0001 (****)		< 0.001 (***)		0.1434 (NS)	

S= South Andaman, NM = North & Middle Andaman

Inference: Correlation of place versus season indicated that during both the season, all three micro minerals *viz*. Cu, Zn and Fe in soil are significantly higher in N & M Andaman as compared to South Andaman. However, Fe and Cu in fodder is not significantly differing place wise in dry season and wet season respectively. Level of Zn in fodder is significantly higher in south during both the season as compared to N & M. The level of Fe and Cu in fodder is significantly higher in N&M in wet season and dry season respectively.

Sero-Surveillance and Monitoring of FMD in Andaman and Nicobar Islands under AICRP-FMD

Jai Sunder and Arun Kumar De

Foot and mouth disease (FMD) is a highly contagious disease of cloven hoofed animals caused due to serotype O, A and Asia -1 in India. During the year 2018, the re-emergence of (FMD) in this Island due to Serotype O has been reported. The laboratory confirmation of the FMD virus was done at D-FMD (Directorate on Foot and Mouth Disease), Mukteshwar. In the present outbreak cattle, goat and buffalo were affected with typical sign and symptoms of FMD. More than 800 livestock was affected due to the FMD which was reported mainly from the Port Blair area. The morbidity was found to be 85 to 90 %, however, the mortality was found to be less than 2 %. A total of twelve clinical samples (tongue epithelium) and 18 sera samples were collected from the cattle showing the typical symptoms of FMD. The samples were transported to Directorate of Foot and Mouth Disease, Mukteswar for confirmatory diagnosis and serotyping of the FMD virus. The serotype specific antigen detection was carried out by using type-specific double-antibody sandwich ELISA, where serotype-specific polyclonal antibodies from rabbit and guinea-pig are employed as trapping antibody and detecting antibody respectively for diagnosis. The samples were also processed for multiplex PCR. The total RNA was extracted from field samples by total RNA isolation kit (Quiagen) as per usage guidelines. Complementary DNA (cDNA) was done by using AMV reverse transcriptase (Promega) and oligodT primer. The serotype specific detection of FMDV was done by multiplex PCR along with respective PCR controls. The amplified products were analysed on 2% agarose gel and visualized by ethidium bromide staining (Fig.17). Based on the laboratory confirmation by sandwich ELISA and mPCR, out of 12 clinical samples four samples showed positive and was confirmed as serotype O. The severity of the outbreak has been found to be very high with typical lesion and symptoms of FMD. The last outbreak which was reported in the 2005 was also due to the Serotype O.

During the year a total of 737 cattle sera samples were screened for DIVA (differentiating vaccinated from infected animals) ELISA test. The result indicated that only 82 (11.12%) samples showed DIVA positive results. The high titre of DIVA might be due to the recent outbreak of the FMD reported in the Port Blair area. The trend of the DIVA test indicated that there is sharp decline in the number of samples showing positive to DIVA test which means that there is less chance of circulation of FMD virus in the population. The herd immunity during the year of outbreak of FMD was found to be only 41 % (Type O), 38 % (Type A) and 44 % (Type Asia-1) (Plate 76). The level of poor vaccinal antibody titre might have played a key role in further aggravating the condition and exposing the animals to the FMD virus.

Plate 76: Foot and mouth lesions observed in the affected cattle

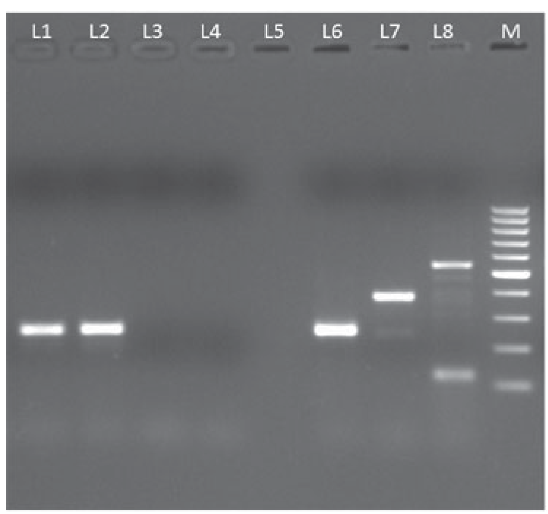


Fig. 17: mPCR showing the positive sample (Serotype O) (Lanes 1&2: Positive sample type O, Lanes 3&4: Negative sample, Lane 5: PCR control (no template), Lane 6: lane 6 positive control type O (~250 bp), Lane 7 positive control type A (~400 bp), lane 8: positive control type XI (~1100 bp)

AICRP on Animal Disease Monitoring and Surveillance

Jai Sunder, T. Sujatha and D. Bhattacharya

Major diseases outbreaks were not recorded in livestock during the year 2018-19 except clinical cases of contagious ecthyma (orf) disease in goat. During the year a total of 18521 cases of various parasitic, bacterial and viral disease were reported (Table 61 and Fig.18). Parasitic diseases were of major problems followed by bacterial and viral diseases. The main parasitic infestation reported were fasioliasis, amphistomiasis and ascariasis.

Table 61: List of the diseases reported in 2018-19

Name of Parasitic cases	Total cases	Percentage
Fascioliasis	4387	39.89
Amphistomiasis	2898	26.35
Ascariasis	1985	18.05
Strongyloids	768	6.98
Round Worms	374	3.40
Coccidiosis	304	2.76
Paramphistomiasis	135	1.22
Monizia	59	0.53
Hemonchuscontortus	25	0.22
Babesiosis	2	0.01
Stephanofilariasis	2	0.01
Grand total	10995	100

Temporal distribution of major parasitic diseases

Fasioliasis: The average number of fascioliasis cases per 1000 animals is 3.72. The overall percent prevalence was found to be high during the rainy season and peak in the month of August.

Amphistomiasis: The average number of Amphistomiasis cases per 1000 animals is 2.45. The frequency trend of amphistomiasis was highly fluctuating and highest number of cases was recorded in the month of January.

Ascariasis: The average number of Ascariasis cases per 1000 animals is 1.68. The percent prevalence was found to be high during the month of May.

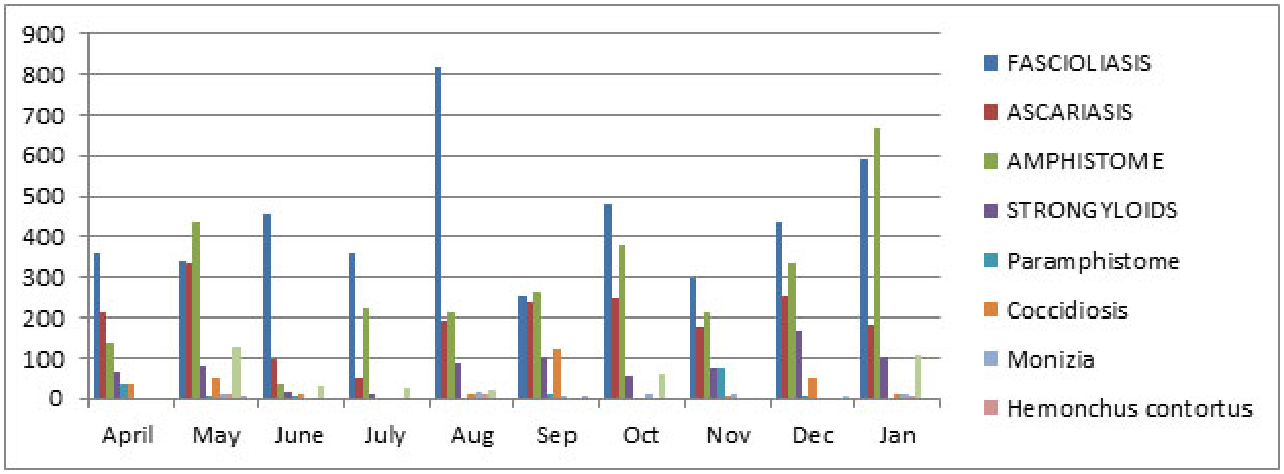


Fig. 18: Temporal disease pattern of parasitic diseases during 2018-19

Spatial distribution of major parasitic diseases

Occurrence of parasitic diseases was comparatively more in South Andaman (53%) followed by North & Middle Andaman (30%) and Nicobar (17%), however, according to the proportion of livestock population density and distribution, number of total parasitic cases are more in Nicobar and lower in N&M Andaman particularly the prevalence of fasioliasis (Table 62, Fig.19 & 20).

Table 62: Spatial distribution of major parasitic diseases

Districts	Spatial distribution of cases per thousand animals per year					
	Total	Fascioliasis	Ascariasis	Amphistome	Strongyloids	Paramphistome
South Andaman	124.27	31.42	28.92	40.90	13.16	1.94
N&M Andaman	54.02	31.67	4.00	12.41	2.14	0.00
Nicobar	187.01	99.47	40.38	23.53	2.47	0.00

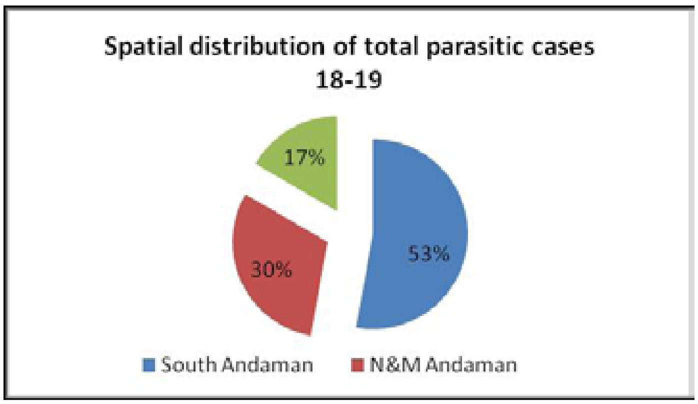


Fig. 19: Spatial distribution of total parasitic diseases during 2018-19

Among major parasitic cases of fascioliasis, ascariasis, amphistomiasis and strongyloids, the total numbers of cases of all parasitic cases were reduced in all districts except fascioliasis in Nicobar during the year 2018-19.

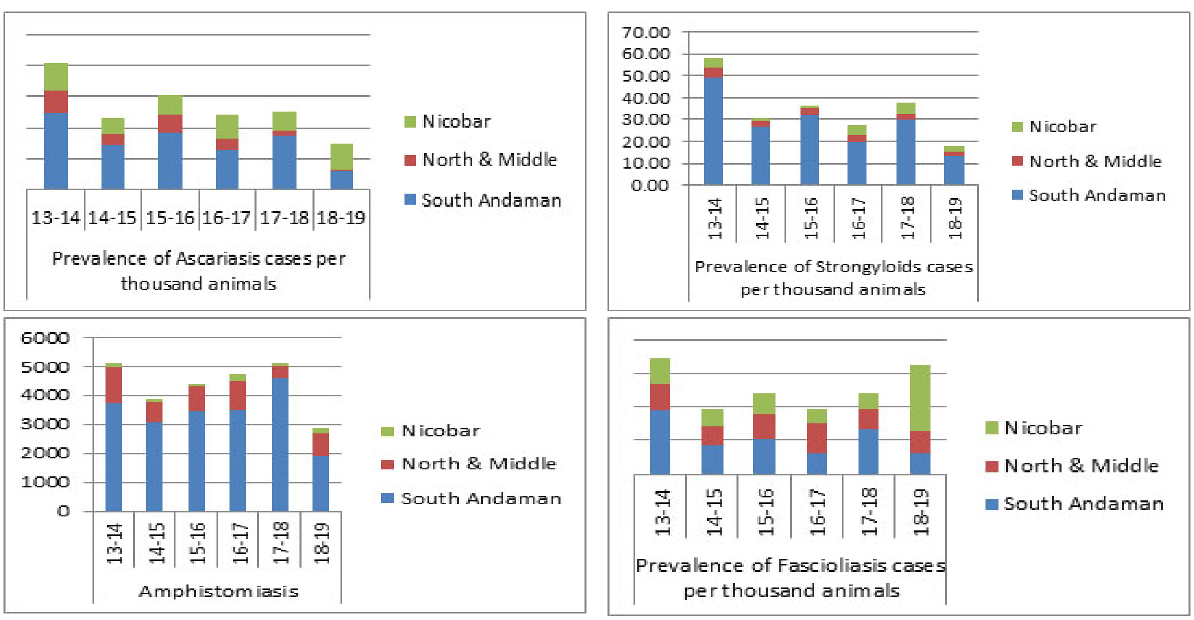


Fig. 20: Secular trend of major parasitic cases

Species wise distribution of parasitic cases

Prevalence of parasitic diseases was comparatively more in caprine (50%) followed by cattle (45%) and buffaloe (5%), however according to the proportion of livestock population; numbers of total parasitic cases is more in cattle and lower in buffaloe. Among the major parasitic cases, occurrence of fasioliasis, ascariasis and amphistomiasis are reported to be more in cattle, buffaloe and goat respectively (Table 63).

Table 63: Distribution of total parasitic cases species wise

Species	Prevalence of cases per thousand animals per year					
	Total	Fascioliasis	Ascariasis	Amphistome	Strongyloids	Paramphistome
Cattle	102.5	56.0	17.7	11.5	13.4	0.0
Buffaloe	70.3	37.5	20.9	3.9	7.8	0.0
Caprine	82.0	23.8	15.7	36.3	1.5	1.6

Sero-surveillance of important disease

During the year, a total of 2022 sera samples including cattle, goat and pig from South, N & M and Nicobar Islands were screened for presence of antibodies by ELISA and rapid test card against Brucellosis, Infectious bovine rhinotrachitis (IBR), bovine tuberculosis, *Peste des petits ruminants (PPR)*, blue tongue and classical swine fever (CSF). The sero-positivity of CSF was found to be 21.57%. Moderate risk was recorded for bluetongue with sero positivity of 32.89%. Low risk was recorded for infectious bovine rhinotrachitis in cattle with sero positivity of 13.61 %. Less risk for bovine tuberculosis was recorded with sero-positivity of 2.0% (Table 64 & Fig.21). No risk for both cattle and goat brucellosis was reported as the sero-positivity was found to be nil.

Table 64: Sero-surveillance of important disease (2018-19)

Diseases	Total sample screened	% Positive
PPR in goat	174	60.92
Bluetongue in goat	75	32.66
IBR in cattle	808	13.61
Bovine Brucellosis	646	0.00
Goat Brucellosis	50	0.00
Bovine tuberculosis	95	2.10
Classical swine fever	51	21.57

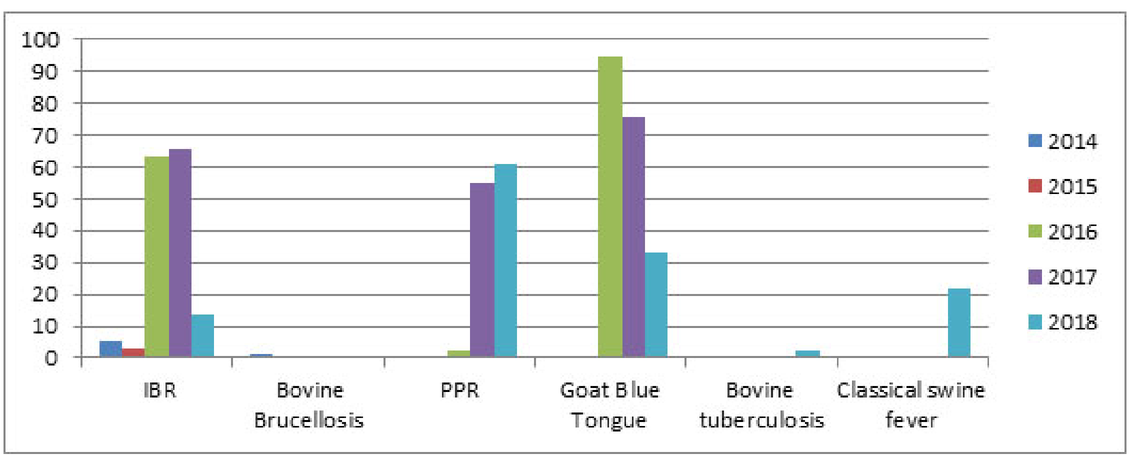


Fig.21: Secular trend of sero surveillance of economically important livestock diseases

AICRP on Pig

M.S. Kundu, Jai Sunder, Perumal P, S.K. Ravi, P.A. Bala, Arun Kumar De and A. Kundu

During this reporting year total 12 farrowing has been recorded with 66 piglets. Salient parameters like litter size at birth, litter weight at birth (kg) and litter size at weaning has been recorded as 5.5 ±0.95, 10.23 ± 1.64, 4.33 ±0.90,respectively. Details of performance of Andaman local pig and mortality pattern has been depicted in table 65 & 66.

Table 65: Performance of Andaman Local Pigs

Traits/ Characters	Mean ± SE		
	Male	Female	Total
Litter size at birth (no.)	3.09 ± 0.50	2.91± 0.53	5.5 ±0.95
Litter weight At birth (Kg)	5.96 ± 1.45	4.63 ± 0.72	10.23 ± 1.64
Litter size at weaning (no.)	2.18 ± 0.0.52	2.54 ±0.52	4.33 ±0.90
Litter weight at weaning (kg)	55.32 ± 12.39	48.12 ± 8.42	98.45 ± 11.76
Avg. individual weight at birth (Kg)	1.63 ± 0.10	1.41 ± 0.09	1.52 ± 0.10
Avg. individual weight at weaning(Kg)	14.20 ± 0.52	13.55 ± 0.36	15.01 ± 0.47
No. of days for weaning (d)	56	56	56
Pre weaning mortality rate (%)	29.41	12.5	21.21
Post weaning mortality rate (%)	0	0	0
Pre weaning growth rate (Kg/d)	0.32 ± 0.005	0.34 ± 1.56	0.33 ± 0.003
Post weaning growth rate (Kg/d)	0.37 ± 0.009	0.38 ± 0.008	0.36 ± 0.005
Overall growth rate (gKg/d)	0.34 ± 0.01	0.39 ± 0.031	0.38 ± 2.50
Body weight at different ages (Kg)			
Birth weight	1.63 ± 0.10	1.41 ± 0.09	1.52 ± 0.10
1 month	5.57 ± 0.15	6.01 ± 0.2	5.9 ± 0.11
2 month	13.42 ± 0.47	14.23 ± 0.23	14.05 ± 0.33
3 month	20.41 ± 0.95	22.42 ± 0.51	21.05 ± 0.46
4 month	27.25 ± 0.46	29.25 ± 0.53	28.62 ± 0.45
5 month	45.40 ± 2.56	43.93 ± 3.56	44.78 ± 3.45
6 month	59.46 ± 3.25	56.45 ± 5.31	57.45 ± 4.32
7month	72.45 ± 2.13	70.81 ± 4.25	70.56 ± 3.25
8 month	81.40 ± 5.48	78.45 ± 8.56	78.60 ± 5.89
9 month	82.50 ± 5.56	79.45 ± 6.35	80.21 ± 5.26

Table 66: Mortality parameter

Animal	Pre Weaning Mortality			Post Weaning Mortality		
	Male	Female	Total	Male	Female	Total
Total animals	34	32	66	27	43	51
Animals Died	10	4	14	0	0	0
Mortality %	29.41	12.5	21.21	0	0	0

Whole Mitochondrial Genome Sequencing of Andaman Desi Pig

Whole mitochondrial DNA (Mitogenome) of Andaman Desi Pig was sequenced by Next Generation Sequencing (NGS) based methodology. The mitogenome was deposited to GenBank with accession number MK248682. The length of the mitogenome was 16613bp and it comprised of 37 genes including 13 protein coding genes (PCGs), 22 tRNAs and 2 rRNAs. The physical map of the mitogenome is presented in Fig. 22.

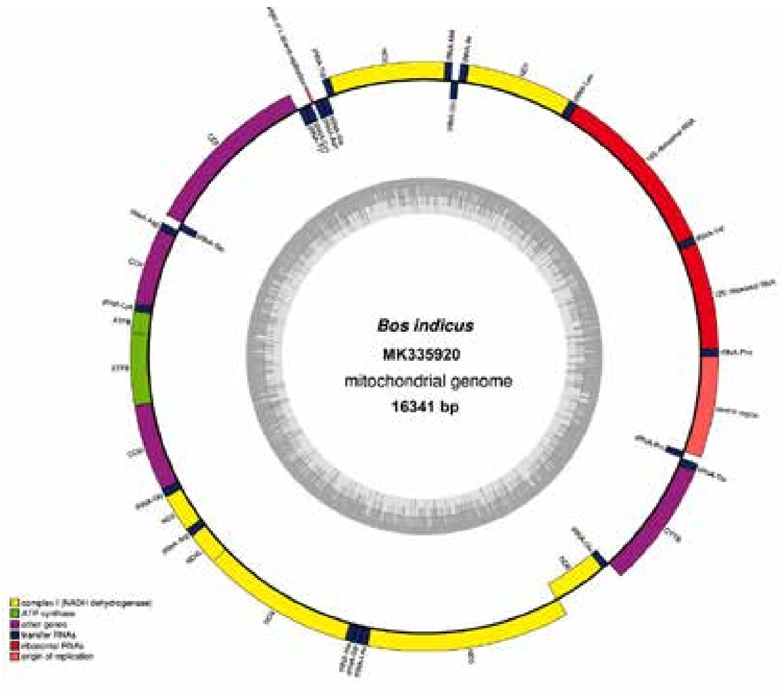


Fig. 22: Physical map of mitogenome of Andaman Desi pig

Genetic and Management Interventions to Identify the Key Role Players in Bull Semen Freezability and to Reduce the Cryoinjury on Bull Spermatozoa

Rafeeque R Alyethodi

The key objectives were to analyze the relative role of seminal plasma and seminal plasma proteins in cryopreservation of bull semen, to catalogue the whole sperm transcriptome in spermatozoa of good and poor semen cryopreservable bulls, to correlate differential expression profiles with cryo- preservability and to assess the use of extracellular polymeric substances (EPS) as a cryoprotectant in semen cryopreservation. In order to ensure the RNA extraction protocols gives optimum results, the project started with the RNA extraction from diploid cells and tissues. PBMC isolated from cattle blood underwent through Trizol protocols with modification gives high quality RNA (Fig. 23a). Sperm cells didn't show any 18/28s rRNA bands as expected (Fig. 23b). The genomic DNA contamination was assessed using RPLP primers which give a 200 bp band on genomic DNA while a 96 band could be detected on pure RNA samples (Fig. 23c). The RNA extracted from different methods were compared at real-time PCR and showed drastic variation (Fig. 24). This difference is utilized for the development of final RNA extraction. SDS PAGE was utilized for the separation of the protein fractions. Of the different protein precipitation protocols used, acetone precipitation is more yielding than other methods *viz* ethanol, chloroform-methanol and TCA (Fig. 25 A). Sensitivity assessment of staining protocols showed that silver nitrate staining is more sensitive than SNAP blue and Commassie brillian blue staining (Fig. 25 B). The sperm proteins are extracted, after the RNA isolation, as per the manufactures recommendations and ran on the SDS PAGE (Fig. 25 C).

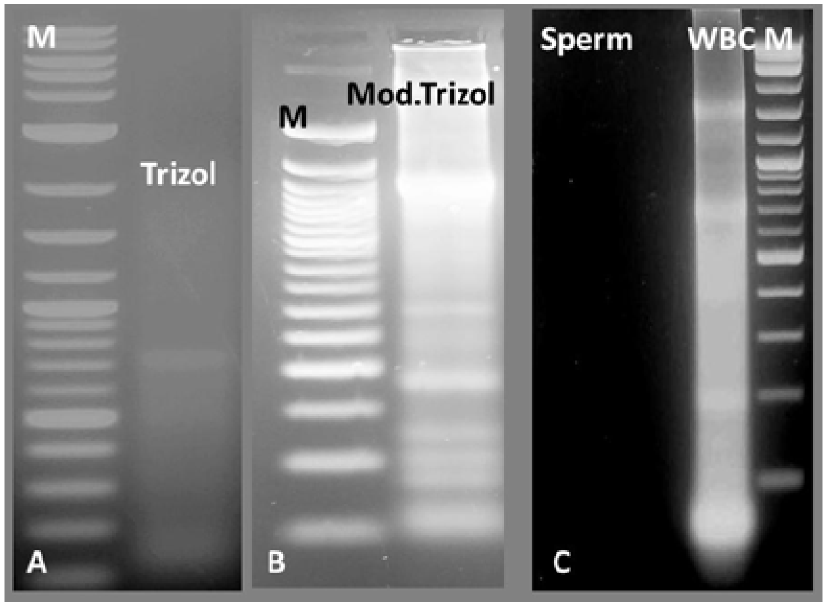


Fig 23: Comparison of RNA extraction methods and sources.(a) RNA extracted by Trizol method (b) RNA by modified Trizol (c) Sperm vs WBC cell RNA. Molecular Marker (M)

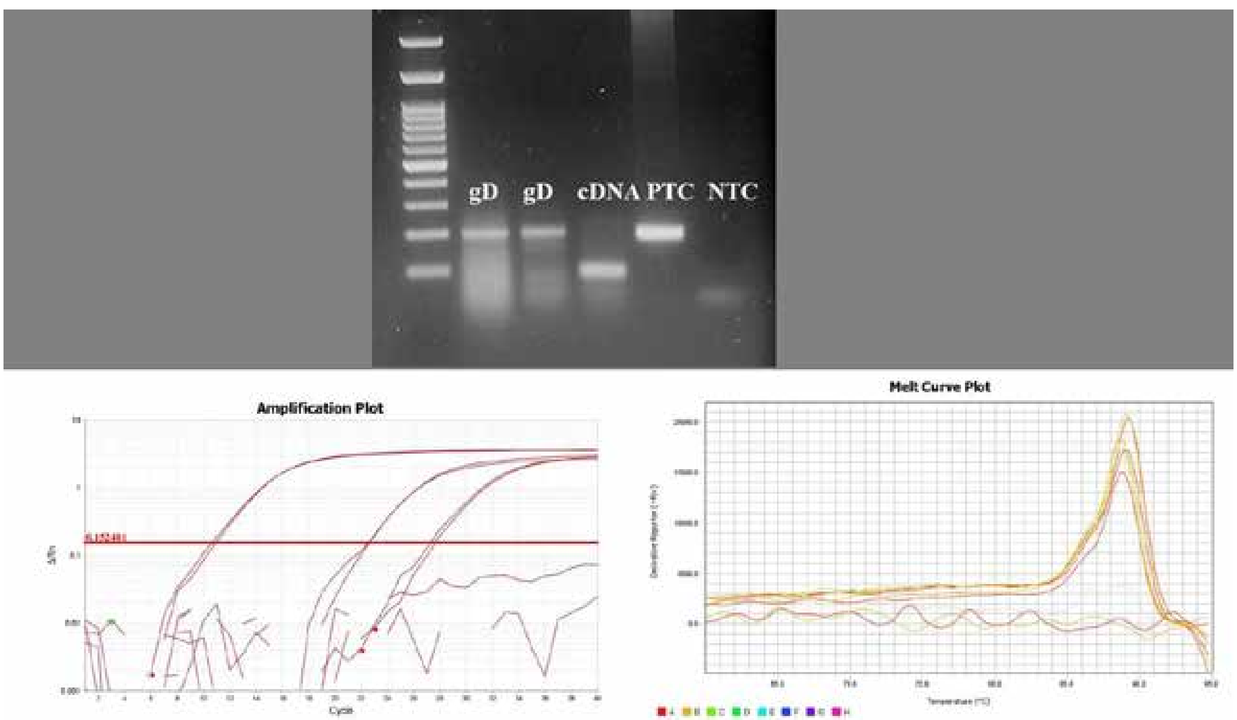


Fig. 24: (a) Genomic DNA (gDNA) contamination assessment using RPLP primers. (b) Comparison of Ct values of different RNA extraction methods using Real time PCR amplification and melt curve analysis of PRM1 primer. Molecular Marker (M), Positive gDNA control (PTC), Negative control (NTC). Contaminated RNA samples (gD), RNA sample with no gDNA contamination (cDNA)

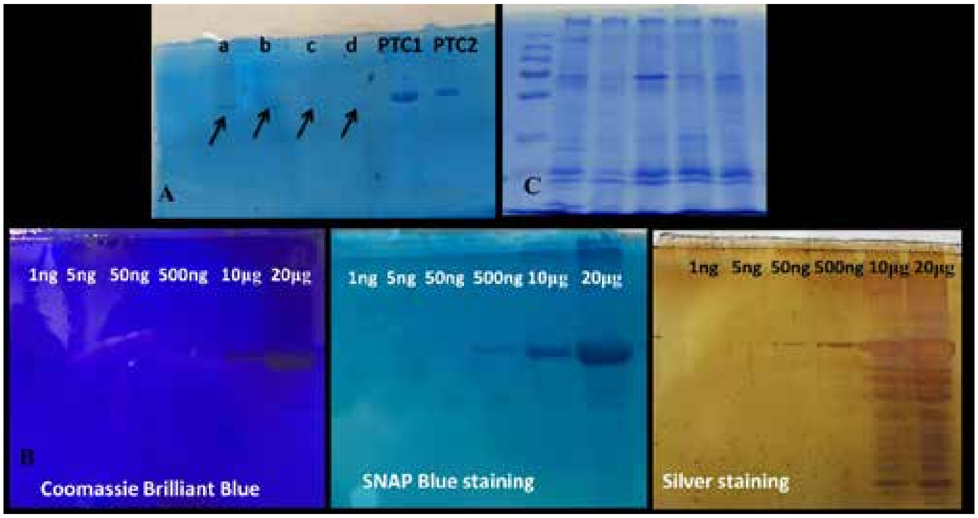


Fig. 25:(A) Comparison of different precipitation protocols viz. Acetone (a), Ethanol (b), Chl-Methanol (c), TCA (d). (B) Comparison of different staining protocols. (C) sperm protein fraction by CBB staining. Positive control_2.6 µgBSA (PTC1), Positive control_1 µg BSA (PTC2).

Identification of Genome-Wide Molecular Signatures Responsible for Higher Fecundity in Andaman Local Goats

Rafeeque R Alyethodi, A. Kundu, Jai Sunder, A.K De, D. Karunakaran, Perumal, P., P.A. Bala and S.K Ravi

This newly formulated project envisages Genome-wide identification of molecular signatures of higher prolificacy in Andaman Local goats and development of faster ways of their detection. The identified markers will be used to evaluate the population structure of Andaman Local goats in the conservation perspectives. Impact will be a faster way of fertility prediction and incorporation of the identified molecular markers in the future selection and breeding programme. Around 60 blood samples were collected from does selectively representing higher fertility and lower fertility based on the twinning and triplet frequency at kidding. The samples were randomly selected from different parts of Port Blair. Genomic DNA was extracted by standard Phenol-chloroform method with minor modifications. The DNA purity, assessed by UV-spectrometry showed an OD 260/280 and OD 260/230 of range 1.7 – 1.9 and 2.0 – 2.3 respectively (Fig. 26 A). The quality, assessed on 0.7% agarose gel electrophoresis also showed good quality non-smearing gel (Fig. 26 B). Two sets of primers (Table 67) were optimized for PCR amplification at different Annealing temperature (Fig. 26 C).

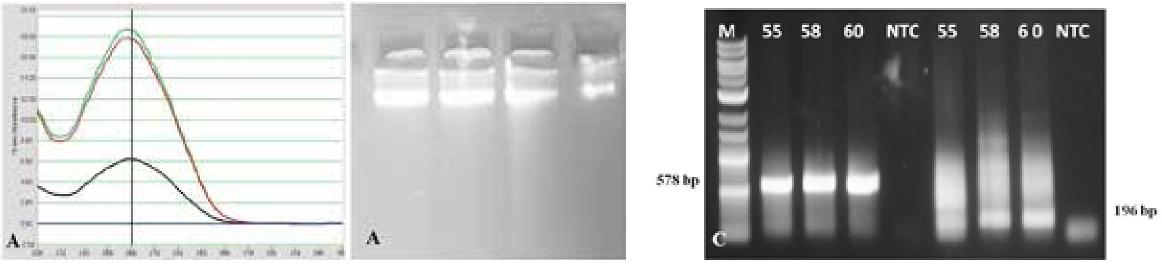


Fig 26: Amplification of BMP and KISS genes in goat genome. A; Purity assessment of extracted genomic DNA, B; Purity assessment via 0.7% AGE, C; Gradient PCR for BMP and KISS genes.Molecular size marker (M), Non template control (NTC).

Table 67: Design of Primers

Gene	Primer sequence	Product size	Annealing temperature (°C)
KISS1F	CGTTCCTCCTCCCTCTCTCT	196	60
KISS1R	CCAACCTTCTTCCCAGACAA		
BMP15F	TCCCTAAAGGCCTGAAAGAGT	578	60
BMP15R	GCTGAAGGCAAGGAATAGAATC		

Prevalence and Economic Impact of Gastro-Intestinal Parasites of Livestock in Andaman & Nicobar Island

D. Bhattacharya, M.S. Kundu, Jai Sunder, T. Sujatha, A.K. De, Zacharia George, Perumal P, Ajit Arun Waman and A. Kundu

Study on prevalence of gastrointestinal parasite was undertaken from April, 2017 to March, 2018. During the period under report a total of 411 samples collected from South, North & Middle Andaman were screened. Based on structure of eggs four types of eggs were detected. They were Trichostrongyles, Strongyloides, Trichuris and Nematodirrus. Besides round worm, protozoan parasite was also detected which belonged to the genus *Eimeria*. On the basis of morphological features, sporulation time and shape-index four species of *Eimeria* was detected. They were *R. arloingi*, *E. parva*, *E. pallida* and *E. faurei*.The result of differential oocyst count suggested that, *E. arloingi* output was 48%, *E. parva* and *E. pallida* output were 16% each and output of *E. faurei* was 20%. The overall positivity of parasitic infection was 61.31%.This was also found that, prevalence of parasitic infection had positive correlation with rainfall. The average eggs per gram of faeces (EPG) and oocysts per gram of faeces (OPG) varied from 30-5742.55.EPG of Trichostrongyles was the highest in the month of July (363.65) and August (363.75) and the lowest in the month of February (0).On the contrary, EPG of *Strongyloides* was the maximum in the month of September (1458.75) and was lowest in the month of February and March (0) The maximum OPG of *Eimeria* were detected in the month of March (75290).

Pharmaco Assessment of Ethno Veterinary Medicinal Plants of A&N Islands for Poultry Diseases

T Sujatha, Jai Sunder, A. Kundu, D. Bhattacharya, Arun Kumar De, K. Abirami and Puro

Evaluation of therapeutic potentials of ethno veterinary plants of Nicobari tribe of Car Nicobar against poultry gut microbe

Invitro experiment was carried out to explore the therapeutic efficacy of medicinal plants for veterinary use against poultry gut microbes. Four medicinal plants *viz.,* Kuyavu, Cham-rev (*Euphoria longan Steud),* To-ku-ro-tong *(Tabernaemontana crispa Roxb..) and* to-ki-ti-nyu (*Leeaindica Merr*.) are in use traditionally in combination to treat bloody diarrheoa in Car Nicobar. Methanolic extracts of these plants were prepared and diluted with Dimethyl Sulfoxide (DMSO). Faecal swabs were collected from poultry birds suffering from diarrhoea, inoculated in nutrient broth and incubated at 37°C overnight. *E.coli*isolates were identified based on colonial morphology on EMB and biochemical tests as per standard method. Herbal extracts in different concentration were used for antibacterial sensitivity against the isolates (10^{-7}) obtained from the culture. Antibiogram of herbal extracts against isolates were performed using conventional disc diffusion method and zone of inhibition were recorded. The present findings showed that the methanolic extract of leaves of these plants had antibacterial activity (Plate 77 and Table 68). To-ki-ti-nyu (*Leeaindica Merr*.) and Kuyavu could be promising plants as an alternative to antibiotics.

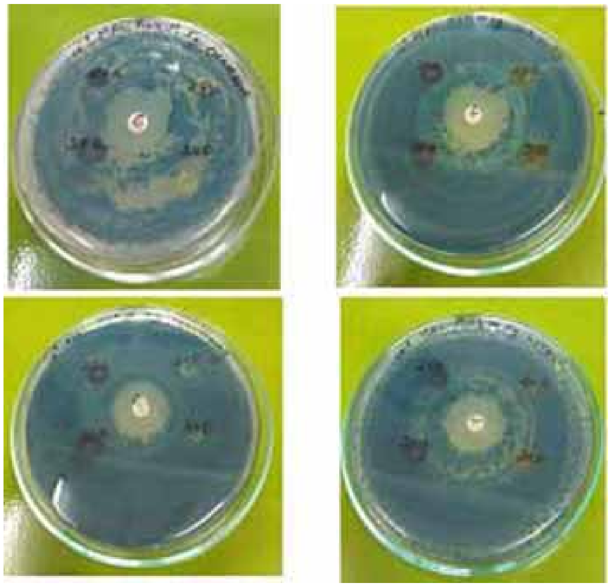


Plate 77: Antibiogram of herbal extracts

Table 68: Zone of inhibition of medicinal plants

Medicinal plant	Zone of inhibition (mm)
Kuyavu	16
Cham-rev	11
To-ku-ro-tong	10
To-ki-ti-nyu	12.75

Antibiogram of isolates from conjunctivitis

Eye swabs were collected from clinical case of conjunctivitis in poultry. *E. coli* and *Salmonella* spp. were isolated and identified based on colonial morphology and biochemical tests as per standard method.Antibiogram of these isolates showed that all of them were susceptible to Gentamicin and 50% susceptibility to Chloramphenicol; and Drug resistance was observed with Trimethoprim, Tetracyclin, Ampicillin, Sulfafurazole and Erthromycin (Plate 78).

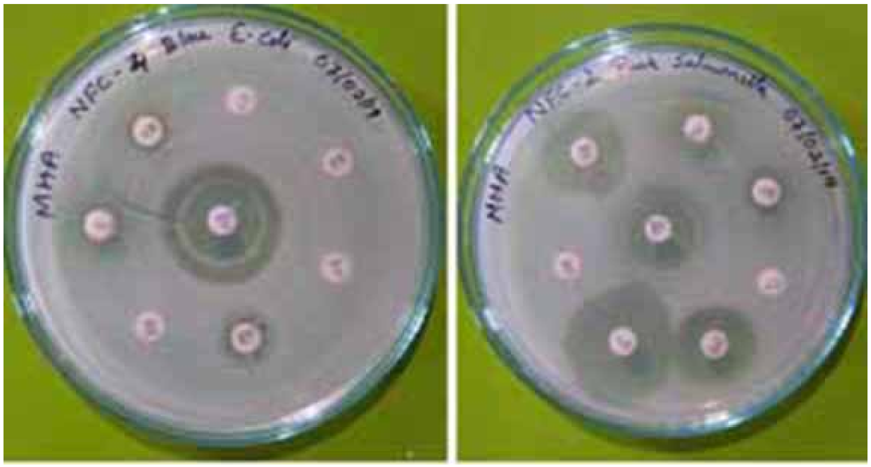


Plate 78: Antibiogram of isolates from conjunctivitis

Evaluation for Microbicidal Activity of herbal extracts towards Pathogenic *Salmonella* isolates of poultry conjunctivitis

This *in-vitro* experiment was carried out to explore the therapeutic efficacy of medicinal plants for conjunctivitis of poultry which is the common problem in rural poultry farming in this Island. Two medicinal plants *viz.*, *Zingeberspectabile* and *Centellaasiatica* were identified for their traditional usage for various ailments. Methanolic extracts of these plants were prepared and diluted with DMSO. Antimicrobial activity assay of herbal extracts against isolates (10^{-7}) were performed using conventional disc diffusion method and zone of inhibition were recorded (Table 69). It was observed that the methanolic extract of leaves of these plants had antibacterial activity and could be explored to search for bioactive components in the management of antibiotic resistant bacterial isolates from poultry chicken threatening public health.

Table 69: Zone of inhibition of medicinal plants

Medicinal plant	Zone of inhibition (mm)
Zingiber spectabile	16
Centella asiatica	11
Ofloxacin (control)	20

Minimum inhibitory concentration (MIC) determination

MIC of methanolic extracts of 12 ethno veterinary medicinal plants (Tokirotong, Tokiteuny, Tuful, Palal, Hotloyuk, Manitongu, Chamrev Raneul, Amra, Poocho, Lurong and Mufut) against *Salmonella* isolates isolated from diarrhoeic cases was determined using sterile 96-well plates. All the wells were filled with 50 µl of sterilized water and subsequently 50 µl of each of crudeherbal extract was serially diluted. Further, 50 µl of culture of *Salmonella* spp.was added in all the wells except in negative control. After 24h of incubation at 37°C, MIC was determined using the standard formula on the basis of turbidity at 600 nm.

Bacterial growth % = 100 – ($A_{Sample}/A_{Control}$)

$A_{Sample\ :}$absorbance of samples measured after incubation

$A_{Control\ :}$absorbance of negative control

MIC to prevent the 50% growth of isolates among tested extracts ranged from 6.11 to 0.25 mg/ml DMSO. The MIC of 0.25 and 0.27 mg/ml of methanolic extract of Mufut and Tokurotong were was the lowest to prevent the 50% growth of isolates of *Salmonella sps* of gut microbes.

Collection of ethno veterinary medicinal plants from tribal farming community

A total of four medicinal plants were collected from tribal farming community of Harminderbay and Hutbay to treat ophthalmic and gastro-intestinal ailments (Table 70).

Table 70: Ethno medicinal plants of tribal farming community

Plants name (local)	Ethno-medicinal property
Tokurotong	Making a decoction of the plant leaves and drinking during dysentry
Marvalu	
Hakonpookore	Application of crude juice obtained from crushing the leaves to treat eye infection
Meuitameuyo	

Augmentation of Fodder Resources to Improve Livestock Productivity in Andaman & Nicobar Islands

M.S. Kundu, B. Gangaiah, T. Sujatha and A. Kundu

Use of dairy farm wash for production of fodder during dry season and their performances under Andaman and Nicobar Island

Napier bajra hybrids (NBH) and guinea grass were cultivated for supply of fodder to the dairy animals under rainfed conditions. But during the dry season these grasses remain dormant due to lack of irrigation and no biomass were produced. Hence an experimental design was made to evaluate the production performances of fodder grasses using water from the dairy farm wash during the dry season. The treatments comprised of three different cultivars of hybrid Napier *viz* CO 4, CO 5, DHN 6 and one variety of guinea grass (Co GG 29) planted at the onset of monsoon during the month of May in the year 2015. The root slips were planted at a spacing of 60 x 60 cm for both. No fodder was produced during the dry season of 2015-16, 2016-17 and 2017-18 from these plots due lack of irrigation. The same plots were used for recording the data for the year 2018-19 dry period. The randomized block design (RBD) with three replications were followed in this experiment. The first harvest was taken at 45 days after close of the of monsoon and subsequently harvests were taken at 50 days of interval and a total of two harvests were made. Bio-mass yield from each plot was recorded immediately after cutting and expressed in ton/ha.

The biomass yield was significantly lower than the wet season, but it supplied the green fodder during the scarcity period. Dry weight was recorded by randomly selecting five plants from each plot and drying them at 80 ± 5^{o}c for 24 hours until constant weight was achieved. No significant differences on average green fodder yield were found among the two Napier bajra hybrids (i.e DHN6 and CO 4) and guinea grass during the dry season. However, CO 5 variety of NBH showed significantly lower yield that the other cultivars (Table 71).

Table 71: Green fodder yield of different cultivars at each harvest (ton/ha)

Fodder crops (Cultivars)	Harvest -1 Dry season	Harvest -1 Wet season	Harvest -2 Dry season	Harvest -2 Wet season	Total yield Dry season (ton/ha)	Total yield Wet season (ton/ha)
	Green	Green	Green	Green	Green	Green
NBH (DHN-6)	35.6	45.4	34.25	54.22	145.7	202.9
NBH (CO-4)	33.4	43.6	32.25	52.30	135.3	195.9
NBH (CO-5)	26.5	31.1	22.26	36.33	122.8	127.0
Guinea grass	25.3	50.2	21.93	60.39	120.2	200.1
SEM ±	0.81	0.91	0.82	0.82	5.2	5.1
CD (P=0.05)	2.20	3.20	2.89	2.89	12.3	17.7

Molecular Characterization of Immune System Genes of Nicobari Fowl

K. Muniswamy, T. Sujatha, Arun Kumar De, D. Bhattacharya, Jai Sunder and A. Kundu

This project has two main objectives: (i) characterization of Mitochondrial DNA (Mt. DNA) and (ii) characterization of immune genes of Nicobari fowl. The study has been initiated with generation of sequence information of D loop region (control region) of mt. DNA because mt. DNA is widely used for phylogenetic studies for of its variability, lack of recombination and maternal inheritance. D loop region was amplified using the following primers:

Forward: 5' AGGACTACGGCTTGAAAAGC 3'

Reverse: 5' CATCTTGGCATCTTCAGTGCC 3'

DNA was extracted from whole blood collected from wing vein of the birds and a total of 15 samples were collected from Nicobari fowls with three different phenotypes i.e. brown, black and white. Amplification of genomic DNA was done after initial denaturation at 94ºC for 5 min followed by 35 cycles, 94°C for 30 sec, 60°C for 30 sec and 68°C for 90 sec followed by final extension at 68°C for 5 minutes. The size of the amplicon was 1325 bp (Fig. 27). Amplified product was further used to generate sequence information through outsourcing.

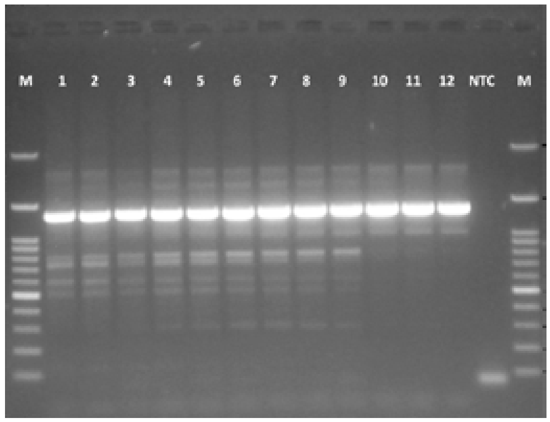


Fig. 27: Thermal gradient PCR of MtDNA control region, Lane M-100bp DNA ladder, Lane 1-12 are temperature gradient from 51 to 62°C respectively, Lane 13- No template control

For phylogenetic analysis, 5 sequences each of Brown, Black and white Nicobari chicken generated in our study were used and compared with 81 sequences of 11 haplogroups after retrieving from Gen Bank.Based on the global mtDNA genome profile, reconstructed matrilineal phylogeny and updated the nomenclature covering most of the major haplogroups of chickens. The phylogeny was inferred by Maximum likelihood method with 1000 bootstrap replications using MEGA X software. The Nicobari chickens grouped with common haplogroups, E1 (known to be widely distributed maternal lineage), E2 (mainly distributed in domestic chicken of South Asia) and B (widely distributed throughout globe except Africa) (Fig. 28).

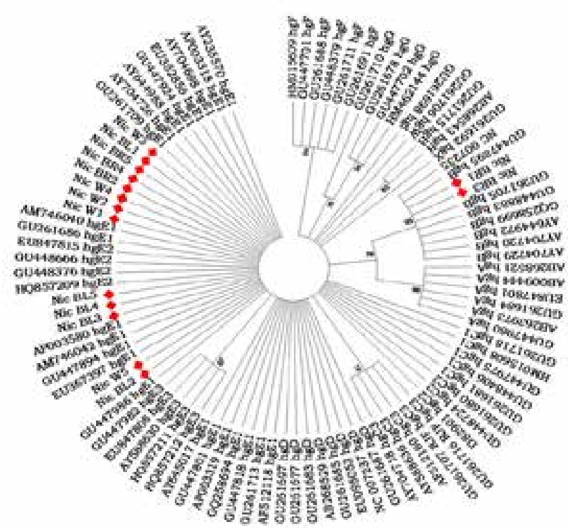


Fig. 28: Unrooted phylogenetic tree of control region (D-Loop) was inferred by Maximum likelihood method based on HKY model and discrete Gamma distribution (MEGA X). Bootstrap value more than 70 is only shown. Nicobari chicken Brown (Nic_Br), Black (Nic_BL) and white (Nic_W).

Selection and Breeding of Nicobari Fowl for Immunity and its Evaluation under Different Season

T.Sujatha, Jai Sunder, A.Kundu, D. Bhattacharya and R.A. Rafeeque

With the aim of selection and developing the native Nicobari fowl for immunological response, the preliminary segregation of short shank and long shank Nicobari fowl was done. A total of 100 Nicobari fowls were segregated into long (>35 mm) and short shank length(<25 mm) at the age of 35 weeks. Their HA titre assay was done after injection of Goat RBC as antigen. During 1st week of post inoculation of Goat RBC, the HA titre was highly significant with short shank Nicobari fowl. However, during 2nd week of post inoculation, there was not any significant difference in the HA titre (Table 72).

Table 72: HA titre after inoculation of goat RBC in two different phenotypes of Nicobari fowl

HA titre	Short shank	Long shank	Short shank	Long shank
	1st week	1st week	2nd week	2nd week
	1.824±0.12	1.57±0.25	1.059±0.45	1.05±0.56
P Value	<0.001 (**)		NS	

Cytokine profile and its comparative evaluation in native Nicobari fowl

Cytokines are proteins secreted by cells that play an important role in the activation and regulation of other cells and tissues during inflammation and immune responses. Cytokines have been classified into a number of groups based on their activity and the cells they are produced by or act upon. These groups include interleukins (IL), interferons (IFN), Toll Like Receptors and Major Histocompatibility Complex groups. Chickens used in traditional poultry farming are of great importance to village households but often neglected by avian researchers. For instance, little is known on cytokine profile of native poultry. Studies on the cytokine profile of native birds and their similarities with other commercial poultry are essential for understanding immuno-competence. Hence in the present study, cytokine profile was studied in native Nicobari fowl of A&N Islands and its comparative evaluation was carried out in other local poultry population. Blood was collected from one hundred and fifty poultry comprising each thirty samples of Nicobari fowl, commercial layer, desi bird, Gramapriya poultry and broilers. Serum was separated and the concentration of cytokines *viz*., Chicken Interferon alpha and Beta (ng/L), Chicken Interleukin-6 (ng/L), Chicken Interleukin-12 (pg/ml), Chicken TLR 4 (ng/ml) and Chicken MHC (ng/ml) were quantified using specific ELISA method. Chicken Interferon alpha and Beta (ng/L) was significantly high in commercial layers followed by Nicobari fowl. Desi birds were having the lowest respective concentration. Chicken Interleukin-6 (ng/L) was statistically on par among commercial layers and Gramapriya while Nicobari fowl and desibirds were having significantly low concentration; whereas, Chicken Interleukin-12 (pg/ml) was significantly high in Nicobari fowl (1005.06±12.10) followed by desi birds and commercial birds. Commercial layers, Nicobari fowl and broilers were not significantly differing in Chicken TLR 4 (ng/ml) whereas; it was significantly lower in desi birds and Gramapriya. Commercial layers, Nicobari fowl, Gramapriya and broilers were statistically comparable in concentration of Chicken MHC (ng/ml) (Table 73). Screening of their sera samples for Newcastle disease and Infectious Bursal Disease, positivity of 66.66 & 55.56 per cent in desi birds by ELISA. Sero positivity of respective diseases in Nicobari fowl was 25.55 and 22.22 per cent. Other poultry were having normal range of sero positivity. The results indicated that Nicobari fowls are having significant quantum of type I interferons (IFN-α and IFN-β), Interleukins, TLRs and MHCs and thus have well defined pro-inflammatory anti-viral and bacterial activity. These findings may contribute to the high immunity of this native Nicobari fowl towards common poultry diseases of RD and IBD as it is evident by their lower sero positivity. This observation indicates that Nicobari fowl has potential and interesting immune genetic pool which increases the processing of antigen and enhances expression of Major Histocompatibility Complex (MHC) Class II molecules on macrophages and upregulates the immune system.

Table 73: comparative cytokine profile in poultry

Poultry Birds	Chicken Interferon alpha (ng/L)	Chicken Interferon Beta (ng/L)	Chicken Interleukin-6 (ng/L)	Chicken Interleukin-12 (pg/ml)	ChickenTLR 4 (ng/ml)	Chicken MHC (ng/ml)
Layer	20.18±3.11	26.44±11.03	11.02±5.52	789.67±10.23	2.468±0.48	2.892±0.66
Nicobari fowl	16.79±2.60	24.82±17.50	6.83±2.90	1005.06±12.10	2.374±0.41	2.441±0.37
Desi bird	3.05±0.54	9.72±21.50	5.92±1.54	865.47±41.54	1.201±0.39	0.905±0.21
Gramapriya	15.03±3.13	21.24±10.81	14.52±4.85	373.26±11.49	1.111±0.87	3.794±2.10
Broiler	10.86±1.40	20.24±9.11	18.22±8.15	384.56±15.55	3.435±1.14	3.454±1.10

Gender Identification in Day Old Poultry by PCR Based Methodology

Arun Kumar De, T. Sujatha, Jai Sunder and A. Kundu

Accurate sex identification of poultry in their early age has significant economic importance. It reduces the feeding, management and labor cost by disposing unwanted sex. It is generally done by manual processes like vent sexing or feather sexing but the accuracy is less. Therefore, a PCR based methodology for accurate sex determination of the indigenous poultry germplasm of these Islands will be very helpful. Therefore, the present project deals with innovative and unique technique towards molecular method of sex determination of non-ratite birds.

Determination of sex of day old birds by PCR based methodology

Sex identification in day old poultry birds was done by a polymerase chain reaction (PCR) following amplification of the avian chromo-helicase-DNA-binding (CHD) gene on the W- and Z-chromosomes. A pair of sex-specific primers was employed for the amplification of a single fragment of 596-bp from the Z-chromosome of male birds and two fragments of 596-bp and 477-bp from the Z- and W-chromosomes of female, respectively. DNA was extracted from feather samples of day old poultry birds. After PCR amplifications, the PCR products were separated through a 1.5% agarose gel containing ethidium bromide and visualized under UV light. Gel photograph of the amplicons shows that the male birds had a single band whereas the female birds had two distinct bands (Fig. 29). Confirmation was done at 4 weeks of age by morphology and it was found that the method was 100 % accurate. So, this methodology can be applied for easy sexy determination in any non-ratite birds. Further, CHD1Z gene were sequences by dideoxy fingerprinting and the sequences were submitted to GenBank with accession numbers MK204748 and MK204748.

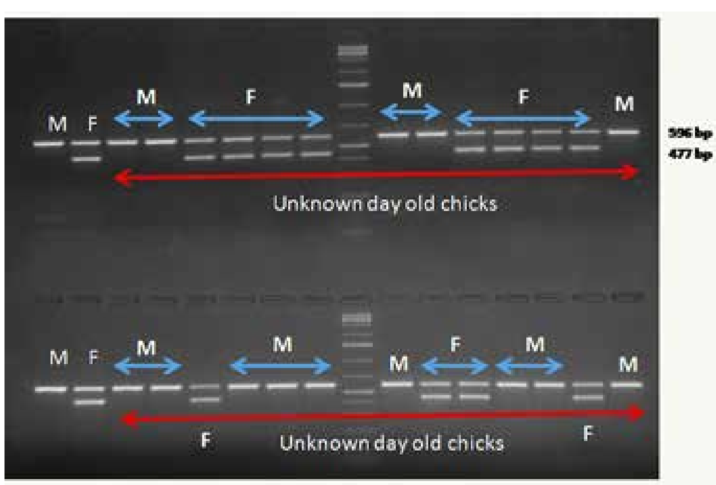


Fig. 29: Gel electrophoresis of PCR Products

Molecular Signature of Eco-Sustainability of Indigenous Livestock Breeds of Andaman & Nicobar Islands and Lakswadeep

Arun Kumar De, Jai Sunder, M. S. Kundu, D. Bhattacharya and A. Kundu

Tracing the genetic root of Trinket cattle

Trinket cattle (Plate 79), a small herd of 150 feral cattle, is inhabitant of a small Island, Trinket. The herd of cattle were introduced to Trinket Island by Danish people during their dynasty in Nicobar archipelago. At that point of time, the cattle were neither semi feral nor feral in nature. When the Island were made abandoned by foreign invaders, indigenes (*Nicobarese*) utilized the animal resource for meat purpose especially during their earmarked festivals. As a result, the cattle became semi feral in nature. After the Great Sumatra earthquake and Indian Ocean Tsunami in 2004, Trinket Island was left abandoned by indigenes and the cattle became totally feral in nature. There was a long lasting mystery about the genetic root of the cattle. To resolve the issue, the study has been undertaken based on sequence information of mitochondrial D loop and cytochrome b gene. Phylogenetic analysis based on D loop (Fig. 30) and CytB gene (Fig. 31) of mitochondrial genome revealed that these cattle belong to *Bosindicus* (I2 haplotype), which is a species or subspecies of domestic cattle originating in the Indian subcontinent.

