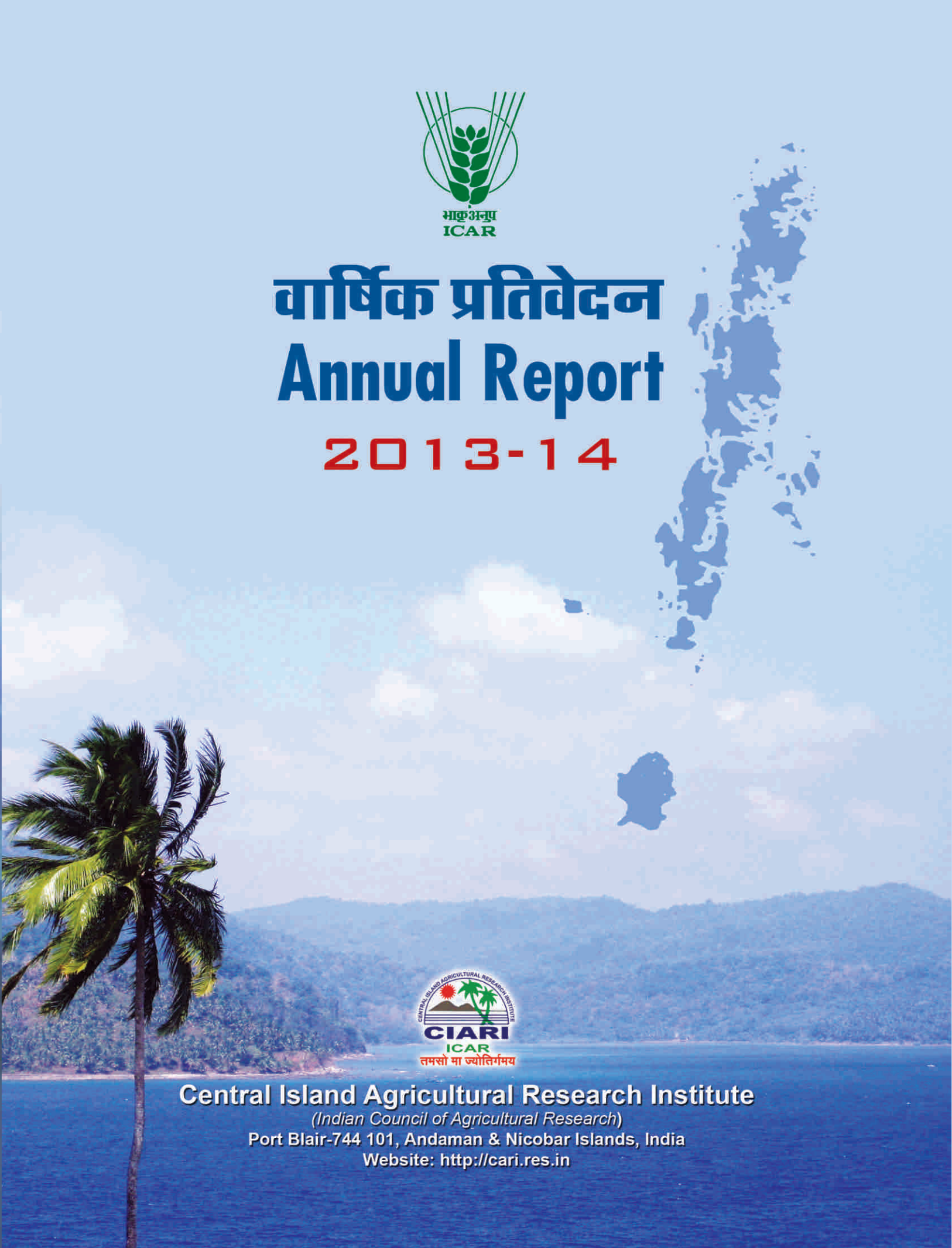

भाकृअनुप
ICAR

वार्षिक प्रतिवेदन
Annual Report
2013-14

CIARI
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तमसो मा ज्योतिर्गमय

Central Island Agricultural Research Institute
(Indian Council of Agricultural Research)
Port Blair-744 101, Andaman & Nicobar Islands, India
Website: http://cari.res.in

भाकृअनुप
ICAR

ANNUAL REPORT
2013 - 14

CENTRAL ISLAND AGRICULTURAL RESEARCH INSTITUTE
CIARI
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तमसो मा ज्योतिर्गमय

केन्द्रीय द्वीपीय कृषि अनुसंधान संस्थान

पोर्ट ब्लेयर - 744 101, अंडमान एवं निकोबार द्वीप

Central Island Agricultural Research Institute

Port Blair – 744 101, Andaman & Nicobar Islands

Published Director, CIARI,
Port Blair

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ANNUAL REPORT 2013-2014

CONTENTS

प्राक्कथन

केन्द्रीय कृषि अनुसंधान संस्थान, पोर्ट ब्लेयर एक अनूठा संस्थान है जो द्वीपों की पारिप्रणाली और द्वीपीय कृषि की ओर बहुविभागीय अनुसंधान कार्यक्षेत्र के प्रति समर्पित हैं। इस संस्थान ने पिछले तीन दशकों के दौरान अपने अनुसंधान और विकास कार्यो के माध्यम से द्वीपीय कृषि के क्षेत्र में अनुभवों की एक विस्तृत सम्पदा एकत्रित कर ली है। द्वीप कृषि को सार्थक नेतृत्व प्रदान करने हेतु परिषद ने इस संस्थान के प्रति बीजवपन की दिशा में प्रदत्त अंशदान को स्वीकार करते हुए सम्पूर्ण विश्वास व्यक्त किया है। भविष्य में संस्थान के अक्षीय भूमिका को स्वीकार करते हुए इसको केन्द्रीय द्वीपीय कृषि अनुसंधान संस्थान, पोर्ट ब्लेयर के नाम से पुनः नामकरण किया गया।

सफल अनुशंसाओं के साथ 12वीं योजना के एस.एफ.सी. दस्तावेज का अनुमोदन कर दिया गया। सीमान्त अनुसंधान के माध्यम से अनुकूली क्षमता में वृद्धि करने की दिशा में उष्ण कटिबंधीय द्वीप के लिए समन्वित कृषि प्रणाली को ध्वजपोत कार्यक्रम के रूप में स्वीकार किया जा रहा है। इसके साथ ही इन द्वीपों में संयुक्त जैव सुरक्षा प्रयोगशाला की स्थापना करने का भी हमारा प्रयास है। टी.एस.पी. व एन.ई.एच. योजना के अंतर्गत सुन्दरबन के बाली द्वीप, एन.ई.एच. क्षेत्र, निकोबार जिला और लिटिल अण्डमान में विशेषरूप से महिलाओं और आदिवासी किसानों के लाभ के लिए कृषि तथा सहायक क्षेत्रों में सतत् तकनीकी हस्तक्षेप के माध्यम से आजीविका के मौकों के साथ गृह आवश्यकता आधारित आई.एफ.एस., कन्द आधारित सुअर पालन, कुक्कुट पालन तथा सम्पदाओं के सृजन की स्थापना का कार्य उल्लेखनीय है।

अण्डमान निकोबार द्वीप समूह के द्वीप किसानों के लाभ के लिए संस्थान की किस्में जारी करने वाली समिति द्वारा कुल 10 किस्में जारी की गई जिनमें चावल और मीठे आलू की दो, नारियल की चार, पोई और बैंगन की एक किस्म शामिल थी। जैवविविधता संरक्षण की समुदाय और मालिक किसानों और अण्डमान तथा निकोबार द्वीपसमूह के उपयोगिता के लिए कल्टिवार/जीवद्रव्य/भू–जाति की पहचान की गई। इनमें अण्डमान नारियल, निकोबारी आलू, खून फल, नीली आम, नोनी, खुशबैया चावल, काला बर्मा, मूसली, न्याविन, सफेद बर्मा, निकोबारी मुर्गी, निकोबारी सुअर तथा तेरेसा बकरी की पहली बार पहचान की गई।

काफी अच्छी संख्या में अनेक महानुभावों ने इस संस्थान का दौरा किया। इनमें से प्रमुख थे – 21 जून से 23 जून, 2013 तक डॉ एन. के. कृष्ण कुमार, उप महानिदेशक (बागवानी विज्ञान), भारतीय कृषि अनुसंधान परिषद, नई दिल्ली, 27 जुलाई, 2013 को श्री आनंद प्रकाश, मुख्य सचिव, अण्डमान तथा निकोबार प्रशासन, डॉ. डी. रामाराव, राष्ट्रीय निदेशक, एन.ए.आई.पी, आई.सी.ए.आर., 19 अगस्त, 2013 को डॉ. मधुमिता मुखर्जी, कार्यकारी निदेशक, एन.एफ.डी.बी. हैदराबाद, 21 सितंबर, 2013 को अण्डमान निकोबार द्वीप समूह के उप राज्यपाल लेटिनेंट जनरल (अवकाश प्राप्त) ए.के. सिंह, पी.वी.एस.एम, ए.वी.एस.एम, एस. एम., वी.एस.एम., 03 दिसंबर, 2013 को प्रोफेसर के. एल. चद्ढा, पदमश्री पुरस्कृत, 19 मार्च, 2014 को डॉ. एस.वी. दान्डिन, वाइस चांसलर, युनिवर्सिटी ऑफ साइन्सेज, बागलकोट, डॉ. आर.सी. अग्रवाल,

महापंजीयक, पी.पी.वी. व एफ.आर.ए., कृषि मंत्रालय, नई दिल्ली और डॉ. भुवोन स्थापित, क्षेत्रीय परियोजना समन्वयक, बायोवर्सिटी इंटरनेशनल तथा डॉ. वी.ए.पार्थसारथी, राष्ट्रीय परियोजना समन्वयक, एन.बी.एम.यू., यू.एन.ई.पी.–जी.ई.एफ.–टी.एफ.टी. । इन सभी ने संस्थान के वैज्ञानिकों और कर्मचारियों के दल के कार्यों की प्रशंसा करते हुए सबके साथ अंतःक्रिया स्थापित की।