Plate 79: Trinket cattle in Trinket Island of Andaman and Nicobar Islands

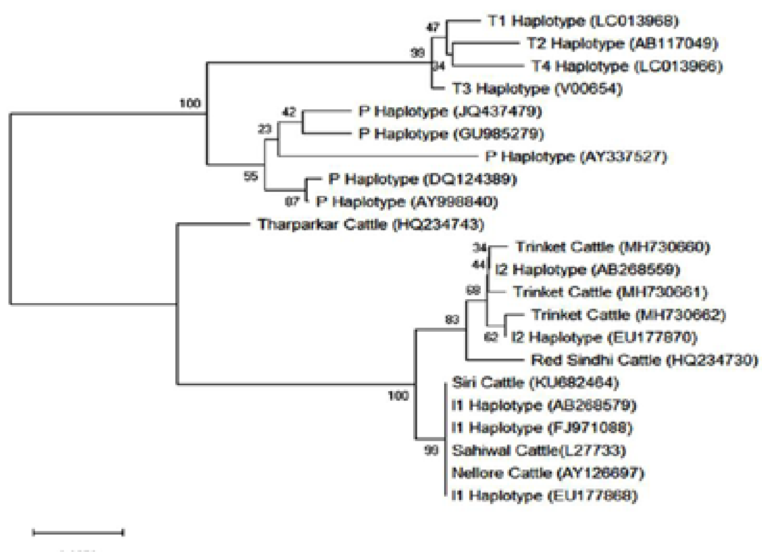


Fig. 30: Phylogenetic tree of D loop sequence in MEGA-based Neighbour-joining (NJ) method using 1000 bootstrap replications

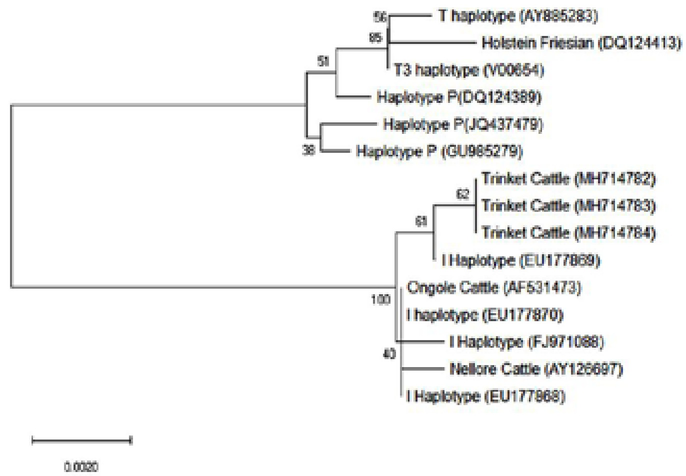


Fig. 31: Phylogenetic tree of cytB sequence (total orf considered) in MEGA-based Neighbour-joining (NJ) method using 1000 bootstrap replications

Complete mitochondrial genome of Trinket cattle

Trinket cattle were further characterized by sequencing of the whole mitochondrial genome by Next Generation Sequencing (NGS) based methodology. The complete mitochondrial DNA sequence of Trinket Cattle was deposited to GenBank with accession number MK335920. The mitogenome was 16341 bp in length and consisted of 37 genes including 13 protein coding genes (PCGs), 22 tRNAs and 2 rRNAs. One A + T rich region (D-loop)of 913bp was also present. Among the protein coding genes, ND6 was present on light strand and rest of the genes were encoded by heavy strand. A total of 14 tRNAs (tRNA-Phe, tRNA-Val, tRNA-Leu1, tRNA-Ile, tRNA-Met, tRNA-Trp, tRNA-Asp, tRNA-Lys, tRNA-Gly, tRNA-Arg, tRNA-His, tRNA-Ser2, tRNA-Leu2 and tRNA-Thr) were present on heavy strand while 8 of them (tRNA-Gln1, tRNA-Ala, tRNA-Asn, tRNA-Cys, tRNA-Tyr, tRNA-Ser1, tRNA-Glu and tRNA-Pro) were present on light strand. Both the large and small subunit of RNA was encoded by heavy strand. A physical map of the mitogenome is presented in Fig. 32.

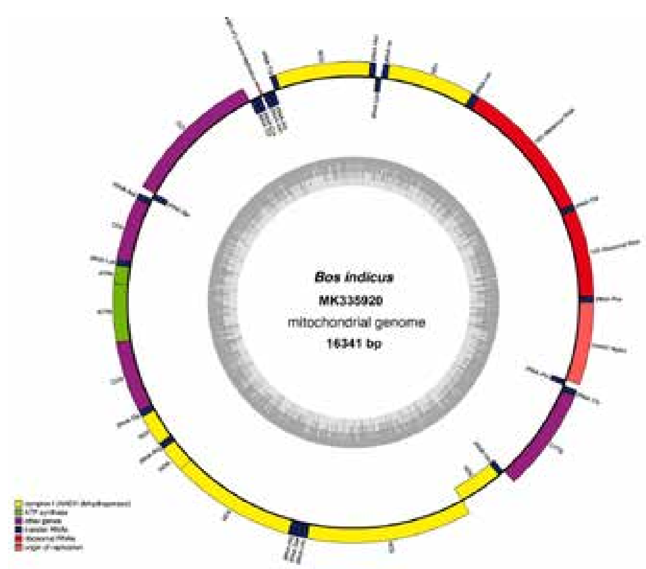


Fig. 32: Graphical representation of the complete mitochondrial genome organization of Trinket Cattle. Transfer RNAs (tRNA) are labelled with their corresponding amino acids. The physical map was generated by using OGDRAW (http://ogdraw.mpimp-golm. mpg.de/) (Lohse et al. 2013).

Complete mitogenome sequencing of Andaman Buffalo

Andaman Buffalo is an indigenous buffalo germplasm of Andaman and Nicobar Islands, India. The present study reports the complete mitogenome profile of Andaman Bufflao. The complete mitogenome of Andaman Buffalo was 16359 bp in length and comprised of 37 genes including 13 protein coding genes (PCGs), 22 tRNAs and 2 rRNAs. In addition, one A + T rich region (D-loop) was also present. A biasness towards A and T base was observed in all the genes. All the protein coding genes (PCGs) except ND6 were present on heavy strand. Start codons for all the 13 PCGs were ATN codon and abbreviated/truncated stop codon was observed in ND1, ND2, COX3, ND3 and ND4. The complete mitochondrial DNA was submitted to GenBank with the accession number MK234704. Phylogenetic analysis revealed that Andaman Buffalo was close to buffalo from India and China (Fig. 33). The results of the study will be helpful for sketching of conservation plan of the breed.

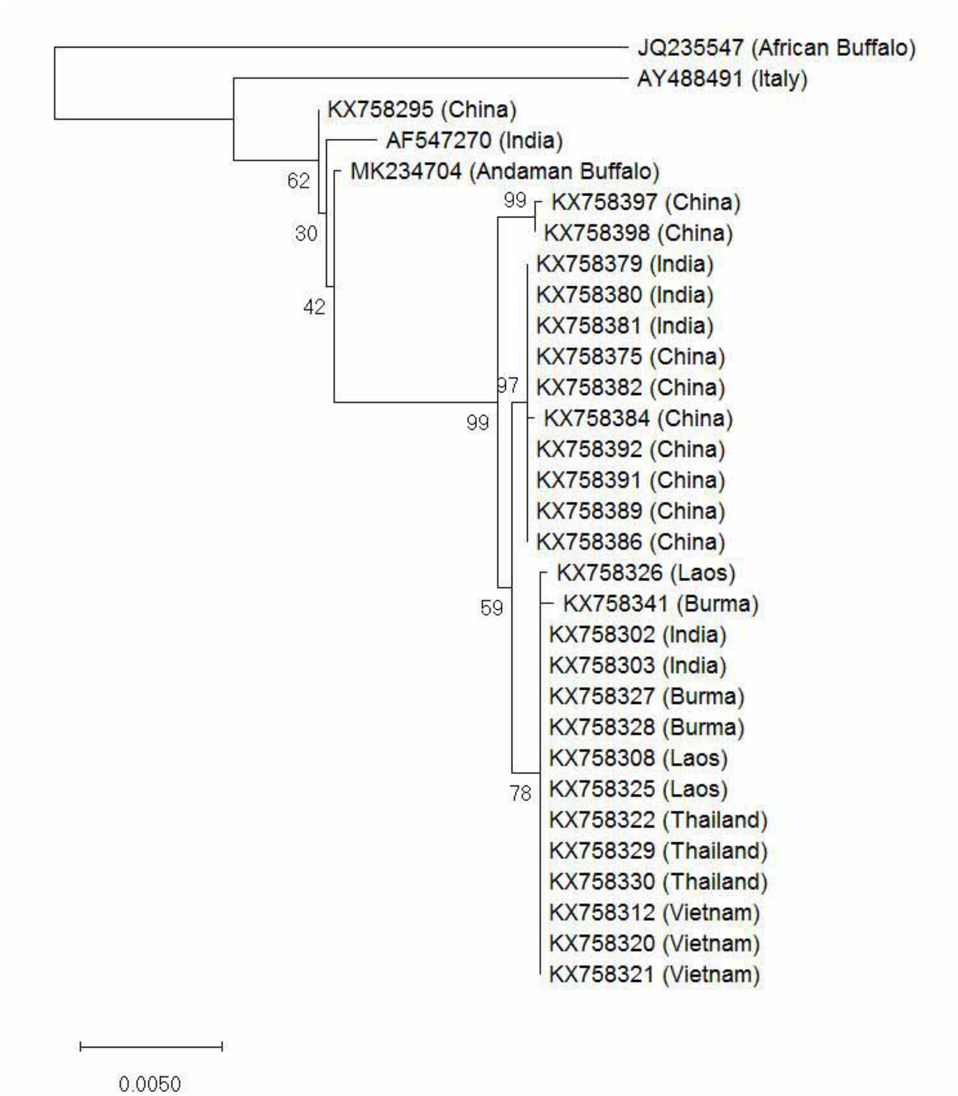


Fig. 33: Molecular Phylogenetic analysis of Andaman Buffalo by Maximum Likelihood method based on concatenated amino acid sequence. Representative mitogenome sequences of buffaloes from different countries was retrieved from GenBank

Evaluation of Reproductive Performance and Egg Quality of Nicobari Fowl using Molecular Marker

Arun Kumar De, D. Bhattacharya , Jai Sunder, Perumal P, T. Sujatha and A. Kundu

Growth and reproduction that are the most economically important traits for the poultry industry. Traditional breeding technique in chicken has made great improvement in many economically important traits but traditional breeding is laborious and time-consuming. Elucidation of genes and their network involved in body weight and reproductive traits determinant is key in chicken genetics and breeding. Andaman and Nicobar Island is the home of prestigious Nicobari fowl, the highest egg producer among indigenous birds of India. Therefore, development of a suitable molecular marker for evaluation of reproductive performance and egg quality will be very helpful for selection of elite birds. For evaluation of reproductive characters of Nicobari fowl, two gene markers (BMPR-IB and STAT5B) have been selected. Primers have been designed for amplification of the genes.

Studies on Endocrinological and Biochemical Profiles of Bovine Species for Enhancing Fertility in Bay Islands

Perumal P, M.S. Kundu, D. Bhattacharya, Jai Sunder, Arun Kumar De, A. Kundu, ZachariaGeorge, Shardul VikramLal and V.M. Abdul Gafoor

Pelvimetric profiles in different age groups of cattle in Andaman and Nicobar Islands

The experimental animals were divided into different age groups based on the dentition or birth register or parity of the animals. The experimental groups were Group I: 24-36 months, Group II: 37-48 months, Group III: 49-72 months and Group IV: 72 months and above. The experiment was conducted during dry and monsoon seasons. Pelvimetric profiles such as transverse pelvic diameter, vertical pelvic diameter and pelvic area were measured. The body weight was calculated by using the Shaeffer's formula by measurement of body length and neck girth of the experimental animals. The results revealed that these pelvimetric profiles were differed between the age groups and increased as age advanced. Significantly higher value was obtained in group IV than other age groups (Fig. 34).

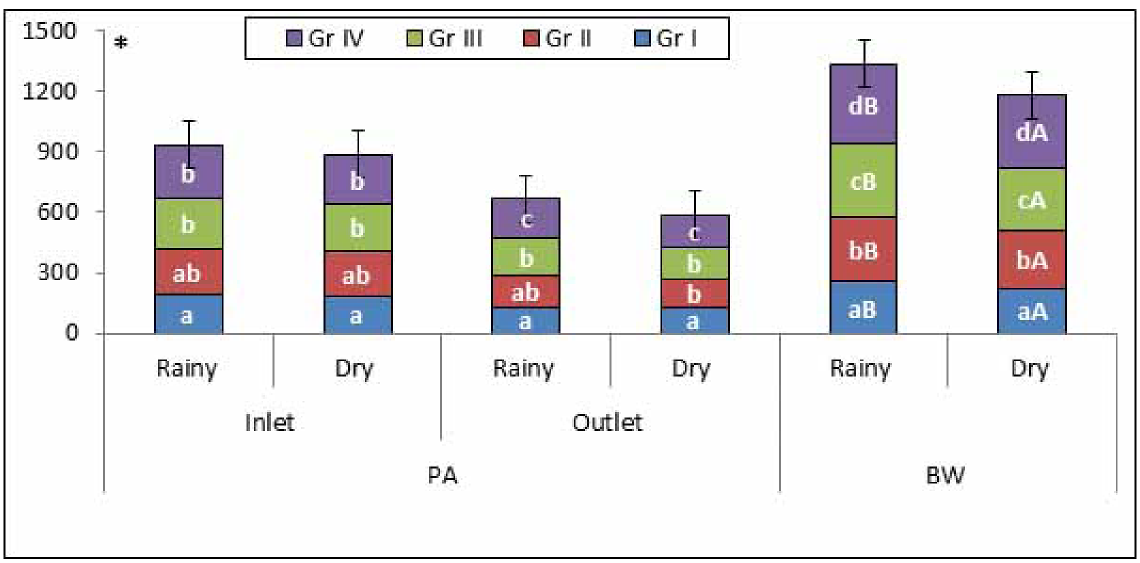


Fig. 34: Pelvimetric profiles of different age groups in different seasons, A, B: between season / a, b, c, d: between groups, * indicates $p<0.05$, PA (cm^2): Pelvic area, BW (kg): body weight

Reproductive pathological conditions in Andaman and Nicobar Islands

The reproductive pathological disorders of Andaman and Nicobar Islands were classified in to post partumanestrus, repeat breeding syndrome, post pubertal anestrus, underdeveloped genitalia, cystic ovarian degeneration, retention of foetal membrane, post partummetritis and endometritis in cattle and buffaloes and these disorders were measured during rainy and dry seasons. The result revealed that the percentage of incidence of the reproductive disorders was higher percentage in dry than rainy season. Blood profiles of the affected animal were shown that there was significant difference between the different reproductive disorders with different intensities. However, in many of the disorders, the values were within the range of cattle and buffaloes. Hormone profiles were significantly deviated from the normal unaffected animals. The result clearly indicated that the affected animals were deficient or misbalance/imbalance between the different hormones. Similarly the antioxidant profiles revealed that significantly reduced in the affected animals than in normal animals whereas the oxidative profile was significantly higher in the affected animals than normal unaffected animals (Fig. 35-40).

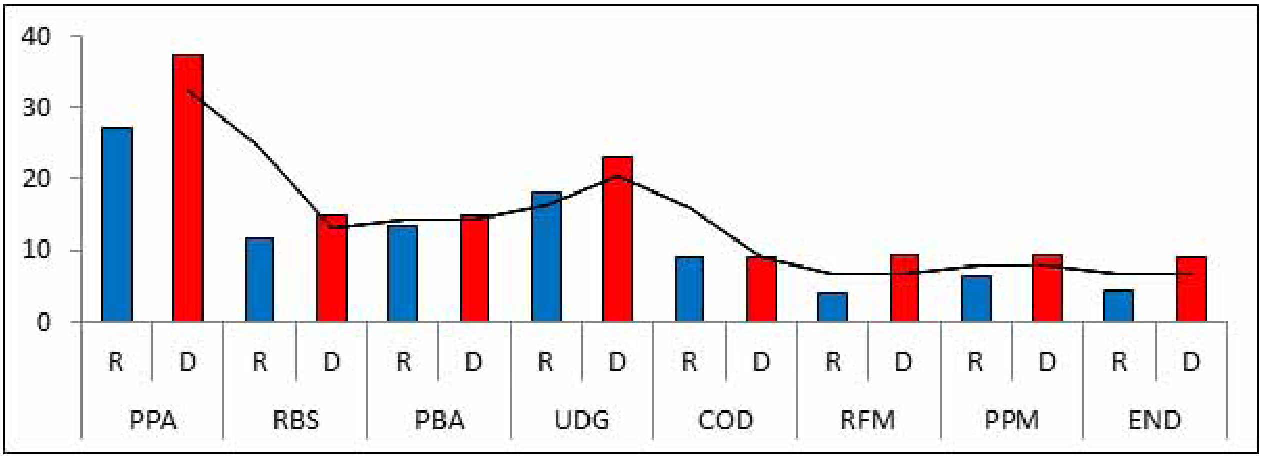


Fig. 35: Reproductive pathological conditions (%) in Andaman and Nicobar Islands in dry and rainy seasons. R: rainy season, D: dry season. PPA: post partumanestrus, RBS: repeat breeding syndrome, PBA: post pubertal anestrus, UDG: underdeveloped genitalia, COD: cystic ovarian degeneration, RFM: retention of foetal membrane, PPM: post partummetritis and END: endometritis

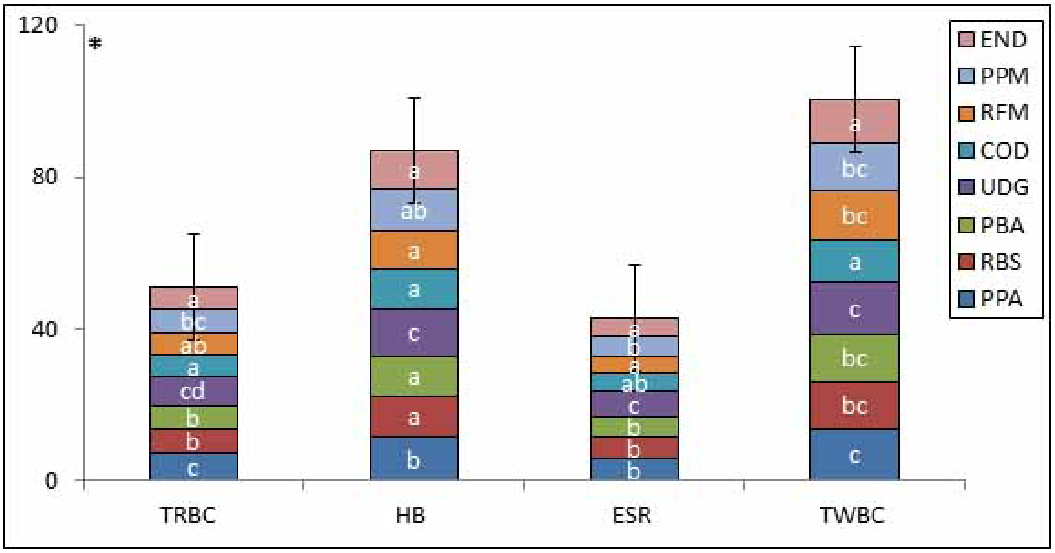


Fig. 36: Blood profiles on different reproductive pathological conditions in Andaman and Nicobar Islands. TRBC: Total red blood cells (x106/mm3), HB: haemoglobin (g/dl), ESR: erythrocyte sedimentation rate (mm/Hr), TWBC: total white blood cells (x103/mm3), a, b, c, d: between pathological conditions, * indicates p<0.05

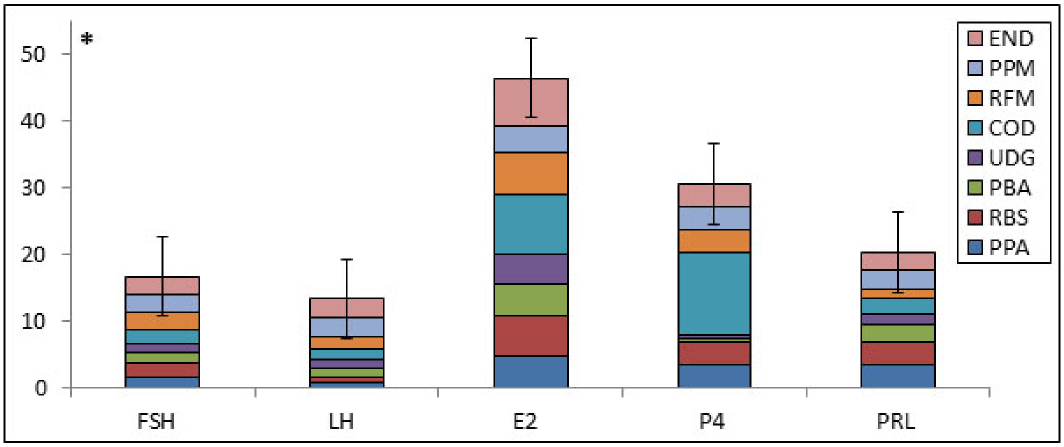


Fig. 37: Endocrinological profiles on different reproductive pathological conditions in Andaman and Nicobar Islands. FSH: follicle stimulating hormone (mIU/ml), LH: luteinizing hormone (mIU/ml), E2: estradiol 17β (pg/ml), P4: progesterone (ng/ml) and PRL: prolactin (ng/ml), * indicates p<0.05 between the pathological conditions

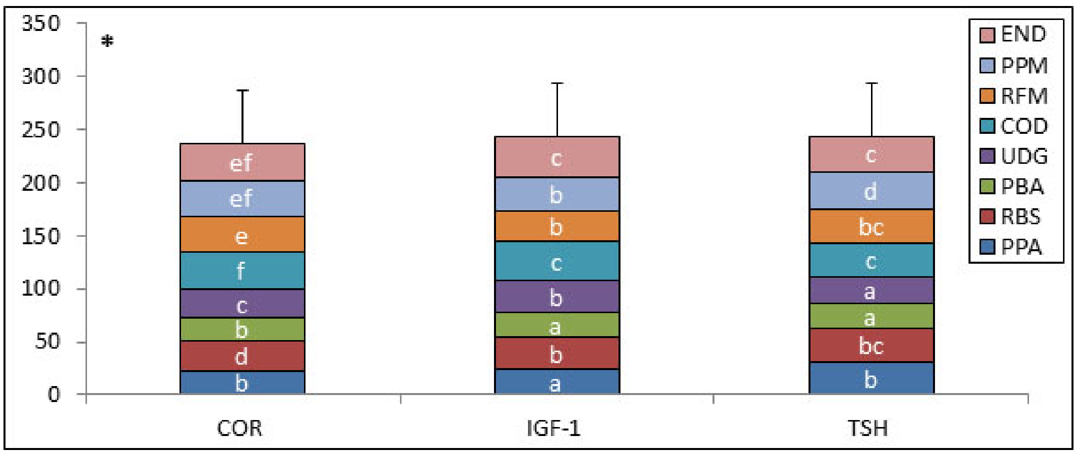


Fig. 38: Endocrinological profiles on different reproductive pathological conditions in Andaman and Nicobar Islands. COR: cortisol (nmol/L), IGF-1: insulin like growth factor-1 (ng/ml) and TSH: thyroid stimulating hormone (nmol/L), a, b, c, d: between pathological conditions, * indicates p<0.05

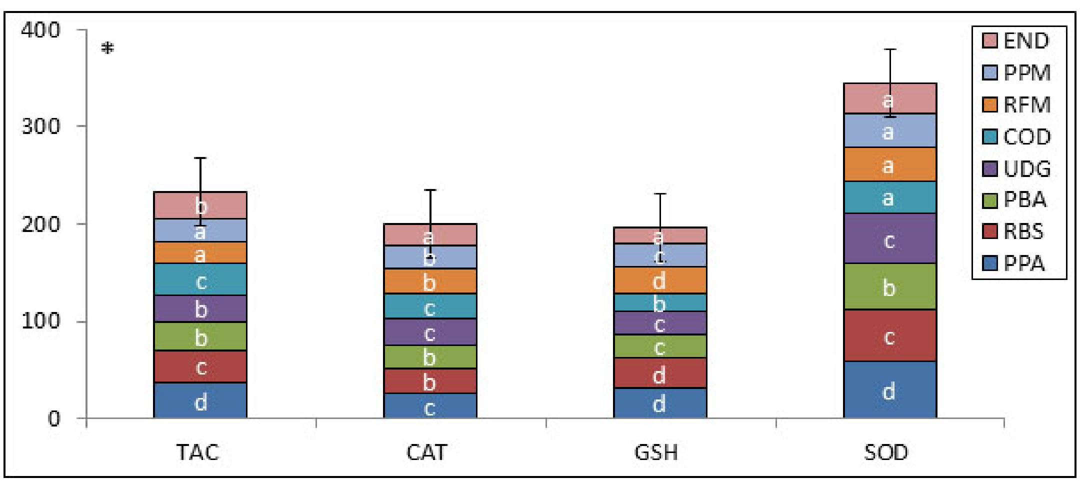


Fig. 39: Biochemical profiles on different reproductive pathological conditions in Andaman and Nicobar Islands. TAC: total antioxidant capacity (nmol/µL), CAT: catalase (nmol/min/L), GSH: glutathione (nmol/min/L), SOD: superoxide dismutase (nmol/min/L), a, b, c, d: between pathological conditions, * indicates p<0.05

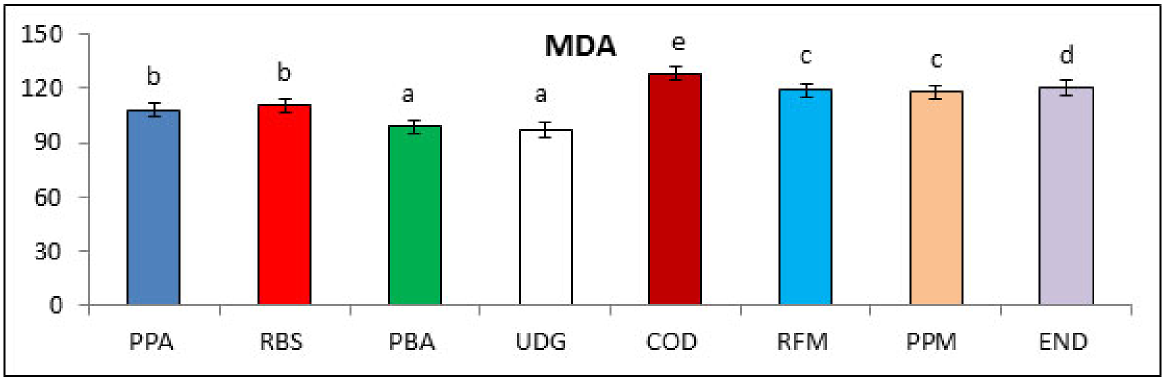


Fig. 40: Biochemical profiles on different reproductive pathological conditions in Andaman and Nicobar Islands, MDA: Malondialdehyde (nmol/L), a, b, c, d: between pathological conditions, * indicates $p<0.05$

Supplementing Zinc and Chromium to Ameliorate Heat Stress in Poultry

P.A. Bala, J. Sunder, T. Sujatha, A.K. De, M.S. Kundu and A.Kundu

Heat stress (HS) occurs after an exposure to high ambient temperatures beyond the thermal neutral zone (TNZ) for a given species. Both acute, a brief intense HS episode, and pro-longed exposure to high temperatures, or chronic HS, can cause adverse effects on the animal's well-being and immunity is jeopardised. Dietary chromium (Cr) supplementation beneficially affects physiological functions such as cell preservation, antioxidant activity and immune response that are of utmost importance to animal homeostasis and thermoregulatory capacity under heat stress conditions. Cr has antioxidant properties which help to attenuate the negative effects of oxidative stress. Cr decreases lipid peroxidation, Cr supplementation increases antibody responses and lymphocyte counts in broiler chickens exposed to high environmental temperatures. In addition, trivalent Cr supplementation increases growth performance and decreases the circulating levels of undesirable metabolites and hormones such as cholesterol and corticosterone in broiler chickens exposed to heat stress. Zinc is actively involved in enzyme function, maintaining immune response, antioxidant enzyme production, maintenance of lymphocyte replication and antibody production. Thus a diet was prepared by supplementing Cr (80ppm) and Zn (1000ppb) for the poultry broilers to ameliorate heat stress in the Island condition. The prepared ration will be tried on the poultry broilers in a feeding trial.

Physical, Biochemical and Molecular Characterization of Semen in Pigs of Bay Islands Vis a Vis Study on Feasibility of Artificial Insemination

S.K. Ravi, Perumal P, M. S. Kundu,D.Bhattacharya,JaiSunder, Arun Kumar De, Rafeeque. R. Alyethodi and A. Kundu

Cross breeding with the use of Artificial insemination (AI) can be a tool to upgrade genetically inferior local pigs and avoid inbreeding that usually happens with less number of available breeding boars or small pig population. The purpose of semen preservation for AI is to maximize the use of superior germplasm with extended sperm viability but without much effect on the sperm fertility essential for successful breeding. With the aforesaid vision, semen collection was attempted in Andaman local pigs using gloved hand technique. This is for the first time to be reported in Andaman local pigs.

Preliminary study on Andaman local pig revealed that total semen volume, gel in semen and gel free semen volume was 220, 190 and 30 ml, respectively, whereas seminal pH was observed to be 7.5. Objective assessment of total and progressive sperm motility was done which were 80 and 75%, respectively. Sperm concentration was

$210x10^6$/ml which was counted using hemocytometer chamber. Morphometric measurements of pig spermatozoa with software enabled microscope were performed. Average head length, head width,tail length and full sperm length was observed to be 9.42, 5.24, 43.93 and 52.37 µm, respectively.

Molecular Epidemiology of *Rhipicephalus* microplus Complex in Andaman & Nicobar Islands and Screening for its Acaricide Resistance

D. Bhattacharya, Jai Sunder, K. Muniswamy, R.R. Alyethodi, Perumal, P.,
Arun Kumar De and A. Kundu

During the period under report, adult female tick of *Rhipicephalusmicroplus* was collected from cattle. The healthy female ticks were selected for production of larvae in the laboratory. The female ticks were incubated in room temperature maintaining 85% relative humidity. Female ticks were seen to lay eggs after 48 hours and on an average each female tick laid 2000 eggs. Larvae started hatching after 22 days of incubation of eggs.

Biochemical and Molecular Mining of Hormonal Profile of Buck under Abiotic Stressors and Managemental Intervention for its Mitigation

P. Perumal, S. K. Ravi, A. K. De, R. R. Alyethodi, K. Muniswamy, Jai Sunder and A. Kundu

Walking and summer stress on physiological, heamatological and antioxidant profiles in Andaman local goat under Island tropical ecosystem

A study was conducted to evaluate the effect of walking stress on physiological, heamatological and antioxidant profiles in Andaman local goat. Twelve buck of adult age of 2 to 3 yrs of age with body condition score 5-6 were selected and divided into two groups, viz. group-I (n=6): control (not exposure to walking stress) and group–II (n=6): treatment (exposure to walking stress). The treatment group was allowed to walk 8 km to and fro from the farm without allowing grazing. The control animals were kept in the adjacent shed. The time of walking was from 0700 hrs to 1100 hrs. Immediately after stress, the animals were restrained and physiological parameters such as rectal temperature, respiration rate, pulse rate and skin temperature were measured. Meanwhile blood samples were collected to study the heamatological such as total red blood cells, haemoglobin, erythrocyte sedimentation rate, mean corpuscular volume, mean corpuscular haemoglobin and mean corpuscular haemoglobin concentration and antioxidant profiles such as glutathione, glutathione reductase, superoxide dismutase, catalase and total antioxidant capacity and lipid peroxide such as malondialdehyde. Result revealed physiological, heamatological profiles and malondialdehyde were significantly higher and antioxidant profiles were significantly lowered in stressed animals than in unstressed animal group. It is concluded that the walking stress and hot summer heat stress has significantly affected the performance of Andaman local goat. Moreover, it is advisable to feed more nutrients with high energy and suitable antioxidants to mithun to counteract the free radicals (Fig. 41-45).

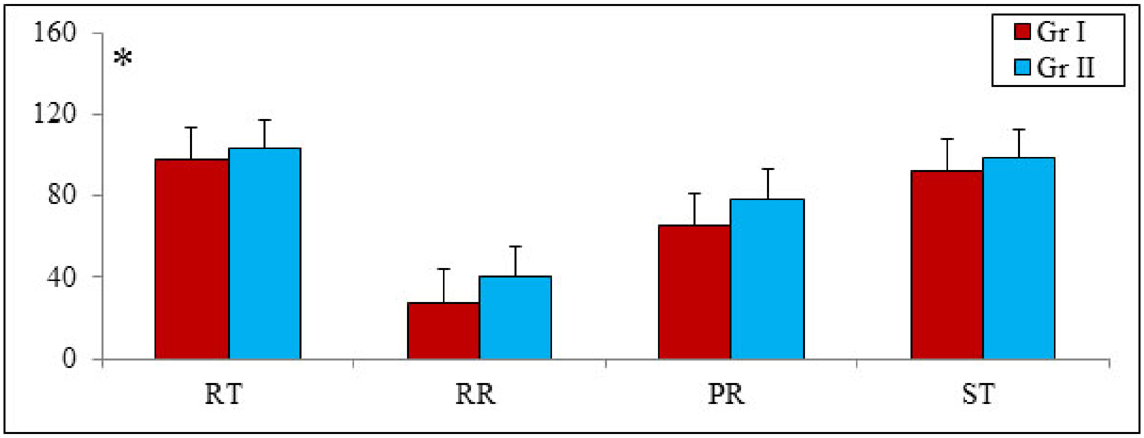


Fig.41: Effect of walking and dry season stress on physiological profiles in Andaman Local goat; RT: Rectal Temperature (°F), RR: Respiration Rate (beats per minute), PR: Pulse Rate (beats per minute) and ST: Skin Temperature (°F). GI: Unstressed animal group, GII: Stressed animal group. * indicates $p<0.05$ between treatment and control groups

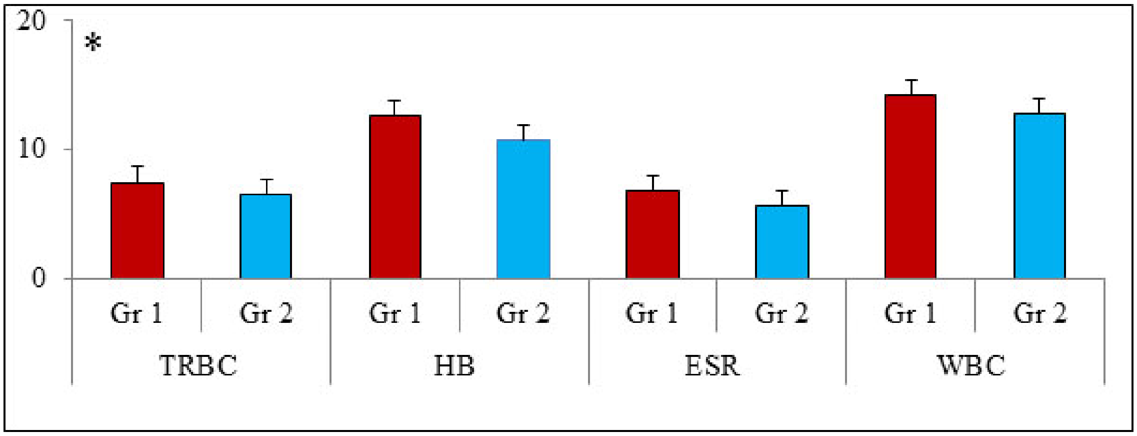


Fig.42: Effect of walking and dry season stress on heamatological profiles in Andaman Local goat, RBC: Red blood cells (x106/ mm3), HB: Haemoglobin (g/dl), ESR: Erythrocyte sedimentation rate (mm/hr), WBC: White Blood Cells (x103/ mm3), G1: Unstressed animal group, G2: Stressed animal group. * indicates $p<0.05$ between treatment and control groups

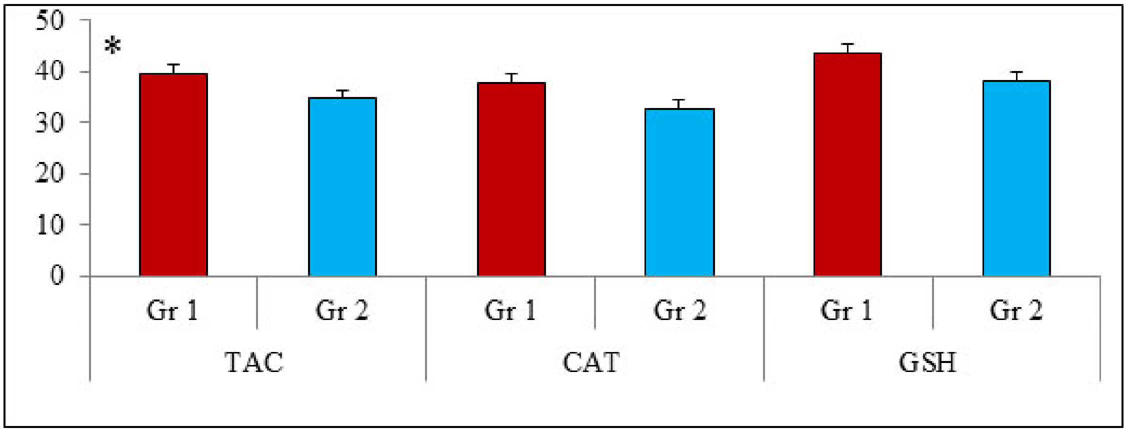


Fig. 43: Effect of walking and dry season stress on antioxidant profiles in Andaman Local goat; TAC: Total antioxidant capacity (nmol/µL), CAT: Catalase (nmol/min/L), GSH: Glutathione (nmol/L), G1: Unstressed animal group, G2: Stressed animal group. * indicates $p<0.05$ between treatment and control groups

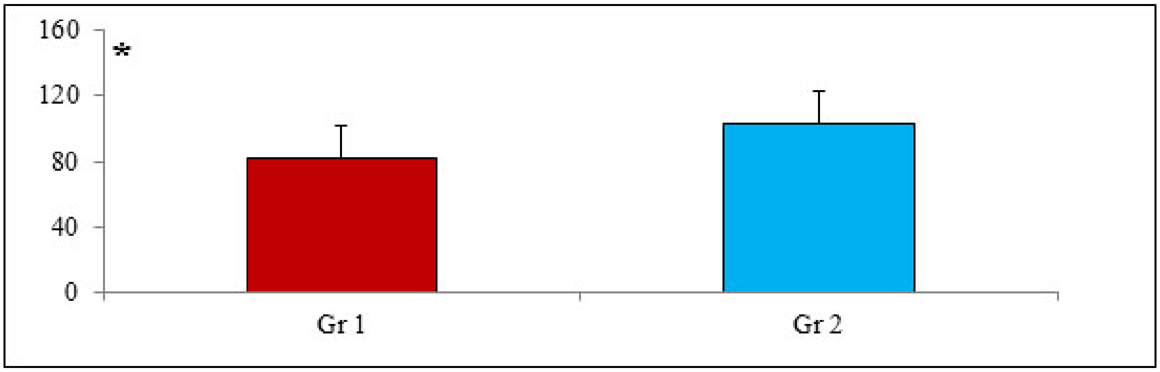


Fig.44: Effect of walking and dry season stress on oxidative profile (Malondialdehyde; nmol/L) in Andaman Local goat, G1: Unstressed animal group, G2: Stressed animal group. * indicates p<0.05 between treatment and control groups

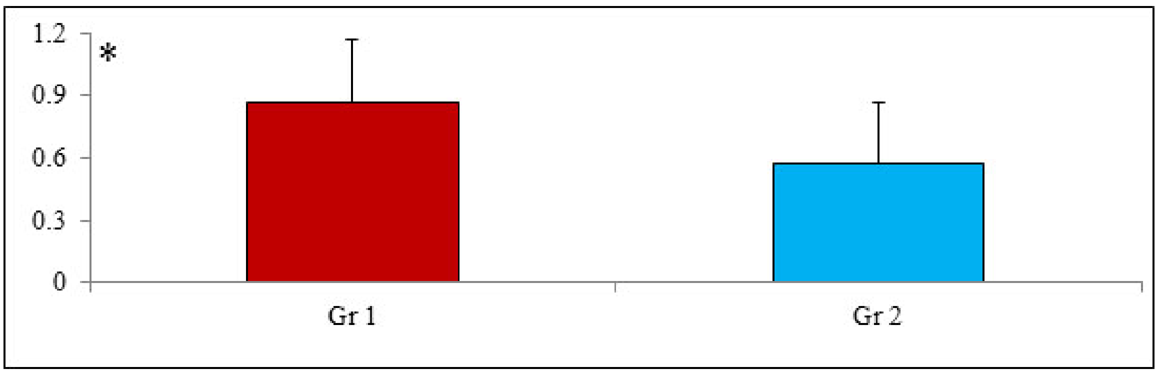


Fig. 45: Effect of walking and dry season stress on superoxide dismutase (nmol/min/L) in Andaman Local goat, G1: Unstressed animal group, G2: Stressed animal group. * indicates p<0.05 between treatment and control groups

SUCCESS STORIES

Success Story 1

Problem of Post Parturient Mastitis and Calcium Deficiency Intervened in Sow: A Success Story in South Andaman

P.A. Bala, M.S. Kundu, P. Perumal, D. Bhattacharya, A.K. De, S.K. Zamir Ahmed and A. Kundu

Mr. Nirmal Sardar, S/o- Shri.Laxman Chandra Sardar, aged 48 yr is a progressive pig farmer of Kamraj Nagar, Port Blair. He started his piggery unit with 11 pigs priced about Rs.51000/-, a year back and now earns approximately Rs. 1,00,000/- per month. Presently his piggery unit with Large white Yorkshire has 40 adults which are ready for the sale in the market and around 37 piglets in growing stage.

Last month when one of his sow and it's 17 piglets died just after furrowing, incurring predicted loss of Rs.1,50,000/-, he contacted scientists of ICAR-Central Island Agricultural Research Institute (CIARI), Port Blair to visit his piggery unit . The team after investigation diagnosed the death of the sow, as post parturient mastitis and calcium deficiency. Further, the farmer was advised to contact the scientists of CIARI for any clinical or managemental assistance in exigency if same situation occurs with the sows for his piggery.

This time, when similar situation prevailed in the forenoon of 30th Dec, 2018, he informed the scientist of CIARI, telephonically about the problem of the sow and asked for the assistance. Immediately a team of scientists went to Kamraj Nagar and found that a Large White Yorkshire (LWY)) sow of about 220 kg which had furrowed 16 piglets, was in lateral recumbencey, unable to stand up, off-feed for three days and the piglets were not getting sufficient milk to suckle. The sow was diagnosed with post parturient mastitis & calcium deficiency and prescription ofantibiotics for prevention of mastitis, hormonal therapy for letting down of accumulated and infected milk; adjunct with analgesics, calcium supplementation and liver tonic was suggested.

The farmer immediately with the help of a local veterinary staff administered the prescribed drugs to the sow and fed the piglets with other sow's milk. This timely intervention of ICAR-CIARI scientists and the local veterinary staff saved the farmer's sow and the piglets, and preventing an anticipated economic loss of 1.5 lakhs in a period of six months to come.The scientists of ICAR-CIARI were in regular contact with the farmer about the health of the sow and piglets'. The progress in the sows and piglets health was solicited telephonically from the farmer on 30th Dec, 2019 evening. The farmer informed that the sow could stand, took feed by her own and the piglets were in good condition, so was on the next day. However, on 1st Feb, 2019 the scientist team had a follow up visit to evaluate the development in sow's and piglets' health, also advised him for better scientific pig management.

The farmer expressed his happiness and gratitude to the ICAR-CIARI scientists and the local veterinary staff for the timely and prompt intervention, which saved his sow, he also acknowledged that he has also acquire knowledge on management of the sows in emergency situation.

Success Story 2

Coccidiosis, a Serial Kid Killer: Problem Resolved by Judicious Amprolium Therapy-A Success Story of Research of ICAR-CIARI

Arun K De, Perumal P., K. Muniswamy, Jai Sunder, D. Karunakaran, S.K. Zamir Ahmed, A. Kundu and D. Bhattacharya

ICAR-Central Island Agricultural Research Institute, Port Blair-744 101

Kids within the age group of 6 months very often suffer from dark and bloody diarrhoea which has been reported by one of the progressive goat farmers of Indiranagar, South Andaman district, named, Arumugam. The farmer experienced severe loss due to death of the infected kids particularly from the month of March to November which could not be controlled either by anthelmintic treatment or by antibiotic therapy. The average death rate within infected kid was 80 per cent and a total of 14 kids died within six months. According to the farmer the average economic loss due to death of one kid was approximately not less than Rs. 1000.00. This problem was investigated through an in-depth study by group of scientists of ICAR-CIARI and much specialised test was carried out in the laboratory through quantification of infection in each infected kid (called scientifically Modified McMaster technique) and identification of organism by setting culture in the laboratory. Investigation result suggested high infection rate of coccidia and count of organism in stool samples in some kids was more than one lac (Plate 80).

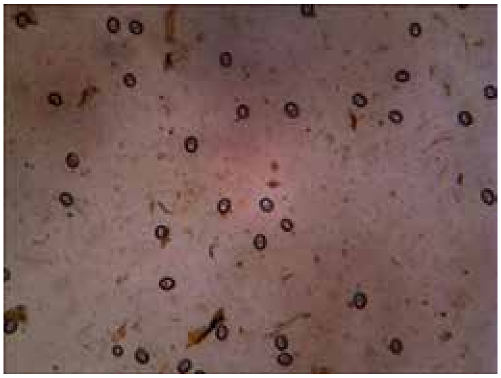


Plate 80: Organism detected by Modified McMaster Technique (X100)

Further the organisms were cultivated in the laboratory in specialised media. Four highly pathogenic species of coccidia were detected constantly which was confirmed in the laboratory of Animal Science Division (Plate 81).

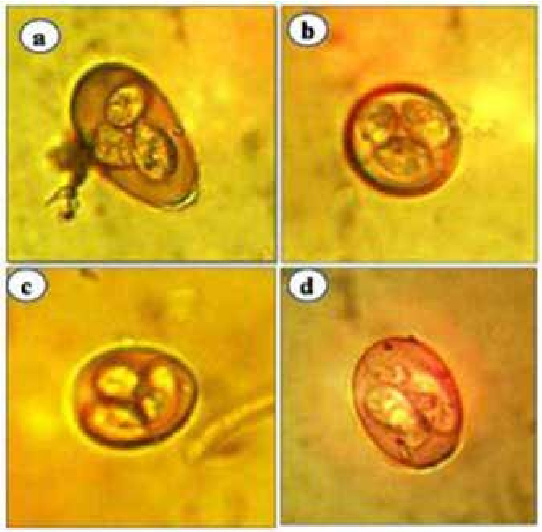


Plate 81: Four pathogenic species of coccidia associated with diarrhoea and death prevalent in South Andaman [a=Eimeria (E.) arloingi, b= E. parva, c= E. pallida and d= E. faurei]

Immediately after diagnosis, the infected kids were provided orally amprolium soluble powder (@ 5 mg/kg of body weight) for a period of 7 days and as a preventive measure the same powder at the same dose rate was provided to the whole flock for 15 days and the disease was controlled completely.

For details study on pattern of infection, scientists of ICAR-CIARI further carried out further investigation round the year to pin point the infection rate in different months. After working on this issue throughout the year this was found that, infection rate was the maximum in the month of March and in between July and November (Fig.46).

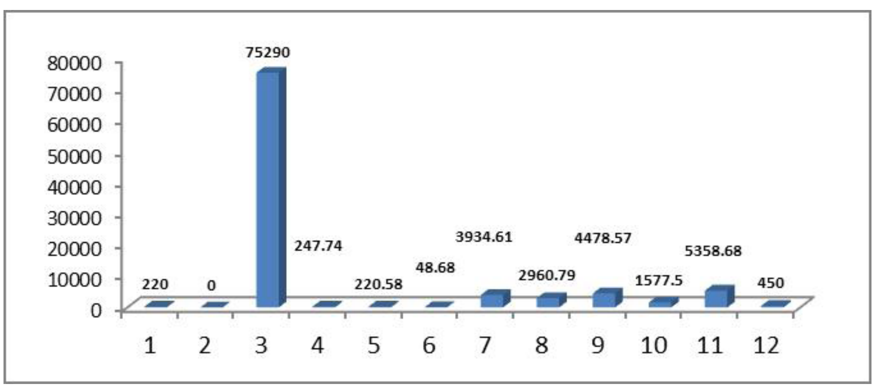


Fig. 46: Infection pattern of Coccidia in twelve different months in South Andaman District of Andaman and Nicobar Islands (study result based on observation of a project entitled, "Prevalence and economic impact of gastro-intestinal parasites of livestock in Andaman and Nicobar Island")

Therefore, in general based on this study the farmers were advised for giving treatment against coccidia in the month of February and another in the month of June to avoid economic loss due to coccidian during training, awareness, visit through print & electronic media and agro advisories at regular intervals for dissemination of the knowhow to the far flung areas of the Islands.

DIVISION OF
FISHERIES SCIENCE

All India Network Project on Mariculture

R. Kiruba Sankar, J. Praveenraj, K. Saravanan, Harsha Haridas and S. Dam Roy

In order to popularize and demonstrate the feasibility of mariculture practices particularly cage culture, the project was initiated. Major objectives of the project were to assess the availability of wild finfish seeds, to identify the sites suitable for cage culture and to demonstrate the cage culture activities. Wild finfish seed surveys were conducted in Mayabunder, Burmanallah, Beodnabad, Kodiyaghat, Chidiyatapu, Corbyn beach, Guptapara, Mithakhari, Wandoor, Dandus point and Ferrargung using cast net (# 20 mm) and drag net (# 10 mm). Grey mullets, *Liza* sp. dominated in all the sites followed by mud skipper, *Boleopthalmus* sp. The seeds of *Hemiramphus* sp., *Signaus* sp*., Ambasis* sp, *Therapon jarbua, Lutjanus johni, Oryza* sp., damsel fishes, *Megalops cyprinoides,* small gobies were collected and transported to the laboratory for identification. Length weight measurements for mullet seeds were noted. Among crustaceans, *Penaeus monodon, Metapenaus monoceros* and *Macrobrachium sp*. were also collected. There is a huge potential for natural seed of mullet (*Liza* sp.) which constituted more than 80% of the seed collections especially in creeks. The average length and weight of *Liza* sp. collected were 4.8cm total length and 1.6g weight respectively (Plate 82). Further site selection studies for cage culture were initiated in South Andaman district in the following locations such as North Bay, Wandoor, Rutland, Sippighat, Minnie Bay, Port Mout (Fig. 47) and collected parameters such as depth, transparency, temperature and salinity.The sites at North Bay and North Wandoor were found to be more protected and conducive for cage culture.

Plate 82: Wild seeds collected during surveys

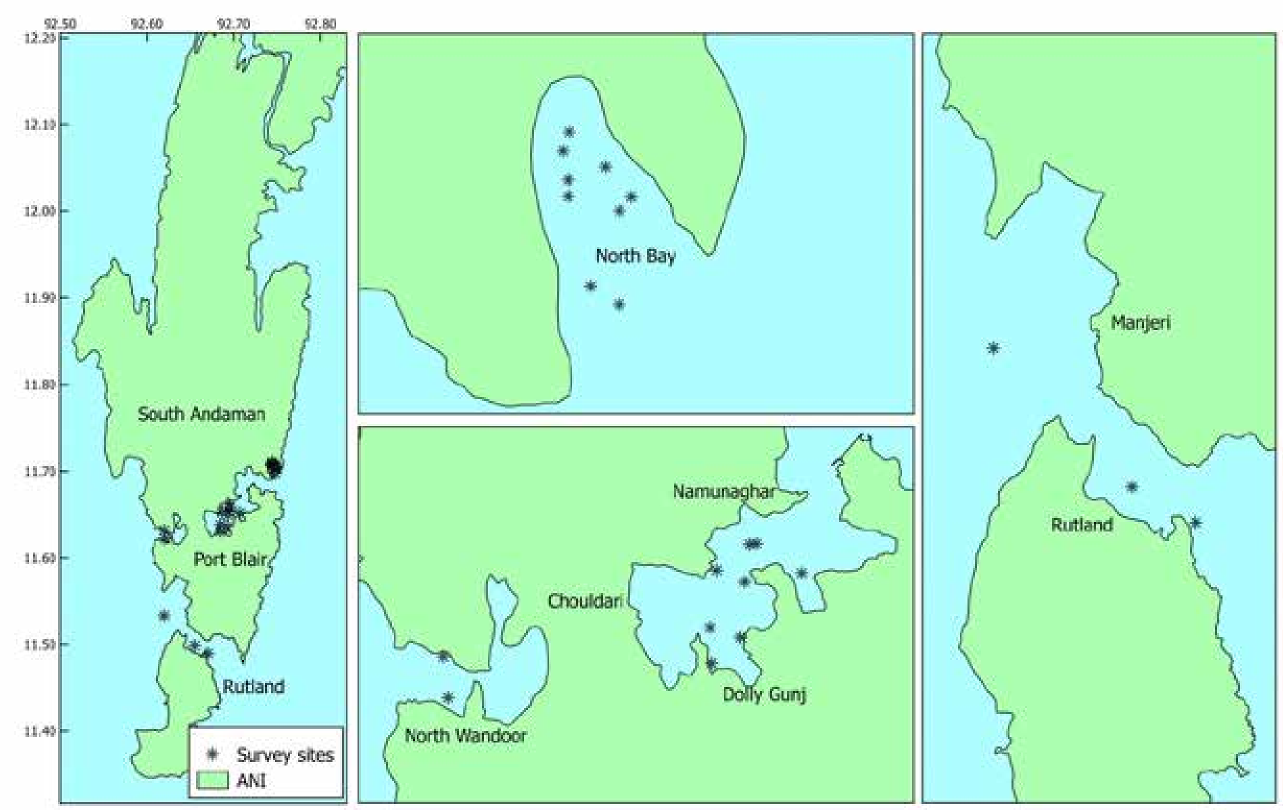


Fig. 47: Site suitability studies conducted in South Andaman for cage culture

For further developments in the open sea cage sector, there was an imminent need to have a roadmap and guiding principles for effective development and management. Since lack of a proper policy directive was found to be a major lacuna, a consolidated Policy Brief was prepared and published in collaboration with Department of Fisheries, Andaman and Nicobar Administration, ACOSTI, Port Blair and ICAR-CMFRI, Kochi.The policy brief addressed the existing issues, challenges ahead, case studies, and innovative management approaches with suitable policy recommendations. The policy brief being a ready reckoner was developed as guiding document towards development of cage culture sector in the Islands.