अन्य आर एण्ड डी संस्थानों के साथ समन्वय के सशक्तीकरण के लिए कई महत्वपूर्ण कार्यक्रमों का आयोजन किया गया जिनमें ज्ञान शेयर मीट, कृषि व्यवसाय शिविर, राष्ट्रीय विज्ञान दिवस, कस्टोडियन फार्मर मीट, पी.पी.वी. और एफ.आर.ए. तथा MULLaRP कार्यशाला, अण्डमान विज्ञान संघ का पुनर्गठन, अण्डमान तथा निकोबार प्रशासन के साथ समन्वय समिति का गठन और नराकास बैठक शामिल थी।

वर्ष के दौरान सरकारी कामकाज में राजभाषा के सर्वोत्तम क्रियान्वयन के लिए नगर राजभाषा कार्यान्वयन समिति (नराकास), पोर्ट ब्लेयर ने निदेशक की अध्यक्षता में पूर्वी क्षेत्र में तीसरा पुरस्कार प्राप्त किया और संस्थान ने राजभाषा संस्थान, नई दिल्ली से कार्यालय स्मृति चिन्ह हासिल किया।

मैं इस अवसर पर उभरते प्रतिस्पर्धाओं से निपटने के मामले में डॉ. एस. अयप्पन, माननीय सचिव, डेयर. तथा महानिदेशक, भा.कृ.अनु.प. को उनके दूरदर्शी नेतृत्व, असीम समर्थन और मार्गदर्शन के लिए अपनी कृतज्ञता प्रकट करता हूँ। मैं उप महानिदेशक (बागवानी विज्ञान) डॉ. एन.के. कृष्ण कुमार का भी कृतज्ञ हूँ, जो हमारे संस्थान के अनुसंधान व अन्य कार्यक्रमों से जुड़े मामलों में भविष्य की गतिविधियों पर उचित सलाह देते रहे और हमारी प्रेरणा के स्त्रोत रहे । मैं डॉ. एस.के. मल्होत्रा, सहायक महानिदेशक (बागवानी–II) का भी उनके द्वारा संस्थान के विभिन्न मामलों में दिए गए समर्थन के लिए धन्यवाद ज्ञापन करता हूँ। मैं सभी संबंधित समितियों के माननीय सदस्यों का धन्यवाद करता हूँ जिन्होंने द्वीपों की आवश्यकतानुसार किए गए अनुसंधान कार्यो के लिए अभिविन्यासात्मक सुझाव दिए।

मैं माननीय उपराज्यपाल, लेफ्टिनेंट जनरल (अवकाश प्राप्त) ए.के. सिंह, पी.वी.एस.एम.,ए.वी.एस.एम, एस. एम., वी.एस.एम, मुख्य सचिव, दक्षिण, मध्य–उत्तर अण्डमान और निकोबार जिले के उपायुक्त, अण्डमान–निकोबार प्रशासन के निदेशकों तथा अधिकारियों, आदिवासी परिषद् व नाबार्ड के सतत् सहायता तथा समर्थन के लिए धन्यवाद करता हूँ।

अंत में मैं, अपने उन सभी सहकर्मियों और कर्मचारियों को धन्यवाद देता हूँ जिन्होंने नई ऊंचाईयों को छूने और तकनीकों के स्थानान्तरण द्वारा द्वीपों के विविध पारिप्रणाली में किसानों और पणधारकों को लाभ पंहुचाने में कठिन परिश्रम तथा अपना सहयोग प्रदान किया।

(शिबनारायण दाम राय)
निदेशक, के.द्वी.कृ.अनु.सं.

21 मई, 2014
पोर्ट ब्लेयर

PREFACE

Central Agricultural Research Institute, Port Blair is an unique Institute engaged in multidisciplinary research devoted to the cause of island agriculture and island ecosystem. The Institute has accumulated wealth of experience on island agriculture by research and development work for last three decades. In recognition of its seminal contribution, the Council has placed its confidence on the Institute to provide authentic leadership in Island agriculture. Recognizing the pivotal role the Institute is poised to play, it has been renamed as **Central Island Agricultural Research Institute, Port Blair.**

The XII Plan SFCdocument was approved with fruitful recommendations. Integrated Agriculture System for Tropical Islandis being taken as the flagship programme to enhance the adaptive capacity through frontier research, beside it is our endeavour to establish a Composite Bio-security laboratory in the Island. Establishment of homestead based IFS, tuber based piggery, poultry and creation of assets with livelihood opportunity through sustainable technological intervention in agriculture and allied fields, benefitting the tribal's farmers and women in particular in Nicobar District, Little Andaman, Bali Islands of Sunderban and NEH Region under TSP & NEH Plan is noteworthy.

A total of 10 varieties *viz.,* two each in rice & sweet potato, four in coconuts, one each of poi & brinjal have been released by the Institute Variety Release Committee for the benefit of Island farmers of A & N Islands. Custodian farmers and communities of biodiversity conservation and utilization in Andaman & Nicobar Islands were identified for cultivar/ germplasm/ land races *viz.,* Andaman Coconut, Nicobari Aloo, Khoon Phal, Blue mango, Noni, Khushbayya rice, Black Burma, Mushley, Nyawin, White Burma, Nicobari fowl, Nicobari pig and Teressa goat and recognised for the first time.

A good number of important dignitaries visited the Institute on the following dates; prominent amongst them are the visit of Dr. N.K. Krishna Kumar, DDG (Hort.), ICAR, New Delhi from 21st to 23rd June, 2013, Shri Anand Prakash, Chief Secretary, Andaman and Nicobar Administration, Dr. D. Rama Rao, National Director, NAIP, ICAR on 27th July, 2013, Dr. Madhumitha Mukherjee, Executive Director, NFDB, Hyderabad on 19th August, 2013, Hon'ble Lt. Governor of Andaman & Nicobar Islands, Lt. Gen (Retd.) A. K. Singh, PVSM, AVSM, SM, VSM, on 21st September, 2013, Prof. K. L. Chadha, Padma Shri Awardee, on 3rd December, 2013, Dr. Prem Mathur, Regional Director, Bioversity International, Dr.S.B.Dandin, Vice Chancellor, University of Horticulture Sciences, Bagalkot, Dr. R.C. Agrawal, Registrar General, PPV& FRA, Ministry of Agriculture, New Delhi and Dr. Bhuwon Sthapit, Regional Project

Coordinator, Bioversity International and Dr. V.A. Parthasarathy, National Project Coordinator, NPMU, UNEP-GEF-TFT on 19th March, 2014. They interacted and appreciated the work done by the team of Scientists and staff of Institute.

To strengthen the coordination with other R&D institution a series of important events namely Knowledge Share Meet, Agri Business Camp, National Science Day, Custodian Farmers Meet, PPV&FRA & MULLaRP Workshop, reconstitution of Andaman Science Association, formation of Coordination Committee with A & N Administration and TOLIC meeting were organized.

During the year for the commendable implementation of Rajbhasha in official use, Town Official Language Implementation Committee (TOLIC), Port Blair has been conferred III prize in Eastern Region under the Chairmanship of Director and the Institute bagged Karyalaya Smrithi Chinah by Raj Bhasha Sansthan, New Delhi.

I take this opportunity to express my deep sense of gratitude to Dr. S. Ayyappan, Hon'ble Secretary, DARE and Director General, ICAR for his visionary leadership, unstinted support and guidance to meet the emerging challenges. I am grateful to Dr. N.K. Krishna Kumar, Deputy Director General (Horticulture 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 thankful to Dr. S.K. Malhotra, ADG (Hort.II) for rendering support on various issues related to the Institute. I am also thankful to Hon'ble members of the respective committees for their suggestions in re-orienting our research to address the needs of the Islands.

I am thankful to the Hon'ble Lt. Governor, Lt. Gen. (Retd.) A.K.Singh, PVSM, AVSM, SM, VSM, the Chief Secretary, Andaman & Nicobar Administration, Deputy Commissioner, South, North & Middle and Nicobar District, Directors, officers of A & N Administration, Chairman & members of Tribal Council and NABARD for their continued support and active collaboration.

At the end, I would like to congratulate my colleagues and staff for their constant hard work and support in achieving new heights and reaching the unreached, to transfer the technologies for the benefit of the farmers/ stakeholders in diversified Island Ecosystem.

21st May, 2014
Port Blair

(Sibnarayan Dam Roy)
Director, CIARI

अधिशासी सार
EXECUTIVE SUMMARY

प्राकृतिक संसाधन प्रबंधन
Natural Resource Management

- Evaluation of pulses under coconut plantation revealed that red gram variety CO 6 performed well with higher grain yield (544 kg/ha) at the spacing of 75×45 cm. Among the green gram ANM-11-12 registered higher grain yield (400 kg/ha) at the spacing of 25×10 cm under coconut plantation. Black gram genotype ANU-11-19 recorded higher yield (354 kg/ha) at 25×10 cm spacing under coconut plantation.
- A total of 20 isolates comprising 9 species of bacteria were isolated from soils of different land uses in Andaman Islands and identified through 16S rDNA and BLAST search. The potential isolates for cellulase production & P solubilization are used for decomposition and P solubilizing studies.
- Farming system characterization revealed that mixed farming predominates in South and North Andaman, vegetables accounted for more than 50% followed by plantation crops (33.3%) to the crop component. While in Middle Andaman, arecanut contributed more than 50% of farm income from crop component followed by vegetables (31.8%).
- Rice- maize (16,773 kg ha^{-1}), & rice-okra (15,630 kg ha^{-1}) were found to be the suitable cropping systems for lowland valley areas with highest yield, net return than rice- green gram and rice-ground nut.
- The fruits of noni, cashew apple and wild mulberry were found to be good feed supplement for pigs. Together with tapioca, sweet potato and colocasia supplemented upto 25% (dry weight) of feed requirement with average weight gain of around 440 g/day.
- Small scale homestead based IFS model of 400 m^2 comprising backyard poultry (25 no's), goat (2 no's) and composting were successfully implemented and evaluated on a participatory mode at farmers' field in Car Nicobar.
- Land shaping activities comprising of six different methods viz. broad bed and furrow, rice-fish, three tier farming, farm pond, paired bed and furrow and pond-nursery systems were made to reclaim the coastal degraded areas under NAIP and found that salinity levels were reduced in the beds of BBF system (1.5 dSm^{-1}) than the adjacent unreclaimed soil. Besides, 4476 m3 ha^{-1} water harvested in the furrows were used for irrigating dry season crops which resulted in increased cropping intensity of 170 -218% from 90% in non intervention sites.
- Under FASAL the rice yield for Kharif 2013 was predicted at 3100 kg/ha by using DSSAT model with total production of 26492 MT (±1059) for the Andaman Islands.
- In comparison to sun drying, solar drying saved 29 %, 31% and 28% of total drying time for cinnamon, clove and black pepper respectively. It requires 10 hrs to dry to safe moisture

content of 4-5 % at 700 C in cabinet dryer. Cinnamaldehyde and eugenol was the major compound contributing about 40.41% and 74.03% in the cinnamon oil and clove oil.

- Farm household survey conducted in North, Middle and South Andaman district covering 300 farm households to assess the chemical fertilizer use pattern indicated 30.9%, not using any kind of chemical fertilizers for growing crops. Pesticide residues viz., chlorpyriphos ethyl, dimethoate and acetamprid were found in 14.5 % of the total samples analyzed. The chlorpyriphos ethyl was found to the extent of 0.008 to 0.07 mg kg-1 with average level of 0.038 mg kg-1.
- During 2013-14 nearly 93 agromet bulletins in English and 64 in Hindi were issued through print and electronic media, apart from conduct of farmers awareness programme. Verification of agromet bulletin indicated that on an average forecasted and observed values of rainfall were matching to the tune of 69 % during pre monsoon period while 54 % in monsoon and 60 % in post monsoon period, respectively.

उद्यान विज्ञान व वानिकी
Horticulture & Forestry

- Among the seven fruits, the lycopene and carotenoids content were estimated to be highest in *M. cochinchinensis* (413.4µg/g; 553.07µg/g) followed by *M. dioica* (354.9µg/g; 457.2µg/g, respectively).
- Total carotenoids, lycopene and xanthophyll in aril fraction of *Momordica dioica* were increased from green mature to fully ripe stage by 205.0%, 524.5% and 303.7%, respectively.
- The molecular analysis of 68 collections of drumstick from Islands revealed significant level of genetic diversity with RAPD (51%) and ISSR (71%) markers.
- CARI Poi Red' of *Basella rubra* L., CARI AMA-Green and CARI–AMA-Red of Amaranthus were identified for higher yield in island conditions.
- The cost effective rainshelter (Rs. 16,400 for 50 m^2) were designed and developed for vegetable cultivation in rainy season and 13 rainshelters were made in Car Nicobar (6), Campbell Bay (3), Nancowry (2) and Hut Bay (2) respectively.
- Round the year cauliflower cultivation technology was developed by integrating the rainshelters, raised beds with double row planting, net house (45 mesh), suitable varieties (White Marble and White Shot) and crop spacing level (45 x 30 cm).
- The promising entries were identified in brinjal (2012/BRBWRES-1, 179.4 q/ha and 2012/BRBWRES-6, 178.9 q/ha), chilli (2012/CHIVAR-5, 80.6q/ha and Kashi Anmol, 77.3 q/ha), bitter gourd (Indra F1, 93.5 q/ha and Palee F1, 84.5 q/ha), cowpea (2012/COPBVAR-5, 61.0 q/ha and 2011/COPBVAR-6, 60.2 q/ha) and Hybrid okra (2011/OKHYB-7, 85.0 q/ha and 2011/OKHYB-11, 81.2 q/ha) respectively.

- The morphological descriptors were developed for fruits (14), leaf (13), seeds (7) and flowers (12) characters and standardized in 33 genotypes of Noni.
- The geostationary hotspots of *Morinda* species were marked in South (Port Blair and Neil Island), North and Middle Andaman and submitted CARI Rakshak, CARI Sanjivini and CARI Sampada genotypes of Noni for Registration in NBPGR.
- The fruit coating with organic solvents *Aloevera* gel coating (100%) improved the shelf-life of Noni fruits as compared to untreated fruits and retained higher content of carbohydrate (0.66 g/100g), phenol (0.267g/100g) and protein (2.186g/100g), which was significantly better than control.
- In the study for extending the self-life of Noni fruits, the coating of harvested fruits with 5% Chitosan retained higher carbohydrate (1103mg/100g), protein (2913.3mg/100g), phenol (172.27mg/100g) and antioxidant activity (60.58%).
- Khoon phal (*Haematocarpus validus*) from the only custodian farmer Shri Maninder Mistry, Diglipur was found to be rich in polyphenol (400 mg/100g), flavonoids (542 mg/100g) and anthocyanin (203.7 mg/100g).
- Physio-chemical characterization of 20 accessions of Papaya from islands showed significant diversity for individual fruit weight (0.25-2.0 kg), pulp thickness (1.70 – 3.50 cm) and TSS content (6.2 – 13.2° B). The molecular analysis with 30 ISSR markers also revealed 69% diversity in 48 accessions of papaya.
- The germplasm of ginger (5), gloriosa (4), rare species of medicinal plants (6), specialty flowers (19), chrysanthemum (35), tuber crops (2) and two rare forms of coconut were collected and added to the germplasm block.
- Molecular characterization of *Asplenium nidus* was done by 15 ISSR markers and maximum discriminating bands were obtained i.e. UBC 842 and UBC 809.
- Antifungal activities of *Cheilocostus speciosu*s and *Costus pictus* were observed and micro-propagation protocol was developed for both the species.
- The rhizomes of *Cheilocostus speciosus* were high in content of ascorbic acid (98.53 mg/100g), flavonoids (96.18 mg/100g) and antioxidant activity (51.45%) while leaves were rich in phenolics (101.38 mg/100g).
- The terminal cutting with two leaves of the chrysanthemum showed maximum root length (22.8cm), number of rootlets (40.6) and survivability (100%) with coir dust.
- Turmeric variety Zeodarick recorded highest yield (11.2 t/ha) compared to Prabha (10.8 t/ha).

क्षेत्रीय फसलें
Field Crops

- Two medium duration and bacterial blight resistant rice varieties (CARI Dhan 6 and CARI Dhan 7) and bacterial wilt resistant brinjal variety (CARI Brinjal 1) was developed and

released by Institute Variety Release Committee (IVRC) for Andaman and Nicobar Islands. A total of 7.5 kg breeder seed of CARI Brinjal 1 was produced during *Rabi* 2013.

- A total of 120 kg Nucleus, 465 kg Breeder seed and 3370 kg Truthfully Labelled Seed of five rice varieties was produced through farmers' participatory approach.
- Selected 13 purified progenies of C14-8 land race in rice revealed the overall best performance of C14-8-11-113 (2.93 t/ha) followed by C14-8-11-108 (2.66 t/ha) thus revealing their superiority of 19% and 8%, respectively as compared to mix C14-8 control (2.46 t/ha). The above top two performing lines C14-8-11-113 (3.88 t/ha) and C14-8-11-108 (3.70 t/ha) also gave higher yield in OFT conducted by KVK, Port Blair. The characterization for 60 DUS (distinctness, uniformity and stability) traits were completed for 7 rice land races.
- The search for effective genes for resistance to bacterial leaf blight pathogen (*Xanthomonas oryzae*) in rice revealed that among individual genes tested across two years, *Xa4, Xa7 and Xa21* conferred resistance reaction across all isolates, whereas among combinations, IRBB50 (*Xa4+xa5*), IRBB52 (*Xa4+Xa21*) and IRBB60 (*Xa4+xa5+xa13+Xa21*) conveyed effective resistance against tested isolates. The RAPD primers S111, S119, S1117, S119, S1103, S109 and S105 were found to be better indicators of molecular diversity among pathogen isolates.
- In farmers participatory selection trial for salt tolerant rice varieties, two lines *viz*. NDRK 11-2 (2.35 t/ha) and RP4353MSC 28-43-6 (2.32 t/ ha) exhibited numerically higher yield than the best check variety CST 7-1 (2.20 t/ha) under combined stress of salinity and acid sulphate soils. Considering the yield superiority and overall preference, CST7-1 was most preferred variety for salt stress conditions in the islands.
- To strengthen the minicore collection of pulse germplasm, 19 mungbean, 23 urdbean and 27 accessions of pigeonpea landraces and advanced lines were collected. The wild relative of *Vigna* spp. namely, *Vigna marina* were collected from different parts of islands and maintained. In preliminary yield evaluation trial of mungbean 6 local landraces, in urdbean 12 local landraces and 7 advanced breeding lines showed tolerance against abiotic and biotic stresses.
- In advanced breeding trial of mungbean 5 entries ANM-12-02, ANM-12-01, ANM-11-12, IPM-02-14 and ANM-11-08 showed significant difference for seed yield per plant over the checks VBN-3, HUM-16 and Pusa Vishal. In urdbean, 6 entries ANU-11-19, ANU-11-10, ANU-11-29, ANU-11-34, ANU-11-11 and ANU-11-22-1 showed significantly higher seed yield compared to standard checks VBN-6, Uttara and IPU 02-43.
- In pigeonpea, nine promising lines IPAC-68, ANP-13-03, IPAC-7-2, ANP-13-01, ANP-11-13, ANP-13-02, ANP-12-02, ANP-11-12-2 and ANP-11-14 were identified.
- Three bacterial wilt resistant lines in brinjal (CARI B2, CARI B3 and CARI B4) have been identified, which have coloured fruits with cylindrical, round and oblong shapes.
- DHM 117 was found as the best hybrid identified for normal maize, HM4 as best hybrid for baby corn purpose and HQPM1, HQPM4, HQPM7 and Vivek QPM9 were found suitable hybrids for island conditions in quality protein maize category.