National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) in Andaman and Nicobar Islands

K. Saravanan and J. Praveenraj

As a part of passive surveillance, baseline data has been collected from a total of 307 freshwater fish farms located at 48 different villages of North and South Andaman and necessary advocacies on better management practices were provided to the fish farmers. A fish leech of the family, Glossiphoniidae was recorded in *Rasbora daniconius* for the first time from Andaman Islands and also the occurrence of bopyrid isopod parasite, *Probopyrus* sp. was reported from freshwater prawn, *Macrobrachium scabriculum* (Plate 83). Besides, an outbreak due to nutritional deficiency was reported in grass carps at a carp farm located at Chouldari, South Andaman.

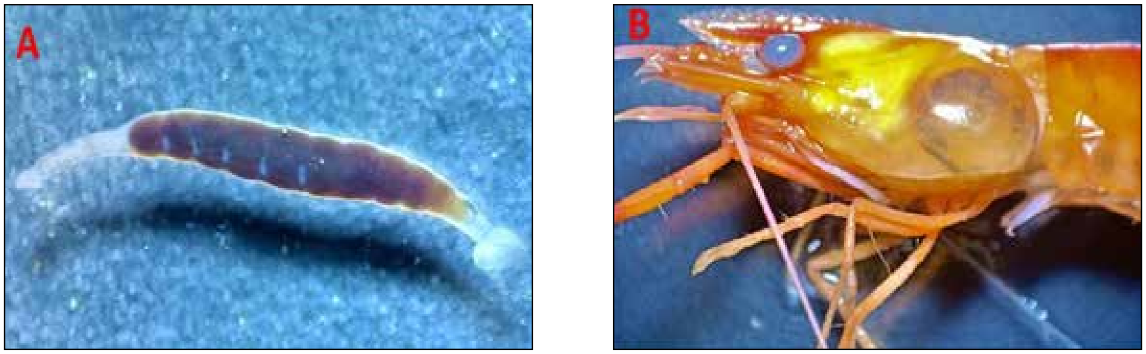


Plate 83: Occurrence of fish and shellfish parasites. A: Fish leech of the family, Glossiphoniidae; B: *Probyprus* sp. in *Macrobrachium scabriculum*

Under the active surveillance, marine and freshwater fish and shellfish samples were collected from North and Middle Andaman, South Andaman and Nicobar Districts for screening against the target pathogens by following the OIE protocol. Altogether, 207 freshwater carp and prawn samples, 306 wild marine shrimp samples and 138 marine grouper and seabass samples were collected (Plate 84). All the analysed freshwater carp samples gave negative result for the screened pathogens like Koi Herpes Virus (KHV) and Spring Viremia of Carp (SVC) and freshwater prawn samples gave negative result for *Macrobrachium* Noda Virus (MrNV) and Extra Small Virus (XSV). Wild marine shrimp samples collected from Durgapur, Mayabunder, Betapur, Lohabarrack, Junglighat and Campbell Bay landing centres gave positive result for White Spot Syndrome Virus (WSSV) and Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV) by PCR method. On the other hand, wild marine shrimp samples gave negative result for Monodon Baculo Virus (MBV), Yellow Head Virus (YHV), Taura Syndrome Virus (TSV) and Infectious Myonecrosis Virus (IMNV). All the marine grouper and seabass samples gave negative result for Red Sea Bream Irido Viral Disease (RSIVD) and Viral Nervous Necrosis (VNN).

Plate 84: Collection of fish and shellfish samples

In order to create awareness among the stakeholders, one training and three awareness programmes (Plate 85) were conducted on fish feed and health management measures at South Andaman and Nicobar Districts in which, a total of 91 farmers benefitted (Table 74). Besides, a Krishi live phone-in programme on "Health Management in Freshwater Aquaculture" was delivered at Doordarshan, Port Blair. Folders on quality fish and shrimp seeds were also published in both English and Hindi version for the benefit of stakeholders.

Plate 85: Training and awareness programme conducted

Table 74: Details of training and awareness programmes

S. No.	Date	Venue	Title	Number of Participants
Training				
1.	13th to 15th Dec., 2018	ICAR-CIARI, Garacharma	Fish Feed & Health Management in Aquaculture	26
Awareness				
1.	29th Sept., 2018	Wandoor, South Andaman	NSPAAD	33
2.	18th Dec., 2018	Campbell Bay, Great Nicobar	NSPAAD	14
3.	29th Jan., 2019	Sawai Village, Car Nicobar	NSPAAD	18

Characterization of *Bacillus* spp. from Andaman Mangroves and Evaluation of its Antagonistic Effect on Fish Pathogens

K. Saravanan, T. Sivaramakrishnan, J. Praveenraj, Harsha Haridas and R. Kiruba Sankar

A field trial was conducted to evaluate the effect of dietary administration of mixture of probiotic bacteria such as *Bacillus amyloliquefaciens* BN06, *B. subtilis* WN07 and *B. megaterium*CT03 on Catla and Rohu fingerlings at Bimblitan, South Andaman. Carp grower feed was formulated by using locally available feed ingredients and the proximate composition of formulated feed was crude protein 24.88%, crude lipid 6%, crude fibre 9.91%, ash 10.45% and moisture 9.17%. Three different treatment groups were selected such as the formulated feed with mixture of probiotic bacteria at the rate of 10^6 cfu/ g feed as T1, formulated feed without probiotic bacteria as T2 and farmer's practice comprising of mixture of rice bran and groundnut oil cake as T3.

Altogether, 2582 numbers of carp fingerlings comprising of 1549 numbers of catla (average weight 3.12 ± 0.43 g) and 1033 numbers of rohu (average weight 9.92 ± 1.25 g) were distributed in three treatment groups to receive the experimental and control diets. The fishes were fed at the rate of 10% body weight per day in two equal portions during the initial time period by using feeding trays and thereafter, gradually adjusted the feeding rate accordingly. Water quality parameters were observed to be optimum level throughout the experiment. Sampling was carried out at monthly intervals and preliminary analysis of growth parameters was carried out during the fourth month of field trial which revealed that the weight gain (g) was significantly higher in T1 group (52.94 ± 3.15) fed with mixture of probiotic bacteria than T2 (28.34 ± 2.55) and T3 (15.45 ± 2.38) groups. Likewise, weight gain percentage was significantly higher in T1 group (87.77 ± 2.47) than T2 (75.82 ± 3.44) and T3 (57.92 ± 2.71). On the other hand, Feed Conversion Ratio (FCR) was less in T1 (2.24 ± 0.17) than the other treatments (Fig. 48).

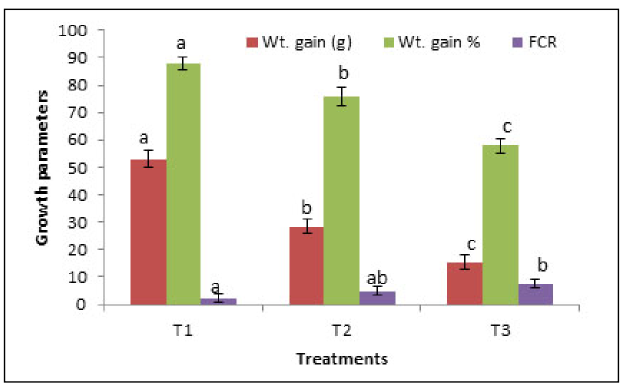


Fig. 48: Growth parameters such as weight gain (g), weight gain percentage and Feed Conversion Ratio (FCR) of Catla and Rohu fingerlings during the fourth month of field trial. Each value is expressed as the mean ± standard error and significant differences ($P < 0.05$) are indicated by different letters (a, b, c)

Specific Growth Rate (SGR) was significantly higher in T1 group (2.40 ± 0.17) when compared with other treatment groups (Fig. 49).

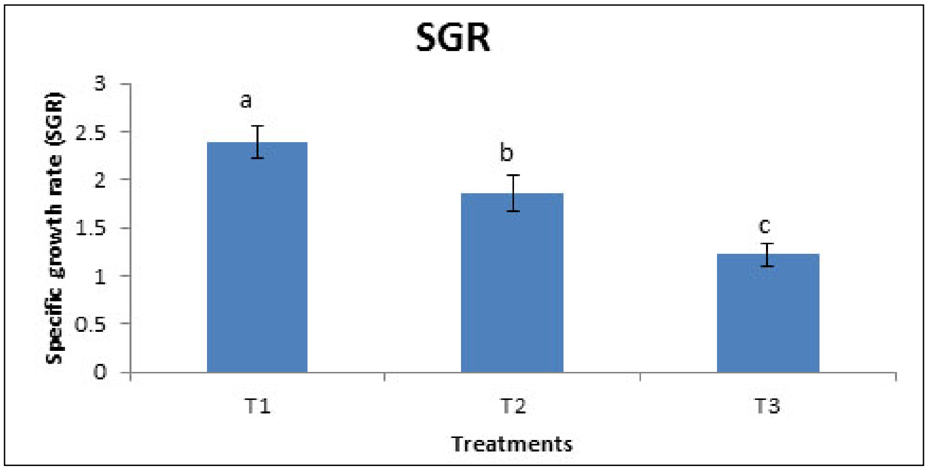


Fig. 49: Specific Growth Rate (SGR) of catla and rohu fingerlings during the fourth month of field trial. Each value is expressed as the mean ± standard error and significant differences ($P < 0.05$) are indicated by different letters (a, b, c)

Simultaneously, Feed Efficiency Ratio (FER) and Protein Efficiency Ratio (PER) were significantly higher in T1 when compared with other treatment groups such as T2 and T3 (Fig. 50). Preliminary analysis of growth parameters revealed that significant difference was observed in the treatment group fed with the mixture of *Bacillus amyloliquefaciens, B. subtilis* and *B. megaterium* at the rate 10^6cfu/ g feed than other two groups fed without probiotic bacteria and farmer's practice which further revealed that the mixture of three *Bacillus* spp. could be an effective source of probiotic for Catla and Rohu fingerlings. Besides, a field day on role of feed probiotics in Island aquaculture was conducted at Bimblitan in which, a total of 25 farmers were participated from various villages of South Andaman.

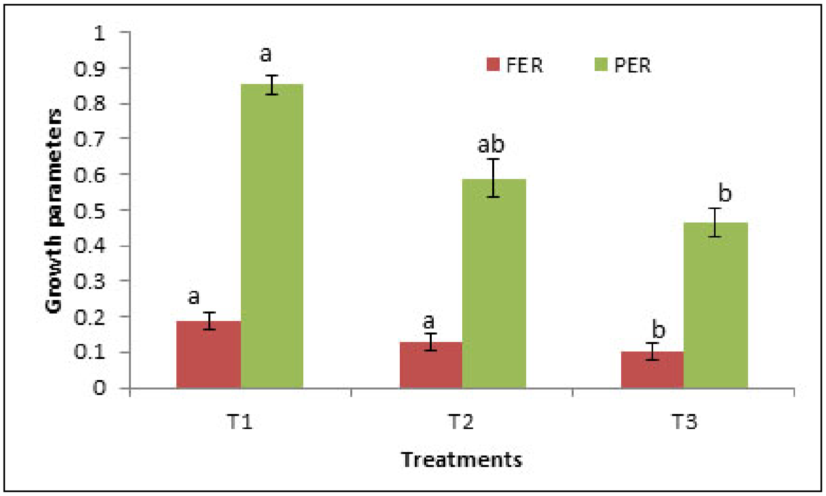


Fig. 50: Feed Efficiency Ratio (FER) and Protein Efficiency Ratio (PER) of catla and rohu fingerlings during the fourth month of field trial. Each value is expressed as the mean ± standard error and significant differences ($P < 0.05$) are indicated by different letters (a, b, c).

Cataloguing Inland Aquatic Diversity and Breeding of Indigenous Freshwater Fishes of Andaman and Nicobar Islands

J. Praveenraj, R. Kiruba Sankar and Benny Varghese

Survey for documentation of the inland aquatic fauna was conducted at Garacharma stream and Mannarghat, which yielded a new species of *Macrobrachium* (Plate 86), and a new record, *Macrobrachium lamarrei* (Plate 87), hitherto not reported from Andaman and Nicobar Islands. Colorful species of prawns such as *Caridinatypus*, *C. brachydactyala*, *C. gracilirostris* and *Atyposis moluccensis* were also collected together and preserved for further study. An eleotrid, *Giurus* sp. (Plate 88) was recorded from the hill stream of Mannarghat possessing a potential ornamental value. A *channa* sp. officially described as *Channa royi*, as per ICZN code and updated in the international taxonomy database "Eschmeyer's Catalog of fish, California Academy of Sciences" (Plate 89). Twenty two COX1 barcodes for *Channa royi* were generated and submitted in the GenBank NCBI. The holotype and paratypes were submitted in the Zoological Survey of India, Andaman regional centre and Kolkatta Headquarters. *Channa royi* also possess huge ornamental potential due to its vibrant colours and graceful nature. Osteological work done for the new species of *Rasbora* from Andamans, revealed it be distinct from all other congener (Plate 90). The *Sicyopterus* sp. collected from Mannarghat differs from *S. microcephalus* from Java, which was previously synonymized with the *S. garra* from Andamans. The sensory pore of the *Sicyopterus* sp. was drawn and compared with its other types from the same locality. Difference in the sensory pore were observed among each individuals, demonstrating that more than one species occur. Examinations of the holotype of *S. garra* will shed more insights on its identity. The endemic killifish *Aplocheilus andamanicus* possessing good ornamental value were collected and maintained for brood stock development. The breeding habitat was recorded in the wild and studied for artificial simulation in the aquarium tanks. The breeding habitat in the wild consists of roots of riparian vegetation adjacent to the streams.

Plate 86: *Macrobrachium* sp. from Garacharma

Plate 87: *Macrobrachium lamarrei* from Mannarghat

Plate 88 : *Giurus* sp. from Mannarghat

Plate 89: *Channa royi* sp. nov.officially described and archived in fish base as per ICZN

Plate 90: Osteology of *Rasbora*sp.from Andaman (From left, ceratobranchial, dentary and premaxilla

Seaweed Diversity and its Culture Prospects in *In-Situ* Conditions of Andaman Waters

Harsha Haridas, S. Dam Roy, K. Saravanan, A. K. O Ratheesh and R. Kiruba Sankar

Seaweed surveys were conducted at various locations such as Wandoor, Chatham, Burmanallah, Kurmadera, Chidiyatapu, Neil and Havelock islands. Seaweeds collected from the sampling sites were identified and preserved in 6% V/V formalin solution. Bar diagram indicating the different classes of seaweeds (Fig.51) and a GIS map of the seaweed sampling sites indicating the richness of genera, family and order was plotted (Fig.52). Burmanallah area showed higher diversity of Chlorophyceae with 12 genera of seaweed. Among the chlorophyceae group, the most prevalent species were *Halimeda* spp. and *Neomeris* spp. and these are also present in all the sampling sites. Among all the sampling sites, *Phaeophyceae* was prominent in Havelock area where 5 genera were identified. Among the *Phaeophyceae,* Padina was present in all the sampling sites. Altogether, 8 genera of Rhodophyceae were reported from different sampling sites withhigher contribution of 7 genera at Burmanallah and Neil Island. Suitable species for seaweed culture in the Islands having commercial application were found to be *Gracilaria* spp., *Gelidiella* spp., *Sargassum* spp. and *Ulva*spp.

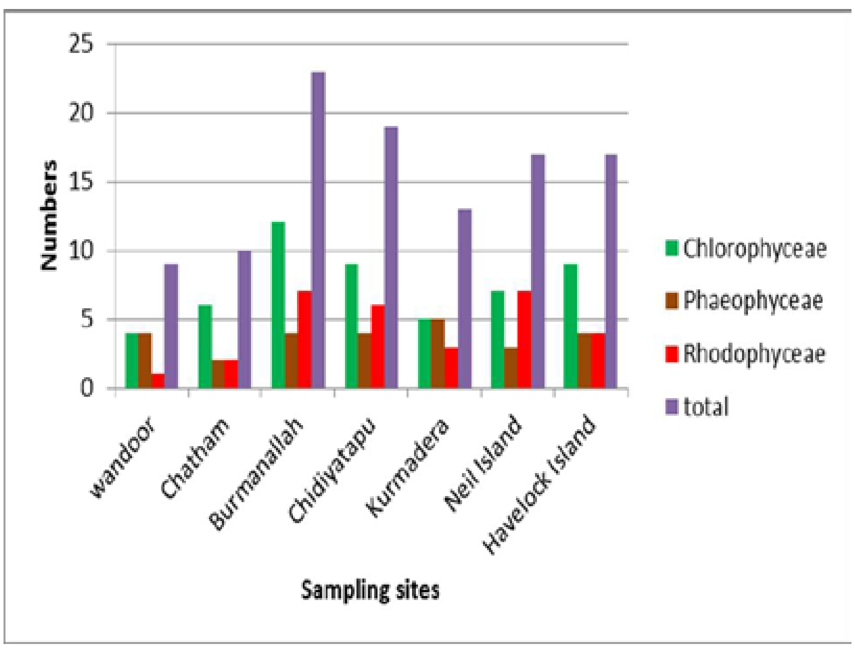


Fig.51: Bar diagram showing diversity of different classes of seaweeds at sampling sites across South Andaman

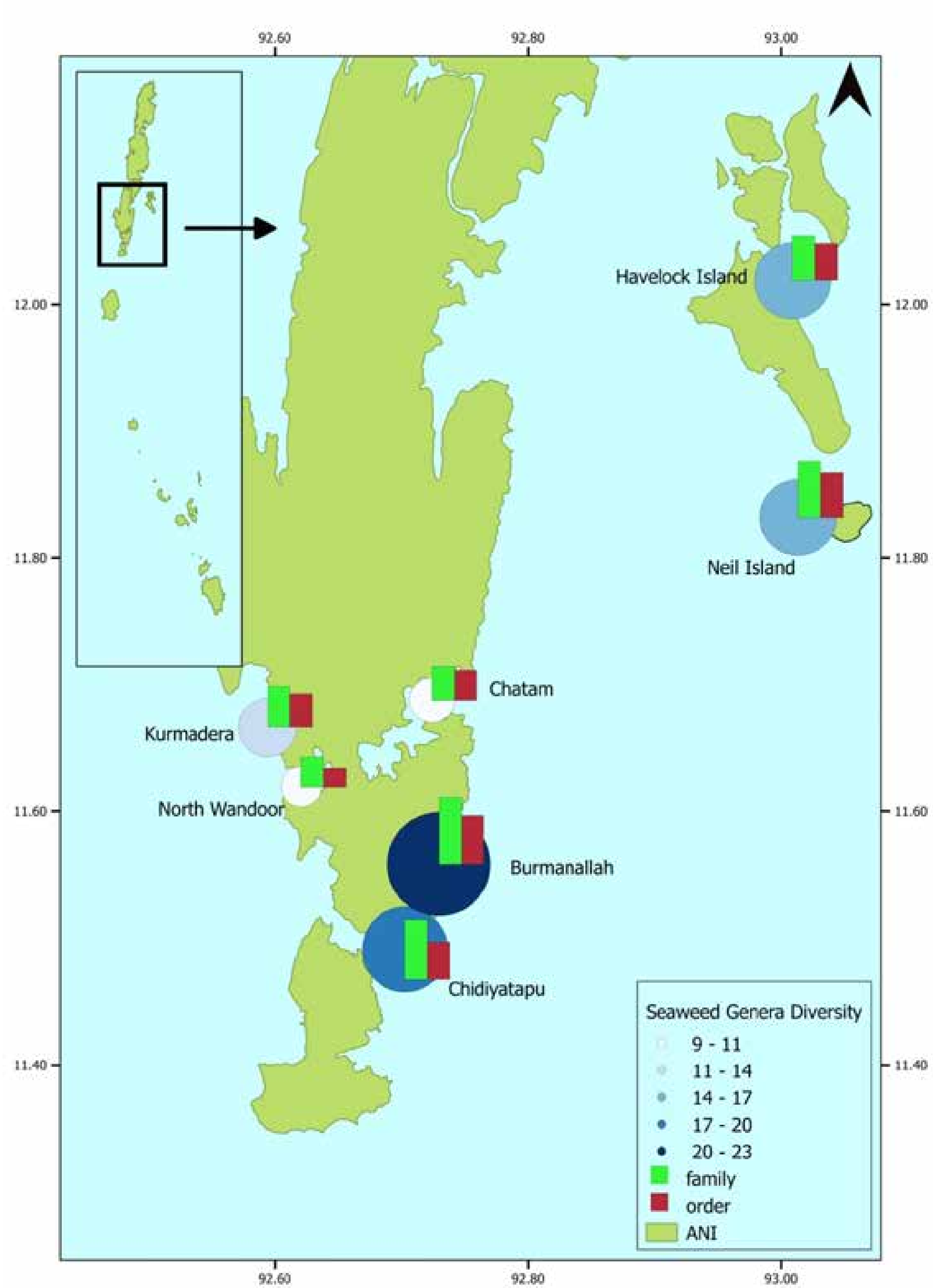


Fig.52: GIS map showing the seaweed diversity at different sampling sites across South Andaman

Evaluation of Suitable Aquaponics System Incorporating Fisheries and Agri-Components under the Island Conditions

Harsha Haridas, S. Dam Roy, T. Subramani, K. Saravanan, Benny Varghese and S. Murugesan

A flood and drain freshwater aquaponics unit (Plate 91) has been designed and set up at freshwater hatchery complex. The system is designed with one fish culture unit and 4 hydroponics unit to use in a split plot design. The fish tank is a rectangular FRP tank with 500L capacity and the hydroponic units are made with plastic crates. Circulation is made in a way to supply the water from the fish tank to each hydroponic unit with a common supply line. A common outlet collects the water from individual hydroponics unit and supply to the fish tank. Metal pieces (stones) measuring 20mm size is used as substrate in hydroponics unit. Initial circulation of water through the system is going on to establish microbial colonies in the hydroponics system. These microbial colonies act as biofilter and make the hydroponic bed as a nitrification chamber to facilitate the easy absorption of nitrate by the plants. Tilapia seeds with average weight 2.89±0.14 g and average length 5.2±0.11 cm were procured from Sippighat. The fishes are being acclimatised in FRP tanks with 150 L capacity. Formulated feed with 25 % crude protein and 6% crude lipid is used as the feed for Tilapia.

Plate 91: Flood and drain Aquaponics unit with 4 hydroponic bed and 1 fish rearing tank

SOCIAL SCIENCE SECTION

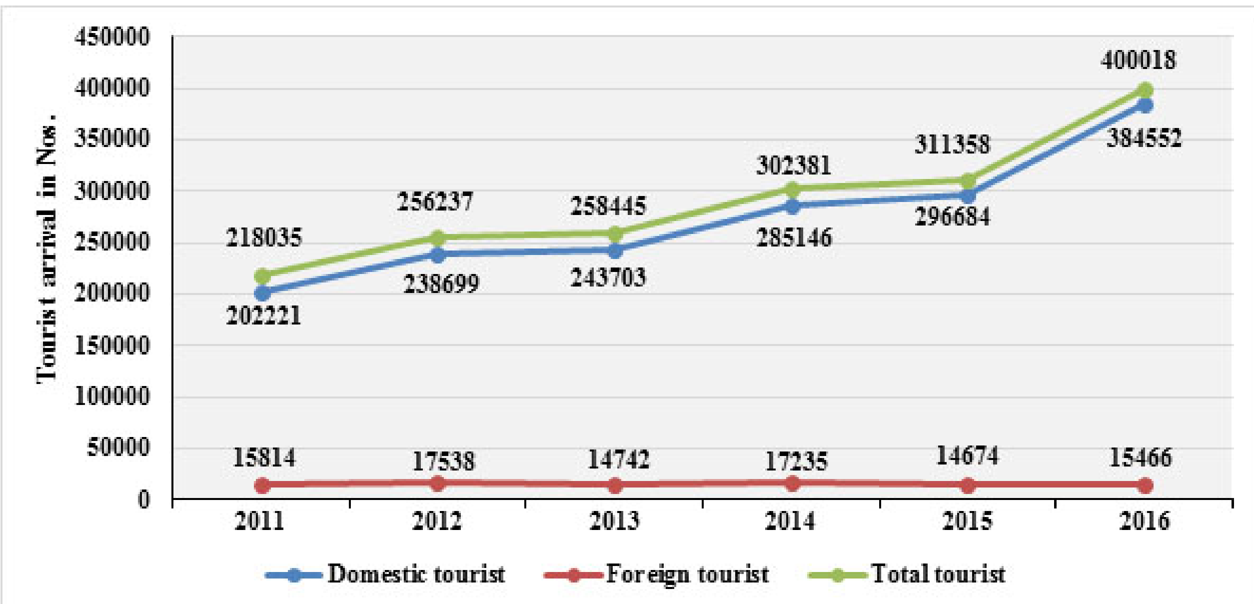
Indigenous Adaptation Strategies of Tribal *Vis-A-Vis* Non-Tribal Farmers and Impact of CIARI Technologies in Mitigating Climate Change Effects on Agriculture in Andaman & Nicobar Islands

R. Jaya Kumaravaradan, S.K. Zamir Ahmed, B. Augustine Jerard, B.L. Kasinath, L.B. Singh, S.K. Pandey, Amit Srivastava and A. Kundu

Vulnerability of ANI

Floating on the Seismic Zone V, Andaman & Nicobar Islands is highly vulnerable to the vagaries of nature. With the occurrence of 384 earthquakes of magnitude >4.5 since 2010 the Islands is reeling under constant threat of Tsunami. The bounty of south-west and north-east monsoons always brings with it severe cyclones causing heavy damage to the infrastructure, agriculture and livelihood of the people. Its sensitivity to climate change is exemplified by the increase in the mean temperature by 0.02°C/year since 1951.

With legal restrictions on forest land conversion and bleak industrial prospects, agriculture and tourism are the mainstay of the Island's economy as exemplified from the contribution of 16.17% and 64.25% by primary (agriculture) and tertiary sectors respectively to the Gross State Domestic Product. Though the footfall of foreigners is constant through the years, the tourist arrival has steadily increased from a mere 10,000 in 1980-81 to a burgeoning 4.00 lakh in 2016 (Fig. 53).



Source: Directorate of Tourism, A & N Administration

Fig. 53: Growth of tourist arrivals to ANI during 2011-16

With the plethora of developmental projects coming up in the fragile ecosystems, climate change is expected to pose severe impact on the agriculture & allied sector of the Islands. In this milieu, this project has been taken up to study the perception of tribal *vis-a-vis* non-tribal farmers of Andaman & Nicobar Islands about climate change, to validate their perception with observational data, to document their indigenous adaptation strategies to mitigate climate change effects on agriculture, to evaluate the climate resilience of selective CIARI technologies *viz.* IFS, BBFS, Agro-advisory Services, improved rice varieties, Noni, Mini Egg Incubator, Composite Fish Culture, Satellite Fish Nursery, PFZ advisories, livestock nutrient and health management; and to evolve suitable climate resilient agricultural policies for the Islands as part of mitigating strategies.

Climate resilience of CIARI technologies and their impact

CIARI Technology 1: Noni

As climate variability increases and related extreme weather events become more frequent and severe, Agro forestry is increasingly recognized as a sustainable land use in multi-functional landscapes owing to its diverse mitigation, adaptation and economic benefits. While it mitigates climate change by sequestering atmospheric carbon in biomass and soil, it increases the adaptive capacity of an agro-ecosystem through soil and water conservation, control of pests and diseases, improved microclimate conditions and improved soil fertility. Moreover, it strengthens the economic resilience of farm household with alternative/additional source of income from timber, fodder, resins and fruits.

Morinda citrifolia L. commonly known as Noni, a small tree of varied therapeutic values is native to south-east Asia, Australia and Pacific Islands. Noni shows extremely wide range of environmental tolerances as it grows from elevations near sea level up to 800 m above MSL, endures temperatures up to 39^{o}C in tropical humid Island environments, thrives well is infertile, acidic, alkaline and sandy carbonatic soils of atolls that poorly suited to agriculture, tolerates brackish tidal pools and flooded conditions for long periods of time making it an invaluable component in various agroforestry systems aimed at climate change adaptation. It integrates well with a wide range of cropping systems *viz.* multi-storey cropping, intercropping, home gardens, alley cropping and mixed forests.

The study conducted revealed that in 2006-07, CIARI promoted Noni cultivation across Andaman & Nicobar Islands for avocation in challenged areas after *T*sunami 2004. In 2007-08, through technology backstopping of the Institute, M/s. Andaman Plantations & Development Corporation Pvt. Ltd. a Kolkata based firm went for mass planting of Noni in 44 acres (17.8 ha) at different locations of South Andaman *viz.* 35 acres at Mithakhari, 8 acres at Minnie Bay and 1 acre at Bambooflat as intercrop in arecanut and coconut, all in rolling terrain and sloped hilly lands.

Though the economic yield started by the third year after planting, the firm could not find any prospective buyer till 2011-12 when it sold 3 tons of fruits to a Vadodara based processing company @ Rs.160/kg (Rs.140 for packaging and transportation + Rs.20 for fruit). Over the years, its sales destinations expanded to Chennai, Noida and Delhi @ 5 t/year.

Sensing the loss of market due to exorbitant freight cost involved in transporting the bulky consignments of fresh fruits to mainland, the firm established a Noni processing plant of 3t/day capacity at Mithakhari in 2016-17 through its sister concern M/s. Alberta Agro Pvt. Ltd. and since then selling Noni as processed material to mainland for further value addition.

Economics of Noni cultivation

As a low input-high value crop, Noni is an ideal choice for alternate/additional source of income from marginal lands (Plate 92). At a commercial scale, an organic Noni plantation of 14 ha with 10,000 trees amidst arecanut attracts an initial investment of Rs.24.00 lakh/annum for first 3 years (Table 75). Thereupon, Rs.14.40 lakh and Rs.1.50 lakh are incurred annually towards operational cost and FYM application respectively. The economic yield starts from the 4th year with 20-30 kg fruits/tree/annum, selling of which to the nearby processing unit at the rate of Rs.20/kg fetches a gross income of Rs.4.00-6.00 lakh/annum. At the end of 10th year, the plantation incurs an undiscounted expenditure and gross income of Rs.1.83 crore and Rs.3.40 crore respectively. When discounted at the rate of 12% per annum, the same amounts to Rs.1.09 crore and Rs.1.52 crore respectively with a B-C ratio of 1.39.

Table 75: Economics of a 10 year old organic Noni plantation of 14 ha with 10,000 trees under arecanut

Particulars	Rate (Rs.)	Cost (Rs.)	Returns (Rs.)	Discounted cost @ 12% (Rs.)	Discounted returns @ 12% (Rs.)
1st year					
Establishment cost #	2,00,000 /month	24,00,000	Nil	21,42,857	Nil
2nd year					
Establishment cost	2,00,000 /month	24,00,000	Nil	19,13,265	Nil
3rd year					
Establishment cost	2,00,000 /month	24,00,000	Nil	17,08,273	Nil
4th year					
Operational cost$	1,20,000 /month	14,40,000			
FYM application*	-	1,50,000			
Total cost		15,90,000		10,10,474	
Sale of fruits	20/kg @ 20kg/ tree/year		40,00,000		25,42,072
5th year					
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		9,02,209	
Sale of fruits	20/kg @ 20 kg/ tree/year		40,00,000		22,69,707
6th year					
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		8,05,544	
Sale of fruits	20/kg @ 20 kg/ tree/year		40,00,000		20,26,525
7th year					
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		7,19,235	
Sale of fruits	20/kg @ 25 kg/ tree/year		50,00,000		22,61,746
8th year					
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		6,42,174	
Sale of fruits	20/kg @ 25 kg/ tree/year		50,00,000		20,19,416
9th year					

Particulars	Rate (Rs.)	Cost (Rs.)	Returns (Rs.)	Discounted cost @ 12% (Rs.)	Discounted returns @ 12% (Rs.)
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		5,73,370	
Sale of fruits	20/kg @ 30 kg/ tree/year		60,00,000		21,62,660
10th year					
Operational cost	1,20,000 /month	14,40,000			
FYM application	-	1,50,000			
Total cost		15,90,000		5,11,937	
Sale of fruits	20/kg @ 30 kg/ tree/year		60,00,000		19,31,839
Total for 14 ha		1,83,30,000	3,40,00,000	1,09,29,338	1,52,13,965
Total for 1 ha		13,09,286	24,28,571	7,80,667	10,86,712
B:C ratio					**1.39**

Note:#Establishmentcostinvolveslandpreparation,pitmaking,mulching,shading,irrigation,nutrientmanagement,pestmanagement,weedingetc.
$ Operational cost involves slash weeding, pruning, trench making, mulching, irrigation, harvesting, transporting etc.
* FYM application @ 10 kg/tree/year in 2 dosages before each monsoon

Given the huge demand for noni pulp in the mainland @ 10t/week @ Rs.200/kg and the assured market price of noni juice @ Rs.750/450 ml, the firm has expanded the acreage under Noni for another (79 ha) *viz.*120 ac at Minne Bay, 35 ac at North Bay, 40 ac at Chunnabhatta with its own saplings of CIARI Sampada and other promising varieties, anticipating a bright future ahead.

Plate 92: Interaction at Noni plantation

Plate 93: Harvested rice variety Gayatri at Dasratpur

CIARI Technology 2: Improved rice varieties

A total of 30 farmers of South Andaman have been interviewed to elucidate their perception about climate change, their indigenous adaptation strategies and the climate resilience of CIARI rice varieties. It has been found that CIARI rice varieties are performing better (55%) than the local varieties with regard to germination and number of productive tillers, while they have lodging tendency during flooding. While CIARI 5, 7 and CSR 36 are the preferred varieties along with Gayatri which was introduced earlier, 45% farmers expressed their willingness to increase the acreage under these varieties owing to their higher yield of 20-25% (Plate 93).

Enhancing on - Farm Production and Promoting Forward and Backward Linkages through Technological Intervention

S.K. Zamir Ahmed, A. Velmurugan, Amit Srivastava, B.L Kashinath, R. Jaya Kumaravaradan and Siba Mahato

Two-tier Broad Bed & Furrow System of cultivation through personalized extension methodology (Scientist-Farmer-Market Approach)

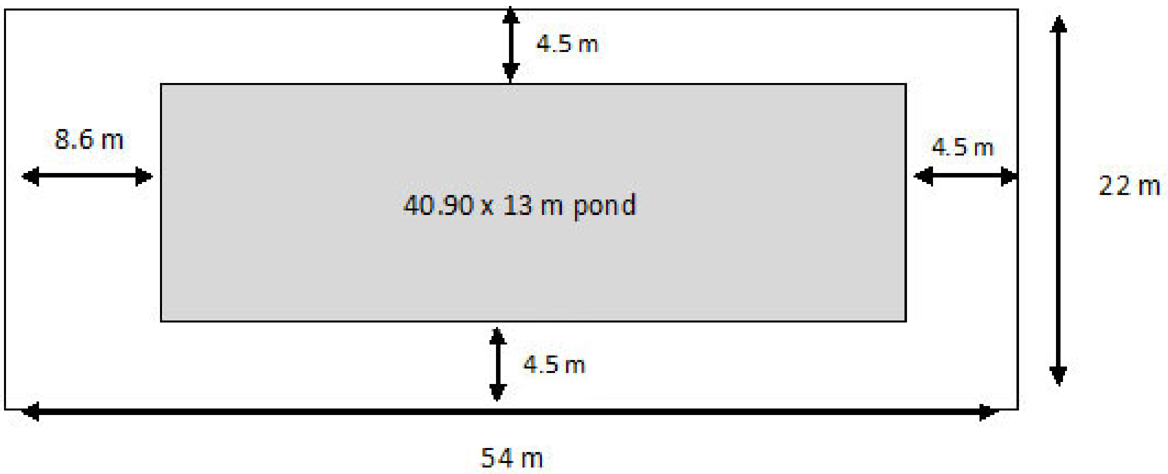


Fig. 54: Modified Broad Bed Furrow System

Shri Sudhir Dutta, a farmer in Creekabad village was earning a net income of Rs.12,000 to 15,000/ha by practicing a single crop of rice in his degraded land affected by *tsunami* since 2004. He was in search of technological intervention wherein he could cultivate and earn income to meet and enhance the livelihood of his family. The project team identified the farmer, analyzed his cropping pattern, resource base *etc.* and found the soil to be highly acidic due to sulphate content. An intervention was made wherein a farm plan was formulated with a modified Broad Bed Furrow System of 1188 sq.m. comprising 2 beds and a furrow in-between (Fig.54).

As the farmer preferred brinjal which fetches good price in the market, seeds of high yielding variety of brinjal were provided to him for planting on the beds and suggested to apply poultry manure as soil amendment.

Impact

During the first year of intervention, the farmer has harvested 2.5 t of brinjal from 656 m^2 bed area and earned a net income of Rs.58, 000 within a span of 5 months from an area which was hitherto uncultivable due to seawater intrusion after *Tsunami*. Further, it has been planned to rear fish in the pond during the next monsoon season.

Lessons Learned

Innovative cultivation technologies disseminated through personalized extension methodologies can make improvement to the livelihood of farmers in challenged situation (Plate 94).

BBFS at Creekabad: Before intervention

After intervention

Inspection by GM, NABARD & his team on 23.05.2018

Chairman & Members of QRT interacting with the farmer on 28.11.2018

Progress of BBFS escavation at Kausalya Nagar

Members of QRT interacting with the adopter farmers at Kausalya Nagar on 10.01.2019

Plate 94: Images of technological intervention

Further, 2 units of BBFS, each at Dasratpur and Kausalya Nagar in Middle Andaman are being established for enhancing the livelihood of farmers who are seen with the QRT members.

National Extension Programme - IARI and CIARI

Mission Leader: A. Kundu

Team: S.K. Zamir Ahmed, P.K. Singh, A. Velmurugan, S. Yadav , R. Jaya Kumaravaradan , Siba Mahato, L.B. Singh, N. Bommayasamy, B.L. Meena, S.K. Pandey and B.L. Kasinath

Table 76: Coverage status of IARI varieties in ANI during rabi 2018-19

<table>
<tr><th>Sl. No.</th><th>Crop and variety</th><th>Quantity received (Kg)</th><th>No. of demonstration</th><th>Area under each demonstration (sq.m)</th><th>Location</th><th>Total area covered (sq.m)</th></tr>
<tr><td>1.</td><td>Cauliflower var. Pusa Meghna</td><td>0.20</td><td>7</td><td>500</td><td>South Andaman</td><td>3500</td></tr>
<tr><td rowspan="4">2.</td><td rowspan="4">Brinjal var. Pusa Uttam</td><td rowspan="3">0.30</td><td>7</td><td>500</td><td>South Andaman</td><td>3500</td></tr>
<tr><td>6</td><td>500</td><td>Middle Andaman</td><td>3000</td></tr>
<tr><td>3</td><td>500</td><td>Nicobar</td><td>1500</td></tr>
<tr><td>Total</td><td>16</td><td>1500</td><td></td><td>8000</td></tr>
<tr><td>3.</td><td>Moong var. Pusa Vishal</td><td>10</td><td>9</td><td>500</td><td>South Andaman</td><td>4500</td></tr>
<tr><td rowspan="3">4.</td><td rowspan="3">Palak var. Pusa Bharti</td><td rowspan="2">4</td><td>7</td><td>100</td><td>Middle Andaman</td><td>700</td></tr>
<tr><td>3</td><td>100</td><td>Nicobar</td><td>300</td></tr>
<tr><td>Total</td><td>10</td><td>200</td><td></td><td>1000</td></tr>
<tr><td colspan="3">Overall coverage</td><td>42</td><td></td><td></td><td>17000 (1.7 ha)</td></tr>
</table>

Under this project, the crop varieties of ICAR-IARI, New Delhi are being demonstrated across Andaman & Nicobar Islands since *rabi* 2017-18 with the assistance of KVKs. For the *rabi* 2018-19 season, a total of 42 FLDs were conducted *viz.* 7 in cauliflower var. Pusa Megna, 16 in brinjal var. Pusa Uttam (Plate 95), 9 in moong var. Pusa Vishal and 10 in palak var. Pusa Bharti covering 1.7 ha in South and Middle Andaman (Plate 96) ; and Car Nicobar (Table 76).

Plate 95: Brinjal var. Pusa Uttam

Plate 96: Palak var. Pusa Bharti

II. Impact Assessment of Technologies and Policy Outlook

1. Impact assessment of technologies

a) Noni

As a low input-high value crop, Noni is an ideal choice for alternate/additional source of income from marginal lands. At a commercial scale, an organic Noni plantation of 14 ha with 10,000 trees amidst arecanut attracts an initial investment of Rs.24.00 lakh/annum for first 3 years. Thereupon, Rs.14.40 lakh and Rs.1.50 lakh are incurred annually towards operational cost and FYM application respectively. The economic yield starts from the 4th year with 20-30 kg fruits/tree/annum, selling of which to the nearby processing unit at the rate of Rs.20/kg fetches a gross income of Rs.4.00-6.00 lakh/annum. At the end of 10th year, the plantation incurs an undiscounted expenditure and gross income of Rs.1.83 crore and Rs.3.40 crore respectively. When discounted at the rate of 12% per annum, the same amounts to Rs.1.09 crore and Rs.1.52 crore respectively with a B-C ratio of 1.39.

b) *CIARI rice varieties*

Under the theme "Technology application of promising high yielding varieties of Rice", 142 FLDs on promising rice varieties of CIARI *viz.* CSR 36, CIARI DHAN 4,5,6,7 and 8 covering 56.80 ha across North & Middle Andaman and South Andaman districts were conducted in collaboration with Division of FCI&P and KVKs during *Kharif*2018. Random survey among 30 adopter farmers revealed that CIARI rice varieties are performing better (55%) than the local varieties with regard to germination and number of productive tillers, while they show lodging tendency during flooding. CIARI 5, 7 and CSR 36 are the preferred varieties along with Gayatri which was introduced earlier. 45% farmers expressed their willingness to increase the acreage under CIARI 5, 7 and CSR 36 owing to their higher yield of 20-25%.

2. Policy outlook

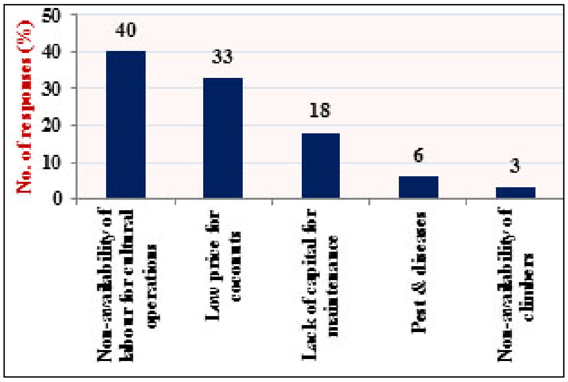
Prospects of Coconut Entrepreneurship Development in Andaman & Nicobar Islands: A Stakeholder's Perspective

R. Jaya Kumaravaradan , S.K.Zamir Ahmed, B.A.Jerard, Ajit Waman, Pooja Bohra,
V. Damodaran and A. Kundu

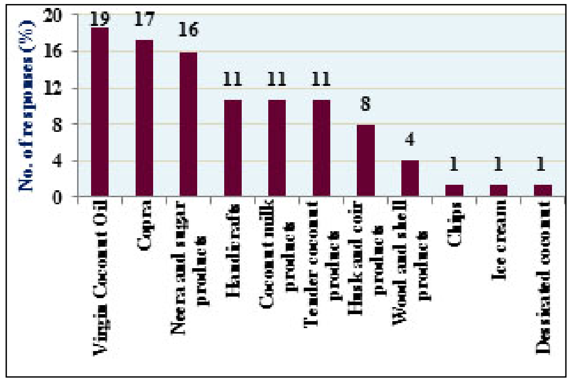
CIARI has organized World Coconut Day and Entrepreneurship Development Programme (EDP) on Coconut Value Addition on 03.09.2018 in collaboration with CPCRI, Kasaragod; Coconut Development Board, Kochi; National Horticulture Board, Gurugram; Department of Agriculture, A & N Administration; NABARD, Port Blair under the theme 'Wealth through Value Addition'.

Feedback on EDP on coconut value addition

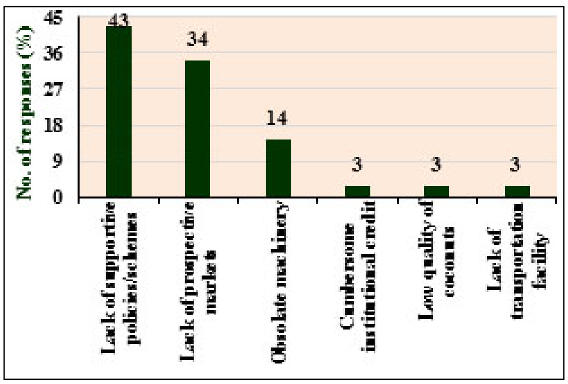
At he end of the programme, a survey has been conducted among randomly selected 56 participants comprising 11% farmers, 5% entrepreneurs, 4% farmer-cum-entrepreneurs, 66% aspiring entrepreneurs and 14% professionals to know their feedback on constraints in coconut cultivation, choice of new coconut start up, constraints in coconut industry, expected Institutional support to start/expand the enterprise, utility of the one-day programme and requirement of additonal programmes to strengthen entrepreneurship. The results are illustrated in the figures down below (Fig.55).



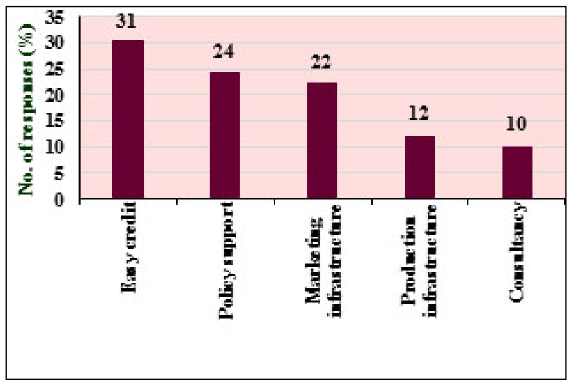
Constraints in coconut cultivation



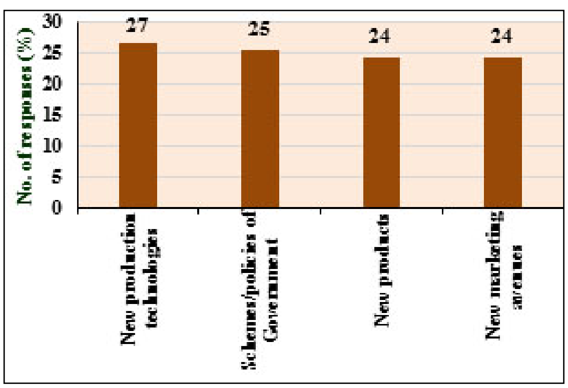
Choice of coconut startup



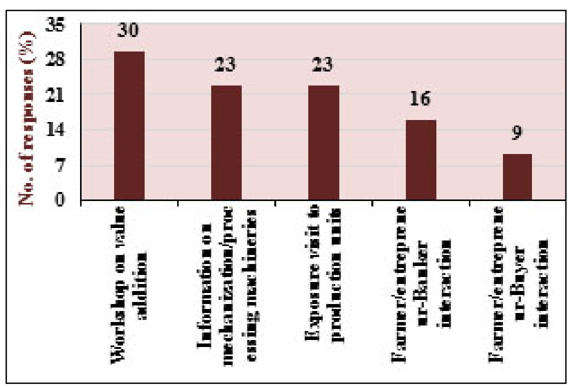
Constraints in coconut industry



Expected institutional support



Learnings from EDP



Future programs required

Fig.55: Feedback on EDP on coconut value addition

Suggestions for coconut entrepreneurship development

Further, the participants suggested various strategies for the coconut entrepreneurship development in the Islands as detailed in the table 77.

Table 77: Participants' suggestions for coconut entrepreneurship development in ANI

Sl. No.	Category	Suggestion
1.	Coconut production and value addition	• Conduct off-campus programs for more participation. • Provide farmers with quality saplings. • Provide trainings to farmers on scientific farm management practices. • Improve coconut productivity through latest technologies. • Create awareness among farmers about the profitability of value added products. • Promote Commodity Interest Groups to produce value added products.
2.	Marketing of coconut products	• Create awareness among public about various value added products by making them available in the market. • Promote retail outlets selling coconut products at subsidized price. • Promote export of coconut and its value added products. • Selectively promote more profitable coconut products. • Provide exposure to farmers/budding entrepreneurs on the marketing institutions.
3.	Coconut industry	• Provide technology support for startups. • Rectify the problems *viz.* non-availability of local labour which compels importing labour from mainland, lack of transportation facility for raw materials and high flight freight charges to send the processed products to mainland which escalate the production charges. • Simplify credit procedures. • Create awareness among stakeholders about the schemes offered by Department of Industries. • Provide consultancy to youth on taking up low investment projects.

Policy implication

From the feedback and suggestions of participants, it has been observed that:

- Location specific dissemination of processing technologies may be pursued, considering the resources, infrastructure and market opportunities *viz.* Neera and virgin coconut oil in Nicobar Islands; copra and food products in South Andaman.
- Market intelligence and quality standards may be strengthened to improve marketing of coconut value added products.
- Organic production of coconut may be projected to fetch premium price for coconut products of Andaman & Nicobar Islands.
- Drudgery reducing and processing equipment may be introduced to strengthen on-farm and community level processing.
- Coconut Processing Clusters may be formed at community level to strengthen product branding and marketing.

Agricultural Information Sharing and Knowledge Generation Towards Sustainable Management of Island Ecosystem with Special Reference to Fishery by Developing Mobile Apps

D. Karunakaran and R. Kiruba Sankar

The marine fishery sector of Andaman and Nicobar Islands is one of the most diverse yet underexploited as the current fish catches of 39284 tonnes against estimated annual harvestable potential of 1.48 lakh tones. One of the major issues identified in fisheries governance and management is the lack of adequate time series data towards assessing the resources in arational manner. The diverse spread of islands all over the lengthy coast of 1912 kms makes it difficult to exactly understand the marine fish landings due to various entry and exit points. Further due to lack of clarity for the needs of the exact data which are to be collected in a scientific manner also dents further planningfor fisheries expansion. There is a definite need to expand the marine fisheries sector with reliable fishery data which would aid in sustainable fisheries planning and management. The study initiated with the following background aims to tap the potential of mobile communications and technology towards gathering the fishery data from parts of the islands.Since almost all the fishermen use android mobile phone, it was considered to be advantageous to develop a mobile app in which fishermen can update their daily catch records which can be gathered all over the islands through a centralized server.

Server has been configured to develop online database for marine fish catch data to systematically store in the centralized databasein structured and organized manner. This will facilitate to bring all scattered catch data into one roof, so that researchers and planners can use this real time data for policy decision. This web application using PHP scripting and MySql database and development of mobile app is under process using Android studio (Plate 97).

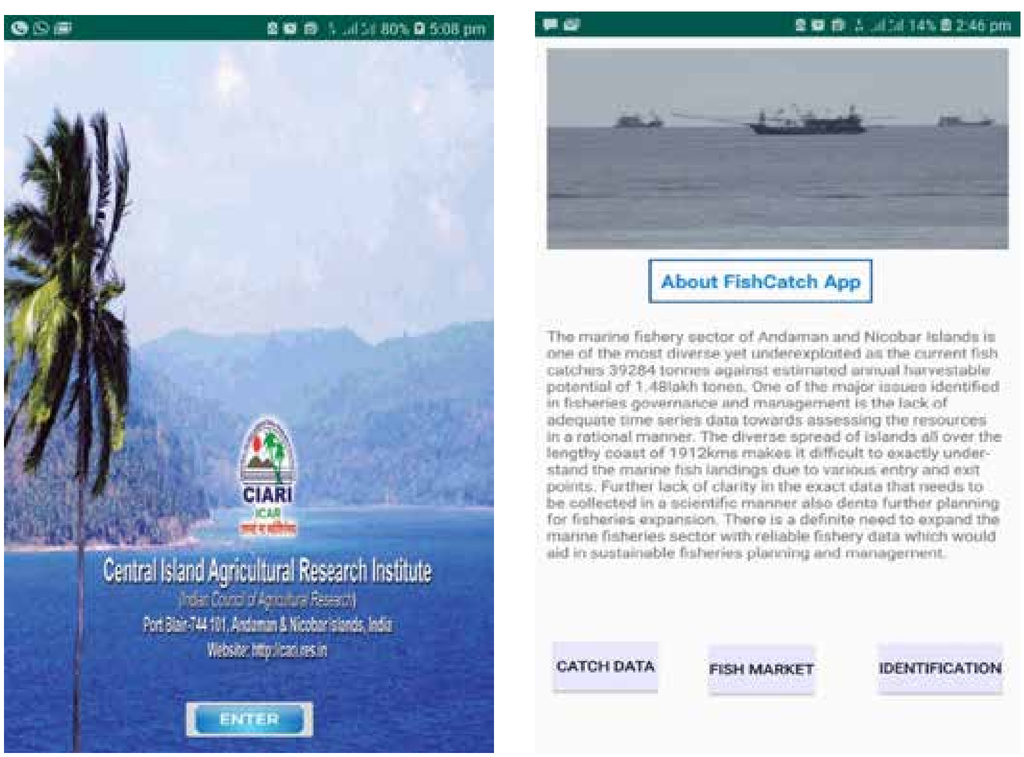


Plate 97 : FishCatch App

ICAR-KRISHI VIGYAN KENDRA, SOUTH ANDAMAN DISTRICT

ICAR-Krishi Vigyan Kendra, Port Blair, South Andaman district is functioning since 17th July, 1993 under the administrative control of ICAR- Central Island Agricultural Research Institute, Port Blair. It is situated at Sippighat on Andaman Trunk Road (NH-4) which is 7 Km away from the host Institute and 16 Km from the district head quarter (Port Blair). Under this district there are 29 Gram Panchayats under three Blocks and 24 Wards under Port Blair Municipal Council.

The KVK, Port Blair functions as change agent to bring about desirable improvement in the income of farmers apart from creating employment opportunities. To achieve its mandates, the KVK-CIARI, Port Blair started as one of the methodologies adoption of a few villages for all round improvement of the villages. 'Transfer of Technology Programmes' (ToTs) in an integrated manner were implemented so that holistic development could be ushered in with an overall upliftment in socio-economical status of farming community, as well as, in production of food and profitability.

The villages, namely, Guptapara, Manglutan, Indira Nagar, Wandoor, Humphrigunj, Sippighat, Chouldari, Ograbranj, Ferrargunj, Manpur, Collinpur, Shoal Bay, Namunaghar, Calicut, Rangachang, Chidiyatapu, 5 villages of Baratang (North and Middle Andaman District), Hut Bay (Netaji Nagar, R. K. Pur, V. K. Pur and Harminder Bay), Shaheed (Neil) Dweep and Swaraj (Havelock) Dweep, have been benefitted from such ToT programmes. The land mark achievements made and the lesson learnt from constraints in technological dissemination by ICAR-KVK in the above villages, have revitalized the approach of KVK with refinement in village adoption and technological intervention for integrated development.

Much emphasis has been laid on diagnosis of problems of farmers, developing their skills in improved technologies to mitigate identified problems, changing of attitude from unscientific to scientific cultivation and in management of farming systems, regular monitoring of the progress and assessment of impact for refinement and improvement and thereby achieving maximum sustainable development in all fields.