- DMR101 was identified best hybrid entry in QPM category with yield of 6.93 t/ha. In normal maize early group DMR502 gave highest yield 5.4 t/ha, in medium group DMR 220 (7.3 t/ha) was best and in late maturity group DMR 140 gave the best yield of 10.3 t/ha.
- All the 14 isolates of *Ralstonia solanacearum* collected from different locations of Andaman island in four different solanaceous vegetables were confirmed as Phylotype I using multiplex PCR technique and race 1 using injection infilteration technique on tobacco plants.
- Six isolates of PGPR (SA1, SA2, SA3, SA8, SA12 and SA29) were found best among 58 PGPR tested in inhibiting the pathogen growth of highly virulent rice bacterial blight pathogen under *in vitro* conditions The molecular characterization of the screened isolates using 16SrDNA amplification revealed that all the isolates belong to the genus *Bacillus* and *Psuedomonas*.
- *Trichoderma* isolates TDK2, TRC3, TNB6 and THB3 were most efficient in percent inhibition of mycelial growth of all three test pathogens. TRV1 and TRC3 showed highest chitinase, whereas TDK2 was recorded with highest cellulase and protease activities. The ITS and tef gene characterization showed that four isolates (*T. harzianum, T. aureoviride, T. asperellum and T. koningiopsis*) were more prevalent among all the isolates.
- The evaluation of two new generation rodenticides (Flocumafen and Difenacoum) at high rodent infested coconut plantations of South Andaman villages during two different seasons revealed that both the rodenticides were effective up to two months in controlling rodents in coconut plantations with single dose application. In the present study, crown application of Flocumafen readymade rodenticide cakes to the coconut palms was found most effective as its rodent control success was higher than the Difenacoum rodenticide cakes.

पशु विज्ञान

Animal Science

- Selection for short shank length in Nicobari Fowl influenced body weight during the growing phase. There was gradual increase of body weight in F_1 and in F_2 generation in all the ages of measurements except 2nd and 3rd month of age. The adult body weight at sexual maturity was higher in F_2 as compared to both F_1 and before selection. Selection for short shank length improved the laying performance, feed efficiency and innate immunocompetence status also. The onset of sexual maturity was five days earlier in F_1 as compared to the groups before selection. Though the peak egg production was comparatively delayed in F_1, its higher hen day egg production was sustained till 44 weeks of age. In both groups of F_1 and before selection, there was reduction in egg production between 36 and 40 weeks of age and again increased thereafter up to 44 weeks of age.
- Oral iron supplementation in the form of iron lactate @ 100 mg /piglet on 3rd and 10th day post- natal period alleviated post -natal piglet anaemia.
- Supplementation with 25 g of mineral mixture daily to the basal diet of cows significantly improved the reproductive performance by enhancing incidence of oestrus, pregnancy and calving rates.

- Nicobari pigs are highly adoptive under intensive system of management with concentrate feeding. Early age at puberty and age at first farrowing were recorded which were significantly less than the exotic breeds. However, the litter sizes were also recorded to be low with low birth weight.
- Feeding of *Morinda citrifolia* 10 ml per day per bird + 200 mg Kalmegh on alternate days showed immune modulator activity and growth promoter effect in Nicobari fowl and could be used as an alternative to commercial tonic.
- Feeding of *Morinda citrifolia* fruit juice (10 ml), Kalmegh (3 g/bird/day) and *Lactobacillus acidophilus (1X10^{8}cfu/ml)* significantly improved the villi height and crypt depth in broiler duodenum.
- Supplementation of iron soya proteinate in Nicobari fowl did not show any significant enrichment of iron in meat unlike enrichment of iron in egg yolk.
- Supplementation of Kalmegh in Nicobari fowl @ 3 g per bird per day improve the feed efficiency.
- Kalmegh feed supplementation at the rate of 3 g per bird per day for breeder fowl improved the humoral and cell mediated immunity of breeders and improved the immunity, improved the height and reduced the depth of duodenal villi of progeny.

मत्स्य विज्ञान
Fisheries Science

- The influence of mesoscale eddies based on sea surface height in correlation with primary productivity and fish catch was studied in Andaman waters. Mean sea level anomaly maps obtained from AVISO database and Chlorophyll map obtained from MODIS Aqua datasets were overlaid.
- Using PFZ advisories it was found that out of 47 advisories validated there was an increase in 50.34% catch in PFZ compared to non PFZ areas from gill nets, long liners, ring netters and hand lines.
- A total of 64 molluscan species were identified *in situ* from Nancowry group of Islands, whereas a total of 53 species distributed under 8 phyla *viz.*, Cnidaria (30), Echinodermata (7), Mollusca (5), Vertebrata (Pisces) and Porifera (4 each) and Urochorata, Crustacea and Annelida representing 1 species each were recorded from Great Nicobar Islands. From Car Nicobar Islands, a total of 70 species distributed under 6 phyla viz., Vertebrata (Pisces) (33), Cnidaria (28), Mollusca and Porifera representing 3 species each, Crustacea (2) and Echinodermata (1) were recorded.
- Two Opisthobranchs *viz.*, *Dolabrifera dolabrifera* (Cuvier, 1817) and *Herviella mietta* Marcus and Burch 1965 are new additions to the Molluscan fauna recorded from Car Nicobar Islands.

- Satlantic Hyperspectral Radiometer surveys have been conducted at Burmanallah and Havelock for developing spectral signatures for different life forms viz., seagrass area, non-seagrass area at different depth zones (0- 35m). A total of 5 seagrass species (*Halophila ovalis, Halophila ovata, Halodule* sp., *Thalassia hemprichii*, from Neil Island and *Enhalus acoroides* from Champin) distributed under 2 families *viz.,* Hydrocharitaceae and Cymodoceacea were recorded of which 4 species belong to the family Hydrocharitaceae.

सामाजिक विज्ञान
Social Science

- Composite Fish Culture technology was found to be encapsulated with all the four major ingredients i.e. technology back up, input provider, good governance and the market which is needed for acceptance, adoption, spread and making it a market led technology for the Islanders. The lacunae identified in goat and pig farming was lack of proper governance and non-availability of inputs in the form of kids and piglets inclusive of the logistic, which acts as a major bottleneck for its up scaling.
- Out Reach Centre has taken technological intervention in Diglipur cluster of villages following group and participatory approach. Twenty five trainings beside demonstrations on high yielding varieties of rice, maize, brinjal, arecanut, spices, seed village were conducted . Horizontal spread of technology i.e. peking cross duck, satellite nursery for fresh water fish and HYV of rice was reflected in the operational area.

कृषि विज्ञान केन्द्र, दक्षिणी अंडमान
Krishi Vigyan Kendra, South Andaman

- Fourty three trainings covering South, North and Middle Andaman were conducted, wherein 960 beneficiaries got benefited in agriculture and allied sector. Under TSP of the Institute , three trainings were imparted exclusively for the tribal population of Car Nicobar district and one training at Tripura under NEH component, wherein a total of 137 tribal people were trained in livelihood options.
- Twelve On Farm Trials at farmer's field were conducted to assess and refine the selected technologies in agriculture and allied fields. Beside sixteen Front Line Demonstrations were also conducted to demonstrate proven technologies in farmer's field.
- Tank cum well system, mulching with coconut husk, paddy stubble and banana leaf in vegetable and plantation crops, land manipulation and water harvesting through BBF system, drought tolerant paddy (Sahbhagi dhan), salt tolerant paddy variety (CSR 36), brown manuring, CARI Poi selection for saline soil, CARI AMA-Green and CARI-AMA-Red as drought tolerant leafy vegetables, fodder cultivation, mineral supplementation to dairy cattle, improved shelter management practices for poultry, goatry , dairy animal, backyard poultry production with improved Nicobari and Vanraja birds, farm pond cleaning for storage of water and ground water recharge were the technologies intervened in the NICRA villages in South Andaman for mitigation and adaptation due to climate change.

कृषि विज्ञान केन्द्र, निकोबार
Krishi Vigyan Kendra, Nicobar

- Nineteen trainings were conducted, wherein a total of 524 beneficiaries participated. Under TSP, seventeen trainings were imparted, wherein a total of 674 tribals got trained in livelihood options in agriculture and allied sectors. To assess and refine the selected technologies in agriculture and allied fields, five OFTs and eleven FLDs at farmers field were conducted.

कृषि विज्ञान केन्द्र, उत्तरी एवं मध्य अंडमान
Krishi Vigyan Kendra, North & Middle Andaman

- Fourteen training programme in agriculture and allied field were conducted for the benefit of the farmers, farm women and rural youth benefitting 476 participants. Through on station demonstration 0.75 quintal of CARI Dhan 5 was produced and diagnostic services was extended by Entomologist on pest and disease control measures.

INTRODUCTION

Central Island Agricultural Research Institute (CIARI) formerly Central Agricultural Research Institute (CARI)

The Central Agricultural Research Institute (CARI), an ICAR unit for A & N Islands 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. CARI caters to the specific needs of agricultural research and development of the Union Territory of Andaman and Nicobar Islands. It was 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. The institute is unique in ICAR system which is engaged in multidisciplinary research, benefiting island ecosystem. It has several accomplishments during the last thirty five years of its service despite various insurmountable constraints. The research activities are carried out under five divisions *viz.*, Natural Resource Management, Horticulture & Forestry, Field Crops, 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, besides an Out Reach Centre supported by NABARD at Diglipur, North Andaman.