Trainings

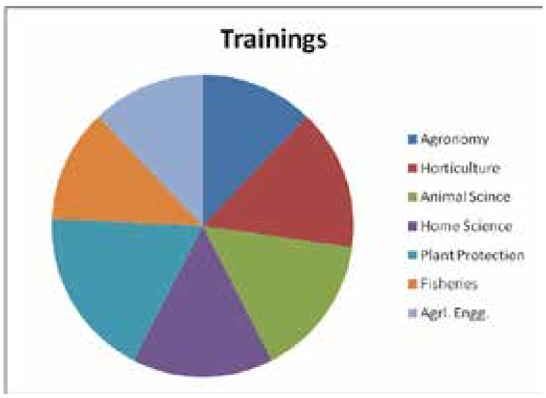
A total of 33 training (Vocational and in-service) were conducted of which 12 were "On" campus and 21 "Off" campus, by the concerned Subject Matter Specialist in closed collaboration with the host institute, line departments (Department of Agriculture, Fisheries, Animal husbandry, Industries, ATMA) of A & N Administration, NABARD and NCUI, Port Blair to have a holistic approach. The target groups trained were Practising farmers (441), Rural youth/Farm women (290), SHGs (210) and the Extension functionaries (46) which totalled to (987) in numbers (Table 78). The training programmes conducted were "Off" and "On" campus, ranging between three to thirty days in durations. While imparting the training, the principles of 'Teaching by doing' and 'Learning by doing' were thoroughly followed with an objective to have a desirable change in knowledge, skill and attitude of the groups (Fig.56).

The practical training programmes envisaged acquiring of high quality skill through appropriate training. Supportive literatures were supplied after the completion of the training programmes which helped in the reinforcement of the technology taught.

During the whole programme, the KVK was conscious to ensure maximum participation of the farm women. So, strategies were formulated to involve them directly in the development process. These training programmes helped them to indirectly come out from the orthodox feeling and paved way for the confidence and capacity building. The trainees after the programme felt sound in the subject taught by self doing. This has led to the adoption of the scientifically tested agricultural technologies by majority of them in the shortest possible time, which in turn helped, to increase the level of productivity of various farm enterprises and income of the farmers.

Table 78: Abstract of Training Programme Conducted

Discipline	Trainings	Male	Female	Total
Agronomy	04	45	60	105
Horticulture	05	72	108	180
Animal Scince	05	48	104	152
Home Science	05	07	128	135
Plant Protection	06	58	139	197
Fisheries	04	52	59	111
Agrl. Engg.	04	72	35	107
Grand Total	**33**	**354**	**633**	**987**



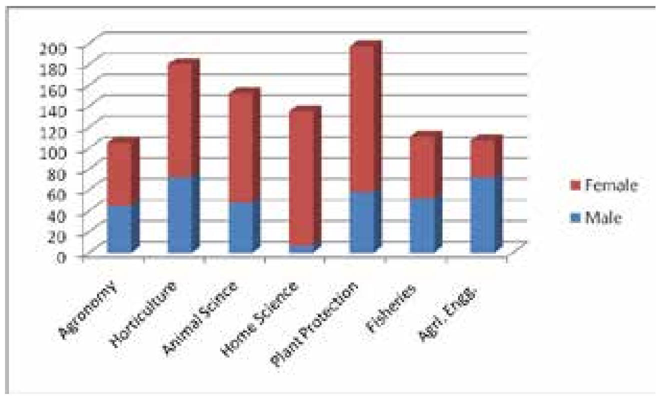


Fig.56: Subject wise training programmes

Skill Development Training Programs at ICAR-KVK, Port Blair (ASCI Affiliated) under Rashtriya Krishi Vikas Yojana (RKVY)

Two 30 days skill development training programs under Rashtriya Krishi Vikas Yojana (RKVY) through Agriculture Skill Council of India (ASCI) for the job role "Coconut Grower" (200 hrs) and "Small Poultry Farmer" (240 hrs) was held at the ASCI affiliated training centre ICAR-KVK, Sippighat, South Andaman from 20th February to 27th March, 2019 (Plate 98). A total 18 trainees benefitted from skill development training programs for the job role "Coconut Grower" and 20 trainees in the job role "Small Poultry Farmer".

Plate 98: Glimpses of Training

Practical session on Debeaking

Exposure visit to Feed Mill

Training interacts with the expert

Skill trainings on tree spices

Advances in paddy production

Groundnut seed production

Backyard poultry farming and value addition

Employment generation through mushroom production

Application of biological control technique in IDM&IPM

Value adition training

On Farm Trials (OFTs)

Eight OFT in the field of Agronomy, Horticulture, Fisheries, Animal science, Agricultural engineering, Home science, Plant protection were conducted and results are as follows:

(OFT-1) Evaluation of Bacterial wilt resistant Brinjal varieties

Three bacterial wilt resistant brinjal varieties were evaluated at South Andaman in seven different locations at farmer's field. The planting was done following inter-row and inter-plant spacing respectively of 65 and 45 cm respectively. The observation data revealed that all three developed varieties are found better for fruit yield than the check variety Pusa Purple Cluster. CIARI Brinjal 1 gave 201.6 g/fruit, followed by CIARI Brinjal 2 (86.25g/ plant) & CIARI – Brinjal 3 (90.93 g/plant). CIARI Brinjal 1 showed the lowest disease index (6.04 %) followed by CIARI Brinjal 2 (7.8 %) and CIARI Brinjal 3 (20.4 %) respectively (Plate 99).

CIARI Brinjal 1

CIARI Brinjal 2

CIARI Brinjal 3

Plate 99: Evaluation of Bacterial wilt resistant Brinjal varieties

(OFT-2) Evaluation of mineral mixture and probiotics in desi cattle

The present OFT revealed that the average milk yield (lit.) recorded highest in the group fed with Normal feeding + Probiotics + Mineral supplementation in the tune of 2.55 / day /animal followed by group fed with Normal feeding + Mineral supplemenation. The lowest milk yield was recorded in the group fed with Normal feeding + Probiotics. However, on average the milk yield characteristic is recorded to be 1.40 litres/day /animal which is quite low to their potential yield which might be due to poor supply of feed and any additives even during the lactation period. Milk yield characteristics were also recorded after the period of supplementation. Hence, it is suggested that, exogenous source of feed additives in the form of mineral / probiotics supplementation is very essential in lactating cows during the peak lactation phase for improving the milk yield as per the genetic potential of desi cattle.

(OFT-3) Performance evaluation of poultry birds through mineral supplementation

The results indicated that the mineral mixture should be added in feed for higher production and to check mortality. Body weights of the bird reared under the different percentage of mineral mixture in the farmer's field were also recorded in order to assess the production performances of the bird. It revealed that the bird reared with 2% mineral mixture recorded the body weight at the age of 8 weeks in the tune of 1900g, which was better than the other two groups. The highest net returns of Rs. 3100/- was recorded in 2% mineral mixture with BC ratio of 1.81.

(OFT-4) Effect of early post emergence herbicide on growth, yield of rice

On farm trail was carried out during kharif season, 2018 in the farmer's field at Collinpur, Manglutan, Guptapara villages of South Andaman to find out the efficacy of early post emergence herbicide on growth, yield of rice. The predominant weed of experimental field were *Echinochloa colonum, Cynodon dactylon* and *Setaria glauca* among grasses, *Cyperus iria, Cyperus difformis, Cyperus eragrostis, Cyperu shaspan* and *Fimbristylis miliacea* among sedges and *Monochoria vaginalis, Marsilea quadrifolia, Sphenoclea zeylanica, Ammannia baccifera* and *Bergia capensis* among BLW were observed during the entire crop growth season. Application of bispyribac sodium + metamifop at 70 g/ha recorded higher weed control efficiency of 62.2 and 75.3 per cent at 20 and 40 DAT. Yield attributes like number of productive tillers/m^2, filled grains/panicle, panicle weight, panicle length and grain yield significantly influenced by weed management practices. Application of bispyribac sodium+ metamifop at 70 g/ha recorded higher grain yield of 41.2, 28.9, 13.5 % as compared to T_3, T_2, T_1 (Plate 100).



Plate 100: Weed management in Rice field

(OFT-5) Effect of integrated nutrient management on growth and yield of maize

On farm experiment was carried out during rabi season of 2018-19 in the farmer's field of Guptapara, Collinpur villages of South Andaman to find out effect of integrated nutrient management on growth and yield of maize. Growth and yield attributes of maize were significantly influence by integrated nutrient management practices. Significantly higher grain and stover yield of 36.5 and 28.4% respectively was recorded with the application of 75% RDF+ biofertilizer (T_4) as compared to farmer's practices. Application of 75% RDF+ biofertilizer (T_4), 100% RFD (T_2), bio-fertilizer (T_1) recorded 36.5, 31.4,15.7% higher nutrient use efficiency as compared to farmer's practices (Plate 101).


Plate 101 : Integrated nutrient management in maize

(OFT-6) Effect of different water application methods in brinjal cultivation

On farm trial in 5 locations were conducted for checking the performance of different water application methods in brinjal cultivation. Results of the trial indicated that adoption basin irrigation method around the individual plant increases the water application efficiency by 22% in comparison to the furrow irrigation. The labour requirement increases by 12% as irrigation in basins requires more time (Plate 102).



Plate 102 : Basin, Furrow and Bamboo Irrigations around the plants

(OFT -7) Effect of different mulching methods in coconut plantations

The trial was conducted in 5 different locations and results showed that the treatment of application of weed mart as the mulching material around the coconut plant is the best as compared to mulching by coconut husk and paddy straw mulching. There is an increase in yield by 6.25% in weed mart mulching as compared to paddy straw mulching due to more available of water at root zone depth and less weed infestation (Plate 103).


Plate 103 : Mulching by plastic weed mate and Coconut husk

(OFT -8) Process optimization for development of finger millet incorporated dietary fiber enriched fish cutlets from marine fish Mrigal (*Lutjanus spp.*) using response surface methodology

The dietary fibre enriched fish cutlet from marine fish Mrigal (*Lutjanus spp.*) was prepared. The process optimization was carried out using response surface methodology (Box-Behnken design). Design Expert software version 10.0.1 was used for data analysis. The independent process parameters selected for optimization of fish cutlet were potato (boiled and mashed) (30, 40 and 50 per cent),minced fish: finger millet (2:1, 3:1 and 4:1) and water intake (10, 15 and 20 ml) against the responses organoleptic evaluation and nutritional quality. The constant parameters were spices and condiments, frying time, frying temperature, cutlet weight, size and thickness. The result showed that appearance ranged from 6.5-8.5, colour 7.0-8.9, flavour 6.2-8.3, texture 6.5-8.3, taste 6.8-8.6 and overall acceptability 6.9-8.6 on nine point hedonic scale (Plate 104 & 105) .

Plate 104 :Ingredients of fish cutlets

Plate 105: Fish cutlets

Front Line Demonstrations (FLDs)

Thirteen FLDs in the field of Agronomy, Horticulture, Fisheries, Animal science, Agricultural engineering, Home science, Plant Protection were conducted and salient achievement are as follows:

(FLD-1) Organic cultivation of Elephant Foot Yam C.V. Gajendra

Conducted 6 FLD on organic cultivation of elephant foot yam var. Gajendra in farmers field at Port Mout, Lal Pahar, Rangachang, Ferrar Gunj and Guptapara villages of South Andaman in an area of 0.05 – 0.2 ha and recorded the yield of 800- 3400 kg/farmer. Each farmer earned net income of Rs. 12,000 – 51,200 from elephant foot yam cultivation with B: C ratio ranging from 2.8 to 3.3 (Plate 106).

Plate 106: Elephant Foot Yam c.v. Gajendra and Harvested Corm

(FLD -2) Organic Production of Colocasia c.v. Sree Kiran

Conducted six numbers of FLD on organic cultivation of Colocasia c.v. Sree Kiran in farmers field at Nayapuram, Mucca pahad, Calicut, Bimblitan and Ogra braj villages of South Andaman in an area of 0.12 ha and recorded the yield of 180 - 200 kg/farmer. Each farmer earned average net income of Rs. 5700 from Colocasia with a B: C ratio of 2.9 (Plate 107).

Plate 107: Colocasia c.v. Sree Kiran in farmers filed

(FLD-3) Backyard Poultry Production

A Front Line Demonstration on Backyard Poultry Production with Nicobari Fowl and Vanaraja were conducted in five selected farmer's field. The result revealed that in limited feed supplementation Nicobari Fowl produced 142 Eggs/bird whereas Vanaraja produced 119 Eggs/bird annually. Though Vanaraj has genetic potential of producing 200-220 Eggs/annum, in backyard condition it produced half its potential wheras Nicobari fowl produced 80-90 percent of its potential in the same condition. Five demonstrations with Nicobari fowl and Vanaraja birds were undertaken in farmers' field. The result showed that Nicobari fowl gave an yield of 140 eggs/birds which was 75 percent more than local bird (Plate 108).

Plate 108: Backyard Poultry Production with Nicobari Fowl and Vanaraja

(FLD-4) Broiler Farming

Four Front Line Demonstration on Broiler farming were conducted in farmer's field .It was found that in 35 days the birds attained marketing age with an average live body weight of 1.56 Kg per bird with feed conversation ratio of 1.89 (Plate 109).

Plate 109 : Front Line Demonstration on Broiler farming

(FLD -5) Real time nitrogen management in rice

Real time nitrogen management in rice were demonstrated in different locations *viz*., Wandoor, Manglutan and Guptapara villages of South Andaman. The results revealed that on an average grain and straw yield of 4395 and 6910 kg/ha respectively was recorded which was 16.3 and 23.7 per cent higher grain yield and straw yield as compared to local check (Plate 110).


Plate 110: Real time N management in rice

(FLD -6) Greengram

Greengram of cv. VBN (Bg)-8 has been demonstrated in nine farmers' field *viz.,* Sundergarh, Nayagarh, Collinpur and Guptapara villages in an area of 0.5 ha. The results revealed that in an average yield of 4.7 q/ha in tune of 30.5 per cent higher grain yield as compared to local check (Plate 111).


Plate 111: Greengram ***cv. Pusa Vishal***

(FLD-7) Oyster mushroom

Front line demonstration on oyster mushroom production was demonstrated on paddy straw. The complete mycelial colonization were found within 15, days where as primordium initiation and fruiting body formation were recorded within 20 & 24, days. The paddy straw substrate gave the maximum mushroom yield (715 g per 1 kg wet substrate) and this yield was significantly different from banana leaves (500 g per 1 kg wet substrate) which act as local check. The maximum percentages of biological efficiency were obtained in paddy straw is 102% as compared to local check 71.42% (Plate 112).


Plate 112: Oyster Mushroom production

(FLD -8) Integrated Disease and Pest Management on Okra

A front line demonstration on Integrated Disease & Pest management in Okra was demonstrated at farmer field. During demonstration complete IPM package with schedule were given to the farmers. From the demonstration it revealed that IPM module had significantly reduces the Downy Mildew & Root Rot disease incidence (47.12% & 62.54%) whereas Leaf hoppers & Shoot and fruit borer infestation were reduced upto 41.32 & 37.59 % as compared to farmers practices (Plate 113).


Plate 113: FLD on IPM module demonstration in Okra

(FLD -9) ICAR-CIAE developed improved Naveen Sickle

ICAR-CIAE developed improved Naveen Sickle was demonstrated among the paddy growing farming community and was found that the output of the implement in cutting of paddy straw was 150m^2/h as compared to the farmers practice of 120m^2/h. The less in drudgery in cutting operation reduces the cost of operation by Rs 911.40 per ha.

(FLD -10) Popularisation of Cow pea as erosion resisting crop

Cow pea crop was popularised among the farmers cultivating on slopes. The crop was found to be effective in checking soil erosion on slopes but as compared to natural vegetation the soil erosion was increased by 150%.

(FLD -11) Popularization of conservation trench with mulching for rainwater conservation in coconut plantation

For effective rain water conservation, conservation trench with mulching was popularised around coconut plant in South Andaman (Plate 114). Result showed that rain water was able to retain in the trenches for 5 days after the cease of last storm event. The crop yield was increased and the BC ratio was found to be 5.7 as compared to farmer's practice of non mulching BC ratio of 4.2.

Naveen Sickle

Erosion resisting crop (Cow pea)

Trench for water conservation

Plate 114: Popularization of conservation trench

(FLD -12) Vermi compost production

Front line demonstration on vermi-compost preparation was carried out in farmers' field at South Andaman for 90 days of duration. The yield of vermi-compost was 60.83%, with BCR of 2.73, whereas sole compost BCR was 1.56 only. A total of 667 kg of vermi-compost was prepared with an area of 1.57m^3, which fetched them a net return of Rs. 10,575 (Plate 115).

Plate 115: Vermi-compost production

(FLD -13) Crab fattening in Tsunami affected land

Two units on water crab fattening technology was conducted at Guptapara and Port Mout villages by involving unemployed youth as trainee. The pond area developed was 400 sq. mtrs each. In the brackish water pond 50 water crabs (av. 1.3 kg size) were released during July, 2018 and daily a total of 3.0 kg low priced fish (ray fish &)were fed twice daily. The cost of water crab was @ Rs. 450/ kg and feed cost was @ Rs. 30/kg. Due to virginity of the pond area without any pollution, availability of enough organic loads (detritus) the hardening of crab took 18 days. Total crab harvested on 18th day was 46 crabs (70 kgs) with survival of 92 %. After hardening of crab, it was exported to Kolkata @ 1500/kg and total gross amount realized was Rs. 1, 05,000/- . The cost of labour was 12,000/- + feed cost of Rs. 1530/-. The feed conversion ratio was 4.0% and B:C ratio was 7.76. After one cycle of 17 days, the activity was discontinued due to some administrative reason (Plate 116).

Plate 116: Crab fattening in Tsunami land in Andaman

Field days

Five numbers of "Field days" were conducted on different activities and a total of 164 numbers of beneficiaries were participated (Table 79). During the field days programme various line department officials, SHGs and NGOs and Extension officers from the National Cooperative Union of India, Port Blair also participated.

Table 79: Details of Field Day

Discipline	Title	Venue	No of participants
Horticulture	EFY cv. Gajendra	Rangachang	20
	CRIFS	KVK, Sipighat	53
Animal Science	Poultry farming	KVK, Sipighat	27
Plant Protection	Mushroom cultivation	KVK, Sipighat	36
Agri Engg	Arecanut Harvester	Muccapahad	28
Total			**164**

Extension activities

During the year a total of 25 numbers of major group of extension activities were conducted. A total of 2255 numbers of farmers including extension personals from line departments like Agriculture, Animal husbandry ,Fisheries, Industries , ATMA, NCUI , Students from Govt. Schools and Colleges from South Andaman district. Honourable M P, Shri Bishnu Pada Ray, Smti. Baby Fareeda , Adhyakshya , Zilla Parishad, South Andaman district, Secy. Agriculture A & N Administration, Pramukh, local Pradhans, BDO's of Ferrargunj block participated (Table 80 and Plate 118) .

Table 80: Details of extension activities

Title of the programme	Date	Venue	No of participants
Krishi Unnati -2018	17.03.2018	CIARI-Port Blair	490
PM's Live Telecast on SHGs	12.07.2018	KVK,Port Blair	165
World Coconut Day	03.09.2018	CIARI, Port Blair	375
Mahila Kisan Diwas	15.10.2018	KVK,Port Blair	120
World Soil Day-2018	05.12.2018	Chouldari	255
National Farmers Day	17.12.2018	DDK, Port Blair	Many
PMKSN	24.02.2019	KVK, Port Blair	150
Pre -Rabi Campaign	23.02.2019	KVK, Port Blair	120
District Kisan Mela	25.02.2019	KVK, Port Blair	580
Grand Total		**2255**	

Plate 117: Glimpses of Extension Activities - (Organizing National Programmes)

Krishi Unnati Mela -2018, Honble M P of A & N Islands Lok Sabha

PM's Live Telecast on SHGs

Mahila Kisan Diwas - 2018

World Coconut Day -2018

World Soil Day-2018

Pre -Rabi Campaign

PMKSN

Secy.Agriculture A & N Administration witnessing District Kisan Mela

Diagnostic visits

During the period 108 diagnostic visits were made on various field crops and horticultural crops and the problems i.e. Banana Wilt Disease (Plate 119), Phomopsis blight (Plate 120), Fruit rot disease in Brinjal (Plate 120), Root rot in Papaya (Plate 121), Bacterial wilt in Brinjal (Plate 122), Leaf eating caterpillar (Plate 123), Pod borer in Beans (Plate 124), Downy mildew in cucurbits (Plate 125), Wilt disease in Arecanut in South Andaman district (Plate 126 and 127) were identified and solved.


Plate 118 : Banana wilt disease


Plate 119 : Phomopsis blight and Fruit rot disease in brinjal


Plate 120: Root rot in papaya

Plate 121 : Bacterial wilt in brinjal

Plate 122 : Leaf eating caterpillar

Plate 123: Pod borer in beans

Plate 124: Downy mildew in cucurbits


Plate 125: Wilt disease in areca nut


Plate 126 : Insect attack symptom in areca nut

Revenues from Farm Products from 0.9 ha.

SL No.	Receipt No-CIARI	Date	Amount deposited(Rs)
01	14337	22.06.2018	6,339.00
02	14408	09.08.2018	2,373.00
03	14443	11.09.2018	4,119.00
04	14469	04.10.2018	3,748.00
05	14498	31.10.2018	2,655.00
06	-	17.12.2018	5,935.00
07	-	09.01.2019	5,895.00
08	-	05.03.2019	35,418.00
09	-	16.03.2019	5,070.00
10	-	30.03.2019	3,255.00
Grand Total			**74,803.00**

SUCCESS STORY

Pond based integrated farming system – a sustainable livelihood of Island farmer

Shri Ashok Kumar Roy, aged 48, a progressive farmer blessed with an inquisitive mind belonged to Badmas Pahad Village, South Andaman district. He earned his livelihood by backyard poultry farming (desi poultry birds 20 Nos.), mud crab culture and cultivating traditional vegetables like amaranthus, nalibhaji, okra, brinjal, chilli, bitter gourd, pumpkin and bottle gourd on his leased land (1.5 ha) employing indigenous methods. With this merger income (Rs.80000/-120000/- per annum) he used to sustain his family life (6 family members). From 2011 he used to have regular contact with the KVK, Port Blair for development of his agricultural land for maximum returns and has undergone many training programmes in the areas of poultry farming, psiculture, vegetable cultivation etc. He meticulously began to put into practice the knowledge, skill in his farming. Initial orientation from the experts of KVK and their frequent visits set him on the path towards progress (Plate 117). Under the NICRA Research Project of ICAR-KVK, Port Blair he had established pond based integrated farming system on his land. The major components were fish + poultry + vegetables & fruits. He adopted composite fish culture (Catla, Rohu and Mrigal) in his small pond of 0.5 acre and got an average yield of 250 kg fish per year. Besides, through ICAR-KVK, Port Blair inputs of high yielding and climate resilient vegetable seeds and seedlings [Amaranthus (CARI Ama red and green),Indian Spinach (CARI Poi 1),Spinach c.v. Jinta, Sweet potato (CARI-SP 1), French Bean (IIHR-909), Chillies (LCA-353, KA-2), Pumkin (Ardhaman red), Cucumber (Point set) , Brinjal (CARI Brinjal-1), Bitter gourd (Rakhushi), False coriander (CARI Broad Dhania), Okra (Arka anamika), Bottle gourd (Tilalauki) etc.], Marigold (Pusa narangi), perennial fruit plants such as papaya, lime, banana, drumstick and curry leave were given. The yield of vegetables and fruits was 4.5 ton/year. He has also adopted backyard poultry (Nicobari fowl-50nos) and Duckery (Khaki Campbell duck-50 Nos.) in his pond based Integrated Farming System model. The total cost of cultivation was Rs.150000/- per annum. However, the gross return obtained was Rs. 350000/- per year with net profit of Rs.200000/- . He also made optimum use of all the farm waste into organic manure and utilized in vegetable cultivation. He received many awards from ICAR-KVK and ICAR-CIARI for his relentless efforts towards agriculture under the vulnerable Island ecosystem. He achieved his self-sustainability and livelihood in pond based integrated farming system and is also an inspiration for others.

Plate 127: ADG (Hort Sc.-I), ICAR-New Delhi visit the field of the farmer

National Initiative on Climate Resilient Agriculture (NICRA)

Nagesh Ram, L.B. Singh, B. K. Nanda, N. Bommayasamy,V. K. Pandey, N.C. Choudhuri, Harapriya Nayak ,Zachariah George and Jopin Chakravarthy

Objectives

- To enhance the resilience of Indian agriculture covering crops, livestock and fisheries to climatic variability and climate change through development and application of improved production and risk management technologies.
- To demonstrate site specific technology packages on farmer's fields for adapting to current climate risks.
- To enhance the capacity of scientists and other stake holders in climatic resilient agricultural research and its application.

[A] Natural Resource Management

During the year 2018-19, some of the climate resilient successful technologies demonstrated under the project are well adopted by the beneficiaries and horizontal expansion has been made in the adopted villages. These are as below.

Broad bed and furrow system of cultivation

The demonstrated technology of Broad bed and furrow system (BBF) of cultivation under the project has been well adopted by the farmers Sri Kasinath Saha and Sri Kartick Roy of Gopal Nagar, Badmaspahad village (Plate 128). They converted their low lying lands into broad beds and furrows and thus brought 2.5 ha of submerged land into cultivation. With technical support and guidance under the project, the farmers invested their own money in making the system of cultivation.

Plate 128: New BBFs constructed in Gopal Nagar, Badmaspahad

Desilting of water harvesting structure

One farmer Sri Kasinath Saha of Gopal Nagar, Badmas pahad desilted his pond and increased the volumetric capacity of the pond. From pond more fresh water (450 cum) was obtained to provide life saving irrigation for the crops during the summer months (Plate 129).

Plate 129: Desilted pond at Gopal Nagar, Badmaspahad

Raised bed system of cultivation

Raised bed system of cultivation was adopted by one farmer Shri Swarn Singh of village Port Mout. In the system, he raised the level of his waterlogged land by 1.2 m by putting the excavated soil from the narrow trenches made inside the same field. The whole land of 1.0 ha has been converted to broad beds and narrow trenches. The main objective behind the land manipulation technique was to facilitate the land for cultivation of vegetable crops during the rainy months (Plate 130).

Plate 130: Raised bed system of cultivation at Port Mout

Crab fattening culture by the rural youth

The pond excavated in the brackish water inundated area under the project during the previous year has been utilised by one rural youth Sri Mandeep Singh of Port Mout village for crab fattening purposes. The cage system of culture has been adopted by him by utilising the locally available material (Plate 131).

Water logging stress tolerance rice (*var.CR Dhan 500*) was demonstrated in submerged area in two farmer's field in an area of 1.0 ha during the wet season (August to December, 2018) at Lalpahar village of South Andaman (Plate 132). The results revealed that significant difference was observed on growth and yield attributes of submergence tolerance rice as compared to local rice variety. CR Dhan 500 recorded 40.7 per cent higher productive tillers/ m^2, 32.2 per cent higher filled grains/panicle higher grain and straw yield of 22.5, 16.1 per cent respectively as compared with local check which is mainly owing to highly suitable for submerged condition. The higher net return of Rs.45000/- with the B:C ratio of 2.43 was recorded under CR Dhan 500 than local check.

Plate 132: var.CR Dhan 500

Salt tolerant paddy varieties (*var. CARI Dhan 5*) was demonstrated in sea water inundated area of tsunami affected land in four farmer's field in an area of 1.5 ha during the wet season (August to December, 2018). CARI Dhan 5 recorded 14.8, 13.8, 14.0, 40.7 per cent more productive tillers/m^2, no. of field grains/panicle, panicle length, grain yield respectively as compared to local check. The higher net return of Rs. 15626/- with B:C ratio of 1.82 whereas, lower grain yield and net return was recorded in local check.

Plate 133: var. CARI Dhan-5

Downey mildew resistant maize (var. CoH (M) 6) was demonstrated in three farmer's field at NICRA adopted villages of lalpahar, Gopalnagar of south Andaman with an average area of 0.4 ha per farmer (Plate 134). The results indicated that higher plant height and plant dry matter production was recorded in CoH (M)-6 compared to P 3204. Significant difference was registered on yield attributes of maize cultivars. The yield parameters of maize *viz.,* cob length, cob girth, no. of rows and grains/cob, test grain weight were higher in maize cultivar of CoH (M)-6. The grain and stover yield of 4.21 and 7.86 t/ha was observed which was 22.7 and 27.0 percent higher grain and stover yield compared to local check. The higher net return of Rs.28620/- with B:C ratio of 1.84 was recorded in CoH(M)-6.

Plate 134: Downey mildew resistant maize

Impact of Climate Resilient Technologies from 2011-2018

Improved shelters for reducing heat stress in livestock & Poultry

A major part of our country is characterized as humid tropic and is subjected to extended periods of high ambient temperature and humidity. Thermal stress lowers feed intake of animal which in turn reduces their productivity in terms of milk yield, body weight and reproductive performance. Climate of Andaman and Nicobar Islands is also having tropical and high humid conditions. Before adoption of village; there was mass mortality of desi poultry birds, which may be due to improper care, scavenging type and completely closed shelters with tins without proper aeration system. Similarly cow shelters were unclean and un-even with tin roof in open areas making the animals unrest during sunny and rainy days, resulting in reduction of milk production due to unhygienic floor condition with health degradation. Therefore, we worked to improve the shed and hygienic condition to enhance the milk production and health of the animals at NICRA adopted village. Necessary trainings were conducted on scientific backyard poultry and dairy farming. For dairy and farm animals, one open shelter is made under the coconut garden with the farmer participation under our guidance for keeping the animals during day in summer and night time during rain. Similarly poultry shed also renovated and provided wire mesh through NICRA for cross ventilation to prevent mortality due to heat stress and accumulation of noxious gases inside the shelter. Poultry mortality were noticed very high during pre-monsoon and post monsoon seasons due to intake of polluted and stagnant water during their scavenging time which is directly linked with the change in climate/ season. To save the birds, farmers were advised not to leave the birds during pre and post monsoon period for scavenging and keep the birds in closed condition with proper feed and water and antibiotics. They were also advised to maintain proper hygienic condition in the shed to check the mortality due to the humid climatic condition. Deworming method was also suggested for control of internal parasites. Due to the NICRA interventions with aerated shelters, mortality in country birds was reduced to 30% in the adopted villages of NICRA after renovation of the shelter into open type. Similarly, milk Yield was increased by 33% over local unmanaged and unhygienic closed shed. Mortality rate in calf was also reduced due to reduction in heat stress in summer (Plate 135). The gross return was `9,600 which were more than the closed shed condition (7,200). The BCR in open shed condition is 2.2 which are higher than the closed shed condition (1.4).

Before Adoption	After Adoption

Shed fully covered with tin

Netted poultry shed

Unmanaged Cow Shed

Open shed under coconut plant

Plate 135: Before and after adaptation scenario

Animal Hump Sore - an endemic Problem

Under the climate change scenario like hot and humid climate of the Island, maximum animals are heavily infected with hump sore disease (Plate 136), which is endemic to the Islands and commonly known as *Stephano filariasis*. It is a filarial disease of cattle caused by a minute nematode parasite measuring a size of 3.0 -4.5 mm in male and 7.0-13.6 mm in female. The intermediate host of the nematode is *Musca conducens*. *Musca conducens*, the intermediate host of the nematode, may be unable to inject the infective larvae of *S. assamensis* through healthy skin but may deposit them in the exudative lesions produced by another agent such as bacteria or injury. The sore is generally occurring in the region on and around the hump, eye, ear, base of the horn, joints in legs etc. However, the sore can be seen primarily on and around the hump and hence it is known as Humpsore. It is a menace in the cattle and buffalo populations in the Islands which decreases the production level in the animal due to conducive climatic conditions. When hump sore appears, an animal are seen to rub / scratches their hump either in tree trunk on in cemented poles may be due to itching sensation due to infection.

The incidence of hump sore is common in Andaman and has been reported in the 'National Initiative on Climate Resilient Agriculture' (NICRA) project operated villages namely, Port Mout and Badmas Pahar. Farmers reported that because of these diseases the animals are not grazing properly which drastically reduces the milk production as well as health degradation.

Relevance to the climate resilient: Generally in these Islands the problem of hump sore is noticed during the end of North-East monsoon (October). A large number of flies which are considered to be a biological vector of the hump sore disease seen on the bodies of grazing animal causing irritation and finally convert into sore on the skin.

Preventive measures adopted in the NICRA Village: The farmers of NICRA villages were advised to follow the following preventive measures to curb down the prevalence rate of hump sore disease.

- Cleaning of shed areas and application of Neem oil twice everyday on the infected areas of the animal in-order to check the fly population.
- Sore or wound should be properly treated with zinc oxide ointment.
- The entire affected animal in the area should be treated in a group.

Treatment under practiced

- Application of Zinc oxide ointment: the composition of ointment is Zinc Oxide- 10g; Vaseline as a base -89 g; Resorcinol-1 g and few drops (2-3) of crystal violet.
- Injection of Ivermectin S/C @ 1ml/50 Kg B.Wt. in the interval of 28 days along with ointment application.
- Injection of Levamisole Hydrochloride I/M @1ml/15-20 Kg body weight to the affected animal.


Plate 136: Infected animals with hump sore disease

System of Rice Intensification

Andaman and Nicobar Islands with 7650 ha of rain fed low lands under rice, have a great potential to improve the productivity through SRI method of cultivation. At present the average productivity of rice is only 2.3 to 2.7 t/ ha due to low level of input and poor management practices. The crop lodging occurs due to intense rainfall and high wind velocity during growth period and maturity stage. Under SRI planting of early single seedlings (14 days old), width spacing of 25 x 25 cm there is greater scope for development of more tillers by intercepting higher solar radiation. In order to elucidate the parameters contributing for yield determination, System of Rice Intensification (SRI) is compared with conventional method of cultivation (Plate 137).

Details of the technology: Type of nursery with age of seedlings (SRI nursery at 14 days old and conventional nursery at 28 days old) was assigned with two spacing (25 x 25 cm & random planting) in the plots. The recommended dose of fertilizer (90: 60: 40 kg NPK ha^{-1}) was applied through urea, rock phosphate and MOP. Nitrogen was applied in four splits at 10, 20, 30 and 40 Days after planting (DAP) while 100 % phosphorus and 50 % potassium was applied as basal. Remaining 50 % potassium was applied at 20 DAP. Cono weeder was operated between the rows in both the directions three times at 15, 30 and 45 days after transplanting, which resulted in incorporation of weeds with simultaneous stirring up of soil (Plate 138). The plots were rainfed and excess water was drained out from the field.

Relevance to climate resilient: Due to heavy rains weeds are the major problem resulting in poor growth and less tiller production in conventional methods. Cono weeder was used for incorporation of weeds with simultaneous stirring up of soil in SRI method of cultivation. It induced biological activities and aeration in the root zone and helped good vegetative growth of plants. Use of cono weeder has enhances root growth and more tillage production during the entire growth period. Due to higher root growth, plant has more opportunity to absorb moisture from different soil layers which facilitate to withstand moisture stress during drought in later stages of rice production.

Heavy rainfall of 150.7 mm was received at harvesting stage. Complete lodging was observed in normal planting whereas no lodging was observed under SRI planting. This might be due to the compact hill with more tillers and deep root with increase root weight.

Plate 137: MAT Nursery

Plate 138 : Cono weeder

Plate 139 : Field day

Economics: It has recorded 38.1% higher root mass which enhances nutrient and moisture from the Rhizosphere. SRI method has obtained higher yield attributes and yield as compared to traditional method of rice cultivation. More number of productive tillers/m^2 (341) was registered in SRI method which was 33.5% higher tiller production than farmer practices. SRI recorded maximum grain yield of 42.95 q/ha and straw yield of 68 q/ha which was 36.4 % higher grain yield over farmers practice. Higher gross return (Rs. 51250/ ha) and net return (Rs. 30650/ ha) with B: C ratio of 2.3 was recorded in SRI method of cultivation with 14 days old seedlings.

Ridge and Furrow Methods

Vegetable production in Badmas Pahad and Port Mout under NICRA adopted villages are hampered because of limited cultivable land and excess rainfall during rainy season (May – December) and also unpredicted rains in summer. The other major problem for vegetable production is extensive damage (Bacterial wilt, water storage in post monsoon period and non-availability of full sun shine in hilly land under plantation. A total of 16.23 ha area covered under paddy and permanently in water logged condition, where no other crop is grown during rainy period. Rice cultivation is becoming highly uneconomical and it was thought that vegetables can fetch high price due to short supply in rainy months. Ridge and furrow is a technology identified to grow vegetable right in the midst of low lying rice field. It involves making of ridges (width 50cm, height 30-40cm) and furrow (width 100 cm) to provide drainage of excess and standing water from the fields (Plate 140).

Description of farming situation where technology practiced

A field experiment was conducted in farmers' field during the month of October-November, 2012 at low lying area of Badmaspahar and Port Mout covering with an area of 0.3 ha under National Initiative on Climate Resilient Agriculture (NICRA). The adopted villages are geographically situated between 11°38.452' N latitude and 92° 39.844' E longitude at an altitude of 5.7 m. The soil was sandy clay with medium organic carbon (0.58%), low in available nitrogen (263.3 kg ha^{-1}), low in available phosphorus (7.4 kg ha^{-1}) and medium in available potassium (224. kg ha^{-1}). Vegetable growing farmers were very less due to loss in cultivation of vegetables during rains and unpredicted rains during summer months because of low lying fields.

Area covered and number of farmers involved in the interventio

A total of six farmers with an area of 2.5 ha (2011-13) are covered from both the villages of Port Mout and Bad mash Pahad

Comparative performance of the technology practice against the existing one

With the meagre investment of Rs 4500 per season, the families get the seasonal vegetables throughout the season also sold the surplus vegetables to the local market and get handsome income. The result showed that earlier the beneficiaries were growing only one crop (paddy) now they are able to grow more than five crops (vegetables) in the their land. The most impressive and effective impact is that, through the intervention of the technology, cultivation of vegetables, reduction in seed rate, integrated pest management approaches are more popular in the NICRA villages .

Justification about the intervention with respect to climate aberration

In the project area, cropping seasons are clearly demarcated as per occurrence of rainfall *viz*. rainy season and dry season. Rainy season categorized with plentiful rains (400-600mm/month) and comparatively higher monthly minimum and maximum average temperature 23-25^{0}C and 28-30^{0}C respectively. These parameters also influence relative humidity that remains much higher (80% or above) during rainy season. Dry season i.e. December to April, is categorized as rain free period and comparatively lower temperature (minimum monthly average temperature 21-22^{0}C up to February but rises in March to April 22-24 ^{0}C); monthly maximum average temperature also follows same trend and rises from 29-32^{0}C. These parameters also influence relative humidity which remains nearly 65-75%. Most of the vegetables are very sensitive to water logging and heavy rains. As rains during flowering and fruiting stages affects pollination and fertilization of solanaceous vegetables. Besides, it also creates congenial climate for pathogens and different insects and pests. But other vegetable crops like Okra, cow pea, amaranths and other local vegetables are performing well in ridge and furrow system under heavy rainy period.

Horizontal spread of technology/practices

Adoption rate is reaching 32 percent in the adjoining villages of NICRA and Production rate of vegetable are also increased. The system has been popularized and promoted in many parts of the Islands for production of vegetable during rains as the system provides good drainage for excess water.

Economic of the technology/ practices

From an area of 0.4 ha, higher gross return with the BC ratio of 3:1 was recorded in ridge and furrow vegetable production as compared to paddy cultivation. The system also resulted in higher yields, weeds free, increased soil health and reduced labor costs compared to the traditional cultivation.

In respect of enterprise development for alternate livelihood generation, gender aspect to be highlighted i.e. benefits gained by women folk. The study confirmed that the ridge and furrow system with mulches is an efficient, simple and economical method enhanced better vegetable production during unpredicted rains in summer and also in rainy months. As a livelihood diversification option vegetable cultivation on ridge and furrow has enormous scope to improve food security and income generation, which in turn can help boost rural and urban economic growth. More females than male obtain information on weather from the Radio. Further, study suggests increasing women's participation in decision making at all level in climate change mitigation and adaptation.

Plate 140: Ridge and furrow methods for saving the crops from rains

Drudgery Reduction through Farm Mechanisation

Andaman and Nicobar Islands receives an annual normal rainfall of 3100 mm which is distributed over seven or more months starting from mid May to December covering both the monsoons i.e. North East and South West. The high intensity of rainfall resulting due to cyclonic storm and the longer duration of rainy days prevents the farmers in cultivating the direct seeded paddy. Therefore, most of the paddy growers in these Islands are transplanting the pre germinated aged seedlings of long duration paddy varieties (*var.* C 14-8). Shortage of labour during peak period of farm operations and limited period of transplanting in rainy days increase the labour costs and makes transplanting costlier and invariably lead to delay in farm operations. Again, the longer rainy days and high intensity of rainfall also makes the transplanting operation to finish as early as possible to avoid flooding. To manage this problem, mechanical transplanting is very much needed in the hilly sloppy land for achieving success in growing paddy in these Islands. Therefore, paddy transplanter was used for mechanisation of transplanting operation in the adopted villages.

Paddy transplanter has been successfully demonstrated and operated in 0.03 ha of land where 15 days old seedlings paddy (Swarna) was transplanted by the machine (Plate 141). Farm women were involved more in the operation and maintenance training of the transplanter was subsequently imparted. The results showed that the total time taken for transplanting by transplanter was reduced by 95 percent but the nos. of missing plants by mechanical transplanting was increased from 0 to 6 when compared with manual transplanting methods. The yield with the BCR 1.3 was at par with the yield data of the line sowing plots.

Plate 141 : Paddy transplanting at Badmaspahad, South Andaman

VIP's Visits at the NICRA - Project Areas

Dr. P. Janakiram ADG (Horticulture) ICAR (Plate 142), New Delhi, Dr. W. S. Dhillon, ADG (Horticulture), ICAR, New Delhi (Plate 143), Institute QRT, Director, CIARI, HODs of CIARI, Port Blair and team of KVK visited the NICRA ongoing project areas (Plate 144) and interacts with the farmers of Port mourt and Badmash pahad villages.

Plate 142: Visit of Dr. P. Janakiram ADG (Horticulture) ICAR, New Delhi

Plate 143: Visit of Dr. W. S. Dhillon, ADG (Horticulture), ICAR, New Delhi

Plate 144 :Prof. Dr. R.C Kole, Chairman and Members of Institute QRT interacts with the Farmers

Swachh Bharat Programme

During the period a total of twenty two programmes were conducted at different villages in collaboration with CIARI, PRIs and villagers in South Andaman district.



ICAR-KVK, Swachh Programme glimpses

Swachhta Pakhwada

Sl. No.	List of activities	Activities undertaken	Site of activity	Dates	Nos.
01.	Display and banner at prominent places, taking Swachhta pledge, Stock taking and briefing of the activities to be organized during the Pakhwada Planting of Tree seedling	• Displayed "Banners & Placards" at prominent places of ICAR-CIARI, Port Blair, KVKs (Sippighat & Nimbudera) • Swacchta Pledge was taken by all the staff of ICAR-CIARI, Port Blair. • Briefed about Swacchta Pakhwada programmes. • Cleaning of proposed site. • Tree seedlings (50 Nos.) planted on the premises of CIARI sports ground.	ICAR-CIARI & KVKs (Sippighat & Nimbudera)	16.12.18	165 Nos.
02.	Basic maintenance-removing of old files, cleaning of office, corridors, premises and white washing.	• Removed old office files, cleaning of laboratory, administrative building and cleaning cum white wash of ATIC building was carried out at ICAR-CIARI. • Removed old office files and cleaning of office premises at KVKs (Sippighat & Nimbudera).	CIARI campus & KVK-Sippighat & Nimbudera	17.12.18	88 Nos.
03.	Sanitation and SWM cleanliness drive	Cleaning work carried out at CIARI campus, Type IV and Type V colony area. Sipighat Research farm area	ICAR-CIARI and Sipighat, Research Farm	18.12.18	106 Nos.
04.	Mera gaon Mera Gourav village cleanliness drive	Cleanliness drive and Awareness rally conducted	Bengali Basti, Ferrargunj Panchayat,	19.12.18	115 Nos.
05.	Organic waste management, plastic free zone, organic Kitchen garden	Awareness rally, organic waste recycling and vermicompost preparation, recycle of plastic waste demonstration and organic kitchen garden programme conducted	Type I CIARI-colony,	20.12.18	107 Nos

SI. No.	List of activities	Activities undertaken	Site of activity	Dates	Nos.
06.	Cleaning of sewage line and cleanliness drive	Awareness rally, cleanliness drive, cleaning of sewage lines around the colony area, removed the bushes near in and around the sewage lines	Type II and Type III CIARI-colony,	21.12.18	94 Nos.
07.	Rally and awareness slogans and distribution of awareness notice	Awareness rally conducted from Bathubasti junction to ICAR-CIARI campus and distributed the awareness notice to shops and residents.	Bathubasti junction to ICAR- CIARI campus	22.12.18	86 Nos.
08.	Special day- Kishan diwas- calling farmers and discussion on waste management and swachhta initiatives	Kisan Diwas conducted at conference hall of KVK and discussed on waste management practices to be carried out in paddy field, poultry, cattle farm and fish farming	ICAR- KVK, Sipighat, Port Blair	23.12.18	91 Nos.
09.	Cleanliness drive-awareness programme-new village	Cleanliness drive and awareness program conducted at the new village also tree seedlings were planted near the community hall of the village with the involvement of villagers	Attampahad village	24.12.18	99 Nos.
10.	Cleanliness drive-tourist place	Cleanliness drive conducted at tourist spot and cleaned the beach area	Carbyn's Cove beach	25.12.18	46 Nos.
11	Organizing competition for school children, Painting, quiz	Conducted quiz and painting competition programme to school students (6 schools)	ICAR- CIARI conference hall	26.12.18	59 Nos.

Activity Photos (16.12.2018)

Activity Photos (17.12.2018)


Activity Photos (18.12.2018)


Activity Photos (19.12.2018)


Activity Photos (20.12.2018)


Activity Photos (21.12.2018)

Activity Photos (22.12.2018)

Activity Photos (23 & 24. 12.2018)

Activity Photos (24 & 25 .12.2018)

KRISHI VIGYAN KENDRA, NICOBAR, CAR NICOBAR

The ICAR-KVK - Nicobar, Car Nicobar was established on 20th May, 2010 under the administrative control of ICAR - Central Island Agricultural Research Institute (CIARI), Port Blair. Presently, the KVK Office is functioning from the Headquarter, Car Nicobar covering entire Nicobar district with 5 ha farm at Auckchung, Car Nicobar.

To achieve its mandates, the KVK – Nicobar started as one of the methodologies i.e. adoption of a village for its all round development. 'Transfer of Technology Programmes (TOT) in an integrated manner was implemented so that holistic development could be ushered with an overall upliftment in socio-economic status of farming community through production of more food and profitability as well.

Trainings

A total of 13 trainings were conducted in the disciplines of Agronomy and Animal Science (Table 82). A total of 429 farmers including 207 female got benefited from the trainings (Plate 145).

Table 82: Discipline wise training done by KVK-Nicobar during 2018-19

Discipline	No. of training	Male	Female	Total
Agronomy	06	102	90	192
Animal Science	07	120	117	237
Total	13	222 (52%)	207(48%)	429

Plate 145: Glimpse of training programme

On Farm Trials

Effect of decomposers on soil properties and yield of coconut

The Nicobarese generally do not practice any scientific management in their coconut plantations and due to which plantations have become dense. Due to the lack of nutrient and other management, the coconut yield is too low compared to the National average. In order to inculcate scientific farming practices among the tribal community it is import to maintain soil fertility year after year. Hence an OFT on 'Effect of decomposers on soil properties and yield of coconut' was formulated at Car Nicobar.Three different technical option *viz*. Farmer practice(Traditional Farming) (TO_0), Use of waste decomposer Pre and Post Mansoon (TO_1) and External application of enriched compost (TO_2) were formulated.

The treatments were initiated in the month of November, 2018 *i.e.* during the end phase of rainy season. The result on soil properties indicated no much effect on availability of soil nutrient due to lack of subsequent irrigation

(Table 83 & 84). The effect of the treatment may be observed in the next year as the process may take some time for showings its impact on the soil properties and thereby yield of coconut. The average coconut yield of trial field before initiation of the OFT was recorded to be 22.34 nuts/palm/annum. The trial is under progress.

Table 83: Evaluation of soil properties before intervention

Treatment	Available Nutrients in kg/ha					
	pH	EC	OC	N	P	K
TO_0-Farmer practice(Traditional Farming)	8.14	102.8	0.2	127.9	6.4	72
TO_1-Use of waste decomposer Pre and Post Mansoon	8.13	108.4	0.8	126.7	4.8	81
TO_2- External application of enriched compost (CIARI Bio Consortia)	8.22	115.6	0.2	123.0	5.7	76

Table 84: Effect of waste decomposer and enriched compost on soil properties (5 months)

Treatment	Available Nutrients in kg/ha					
	pH	EC	OC	N	P	K
TO_0-Farmer practice(Traditional Farming)	8.12	272.7	0.8	135.5	6.9	80
TO_1- Use of waste decomposer Pre and Post Mansoon	8.35	157.8	0.8	133.0	4.2	67
TO_2- External application of enriched compost (CIARI Bio Consortia)	8.22	128.4	0.6	130.0	4.9	89

Effect of waste decomposer on growth and yield of CARI Brinjal 1

The trials were initiated in the month of January, 2019. The result revealed that, the application of waste decomposer has been promoting plant height and number of leaves per plant followed by application of CIARI Bio Consortia and Farmers' practice. The details of recorded observation are given in Table 85 & 86 for perusal. The trial is under progress.

Table 85: Effect of Waste Decomposer and Growth promoting consortia on plant height of CARI Brinjal 1

Treatments	Avg. plant height at 30 DAT							Avg. plant height at 60 DAT						
	R1	R2	R3	R4	R5	R6	R7	R1	R2	R3	R4	R5	R6	R7
TO_0-Farmer practice(Traditional Farming)	16.8	16.6	16.8	16.8	16.8	17.8	17.2	28.8	31.6	31.8	33.8	29.8	28.8	28.8
TO_1-Waste Decomposer	18.8	19.2	19.6	18.8	18.8	20.6	20	41.2	45.4	41.8	41.2	43.6	44.4	41.2
TO_2-CIARI Bio Consortia	17.2	18.6	17.8	18.4	18.2	19.2	18.4	34.2	38.8	37	36.6	41.8	34.2	34.2

Table 86: Effect of waste decomposer and growth promoting consortia on numbers of leaf per plant of CARI Brinjal-1

Treatments	Avg. No. of leaf per plant at 30 DAT							Avg. No. of leaf per plant at 60 DAT						
	R1	R2	R3	R4	R5	R6	R7	R1	R2	R3	R4	R5	R6	R7
TO_0-Farmer practice (Traditional Farming)	7.4	7.8	7	7.2	7.2	7.4	8.6	13.2	10	11.2	11.8	9.6	9.8	11.4
TO_1-Waste Decomposer	11.6	11.2	9.6	9.4	9	10.2	11.8	15.4	18	14.2	13.8	15.6	13.4	12.6
TO_2-CIARI Bio Consortia	10.8	8.6	8.6	8.8	8	8.8	9.4	13	13.6	11.6	8.8	12.4	12.4	10



Plate 146: Effect of waste decomposer on growth and yield of CARI Brinjal 1 at Tapoiming Village

Evaluation of different varieties of Hybrid Napier in Nicobar

The Nicobarese are slowly adopting dairy farming. The milk production per cow is low in Car Nicobar due to minimal management practice and nutritional supplementation. This varietal evaluation will help in identifying and selecting the suitable variety of Hybrid Napier (fodder crop) in island ecosystem of Car Nicobar (Plate 147 & 148).

The study revealed that, the yield of Hybrid Napier CO5 was maximum followed by CO4, DHN6and CO3 which were found to be 1983q/ha, 1856q/ha, 1775q/ha and 1493q/ha with B:C ratio of 4.41, 4.12, 3.95 and 3.32 respectively (Table 87).

Table 87: Evaluation of yield and economic performance of different varieties of Hybrid Napier at Nicobar

Technical Options	Yield (q/ha)	Gross Cost (Rs.)	Gross Income	Net Income (Rs.)	B:C Ratio
TO_0 Hybrid Napier CO3	1493.34	90000	298668	208668	3.32
TO_1 Hybrid Napier CO4	1856.00	90000	371200	281200	4.12
TO_2 Hybrid Napier CO5	1983.16	90000	396632	306632	4.41
TO_3 Hybrid Napier DHN6	1775.38	90000	355076	265076	3.95

Plate 147: Initial sprouting of Hybrid Napier in the Field

Plate 148 : Hybrid Napier in the Field

Evaluation of efficacy of Herbal Eye Drop in treating conjunctivitis in poultry

Conjunctivitis in poultry is a common problem in these Islands caused by different etiological agents. If not treated it cause high morbidity and unilateral blindness among the affected birds leading to economic loss to the poor farming community. The scenario is same in Nicobar group of islands wherein Nicobarese rear poultry birds under backyard condition and conjunctivitis is one of the common problems. This leads to lower marketability of the birds. ICAR-CIARI, Port Blair has developed an herbal eye drop which has shown good results and healing property when treated in poultry with conjunctivitis at Institute farm level (Plate 149). It was much required for testing and evaluating efficacy of the eye drops at field level. Therefore, the ICAR-Krishi Vigyan Kendra- Nicobar formulated an On-Farm Trial on “Evaluation of efficacy of herbal eye drop in treating conjunctivitis in poultry” at Car Nicobar Island with an objective to compare the eye drop with available conventional eye drop in market and to assess safeness of the newly developed eye drop in field conditions. For the experiment, three technical options (TO) considered *viz.* farmer’s practice *i.e.* no treatment (TO_0), herbal eye drop (TO_1) 1 drop in each eyes for 10 days, Gentamycin eye drop (TO_2) 1 drop in each eyes for 10 days with fifteen replications in each treatment. The results revealed that, the use of herbal eye drop developed by ICAR-CIARI, Port Blair was safe in field condition and there was no sign of irritations and other complications in the unaffected eyes in poultry. Further, a mere 20% birds recovered without treatments but cent percent were cured by providing above cited treatments. The average day of recovery was found to be 14.25 days in untreated birds whereas it was 9.20 days (TO_1) and 9.07 days in TO_2. The B: C ratio derived from the study revealed 1.03 for TO_0 and 1.94 in other treatments (Table 88). From the study it can be concluded that, the herbal eye drops worked at par with antibiotics and could be an effective ethno veterinary medicine and best alternative in organic farming setup for treatment of conjunctivitis in poultry.

Table 88: Efficacy and economics of different conjunctivitis treatments in poultry

Technical Options	Average days of recovery	No. of recovered birds	Gross Cost (Rs.)	Gross Income	Net Income (Rs.)	B:C Ratio
TO_0 Farmer's Practice	14.25	8 (15)	2904.00	3000.00	96.00	1.03
TO_1 Herbal Eye Drop	9.20	15 (15)	2904.00	5625.00	2721.00	1.94
TO_2 Gentamycin	9.07	15 (15)	2904.00	5625.00	2721.00	1.94

Plate 149 : Treatment of conjunctivitis in poultry with herbal eye drop at Car Nicobar

Table 89 : Front Line Demonstrations

Title of the FLD	Results
Popularization of Okra *cv.* Arka Anamika	FLD conducted in two different seasons at Tapoiming Village, Car Nicobar from an area of 200 m^2 land, 512 kg Okra were produced with an net income of Rs. 23840/- and 2.99 B:C Ratio recorded.
Popularization of Maize crop	FLD conducted at Big Lapathy Village, Car Nicobar failed due to heavy rain.
Supplementation of mineral mixture in goat farming	The supplementation of mineral mixture in ten (10) kids at the rate of 5g per day for 6 months after 3 months of age has show positive effect on the boody weight at 9th month of age to the tune of 18.03kg compared to 15.52 kg in control with B:C ratio of 2.1 and 1.9 respectively.
Intensive Pig Farming	During the period reported upon, pig feed was provided for demonstrating the importance of feeding balanced feed in intensive pig farming to tribal farmers of Car Nicobar. Prior to the study, the average weight of pigs were 55.33kg (11 months). After feeding the balanced feed for 3 months, the pigs attained an average body weight of 98.33kg. The average gross cost, net income and B:C ratio were to the tune of Rs.7350/-, Rs. 5550/- and 1.76 respectively.