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. Accordingly, the Institute in this year of XII five year plan, has been re-named as **Central Island Agricultural Research Institute (CIARI)** and it is high time we capitalize on our own research foundation and the cumulative strength as a member of NARS to be a model for tropical Island agriculture research to the South East Asian countries in short term and entire world, in long term.

Our primary focus for the 12th plan is to enhance productivity through characterization and conservation of Island genetic resources, development of genetically superior varieties/breeds, systems approach in Island farming, development of climate resilient agricultural technologies suitable for the agro-ecological conditions of these Islands and effective management of post-harvest losses. The effective transfer of technologies would help to achieve self sufficiency in major food items, particularly the perishable commodities and to ensure nutritional and livelihood security to the Island farmers/fishers/farm women especially the tribal farmers of the Nicobar group of Islands. For socioeconomic amelioration of the tribal communities and the farm women it is envisioned to provide livelihood opportunity through sustainable technological intervention and capacity building under Tribal and NEH Plan.

In order to utilize the financial resources optimally and in the light of the fact that CIARI is the only ICAR Research Institute in this region, it is planned to strengthen the state of the art centralized research facilities for

conducting research on impact of climate change, bio-prospecting of Island genetic resources, post harvest and pre-harvest, animal and fish health, research on soil, water and tissue culture research. Integrated Agriculture System for Tropical Island is being taken up as the flagship programme of this Institute to enhance the adaptive capacity of the Island farmers and fishers in order to build disaster and climate resilient Islands through frontier research. The integrated approach will be promoted by developing location-specific farming system models, including the wealth of the vast coastal and marine resources in the Islands, which can serve as unique models for Tropical Island ecosystems. The geographical location of Island confers freedom from various diseases, insect, pest, however, the unrestricted entry of unwanted bio-organisms pose a continual threat to the crop-animal-fish component of the Islands. In order to protect the precious flora and faunal diversity of the Islands, it is envisioned to develop facilities for Composite Bio-security and Quarantine Facility in the XII Plan.

Mission

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

Vision

- The Institute envisages developing the 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.

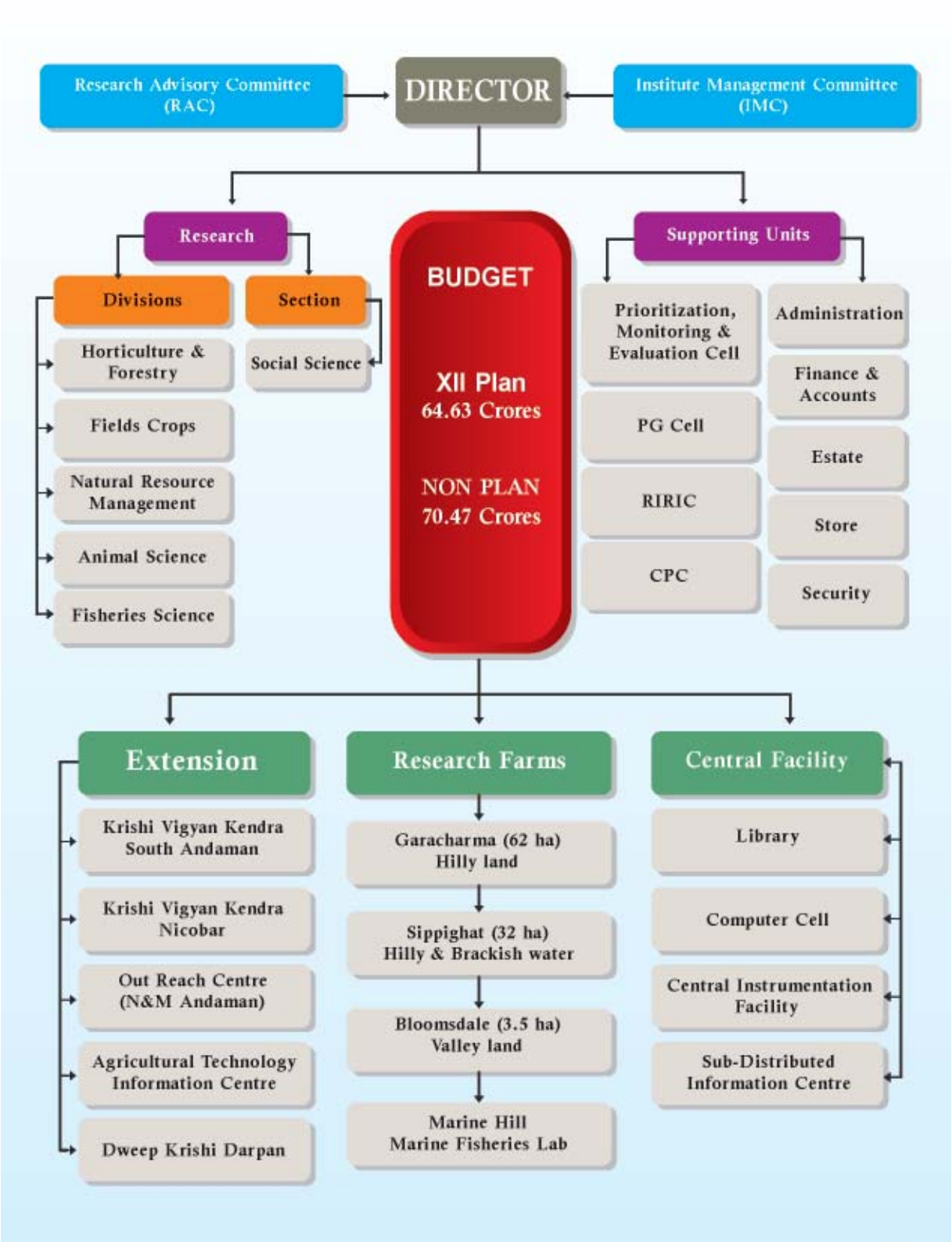
MANDATE

- ✓ To provide a research base to improve the productivity of important agri-horticulture, livestock and fisheries of A&N Islands through adaptive and basic research for attaining economic self sufficiency.
- ✓ To develop appropriate plans for conservation of natural resources and their sustainable use.
- ✓ To standardize technologies for animal health coverage and livestock production.
- ✓ To standardize techniques for capture and culture fishers including coastal aquaculture.
- ✓ First line transfer of technology and training to the relevant state departments.

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.

ORGANOGRAM


Research Advisory Committee (RAC)
DIRECTOR
Institute Management Committee (IMC)
Research
Divisions
Section
Horticulture & Forestry
Fields Crops
Natural Resource Management
Animal Science
Fisheries Science
Social Science
BUDGET
XII Plan
64.63 Crores
NON PLAN
70.47 Crores
Supporting Units
Prioritization, Monitoring & Evaluation Cell
PG Cell
RIRIC
CPC
Administration
Finance & Accounts
Estate
Store
Security
Extension
Krishi Vigyan Kendra South Andaman
Krishi Vigyan Kendra Nicobar
Out Reach Centre (N&M Andaman)
Agricultural Technology Information Centre
Dweep Krishi Darpan
Research Farms
Garacharma (62 ha) Hilly land
Sippighat (32 ha) Hilly & Brackish water
Bloomsdale (3.5 ha) Valley land
Marine Hill Marine Fisheries Lab
Central Facility
Library
Computer Cell
Central Instrumentation Facility
Sub-Distributed Information Centre

THRUST AREAS FOR XII PLAN

Broad research programmes for the XII Plan are as under:

- Characterization and bioprospecting 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 three other programmes are:

- Flagship programme on integrated agriculture system for tropical Island
- Establishment of Composite bio-security & quarantine facility
- Tribal Sub Plan

STAFF POSITION

Sl. No.	Category	Sanctioned	Filled
1.	Scientific	50 + 1	25+1
2.	Technical	43	35
3.	Administrative	25	24
4.	Skilled Supporting Staff	78	68
	Total	196+ 1	152+1

* Excess of Jr. Steno due to cadre revision

BUDGET UTILIZATION DURING 2013-2014

Head of Account	Plan (In Lakhs)		Non-Plan (In Lakhs)	
Particulars	**Sanction**	**Expenditure**	**Sanction**	**Expenditure**
Establishment Charges	-	-	1125.20	1105.94
Travelling Allowances	50.00	45.42	14.00	13.93
Recurring Contingencies	138.00	137.99	131.50	131.32
Works	40.00	40.00	70.00	69.98
Equipment, furniture & livestock	175.69	175.41	-	-
Books (Library)	9.00	8.99	-	-
HRD/Fellowships	12.00	11.74	-	-
TSP	120.00	119.84	-	-
P-Loans & Advances	-	-	25.00	25.00
Pension	-	-	108.00	107.57
Total	**544.69**	**539.41**	**1473.70**	**1453.75**





अनुसंधान कार्यक्रम
Research Programmes

प्राकृतिक संसाधन प्रबंधन प्रभाग

Division of Natural Resource Management

Feasibility Evaluation of Pulse Cultivation and Resource Optimization under Coconut Plantation