Plate 150 : Front Line Demonstration on Arka Anamika at Tapoiming, Car Nicobar

Plate 151 : FLD on mineral mixture in goat

Plate 152 : FLD on intensive pig farming

Kisan Kalyan Karyashala

Kisan Kalyan Karyashala at Community Hall, Perka, Car Nicobar

Kisan Kalyan Karyashala at EOC building, Kamorta

Mahila Kisan Divas

Mahila Kisan Divas at Big LapathyVillage, Car Nicobar

Plate 153: Glimpses of other important events conducted

Swachchta Hi Seva/ Swachchta Pakhwada observed at Car Nicobar

Sl.No.	Date	Venue	No. of participants	VIP	Activity
1	30.09.2018	Chuckchucha, Car Nicobar	20	Shri. Peterson Job, 1^{st} Headman, Chuckchucha village	1. Conducted cleanliness drive in the village 2. Delivered lectures on importance of cleanliness, sanitation and hygiene 3. Proper disposal of waste
2	01.10.2018	ICAR-KVK-Nicobar, Car Nicobar	06	-	1. Shramdan by KVK officials and staff along with neighbours 2. Proper disposal of waste
3	02.10.2018	Tapoiming, Car Nicobar	55	Shri. Lawrence Mathew, 1^{st} Headman Shri. John Crispin, 5^{th} Headman Tuhet Heads of Tapoiming village	1. Delivered lecture on teachings of Mahatma Gandhi Ji. 2. Conducted cleanliness drive in the village 3. Organized rally for creating awareness among the tribal villagers on Swachch Bharat Mission. 4. Delivered lecture on proper waste disposal.

Chuckchucha, Car Nicobar

ICAR-KVK-Nicobar Office

Tapoiming, Car Nicobar

Plate 154: Glimpses of Swachchta Pakhwada

Celebration of World Soil Day (WSD) at Car Nicobar

Plate 155 : Celebration of World Soil Day with tribal farmers at Tapoiming, Car Nicobar

Three Live Telecast Address by Hon'ble Prime Minister of India

Plate 156 : Community Hall, Kinyuka

Plate 157 : Community Hall, Tamaloo

Plate 158 : Community Hall, Big Lapathy

Soil Health Card Distribution

Plate 159 : Soil Health Card handing over to Chief Tribal Council, Nancowerie

Plate 160 : Soil Health Card handing over to Captain Vikas Nagar

Survey of Trinket Cattle

Surveyed Trinket Island and Kamorta Island for Trinket Cattle in association with Division of Animal Science during 28th April to 3rd May, 2018 and for collection of blood sample for genetic studies.

Plate 161 : Settlement at Trinket Island

Plate 162 : Trinket Cattle

Collection of Samples for Survey of Parasitic and Livestock Diseases

Surveyed Trinket Island and Kamorta Island for collection of fecal and blood samples for surveillance of parasitic and livestock diseases in association with Division of Animal Science during 28th April to 3rd May, 2018.

Plate 163 : Settlement at Trinket Island

Plate 164 : Trinket Cattle

Demonstration on Organic Kitchen Garden at IAF Station and Malacca Village

Organic Kitchen Garden was developed and demonstrated at Indian Air Force Station, Car Nicobar and Farmer's field at Malacca, Car Nicobarunder full support and overall supervision of ICAR-KVK, Nicobar. This has benefitted both defense personnel and tribal farmers for acquiring skill on organic vegetable gardening.

Plate 165 : Demonstration at IAF Station, Car Nicobar

Plate 166 : Field demonstration at Malacca

Extension Activities

Nature of Extension Activity	No. of activities	Farmers			Total		
		M	F	T	M	F	T
Field Day	02	47	29	76	47	29	76
Kisan Ghosthi	02	92	83	175	92	83	175
Lectures delivered as resource persons	04	134	112	244	134	112	244
Scientific visit to farmers field	91	182	66	248	182	66	248
Diagnostic visits	16	09	07	11	6	5	11
Soil health Camp	05	189	51	240	189	51	240
Exposure visits	03	10	03	13	10	03	13
Animal Health Camp	08	29	15	44	29	15	44
Swachchta Hi Seva	03	39	42	81	39	42	81
Awareness on Conservation of petroleum products in farming	02	39	22	61	39	22	61
Live Telecast	03	101	171	272	101	171	272
Total	**139**	**871**	**601**	**1465**	**868**	**599**	**1465**

KRISHI VIGYAN KENDRA –NIMBUDERA, N&M ANDAMAN

ICAR-Krishi Vigyan Kendra North and Middle Andaman of A&N Group of Islands under ATARI Zone-V, Kolkata working under the administrative control of host institute ICAR-Central Island Agricultural Research Institute, was sanctioned in the year 2012 and started functioning from the year 2013-14. It is situated at Nimbudera, which is about 215 Kms away from Port Blair. Krishi Vigyan Kendra act as an innovative institution with the mandate of imparting vocational training to the practicing farmers, farm women, rural youth and extension functionaries on recent and improved technologies in the field of Agriculture, Horticulture, Animal husbandry, Fisheries, Agricultural Engineering and Home Science. In addition to this KVK is proactively involved in testing and refining of new technologies in local condition in the form of On Farm Trials (OFT) and demonstration of proven technologies in the farmer's field as Front Line Demonstrations (FLD).In addition to these KVK caters the need of the farmers for seeds, planting material, chicks, soil testing and diagnostic services etc. The salient achievements made during the year.

Trainings

In this year a total of 32 trainings were conducted by KVK, N&M Andaman in different disciplines of Agriculture *viz*. Agronomy, Horticulture, Animal Science, Fisheries, Agriculture Engineering and Home science. A total of 996 farmers including 552 women got benefited from the trainings (Table 89).

Table 89: Details training conducted by KVK in different disciplines

Discipline	No. of training	Male	Female	Total
Agronomy	06	85	89	174
Horticulture	02	18	34	52
Animal Science	06	85	77	162
Agricultural Engineering	06	65	94	159
Fisheries	06	172	97	269
Home Science	06	19	161	180
Total	32	45%	55%	996

Plate 167 : Glimpses of training imparted in Agriculture & allied fields

Agronomy

Horticulture


Agricultural Engineering


Fisheries

Sponsored Trainings under NABARD Funded Project

Three sponsored trainings under NABARD funded project were conducted by wherein a total of 95 farmers including 59 women got benefited from the trainings (Table 90).

Table 90: Details of sponsored trainings programmes

Sl.No	Name of Training	Male	Female	Total
1	Seed Production	00	32	32
2	Brood Stock Management for quality seed production	26	02	28
3	Establishment of nursery for supply of quality planting materials to farmers	10	25	35
	Total	**36**	**59**	**95**


Plate 168: Quality fish seed production


Plate 169: Nursery Management

Front Line Demonstration [FLD]

Paddy Variety Gayatri (Medium duration, high yielding) was conducted at three different villages at four farmer's field i.e Harinagar, Rampur and Pinakinagar villages of N & M Andaman during Kharif season 2018. The trial was conducted in a total area of 1.0 ha (0.25 ha each at farmer's field). The result showed that on an average paddy yield of 4.65 t/ha (average yield of 4 farmer's) which is 12 % higher than local check variety (Jaya) which was recorded 4.15 t/ha. The farmer's accepted the consumable quality of Gayatri variety (Plate 170).

Plate 170: Paddy Variety Gayatri (Medium duration, high yielding)

Artificial incubation of fertile Duck eggs in Mini-egg incubator

The demonstration was conducted at four different villages *viz*. Profullya nagar, Dharampur, Harinagar, and Govindpur. In this demonstration one hundred fertile duck eggs were collected from the farmer's field and incubated for setting and hatching in Mini-egg incubator (Plate 171). During the course of this demonstration, the farmers were advised regarding the methods for selection, cleaning and storage of fertile duck eggs for incubation, and the operation of Mini-egg incubator at KVK, Nimbudera. In this demonstration, the fertile duck eggs were incubated for setting at temperature of 99.5 ˚F, and relative humidity of 58-62 percent, and kept on automatic turning mode for the period of twenty five days. After that the eggs were transferred to hatching trays and kept at temperature of 98.5 ˚F and 66-72 percent relative humidity without turning. 52% hatchability was obtained from the incubated egg in Mini-egg incubator. The cost benefit ratio of this demonstration was 1.63 compared to local check 1.16.

Plate 171: Artificial incubation of fertile duck eggs in Mini-egg incubator

Supplementation of chelated mineral mixture in the ration of dairy cattle

The demonstration was performed with four farmers in four different villages *viz.* Profullyanagar, Pinakin nagar, Govindpur and Pehalgaon. The demonstration was conducted on local cattle which had calved twice and were passing through mid to late (3 to 6 months) stage of lactation. In this demonstration, the farmers were advised to supplement the ration of dairy cattle with chelated mineral mixture @ 35 gm / day and necessary inputs like chelated mineral mixture (Bestmin gold forte) were supplied to the farmer's (Plate 172). After supplementation of chelated mineral in the ration of dairy cattle the farmers observed 10-13 percent improvement in milk yield; and reduced incidence of repeat breeding. The BC ratio of this demonstration was found 2.16, when compared to the check 1.83.

Plate 172: Supplementation of chelated mineral mixture in the ration of dairy cattle

Pond based IFS (Fish species- Pangas, Catla & Puti)

Farmer received an additional source of income of Rs 23100.00 within a short span of time (6 month) which was initial phase of establishment from an area of 1000 m^2. Farmer has obtained B:C ratio of 1.47 from treatment as compared to 1.39 in control. He also agreed that feed formulation using locally available ingredients will further improve the economic status of his farm. This was his first experience in agriculture and practically learnt many aspects in farming (Plate 173). Now he is more confident of expanding his venture in integrated fish farming.

Plate 173: Pond based IFS

CIARI fish grower diet

Fish culture using CIARI fish feed was carried out in farmers field and compared with farmer practice of pond culture for three months. During the demonstration trials CIARI fish feed was fed to fishes twice a day adlibitum where as control group was managed by farmers without any intervention of KVK (Plate 174). Catla (Catla catla) and Rohu (Labeo rohita) was stocked in treatment and control pond @ one /m^3. On the end of feeding trials fishes were harvested from both ponds for analyzing growth parameters. Field trial data indicated higher pond productivity of 737.5 kg/ ha when fish was fed with CIARI diet as compared to 415 Kg/ha in control. Similarly higher B: C ratio of 1.56 was recorded in demonstration whereas B:C ratio in control was 1.42.

Plate 174 : CIARI fish grower diet

Manual fish feed pelletizer

Fish farming in N&M Andaman is in very extensive state where farmer stock fish in pond with or without proper feeding. Fish feed availability is almost nil in the local market. Fish feed used by farmers are of poor nutritive quality impacting growth and productivity of fish pond. Most of the fish feed ingredients are available in the local market like rice bran, wheat flour, groundnut oil cake, coconut cake, mustard oil cake, fish meal etc which can be used for fish feed preparation. Demonstration on fish feed pelletizer was an initiative to show them preparation of pellet fish feed which can serve as nutritionally balanced, palatable, storable and cheaper (Plate 175). Small scale fish farmer can use 1.0 HP pellet machine which can produce 40 kg fish pelleted feed per day.


Plate 175: Manual fish feed pelletizer

Manual seed treater

Seed born diseases are very common in N&M Andaman district. There is very less knowledge and information about method of seed treatment among farming community. The demonstration on manual seed treater was undertaken to apprise farmer about a very cost effective, easy, reduced risk of chemical to human contact and with improved seed coating efficiency as compared to manual mixing of chemical. Under this demonstration uniformity of chemical coasting was recorded to 96% as compared to 70% in manual mixing. Manual mixing is very time consuming, less efficient and hazardous to human life.

Promoting vermi composting by involving SHG's

Vermicomposting is the process by which worms are used to convert organic materials (usually wastes) into a humus-like material known as vermicompost. The goal is to process the material as quickly and efficiently as possible. Vermicomposting is less labour-intensive than traditional plant composting because the worms do almost all of the work. Rural household women have plenty of leisure time during afternoon to practice some sort of revenue generation work. But it becomes important to select an enterprise, which does not require any major investment. Rural women can become entrepreneur by taking up vermin composting and contribute towards family income. Three SHG's from different villages i.e Burma Kona, Harinagar and Shantipur of N & M Andaman were selected who already had a vermicompost unit built by Dept. of Agriculture (Plate 176). They were trained in scientific ways of vermicomposting. All Inputs (Tin sheds, repair of vermicompost unit and worms) were provided to all the three SHG's and the compost that was prepared in 2-3 months were later sold by SHG's in the retail market at par with the market prices (i.e. Rs.10/kg).Gross cost was calculated which was Rs.3500/- and Gross return was Rs.5000.The B.C ration was found to be 1.42.

Plate 176: Vermicomposting by involving SHG's

Tie and dye technique on fabric as a source of income generation

Rural women play a crucial role for the well being of their families. Entrepreneurship development and income generating activities are feasible solution for empowering the women. Tie and dye printing is one of the ancient arts and it is very much popular among rural as well as urban women. Although they frequently wear clothes fashioned in this art, very few actually have the knowledge of its printing technique.

Tie and dye is one of the easiest printing techniques and comparatively cheaper too. It is a kind of value addition in clothes thereby increasing the value of the fabric and enhancing the income of the family. For skill up gradation of SHG members the training programmes were conducted on tie and dye for three SHGs (Plate 177). During the training demonstration of tie and dye were conducted and participants were asked to develop tie and dye product themselves. Training was provided on different techniques of tying the fabric to get various patterns and ways of using dyes and fixers on the fabric. SHG's showed keen interest in learning the skill and further taking it as an enterprise .At the end of the programe many SHG members expressed their willingness to start this as an activity in their groups using chemical and natural dyes which will generate considerable income to the groups.

Plate 177: Demonstration on tie and dye on fabric

ON FARM TRIALS [OFT]

Effect of application of fertilizer with/without FYM on yield of Paddy under high rainfall condition

In order to increase the fertilizer efficiency the OFT trial was taken up during Kharif season with following technical options (Variety CARI 7) T0 Farmer's practice - Urea-60 kgs N/ha, T1 -100% Recommended dose–NPK (90:60:40) without FYM ,T2–50% Recommended Dose NPK (45:30:20) + Full dose FYM(5 tons/ha). The trial was conducted in 07 farmer's field and 01 trial at KVK farm in an area of 1.2 ha (each replication @0.15 ha) (Plate 178). Amongst the treatments T2 recorded highest yield of 4.88 t/ha over the T1 47.20 q/ha. Farmer's practice i.e T0 recorded 4.13 t/ha. It can be envisaged from the results that T2 recorded 3.38 % over T1.Use of only 50% NPK reduced the cost of cultivation considerably, in addition to increasing the soil fertility status. The results showed that T2 option had given a B C ratio of 1.93 over T0 (Farmer's Practice) of 1.78.


Plate 178: Paddy plots (farmer's field)

Evaluation of commonly used anthelmintics to control gastrointestinal nematodes of goat

The trial was carried at the field of seven farmers from three villages namely Profullyanagar, T. V. Kulum, Govindpur, and Jaipur. During the trial, two commonly used anthelmintics drugs Albomar (Albendazole oral suspension) @ 5mg/kg body weight (T1) and Hitek (Ivermectin oral solution 0.08% W/V) @ 0.25 ml/Kg body weight (T2) were administered by oral route to control gastrointestinal nematodes of goat, and was compared with farmers practice (left untreated) (T0). Faecal samples were collected on day 0 (before treatment), and day 14 (post-treatment), and faecal egg count reduction test (FECRT) was performed to determine the efficacy of anthelmintic at day 14 (post treatment) (Plate 179). In this study, the tested anthelmintics showed reduction in nematode egg excretion in the goat post treatment. Faecal egg count reduction (FECR) levels for Albendazole, and Ivermectin were found 97.3%, and 97.8%, respectively. It was noted that post-treatment egg counts and percentage reduction of egg counts were not significantly different for the treatment groups.


Plate 179: Trial on Field Efficacy of commonly used anthelmintics

Performance evaluation of laying ducks fed with diets substituted with fresh azolla

The trial was performed at the field of seven farmers selected from four villages *viz*. Profullya nagar, T. V Kulum, Govindpur, and Paresh nagar. In this trial, the laying ducks were assigned into two treatments groups namely normal feeding allowance of 150 g commercial feed/head per day (T1) and 75 g commercial feed + ad libitum feeding of azolla/head per day (T2) and compared with farmers practice of feeding kitchen waste (T0) (Plate 180). Ad libitum feeding of azolla gave a 59.31 percent hen day production, while that for commercial diet-fed ducks was 60.20 percent. Both treatments produced eggs with acceptable weight range of 64-72 g/egg. The overall average egg weight for azolla fed ducks was 68.20 g and commercial diet-fed ducks was 68.63 g. The result implies that azolla can provide enough nutrient if substituted to 50 percent of commercial feeds on ad libitum system of feeding and help in reducing the cost of production.


Plate 180: Trial on laying ducks fed with diets substituted with fresh azolla

Evaluation of KVK pond cleaner in improving fish health and water quality in fish ponds

The experiment was conducted with three technical options i.e Farmer's Practice (T0) , Pond Cleaner formulation 1 (T1) and Pond Cleaner formulation 2 (T2). Due to onset of diseases due to poor quality water or common bacterial fish diseases, farmer suffers a lot due to non availability of proper fish medicines in the market. Taking it into the consideration KVK pond cleaner was formulated to serve preventive and curative requirements in fish ponds. Treatment ponds were selected with problem of fish diseases or poor water quality as determined with fish mortality and water color i.e transparent/ turbid/yellow/brown. Among different technical options, the technical option 2 was found to be suitable for improving the water quality and also act as preventive measure for incidence fish disease in ponds, whereas its application is not very effective in controlling diseases like motile hemorrhagic septicemia and EUS within short time. For improving quality of water technical option 2 found to be more useful than technical option-1 as application of higher doses frequently cause stress to fishes. Whereas technical option-1 improves water quality within short time and found very effective in controlling motile hemorrhagic septicemia and EUS with a span of 1-3 days with almost nil mortality. Feedback of 10 randomly selected farmers those used pond cleaner were collected through a pretested questionnaires from Billiground to R. K. Gram, Diglipur (Plate 181). Majority of farmers responded that pond cleaner improves water quality, those farmers used Technical option-01 to treat fish disease reacted that it effectively controls disease with reduced fish mortality from first day itself and nil mortality on third day of application. Normally two dose of treatment on alternate days as applicable in technical option 01 is effective against control of fish mortality due to poor water quality, EUS and Hemorrhagic septicemia whereas in exceptional cases it goes for three to four doses (Plate 181). Almost all farmers responded that quality of pond water turn green within seven to ten days of treatment. Respondents also rated effectiveness of KVK pond cleaner as good to very good.


Plate 181: Trial on KVK pond cleaner

Efficiency of different type of sprayers used for vegetable production

Incidence of pest and disease in vegetable and other crops are very high in the region. Present experiment was undertaken to evaluate the efficiency of different types of sprayer in farmer's fields (Plate 182). Okra crop was selected for the experiment with three technical options i.e Farmer's practice Knapsack Sprayer (T0), Gutter

Sprayer (T1) and Knapsack Sprayer Battery Operated (T2). Among different treatment group technical option 2 was found to be more efficient, cost effective with higher field capacity as compared to technical option. As per field observation technical option 1 was found be to least effective in vegetable field and required high manpower as compared to technical option 0 and technical option 2.

Plate 182: Trial on sprayers used for vegetable production

Manual vegetable seed drill/ planter (one row)

Vegetables are grown on large scale by farmers of N&M Andaman district. Manual seed planting is practiced by farmers which are more exhaustive and labour intensive. Present field trial was undertaken to evaluate mechanical mean of sowing with seed drill (Plate 183). Two technical options were carried out i.e. Manual dibbling (T0) and Seed drill sowing (T1).Technical option 1 was found to be more scientific, accurate and uniform (92 % efficiency) in seeding as compared to technical option 0 (89 %) efficiency. Further seed drill sown plot showed uniform germination (due to desired depth sowing) as compared to manual method.

Plate 183: Trial on vegetable seed drill/ planter

Nutrition education in improving knowledge, attitudes and behaviours of adolescents

Adolescence girls are more vulnerable to the effects of malnutrition, stunting, anemia etc, because of frequent erratic eating pattern, lack of nutritional knowledge and poor dietary habits. Occurrence of series of nutritional problems like under nutrition, anemia, vitamin A deficiency, iodine deficiency and overweight or obesity may develop too in them. For prevention of these problems, WHO has emphasized that the mass information and awareness programmes should be organized to alert government and communities about the importance of health and nutrition. Therefore, the above study was carried out to assess the impact of nutrition education in improving knowledge, attitudes, and behaviours of adolescent girls. The OFT was carried out with three technical options. Technical option -0-Control group -No Nutrition Education was imparted, Technical option -1-Nutrition Education was imparted and Technical option -2- Skilled based Nutrition Education was imparted. A total of 24 adolescent girls in the age group of 13-16 years were randomly selected (8 girls in each group). A pre & post evaluation was conducted before and after imparting nutrition education to determine the level of increase in awareness and knowledge of the girls. For Technical option 1& 2 Nutrition Education was imparted through lectures and audiovisual aids, whereas demonstration of low cost nutrient dense recipes from local ingredients was conducted only for technical option 2. Before and after imparting nutrition education, the level of knowledge, attitude, beliefs and practices regarding good nutrition was adjudged by questionnaire cum interview method (Plate 184). There was no increase in knowledge among the respondents belonging to Technical option 0.Pre and Post evaluation in Technical option -1 showed an increase in Knowledge from 42% to 68% whereas in Technical option - 2 the increase in knowledge was from 44% to 76%.There was significant improvement in the nutritional knowledge of the subjects after nutrition education. Nutrition education is an important measure to improve dietary habits and food choices of the adolescent girls, as poor dietary habits and ignorance are the main reason for poor nutritional status of the adolescent girls.

Plate 184: Feedback on nutrition education

Evaluation of consumer acceptability for banana value added products

Bananas are one of most popular fruits that are easily/cheaply available throughout the year and Andaman is no exception to it. However banana is highly perishable fruit, difficult to transport & even refrigeration storage is not promising. Value addition to Banana seems the most appropriate solution to prevent losses and achieve Nutritional security. Four different value added products of Banana i.e Banana jam, Banana bar, Banana cookies and Banana chapaties were prepared (Plate 185). Sensory evaluation on the basis of 9-point hedonic scale of all the prepared samples was done by taste panel. The taste panel consists of 5 members. Sensory evaluation was done to know the acceptability of the product. The panel members were asked to evaluate the appearance, taste, texture, odour and overall acceptability by a scoring rate, 9 means like extremely, 8 means like very much, 7 means like moderately, 6 means like slightly, 5 means neither like nor dislike, 4 means dislike slightly, 3 means dislike moderately, 2 means dislike very much and 1 means dislike extremely. Mean scores of sensory evaluation showed that banana cookies received maximum score of 8.6 in overall acceptability followed by Banana Bar (score of 8.0) Banana Jam (score of 7.6) and Banana Chapaties (score of 6.8). Thus, current study can help the farmers to adopt the value added products developed at household levels and thereby increasing the opportunities for enhanced income generation.

Plate 185: Trial on banana value added products

Extension Activities

Table 91: Extension activities organized by KVK

Nature of Extension Activities	Number	Farmers			Extension Official			Total		
		M	F	Total	M	F	Total	M	F	Total
Field day	06	70	41	111	0	0	0	70	41	111
Kisan ghosthi	05	94	129	223	0	0	0	94	129	223
Seed day	01	108	34	142	0	0	0	108	34	142
Live telecast of Prime minister interaction with farmers	01	42	16	58	0	0	0	42	16	58
Live telecast of Prime minister interaction with SHGs & farm women	01	06	35	41	0	0	0	06	35	41
Mahila kisan diwas	01	02	60	62	0	0	0	02	60	62
Vigilance awareness week	01	30	64	94	05	03	08	35	67	102
World soil day	01	36	15	51	0	0	0	36	15	51
Swachhta hi sewa (SHS) (15.09.2018 to 02.10.2018)	01	216	117	333	0	0	0	216	117	333
Swachhta pakhwada (15.12.2018 to 31.12 2018)	01	218	94	312	0	0	0	218	94	312
Kisan diwas	01	29	17	46	0	0	0	29	17	46
National productivity day	01	16	20	36	0	0	0	16	20	36
Live telecast “PMKSN”	01	41	11	52	0	0	0	41	11	52
International women’s day	01	0	37	37	0	0	0	0	37	37
Film show	26	381	457	838	0	0	0	381	457	838
Method demonstration	14	229	58	287	07	03	10	236	61	297
Group meetings	11	132	143	275	0	0	0	132	143	275
Lecture delivered as resource persons	37	661	164	825	0	0	0	661	164	825
Advisory Services	411	249	62	411	0	0	0	249	62	411
Scientific visit to farmers field	1022	702	320	1022	0	0	0	702	320	1022
Farmers visits to KVK	264	227	37	264	0	0	0	227	37	264
Diagnostic visits	72	109	24	133	0	0	0	109	24	133
SHGs conveners meeting	02	0	22	22	0	0	0	0	22	22
Swachh bharat abhiyan	11	138	200	338	0	0	0	138	200	338
Total	**1892**	**3723**	**2166**	**5989**	**12**	**06**	**18**	**3735**	**2172**	**6007**

Plate 186: Glimpses of Extension Activity

Field days

Gyatri Dhan

Chelated mineral mixture

Mini egg incubator

Pond based IFS

CIARI fish grower feed

Kisan Ghosthi

Seed Day

Live Telecast of Prime Minister interaction with farmers

Live Telecast of Prime Minister interaction with SHGs & farm women

Mahila Kisan Divas

Vigilance Awareness Week

World Soil Day


Swachhta Hi Sewa (SHS)




Swachhta Pakhwada



Kisan Diwas

National Productivity Day

Live telecast programme "PMKSN"

International Women's Day celebration

Group Meetings

Method Demonstrations






Film Shows



Field visits






Diagnostic services



Advisory services






Distribution of inputs






Visit of QRT Chairman & members






Visit of NABARD Team



Celebration of Independence Day & Republic Day

The 72th Independence Day and 70th Republic Day were celebrated at KVK, Nimbudera in a befitting manner with staff, KVK, Pradhan, Basantipur, local farmers and others (Plate 187 & 188) .

Plate 187: Celebration of Independence Day

Plate 188 : Celebration of Republic Day

Swachh Bharat Abhiyan

Swachh bharat abhiyan was observed by KVK, N&M Andaman by cleaning office premises of KVK on every Saturday. KVK has also created awareness about Swachh Bharat Abhiyan among PRI's, farmers and fishermen at different places in N&M Andaman district (Plate 189).

Plate 189: Cleaning of KVK Office and creating awareness about Swachh Bharat Abhiyan

Sansad Adarsh Gram Yojona

Name of the village	Action taken for development
Dharmapur, Panchvati, T.V.Kulam, Betapur, RRO village, Sansad Adarsh Gram, Shivpuram Panchayat, N & M Andaman	• Delivered guest lecture on “Organic Farming” during kharif campaign organised by Department of Agriculture, A & N Administration at Dharampur on 30.07.17. • Organised three days training programme on “Quality fish feeds and feed management in aquaculture” at Community Hall, Dharampur from 18.09.18 to 20.09.18. • Animal Science Section, ICAR-CIARI in association with KVK, Nimbudera organised one day training on “Scientific goat and pig farming practices” at Community Hall, Dharampur on 18.12.18. A total of forty farmers were benefitted. During the programme inputs such as mineral mixture and vitamin supplement were also distributed to the participants. • Organised programme for distribution of goat under AICRP project for Improvement of local goat at Profullayanager. In this, ten superior breeding bucks were purchased from the local area and five superior bucks were distributed among five farmers of Shivpuram panchayat for breeding purpose. • Two on farm trial namely Field Efficacy Evaluation of commonly used anthelmintics to control gastrointestinal nematodes of goat in North and Middle Andaman and performance evaluation of laying ducks fed with diets substituted with fresh azolla were conducted. • Front line demonstration on Mini-egg incubator was conducted from which one farmer in the Dharampur village named Shri. R. K. Nair has been benefitted. The KVK is also providing him consultancy for successful implementation of Duck cum Fish Farming system. Under this, the KVK is helping the farmer by providing necessary technical support and input. • As per the direction of Ministry and ATARI, the KVK has organised “Kisan Samman Nidhi Programme” on 24.02.19. In this programme, the Pamukh, Rangat; Pradhan, Shivpuram; Samiti Member; Zila Parishad Member; and officials of Agriculture Department were present. During the programme, the farmers were showcased the live telecast of PM inaugural speech for “Kisan Samman Nidhi” scheme. • Organised visit of QRT team at M. P. Adarsh Gram on 02.01.19 and 03.03.19. During this visit, the team interacted with the farmers and obtained the feedback of farmers. The team suggested the farmers to contact Krishi Vigyan Kendra for technical support in agriculture.


QRT Visit


Goat Distribution


Demonstration

Training

Live telecast programme “PMKSN”

Advisory services

Plate 191 : Glimpses of activities under Sansad Adarsh Gram Yojona

SUCCESS STORY 1

Ushering growth of indigenous chicken production in rural North and Middle Andaman using Mini-egg setting cum hatching unit

Background before Intervention

The poultry production particularly indigenous chicken production plays vital role in the socio-economic and cultural life of resource poor rural farmers of North and Middle Andaman. Here, majority of farmers keep the chickens under traditional low input scavenging system and use broody hen to naturally incubate fertile chicken eggs. In this region, few numbers of farmers have adopted, the high input broiler chicken farming and none of the farmers were practicing artificial incubation of fertile chicken eggs.

The low input farmer friendly technology for artificial incubation of fertile eggs was not known among the farmers of this region. Thus, the farmers were dependent on the Department of Animal Husbandry and Veterinary services, North & Middle Andaman or Private Poultry firms for supply of Day old chicks (DOC). As a result the farmers had to wait for long time to procure DOC from department or pay hefty prices for DOC and transportation costs to the private firms located at Port Blair, which is situated almost 200 kms away from the district.

KVK Technical Interventions

The Animal Science Section, ICAR-CIARI, Port Blair in association with Krishi Vigyan Kendra, Nimbudera started a NABARD funded project on “Sustainable duck production in North and Middle Andaman”. Under this project a “Mini-egg setting cum hatching” unit was installed at the premises of KVK, Nimbudera, and the farmers friendly technology for artificial incubation were transferred by conducting the front line demonstration and training programme. The KVK also facilitated the needy and interested farmers by providing the hatching services @ Rs.4/- per hatched chick.

Successful operation and maintenance of Mini- egg setting cum hatching unit at KVK, motivated three rural youths in the region from three different panchayat namely Basantipur, Harinagar, and Shivapuram to purchase the same and adopt the farmer friendly technology for artificial incubation of eggs. The KVK also demonstrated the technology for operation of “Mini-egg setting cum hatching” units to these farmers and assisted them by provided technical and advisory service as and when needed.

Technological Benefits after Intervention

As a result of scientific intervention, and technical support by ICAR-CIARI and KVK, Nimbudera, three rural youths in three different locations of North and Middle Andaman are producing and supplying Vanraja DOC to farmers. Hence, the input cost for DOC has reduced considerably for farmers. In addition to this, the availability of Vanraja DOC has helped in bringing the component of sustainability in the forward supply chain of rural chicken production. Thus, the initiative is helping the farmers to earn more income, and generating employment opportunities for the rural youth. Under this programme, the KVK motivated Smt. Sujata Bacchar, 28 year old rural women of Basantipur village to purchase the Mini-egg setting cum Hatching unit. The KVK also provided technical support for successful hatching operation at the farm of Smt. Sujata Bacchar.. Thus, Smt. Sujata Bacchar was able to produce Vanraja DOC at his own farm and supply the DOC to other farmers also. All this has helped her to earn more income and establish herself as an independent women of new India. The detailed farm income of Smt. Sujata Bacchar is presented below.

Impact Factor	Before Adoption	After Adoption
Farmer Practice	Natural Incubation using broody hen	Artificial Incubation using Mini-egg setting cum hatching unit
Yield of Product	252 DOC	3444 DOC
Fixed Cost	Rs.1840/-	Rs. 49700/-
Recurring Cost	Rs. 9684/-	Rs.75600/- +
Depreciation Cost @ 10%	-	Rs. 4970/-
Gross Income	Rs. 11340/-	Rs. 154980/-
Net Profit	Rs. 1656/-	Rs. 79380/-
B:C Ratio	1.17	1.92

Cost Benefit Analysis for Mini-egg setting cum hatching unit at the field of Mrs. Sujata Bacchar, a resident of village-Basantipur, North and Middle Andaman.

Plate 192: Mr. Krishna Bacchar a rural youth of Basantipur village with Mini-egg setting cum hatching unit

Plate 193 : Farmer monitoring the hatching of vanraja eggs

SUCCESS STORY 2

Innovative practice of integrated fish farming by MBA graduate- Mr. Debabrata Das, Swadeshnagar

Background

Dependence of young graduate on Government job only is becoming a concern in the society, under such circumstances steps taken by a young MBA graduate to initiate farming proved to be an example and paved way for other unemployed youth to follow. Reducing soil productivity due to excess use of fertilizer and fragmentation of land due to growing population are worries for sustaining farm productivity and income of a farmer. Further, growing health concerns due to poor farm produces is also invigorating erudite to search for an alternate way to inorganic farming which is equally productive and profitable. Andaman and Nicobar Islands always witness acute shortage of water in summer where year round conventional way of farming gets affected and farmer looses their source of income. India being major agriculture based employment generator which is equally applicable in the Islands, a little vagaries of nature impacts huge masses. N&M Andaman district is endowed with greater than 1655 ponds (121 ha area), 01 reservoir and few river & canals with good potential for fish farming, these water bodies are equally important for water supply during dry period to household and agriculture field. Moreover their judicious use for better earning is the need of hour and Mr. Das has adopted innovative practice of farming taking into account of above factors. He is also well aware about demands of meat in the region particularly preference for duck and pork. Similarly his keenness for fish farming is mainly due to low input high return agriculture where waste of one component is input for other and availability of water are major requirements for rest of the component.

Interventions of ICAR-KVK, N&M Andaman

KVK-CIARI, N&M Andaman from initial days of establishment of Mr. Debabrata Das farm made several attempts to guide him in every stage of development. After approaching KVK, Mr. Debabrata Das discussed his idea and available resources for start of farming practices. His motivation and interest attracted our attention to make visit of KVK team to his land. Proximity of us improved everyday with transforming idea into reality under the guidance of KVK. Within short time he has executed almost all interventions with technical supports of KVK, N&M Andaman. Scientific advisory and other inputs from KVK-CIARI included layout and construction of farm, stocking and post stocking management of pond based integrated farm, water quality management, feed preparation and feeding management etc. Besides these technical supports KVK, N&M Andaman supported the farmer under Front Line demonstration scheme. Farmer's major worries for costly feed was solved through local formulations of fish/animal feed which has not only lowered feed cost but also solved problem of nutritional diseases. Fish diseases due to poor quality water were effectively controlled using KVK formulations. Time and again visits of KVK scientists to his farm not only supported him technically but also boost his confidence to invest more in the sector. His associations with KVK, N&M Andaman became stronger day by day because of his sincerity, dedication and perseverance for his dream farm which can support livelihood of a farmer family within scarce land and water resources.

Impact

Several trainings, field demonstrations, and other technological interventions by the KVK in the field of fisheries and allied sector impacted adoption of pond based integrated farming by Mr. Debabrata Das, Swadeshnagar. Adoption of technologies provided additional income to the farmer and gave him an avenue for better livelihood and employment opportunities. His problem of costly feed to animals and fishes and deterioration of water quality parameters due to addition of animal excreta were effectively addressed with a pragmatic and cost effective solution. Furthermore it also helped improving the status of scientific fish farming through integrated approach in the region. During interactive discussion with him he recall that initially he has started this venture with only 10 Vigova duckling as per the suggestion of KVK to opt for meat purpose duck which is economic and slowly raised upto 60 nos. Still he is maintaining more than 25 ducks in his farm. Enthusiastically he shares that when he had harvested first lots of fish from pond and supplied to the market excellent response was seen and during second harvest many persons came to his house to buy fishes owing to good taste of fish. He also said that initially he bought only one female pig with 05 piglets. Now total strength rose to 6 pigs and same female gave birth to 05 surviving piglets. He also happily shared that all new born piglets are booked by the local farmers. Beside fish farming his intension is to make his farm for supply of piglets to local farmers. In days to come he would expand his farm further to accommodate more fish, duck and pigs.

Intervention of pond based integrated farming gave Mr Das an additional source of income and opportunities for him to expand his farming. There is good demand for fish in the market and fish growth under IFS system is appreciable with minimum level of feed cost he said. Further he added that there is a high demand for piglets in the locality and pork fetches good rate in the market.

Cost benefits analysis (Rs)

Fisheries					
Fixed cost	**Variable cost**	**Gross return**	**Net return**	**B:C ratio**	**Payback period**
70,000.00	11100.00	20400	9300	**1.26**	**6.0 years**
Duckery					
5000.00	16200.00	22000	5800		
Piggery					
200000	59000	67000	8000		
Total	**86300**	**109400**	**23100**		

Conclusion: Farmer received an additional source of income of Rs 23100.00 within a short span of time (6 month) and during initial phage of establishment from an area of 1000 m^2. He also agreed that feed formulation using locally available ingredients will further improve the economic status of his farm. This was his first experience in agriculture and practically learnt many aspects in farming. Now he is more confidents of expanding his venture in integrated fish farming.




Plate 194: Integrated Fish Farming

SUCCESS STORY 3

Seed production of *Pangasius hypophthalmus* - First time in Andaman & Nicobar Islands

Background

N&M Andaman is the hub of farm production in A&N islands and fisheries as a component plays vital role in doubling farmer's income of island farmers. Vast area of more than 100 ha for freshwater fish culture is centralized in N&M Andaman district and there lies with high potential of fish production although present average productivity of freshwater resources is poor (< 500 Kg/ha) and need appropriate intervention for higher income of fish farmers. Along with popularization of scientific management practices in farmer's field, diversification of fish culture through culture of fast growing spies can pave for fast development of aquaculture in the region. Pangasius Hypophthalmus (Locally known as Pangas) already existed in this area and preferred by local populous due to their certain traits such as fast growth rate, less spines, meat quality etc but unavailability of seed was the major bottleneck for adoption of culture practices of Pangasius in this area. Culture of Pangasius Hypophthalmus gained immense popularity in India and neighboring countries due to high growth rate and higher production potential as compared to other similar cat fishes. Foreseeing demand of fish seedlings particularly Pangas and other fishes in A&N Islands a contractor turned farmer Shri Srivas Das, R/o Madhupur, Diglipur wanted to establish an Eco hatchery in his farm. On construction of eco-hatchery he approached KVK, N&M Andaman for providing technical supports for seed production of Pangasius and other species. Accordingly Dr. Shailesh Kumar, SMS (Fisheries) took all possible efforts to guide him in seed production of Pangasius, Catla, Rohu etc besides extending inputs like hapas, inducing hormones etc for successful accomplishment of fish breeding and seed production programme. Due to success of his venture he could supply more that 1 lakh fish fingerlings (Pangasius contributed more than 60000 Nos of) to farmers of Diglipur and neighboring regions. Following him many farmers are investing more capital in fish farming and some want to replicate same model in his farm. Shri Srivas Das express his satisfaction for achieving fish seed production under active guidance and support of KVK, N&M Andaman.

Interventions of ICAR-KVK, N&M Andaman

KVK-CIARI, N&M Andaman from initial days of establishment of Mr. Srivash Das farm made several attempts to guide him in every stage of fish breeding and seed production programme. Earlier Mr. Das was involved in private/govt. construction works and last year wanted to do fish seed production in his farm. Knowing about KVK, N&M Andaman he approached us as survival of fish seedling in his hatchery was very less or almost nil. He had approached KVK, N&M Andaman for the first time and he was very dissatisfied with result in fish seed production. He had already invested 8-10 lakh in establishment of circular fish seed hatchery but success in seed survival was very poor. Expert he hired from mainland was not very known to condition of N&M Andaman and required technical guidance from experienced experts. Scientific advisory and other inputs from KVK-CIARI included method of fish breeding and seed production, stocking and post stocking management in pond, water quality management, preparation and application of suitable plankton booster, preparation of feed, feeding management in nursery, handling and management of fish brooders etc. KVK N&M Andaman also extended all technical support to improve water quality of his pond and suggested suitable measures to enhance seed survival through nutrient and feed management in nursery ponds. He was also in constant touch with SMS (Fisheries) for proper technical guidance and advice. After following of recommendations as suggested by Dr. Shailesh Kumar survival of Pangasius fish seed improved with good return. He was also guided in production of Indian major carp and exotic carp's seedlings which gave additional return to his intervention. During this period several field visits were made to his farm and water quality parameters were checked with necessary recommendation, supplementation of lime and manure, feed management etc were suggested for maintaining optimum health condition of fish seedling. Farmer was also supported with supply of essential inputs such as Hapas and Homones etc during fish seed production.

Impact

Several trainings, field demonstrations, and other technological interventions by the KVK in the field of fisheries and allied sector impacted Mr. Srivas Das, Madhupur to adopt fish seed production in the region, due to KVK efforts he could get some trained expert from local area. Adoption of technologies provided additional income to the farmer and gave him an avenue for better livelihood and employment opportunities. His problem of fish fry feed, poor plankton production and poor survival of seeds were effectively addressed with a pragmatic and cost effective solution. On successful production of fish seed in his hatchery he is now more confident of improving the production level in his farm. He also likes to take fish breeding and seed production of more species such as Grass carp, Silver carp, Rupchanda etc in ensuing season. Intervention made in Mr. Das farm benefitted more than 140 farmers through supply of Pangasius and other fish seedling. Further, successful execution of technologies by him motivated other farmers to opt fish farming as an economic venture thereby improving the status of scientific fish farming through multispecies aquaculture. Now farmers also focus of pre-stocking management of fish ponds for better productivity. Farmers from Diglipur regions are approaching KVK, N&M Andaman for suggestion and guidance for start of aquaculture on commercial scale.

Cost benefits analysis (Rs)

Fish species	F. Cost	V cost	Gross return	Net return	B:C ratio	Payback period
Pangasius	**995000**	201200	650000	448800	**3.27**	**1.87 yr**
Catla		11000	55000	44000		
Rohu		10200	24900	14700		
Puti		11000	35600	24600		
Total		233400	765500	532100		

* F. Cost- Fixed cost ** V cost- Variable cost

Conclusion: Fish seed production programme is a seasonal activity where farmers can involve him for 5-6 month in a year. Return from fish seed production and rearing is good as compared to table size production of fish. During last year farmer received an income of Rs 532100.00 during initial phage of establishment from an area of about 1 ha land. He also agreed that fish breeding and nursery management under the guidance of KVK, N&M Andaman yielded satisfactory result. In the coming season he would follow advice of KVK, N&M Andaman in all steps of fish breeding and nursery preparation. Now farmer is more confidents of expanding his venture and producing fish seed of additional varieties.



Plate 195 : Seed production of *Pangasius hypophthalmus*

KVK Farm Development

- As a part of KVK farm development, vermicompost unit have been constructed for farm waste recycling and production of vermicopst for manure (Plate 196).
- Peripheral roads around KVK low land was taken up under MGNREGA scheme with the help of Basantipur Panchayat with total out lay of Rs 12.00 lakhs (Plate 197).
- Under NABARD Fish Feed project a Fish Feed production unit was constructed for the production of fish feed (Plate 198).

Plate 196: Vermicompost unit

Plate 197: Road construction by MGNREGA

Plate 198: Fish feed unit

Farming activities at KVK Farm, Nimbudera

Development of KVK farm at N&M Andaman is benefitting local farmers. Different innovative technologies is being demonstrated on farm to farmers and KVK land is also being used for production of seeds of paddy, pulses, vegetables, nursery plants and fish seeds (Plate 199).

Plate 199: Glimpses of farming activities at KVK Farm, Nimbudera

Demonstration models at KVK, N&M Andaman

In order to demonstrate and to produce fish seeds two demonstration models were developed at KVK farm to motivate the farmers of N & M Andaman:

Integrated fish farming

Pond based integrated farming comprising duck was successfully established at KVK, Nimbudera farm to serve as a prototype for farmer to replicate in their farms (Plate 200 & 201). During demonstration trial several farmers got motivated to replicate similar model in their farm where one component of IFS supply food or input for another thereby improving productivity and income with minimum or no waste.

Plate 200 & 201: Pond based integrated farming

Rearing of fish fry in rice field

N&M Andaman is endowed with huge water resources for fish culture and considered as hub of farm production in A&N islands. Fisheries as a component plays vital role in doubling farmers income of island farmers. In N&M Andaman district paddy farming is practiced by almost all farmers in low land where paddy field can be integrated with fish culture (Plate 202). Paddy fields stocked with fish fry will always have advantage of minimizing insect and pest, weed, rodent etc those are serious problem in the region. Hence, in order to popularize rice cum fish culture in this region, a demonstration model was successfully established in KVK farm for the benefits of farmers of N&M Andaman district.

Plate 202: Fish fry in paddy field

Table 93: Farm Production and Revenue generation (2018-19)

Sl. No.	Crop & variety	Area (Ha)	Production		Sold (unit)	Revenue Generation (Rs.)	Remarks
			Commercial	Seed			
1	Paddy (Mixed)	1.0	1370 kg		970 kg	12270	400 kg used as feed for duck in farm
2	Paddy CARI 7			10 kg	10 kg	300	
3	Bhendi seed	0.03		1.1 kg	1.1 kg	440	
4	Cowpea seed	0.02		0.8 kg	0.8 kg	240	
5	Amaranthus seed	0.03		0.4 kg	0.4 kg	80	

6	Brinjal seedling		705 Nos.		705 Nos.	423	
7	Chilli seedling		910 Nos.		910 Nos.	546	
8	Tomato seedling		25 Nos.		25 Nos.	17.5	
9	Ornamental plants / Seedling		80Nos		80 Nos.	1600	
10	Arecanut seedling (Mixed)		530Nos.		530 Nos.	7150	
11	Poultry (Duck) live		119.2 kg		119.2 kg	20987	
12	Egg grade "A"		231 Nos.		231Nos	1386	
13	Egg grade "C"		11 Nos.		11 Nos.	44	
14	Hatching egg		11 Nos.		11 Nos.	187	
15	Poultry egg hatching facility		334 Nos.		247 Nos.	988	87 nos. for OFT & FLD
16	Day old chicks		26 Nos.		26 Nos.	650	
17	Spinach		48kg		48 kg	960	
18	Amaranthus		2 kg		2 kg	20	
19	Coriander leaf		500 gm		500 gm	50	
20	Chilli (green)		4.9 kg		4.9 kg	245	
21	Bhendi (A. Anamika)		24.45 kg		24.45 kg	980	
22	Brinjal (raw)		39.5 kg		39.5 kg	1580	
23	Cucumber		7.5 kg		7.5 kg	225	
24	Cowpea		4.0kg		4.0kg	80	
25	Maize		3.0kg		3.0kg	90	
26	Dolichos bean		600 gm		600gm	24	
27	Ginger		1.5 kg		1.5 kg	120	
28	Turmeric (raw)		5kg		5kg	125	
29	Fish fingerlings			2500Nos.	2500Nos.	17500	
30	Arecanut with husk		250 Nos.		250 Nos.	250	
31	Coconut grade "B"		52 Nos.		52 Nos.	520	
	Total				**Total**	**69,637.50**	

Projects undertaken by KVK-Nimbudera

1. Vegetable Seed Production and Supply of Quality Seeds to Island Farmers for Increasing Vegetable Productivity and Nutritional Security of Island

Activities

Okra Variety Arka Anamika seed production was taken up in farmers field

Name of the farmer	Shri.Mahadev
Name of the village	Jaipur
Area cultivated	2 Bigas
Date of sowimg	09.02.2018
Variety	Arka Anamika
Quantity of seeds produced	185 kgs
Net profit (Rs.)	Rs 26750

OKRA (A.Anamika) seed production

Paddy varieties seed production was taken in farmers field and in KVK

Farmers field

Name of the Variety	Name of the farmer and Village	Area (ha)	Yield Obtained (Kg)
Gayathri	Bikash Bairagi, Basantipur	0.2	960
CARI 7	Ruben Kerketa, Long Island	0.2	880
CARI 6	Sibiyal Ekka, Burma kona	0.1	410

KVK Farm

Sl.No.	Variety	Area (Ha.)	Quantity Produced (Kg)
1	CARI 6	0.2	602
2	CARI 7	0.32	717
3	CARI 8	0.2	164
4	CARI 9	0.3	420

Gayatri variety

2. Supply of Quality Planting Materials to Farmers of N & M Andaman for Generating Higher Income

Activities

Collection of seed & planting materials from CIARI Port Blair and local collection for production of planting materials as detailed below:

Sl.No	Planting Materials	Qty.
1.	Arecanut	1200 Nos
2	coconut	50 Nos
3.	Turmeric	35 Kg
4.	Ginger	15 Kg
5.	Elephant Foot yam	15 Kg
6.	Colocasia	10 Kg

Production of planting material at KVK, Farm

- **Establishment of black pepper multiplication nursery:** Superior black pepper variety (Panniyur-1, 2 and other improved variety) collected, planted and raising for rapid multiplication in KVK Farm.

- **Planting of banana as mother block:** Superior variety of banana collected from farmer's field and planted as mother block in KVK Farm.

- **Multiplication of ginger & turmeric:** Superior varieties of ginger & turmeric were grown in an area of 0.1 ha for its multiplication.

- **Raising of vegetable seedling nursery:** Suitable and superior variety of brinjal, chilli, and tomato seedling were raised and distributed among the farmers.

Production and distribution of planting materials to the farmers

Sl. No.	Crop	Production	Distribution	No. of farmers benefitted
1	Mango graft	100 Nos.		
2	Guava	100 Nos.		
3	Lemon layer	100 Nos.		
4	Cherry	50 Nos.		
5	Arecanut seedling	1200	700 Nos.	10 Nos.
6	Coconut	75 Nos.		
7	Black Pepper	200 Nos.		
Ornament Plants				
8	Flowering	500	100	15
9	Foliage	200	75	10
10	Vegetable seedlings			
11	Brinjal	1000 Nos.	600 Nos.	20
12	Chilli	1000 Nos.	600 Nos.	20
13	Tomato	500 Nos.	200 Nos.	10
14	Ginger	50 Kg		
15	Turmeric	250 Kg		
16	Elephant foot yam	50 Kg		

Plate 203: Distribution of planting materials

3. Quality Fish Seed Production for Adoption of Scientific Fish Farming for Economic, Nutritional and Social Upliftment of Farmers in N&M Andaman

Activities

Base line survey: Field survey was conducted randomly from more than 90 farmers of Mayabunder and Rangat Tehsil using pre- tested questionnaire. It covered personal information and different aspects of fish farming such as method of fish culture and management measures, rate of stocking, liming and manuring, fish yield and economics of farming.

Personal Information of fish farmers

Tehsils	Average age of farmers (yr)	Education level (%)			Family size (No)
		<5	6 to 12	> 12	
Rangat (R)	52.14	58.62	31.03	10.34	4.92
M/bunder (M)	49.86	28	69	03	4.63

Information on fish farming

Pond age (Yr)	Dist. House (M)	S.Density (No)	Manure (Kg/ ha)	Feeding practices			Pond use		Prodn (Kg/ha)
				RB & COC	RB& CD	No	Irri & Cul	Cul & HH	
(R) 14.94	11.04	6703.5	1919.55	77%	14%	9%	46%	54%	**1281**
(M) 17.88	33.94	**11528.67**	1723.57	67%	8%	25%	**61%**	39%	1110

Maintenance of fish brooders: More than 200 fish brooders of Calta, Rohu, Mrigal and Puntius are collected from different region of North and Middle Andaman and being maintained in KVK farm and farmers field.

Fish breeding and seed production: Under this project more than 10 farmers from different region of N&M Andaman were supported through supply of inputs, motivated and technically guided in quality fish seed production. Farmer was guided in selection of quality fish brooders, preparation of fish nursery pond, feed management in brood stock pond and nursery pond, regular maintenance of water quality parameters, timely supply of induced breeding hormones and other inputs, guidance in supply of fish spawn to other nursery owners and marketing of other fish seedlings etc. This year induced fish breeding and seed production of catla, Rohu, Mrigal, Puti and Pangasius were successfully achieved at Dasarathpur, Govindpur, Madhupur, R. K. Gram and Nabagram. Total fish seed production of 1.49 lakh fish fingerlings with revenue generation of Rs 9.4 lakh. Breeding and nursery rearing of *Pangusius hypophthalmus* was achieved for the first time in A&N Islands. More than 265 farmers from different region of N&M Andaman were benefitted and received quality seedling under the project. Three new entrepreneurs were also supported under this project for their income and livelihood option.


Plate 204: Collection of fish brooders


Plate 205: Input to farmer


Plate 206: Eco hatchery for seed production

4. Quality Fish Feed Production for Nutritional and Augmenting Fish Production in N&M Andaman

Activities

Pellet fish feed formulations were evaluated under field condition: on availability of proper fish feed is the biggest lacuna in development of scientific fish farming in the area. Fish culture using suitable fish grower diets viz CIARI fish grower diet 1 and CIARI fish grower diet 2 were evaluated in farmer fields and compared with their farmers existing fish farming practice. Growth performance was superior in CIARI fish feed 1 followed by CIARI fish feed 2 and control. Cost incurred towards the farming operation was recorded to be Rs.44,525 /ha, Rs.51,786 /ha and 47,396 /ha for T1, T2 and control respectively. Net return obtained for T1 was Rs 38818 / ha with a B: C ratio of 1.75.

Technology option	Yield component		Survival (%)	Nos of fish fingerling harvested/ ha (Nos)	Cost of cultivation (Rs./ha)	Gross return (Rs/ ha)	BC ratio
	Weight on day of stocking (g)	Weight on 13th week (g)					
Farmers practice	6.89	20.27	94	7520	44525.08	38107.6	-
CIARI fish feed 1	6.94	47.19	96	7680	51786.54	90604.8	1.7
CIARI fish feed 2	6.43	29.64	96	7680	47395.86	56908.8	1.2

Establishment of fish feed mill: Under the project low cost feed mill shed was constructed with an outlay of Rs 1.42 lakhs at KVK, Nimbudera.



Plate 207: Evaluation of CIARI fish feed

5. Farmer's Producer's Organization (Mayabandar Agricultural Producer's Company)

Activities

In order to create better marketing facililities to the farmers KVK with the financial support from NABARD, established Farmer's Producer's Organization (Mayabandar Agricultural Producer's Company) at Harinagar. The company was registered under Companies Act. Presently it is having a paid up capital of Rs 5.00 lakhs with 100 members. Intially the company was procuring arecanut from farmers. In the year 2018-19 it had made a business of more than Rs 10.00 lakhs. Apart from this organised 04 BOD's and 02 review meetings at Harinagar. A meeting in the presence of General Manager, Shri. V.V.S. Prasad, NABARD and Asst. General Manager Smt. Shamila Sheela were also conducted to review the progress of the company on 12/12/2018. Apart from this awareness campaigns were also conducted by FPO in association with KVK.

Plate 208: Glimpses of FPO meetings

ICAR-CIARI, REGIONAL STATION, MINICOY, LAKSHADWEEP

The farm and infrastructure at Minicoy Regional Station suffered heavy damages during the Cyclone Oakhi on 30th November and 1st December 2017. Almost all the intercrops expect for a few fruit trees were destroyed. The damages caused were of the extent of rupees 1.14 crores.

With the limited manpower available at the centre, the initial few months were aimed at clearing the farm of debris and creating plots in interspaces. Thus vegetable plots were created in the interspaces of hybrid coconut palms in G-block. Brinjal, okra, chilli, spinach, pumpkin, bitter gourd, ash gourd, snake gourd, and palak varieties were used for vegetable cultivation in these plots. The planting material was sourced from ICAR institutes (CIARI & IIHR), State Agricultural Universities (KAU &TNAU), local bodies as well as commercial private companies (VFPCK, Naamdhari, Mahyco, Indo-American Hybrid seeds). The performance of CIARI Brinjal 1 sourced from the Division of Field Crops CIARI HQ was also evaluated in one of the plots, which did not perform well in Minicoy conditions. The produces from these plots were sold to local public through the sales counter, mostly on Fridays. The annual vegetable production from the farm was to the tune of 2061 Kg. The arecanut varieties, CPCRI-Mangala and CIARI-Samrudhi sourced from Division of Horticulture, CIARI HQ were also tried in the interspaces. They gave cent percent germination indicating the quality of planting material, but the emergent crop failed to survive the first seven months, mostly due to the unsuitability of the plot. Coconut nursery was established in D-block and several hundreds of seedlings of Lakshadweep ordinary, Laccadive orange dwarf, Laccadive green dwarf and naturally crossed hybrid varieties were produced. These seedlings were sold to line department as well as farmers. The main produce from the farm was coconut, tender nut, seed nuts and coconut seedlings. Coconut oil was also produced from the copra of Laccadive micro nuts. The farm interspaces also house some fruit trees, which generated an appreciable crop of 204Kg. Quality saplings of vegetables performing well in the RS farm were produced and sold to farmers through the sales counter. The total sale produce from the farm was Rs.2, 48,735.00.

With the mandate to work in veterinary aspects unlike the earlier institute, a few veterinary components were established in the farm. Shri. V Asif, PPO, Agati island donated two heads of Kasaragod Dwarf variety cattle to the farm. They have been maintained in the farm ever since. The Kasaragod dwarf is a variety that could be raised purely on free grazing with practically zero food cost. Hence the suitability of this variety in island condition is being evaluated. The local non-descript goats, though small, deliver more kids. On an average 2-3 kids are delivered with 4 kids not so uncommon. One goat of the same is reared in the farm. The local poultry bird in Minicoy shows most similarity to the original red jungle fowl. A semi intensive rearing unit for the same with around 24 birds is established in the farm. Five numbers of Kadaknath birds are also reared in the farm in a separate unit with a view to multiplying the same. The process is on the way and 3 months old chicks (7 nos) were produced by brooding the eggs naturally by using country chicken. The honourable Administrator, UT of Lakshadweep in his visit to the centers stall suggested the possible introduction of Kadaknath. Twelve numbers of Kakhi-Campbell ducks are also reared in the farm to establish a demonstration unit for IFS from the irrigation pond. With a view of introducing large poultry birds, Turkey birds of the breed Broad breasted white and Broad Breasted Bronze are also reared in the farm in a demonstration unit for popularizing the same among farmers.

In collaboration with the Animal Husbandry unit of Lakshadweep Administration at Minicoy, the cattle from the AH unit is allowed to graze among the interspaces of the coconut farm whereby the interspaces are cleared of grass and small plants that grow there. The dung and urine from the cattle form excellent biological fertilizer for the crop, as a result of which, the coconut yield from the respective plots got enhanced significantly. This was a win-win situation for both the centres i.e. free fodder for the cattle and free weed removal with bio-fertilizer for coconut palms.

Components of two of the institute-funded projects are also carried out at the Minicoy RS. Under the same, indigenous technical knowledge of the fisher folks as well as the breeding and reproductive biology of bluefin trevally from in and near the Minicoy lagoon was documented.

Apart from this the regional station provides technical support and planting material of ornamental plants to other government organizations like, Indian Navy, Coast Guard etc. for their campus beautification. As part of Swachhta mission, cleaning activity was carried out in farm, administrative block and quarter's surroundings in the morning hours of 07.00-09.00 (two hours) on the first Saturday of every month. Occasionally, *Parthenium* eradication programs were coupled with Swachhta mission. The staff of RS acted as resource persons for several training programs and workshops of line departments and other departments of the Lakshadweep administration. Staff also served as members in several committees in the celebration of events like National Minicoy Fest, Independence day, Republic day etc. The RS provides planting material, organic fertilizer and technical knowledge to progressive farmers in the establishment of nutritional kitchen garden.

Under the STC Project, 120 units of snorkelling kits were distributed to fishermen engaged in baitfish collection. Multivitamin tonics (5L) carboys (30 nos) were distributed to poultry and livestock farmers under the same project. A total of 49 marginal fishermen also benefitted from the same project by receiving 1Kg of monofilament, which could be used in line fishing.

The center exhibited the popular technologies of CIARI and other ICAR institutes in the National level exhibition organized as a part of National Minicoy Fest 2019. The stall was very well received and appreciated by the Administrator himself and other officials from Lakshadweep Administration. The RS participated in the Kisan Mela organized by ICAR-CCARI and had put up a stall in the exhibition. The RS also facilitated the participation of 14 farmers from different islands in Lakshadweep on the mela. Hon. DG, ICAR, appreciated the activities of the centre and he also felicitated the participants in the event

At Regional Station Minicoy

Farmers' with team members

With staff members of Regional Station

Scientist interacting with Administrator

SCHEDULE TRIBE COMPONENT

Under Scheduled Tribe Component (Tribal Sub Plan) the agriculture and allied activities were taken up to enhance the livelihood and income generation of the tribal farmers through capacity building, input distribution, demonstration of technologies and extension programme.

Capacity building programme

Sl. No.	Title	Venue	Date	Participants		
				Male	Female	Total
1	Pig farming for livelihood of tribal farmers of A & N Islands and awareness building and sensitization	ICAR- CIARI	18th - 24th April 2018	16	11	27
2	Bio waste decomposer: preparation and its uses in horticultural crops	Tapoiming & Chuchuka, Car Nicobar	22nd – 23rd May, 2018	89	7	96
3	Emerging diseases of pig and its sero surveillance	Car Nicobar	9th to 11th August, 2018	47	60	107
4	Indigenous poultry germplasm	Car Nicobar	12th to 14th August,2018	50	60	110
5	Nutritious kitchen garden for livelihood security & input distribution	Minicoy, Lakshadweep	12th & 16th Jan.,2019	150	128	278
6	Cultivation of pulses in A & N Islands	Harminder Bay, Hut bay	23rd January, 2019	36	7	43
7	Cultivation of pulses in A & Nicobar Islands	Hut Bay, Little Andaman	23rd Jan., 2019	36	7	43
8	Nutritious kitchen garden	Dugong Creek , South Andaman	20th Feb.,2019	15	-	15
9	High density multi-species cropping system for Nicobari tribes	Harminder Bay, Little Andaman	22nd Feb.,2019	31	26	57
10	Role of feeding in health management of livestock and poultry	Harminder Bay, Hutbay	27th February 2019	20	50	70
11	Vanaraja poultry farming	Harminder Bay, Hutbay	28th February 2019	17	20	37
12	Cultivation of bacterial wilt resistant Brinjal	Chuckchucha, Car Nicobar	2nd March, 2019	17	18	35
13	Importance of high yielding varieties and quality seed in agriculture	Harminder Bay, Hut bay	16th March, 2019	70	64	134
14	Fold scope for personal hygiene and zoonotic disease for Nicobari tribes	Harminder Bay, South Andaman	20th March, 2019	20	31	51
15	Training on better management practices of aquaculture	Campbell Bay				28

Technology backstopping and capacity building of Nicobari tribal farmers with NASI

An awareness building and sensitization program on “Health, Nutrition and Environment” for Nicobari tribal farmers has been organized during 20th-21st April, 2018 in collaboration with National Academy of Sciences, Allahabad. Based on the interaction held with the participants, the specialist team headed by Dr Manju Sharma, Distinguished Scientist in Chair has agreed upon in principle to fund projects in the areas of fisheries, piggeries, horticulture and handicraft as a sustainable livelihood option for tribes in Andaman & Nicobar Islands. Subsequently, 6 projects on fisheries, horticulture, value addition, mushroom, pig farming and handicraft were submitted, out of which two projects *viz.* piggery and horticulture were sanctioned with the financial outlay of Rs.30 lakhs.

NASI Programme

Foldscope Microscopy for Nicobari tribal farmers with ICAR-NIBSM

As a part of the “frugal science” movement which aims to make cheap and easy tools available for scientific use in the developing world, a one-day workshop on “Role of Foldscope Microscopy in minimizing the risk of zoonotic diseases at field level, diagnosis of plant diseases and ensure the personal hygiene of tribal farmers” has been jointly organized by ICAR-NIBSM and ICAR-CIARI under the DBT sponsored Foldscope Project for Nicobarese tribal farmers at Harminder Bay, Little Andaman on 20/3/2019.A total of 51Nicobarese participated of which 31 were female.

Foldscope is an ultra-affordable, paper microscope weighing 8 grams. Designed to be extremely portable, durable and to give optical quality similar to conventional research microscopes (magnification of 140X and 2-micron resolution), Foldscope brings hands-on microscopy to new places. The magnification power is enough to enable the spotting of organisms such as *Leishmania donovani* and *Escherichia coli*, as well as malarial parasites. Foldscope can be printed on a standard A4 sheet of paper and assembled in 7 minutes.

Foldscope

Interacting with farmers


Foldscope demonstration at Harminder Bay

Homestead based nutritional kitchen garden for Onge tribes with AAJVS

Onges are one of the 6 aboriginal tribes of ANI settled at Dugong Creek, Little Andaman. A project has been initiated in collaboration with Andaman Adim Janjati Vikas Samiti (AAJVS) to demonstrate "Homestead based nutritional Kitchen Garden" for them who are numbered 122.In this regard, the project team has visited Dugong Creek on 20-21 February 2019. After sensitizing the tribals about the need for balanced diet and the benefits of vegetables, demarcated the demonstration plot of 600 m^2 and made a layout for planting various crops of different nutritional value *viz.* banana, tapioca, curry leaf, cherry, bael, alacasia, papaya and dragon fruit. As a mark of initiation, planted the seedlings taken along with the team.


Interction with Onge Leader & others at Dugong Creek


Voyage to Dugong Creek by team

Demarcated demonstration plot

Literacy of Onges

Planting at demonstration plot

Project team

Capacity Building & Inputs to Tribal Farmers of Minicoy, Lakshadweep

One Scientist-Farmer Interaction has been organized at the Regional Station in Minicoy, Lakshadweep on 16th January2019, wherein 278 farmers participated. Besides,300 vegetables kits were distributed to the trainees for growing under backyard to ensure nutritional security.

View of the stall

Distribution of vegetable kits

Distribution of critical input

Scientists- farmers interaction

Input distributions

Sl. No.	Inputs	Quantity	Place	Beneficiaries
1	Seed of rice	15 q	Hut Bay, and Car Nicobar	20
2	Seed of green gram and black gram	1.27 q	Hut Bay	167
3	Brinjal seed	0.5 kg	Hut Bay	
4	Coconut dehuskers	40 nos	Harminder Bay	40
5	Coconut climbing devices	30 Nos.	Tapoiming and Chuchuka , Car Nicobar	3 community
6	Coconut climbing devices	30 Nos	Harminder Bay	30
7	Vegetable kits	300	Minicoy, Lakshadweep	300
8	Pig feed	5 tonnes	Harminder Bay	50
9	Mineral mixtures	100 kg	Harminder bay	50
10	Plastic drum for biowaste preparation	02 Nos.	Tapoiming and Chuchuka	02
11	Seeds, saplings, manures, implements, shade net, fencing material etc.	One unit	Dugong creek, Little Andaman	Community
12	Lined dug out ponds	3 Nos.	Car Nicobar	03
13	Lined dug out ponds	3 Nos.	Harminder Bay	03
14	Small farm implements	36 Nos.	Car Nicobar	36
15	CIARI-Bioconsortia	50 Kg	Hut Bay	

Demonstration(s)

Sl. No.	Technology	Date	Venue	Farmers
1	Demonstration on coconut climbing device	18th Feb., 2019	Harmindar Bay	30
2	Demonstration on coconut dehusker	19th Feb.,2019	Harmindar Bay	40
3	Homestead based kitchen garden (600 m^2)	20th – 21st Feb., 2019	Dugong Creek	15
4	Demonstration on Role of Foldscope Microscopy in minimising the risk of zoonotic diseases at field level, diagnosis of plant diseases and ensure the personal hygiene of tribal farmers	20th March, 2019	Harminder Bay	51
5	Demonstration of lined ponds		Harmindar Bay, Car Nicobar	02

Exhibition

Sl. No.	Title	Participants (No.)	Period	Venue
Exhibition				
1	National Minicoy Festival	1120	12th - 13th Jan.,2019	Minicoy, Lakshadweep

Impact of Fisheries intervention

Impact Assessment of the interventions conducted during the period 2012-17 has been completed at Car Nicobar through structured interviews based on the interventions including FRP fishing boats, outboard engines, GPS etc. Categorized under social, economic and technical categories, the beneficiaries ranked leadership, improved income and better access to navigation uses on Rank I. Further on assessing their perceptions of the interventions, they scored higher rank for using improved fisheries technologies which saves time. The impact analysis also revealed that economic benefits, followed by alternative livelihood, training and support, motivation/leadership, accomplishment/satisfaction as satisfaction factors realized due to the interventions. A compilation of the activities completed during the period of intervention has been compiled and published as database incorporating overall activities carried out under the Schedule tribe component.

Glimpses of other interventions/ activities with tribal farmers

WOMEN PARTICIPATION (SC/ST)

Thrust has been given for empowering women specially the SC/ST beneficiaries through various capacity building and a need based technological demonstration in agriculture and allied fields by the Institute. The women folks participated with lots of enthusiasm to harness the benefit of latest knowledge and skill in the field of pig farming, biowaste decomposer, disease of pig and sero surveillance, nutritious kitchen garden, pulses, HDMS, health management of livestock, importance of poultry seed, foldscope, scientific goat farming, Nicobari fowl etc.

The participation of women were 693 in the category of ST comprising from Nicobar District and Little Andaman, beside 633 from South Andaman & 552 from North & Middle Andaman District belong to other than SC& ST category.

TECHNOLOGIES TESTED, DEMONSTRATED & TRANSFERRED

- Water harvesting technology to tribal farmers through making lined dugout ponds at Car Niocbar (3 nos) and Harminder Bay (3 no's) under Scheduled Tribe Component
- Demonstrated tsunami lands restoration technology to stakeholders
- Standardized technology for the development of spiced based ready-to-serve (RTS) products of noni at Food Process Engineering Laboratory (FPEL)
- High Yielding Varieties of rice *viz.*Gayatri, CARI 6, CSR 36 and CARI 7 transferred & popularized in North Andaman
- Demonstrated Horticulture based Nutritious Kitchen garden for Onge tribe at Dugong Creek
- Under frugal science movement introduced and demonstrated Foldscope to Nicobari Tribes for the first time in ANI in Collaboration with ICAR-NIBSM, Raipur.
- Oyster mushroom production technology transferred at North Andaman through demonstrations
- Quality seed (TFL) 17 q of CIARI rice varieties viz. CARI Dhan 4, 5, 6, 7, 8 and 9 were demonstrated to 197 farmers under FLDs at North and Middle Andaman and South Andaman district
- 1.0 q seed of CIARI Pulses Varieties CARI Mung 1, CARI Mung 2, CARI Mung 3 CARI Mung 4, CARI Mung 5, CARI Urd 1 and CARI Urd 2 to 62 farmers under FLDs at Long Island, North and Middle Andaman with the collaboration of KVK, Nimbudera and Social Science Section.
- Under STC total of 15 quintal Truthfully Labelled Seed of five rice varieties (CARI Dhan 4, CARI Dhan 5, CARI Dhan 6, CARI Dhan 7 and CSR 6) demonstrated in tribal dominated areas at Little Andaman and Campbell Bay.
- A total of 1.27 quintal Truthfully Labelled Seed of Pulses CARI Mung 2 (29 Kg), CARI Mung 3 (17 Kg), CARI Mung 4 (52 Kg), CARI Urd 1 (11 Kg) and CARI Urd 2 (15 Kg) demonstrated in tribal dominated areas in Little Andaman and Campbell Bay under STC Programme
- Seeds (0.5 Kg) of bacterial wilt resistant brinjal variety CARI Brinjal 1 demonstrated among the tribal farmers of Car Nicobar
- CIARI Bioconsortia and Microbe enriched Farm yard manure (MFYM) technology of bioagents for plant disease management demonstrated at South and North Andaman Islands.
- Nicobari fowl germplasm propagated and transferred at South Andaman.
- Package of practices for rearing Vanaraja chicks standardized and transferred at South Andaman
- Duckling production using mini incubator demonstrated at North & Middle Andaman.
- Herbal eye drop to control conjunctivitis of affected birds demonstrated of South Andaman

PATENT FILED

METHOD OF DETERMINING THE SEX OF NON-RATITE BIRDS; APPLICATION NO : 201911006026 DATED 15.02.2019

Inventors : Arun Kumar De, A. Kundu, Jai Sunder, T. Sujatha, P. Perumal, D. Bhattacharya and S.K. Zamir Ahmed.

SEED & PLANTING MATERIAL PRODUCED

Particulars	Variety	Quantity (Nos. / Kg.)
Dragon fruit (rooted cuttings)	DGF-1,2,3 & 4	1000 Nos
Marigold (rooted cuttings)	Assorted varieties	200 Nos
Jasmine (rooted cuttings)	*Jasminum sambac*	200 Nos
Blood Fruit (seedlings)	Local	50 Nos
Black Pepper (rooted cuttings)	Panniyur – 1, 2 & 5	96 Nos
Noni (seedlings)	Samapada, Rakshak, Samradhi & Sanjivini	8900 Nos
Cinnamon (air layers)	Local	36 Nos
Cinnamon (seedlings)	Local	75 Nos
West Indian Cherry (rooted cuttings)	Local	300 Nos
Tejpata (air layers)	Local	18 Nos
Bael (seedlings)	Local	10 Nos
Coconut dwarf (seedlings)	Annapurna, Chandan, Surya & Omkar	883 Nos
Coconut tall (seedlings)	Andaman ordinary	58 Nos
Coconut Dwarf (seed nuts)	Annapurna, Chandan, Surya & Omkar	108 Nos
Arecanut (polybag seedlings)	Samridhi & Andaman Local	2396 Nos
Arecanut (seed nuts)	Samridhi & Andaman Local	1660 Nos
Nutmeg (seedlings)	Local	65 Nos
Clove (seedlings)	Local	88 Nos
Elephant foot yam (seed tubers)	Gajendra	870 kg
Ginger (mother rhizomes)	Jorhat	80 kg
Turmeric (mother rhizomes)	Prabha & Pratibha	5 kg
Colocasia (seed tubers)	Sree Rashmi, Sree Kiran and Locl	10 kg
Rice (Nucleus Seed)	CARI Dhan 1, CARI Dhan 2, CARI Dhan 3, CARI Dhan 4, CARI Dhan 5, CARI Dhan 6, CARI Dhan 7, CARI Dhan 8 and CARI Dhan 9	26 kg
Rice (Breeder Seed)	CARI Dhan 1, CARI Dhan 2, CARI Dhan 3, CARI Dhan 4, CARI Dhan 5, CARI Dhan 6, CARI Dhan 7, CARI Dhan 8 and CARI Dhan 9	157 kg
Rice (TFL)	CARI Dhan 2, 4, 5, 6 7, 8, 9, CSR36 and Gayatri	52.06 quintal
Pulse (TFL)	Mungbean (CIARI Mung 1, 2, 3 and 4) and Urdbean (CIARI Urd 1 & CIARI Urd 2)	4.01 quintal
Brinjal (TFL)	CARI Brinjal 1	0.5 Kg
Mushroom	CIARI Mushroom	100 packets
Hatchable eggs	Vanraja	16284 germplasms
Carp grower feed	-	430 kg

TECHNOLOGY DEVELOPED

1. Sex determination kit for differentiation of sex of non-ratite birds

Inventors :Arun Kumar De, A. Kundu, Jai Sunder, T. Sujatha, P. Perumal, D. K. Muniswamy, D. Bhattacharya and S. K. Zamir Ahmed

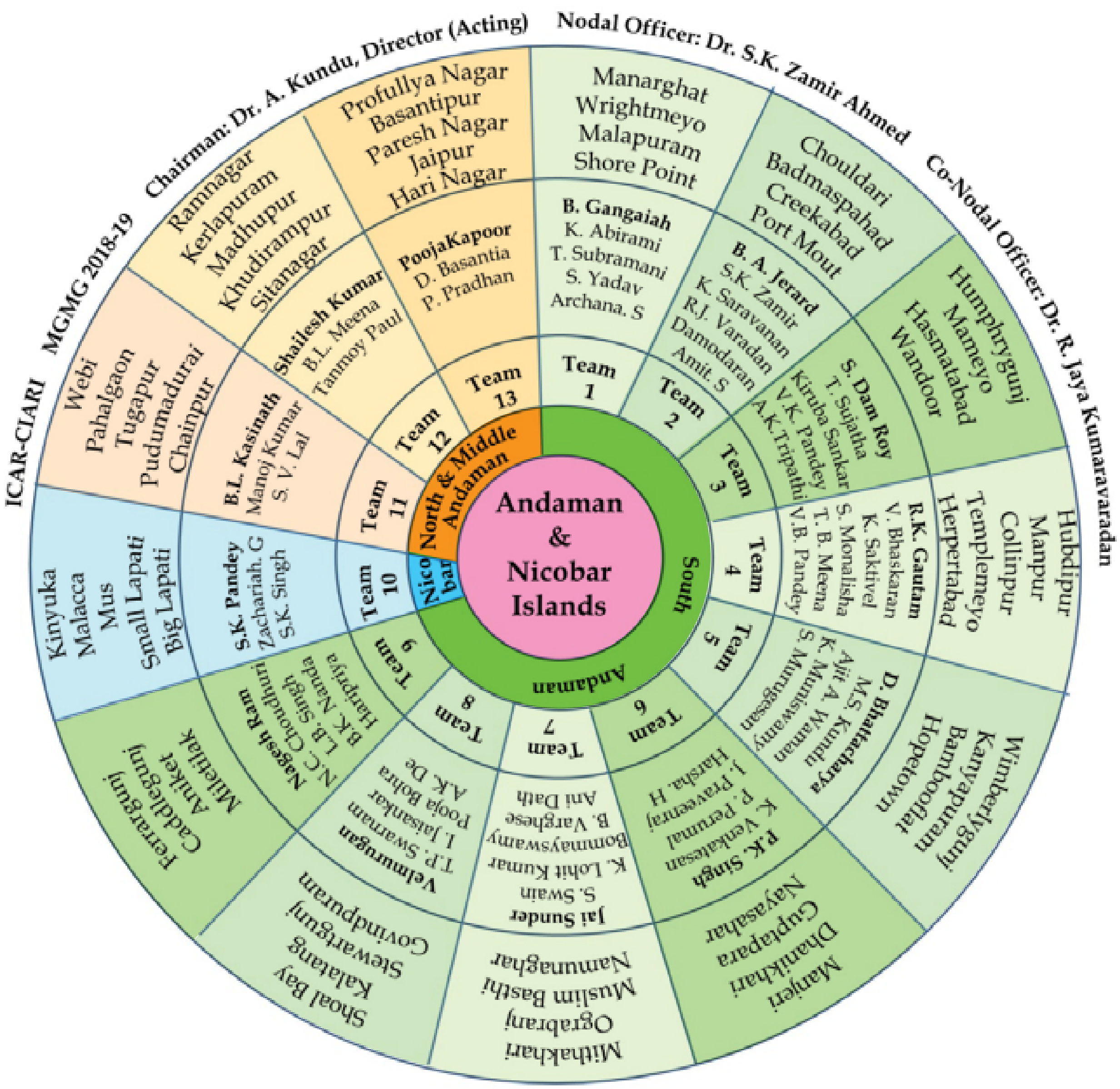
2. Carp Grower Feed

A formulated feed, 'Carp Grower Feed' was developed by Fisheries Science Division and evaluated at North and Middle Andaman with the collaboration of KVK, Nimbudera.

MERA GAON MERA GAURAV (MY VILLAGE MY PRIDE)

Introduction

On the occasion of the 87th Foundation Day of ICAR on 25th July 2015, Government of India had implemented an innovative initiative "Mera Gaon Mera Gaurav" (My Village My Pride) to promote the direct interface of Scientists with the farmers to hasten the lab to land process. The objective of this scheme is to provide farmers with required information, knowledge and advisories on regular basis by adopting villages. The programme is being implemented by the Institute since 2015-16 covering 57 villages across all the three districts of Andaman & Nicobar Islands through 13 teams comprising Scientists and Technical Officers of CIARI; and Subject Matter Specialists of KrishiVigyan Kendras. The details of the teams, number of villages in the respective district covered are depicted in the figure.



Salient achievements for the year 2018-19

During 2018-19, the multi-disciplinary teams regularly visited their respective adopted villages and provided diagnostic services to the farmers on the specific problems in participatory mode *viz.*kolerago disease in arecanut, bud rot in coconut, nut fall in coconut and arecanut, *loranthus* in sapota, bunchy top in banana, bacterial wilt in brinjal, mealy bug in chillies, FMD in cattle and goat, animal infertility, poultry mortality and hump sore in cattle.

Diagnosing Koleroga disease in arecanut

Identifying bud rot disease in coconut

Providing IPM advisory for Rhinoceros beetle in coconut

Diagnosing bacterial wilt disease in brinjal at Creekabad

Diagnosing bunchy top disease in banana at Lal Pahad

Diagnosing Loranthus infestation in Sapota at Lal Pahad

Diagnosing animal diseases at Guptapara

Besides, the teams have conducted 32 interface meetings/Goshthies *viz.* Seed Day celebration, Kisan Kalyan Diwas and Mann Ki Baat; organized 42 training programmes on ornamental fish rearing, role of feed probiotics in Island aquaculture, agri and fish cultural practices, value addition of flower crops, scientific harvesting in cinnamon, bay leaf cultivation in coconut plantation, management of common diseases in livestock, management of FPO etc.; conducted 35 demonstrations in total on various enterprises *viz.*Gajendra variety of Elephant Foot Yam, Jorhat variety of Ginger, setting up of glass aquarium, scientific harvesting in cinnamon etc.; besides provided 400 mobile based advisories for effective crop management; distributed seeds and planting materials of brinjal var. Arka Nidhi, clove, CIARI rice varieties, black pepper, bayleaf; and veterinary medicines as critical inputs.

Distributing CIARI rice seeds to farmers during the Seed Day celebration at KVK, South Andaman

Seed Day celebration at Rangat, Middle Andaman

Kisan Kalyan Diwas at Tugapur

Mann Ki Baat programme at Basantipur

Interaction with Pradhan, Mannarghat

Field day on "Role of feed probiotics in Island aquaculture"

Demonstration on setting up of glass aquarium during the training on ornamental fish rearing

Interaction with farmers of Humfrygunj on agri and fish cultural practices

Training on Value addition of flower crops at Herpatabad

Demonstration on scientific harvesting of cinnamon during training at Kanyapuram

Awareness on bay leaf cultivation in coconut plantations at Kanyapuram

Awareness on Common diseases of animals and their management at Guptapara

Interaction with FPO at Diglipur

Interaction with FPO at Harinagar

Monitoring FLD on Gajendra variety of Elephant Foot Yam at Lal Pahad

Monitoring the FLD on Jorhat variety of Ginger at Lal Pahad

Distribution of clove saplings to women farmers at Lal Pahad

Distribution of brinjal var. Arka Nidhi seeds to a farmer at Creekabad

Distribution of planting material of black pepper to trainee farmers at Kanyapuram

Distribution of planting material of bay leaf to the trainee farmers at Kanyapuram

Distribution of veterinary medicine to the trainee farmers at Guptapara

The newly constituted Quinquinneal Review Team headed by Dr. Chittaranjan Kole visited the experimental farms and technology demonstrations in the MGMG villages of South Andaman on 28.11.2018 and interacted with the farmers.

QRT interacting with a farmer in Creekabad

QRT interacting with a farmer in Gopal Nagar

QRT interacting with a farmer in Ograbraj

QRT interacting with a farmer in Port Mout

CASE STUDIES OF MGMG

Case Study 1: Modified Broad Bed & Furrow System of cultivation for challenged areas

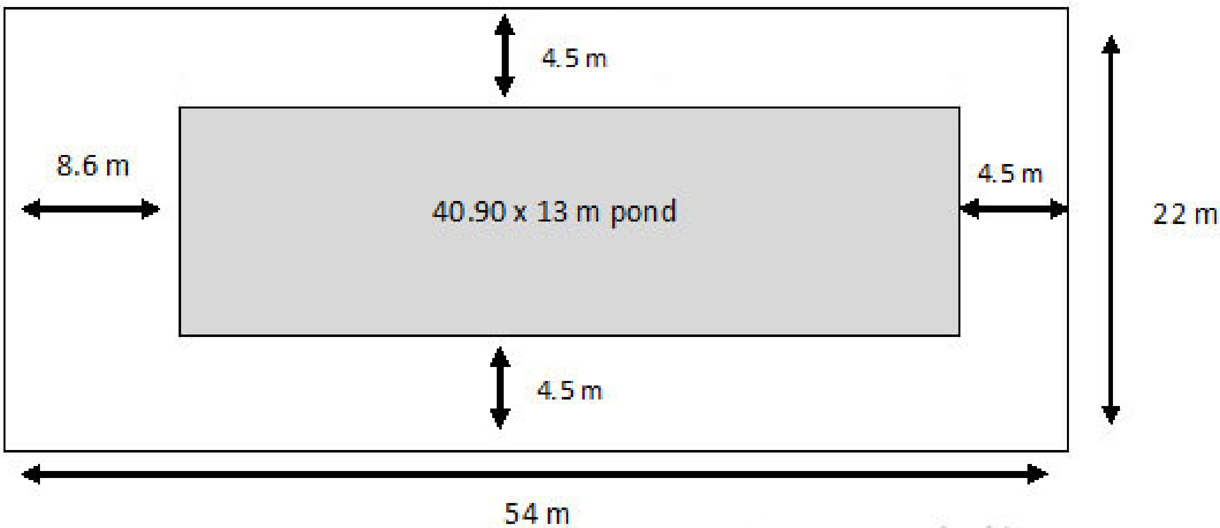
Team members: S.K. Zamir Ahmed, R. Jaya Kumaravaradan, B.A. Jerard, K. Saravanan, V. Damodaran and Amit Srivastava

Background Information

Shri Sudhir Dutta, a farmer in Creekabad village was earning a net income of Rs.12,000 to 15,000/ha by practicing a single crop of rice in his degraded land affected by Tsunami 2004. He was in search of technological intervention wherein he could cultivate and earn income to meet and enhance the livelihood of his family.

Technological intervention: Two-tier Broad Bed & Furrow System of cultivation

The MGMG team inspected the farm during 2017-18 and analyzed its cropping pattern, resource base, soil quality etc. and found the soil to be highly acidic due to sulphate content. Under NABARD funded project, an intervention was made wherein a farm plan has been formulated with a modified Broad Bed Furrow System of 1188 sq.m. comprising 2 beds and a furrow in-between as below:



As the farmer preferred brinjal which fetches good price in the market, seeds of high yielding variety of brinjal were provided to him for planting on the beds and suggested to apply poultry manure as soil amendment.

Innovative extension methods used

Personalized extension methodology (Scientist-Farmer-Market Approach)

Linkage developed through Govt. sponsored schemes /Spread/benefits:

NABARD,KVK, South Andaman, Development Department, Input suppliers etc.

Impact

During the first year of intervention,the farmer has harvested 2.5 t of brinjal from 656 m^2 bed area and earned a net income of Rs.58,000 within a span 5 months from an area which was hitherto uncultivable due to seawater intrusion after Tsunami.

Further, it has been planned to rear fish in the pond during the next monsoon season.

Lessons Learned

Innovative cultivation technologies disseminated through personalized extension methodologies can make improvement to the livelihood of farmers in challenged situation.

Supporting Images

Before intervention

After intervention

Providing agro advisories to the farmer

Brinjal crop at harvest stage

Case Study 2: Resource Use Management

Team members: A.Velmurugan, T.P. Swarnam, I. Jaisankar and Pooja Bohra

Background Information

Smt. Anbumalar is woman farmer from shoal bay who has 2ha of plantation crops of coconut and arecanut with a small farm pond (300 m^2) and two dairy animals. The productivity was very low with an annual income of Rs.60,000 only. On visit, the team identified soil erosion and water scarcity as the two major problems needing immediate attention. The crop residues generated from the field was kept unutilized and wasted. The team set the goals of preventing soil erosion and moisture conservation, composting as the priorities to improve the farm productivity and farm income.

Technological intervention

- Soil and moisture conservation – Residue mulch around the trees to reduce soil erosion and water loss
- IFS for income and farm diversification
- Composting technology for residue recycling – Vermicomposting and value addition
- Agroforestry measures for enhancing farm performance, output, diversification, sustainability (Boundary planting of green manure crops and intercropping of fodder grass in coconut plantation)

Innovative extension methods used

Use of SMS, Whatsapp, personal phone calls and field visit.

Linkage developed through Govt. sponsored schemes /Spread/benefits

Linkage at field level is challenging, as regular working require common mandate. However, during training, need based assessment collaboration with line departments viz., agricultural and animal husbandry were established.

Impact

- The fruit retention was improved by water residue mulching around the trees and productivity improved by 10 -20%
- The farm waste is composted with cow manure through vermiculture and sold at Rs.15/kg giving an additional annual income of Rs.25,000.
- The timely weather forecast helped the farmer to reduce the loss of fish by preventing the escape through flood waters through installation of nets around the ponds
- The farmers in the nearby areas are adopting the moisture conservation measures and composting the waste for utilization in the field.

Lessons Learned

It is very essential to maintain linkage with farmers and nurture it to gain confidence. However, without proper planning, financial support and adequate focus we cannot bring desired changes. Logistics and input support is very essential to motivate and help the farmers. This should be linked with Agricultural department/NAFED, to promote/support marketing. Without this, market network development to help farmers is difficult.

Media focus on MGMG

The developmental activities undertaken by the Institute in MGMG villages were widely publicized through local media.


QRT visits experimental farm, technological demonstrations at MGMG villages


Diagnostic services by CIARI Scientists


Farmers trained in 'value addition of flower crops'

INFORMATION ON OTHER SECTION

Priority setting, Monitoring and Evaluation (PME) Cell

XI Institute Research Committee (IRC-2018) Meeting for Institute funded projects was held on 22nd, 23rd and 24th August, 2018 at Dr. N.T. Singh Conference Hall under the Chairmanship of Dr. A. Kundu, Director (Acting), CIARI. Dr. W.S. Dhillon, ADG (HS), ICAR, New Delhi and Dr. T.V.R.S. Sharma, Member, GB, ICAR, New Delhi were the experts and Mr. Sushil Kumar Singh, Senior Admn. Officer was the special invitee during the IRC. A total of 54 Institute projects were presented and reviewed with appropriate suggestions by the house.

PME Cell is involved in accomplishing time frame work like Institute Annual Report 2017-18, DARE/ICAR Annual Report 2018-19, Coffee book 2018-2019, DSIR & Major contribution of last five years, Cabinet Report (Every month),Half Yearly Performance Review, Statewise achievements (2014-2018),Information on Committed liabilities and Budget outlay, Sector wise Output-Outcome Frame Work for 2019-2020, Information for consideration of XV finance Commission, Prioritized research activities to the next level of requirement,(5 – 10 Years), Annual Plan 2018-2019 & 2019-2020, Output-outcome framework for the schemes (2017-18 to 2019-20), Outcome Budget (2018-2019), Outcome Review (2017-2018), Document on PM's Vision on Agriculture Research and ICAR, Annual programme in agriculture & allied fields for Kisan Vaani broadcast from AIR & DDK, Port Blair, Action plan on R & D activities of the Institute, monitoring of soil health card submission on portal etc. Beside, the parliamentary replies, press releases both to the Island and mainland press and other major technological dissemination events were coordinated like Productivity day, Soil health day, Institute foundation day and Agriculture Education Day etc.

The cell also maintains repository of RPFs of the Institute funded projects along with the annual report, bulletins, folders, books and other related publication for ready reference. A database of research projects from 1978 to 2018 was developed as a ready reckoner and also felicitated signing of 4 MoU with mainland University to encourage PG studies.

Library

The Central Library of ICAR-CIARI plays a vital role in the collection, development and dissemination of scientific information to cater various needs of the Institution. Library is the store house of knowledge especially on Horticulture, Field Crops, Natural Resource Management, Animal Science, Fisheries Science, Social Science and many other related areas and play a pivotal role in catering to the needs of scientists, technicals, research workers, students and administrative staff of the Institute. It also extends these facilities to the local researchers and education institutes of these Island and mainland.

Collection of books and journals

- The library is the store house of 7034 books and 2621 miscellaneous publications in addition to various journals databases and technical books. Moreover annual reports, newsletters and research bulletins received from different Indian and Foreign Institutes are also been maintained in the library.
- **Island Special Section:** The library maintains a special section named 'Island Special Section', which is equipped with 490 books on different aspects of Andaman and Nicobar Islands, some of them are rare in nature. Beside special collection on Hindi literature along with reprographic facility is also available.

Rare Collection: CIARI library has kept 07 No. old and rare British publication 'Memoirs of the Asiatic Society of Bengal' from 1925-1935 (Digitize copy also available).

Activities: A total of 33 meeting, conference, seminar, workshop were organized in the N.T.Singh conference hall and a total of 4976 no. of readers visited during the period.

Newspaper clippings: "The glimpse" covering news related to agriculture and allied science were collected on daily basis for ready reference.

Rajbhasha Cell

For the implementation of the official language policy and the targets fixed in annual programme, efforts were made for doing maximum work in official language. Various steps were taken to popularize Official Language among the officers and staff and to promote the use of Hindi in the official work of the institute.

- Hindi Fortnight was conducted from 14th September to 26th September, 2018. Various programmes like quiz, extempore, essay, letter-writing, noting-drafting, vocabulary, best division/section/unit, overall participant and speech competition for scientist/technical and administrative staff and farm ladies were organized to bring awareness about the importance of increasing use of Hindi in day to day work.
- Rajbhasha Seminar on **"Hindi -Link language of farmers and scientists of these Islands"** was held on 14th September, 2018 under. The scientist and staff of the institute attended as speakers.
- For extension and maximum use of Hindi in official works, bilingual scientific bulletins/ folder in Hindi were prepared for the local farmers of these islands. Doordarshan and All India Radio, Port Blair broadcasted/ telecasted agricultural article/programmes related to institute activities for the Island farmers.
- Relevant technologies in the fields of Agriculture, Horticulture, Animal Sciences, Fisheries, Natural resource management and Social science section were translated in Hindi suitable for the local farmers understanding and transmitted.
- Achieved the targets of using Hindi fully in the field of transfer of technology and extension. The use of official language in extension and transfer of technology has reached a new height. All the training materials used were bilingual.
- Institute library has established a separate section for Hindi books.
- **'Dweep Krishi Sandesh'** a technical book in Hindi was prepared.

Town Official Language Implementation Committee (TOLIC), Port Blair

As per the Office Memorandum No. 12024/09/2010/OL, dated 15.10.2010 issued by the Rajbhasha Vibhag, Home Ministry, Govt. Of India, the charge of Town Official Language Implementation Committee (TOLIC), Port Blair was given to Central Island Agricultural Research Institute, Port Blair.

Activities conducted

Half Yearly Meeting : During the year, half yearly meeting of Town Official Language Implementation Committee, Port Blair was conducted on 13th July, 2018. On the basis of quarterly report received from different member offices the *Chal Vaijayanti Shield* and *Cup* were given to awarded offices on annual basis.

Awarded 17 officers and staff of member office of **TOLIC** with memento and certificates for their contribution and co-operation in implementation of the official language programme for the year 2016-2017 in the half yearly meeting of Town Official Language Implementation Committee, Port Blair on 13th July, 2018.

Smt Sulochana, Asstt. Director (OL) attended the Technical Seminar and workshop on official language organised by ICAR-CRIDA, Hyderabad on 22nd to 25th April, 2018 and Regional Official Language Seminar and prize distribution function organised by Regional Implementation Office, Kolkata, Ministry of Home Affairs, OL Deptt., New Delhi on 10th March, 2018 at Patna.

Official Language Activitie

Post Graduate Cell

Post Graduate Cell has been established to facilitate the training/ dissertation/ implant training to graduate & post graduate students at ICAR-CIARI in collaboration with the other research Institutes. With an aim to expand the research linkages with the other Universities of the National Agricultural Research System, during the year, the institute has signed MoU with four Universities *viz*. Bidhan Chandra Kirshi Viswavidyalaya, West Bengal, West Bengal University of Animal & Fisheries Sciences, West Bengal, Odisha University of Agricultural & Technology, Odisha and Dr J Jayalalithaa Fisheries University, Tamil Nadu. With the signing of MoUs, the faculty and students of CIARI as well as the Universities will get an opportunity to do their project dissertation work at CIARI as well as in the respective universities. During the year a total of 12 students from various universities of mainland have registered to undertake dissertation and implant training for a period of 15 days to 6 months.

Sl.No.	Name of the student	Course	University	Supervisor	Duration
1	Ms. Prithvi M.	M.Tech (Biotechnology), Final year	Kumaraguru College of Technology, Coimbatore, Tamil Nadu	Dr. K. Venkatesan	6 months
2	Ms. Nazia Aziz	B.Tech (Biotechnology) 2nd year	Hindustan Institute of Technology and Science, Chennai	CIF	15 days

Sl.No.	Name of the student	Course	University	Supervisor	Duration
3	Ms. Shaheen Hussain	B.Tech (Biotechnology) 2nd year	Hindustan Institute of Technology and Science, Chennai	CIF	15 days
4	Ms. Shaba Tarannum	B.Sc Botany	JNRM College, Port Blair	Dr. Pooja Bohra	3 months
5	Ms. Twinkle Shukla	B. Sc. (Biotechnology) 3rd Year	Amity University Kolkata	Dr. D. Bhattacharya	1month
6	Ms. Amita Dung Dung	B.Sc. (Biotechnology), 3rd Year,	St. Xavier's College, Ranchi	Dr. A.K. De	1month
7	Mr. Nishit Xalxo	B.Sc. (Biotechnology) 3rd Year	St. Xavier's College, Ranchi	Dr. K.Sakthivel	1month
8	Mr. Ankit Topno	3rd Year, B.Sc. (Biotechnology)	St. Xavier's College, Ranchi	Dr. A.A. Waman	1month
9	Ms. Prema Rashmi Ekka	3rd Year, B.Sc. (Biotechnology)	St. Xavier's College, Ranchi	Dr. P. Perumal	1 month
10	Ms. Ankita Xalxo	3rd Year, B.Sc. (Biotechnology)	St. Xavier's College, Ranchi	Dr. P.K. Singh	1 month
11	Ms K Asmin Bibi	M.Sc (Plant Biology & Plant Biotechnology) First year	Madras Christian College, Chennai	Dr. R.Kiruba Sankar	15 days
12	Ms Moumita Das	B.Tech (Biotechnology) 4th Year	National Institute of Technology, Durgapur, West Bengal	Dr. Pooja Bohra	1 month

Estate Section

The Estate Section consists of Estate, Workshop and Instrumentation Centre. It takes up works related to infrastructure development and repair & maintenance of the Institute buildings to support its research activities. The power supply plays an important role for laboratory research works. Three Diesel Generator Sets are kept as stand by for restoration of power supply during power cuts and exigencies. The electricity and water supply system to residential & non-residential buildings are also operated and maintained by the Estate Section to support research activities and staff welfare.

Repair and Infrastructure Development

A number of civil structures have been developed in this financial year to facilitate research and developmental activities. A goat shed of size 6.70x4.20m was constructed for Animal Science division under AICRP project to carry out research on goat farming. A small C.C. Culvert/bridge of 6.00m length with guard rail was constructed across the Nallah near Field office of Horticulture & Forestry Division as the existing wooden bridge was broken after prolong use. This culvert was essential for the field staff/Scientist to cross the Nallah. A pig waste collection tank under AICRP-IFS project was also constructed. The rain water harvesting structure for harvesting rain water from the roof of Scientist Apartment building at Marine Hill was re-constructed as the existing one was damaged during cyclone. A cement concrete approach road (4.15m-L) for the new Guest House building was constructed. A room was created from the available space in the ground floor of new Guest House building by making a partition with aluminium section and other materials for office/reception. Arrangement for fixing of black granite stone on the building front wall have been made for modern hatchery, micro plot and pig shed cum feed store building at Garacharama Farm. Polishing of entrance of phase-I &II office building and wooden panel on the walls of Phase-II office building including reception area have been done for face lifting during the visit of Hon'ble Vice President. Dweep Krishi Darpan and prominent wall areas of phase-I &II office building were also painted for face lifting. The road marking on both sides of the roads connected to all the Institute buildings have been done at Garacharama Farm complex. Several measures were taken up to arrest roof leakages in the Institute buildings. Open rain water pipe line at the back side of Central block of Central Laboratory was fixed as the existing concealed C.I pipe line was blocked thus causing leakages in the building. To arrest leakages through roof slab and other areas, Galvanised Iron sheet roofing was provided on the terrace area of type-V/1 & V/2 quarters at Garacharama Farm. Similarly, galvanised iron sheet roofing was also done at the terrace level in four blocks of type-IV quarters at Garacharama Farm to arrest leakages of rain water . The plumbing installations and drainage pipe lines in all bathroom & toilets (07 nos) have been realigned to arrest the leakage of water. The Institute Name Board fixed on the roof of Watchman Kiosk and on the Arch gate at the entrance of the main gate was replaced. Painting of H&F Division Laboratories, Scientists'/Officers' room and CIF Laboratory in Central Laboratory building ,Sports complex room was done. Major structural repair works was carried out in the quarantine room, hatchery shed and mass culture laboratory at Marine Hill to make it fully functional. The doors, walls, floors, gate etc. of both the Pig shed were repaired and roof painted. Major carpentry repair works such as replacement of doors, windows, fly proof nets etc. in about 23 Nos. quarter were carried out. About 19 Nos of residential quarters were painted before allotment to the staff. Eight stalls were constructed on the terrace of KVK Administrative building for conducting District Kisan Mela held on 24th Feb. 2019 in collaboration with Directorate of Agriculture, A&N Administration and a pandal of size 12x8 m was constructed for display of exhibits for the said Kisan Mela at KVK Sippighat.

Workshop

The Workshop plays an important role for arranging transportation for Scientists', staff , farmers and student for carrying out research activities and welfare activities of the Institute. It also plies regular school trip, arrange and manage vehicles during major events of the Institute. The routine and major repairs of staff car, jeep and staff/ school bus were also carried out in stipulated time to facilitate research activity of the Institute.

Instrumentation Cell

The repairs and maintenance of scientific equipments, refrigerators and air conditioners installed in the Central Laboratory and other building were carried out to keep it in good condition to facilitate research activities of the Institute. Un-interrupted power supply was also maintained through our stand by Diesel generators during important meetings and functions of the Institute to cater to the need of the Scientists and the Institute as a whole.

Agriculture Knowledge Management Unit (AKMU)

Agriculture Knowledge Management Unit (AKMU) envisages providing online inter-connectivity between the different research institutes, national centres and state agricultural universities. This cell is responsible for the creation and updating of the Institute website and for the conduct of ARS-NET online examination through ASRB, New Delhi. It is equipped with 2 servers, switches, router, modem, 20 desktop/terminals and one 10 KVA UPS.

Activities during the period

- AKMU and SUB-DIC jointly organized training program on "**Data Analysis and Interpretation using SAS"** at ICAR-CIARI, Port Blair during 18th – 20th September, 2018. A total of 21 scientists and 3 technical staff participated.

- Conducted ICAR National Eligibility Test (II) – 2018 Examination in online mode during 27.12.2018 to 29.12.2018
- Maintenance of Hardware/ Software, Servers LAN and internet connectivity. VSAT equipment and its peripherals.
- Handling Personnel Management Information System Network (PERMISnet-II) and Project Information & Management System (PIMS) of ICAR PIMS.
- Maintaining records with respect to inventory management of Computer Cell, antivirus licenses, cartridges etc.
- Online submission of tender in Central Public Procurement Portal (CPPP). e-Procurement and e-Publishing of tenders. Purchase and handling of DSC of all the designated users.
- Maintenance and management of biometric attendance system.
- Handling Government E-market Place (GeM), DGSnD, social media account *viz;* Facebook and Twitter.
- Preparation of banners, posters, brochure, certificates, name plates for various meetings/ seminars etc. and slide operating for various meetings/ seminars for Director.

ITMU Cell

Institute Technology Management Unit (ITMU) has organized two Institute Technology Management Committee (ITMC) meetings. The first meeting was held on 12th April, 2018, at ICAR-CIARI, Port Blair, wherein the technology profiles of 11 commercializable technologies and varieties/breeds developed at ICAR-CIARI were presented. Dr. S.B Roy, Principal Scientist, NIRJAFT and Member, ITMC, ICAR-CIARI participated in the meeting. A Seminar was organized on same day, in which Dr. S. B. Roy, delivered a lecture on the topic "Intellectual Property Rights- an Indian Perspective", considering IPR/Patenting/Commercialization and interacted with the staff members of CIARI. The second Institute Technology Management Committee Meeting was held on 28th August, 2018, regarding commercialization of four Noni varietiesat developed at ICAR-CIARI, Port Blair with Andaman Plantations, Port Blair. A model MoU was prepared for commercialization of CIARI varieties and presented in the ITMC meeting. Various private parties were contacted along with Agri-innovate India for commercialization of Institute Technologies and varieties. The "technology disclosure form" and "technology valuation sheet" from Agri – Innovate India was sent to all the concerned scientist of the institute for the commercialization of their respective technology with Agri-Innovate India.

A report was prepared on "Major inventions/discoveries in the field of science and technology, steps taken for the commercialization of these inventions/discoveries and extent of success achieved as a result thereof", for onward transmission to Horticulture Science Division, KAB-II, New Delhi. Compilation of technologies/ methodologies developed refined for farmwomen was sent to ICAR- Central Institute for Women in Agriculture (CIWA), Bhubaneswar for publication. Furthermore, collection and compilation for updating the Information of Technology Licensing and patent filing at ICAR Institutes was also done and sent to Council. A Brochure on "list of technologies of ICAR-CIARI, Port Blair" was published for distribution among farmers and stakeholders of the Island.

A new patent application entitled "METHOD FOR DETERMINING THE SEX OF NON RATITE BIRDS" was filed with the registration number (App no. TEMP / E - 1 / 6369 / 2019 DEL), on 15th February, 2019. A Material Transfer Agreement was signed between ICAR and ATCC for purchase of psychrophilic BSA Level I organism, *Colwellia psychrerythrea* strain 34H.

Sports Activities

A team of 13 member sports contingent of ICAR-Central Island Agricultural Research Institute (ICAR-CIARI), Port Blair participated in the ICAR zonal sports (Eastern region) tournament-2018 held at Ranchi, Jharkhand during 05th – 08th October, 2018. The zonal sports tournament was attended by the participants from 18 ICAR Research Institutes of Eastern zone with Dr. Jai Sunder as Chief-De-Mission and Shri. Karuppaiah as Team Manager. Smt. Champa Rani Das bagged a gold medal in the caroms event. Besides, 2 silver medals and 2 bronze medals were secured by the CIARI team comprising of Smt. Saida Bibi, Smt. Archana Sharma, Shri. Anup Indwar, Shri. K. Pradhan, Shri. Karuppaiah and Shri. A. Babuswamy.

Annual sports-2019 of ICAR-CIARI was conducted at Garacharma campus from 12th December, 2018 to 18th January, 2019. A total of 78 events including outdoor, indoor and athletic events were conducted for the staff and their family members. Havelock House was awarded with 'Overall Championship Trophy' for their fabulous performance in all the events. Besides 'Best Athlete Trophies' were awarded to Shri. K. Pradhan and Smt. Minakshi Routray, respectively.

ICAR-CIARI also participated in the Annual Sports 2019 of Central Government Employees' Welfare Co-ordination Committee (CGEWCC), Port Blair which includes Indoor games held on 27th January, 2019 at Multipurpose Hall of ALHW, Port Blair and Athletic Events held on 03rd February, 2019 at Kendriya Vidyalaya No. 1, Port Blair. Excellent performance was shown by the players of our Institute in all the sports events.

Besides, a team of players from our Institute also participated in the ICAR Inter-Zonal Sports Tournament-2018 held at ICAR-IVRI, Izatnagar during February 25th – 28th , 2019. The team was represented by Mrs. Saida Bibi as Team Manager. Smt. Champa Rani Das bagged a silver medal in the caroms event.

The facilities for outdoor sports and indoor sports like table tennis, carom, multi gym, etc. have been well maintained for the welfare of staff members. All the sports activities were coordinated by Dr. Jai Sunder, Chairman, Shri. S.K. Singh, Co-Chairman and Dr. K. Saravanan, Member Secretary of Sports Committee along with the committee members.