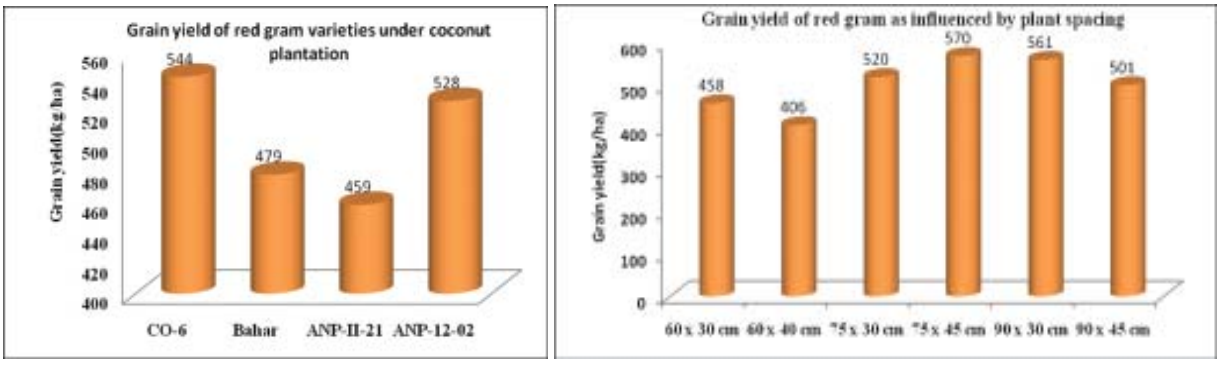
T.Subramani, A.Velmurugan A.K.Singh, B.K.Nanda and V.Damodaran

The production of pulses in A & N islands is 1155 t/yr (81 % deficit) as against the requirement of 6200 t/year due to lesser area (2610 ha) and low productivity (571 kg/ha). Out of 50,000 ha of cultivated land, 21768 ha is under coconut plantation. In coconut plantation, 76 % of land is lying vacant which can be utilized for pulse cultivation. Under this context, the field trial was conducted at Sippighat Research farm of CIARI from August 13 to March 14 to evaluate the feasibility of pulse cultivation under coconut plantation. The trial was laid out in split plot design by assigning varieties/lines of pulse crops (red gram, green and black gram) in main plots and plant spacing in subplots with 2 replications. The soil was sandy loam with p.H 5.1, E.C 0.3 dSm^{-1}, very low in soil available N, P and K.

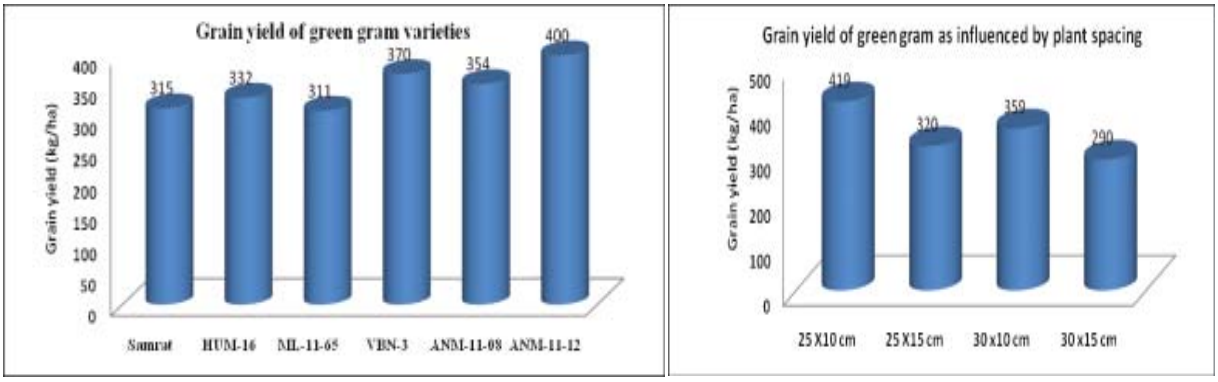
Among the red gram varieties, CO6 recorded higher number of pods per plant (89 nos), seed weight/plant (22.31 g/plant) and grain yield (544 kg/ha) which was at par with ANP-12-02. Among the spacing adopted, 75×45 cm recorded higher number of pods/plant (71 nos), seed weight/ plant (18 g/plant) and grain yield (520 kg/ha). Similarly among the green gram variety/line, ANM-11-12 recorded number of pods/plant (6.29 nos), seed weight/ plant (1.86 g/plant) which lead to higher grain yield (400 kg/ha), while 25×10 cm spacing recorded higher yield attributes and yield (419 kg/ha). The black gram varieties/lines, AN-11-19 recorded higher yield (354 kg/ha) which was at par with VBN 6 (330 kg/ha) and the 25×10 cm spacing recorded higher grain yield (379 kg/ha).

The results of the experiment revealed that all the experimental crops registered 40-60 % lesser than

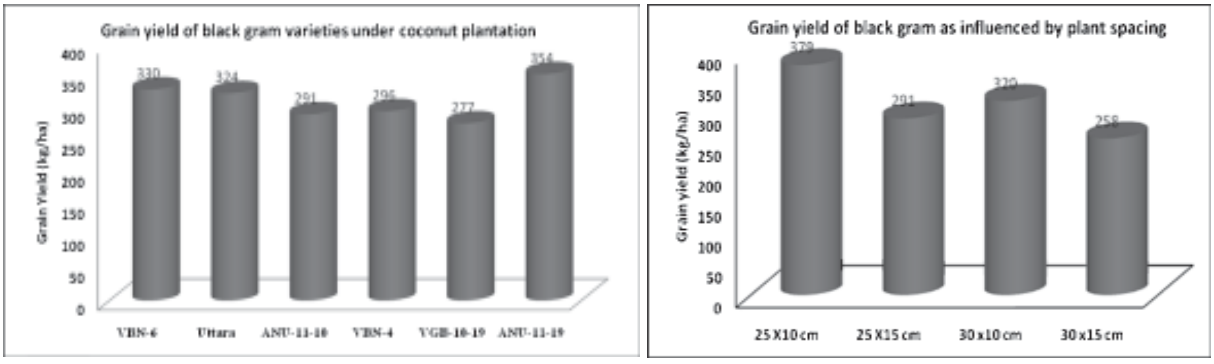
Plate 1 : Evaluation of red gram, green gram and black gram under coconut



a. Red gram



b. Green gram



c. Black gram

Fig. 1: Grain yield of pulses as influenced by different varieties and spacing under coconut plantation

the normal yield of sole crop grown in low lying areas. Though the yield level of pulses under coconut plantation is low, there is a scope to increase the pulse production in Andaman through area expansion. The red gram variety (CO6) with 75 x 45 cm spacing, green gram (ANM-11-12) and black gram (AN-11-19) with 25 x10 cm spacing recorded comparatively higher yield under coconut plantation.

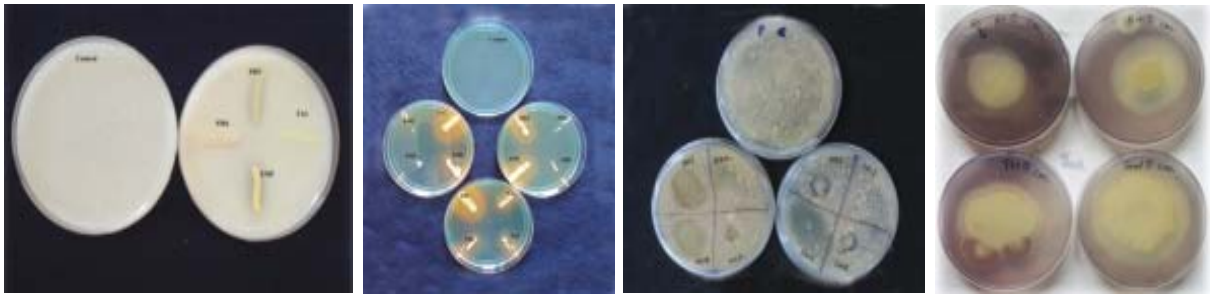
Assessment and Utilization of Soil Biodiversity for Improving Soil Health under Tropical Island Condition

A.Velmurugan, T.P.Swarnam and K. Sakthivel

A field survey and laboratory study was initiated in order to identify and utilize native effective microorganisms present in the soils to enhance organic waste recycling and soil fertility. During the year soil samples were collected from different land uses of Andaman Islands and used for isolation and identification of microbial diversity. A total of 20 bacteria have been isolated and identified through 16S rDNA and BLAST search. All the isolates have showed cellulose and protease activities and only 9 isolates showed chitinase activity and 4 isolates showed the siderophore production (Plate 2 a-d). Among the isolates *Bacillus cereus* produced maximum quantity of cellulase (1.2g/ml) and *B. flexus* produced maximum quantity of protease enzyme (120.7 g/ml). These are potential microbes for compost production.

Among the 20 isolates, *Bacillus subtilis*, *Bacillus cereus*

and *Bacillus megaterium* were identified as P solubilizers having maximum phosphate solubilization of about 46, 40 and 38 µg/ml respectively (Table 1). These microbes are potential P solubilizers and can be used even in acid soils as they are isolated from acid soils (pH 6.1).



a) P-solubilization b) Siderophore Production c) Protease Production d) Cellulase Production

Plate 2: *In vitro* performance of bacterial isolates for selected properties

Table 1: Selected properties of bacterial isolates from Andaman and Nicobar Islands

Organism identified	P solubilization		Cellulase		Chitinase		Protease	
	Zone	µg/ml	Zone	U/ml	Zone	U/ml	Zone	U/ml
Bacillus cereus	Single	40.47	Triple	0.84	Single	0.98	Triple	102.33
Bacillus pumilus	Single	39.24	Double	0.65	Negative	0.0	Double	93.28
Bacillus subtilis	Single	23.68	Double	0.76	Single	0.67	Double	82.66
Lysinibacillus sphaericus	Single	31.8	Single	0.53	Single	0.32	Double	76.31
Bacillus flexus	Single	30.00	Double	0.66	Negative	0.0	Triple	120.74
Bacillus subtilis	Single	29.46	Single	0.58	Single	1.11	Double	89.65
Bacillus cereus	Double	42.18	Triple	0.84	Negative	0.0	Single	62.24
Bacillus cereus	Negative	0.0	Triple	0.79	Negative	0.0	Single	54.15
Bacillus thuringiensis	Negative	12.05	Triple	1.20	Double	1.92	Double	93.88
Bacillus subtilis	Double	46.32	Double	0.72	Negative	0.0	Double	87.31
Lysinibacillus sphaericus	Single	35.37	Double	0.49	Single	1.54	Double	79.55
Bacillus cereus	Single	19.84	Double	0.69	Negative	0.0	Double	91.94
Bacillus megaterium	Single	38.21	Single	0.11	Negative	0.0	Double	84.11

Assessing the Status of Pesticide Residues in Sediments and Aquatic Biota in Neil Island

S.Dam Roy, T.P.Swarnam, A.Velmurugan and R.Kiruba Sankar

In the Island ecosystem of Neil, rice and vegetables are the major crops grown with sizable fish catch as well. Intensive vegetables cultivation is practised and lots of insecticides are being used which affects the soil, water and aquatic system of the Island as the pesticide residues moves from one component of the ecosystem to other. In order to assess the presence of pesticide residues a systematic survey was conducted in a three transect drawn across the Island (Plate 3a). This includes 3 each of fresh water and marine aquatic systems under the influence of vegetable cultivation. The type and quantity of pesticides used for vegetables were recorded (Plate 3b & c).