Glimpses of sports activities

AWARD AND RECOGNITION

Scientist	Award/ Recognition	Awarding Agency/ Organizing Society
B. Gangaiah	Editor	Indian Journal of Agronomy
	Expert Member, Wet Land Ecology	Andaman & Nicobar Administration
	Hindi Essay writing. 3rd Prize	Hindi Fort Night, ICAR-CIARI, Port Blair
	Invited Speaker for FOCARS lecture	ICAR-NAARM, Hyderabad
	Advisor, State Specific Action Plan Preparation for A & N Islands	Andaman and Nicobar Administration
B. Augustine Jerard	Fellow of ISPC	Indian Society for Plantation Crops, ICAR-CPCRI for the outstanding contribution in plantation crops research
	Vice President	Indian Society for Plantation Crops, ICAR-CPCR for the years 2018 and 2019
	Best Oral Presentation award	XXXV Annual Conference of Indian Poultry Association (IPSACON2018) ICAR-CIARI, Port Blair during 15th to 17 November 2018
	Dr. C.S. Venkataram Memorial Award for the biennium 2017-18	Indian Society for Plantation Crops, ICAR-CPCRI & Dr. CS Venkataram Memorial Trust - for the best original research paperpublished in the Journal of Plantation Crops (2016), 44(2):77-84 entitled 'Identification and utilization of informative EST-SSR markers for genetic purity testing of coconut hybrids
	Member of the Editorial Board	Fiji Agriculture Journal, Ministry of Agriculture, Suva, Fiji
	Peer Reviewer	• *Journal of Plantation Crops* from *Indian Society for Plantation Crops*, CPCRI, Kasaragod. • *Genetic Resources and Crop Evolution* by Springer Publications. • *Indian Journal of Horticulture* by Horticulture Society of India, New Dlehi • *Crop Breeding and Applied Biotechnology* from Brazilian Society of Plant Breeding. • *Journal of Spices and Aromatic Crops* by Indian Society for Spices, ICAR-IISR, Kozhikode. • *Fiji Agriculture Journal,* Ministry of Agriculture, Government of Fiji.
	Chairman, State level Technical Committee for High Value Agriculture Development Agency (HVADA)	Directorate of Agriculture, A&N Administration

Scientist	Award/ Recognition	Awarding Agency/ Organizing Society
S. Dam Roy	Fellow	Indian of Society of Coastal Agricultural Research (ISCAR).
	Member, QRT	ICAR-Indian Institute of Farming System Research (IIFSR) Modipuram, Meerut
	Member, Project Monitoring Committee	DBT, New Delhi
	External expert, Ph.D., Thesis evaluation	CIFE, Mumbai
	External Expert for *Viva – voce* of Ph.D., Thesis Award	CIFE, Mumbai
	Member, Promotion Committee of Scientist	CAS of CIFE, Mumbai CAS of CIBA, Chennai
R.K. Gautam, P.K. Singh, S.K. Zamir Ahmed, Naresh Kumar, A.K. Singh, Israr Ahmed & S. Dam Roy	Facilitators for registration of Karen community rice varieties in PPVFRA, New Delhi	Protection of Plant Varieties & Farmers' Rights Authority (PPVFRA), GoI, New Delhi
R.K. Gautam	Fellow, Indian Society of Coastal Agricultural Research	Indian Society of Coastal Agricultural Research, ICAR-CSSRI-RRS, Canning Town
S.K. Zamir Ahmed	ISEE Fellow Award	West Bengal University of Animal & Fishery Science (WBUAFS), Kolkata (West Bengal) during 7th December, 2018
S.K.Zamir Ahmed, S.Dam Roy & Amit Srivastava	Best publication in Hindi	41st Foundation Day of ICAR-CIARI, Port Blair on 23rd June, 2018
V. Baskaran	Member	Formation of Block Technology Team, Prothrapur, UTATMA, South Andaman District.
	As an expert	Examining the consignment of tuberose and gladiolus planting material at Haddo, Department of Agriculture, A & N Administration during April, 2019
	Fellowship 2018	Indian Society of Ornamental Horticulture for significant contribution and commitment in research and development of Ornamental Horticulture in the country
	Judge	State Level exhibition Gyanodhya during 17th to 18th December, 2018
V. Baskaran & K. Abirami	Judge	• Flower show during ITF 2018 on 20th April, 2018 • Flower arrangement competition held at DIET Campus, Port Blair during 26.02.2019

Scientist	Award/ Recognition	Awarding Agency/ Organizing Society
T. Sujatha, Arun Kumar De, Jai Sunder, A. Kundu & D. Bhattacharya	Best Poster	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
R. Kiruba Sankar	Organizing Secretary	National Workshop on prospects and potential of seaweed culture in Andaman and Nicobar Islands on 10th Oct., 2018 organized by NFDB, Hyderabad
	Organizing Secretary	National Workshop on Open Sea cage culture development in Andaman and Nicobar Islands on 11th October, 2018 organized by NFDB, Hyderabad
K. Abirami	Best publications in English for the year 2017-18	ICAR-CIARI
Pooja Bohra	Editor	• Journal of Horticulture & Forestry, Academic Journals • Selcuk Journal of Food & Agricultural Sciences
	Outstanding Reviewer Award	Scientia Horticulturae, Elsevier
	Peer Reviewer	• Scientia Horticulturae, Elsevier • Current Science, Indian Academy of Sciences • Plant Growth Regulation, Springer Nature • Journal of Food Science & Technology, Springer Nature • Proceedings of National Academy of Sciences - India, Section B: Biological Sciences, Springer-Nature • African Journal of Biotechnology, Academic Journals • African Journal of Agricultural Research, Academic Journals • International Journal of Biodiversity and Conservation, Academic Journals • African Journal of Food Science, Academic Journals
Ajit A. Waman	Best Young Scientist Award- 2018	ICAR-CIARI, Port Blair
	Editor	• African Journal of Agricultural Research, Academic Journals • Amity Journal of Agribusiness • Current Agriculture Research Journal, India
	Peer Reviewer	• The Indian Journal of Agricultural Sciences, ICAR • Medicinal Plants: International Journal of Phyto-medicines and Related Industries • Plant Cell Biotechnology and Molecular Biology, International Knowledge Press
K. Sakthivel	SERB	Earlier Research Career Award-2019
	Reviewer	Journal of Environmental Biology
K. Venkatesan	Reviewer	• International Journal of Tropical Biology and Conservation • Greener Journal • eBook: Abstract review: Bentham Science Publisher

Scientist	Award/ Recognition	Awarding Agency/ Organizing Society
K. Saravanan	Best Scientist Award	41st Institute Foundation Day of ICAR-CIARI, Port Blair
	Award for Institutional Building	41st Institute Foundation Day of ICAR-CIARI, Port Blair
	Young Faculty in Science Award	Venus International Foundation, Chennai during Venus International Faculty Awards-VIFA 2018
	Bharat Excellence Award and Leading Educationist of India Award	Friendship Forum of India during a National Conference held at New Delhi
	External Examiner for Practical Examination of M.Sc. Marine Biology	Pondicherry University, Brookshabad Campus, Port Blair
J. Praveenraj	Member	American Society of Ichthyologists and Herpetologists.
	Contributor and assessor for the family Channidae in Eschmeyer's Catalog of fishes	California Academy of Science
R. R. Alyethodi, Dharmeswar Das and B. Pain	Best Poster	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
P.A. Bala, D. Bhattacharya, M. S. Kundu, S. K. Ravi, T. Sujatha, J. Sunder, A. K. De, R. R. Alyethodi and A. Kundu	Best Poster	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
P. Perumal, K. Muniswamy, A. K. De, D. Bhattacharya, Jai sunder, T. Sujatha, S. K. Ravi, R. A. Rafeeque, M. S. Kundu and A. Kundu.	Best Oral	Indian Poultry Science Association (IPSACON) – 2018 held from 15th to17th November, 2018
P. Perumal, A. Kundu, J. Sunder, D. Bhattacharya, K. Muniswamy, Sneha Bhowmick and A. K. De	Best Oral	Asian Regional Conference on Goats (ARCG-2018) at Amity University, Jaipur, Rajasthan, 22nd to 26th October, 2018

Scientist	Award/ Recognition	Awarding Agency/ Organizing Society
Kiran K R	Best Research Paper Award (Poster Session)	Indian Poultry Science Association (IPSACON) – 2018 held from 15th to17th November, 2018
Sirisha Adamala	IEI Young Engineer Award 2018-19 in Agricultural Engineering discipline	Institute of Engineers (India), Kolkata
V. Damodaran	Judge	Selection of best vegetable & fruits in the Fruits and Vegetable show organized by the Department of Agriculture, A&N Administration during the Island Tourism Festival-2018 held from 18th-22nd April, 2018.
R. Jaya Kumaravardan, S.K. Zamir Ahmed, B A Jerard, B L Kasinath, S.K.Pandey, Amit Srivastava and A Kundu	Best Poster Award	IPSACON, ICAR- CIARI Port Blair, during 17th November, 2018
Zachariah George, Sanjeev Kumar Singh, A. Kundu, Nagesh Ram, L.B. Singh, Jai Sunder, T. Sujatha, Sanjay Kumar Pandey, N.C. Choudhuri and D. Bhattacharya	Best Poster	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
Zachariah George, A. Kundu, Nagesh Ram, L.B. Singh, Jai Sunder, T. Sujatha, Sanjay Kumar Pandey, N.C. Choudhuri and Sanjeev Kumar Singh	Best Poster	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
Sanjay Kumar Pandey, Zachariah George, Sanjeev Kumar Singh, T.P. Swarnam and Nagesh Ram	Second Prize	IPSACON – 2018 held at ICAR-CIARI, Port Blair during 15th to 17th November, 2018
Division NRM	Best Division Award	ICAR-CIARI, on Foundation Day

ONGOING RESEARCH PROJECTS

External Funded

Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
DBT, New Delhi						
1	Regeneration and Molecular Characterization of Andaman Padauk (*Pterocarpus dalbergioides)*	I. Jaisankar	B. Augutine Jerard & Nabanita Ganguly	43.11	2018	2021
2	*In vitro* Mass Multiplication, Characterization and Habitat Enrichment of two horticulturally Important Underutilized Species from Andaman and Nicobar Islands	Pooja Bohra	Ajit A. Waman	16.72	2017	2020
PPV&FRA, New Delhi						
3	Development and Standardization of DUS Characteristics Procedures for Noni (*Morinda citrifolia* L.)	I. Jaisankar	-	27.08	2013	2020
DASD, Kozhikode						
4	CSS-MIDH (NHM) Project	K. Abirami	V. Damodaran	8.10	2002	Contd.
NICRA						
5	Restoration of Agriculture in *Tsunami* affected Lands of Andaman and Nicobar Islands	B. Gangaiah	M.S. Kundu, T. Subramani, S. Swain, L.B. Singh, S.K. Pandey & B.L. Meena	76.5	2016	2019
IMD (MoES)						
6	Integrated Agromet Advisory Services for A&N Islands	A.Velmurugan	T. Subramani	60.0	2008	2019
NFDB, Hyderabad						
7	National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) in Andaman and Nicobar Islands	K. Saravanan	J. Praveenraj	68.44	2015	2019
NABARD						
8	Evaluation and Popularisation of Value added Compost and other Organic Inputs in Neil Island	A.Velmurugan	I.Jaisankar, S.K.Zamir Ahmed & T.P.Swarnam	10.0	2017	2019

Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
9	Establishment of Duckling Resource Unit for N&M Andaman	T.Sujatha	A.Kundu Jai Sunder & Shradul V.Lal	10.99	2017	2020
10	Enhancing On-Farm Production and Promoting Forward and Backward Linkages through Technological Intervention	S. K. Zamir Ahmed	A. Velmurugan, Amit Srivastava, B.L Kashinath, R. Jaya Kumaravaradan & Siba Mahato	9.99	2017	2019
11	Vegetable Seed Production and Supply of Quality Seeds to Island Farmers for Increasing Vegetable Productivity and Nutritional Security of Island	B.L. Kasinath	Nagesh Ram, D. Basantia, B.L. Meena, Shailesh Kumar, Pooja Kapoor, Manoj Kumar, Shardul Vikram Lal, Tanmay Paul & S. Dam Roy	10.65	2016	2019
12	Supply of Quality Planting Materials to Farmers of N & M Andaman for Generating Higher Income	D.Basantia & Tanmai Paul	B.L.Kasinath, Shailesh Kumar, B.L. Meena, D. Basantia, Pooja Kapoor, Manoj Kumar, S.V. Lal, Ajit Waman &. S.Dam Roy	9.99	2017	2019
13	Quality Fish Seed Production for Adoption of Scientific Fish Farming for Economic, Nutritional and Social Upliftment of Farmers in N&M Andaman	Shailesh Kumar	B. L. Kasinath, Nagesh Ram, B. L. Meena, Sivaramakrishnan, Pooja Kapoor, Manoj Kumar, D. Basantia, Tanmay Paul & S. Dam Roy	9.99	2016	2019
14	Quality Fish Feed Production for Nutritional and Augmenting Fish Production in N&M Andaman	Shailesh Kumar	B. L. Kasinath, Nagesh Ram, B. L. Meena, Sivaramakrishnan, Pooja Kapoor, Manoj Kumar & S. Dam Roy	9.99	2017	2019

Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
15	FPO - North and Middle Andaman Agricultural Producers Company	B.L.Kasinath	B.L. Meena, Shailesh Kumar, Pooja Kapoor, Manoj Kumar, Shardu Vikram Lal, D.Basantia, Prasant Pradhan & Tanmay Paul	9.09	2016	2019
Bill and Melinda Gates Foundation						
16	Stress Tolerant Rice for Poor Farmers of Africa and South Asia	R.K. Gautam	P. K. Singh, S. K. Zamir Ahmed & A. Velmurugan	15.00	2014	2019
IRRI-ICAR						
17	The Global Rice Array: India Partnership to Strengthen Global Phenomics Network	R.K. Gautam	P.K. Singh, K. Sakthivel & K. Venkatesan	7.00	2018	2022
RKVY, A&N Administration						
18	Study on the Status of Minerals Profile in Cattle Sera, its Correlation with Infertility and Production and Development of Area Specific Mineral Mixture to Augment Productivity	Jai Sunder	T.Sujatha, M.S.Kundu & A.Kundu	32.02	2018	2020
DAC, Ministry of Welfare Agriculture and Farmers						
19	Monitoring of Pesticide Residues at National Level	T.P. Swarnam	-	25.0	2011	2020
MOFPI						
20	Food Processing Training Centre (FPTC)	S. Swain	-	20.0	2014	2023
DST-SERB						
21	Genetic and Management Interventions to Identify the Key Role Players in Bull Semen Freezability and to Reduce the Cryo Injury on Bull Spermatozoa	Rafeeque Rahman Alyethodi	-	32.11	2018	2021

Institute Funded

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
Horticulture & Forestry						
1.	Conservation and Utilization of Coconut and Arecanut Genetic Resources of Andaman & Nicobar and Lakshadweep Islands for High Yield and Product Diversification	B. Augustine Jerard	V. Damodaran, I. Jaisankar & S.K.Zamir Ahmed	45	2018	2023
2.	Collection, Conservation and Evaluation of Commercial Fruit Crops of Andaman and Nicobar Islands	K. Abirami	V. Baskaran, B. A.Jerard, Sachidananda Swain, K. Venkatesan & D. Basantia	40	2018	2023
3.	Collection, Characterization, Evaluation and Mass Multiplication of Unconventional Native and Exotic Fruit Crops for Bay Islands	Pooja Bohra	Ajit Arun Waman, T. Bharathimeena & S.K. Zamir Ahmed	32	2015	2021
4.	Development of Protocols for Micropropagation of Selected Fruit Crops for Bay Islands	Pooja Bohra	Ajit Arun Waman and L.B. Singh	35	2015	2019
5.	Improvement of Vegetable and Tuber Crops for Andaman and Nicobar Islands	B. Augustine Jerard	Soobedar Yadav, I. Jaisankar, V. Damodaran, S.K. Zamir Ahmed, L. B. Singh & B.L. Kasinath	40	2018	2023
6.	Collection, Characterization and Utilization of Natural Diversity of Important Spice Crops from Bay Islands and Evaluation of their Improved Varieties	Ajit Arun Waman	Pooja Bohra, T. Sujatha, V. Damodaran and L.B. Singh	30	2015	2021

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
7.	Exploration, Characterization, Micro-Propagation and Agro-Technique Standardization of an Important Rhizomatous Species-Mango Ginger from Bay Islands	Ajit Arun Waman	Pooja Bohra, I. Jaisankar, D. Basantia & V. Damodaran	35	2015	2019
8.	Development of Production Technology of Ornamental Crops in Bay Islands	V. Baskaran	K. Abirami and A. Velmurugan	35	2011	2019
9.	Exploiting Endemic and Promising Orchids of Andaman and Nicobar Islands for Crop Improvement	V. Baskaran	K. Abirami B. A. Jerard & K. Venkatesan	35	2018	2022
10.	Planting Material Production in Horticultural Crops	B. Augustine Jerard	V. Baskaran, K. Abirami, V. Damodaran, I. Jaisankar, Ajit Arun Waman, Pooja Bohra, Soobedar Yadav & S.K.Zamir Ahmed	45	2018	2023
11.	Enriching Coconut Plantations of Andaman and Nicobar Islands through Augmentation of Indigenous Multipurpose Tree Resources	I. Jaisankar	B.Augustine Jerard, T. P. Swarnam & V. Damodaran	30	2018	2023
12.	Enhancing Production and Quality of Rhizomatous Spices Through Varietal, Biotic Stress and Processing interventions in Plantation Based Cropping System under Island Conditions	Soobedar Yadav	Ajit Arun Waman, V. Damodaran, K. Sakhtivel & S. Swain	25	2015	2020
13.	Collection, Characterization and Evaluation of Selected Economically Important Aromatic Crops in Andaman & Nicobar Island	Soobedar Yadav	K. Abirami & R. K. Gautam	25	2015	2020

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
Field Crops Improvement & Protection						
1.	Augmenting Rice Productivity through Varietal Purification of Popular Land Races	R.K. Gautam	P.K. Singh, S.K. Zamir Ahmed, K. Sakthivel, S. Swain & Pooja Kapoor	40.00	2012	2019
2.	Genetic Improvement of Rice for Higher Productivity in Andaman and Nicobar Islands Conditions	P.K. Singh	R.K. Gautam, B. Gangaiah, K. Sakthivel, T. Bharathimeena, S.K. Zamir Ahmed & B.L. Meena	18.00	2017	2021
3.	Characterization of Viral Diseases of Important Vegetable Crops of Andaman and Nicobar Islands and Development of Eco-Friendly Integrated Disease Management (IDM) Modules	K. Sakthivel	R.K. Gautam, P.K. Singh, K. Venkatesan, V.K. Pandey, V. Baskaran, T. Barathimeena & Soobedar Yadav	48.0	2018	2021
4.	Enhancing Pulse Productivity of Andaman and Nicobar Islands through Development and Promotion of High Yielding and Stress Tolerant Varieties	K. Venkatesan	R.K. Gautam, K. Sakthivel, P.K. Singh, B. Gangaiah & S.K. Zamir Ahmed	24.20	2018	2021
Natural Resource Management						
1.	Vulnerability Assessment and Adaptation Led Mitigation Strategies of Andaman and Nicobar Islands Farming to Climate Change	B. Gangaiah	T. Subramani, S. Swain, A. Velmurugan, B.K. Nanda, V. Damodaran, A. Velmurugan & M.S. Kundu	40.00	2015	2019
2.	Assessment of Post Harvest Losses in Fruits and Vegetables and Strategies for their Reduction in the Islands	S. Swain	S.K.Zamir Ahmed, L.B Singh, Chandrika Ram, Manoj Kumar, Tauqueer Ahmed & P. Misra Sahoo	20.00	2015	2019
3.	Development of Nutraceutical Beverages from Potential Underutilized Fruits and Medicinal Herbs of Andaman and Nicobar Islands	S. Swain	K.Abirami, Pooja Bohra and Pooja Kapoor	40.00	2015	2019

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
4.	Development of Production Technologies for High Value Vegetables in Soil less Culture	T. Subramani	B. Gangaiah, V& Baskaran	34.29	2017	2020
5.	Organic Farming Studies for Sustaining Productivity of Island Cropping Systems	K. R. Kiran	B. Gangaiah, A. Velmurugan & K. Sathivel	64.0	2018	2023
Animal Science						
1.	Prevalence and Economic Impact of Gastro-Intestinal Parasites of Livestock in Andaman And Nicobar Island	D. Bhattacharya	M.S. Kundu, Jai Sunder, T. Sujatha, A.K. De, Zacharia George, Perumal P, Ajit Arun Waman & A. Kundu	25.00	2017	2020
2.	Molecular Epidemiology of Rhipicephalus Microplus Complex in Andaman & Nicobar Islands and Screening for its Acaricide Resistance	D. Bhattacharya	Jai Sunder, K. Muniswamy, R.R. Alyethodi, Perumal, P, Arun Kumar De & A. Kundu	23.00	2018	2021
3.	Pharmaco-Assessment of Ethno-Veterinary Medicinal Plants of A&N Islands for Poultry Diseases	T.Sujatha	Jai Sunder, A.Kundu, D.Bhattacharya, Arun Kumar De K. Abirami & Puro	25.95	2017	2020
4.	Selection and Breeding of Nicobari Fowl for Immunity and its Evaluation under Different Seasons	T.Sujatha	Jai Sunder, D. Bhattacharya, A. Kundu & R.A.Rafeeque	26.50	2018	2021
5.	Gender Identification in Day Old Poultry by PCR Based Methodology	Arun Kumar De	T. Sujatha, Jai Sunder & A. Kundu	15.00	2017	2019
6.	Molecular Signature of Eco-Sustainability of Indigenous Livestock Breeds of Andaman and Nicobar Islands and Lakshwadeep	Arun Kumar De	Jai Sunder, M. S. Kundu, D. Bhattacharya & A. Kundu	45.00	2017	2019

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
7.	Evaluation of Reproductive Performance and Egg Quality of Nicobari Fowl using Molecular Marker	Arun Kumar De	D. Bhattacharya , Jai Sunder, Perumal P, T. Sujatha & A. Kundu	40.00	2018	2021
8.	Studies on Endocrinological and Biochemical Profiles of Bovine Species for Enhancing Fertility in Bay Islands	Perumal P.	M. S. Kundu, D. Bhattacharya, Jai Sunder, A. K. De, A. Kundu, Z. George, S. V. Lal & V.M. Abdul Gafoor	37.13	2017	2020
9.	Molecular Characterization of Immune System Genes of Nicobari Fowl	K. Muniswamy	A. K. De, T. Sujatha, D. Bhattacharya, Jai Sunder & A. Kundu	37.13	2017	2020
10.	Supplementing Zinc and Chromium to Ameliorate Heat Stress in Poultry	P.A. Bala	J. Sunder, T. Sujatha, A. K. De, M.S. Kundu & A. Kundu	28.972	2019	2022
11.	Identification of Genome-wide Molecular Signatures Responsible for Higher Fecundity in Andaman Local Goats	Rafeeque Rahman Alyethodi	A. Kundu, Jai Sunder, A.K De, K. Karunakaran , Perumal.P, A.P Bala & S.K Ravi	27.0	2019	2022
12.	Biochemical and Molecular Mining of Hormonal Profiles of Buck under Abiotic Stressors and Managemental Intervention for its Mitigation	Perumal P.	S. K. Ravi A. K. De R. R. Alyethodi K. Muniswamy Jai Sunder & A. Kundu	34.17	2018	2021
13.	Physical, Biochemical and Molecular Characterization of Semen in Pigs of Bay Islands *Vis a Vis* Study on Feasibility of Artificial Insemination	S.K. Ravi	Perumal P, M. S. Kundu, D.Bhattacharya, Jai Sunder, Arun Kumar De, R. R. Alyethodi & A. Kundu	21.90	2018	2021

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
14.	Augmentation of Fodder Resources to Improve Livestock Productivity in Andaman & Nicobar Islands	M.S.Kundu	B. Gangaiah, T. Sujatha & A. Kundu	43.3	2015	2019
Fisheries Science						
1.	Cataloguing Inland Aquatic Diversity and Breeding of Indigenous Freshwater Fishes of Andaman and Nicobar Islands	Praveenraj J	R Kiruba Sankar & B.Varghese	38.11	2015	2019
2.	Seaweed Diversity and its Culture Prospects in *in-situ* Conditions of Andaman	Harsha Haridas	S. Dam Roy, K.Saravanan, A.K.O. Ratheesh & Kiruba Sankar.R	57.3	2015	2019
3.	Characterization of *Bacillus* spp. from Andaman Mangroves and Evaluation of its Antagonistic Effect on Fish Pathogens	K. Saravanan	T. Sivaramakrishnan, J. Praveenraj, Harsha Haridas & Kiruba Sankar, R	53.3	2015	2019
4.	Biology of Blue Fin Travelly *(Caranx melampygus)* from Andaman Waters	A.K.O. Ratheesh	S.Dam Roy, Kiruba Sankar,R, S.Monalisha Devi & K. Lohith Kumar		2017	2020
5.	Documentation of Indigenous Fishing Practices of Nicobari Tribes	A.K.O. Ratheesh	S.Dam Roy, Nagesh Ram, S.K.Zamir Ahmed & S.K. Pandey		2017	2019
6.	Evaluation of Suitable Aquaponics System Incorporating Fisheries and Agri Components under the Island Conditions	Harsha Haridas	S.Dam Roy, T.Subramani, K. Saravanan, Benny Varghese & S.Murugesan	49.7	2018	2020
Social Science						
1.	Indigenous Adaptation Strategies of Tribal *vis-a-vis* Non-Tribal Farmers and Impact of CIARI Technologies in Mitigating Climate Change Effects on Agriculture in Andaman & Nicobar Islands	R.Jaya Kumaravaradan	S.K. Zamir Ahmed, B. Augustine Jerard, B.L. Kasinath, L.B. Singh, S.K. Pandey, Amit Srivastava & A. Kundu		2018	2021

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
Director Cell						
1.	Agricultural Information Sharing and Knowledge Generation Towards Sustainable Management of Island Ecosystem with Special Reference to Fishery by Developing Mobile Apps	D. Karunakaran	R. Kiruba Sankar	32.00	2018	2021
ICAR Funded						
Sl. No.	**Title**	**Principal Investigator**	**CO-PIs**	**Budget (lakhs)**	**Year of Start**	**Year of Completion**
ICAR, New Delhi						
1	AICRP on Palms	Ajit Arun Waman	-	5.12	2015	Contd.
2	AICRP on Fruits	K. Abirami	-	3.95	2015	Contd.
3	AICRP on Flowers	V. Baskaran	-	1.06	2016	Contd.
4	AICRP on Tuber Crops	V. Damodaran	B. A. Jerard & L.B. Singh	5.0	2010	Contd.
5	AICRP on Vegetable Crops	Soobedar Yadav	-	6.0	2005	Contd.
6	AICRP on Management of Salt Affected Soils and use of Saline Water in Agriculture	A.Velmurugan	T.P. Swarnam & T. Subramani	-	2014	2020
7	AICRP on Integrated Farming Systems	T.P. Swarnam	A. Velmurugan, T. Subramani, S.Swain, M.S.Kundu, R. Kiruba Sankar, I. Jaisankar, Ajit Arun Wamen, B.K.Nanda, S.K. Pandey & Zacharia George		2010	2020
8	AICRP on Rice	B. Gangaiah	-		2015	Contd.
9	AICRP-Weed Management	B. Gangaiah	-		2015	Contd.
10	AICRP-PHET(Post Harvest Engineering & Technology)	S. Swain	-		2017	Contd.

Sl.No.	Project Title	PI	Co-PIs	Budget	Year of start	Year of completion
11	AICRP on Mushroom	K. Sakthivel	R.K. Gautam & V.K. Pandey	3.85	2015	Contd.
12	AICRP on FMD	Jai Sunder	A.K. De	3.50	2014	2020
13	AICRP on Goat Improvement	Jai Sunder	A.Kundu, M.S.Kundu & R.R.Aleythodi	26.62	2014	2020
14	AICRP on ADMAS	Jai Sunder	T.Sujatha & D.Bhattacharya	3.50	2014	2020
15	AICRP on Pig	M.S.Kundu	Jai Sunder, Perumal P, S.K. Ravi, P.A. Bala, Arun Kumar De & A. Kundu	142.06	2015	2020
16	Poultry Seed Project	A.Kundu	T. Sujatha	190.68	2014	2020
ICAR-CMFRI, Cochin						
1	All India Network Project on Mariculture	R Kiruba Sankar	J. Praveenraj, K. Saravanan, Harsha Haridas & S. Dam Roy	-	2018	2021
2	National Extension Programme	A. Kundu	S. K. Zamir Ahmed, P.K. Singh, A. Velmurugan, S. Yadav, R. Jaya Kumaravaradan, Siba Mahato, L.B. Singh, B.L.Meena, S.K.Pandey, N. Bommayasamy & B.L. Kasinath	-	2017	Contd.
ICAR (IISR)						
1	ICAR Seed Project: Seed Production in Agricultural Crops	P. K. Singh	R. K. Gautam	75.50	2006	2020
ICAR-NBAIM						
1	Exploring Antimicrobial Peptide Genes in Developing Bioformulation for the Management of Plant Disease of Andaman & Nicobar Islands (AMAAS)	K. Sakthivel	R.K. Gautam, V.K. Pandey, P.K. Singh & K. Venkatesan	6.00	2014	-

PUBLICATION

Research Article

Abirami, K., Baskaran, V., Simhachalam, P., Venkatesan, K and Singh, D. R. (2018). Molecular characterization of *Aspleniumnidus* L. –A potential fern species from Andaman. *Agricultural Science Digest*, 38 (4): 265-269. (NAAS Rating: 4.21).

Abirami, K., Baskaran, V and Simhachalam, P. (2018). ISSR marker based diversity assessment of *Piper spp*. in Bay Islands, India. *Indian Journal of Agricultural Research*, 52(4): 434-438. (NAAS Rating: 4.86)

Abirami, K., Sakthivel, K., Baskaran, V., Gautam, R.K., Neelam A, S., Jerard, B.A and Kumar, A. (2019). Occurrence of anthracnose disease caused by *Colletotrichum siamense* on dragon fruit (*Hylocereus sp) in* Andaman Islands, India. *Plant Disease,* http://dx.doi.org/10.1094/PDIS-09-18-1489-PDN. (NAAS Rating: 8.94).

Bohra, Pooja and Waman, Ajit Arun (2019). Morphological and biochemical studies in *Garciniagummi-gutta* (L.) Roxb. *Erwerbs-Obstbau*. DOI: 10.1007/s10341-019-00419-3 (NAAS Rating: 6.56)

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S.K. Zamir Ahmed., R.Jaya Kumaravaradan.,Siba Mahato., Amit Srivastava., Rina Saha., and K.Ali Akbar (2019). Out Reach Centre: An Innovative Institutional Approach for Technology Application in Agriculture & Allied Fields at North & Middle Andaman District, India (2009-2017), ICAR-CIARI, Port Blair.

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MH714782. De, A.K., Muniswamy, K., George, Z., Muthian, R., Perumal, P., Kundu, M.S., Sunder, J., Kundu, A. and Bhattacharya, D. 2018. Unique cytochrome b (cytb) gene, complete cds of Trinket cattle of Trinket island of India, *Bostaurus* isolate TCy-1 cytochrome b (cytb) gene, complete cds; mitochondrial.

MH714783. De, A.K., Sunder, J., George, Z., Perumal, P., Kundu, M.S., Kundu, A., Muniswamy, K., Muthian, R., and Bhattacharya, D. 2018. Unique cytochrome b (cytb) gene, complete cds of Trinket cattle of Trinket island of India, *Bostaurus* isolate TCy-2 cytochrome b (cytb) gene, complete cds; mitochondrial.

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EEV envelope phospholipase gene, partial cds.

MH730659. Sunder, J., Sujatha, T., De, A.K., Kundu, M.S., Kundu, A., Perumal, P. and Bhattacharya, D. 2018. Orf virus South Andaman isolate-2 EEV envelope phospholipase: A first molecular signature. Orf virus isolate SA-2 EEV envelope phospholipase gene, partial cds.

MH730660. De, A.K., Muniswamy, K., George, Z., Perumal, P., Sunder, J., Kundu, M.S., Kundu, A., Muthian, R. and Bhattacharya, D. 2018.*Bostaurus* (Trinket cattle) TC isolate D loop, partial sequence mitochondrial. *Bostaurus* isolate TC-1 D-loop, partial sequence; mitochondrial.

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MK139101-139130. De, A.K., Sunder, J., Sujatha, T., Ponraj, P., Muniswamy, K., Zamir Ahmad, S.K., Kundu, A., Muthian, R. and Bhattacharya, D. 2018. D-loop complete sequence; mitochondrial; isolate Andaman local goat.

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MK159198-159227. De, A.K., Sunder, J., Ponraj, P., Muniswamy, K., Kundu A., Zamir Ahmed, S.K., Muthian, R. and Bhattacharya, D. 2018. Capra hircus isolate Andaman local goat cytochrome b gene, complete cds, mitochondrial.

MK159228-159237. De, A.K., Sunder, J., Ponraj, P., Muniswamy, K., Kundu A., Zamir Ahmad, S.K., Muthian, R. and Bhattacharya, D. 2018. Capra hircus isolate Teressa goat cytochrome b gene, complete cds, mitochondrial.

MK204747-48. De, A.K., Kundu, A., Sujatha, T., Sunder, J., Ponraj, P., Muniswamy, K. and Bhattacharya, D. 2018. Nicobari fowl chromo-helicase DNA binding protein (CHD1Z) gene partial cds.

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MK234705. De, A.K., Muthiyan, R., Sunder, J., Perumal, P., Malakar, D., Kundu, A., Muniswamy, K. and Bhattacharya, D. 2018.Capra hircus (Teressa goat from Andaman and Nicobar Islands, India) mitochondrion sequence, complete genome.

MK234706. De, A.K., Muthiyan, R., Sunder, J., Perumal, P., Malakar, D., Muniswamy, K., Kundu, A. and Bhattacharya, D. 2018.Capra hircus (Andaman local goat from Andaman and Nicobar Islands, India) mitochondrion sequence, complete genome.

MK248681. De, A.K., Muthiyan, R., Perumal, P., Kundu, M.S., Kundu, A., Malakar, D. and Bhattacharya, D. 2018. Susscrofa (Nicobari pig from Andaman and Nicobar Islands, India) mitochondrion sequence, complete genome.

MK248682. De, A.K., Muthiyan, R., Perumal, P., Kundu, M.S., Kundu, A., Malakar, D. and Bhattacharya, D. 2018. Susscrofa (Andaman desi pig from Andaman and Nicobar Islands, India) mitochondrion sequence, complete genome.

PEER RECOGNITION TO DIRECTOR

in the committes and panels

- Vice President, Andaman Science Association (ASA), Port Blair , A&N Islands
- Chairman, Town Official Language Implementation Committee (TOLIC), Port Blair
- Member, High Value Agriculture Development Agency (HVADA) for the UT of A&N Islands
- Member, Working Committee of the Andaman and Nicobar Medicinal Plant Board(Society) (ANMPB(S)), Port Blair
- Chairperson, Institute Animal Ethics Committee (IAEC). ICAR- CIARI, Port Blair
- Member state level technical committee (SLTC)of A&N State Cooperative Bank, Port Blair to review and revise for fixation of scale of finance for the seasonal agricultural operation for the year 2018-19
- Member, State Level Sanction Committee for Rashtriya Krishi Vikas Yojana (RKVY) & PMSKY of A&N Islands
- Member, state level project screening committee for Rashtriya Krishi Vikas Yojana (RKVY) of A&N Islands
- Member, State Board for Wildlife , Andaman and Nicobar Islands
- Member, UT Coordination Committee between A&N Administration & CIARI, Port Blair
- Member, Special Gram Sabha, Gram Panchayat, Tushnabad
- Member, Gram Sabha, Gram Panchayat, Mithakhari
- Member, State Level Approval & Monitoring Committee (SLAMC) for the implementation of the Centrally Sponsored Scheme on “Blue Revolution: in A&N Islands.
- Member, UTATMA, Department of Agriculture, A &N Administration, Port Blair
- Member, Policy Committee on Fisheries, A & N Administration.
- Member, UT level Unit Cost Committee, NABARD, A&N Islands
- Member, Committee to discuss scope of Red Oil Palm with the NITI Aayog Team
- Member, Committee for promotion of Sea Weed Farming, Open Sea Cage Culture, Deep Sea Fishing etc.
- Member, Zoonotic Disease Committee of A&N Islands
- Member, Implementation of Paramparagat Krishi Vikas Yojana (PKVY), A&N Administration
- Member, Committee for designing, evaluation of question paper and answer script for selection of Assistant Fisheries Development Officer under the Directorate of Fisheries, A&N Administration
- Member, Committee for promotion of Trade and Tourism with South East Asian Countries, Directorate of Industries, A&N Administration
- Member, Introduction of Dairy Development Mission in A&N Islands, A&N Administration
- Member, in the Committee for evaluation of the Global Expression of Interest, Deptt. of Fisheries, A&N Administration
- Member in the Core Committee for the inspection of the project on “Establishment of Tissue Culture Laboratory as Turnkey project” at Progeny Farm, Jirkatang under NHM Scheme.

PARTICIPATION OF SCIENTIST IN CONFERENCE/ SEMINAR/ SYMPOSIUM/ MEETINGS & TRAINING

Scientist	Programme	Venue	Date/ duration
B. Augustine Jerard	Brainstorming Session on Acceleration of Commercial Horticulture Development	National Horticulture Board at Gurugram	23rd April, 2018
B. Augustine Jerard	Group Discussion on Technology Mapping, Gaps Identification, Development of Collaboration and Transfer of Technologies including Networking with ICAR	National Horticulture Board at Gurugram	23rd April, 2018
Pooja Bohra	Review Meeting of DBT-BioCARe Project	Department of Biotechnology, New Delhi	16th May, 2018
S. Dam Roy	Invited lecture in 3rd International Symposium on Agriculture and Fisheries Education	Asian Fisheries Society, Malaysia in partnership with Indian Fisheries Association	16th – 18th May, 2018
B. Augustine Jerard	27th Annual Group Meeting of AICRP on Palms	ICAR-IIOPR, Pedawegi	23rd - 26th May, 2018
Ajit Arun Waman	Annual General Meeting of AICRP on Palms	ICAR-IIOPR, Pedavegi, Andhra Pradesh	24th – 26th May, 2018
Jai Sunder	Regional Committee Meeting Zone –II	ICAR-CIFA, Bhubaneswar	22nd – 23rd June, 2018
V. Baskaran	Annual Review Meeting of CSS-NHM project on Spices	IGKV, Raipur	26th - 27th June, 2018
R. Kiruba Sankar, K. Saravanan, A. Velmurugan, I. Jaisankar	Workshop on Marine Biotechnology, Biodiversity and Fisheries (WMBBF-2018)	ACOST, NIOT, Port Blair	28th June , 2018
Jai Sunder	Annual Review meet of AICRP on Goat Improvement	Palampur	20th – 21st July, 2018
S.K. Zamir Ahmed	ISO 9001:2015 Lead Implementer Training Course	BSI, Banglore	23rd - 27th July, 2018
K. R. Kiran	Institute Orientation Training	ICAR-CIARI, Port Blair	25th July - 25th Aug., 2018
R. Kiruba Sankar	Annual Review Meeting of All India Network project on Mariculture	ICAR-CMFRI, Kochi	27th -29th July, 2018
V. Baskaran	Annual Group Meeting of AICRP on Floriculture	TNAU, Coimbatore	27th – 29th July, 2018

Scientist	Programme	Venue	Date/ duration
B. Augustine Jerard	UT level Unit Cost Committee meeting for 2018-19	NABARD, Port Blair	27th July, 2018
B. Gangaiah	NICRA Review Meeting	NAAS, New Delhi	6th – 12th Aug., 2018
Jai Sunder	Annual Review Meet of AICRP on FMD	Bhubaneswar	7th – 8th Sept., 2018
Sujatha, T.	Annual Review Meet of PSP	Barapani	22nd -23rd , Aug., 2018
S. Swain	CAFT training on: Food Safety and Quality Management of Food Products with reference to HACCP, Value addition & Quality Standard	Institute of Agricultural Science, Varanasi	4th - 24th Sept., 2018
S. Swain	Food safety management system (ISO 22000:2018) with reference to Hazard Analysis and Critical Control Points (IS 15000:2013)	Institute of Agricultural Science, Varanasi	13th – 15th Sept., 2018
K. R. Kiran, K. Saravanan, Harsha Haridas, R. Kiruba Sankar	SAS training programme	ICAR-CIARI, Port Blair	18th - 20th Sept., 2018
S. Dam Roy	12th National Symposium on Coastal Agriculture Boosting Stressed Environment	Indian Society of Coastal Agricultural Research (ISCAR)at Dr.BalaSaheb, Konkan Krishi Vidyapith, Dapoli (Maharastra)	28th Sept. - 1st Oct.., 2018
Gladston Y, Sreepriya Prakasan, Ajina SM, Deepitha RP, Sirisha Adamala	Orientation training	ICAR- CIARI	8th Oct. - 12th Nov., 2018
S.K. Zamir Ahmed, R. Kiruba Sankar, K. Saravanan, Harsha Haridas, K. R. Kiran, Gladston Y, Sreepriya Prakasan, Ajina SM, Deepitha RP	National Workshop on Mariculture Technologies for Andaman and Nicobar Islands: Potentials, Prospects and Strategies towards Seaweeds and Open Sea cage Farming	ACOSTI, NIOT, Port Blair	10th – 11th Oct., 2018
J Praveenraj	First Eastern Ghats Icthyologist Meet at Vishakhapatnam.	Wild life institute of India and Eastern Ghat Wildlife Society	13th -15th Oct., 2018
B. Gangaiah	Women Kisan Day	ICAR-KVK, Port Blair	15th Oct., 2018

Scientist	Programme	Venue	Date/ duration
Perumal P.	Asian Regional Conference on Goats	Amity University, Jaipur, Rajasthan	22nd - 26th Oct., 2018
B. Gangaiah, T. Subramani	Indian Society of Agronomy National Symposium on Doubling Farmers Income through Agronomic Innovations under Changing Scenario	Udaipur	24th - 26th Oct., 2018
S. Dam Roy	Green Skill Development Programme (GSDP)	Ministry of Environment & Forest and Climate Change. Government of India	31st Oct ., 2018
B. Gangaiah	Entrepreneurs Space and R & D activities taken for Development of Ag. Sector in Islands	Port Blair	10th Nov., 2018
Ajina SM, Deepitha RP, Sreepriya Prakasan, Gladston Y,	Professional Attachment Training	ICAR-CIFE, Mumbai	14th Nov., - 13th Feb., 2019
Sirisha Adamala	Professional Attachment Training (PAT) for 3 months	International Development Centre (IDC), ICRISAT, Patancheru, Hyderabad	15th Nov., 2018 – 14th Feb, 2019
All Scientist’s	National Symposium on Rural poultry production: Challenges for sustainable Entrepreneurship Development	ICAR-CIARI, Port Blair	15th - 17th Nov., 2018
B. Gangaiah	ICAR-Winter school	NRRI, Cuttack	20th Nov., 2018
B. Gangaiah	Indian Society of Weed Science Golden Jubilee International Conference: Weeds and Society: Challenges and Opportunities	Jabalpur	21st - 24th Nov., 2018
M.S.Kundu	Annual Review Meet of AICRP on Pig	ICAR- NRC	23rd - 24th Nov., 2018
S.K. Zamir Ahmed	National Seminar on Integrated Farming System for Enhancing Farmers’ Income and Nutritional Security	WBUAFS, Kolkata	5th -7th Dec., 2018
S.K. Zamir Ahmed	Management Development Programme on Priority Setting, Monitoring and Evaluation (PME) of Agricultural ResearchProject	NAARM, Hyderabad	17th – 22nd Dec., 2018
T.P. Swarnam	Biennial Workshop of AICRP on Integrated Farming Systems	University of Agricultural Sciences, GKVK, Bengaluru	20th – 23rd Dec., 2018

Scientist	Programme	Venue	Date/ duration
K. Sakthivel	National Seminar on Cutting Edge Approaches for Sustainable Plant Disease Management and Ensuring Farmers' Profit	ICAR-NRC, Banana, Trichy	21st - 23rd Dec., 2018
T.P. Swarnam	National Symposium on Integrated Farming Systems for 3Es (Ecological Sustainability, Enhanced Productivity and Economic Prosperity	University of Agricultural Sciences, GKVK, Bengaluru.	23rd - 24th Dec., 2018
B. Gangaiah	Indian Science Congress-2019	Phagwara, Punjab	3rd – 6th Jan., 2019
B. Gangaiah	FOCARS	NAARM, Hyderabad	16th Jan., 2019
V. Baskaran	8th Indian Horticulture Congress 2019 Shaping future of Indian Horticulture	IGKV, Raipur, Chattisgarh	17th – 21st Jan., 2019
R.K. Gautam	AICRP-Rice QRT meeting	GKVK, Bengaluru	29th - 30th Jan., 2019
Jai Sunder, M.S.Kundu	IAAVR Conference	Kolkata	1st – 2nd Feb., 2019
B. Gangaiah	Workshop Skill Development in Agriculture	ZSI, Port Blair	02nd Feb., 2019
K. Abirami, V. Baskaran, Ajit Arun Waman & Pooja Bohra	State level workshop on Skill Development in Agriculture and Allied Sectors	Zoological Survey of India(ZSI), Port Blair	2nd Feb., 2019
Jai Sunder, Sujatha, T.	National Conference at IAVMI	Patna	4th - 6th Feb., 2019
T. Subramani	Biennial Workshop on AICRP Management of Salt Affected Soil and Use of Saline Water in Agriculture	ICAR-CSSRI, Karnal	05th - 06th Feb., 2019
B. Augustine Jerard	National Collaboration Building Conference of NHB - ICAR Horticulture Institutions - SAUs/SHUs/ CAUs &- Horticulture Training Institutions organized by National Horticulture Board	NASC Complex, New Delhi	5th - 6th Feb., 2019
B. Gangaiah	NICRA Review Meeting	IIHR, Bengalauru	6th – 7th , Feb., 2019
R.K. Gautam	Golden Jubilee International Salinity Conference on Resilient Agriculture in Saline Environments Under Changing Climate: Challenges & Opportunities	ICAR-CSSRI, Karnal	7th -9th Feb., 2019
K. Abirami	Annual Group Meeting of AICRP on Fruits	AAU, Jorhat, Assam	14th -16th Feb., 2019

Scientist	Programme	Venue	Date/ duration
V. Baskaran	National Conference cum Workshop on Recent Advances in Orchidology with Special Emphasis on Biology, Climate Change, Conservation and Commercialization of Floriculturally and Therapeutically Important Taxa and Orchid Show	ICAR-CIARI	15th -17th Feb., 2019
S. Swain	Food Business Conclave-2019	Hotel Megapode, Port Blair	19th Feb., 2019
S. Dam Roy	XIV Agricultural Science Congress	NASC, New Delhi	20th -23rd Feb., 2019
S. Dam Roy	Stakeholder's Consultations Meeting of Andaman and Nicobar Islands of BOBLME, SAP Implementation and Project Document Preparation	Fishery survey of India	25th Feb., 2019
S. Swain	Prospects for Agro-Based Rural Industry in A&N Islands- A Way to Growth	JNRM College Port Blair	6th -7th March, 2019
S. Dam Roy	Workshop on Island Biodiversity Conservation for College Students	CPR environmental education centre	26th Feb., 2019
B. Augustine Jerard	Plantation Crops Symposium XXIII (PLACROSYM XXIII) organized by CCRI, Govt of India and ISPC, ICAR-CPCRI, Kasaragod	Chikkamagalauru, Karnataka	6th to 8th March, 2019
P.K. Singh	XI Annual Review Meeting of ICAR Seed Project- Seed Production in Agricultural Crops	PAJANCOA & RI Karaikal, Puducherry (UT)	9th - 11th March, 2018
S. Swain	35th Annual Review Meeting of AICRP on PHET	TNAU Campus, Coimbatore	12th -15th March, 2019
R.K. Gautam	Management Development Program for HRD Nodal Officers of ICAR for Effective Implementation of Training Functions	ICAR-NAARM, Hyderabad	14th - 6th March, 2019
S. Dam Roy	Food Processing Conclave 2018 at Megapode Nest, Port Blair, Andaman & Nicobar Islands	Directorate of Industries, Andaman & Nicobar Administration, Ministry of Food Processing Industries, GOI and Indian Chamber of Commerce	22nd March, 2018

Scientist	Programme	Venue	Date/ duration
I. Jaisankar	Research Advisory Committee meeting	Department of Environment and Forest, Andaman and Nicobar Administration	22nd March, 2019
B. Gangaiah	Nutrition Kitchen Garden	ICAR-KVK, Port Blair	24th March, 2019
T. Subramani	Training programme on Agri Journalism	MANAGE, Hyderabad	27th - 29th March, 2019
B.L.Kasinath	Community radio awareness workshop	Ministry of Information & Broadcasting along with SMART	28th-30th Jan., 2019
S.K. Zamir Ahmed & Jai Sunder	Signing MOU between TNJFU, TN &ICAR CIARI, 2018 for PG studies in the presence of V.C & Director	CIARI	23rd October, 2018

HUMAN RESOURCES DEVELOPMENT OF STAKEHOLDERS

a) **Training to stakeholders**

Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
1	Cultivation of fodder to improve livestock productivity	25th -26th July, 2018	25	Farmers	Indira Nagar	ASD
2	Importance of quality seed in agriculture	27th July, 2018	34	Farmers	Keralapuram, N& M Andaman	FCI&P
3	Post-harvest management and value addition in mango, pineapple and bael: A way to doubling of income	1st - 3rd Aug., 2018	30	Farmers and SHG members	ICAR-CIARI	NRM
4	Reproductive management in goat	14th Aug., 2018	27	Farmers	ICAR-CIARI	ASD
5	Pig farming for sustainable livelihood	11th -13th , Sept., 2018	27	Farmers	ICAR-CIARI	ASD
6	Scientific dairy farming and value addition in milk	18th to 20th Sept., 2018	25	Dairy farmers	KVK, South Andaman	NCUI
7	Data analysis and interpretation using SAS	18th to 20th Sept., 2018	21	Scientist & Technical staff	ICAR-CIARI	AKMU & SUB-DIC
8	Value addition of flower	20th Sept., 2018	50	Farmers and SHG members	Herpatabad, South Andaman	H&F and FCIP
9	Rearing of pig under semi intensive system	5th Oct., 2018	06	Farmers	ICAR-CIARI	ASD
10	Farmers participatory seed production in pulses	25th Oct., 2018	43	Farmers	Nabagram, N & M Andaman	FCIP
11	Oyster mushroom cultivation	6th Dec., 2018	25	Farmers	Webigram, N & M Andaman	FCIP
12	Application of microbial products in plant health management	7th Dec., 2018	20	Farmers	R.K. Gram, N & M Andaman	FCIP
13	Oyster mushroom cultivation	8th Dec., 2018	25	Farmers	N & M Andaman	FCIP
14	Fish feed and health management in aquaculture	13th -15th Dec., 2018	26	Farmers	ATIC	NFDB & ICAR-CIARI
15	Scientific goat farming for improving productivity	18th Dec., 2018	40	Farmers	Nimbudera	ICAR-CIARI

Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
16	Applications of plant tissue culture for conservation of diversity	05th Jan., 2019	15	Postgraduate students	ICAR-CIARI	DBT-BioCARe
17	Scientific pig farming for better productivity	17th Jan., 2019	21	Farmers	Baratang	ICAR-CIARI
			40	Farmers	Dharmapur Village	
18	Reproductive health management of dairy animals towards one calf every year	21st -23rd , January, 2019	35	Farmers	Chouldari	ASD
19	Cultivation of pulses in A & N Islands	23rd Jan., 2019	43	Farmers	Hut Bay, South Andaman	FCIP
20	Job role: small poultry farmer	20th Feb. to 27th March, 2019	21	Unemployed youth	KVK, South Andaman	RKVY, AKCI, NSDC, ATARI, Kolkata
21	Fresh water ornamental breeding and aquascaping techniques	25th -27th Feb., 2019	52	Farmers	ATIC	NFDB & ICAR-CIARI
22	Spices as intercrops in plantation based cropping system for livelihood security of Island farmers	26th - 28th Feb., 2019	60	Farmers, students and SHG members	KVK, South Andaman	H&F
23	Importance of high yielding varieties and quality seed in agriculture	16th March, 2019	134	Farmers	Hut Bay, South Andaman	FCIP
24	Post harvest management and value addition of coconut and noni	28th – 30th March, 2019	30	Farmers and SHG members	ICAR-CIARI	NRM

b) Conference

Sl. No.	Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
1.	IPSACON2018	15th -17th Nov.,2018	210	Academicians, Scholars, Researchers	ICAR-CIARI	ICAR, SAUs and Scientific organizations
2.	Recent advances in orchidology with special emphasis on biology, climate change, conservation and commercialization of floriculturally and therapeutically important taxa and Orchid show	15th – 17th Feb., 2019	75	Scientists, professors, students and research scholars	ICAR-CIARI	TOSI, ICAR-CIARI and Dept of Agriculture, A & N Administration

c) Field/Seed Day

Sl. No	Title	Period	Participants (Nos.)	Venue	Conducted by
1	Seed day on technology application of promising high yielding varieties of rice	6th June, 2018	132	Rangat, N & M Andaman	FCIP, KVK, North Andaman and Social Science
		7th June, 2018	33	Sundergarh Gram Panchayat, N & M Andaman	FCIP, KVK, North and South Andaman & Social Science
		30th June, 2018	32	KVK, Port Blair	FCIP, KVK, South Andaman and Social Science
		26th Oct., 2018	19	Madhupur, N & M Andaman	FCIP
2	Fodder production	13th Sept., 2018	27	ICAR-CIARI	ASD
3	Organic cultivation of betelvine	25th Sept.,2018	30	New Bimblitan, South Andaman	H&F
4	Marigold and gladiolus cultivation cum planting material distribution of gladiolus	05th Dec., 2018	32	New Bimblitan, South Andaman	H&F and ICAR-DFR
5	Seed day on promoting high yielding varieties of pulses at North & Middle Andaman through FLD	10th Jan., 2019	62	Long Island, North and Middle Andaman	FCIP, KVK, North Andaman and Social Science
6	Goat farming	22nd Jan., 2019	21	Praffulnagar	ASD
7	Revolution in dry fodder for livestock	21 Feb., 2019	15	KVK, South Andaman	NABARD , Adhithi & Agri. Producer Ltd.
8	Vanaraja poultry farming	12th March, 2019	20	Livestock farm complex, Garacharma	RKVY, AKCI, NSDC, ATARI, Kolkata
9	Application of CIARI-bioconsortia for bacterial wilt disease management in brinjal	12th March, 2019	30	ICAR-CIARI	FCIP and KVK, South Andaman
		19th March, 2019	60	Webigram, N & M Andaman	FCIP and H & F
10	Importance of deworming in livestock	16th March, 2019	51	Coffee Bagecha, South Andaman	ICAR-CIARI
11	Role of feed probiotics in Island aquaculture	27th March, 2019	25	Bimblitan, South Andaman	ICAR-CIARI

d) Interaction Meet

Sl. No	Title	Period	Participants (Nos.)	Venue	Conducted by
1	Interaction meet with pig farmers (NICRA)	5th Oct., 2018	6	ICAR-CIARI	NRM
2	Farming of vanaraja poultry cum farmers meet	26th Nov., 2018	09	Animal Science farm complex	ASD
3	Interaction meet with Farmers (NICRA)	19th Jan., 2019	20	Wandoor	NRM

e) Field Demonstration

Sl. No.	Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
1	Carp breeding	25-28 June, 2018	05	Farmers	ICAR-CIARI	FSD
2	Compost making methods from farm waste and poultry manure	23rd March, 2019	16	Farmers	KVK, Port Blair	ASD
3	Areca nut leaves thresher	21 Feb., 2019	20	Farmers	Sippighat	NIANP-NABARD
		25th Feb., 2019	20	Farmers	KVK, South Andaman	NIANP-NABARD

f) World Coconut day and EDP

Sl. No.	Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
1.	World Coconut Day and Entrepreneurship Development Programme (EDP) on coconut value addition	03.09.18	126	Entrepreneurs, Progressive Farmers, Development Department officials and Students	ICAR-CIARI	NHB, CDB, Dept of Agriculture, NABARD, ICAR-CIARI

g) Workshop

Sl. No.	Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
1.	Bouquet making and flower arrangement	20th Feb., 2019	50	Students of JNRM	ATIC	H&F

h) Awareness campaigns

Sl. No.	Types of participants	Participants (No.)	Period	Venue
1	Building and sensitization on health, nutrition and environment for tribal Farmers with NASI	54	20th – 21st April, 2018	ICAR-CIARI
2	Scientific management of goats during rainy season	24	26th June, 2018	Indira Nagar
3	Cultivation of spices as intercrops in coconut plantations	12	30th June, 2018	Kanyapuram
4	Reproductive management in goats	15	14th August ,2018	ICAR-CIARI
5	National surveillance programme for aquatic animal diseases (NSPAAD) in Andaman and Nicobar Islands	33	29th Sept., 2018	Wandoor, South Andaman
		14	18th Dec.,2018	Campbell Bay, Great Nicobar
		18	29th Jan., 2019	Sawai Village, Car Nicobar
6	Scientific goat farming for improving productivity	20	17th Dec., 2018	Baratang
7	Tejpat cultivation in coconut plantations	16	31st Dec., 2018	Nayapuram
8	Diversity of underutilized species in ANI	121	11th Jan.,2019	GSSS, Bamboo Flat
9	Conservation of underutilized species in ANI	70	11th Jan., 2019	Crescent Public School, Nayapuram

i) Health Camp

Sl. No.	Types of participants	Participants (No.)	Period	Venue
Camp				
1	Livestock	24	11th August, 2018	Indira Nagar
		25	28th Sept., 2018	Guptapara
		30	18thDec., 2018	Nimbudera
		36	19thDec., 2018	Mayabunder
		32	20th Dec., 2018	Diglipur
		18	1st Nov., 2018	Namunagar
		06	1st Dec., 2018	Indiranagar
2	Pigs	20	20th June, 2018	Kamrajnagar
		16	22nd June, 2018	Kamrajnagar

j) Exposure Visit

Sl. No.	Types of participants	Participants (No.)	Period	Venue
Students				
1.	Government Senior Secondary School, Bamboo flat, South Andaman	56	3rd Nov., 2018	CIARI
2.	Government Senior Secondary School (Telugu Medium), Haddo , South Andaman	86	30th Nov.,2018	CIARI
3.	Government Model Senior Secondary School, Aberdeen Bazaar, South Andaman	88	12th Dec.,2018	CIARI
4.	Government Model Senior Secondary School, Aberdeen Bazaar, South Andaman	87	15th Dec.,2018	CIARI
5.	Model Senior Secondary School, Aberdeen, Port Blair	85	18th Dec.,2018	CIARI
6.	Model Senior Secondary School, Aberdeen, Port Blair	89	20th Dec,2018	CIARI
7.	Govt. S.S.S School Line, Port Blair	53	28th Dec.,2018	CIARI
8.	Government Model Senior Secondary School, Aberdeen Bazaar, South Andaman	62	29th Dec., 2018	CIARI
9.	Government Senior Secondary School , South Andaman	115	29th Dec., 2018	CIARI
10.	Government Secondary School, South Point, South Andaman	22	5th Jan.,2019	CIARI
11.	Government Senior Secondary School, Prothrapur, South Andaman	78	2nd Feb.,2019	CIARI
12.	Saraswati Shishu Mandhir , South Andaman	25	6th Feb., 2019	CIARI
II. Professionals				
1.	Officials of HPSDP-JICA-ODA, Himachal Pradesh	7	15th – 17th March, 2019	CIARI

k) Exhibition

Sl. No.	Title	Participants (No.)	Period	Venue
1.	National Minicoy Festival	1120	12th -13th Jan.,2019	Minicoy, Lakshadweep
2.	District Kisan Mela	235	25th Feb. ,2019	KVK , South Andaman

l) Radio Talks

Title	Date of broadcast	Expert
Value addition in vegetable, fruits and milk.	15th May, 2018	N.C. Choudhari
Agriculture technology for enhancing farmers income	1st Oct.,2018	S.K. Zamir Ahmed
Production of healthy fruits and vegetables	2nd Oct., 2018	Pooja Bohra