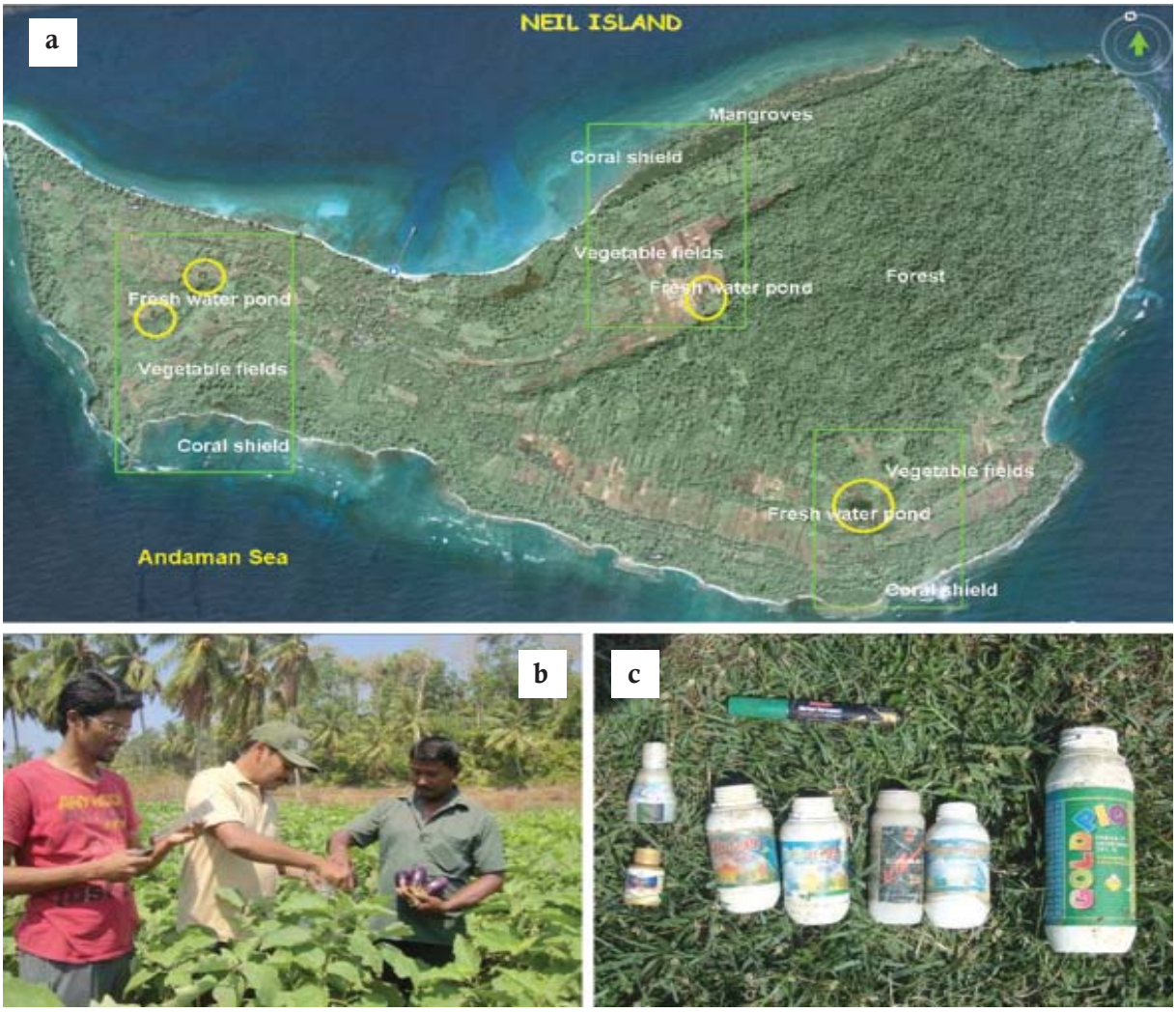


Plate 3: a. Neil Island showing the location of study transects
b. Sample collection c. Pesticides used in the Island

All India Coordinated Research Project on Integrated Farming Systems

T.P.Swarnam , A.Velmurugan, T.Subramani, S.Swain, M.Sankaran, Shrawan Singh, M.S.Kundu, R . Kirubasankar, B.K.Nanda and Ajmer Singh

Farming system characterization

Farm household survey was conducted to characterize the existing farming systems of Andaman Islands. The analysis showed that mixed farming predominates in the Islands where crops and livestock including poultry equally contribute to the total farm income. However, the percent contribution of different crops varied across the Island. In North and South Andaman, vegetables accounted for more than 50% followed by plantation crops (33.3%) compared to rice and pulses to the crop component. While in Middle Andaman, plantation crops especially areca nut contributes more than 50% of income from crop component followed by vegetables (31.8%). This is in contrasts to predominance of plantation based farming in Nicobar Islands.

Evaluation of IFS models

Rice + dairy based integrated farming system model is being developed for coastal valley areas in which

broad bed and furrow system was included to achieve crop diversification. In BBF of 0.4 ha area, vegetables and rice-fish were grown in the beds and furrows, respectively. Different cropping sequences like okra-brinjal-french bean, okra-green chili-okra, okra-brinjal, lab lab-lobia-okra were evaluated and found okra-Brinjal-French bean and okra-brinjal as most remunerative combinations. Suitable rice based cropping systems viz., rice-green gram, rice-maize, rice-vegetables (okra), rice-ground nut, and rice-fallow were evaluated for the valley areas (Table 2). The results indicated that highest system yield was obtained in rice-maize (16,773 kg ha^{-1}) followed by rice-okra (15,630 kg ha^{-1}). Consequently these systems recorded highest net return and B: C ratio of more than 3.0. A net return of ₹.90,612 was obtained only from crop and fish components of the IFS model in which BBF system contributed 61% to the total return.

Table 2: Production and economics of rice based cropping systems in valley areas of Andaman

Cropping system	Duration (days)	Yield (kg/ha)		S.Y[1] (kg/ ha)	P.E[2] (kg/ha/ day)	Cost of cultivation (₹/ha)	Gross return (₹/ha)	Net return (₹/ha)	B:C ratio
		Wet	Dry (REY)						
Rice-Green gram	173	4053	1440	5493	32	24892	54930	30038	1.21
Rice-Maize*	200	4773	12000	16773	84	34200	167730	133530	3.90
Rice-Okra	190	4710	10920	15630	82	34830	156300	121470	3.49
Rice-Ground nut**	218	4367	5143	9510	44	27650	95100	67450	2.44
Rice-Fallow	120	4560	-	4560	38	19956	45600	25644	1.29

* Sweet corn, ** - Table purpose ground nut, System Yield[1] Production Efficiency[2]

Coconut based integrated farming system model comprising pig, fish cum poultry is being developed for hilly uplands (Plate 4 a,b & c). In order to find suitable alternate feed sources for pigs under captive condition noni, cashew apple and wild mulberry grown along the boundary of IFS field were fed to the animals which served as a good protein and mineral source. Besides, tapioca, sweet potato and colocasia were grown as inter crops in coconut and used as pig feed. These together supplemented upto 25% (dry weight) of feed requirement and increased the body weight to 118 kg within 8 months resulting in production efficiency of around 440 g /day.

Plate 4: a. H.E.Lt. Governor of A&N Island visiting IFS Research farm, Garacharma
b. Pig being fed with Noni c. Vermicompost unit to recycle organic wastes

Nutrient cycling:

In order to meet the nutrient requirements and effective recycling of organic wastes vermicomposting of crop residues with 20% poultry manure was studied. The results indicated that vermicomposting of rice straw with *gliricidia* and poultry manure was much faster (100 Days) than in other substrates (150 days for coconut husk). The N content of final compost was significantly higher in rice straw compost (1.72%) followed by coconut leaf compost (1.64%) and coconut husk compost (1.36%). The analysis of water quality parameters of IFS pond indicated a significant difference in Nitrate and Ammonia content. It was 15.0ppm and 18.6 ppm in unlined pond at the foot hill slope but in lined pond at the top of the hill 3.75 ppm and 2.63 ppm, respectively. Nearly 10-15 ppm of nitrogen is enriched in the pond due to leaching of nutrient from the field and poultry litter.

AICRP - Tribal Sub Plan

T.P.Swarnam, A.Velmurugan, S.K.Pandey and Zacharia George

Considering the remoteness, dietary intake, limited land availability and lack of market for the farm produce, a small scale Homestead based IFS model of 400 m^2 comprising backyard poultry (25 no's), goat (2 no's) and composting were evaluated on a participatory mode at farmers' field in Car Nicobar (Plate 5). The model aims at improving nutritional security of the tribal household besides improving the farm production and employment generation. The results showed that after one year the frequency of consumption of meat, fruits and vegetables by the farm family increased more than 70 % after the intervention. The consumption of vegetables including greens and fruits increased significantly due to on farm production and there was a reduction in intake of tubers indicating a change in dietary pattern more towards balanced nutrition (Table 3).