Technique of silage production	6th Nov.,2018	B. Gangaiah
Foot and mouth disease (FMD) in animals	21st Jan., 2019	Jai Sunder
Mud crab fattening for the tsunami areas	25th Jan., 2019	Nagesh Ram
Backyard poultry farming	31st Jan., 2019	N.C. Choudhari
Grafting methods on fruit crops	01st Feb., 2019	L.B. Singh
Alternate feed resources for livestock	4th Feb., 2019	M.S.Kundu
Eco-friendly disease management in vegetable crops in Island conditions	04th Feb., 2019	V.K. Pandey
Career opportunities in agriculture in allied fields	6th Feb., 2019	S.K. Zamir Ahmed
Beejon ka surakshit bhandaran	1st March, 2019	P. K. Singh

m) Doordarshan Interview

Title	Date of broadcast	Expert
Role of KVK in technology dissemination	3rd April, 2018	B.L. Kasinath
Health management in freshwater aquaculture (Live)	4th April, 2018	K. Saravanan
Mushroom production for doubling farmers income	30th April, 2019	N.C.Choudhuri
Career opportunities in agriculture (live)	2nd May, 2018	S.K. Zamir Ahmed
Disease management in field crops in Island condition	16th May, 2018	V.K. Pandey
Soil and water conservation	21st May, 2018	B K Nanda
Nursery raising techniques	11th July, 2018	L.B. Singh
Integrated farming system	5th Sept., 2018	L.B. Singh
Sustainable disease and pest management in Island ecosystem	3rd Oct., 2018	V.K. Pandey
Silage	13th Nov., 2018	B. Gangaiah
Paddy seed production technologies	20th Nov., 2018	B. L. Meena
Pond based integrated farming System	20th Nov., 2018	Shailesh Kumar
Role of arecanut harverster/climber	20th Nov., 2018	Manoj Kumar
Pond based IFS	3rd Dec., 2018	Nagesh Ram
Dweep samooho me dalchini ki kheti	12th Dec., 2018	Ajit Arun Waman
Farm lay out and planting techniques	2nd Jan., 2019	L.B. Singh
Backyard poultry farming	9th Jan.,2019	N.C. Choudhuri
Weed management in orchards and plantation crops	13th Feb.,2019	B. Gangaiah
Career opportunities in agriculture in allied fields	25th Feb.,2019	S.K. Zamir Ahmed
धान की उन्नत किस्में, बीज उत्पादन एवं प्रचार प्रसार-	27th Feb., 2019	P. K. Singh
Nariyal ke baagano me kali mirch ki kheti	05th March,2019	Ajit Arun Waman
Kali mirch ki kheti- tudai uprant prabandhan	07th March,2019	Ajit Arun Waman
Diseases of goats and its management	23rd March, 2019	Jai Sunder

TRAINING AND CAPACITY BUILDING

Physical targets and achievement

S.No	Category	Total No. of employees	No. of training planned for 2018-19 as per ATP	No. of employees undergone training		
				April - Sept.2018	Oct., 2018-19	April 2018 - March 2019
1.	Scientist including KVK Head	46	26	14	12	26
2.	Technical + KVK SMS	50	14	10	9	19
3.	Administrative & Finance	21	15	7	4	11
	Total	117	55	31	25	56

Category – wise training attended by employees

1. Category: Scientific staff

S. No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (Days)	Organizing Institution
1	R. R. Alyethodi, P.A.Bala, S.K.Ravi,	Scientist	Animal Science Division	Data Analysis and Interpretation using SAS	3	ICAR-CIARI
2	P.A.Bala	Sr. Scientist	Animal Science Division	Nano-Technological and Biochemical Techniques for Assessing the Quality and Safety of Milk and Milk Products	21	ICAR-NDRI, Karnal
3	R. R. Alyethodi	Scientist	Animal Science	Next Generation Sequencing (NGS) Data Analysis under Skill Development Program	19	Center for Cellular and Molecular Biology (CCMB), Hyderabad
4	R Kiruba Sankar, Harsha Haridas, K.Saravanan	Scientist	Fisheries Science Division	Data Analysis and Interpretation using SAS	3	ICAR-CIARI
5	S. K. Zamir Ahmed	Pr. Scientist	Social Science Section	Management Development Programme on Priority setting, Monitoring and Evaluation (PME) of Agricultural Research Project	5	NAARM Hyderabad

S. No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (Days)	Organizing Institution
6	Srividhya, S.	Scientist	Plant Physiology	Professional Attachment Training on Precision Phenotyping Techniques For Abiotic Stress	96	ICRISAT, Hyderabad
7	B. Gangaiah	HoD	NRM	Doubling Farmers Income Through Agronomic Interventions under Changing Scenario	3	MPUAT, Udaipur, Rajasthan
8	S. Swain	Scientist	NRM	CAFT Training	21	BHU Varanasi
9	V. Baskaran	Pr. Scientist	H&F	Analysis of Experimental Data	6	NAARM, Hyderabad
10	B. A. Jerard	Head	H&F	MDP on Leadership Development	12	ICAR-NAARM
11	K. Abirami	Scientist	H&F	Data Analysis and Interpretation using SAS	6	ICAR-CIARI, Port Blair
12	Jaisankar, I	Scientist	H&F	Winter School Training on Maintenance Breeding and Assured Quality Seed Production in Dual Purpose Crops and Grasses	21	ICAR-IGFRI, Jhansi
13	Ajit Waman	Scientist	H&F	Essentials Oil Perfumery and Aromatherapy	5	Forest Research Institute, Dehradun
14	Karunakaran	Scientist	Computer Cell	Workshop of Nodal Officer	2	IASRI PUSA, New Delhi
15	Gladston Y	Scientist	Fisheries Science Division	FOCARS (Foundation course for Agricultural Research Service)	118	ICAR-NAARM, Hyderabad
16	Gladston Y	Scientist	Fisheries Science Division	PAT (Professional Attachment Training	92	ICAR-Central Institute of Fisheries Education

S. No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (Days)	Organizing Institution
17	P. K. Singh	Pr. Scientist	FCIP	Data Analysis and Interpretation using SAS	3	ICAR-CIARI, Port Blair
18	B.L.Kasinath, Nagesh Ram, L B Singh	Senior Scientist	KVK, Nimbudera	Community Radio Awareness Workshop	3	Ministry of information & broadcasting along with SMART
19	R. K. Gautam	Pr. Scientist	FCIP	MDP for HRD Nodal Officers of ICAR	3	ICAR-NAARM
20	L B Singh	Senior Scientist	KVK, Port Blair	Job role on Coconut Grower- ASCI, Skill India. PMKVY.	3	BCKV, Kalayani, West Bengal.
21	R. Jaya Kumaravaradan	Scientist	Social Science Section	Data Analysis and Interpretation using SAS	3	ICAR-CIARI

2. Category: Technical Staffs

S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration	Organizing Institution
1	Sunil Chakarborty	Sr. Technician (Driver)	Workshop, ICAR-CIARI	Automobile Maintenance, Road Safety and Behaviourial Skills	7	CIAE, Bhopal
2	Babu Swamy	Technical Assistant (Driver)	Workshop, ICAR-CIARI	Automobile Maintenance, Road Safety and Behaviourial Skills	7	CIAE, Bhopal
3	Nutan Roy	Sr. Technician	H&F Division	Motivation Positive Thinking and Communication Skill for Technical Staff	7	ICAR-CIAE, Bhopal
4	V. Damodaran	ACTO	H&F Division	Farm Management	7	ICAR-IIFSR
5	Manoj Kumar	SMS (Agri. Engg.)	KVK, Nimbudera	Orientation Course	30	Banaras Hindu University
6	A. K. Tripathi	STO	Animal Science Division	Farm Management	7	ICAR-IIFSR, Modhipuram, Meerut, UP

S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration	Organizing Institution
7	Alex Praveen Barla	Technical Assistant	Library Section	Koha for Library Staff	7	NAARM, Hyderabad
8	Sanjay Kumar Pandey	SMS (Agronomy)	KVK, Nicobar	Advances in Salinity Sodicity Management under Different Agro Climatic Regions for Enhancing Farmers Income	21	ICAR-CSSRR
9	Sanjay Kumar Pandey	SMS (Agronomy)	KVK, Nicobar	Community Radio Awareness Workshop	3	SMART, New Delhi
10	Zachariah George	SMS (Animal Science Division)	KVK, Nicobar	Job Role: Small Poultry Farming	3	BCKV, ASCI
11	Archana Sharma	Technical Officer	CIF	Data Analysis and Interpretation using SAS	3	ICAR-CIARI, Port Blair
12	Lakhan Singh	Technical Assistant	Bloomsdale Farm	Data Analysis and Interpretation using SAS	3	ICAR-CIARI, Port Blair
13	Pooja Kapoor	SMS (Home Science)	KVK, Nimbudera	Community Radio Awareness Workshop	3	Ministry of Information & Broadcasting along with SMART
14	Shardul Vikram Lal	SMS (Animal Science)	KVK, Nimbudera	Updates in the Disease Diagnosis and Treatment Protocols in Health Management of Farm & Companion Animals	21	TANVASU, TN
15	Prasanta Pradhan	Programme Asst. (Computer)	KVK, Nimbudera	KVK, Sandesh App	1	ATARI, Kolkata
16	Ravish Kataria	Technician-T1	KVK, Nimbudera	Selection, Adjustment, Operation and Maintenance of Agricultural Implements for Field and Horticulture Crops	14	Sponsored by ICAR-KVK, Nimbudera, CIARI & organized by CIAE, Bhopal

S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration	Organizing Institution
17	N. Bommayasamy	SMS(Agro)	KVK, Port Blair	Climate Change and its Impact on Photosynthesis and Productivity of Rice	22	ICAR-National Rice Research Institute, Cuttack
18	Harapriya Nayak	SMS(Home Science)	KVK, Port Blair	Dynamics of Entrepreneurial Development for Empowering Rural Youth in Agriculture	21	Ouat, Bhubaneswar
19	B. K. Nanda	SMS(Agri Eng)	KVK, Port Blair	Recent Advances in Pressurized Irrigation System for Enhancing Water Use Efficiency	10	CAET, OUAT, Bhubaneswar

3. Category: Administrative Staff

S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration	Organizing Institution
1	Rina Saha	Jr. Stenographer	PME Cell	Enhancing Efficiency and Behavioral Skills of Stenographers Grade III/Pas/PPSs & Sr. PPSs	6	RC, NBSS&LUP, Kolkata
2	Ashima Saha	Assistant	Audit Section	FMS Payroll of ICAR ERP	2	NRRI Cuttack
3	Prakash Mondal	Sr. Clerk	Audit Section	FMS Payroll of ICAR ERP	2	NRRI Cuttack
4	Nehru Ram	Sr. Clerk	Bill & Cash Section	FMS Payroll of ICAR ERP	2	NRRI Cuttack
5	C. Siji	Jr. Clerk	Est. Section	Pension & Retirement Benefit	2	ICAR-Fisheries Research Institute, Barrackpur
6	Shibani Sengupta	Assistant	Administration	Management Development Programme on Analysis of Financial Statement	5	Faridabad, Haryana, NIFM, Faridabad

S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration	Organizing Institution
7	Sushil Kumar Singh	SAO	Administration	MDP on Administrative & Financial Matters	4	NAARM, Hyderabad
8	Shyam Prakash Narayan	Assistant	Bill & Cash Section	Pension & Refreshment Benefits	2	CIFRI, Barrackpore
9	S K Biswas	AAO	Administration	Procurement Under GFR 2017 & Evolution of GeM	3	AIMA, New Delhi
10	Ravi Babu	UDC	Administration	Procurement Under GFR 2017 & Evolution of GeM	3	AIMA, New Delhi
11	Kakesh Rao	Jr. Clerk	Central Store	Management Development Programme on Analysis of Finacial Statement	5	Faridabad, Haryana, NIFM, Faridabad

ROUND UP OF INSTITUTE ACTIVITIES

Sl. No.	Activities	Date
1	Kisan Call Centre at ICAR-CIARI, Port Blair	4th April, 2018
2	Agricultural Research Service (ARS) examination - 2017 (Preliminary) and National Eligibility Test (NET-I)-2018	6th to 10th April, 2017
3	Awareness Building and Sensitization on Health Nutrition and Environment of Nicobari tribals by NASI	20th and 21st April, 2018
4	ICAR 3rd Interactive Meet of Nodal Officers of SAUs / CUs/DUs by WBVUAFS, Kolkata and ICAR-CIARI	4th & 5th May, 2018
5	Seed day on improved paddy varieties to farmers at North Andaman	6th June, 2018
6	4th International Yoga Day	23rd June, 2018
7	41st Foundation Day	23rd June, 2018
8	Seed day and technological application on HYV of rice at South Andaman	30th June, 2018
9	Visit of the Hon'ble Vice President of India, Shri. M. Venkaiah Naidu	4th July 2018
10	World Coconut Day & EDP on coconut value addition	3rd September, 2018
11	Swacch Bharat Abhiyan Campaign	7th September, 2018
12	Mahila Kisan Diwas (MKD)	15th October, 2018
13	Vigilance Awareness Week-2018	29th Oct., to 3rd November, 2018
14	XXXV Annual Conference of Indian Poultry Science Association & National Symposium (IPSACON-2018)	15th to 17th November, 2018
15	Quinquennial Review Team (QRT) visit	28th November, 2018
16	Annual Sports Meet 2019	12th December, 2018 to 18th January, 2019
17	National Conference on Recent Advances in Orchidology for the Welfare of Science and Society	15th to 17th February, 2019
18	International Women's Day	8th March, 2019
19	Foldscope Workshop Jointly by ICAR- NIBSM & CIARI for Tribals	20th March, 2019

MOMENTS TO CHERISH

Hon'ble Vice President of India Shri M.Venkaiah Naidu visits ICAR-CIARI on 5th July, 2018

IMPRESSION OF DELEGATES

Delegates	Impression
Hon'ble Vice President of India Shri M.Venkaiah Naidu	**Lab-land-interface with farmers , dialogue are very much required. Focus on these two aspects**
Dr. Manju Sharma, NASI, Allahabad	Excellent Institute fully concerned with the problem of the local population. Good science, manageable extension service, training, demonstration. A & N Islands being very fragile ecosystem this Institute motivated towards protection and sustainable development.
Dr. N.S. Rathore, DDG (Edn.), ICAR HQ, New Delhi – 12	Excellent arrangement of traditional agriculture property of Andaman Islands. The museum reflects all about traditional, technology (recent) and their integration to preserve island. All staff deserve appreciation for well maintain museum and other infrastructural facilities of Institute. I wish they will plan few more reforms which are need of hours for increasing productivities of animals and plant.
Dr. A.K. Bandyopadhyay, Former Director, ICAR-CIARI, Port Blair	I am very very happy to see the progress and impact of technology on farmers.
Prof. Purnendu Biswas, Vice Chancellor, W.B. University of Animal & Fishery Sciences, Kolkata	It is a nice experience to see the role of CIARI in the agriculture development of Andaman & Nicobar Islands. Works done by the scientists of this Institute are splendid and I hope it will continue to improve the livelihood of farmers of these Islands through agricultural interventions.
Prof. S. Felix, Vice Chancellor, TNJFU, Nagapatinum, Tamil Nadu	Excellent presentation of various components of agriculture. Narrated nicely by the scientist. All the best.
QRT visit	It clearly evidence the problems, priorities, prospects of Agril. Education, research and extension on agriculture for the entire region.
Dr. T. Janakiram, ADG (HS), ICAR, KAB-II, New Delhi – 110 012	Extremely delighted to visit on of the unique Institution in the country which has alone immense contribution in Island Agriculture. The Institute has been recognized for its achievements and has been awarded ICAR-Sardar Patel outstanding Institute award. In congratulate Dr. Kundu, Director and his dedicated scientists, administrative, supporting staff and wish may more success in future.
Dr. Vinod Kumar Sharma, Project Director, HP Crop Diversification Promotion Project, SICA-ODA, Hamirpur, UP	The interaction with the scientist of the Institute was very interesting and knowledgeable. The commitment and dedication of the scientists to develop technology suitable to the farming community focusing on increasing their income is worth mentioning. The Institute is contributing significantly to develop integrated model for the Island eco-system. On behalf of the project I wish the Institute good luck and sure that it will remain a top Institute of the ICAR..
Dr. R. P. Kaushal, Joint Director (Research), ICAR-NIBSM, Raipur	The visit is definitely a learning experience observing difference between agriculture in main land and this Island. Efforts of the Institute is developing and disseminating technology is appreciable. The important technologies are nice depicted in the museum. I wish many lauds in the forth coming days to this unique Institute. Best wishes to the Institute.
Dr. S.K. Tayagi, PC, AICRP (PHET), CZPHET, Ludhiana	The work conducted by the Institute is very wide and impressive. I am very happy to see the improvement of different discipline Scientist working at this place is a very exhausting manner.

LINKAGE AND COLLABORATION WITH OTHER DEPARTMENTS

1. ICAR-IIHR, Bengaluru, Karnataka
2. ICAR-IARI, New Delhi
3. ICAR-IISR, Kozhikode, Kerala
4. ICAR-NBPGR, New Delhi
5. ICAR-CPCRI, Kasaragod, Kerala
6. ICAR-NRCB, Tiruchirapalli, Tamil Nadu
7. ICAR-DFR, Pune
8. National Horticulture Board, Gurugram
9. Coconut Development Board, Kochi
10. NABARD, Mumbai
11. ICAR-AICRP on Palms, Floriculture, Fruits, Vegetables, Tuber crops
12. DASD, Kozhikode, Kerala
13. Department of Agriculture, A & N Administration
14. University of Horticultural Sciences, Bagalkot, Karnataka
15. Tamil Nadu Agricultural University, Coimbatore
16. BCKV, Kalyani
17. Indian Institute of Pulses Research, Kanpur
18. ICAR-DMR, Solan
19. ICAR-NBAIM, Mau, UP
20. ICAR-IISR, Mau, UP
21. NBAIR, Bengaluru
22. IIRR, Hyderabad
23. RMRC, ICMR, Port Blair
24. ICAR Institutes; IVRI, PD_ADMAS, CIRG, DPR, DFMD
25. DAHVS, A&N Administration.
26. TANUVAS, Chennai
27. NABARD, Port Blair
28. ICAR-CIBA, Chennai
29. ICAR-NFDB, Hyderabad
30. I CAR-NBFGR, Lucknow
31. ICAR-CMFRI, Kochi
32. ICAR-CIFT, Kochi
33. TNJFU, Nagapattinam, Tamil Nadu
34. ICAR-NAARM, Hyderabad
35. Regional Remote Sensing Center, Nagpur
36. India Meteorological Department, Pune
37. ICAR-CSSRI, Karnal
38. ICAR-IIRR, Hyderabad
39. ICAR-DWSR, Jabalpur
40. ICAR-CIPHET, Ludhiana , Punjab
41. Directorate of Industries, A&N Administration and MOFPI, GOI
42. ICRISAT, Hyderabad
43. Tribal Council, Nicobar & Nancowrie group of Islands
44. AAJVS, A & N Administration
45. ANTRI, A & N Administration
46. Department of Fisheries, A & N Administration
47. Prasar Bharati, A & N Islands

PERSONNEL

Director (Acting) **Dr. A. Kundu**

Head / Incharge Divisions / Section/ KVK

Head, Division of Animal Science	Dr. A. Kundu
Head, Division of Natural Resource Management	Dr. B. Gangaiah
Head, Division of Horticulture & Forestry	Dr. B. A. Jerard
Head I/c, Division of Field Crop Improvement & Protection	Dr. P.K. Singh
Head i/c, Division of Fisheries	Dr. S. Dam Roy
Incharge, Social Science Section	Dr. S.K. Zamir Ahmed
Senior Scientist & Head, KVK (South Andaman & Nicobar)	Dr. Nagesh Ram Dr. L.B. Singh w.e.f. 2nd Jan., 2019 Shri. Sanjay Kumar Pandey
Senior Scientist & Head, KVK, N & M Andaman	Dr. B.L. Kashinath
Head of Office	Mr. Sushil Kumar Singh
Senior Administrative Officer	Mr. Sushil Kumar Singh
Finance & Accounts Officer	Dr. Jai Sunder Smt. Sulochana w.e.f. Sept., 2018 Shri P.P. Anil Kumar w.e.f. 28th Feb.,2019
Incharge, Priority setting, Monitoring & Evaluation Cell	Dr. S.K. Zamir Ahmed
Incharge, AKMU	Shri D. Karunakaran
Incharge, Library	Dr. Arun Kumar De
Incharge, Central Instrumentation Facility	Dr. Jai Sunder
Incharge, Estate Section	Er. S.L. Paik
Incharge, Workshop &Instrumentation Cell	Er. M. Arul Selvam
Incharge, Guest House	Mr. Amit Srivastava
Incharge, Security Officer	Mr. A.K. Tripathi Dr. V.K. Pandey w.e.f. December, 2018
Incharge, Sippigaht Farm	Dr. V. Bhaskaran
Incharge, Bloomsdale Farm	Dr. P.K. Singh
Coordinator, Bio-Informatics Centre	Dr. A.K. De
Incharge, ITMU	Dr. Jai Sunder
Incharge PG Cell	Dr. Jai Sunder
Assistant Director (OL)	Mrs. Sulochana
Nodal Officer, Regional Centre, Minicoy	Dr. B. Gangaiah
Asstt. Nodal Officer , Regional Centre, Minicoy	Dr. S.K. Zamir Ahmed
Incharge Head, Regional Station, Minicoy	Mr. Arun Kumar Oppoottil Ratheesh
Farm Managers	
Garacharma	Mr. A.K. Tripathi
Sippighat	Dr. V. Damodaran
Bloomsdale Farm	Shri Lakhan Singh

Vigilance Officer	Dr. D.Bhattacharya
Transparency Officer	Dr. R.K. Gautam
Nodal Officer, HRD	Dr. R.K. Gautam
Central Public Information Officer	Dr. R. Kiruba Sankar
Nodal Officer online HYPM	Dr. S.K. Zamir Ahmed
Nodal Officer, PIMS, PERMISnet, ASRB Online & Krishi Kosh	Mr. D. Karunakaran
Nodal Officer, CPGRAMS	Mr. Sushil Kumar Singh
Nodal Officer, Court Case Monitoring System	Mr. Amit Srivastava
Nodal Officer, Swachh Bharat Abhiyan	Dr. A. Velmurugan
Co Nodal Officer, Swachh Bharat Abhiyan	Dr. I. Jaisankar
Nodal Officer, MGMG	Dr. S.K. Zamir Ahmed
Co Nodal Officer, MGMG	Dr. R. Jaya Kumaravaradan
Nodal Officer, TSP	Dr. A. Kundu

Division of Natural Resource Management

Dr. B. Gangaiah, Head & Principal Scientist (Agronomy)

Dr. A. Velmurugan, Principal Scientist (Chemistry, Fertility & Microbiology)

Dr. T.P. Swarnam, Principal Scientist (Agronomy)

Dr. T. Subramani, Scientist (Agronomy)

Dr. Sachidananda Swain, Scientist (Ag. Structure & Process Engineering)

Shri. K.R. Kiran, Scientist (Soil Science); Joined on 25-07-2018

Dr. Sirisha Adamala, Scientist (Land & Water Management Engineering): Joined on 09-10-2018

Division of Field Crops Improvement & Protection

Dr. Pankaj Kumar Singh, Principal Scientist & Head (I/c)

Dr. R.K. Gautam, Principal Scientist (Plant Breeding)

Dr. Venkatesan, K., Scientist (Economic Botany)

Dr. K. Sakthivel, Scientist (Plant Pathology)

Dr. T. Bharathimeena, Scientist (Agri. Entomology) (on Study leave)

Dr. Srividhya, S. (Plant Physiology)

Dr. Joshitha Vijayan (Agricultural Biotechnology)

Dr. Rakesh, B. (Plant Breeding)

Division of Horticulture & Forestry

Dr. B. Augustine Jerard, Principal Scientist (Horticulture) and Head

Dr. V. Baskaran - Principal Scientist (Horticulture) and Scientist-In-charge, Sippighat farm

Dr.(Mrs) K. Abirami, Scientist (Fruit Science)

Dr. I. Jaisankar, Scientist (Forestry)

Dr. (Ms). Pooja Bohra, Scientist (Fruit Science)

Dr. Ajit Arun Waman, Scientist (SPMA)

Dr. Soobedar Yadav, Scientist (SPMA)

Division of Animal Science

Dr. A.Kundu, Principal Scientist (LP&M) & Head

Dr.D.Bhattacharya, Principal Scientist(Veterinary Parasitology)

Dr. Jai Sunder, Principal Scientist (Veterinary Microbiology)

Dr. M.S. Kundu, Principal Scientist (Animal Nutrition)

Dr. T. Sujatha, Sr.Scientist (Poultry Science)

Dr.P.A.Bala, Sr.Scientist (Animal Nutrition)

Dr. P.Perumal, Scientist (Animal Reproduction &Gyneacology)

Dr.S.K.Ravi, Scientist (Animal Reproduction &Gyneacology)

Dr. A.K. De, Scientist (Animal Biotechnology)

Dr.K.Muniswamy, Scientist (Animal Biotechnology)

Dr.Rafeeque Rahman Alyethodi (Animal Genetics & Breeding)

Division of Fisheries Science

Dr. S. Dam Roy, Principal Scientist & Head I/c (Fish & Fisheries Science)

Dr. R. Kiruba Sankar, Scientist (Fish & Fisheries Science)

Dr. K. Saravanan, Scientist (Fish Health)

Mr. J. Praveenraj (Fish Health)

Mr. Arun Kumar Oppoottil Ratheesh (Fisheries Resource Management)

Mrs. Harsha Haridas (Aquaculture)

Mr. Gladston Y (Fisheries Resource Management)

Ms. Sreepriya Prakasan (Fish Processing Technology)

Mrs. Ajina S.M (Fisheries Resource Management)

Ms. Deepitha R P (Fish Processing Technology)

Social Science Section

Dr. S.K. Zamir Ahmed, Principal Scientist, (Agricultural Extension) & Section I/c

Dr. R. Jaya Kumaravaradan, Scientist (Agricultural Economics)

Director Cell

Mr. D. Karunakaran, Scientist (Computer Application in Agriculture)

Krishi Vigyan Kendra, Port Blair

Dr. Nagesh Ram, Sr. Scientist & Head

Dr. L.B. Singh, Subject Matter Specialist (Horticulture) & I/c Head w.e.f. 2^{nd} Jan., 2019

Er. Bijaya Kumar Nanda, Subject Matter Specialist (Agri. Engineering)

Mrs. Haripriya Nayak, Subject Matter Specialist (Home Science)

Mr. N. Bommayswamy, Subject Matter Specialist (Horticulture)

Dr. Vivek Kr. Pandey, Subject Matter Specialist (Plant Protection)

Dr. N.C. Choudhuri, Asstt. Chief Technical Officer (Animal Science)

Krishi Vigyan Kendra, Nicobar

Dr. Nagesh Ram, Sr. Scientist & Head i/c

Mr. Sanjay Kumar Pandey, Subject Matter Specialist (Agronomy) & Head I/c w.e.f. 2^{nd} Jan., 2019

Dr. Zachariah George, Subject Matter Specialist (Animal Science)

Krishi Vigyan Kendra, North & Middle Andaman

Dr. B.L. Kashinath, Senior Scientist & Head

Dr.Pooja Kapoor, Subject Matter Specialist (Home Science)

Er. Manoj Kumar, Subject Matter Specialist, (Agricultural Engineering)

Mr. Debabrata Basantia, Subject Matter Specialist (Horticulture)

Mr. Batti Lal Meena, Subject Matter Specialist (Agronomy)

Dr. Shardul Vikram Lal, Subject Matter Specialist (Animal Science)

Dr. Shailesh Kumar, Subject Matter Specialist (Fisheries)

COMMITTEE OF THE INSTITUTE

I.	**Rajbhasha Karyanvayan Samiti**	
	Director, CIARI	Chairperson
	HoD (NRM)	Co-Chairperson
	HoD (FCI&P) or representative	Member
	HoD (Horticulture & Forestry) or representative	Member
	HoD (Fisheries) or representative	Member
	I/c Social Science Section	Member
	Dr. Debashish Bhattacharya, Principal Scientist, Animal Sci. Division	Member
	Sr. Administrative Officer or representative	Member
	Shri A. K. Tripathi, Sr. Technical Officer	Member
	Assistant Director (Official Language)	Member Secretary
II.	**Sports Committee**	
	Dr. Jai Sunder, Principal Scientist	Chairperson
	Shri Sushil K. Singh, Sr. Administrative Officer	Co-Chairperson
	Mrs. Saidi Bibi, Private Secretary	Member
	Shri Babuswamy, Technical Assistant	Member
	Shri K. S. Pradhan, Technician	Member
	Secretary, IJSC (SS)	Member (*Ex-Officio*)
	Officer-in-Charge (Sports) – Dr. K. Saravanan	Member Secretary (*Ex-Officio*)
III.	**Security Committee**	
	Dr. M. S. Kundu, Principal Scientist	Chairperson
	Dr. A. Velmurugan, Principal Scientist	Co-Chairperson
	Finance & Accounts Officer or representative	Member
	Shri Nehru Ram, UDC	Member
	Officer-in-Charge (Security)	Member Secretary (*Ex-Officio*)
IV.	**Un-serviceable Stores & Farm Produce Disposal (Auction) Committee**	
	Dr. P. K. Singh, Principal Scientist	Chairperson
	Dr. Kiruba Sankar R., Scientist	Co-Chairperson
	Finance & Accounts Officer or representative	Member
	OIC (Stores)/ AAO	Member Secretary(*Ex-Officio*)
V.	**Technical Scrutiny / Evaluation Committee**	
	Dr. B. Gangaiah, HoD, NRM	Chairperson
	Dr. Jai Sunder, Principal Scientist	Member
	Indenter	Member (*Ex-Officio*)
	OIC (Stores)	Member Secretary *(Ex-officio)*
VI.	**Proprietary Article Declaration Committee**	
	Dr. Debashish Bhattacharya, Principal Scientist	Chairperson
	Dr. A. K. De, Scientist	Member

	Indenter	Member (*Ex-Officio*)
	Assistant Administrative Officer	Member Secretary (*Ex-Officio*)
VII.	**Institute Website Management Committee**	
	Dr. B. Augustine Jerard, HoD, H&F	Chairperson
	Dr. A. Velmurugan, Principal Scientist	Co-Chairperson
	Dr. A. K. De, Scientist	Member
	Shri Amit Srivastava, Senior Technical Officer	Member
	Mrs. Ani Dath, Senior Technical Officer	Member
	I/c Computer Cell	Member Secretary (*Ex-Officio*)
VIII.	**Estate Management & House Allotment Committee**	
	Dr. S. K. Zamir Ahmed, Principal Scientist	Chairperson
	Dr. K. Abirami, Scientist	Co-Chairperson
	Sr. Administrative Officer or representative	Member
	Finance & Accounts Officer or representative	Member (*Ex-Officio*)
	Secretary, IJSC (SS)	Member (*Ex-Officio*)
	OIC (Estate)	Member Secretary (*Ex-Officio*)
IX.	**Purchase Advisory Committee**	
	Dr. B. Augustine Jerard, HoD, H&F	Chairperson
	Dr. P.K. Singh	Co-Chairperson
	Dr. Venkatesan K., Scientist	Member
	Dr. R. Kiruba Sankar, Scientist	Member
	Dr. S. Swain, Scientist	Member
	Sr. Administrative Officer or representative	Member (*Ex-Officio*)
	Finance & Accounts Officer or representative	Member (*Ex-Officio*)
	Officer-in-charge (Stores)	Member Secretary (*Ex-Officio*)
X.	**Local Purchase Committee**	
	Dr. V. Baskaran, Sr. Scientist	Chairperson
	SAO / AAO / Representative	Co-Chairperson
	Finance & Accounts Officer / Representative	Member (*Ex-Officio*)
	Indenter/ Concerned Sectional In-charge	Member (*Ex-Officio*)
XI.	**Works & Maintenance Committee**	
	Dr. R. K. Gautam, Principal Scientist	Chairperson
	Dr. Velmurugan, Principal Scientist	Co-Chairperson
	Dr. T. Sujatha, Sr. Scientist	Member
	Dr. Arun Ratheesh, Scientist	Member
	Sr. Administrative Officer or representative	Member*(Ex-Officio)*
	Finance & Accounts Officer or representative	Member (*Ex-Officio*)
	Officers-in-Charge (Estate)	Member Secretary (*Ex-Officio*)
XII.	**Institute Grievance Committee**	
	Director	Chairperson
	Dr. B. Gangaiah, HoD, NRM	Co-Chairperson

	Dr. Nagesh Ram, Sr. Scientist & Head, KVK	Member
	Dr. T. Sujatha, Sr. Scientist	Member
	Finance & Accounts Officer or representative	Member
	Secretary, IJSC (SS)	Member (*Ex-Officio*)
	Sr. Administrative Officer	Member Secretary (*Ex-Officio*)
XIII.	**Staff Welfare Committee**	
	Director	Chairperson
	Dr. Jai Sunder, Principal Scientist	Co-Chairperson
	Smt. Archana Sharma, Technical Officer	Member
	Finance & Accounts Officer	Member
	Secretary, IJSC (SS)	Member (*Ex-Officio*)
	Sr. Administrative Officer	Member Secretary (*Ex-Officio*)
XIV.	**Library Advisory cum Management Committee**	
	Dr. R. K. Gautam, Principal Scientist	Chairperson
	Dr. S. K. Zamir Ahmed, Principal Scientist	Co-Chairperson
	Dr. K. Muniswamy, Scientist	Member
	Sr. Administrative Officer or representative	Member (*Ex-Officio*)
	Finance & Accounts Officer or representative	Member (*Ex-Officio*)
	In-charge (Library)	Member Secretary (*Ex-Officio*)
XV.	**Price Fixation Committee**	
	Dr. M. S. Kundu, Principal Scientist	Chairperson
	Dr. V. Baskaran, Senior Scientist	Co-Chairperson
	Concerned Farm Manager / Laboratory Official	Member
	Sr. Administrative Officer or representative	Member (*Ex-Officio*)
	Finance & Accounts Officer or representative	Member (*Ex-Officio*)
	Secretary, IJSC (SS)	Member (*Ex-Officio*)
	AAO / OIC (Stores)	Member Secretary
XVI.	**VIP Visit Arrangements Committee**	
	Dr. Jai Sunder, Principal Scientist	Chairperson
	Shri Sushil Kumar Singh, Senior Administrative Officer	Co-Chairperson
	Shri A. K. O. Ratheesh, Scientist	Member
	Shri K. Shyam Sunder Rao, Sr. Technician	Member
	Protocol Officer –Shri Amit Srivastava, Sr. Tech. Officer	Convenor/ Member Secretary
XVII.	**Results Framework Document Committee**	
	Director	Chairperson (*Ex-Officio*)
	Nodal Officer (RFD) / I/c PME	Member (*Ex-Officio*)
	Co-Nodal Officer (RFD)	Member (*Ex-Officio*)
	Dr. A. K. De, Scientist	Member Resource Centre
	Shri Sushil K. Singh, Sr. Administrative Officer	Member Resource Centre

XVIII.	**Internal (Women) Complaints Committee**	
	Dr (Mrs.) T. Sujatha	Chairperson
	Shall be nominated separately after seeking consent	Member (External)
	Mrs. Lucy Thomas	Member
	Dr. P. Perumal, Scientist	Member
	Sr. Administrative Officer	Member
	I/c Women's Cell – Dr. Pooja Bohra	Member Secretary
XIX.	**ISO Management Committee**	
	Director	Chairperson
	Dr. R. K. Gautam, Principal Scientist	Co-Chairperson
	Dr. T. Subramani, Scientist	Member
	Finance & Accounts Officer	Member
	Sr. Administrative Officer	Member
	Management Representative	Member Secretary
XX.	**Institute Joint Staff Council (Office Side)**	
	Director	Chairperson
	Dr. B. Augustine Jerard, HoD, H&F	Member
	Dr. S. K. Zamir Ahmed, Principal Scientist	Member
	Dr. K. Abirami, Scientist	Member
	Dr. V. Damodaran, Asstt. Chief Tech. Officer	Member
	Finance & Accounts Officer	Member *(Ex-Officio)*
	Senior Administrative Officer	Secretary (Office Side)
	Institute Joint Staff Council (Staff Side) – Elected	
	Shri S. P. Narayan	Secretary (Staff Side)
	Shri A. Babuswamy	Member
	Shri P. Kakesh Rao	Member
	Shri K. Ali Akbar	Member (CJSC)
	Smti S. Sheela Pal	Member
XXI.	**Institute Variety Release Committee**	
	Director	Chairperson
	Dr. B. Augustine Jerard, HoD, H&F	Co-Chairperson
	Shall be nominated separately after seeking consent	Member (External Expert)
	Dr. M. S. Kundu, Principal Scientist	Member
	HoD (FCI&P)	Member Secretary
XXII.	**Institute Foreign Deputation Committee**	
	Director	Chairperson
	Dr. B. Augustine Jerard, HoD, H&F	Co-Chairperson
	Dr. A. K. De, Scientist	Member
	I/c PME Cell	Member Secretary

XXIII.	**Tenders Opening Committee**	
	Dr. T. Sujatha, Sr. Scientist	Member
	Dr. I. Jaisankar, Scientist	Member
	Mrs. Ani Dath, Sr. Tech. Officer	Member
	Mrs. Shibani Sengupta, Assistant	Member
	AAO / I/c Estates / OIC (Stores)	Member Convenor
XXIV.	**Institute Publication Committee**	
	Dr. B. Augustine Jerard, HoD, H&F	Chairperson
	Dr. Debasis Bhattacharya, Principal Scientist	Co-Chairperson
	Dr. A. K. De, Scientist	Member
	Dr. Soobedar Yadav, Scientist	Member
	Assistant Director (OL)	Member
	I/c PME Cell	Member Secretary
XXV.	**Campus Cleanliness & Beautification Committee**	
	Dr. V. Baskaran, Sr. Scientist	Chairperson
	Dr. V. B. Pandey, Chief Technical Officer	Member
	Shri S. L. Paik, Asstt. Chief Technical Officer	Member
	I/c(Security)	Member Secretary
XXVI.	**Farm Management Committee (for all farms)**	
	Dr. S. K. Zamir Ahmed, Principal Scientist	Chairperson
	Shri N. C. Chaudhary, Asstt. Chief Tech. Officer	Member
	Shri Benny Varghese, Sr. Technical Officer	Member
	Concerned Farm Manager	Member Secretary
XXVII.	**Guest House Management Committee**	
	Dr. Jai Sunder, Principal Scientist	Chairperson
	Dr. A. Velmurugan, Principal Scientist	Member
	Shri Sushil Kumar Singh, Sr. administrative Officer	Member
	Shri Benny Varghese, Sr. Technical Officer	Member
	OIC (Guest House)	Member Secretary
XXVIII.	**Biosafety Standards Committee**	
	Dr. Debasis Bhattacharya, Principal Scientist	Chairperson
	Shall be nominated separately after seeking consent	Member (External)
	Dr. Kiruba Sankar R., Scientist	Member
	Dr. Pooja Bohra, Scientist	Member
	Scientist In-Charge (CIF)	Member Secretary
XXIX.	**Institute – Regional Station – KVK Coordination Committee**	
	Director	Chairperson
	Dr. B. Augustine Jerard, HoD, H&F	Co-Chairperson
	Head, KVK, South Andaman	Member
	Head, KVK, North & Middle Andaman	Member

	Head, KVK, Nicobar	Member
	Senior Administrative Officer	Member
	Finance & Accounts Officer	Member
	I/c Social Science Section	Convenor / Member Secretary
XXX.	**Cultural Programmes Committee**	
	Dr. K. Abirami. Scientist	Co-Chairperson
	Shri Amit Srivastava, Sr. Technical Officer	Member
	Shri Shyam Sunder Rao, Sr. Technician	Member
XXXI.	**Institute Technology Management Committee**	
	Director	Chairperson
	I/c PME Cell	Member
	Dr. I. Jaisankar, Scientist	Member
	Dr. Ajit Arun Waman, Scientist	Member
	Scientist – In – charge, ITMU	Member Secretary

NEW ENTRANTS/ TRANSFER / PROMOTION/ RETIREMENT/ DEATH

New Entrants to CIARI

Scientist

Shri D. Karunakaran, Scientist on 02.07.2018

Dr. Prokasananda Bala, Scientist (Sr. Scale) on 10.07.2018

Dr. Sanjay Kumar Ravi, Scientist on 09.07.2018

Dr. Rafeeque Rahman Alyethodi, Scientist (Sr. Scale) on 16.07.2018

Dr. Kiran K. R., Scientist (Soil Science) on 23.07.2018

Dr. (Ms) Sirisha Adamala, Scientist on 09.10.2018

Dr. (Ms) Srividhya S., Scientist on 04.10.2018

Ms Deepitha R. P., Scientist on 08.10.2018

Shri Gladston Y, Scientist on 08.10.2018

Dr. Rakesh B., Scientist on 09.10.2018

Smt. Ajina S.M., Scientist on 08.10.2018

Ms Sree Priya Prakasan, Scientist on 08.10.2018

Dr. (Ms) Joshitha Viyayan, Scientist on 09.10.2018

Technical

Smt. Asma Bibi, Technical Assistant on 01.08.2018

Mr. Stanley Sebastine, Technical Assistant on 19.07.2018

Miss. Tripti Dubey, Technician on 07.12.2018

Shri Alex Praveen Barla, Technical Assistant on 20.07.2018

Shri Lakhan Singh, Technical Assistant on 04.08.2018

Shri K. Shyam Sunder Rao, Technical Assistant

Administrative

Shri K. Errayya, Lower Division Clerk on 16.11.2018

Shri P.P. Anil Kumar, FAO on 28.02.2019

Promotion /Assessment

(a) Technical

Dr. N.C. Choudhuri, CTO (T-9)

Dr. L.B. Singh, SMS (T-9)

Dr. V.B. Pandey, CTO (retired) advance increment

Shri A. K. Tripathi, ACTO (T-7/8)

Smt. Harapriya Nayak, SMS (T-7/8)

Shri Amit Srivastava, ACTO (T-7/8)

Shri Sanjay Kr. Pandey, SMS (T-7/8)

Dr. Zakariah George, SMS (T-7/8)

Smt. Nutan Roy, T-2

Shri Sunil Chakrabortty, T-3

Smt. Naga Venkat Laxmi, T-2

Smt. Ani Dath, ACTO (T-7/8)

Shri T. Ravi, T-4

Shri P. Gangopadhyay (retired) ACTO (T-7/8)

Shri Kishor Tete, Technical Officer

Shri Derick, Technical Officer

(b) Administrative

Shri S. K. Biswas, AAO

Smt. Shibani Sengupta, AAO/DDO

Shri Prakash Mandal, Assistant

Shri Ravi Babu, Sr. Clerk

Shri S.P. Narayan, Assistant

Shri P.K. Das, Assistant

Retirement

Shri K. Mani, SSS on 01.01.2019

Dr. V.B. Pandey , CTO on 31.10.2018

Shri A.K. Betal, Technical Officer on 30.09.2018

Shri Somra Uraon,SSS on 01.01.2019

Dr. Nagesh Ram, Sr. Scientist & Head KVK on 01.01.2019

Shri R. N. Mozumdar, AAO on 31.07.2018

VRS

Smt. Sulochana, AD (OL) on 31st March, 2019

Left to heavenly abode

Shri K. Sri Ramaluo, Ex-SSS on 29.11.2018

CIARI IN NEWS

Hon'ble Vice President, Shri M. Venkaiah Naidu interacted with KVK scientists and farmers at Port Blair

5th July 2018, Port Blair

Steep hike in Minimum Support Price (MSP) for Kharif crops will go a long way in improving the income of the farmers, said Shri M. Venkaiah Naidu, Hon'ble Vice President of India while interacting with the Island farmers and KVK scientists under ICAR-CIARI, Port Blair. The Vice President stressed on the need to streamline the procurement process and Public Distribution System network so that the farm derives the maximum benefit apart from providing MSP at 50% or more over the cost of production. Other income enhancing measures need to be taken to mitigate agrarian distress, especially of the small and marginal farmers, he added.

Hon'ble Vice President urged the scientific community present at the gathering to have regular interaction with farmers through their scientific teams and Krishi Vigyan Kendras. A good synergy between the research institutes, farmers and KVKs along with the local administration is crucial for development of farm sector, he stated.

While expressing his concern over the unstable income of farmers owing to risks relating to production, markets and prices, the Vice President emphasised on the need to improve/ double the farmer's income. Awareness among farmers on crop diversification, livestock (dairy and poultry), and horticulture (green house cultivation, hi-tech horticulture) sectors can be created more and more for enhancing farmers' income and employment opportunities, he stressed.

He viewed that Government schemes like Soil Health Card (SHC), Pradhan Mantri Krishi Sinchayee Yojana (PMKSY), Pradhan Mantri Fasal Bima Yojana (PMFBY) and the electronic National Agriculture Market (eNAM) should go a long way to increase the farm income, if properly implemented. He further added that secondary agriculture like processing and value addition and creation of Farmer Produce Organisations (FPOs) and Village Producer Organisations (VPOs) for scaling up post-harvest operations have great potential in improving the farmer's economy.

Earlier, Dr. A. Kundu, Director, ICAR-CIARI, welcomed the Vice President and other dignitaries.

The Lt. Governor of A & N Islands, Admiral D.K. Joshi, the Member of Parliament, Shri Bishnu Pada Ray, Chief Secretary, A & N Administration, Shri Vikram Dev Dutt and other dignitaries from scientific and farming community were present in the occasion.

(Source: ICAR-CIARI, Port Blair; KVKs of Andaman & Nicobar Islands and ICAR-ATARI, Kolkata)

Swachhta Hi Sewa campaign by ICAR-CIARI

PORT BLAIR, SEPT 22/--/ A nationwide intensive cleanliness drive, Swachhta hi Sewa, has been launched by Govt. of India for a fortnight (15th Sep to 2nd Oct) to make India clean. The major thrust is on awareness among people and spread cleanliness, bringing behavioural changes to people, disposal of all forms of wastes safely and complete elimination of open defecation. In this endeavor, ICAR-CIARI here started their programme from Sept 7 with door to door awareness campaign, which will continue till Oct 2 with various cleanliness and awareness programmes.

On Saturday, ICAR-CIARI has carried out cleaning of Corbyn's Cove beach and its surrounding, Science Centre and marine hill area. The cleanliness drive was led by Dr A.Kundu, Director, ICAR-CIARI, and more than 100 staff members have actively participated. During the campaign they have collected more than 200 kg of different waste materials and safely disposed off. Segregation of waste materials by the scientists revealed that nearly 35% are of glass bottles, 30% plastics, 10% cloths and remaining are organic and human artifacts. They have also found dead birds and some other carcasses lying in the beach area. The programme was coordinated by Dr Velmurugan, Nodal officer, SBA. The broken glasses lying in the sand may cause serious injuries to the tourist and nature lovers. Organic wastes and carcasses may attract natural scavenger including crocodiles. Further, lots of glass and polythene bottles are found thrown out in the cliff slope in front of Science centre which may get washed out by runoff water into the sea. This seriously affects our island ecosystem and importantly the island image as a green tourist destination. Therefore it is kindly requested that public should be aware of these danger and not to engage in such activities or don't allow other to do so. Be an elite citizen, by informing civic authorities of such activities. Take a snap of such activities and send a complaint to police control room for suitable penal action. Our island can be made as an example for cleanliness if all of us come together. Let's make our island clean and green, a release from CIARI said.

World Coconut Day, EDP on value addition held at CIARI

Shri M. J. Akbar, Union Minister of State for External Affairs visits KVK Port Blair

20 June 2018

Shri M.J. Akbar, Union Minister of State for External Affairs, visited KVK, South Andaman, Sippighat and ICAR-CIARI, Port Blair for reviewing the working of KVKs – South Andaman and North &Middle Andaman under CIARI today. During an interaction at ICAR-CIARI, Port Blair, he briefed about various welfare schemes/ yojana of the Government of India.He said, the Prime Minister, Shri NarendraModi's vision for 'Doubling the Farmer's Income by 2022', is aimed at uplifting the farmers, who are the backbone of the country's economy. Enumerating the various schemes launched by the Government viz. PMJDY, PMBY, MUDRA scheme, Health Insurance schemes etc. the Minister reiterated that the Govt. is committed towards the welfare of the citizens. The Minister also highlighted about various self-employment schemes and opportunities available for women and urged them to come forward and embrace these schemes. The Minister, while reviewing the working of KVKs under CIARI, remarked that every department should maintain a calendar of events along with the target dates, so that the objectives and mission of the works/projects are achieved within the stipulated time. He urged scientists to reach out to the farmers and the rural populace and apprise them about various agricultural related schemes as well as other pro-people schemes which are being implemented by the Government for the welfare of the people.

Later, the Minister planted a sapling in the campus and visited the Instructional Farm on IFS at KVK, SippighatThe Minister also visited the 'DweepKrishiDarpan' at the Administrative building.

Dr. A. Kundu, Director, ICAR-CIARI, Port Blair presented the mission, vision, objectives, activities, milestone achievements and the way forward of CIARI.

Farmers from the South Andaman highlighted various issues pertaining to availability of land, proper implementation of insurance schemes for farmers and marketing support.Farmers from various parts of the Islands also raised issues related to land mutation, irrigation, marketing support, cold storage, transportation challenges, proper implementation of Agricultural schemes for farmers, availability of bio fertilizers and pesticides besides other agricultural related issues.

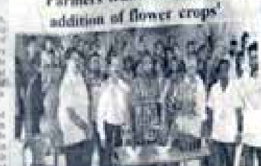
The Heads of KVKs of South Andaman and North &Middle Andaman, presented the mission, vision, mandates and achievements of the respective KVKs

(Source: ICAR-Agricultural Technology Application Research Institute Kolkata, ICAR-Central Islands Agricultural Research Institute, Port Blair and KVK Port Blair)

QRT visits experimental farm, technological demonstrations at MGMG villages

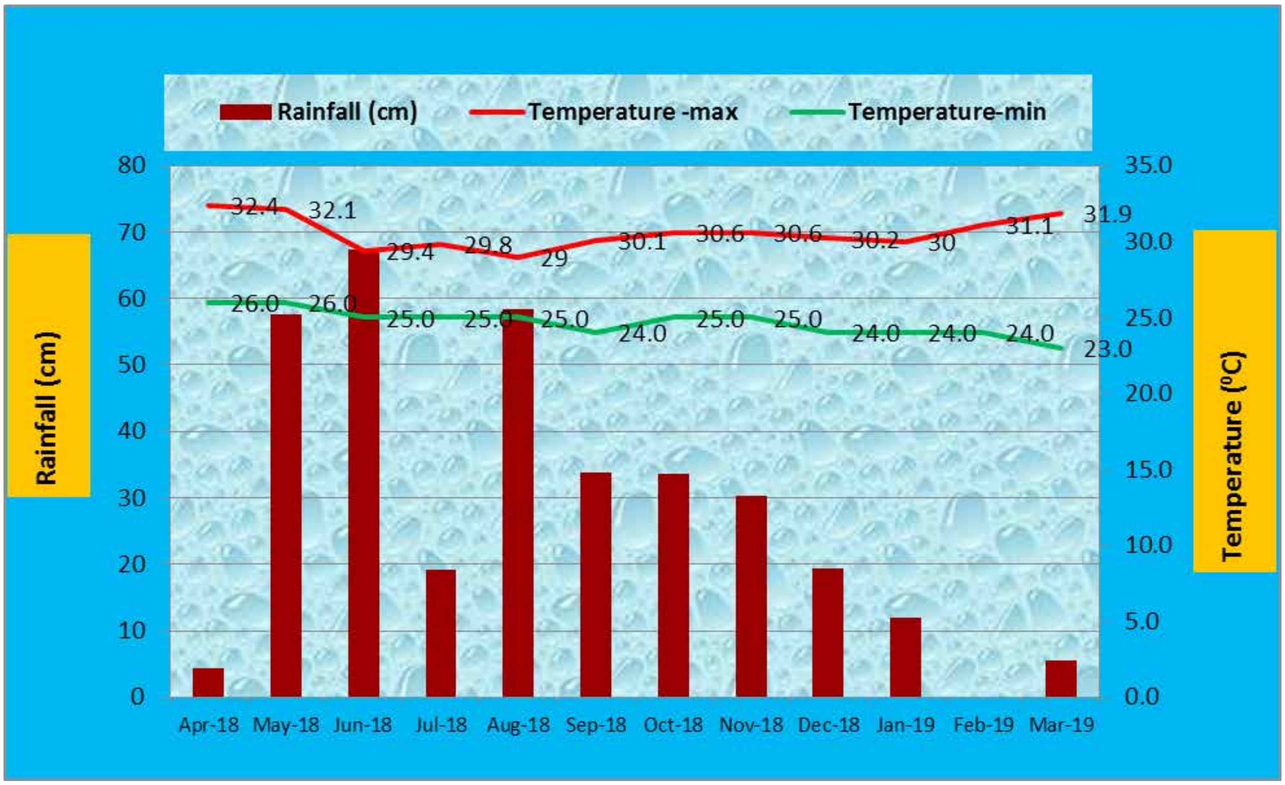
Diagnostic services by CIARI Scientists

Farmers trained in 'value addition of flower crops'



WEATHER CONDITIONS AT PORT BLAIR, ANDAMAN AND NICOBAR ISLANDS AN OVERVIEW

Port Blair, Andaman & Nicobar Islands received a rainfall of 341.54 cm during the year (April, 2018 –March, 2019) in 138 rainy days. Of this rainfall, 178.84, 83.28 and 79.42 cm were received from South-West (June-September), North-East (October-December) and post monsoon period (January-May). Rainfall received was highest (67.39 cm) in June and least in February (0.0 cm). The overall performance during the year was rated as normal though it was 23.54 cm higher than the mean rainfall of 318.0 cm. The year has recorded a mean annual temperature of 27.65^{0}C with a mean maximum and minimum temperatures of 30.6 and 24.7^{0}C. Mean monthly temperature was highest during April 2018 (32.4 ^{0}C) and lowest during March, 2019 (23.0^{0}C). The climatic parameters are depicted in the figure below.



ICAR-Central Island Agricultural Research Institute

Port Blair – 744 101, Andaman & Nicobar Islands, India