Plate 5: On farm trial of Homestead IFS at Car Nicobar

Table 3: Effect of IFS intervention on consumption of specific food items

Food Item	RDA/person (g)	RDA/ Family* (g)	Daily Consumption (g/family)			Deficit/surplus	
			Before	After	Change	Before	After
Cereals	400	2000	1360	1625	265	-640	-375
Pulses	80	400	190	265	75	-210	-135
Vegetable	150	750	255	625	370	-495	-125
Greens	50	250	50	175	125	-200	-75
Fruits	100	500	265	480	215	-235	-20
Tuber	100	500	750	560	-190	250	60
Fish, Meat	50	250	200	260	60	-50	10

* family of 5 members

Besides improving the food and nutritional security, a total of 80 man days were generated by the system spread throughout the year. Composting of organic residues on farm resulted in effective recycling of farm waste for crop production. The sale of surplus produce of vegetables, tubers, egg and goat produced additional income of about ₹ 7750/- from the system within the limited resources. The additional income was reflected in increased consumption of cereals and pulses enabling the household to improve the share of cereals and pulses in the daily intake resulting in a more balanced consumption of food.

Strategies for the Sustainable Management of Degraded Coastal Land and Water for Enhancing Livelihood Security of Farming Communities

A. Velmurugan, T.P.Swarnam, T.Subramani, M.S. Kundu, Nagesh Ram, M. Sankaran, S. Swain and Subhash Chand

Andaman and Nicobar Islands face the twin problems of waterlogging in coastal plains and valley areas during monsoon season and scarcity of water during dry season. Under NAIP land shaping activities comprising of six different methods viz. broad bed and furrow, rice-fish, three tier farming, farm pond, paired bed and furrow and pond-nursery systems are beings made as a means of reclaiming these areas to bring them under cultivation.

The results showed that different land shaping methods improved the drainage of the raised beds which simultaneously resulted in harvesting of rain water in the furrow or trench. The surface soil pH of the beds was slightly acidic (6.36) whereas it was significantly lower (5.8) for the surrounding soils. Moreover, the salinity level in the beds of BBF made in water logged soil was much lower (1.5 dSm^{-1}) than under saline soils (>2.0 dSm^{-1}). Significantly lower Na^{+}, Ca^{2+} and SAR values were observed in the beds of BBF than both the initial value and the surrounding areas where no intervention was carried out. The harvested rainwater in the furrows (4476 m^3 ha^{-1}) was used for providing life saving irrigation for crops grown during dry periods on the beds and even in the adjoining areas. The system also provided ample scope for crop diversification and the cropping intensity increased upto 170 – 218% while it was only 90 % in no intervention areas but cultivated (Plate 6 a, b & c).

Organic cultivation of fruits and vegetables using organic inputs such as vermicompost, panchgavya and bio control agents have been popularised through training and demonstration in the intervention areas. In addition poultry birds (vanaraja) distributed to the farmers gave a net income of 2,000 per farmer within 40-50 days per cycle. Further the land manipulation techniques confers maximum scope for fish culture

and it can be increased upto 2.3 t/ha. A total of 600 farm families have been directly benefited by NAIP interventions during which 14 farmers groups were formed and interlinked for benefit and knowledge sharing.

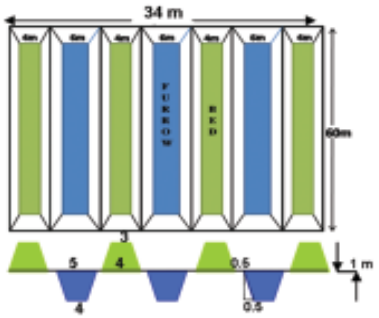


Plate 6: a. BBF System b. Vegetable cultivation on BBF c. Fish culture in BBF

Forecasting Agricultural Output Using Space, Agro-meteorology and Land Based observations (FASAL)

A.Velmurugan and T.Subramani

Crop production forecast has become a very essential component in understanding the impact of weather on crop yields apart from ensuring timely availability of production information to support policy decision at National level. In this context it has been observed that crop production in Andaman and Nicobar Islands is highly vulnerable to inter-annual and sub-seasonal climate variability.

Simulation and regression based crop yield forecast models were developed for Kharif rice using meteorological and crop data and validation of the same was carried out. Using this model the dependency of rice yield on the weather parameters (1981 to 2012) such as maximum and minimum temperature, rainfall, maximum and minimum relative humidity was estimated. It was observed that linear regression model predicts rice yield more accurately (R^2 = 0.863) than trend analysis (Table 4). Using the experimental data Decision Support System for Agro-technology Transfer (DSSAT) model was calibrated and used for yield prediction. In addition the rice growing areas of Andaman has been delineated (8546 ha) using remote sensing data (Fig. 2). The models predicted rice yield for Kharif 2013 was 3100 kg/ha with the total production of 26492 MT (±1059).

Table 4 : Rice and Maize yield forecast models for Andaman Island (2013-14)

Method	Model	R^2	Forecast
Rice (kg ha^{-1})			
Trend Analysis	Y=45.279x-87906	0.580	3100
Linear Regression	Y=3076.875+ 2.832*(Z251) + 0.853* (Z141))	0.863	2975
DSSAT model	Yield = Simulated Yield- C.F; C.F = Deviation of S.Y from the Trend yield		3150
Maize (kg ha^{-1})			
Trend Analysis	y = -39.97x + 82817	0.324	2380
Linear Regression	Y=2536.797 + 0.512*(Z451) +3.777*(Z241)	0.837	3310
DSSAT model			3522

* C.F - correction factor = 176

Similarly crop yield forecast for Rabi maize was developed with regression and stimulation model and field experiment is in progress for validation of the DSSAT model. The indicated that the productivity of maize is static over time (R^2 = 0.32). Weather integrated linear model forecast for maize was 3300 kg/ha (R^2 = 0.837). The approximate cropped area has been estimated.

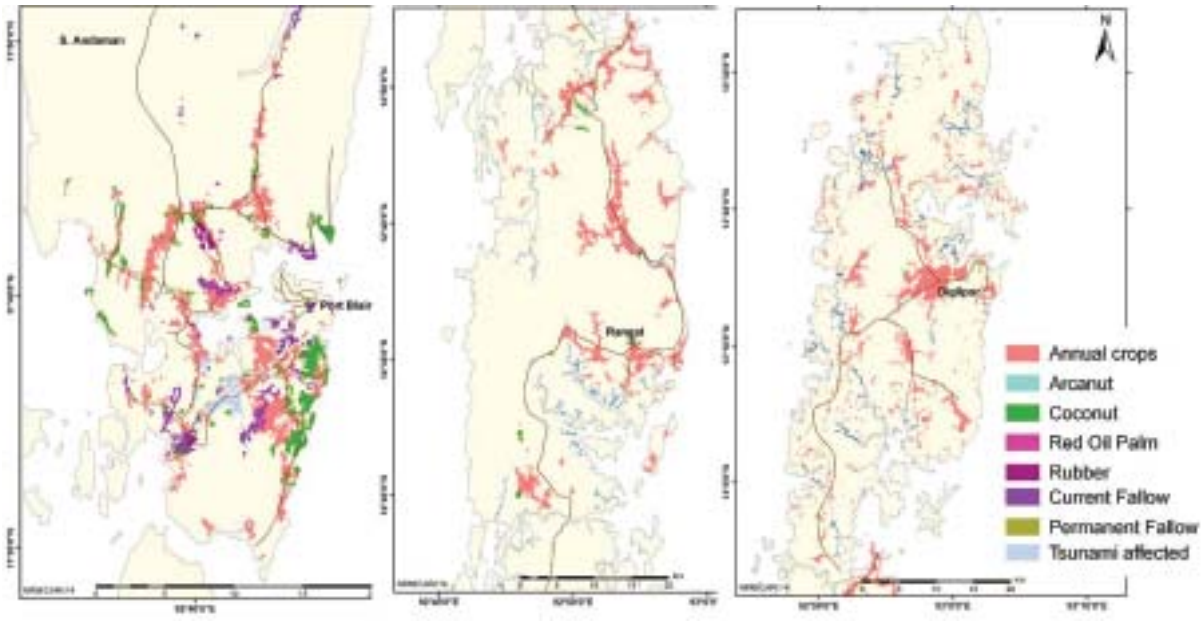


Fig. 2: Cropping map of Andaman Islands

Baseline Survey to Ascertain the Status of Chemical Residues in Soil, Water and Agricultural Products and its Regular Monitoring in Andaman Islands

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

A farm household survey was conducted in North, Middle and South Andaman district covering 300 farm households to assess the chemical fertilizer use pattern. The results revealed that 30.9% of the respondents are not using any kind of chemical fertilizers for growing crops (Table 5). This varied from 19.1 in North Andaman to 55.4% in South Andaman mainly due to lack of land records and poor economic status of leased farmers. Similarly, in Diglipur and Mayabunder region equal number of farmers used both N and P fertilizer materials but very less of K. In Rangat 33.3% farmers have not used P fertilizer meaning at least 6.8% of those who used urea have not applied any P source. This was reverse in the case of South Andaman, where more percent farmers used P than N fertilizer materials. The problem was acute in the case of potassic fertilizer, where almost 89.6% of the farmers were not using K fertilizer. This could be due to higher cost of the K fertilizer material and lack of awareness on the importance of K application.

Table 5: Percent farmers not using N, P and K fertilizers in Andaman Island

Location	N	P	K
Diglipur	19.1	19.1	84.4
Rangat	27.5	33.3	94.1
Mayabunder	20.5	20.5	89.7
South Andaman	55.4	50.6	94.0
Overall Mean	31.3	30.9	89.6

During the year vegetable samples were collected from farmer's field and analyzed for the presence of pesticide residues of organochlorine (OC), organophosphorus (OP) and synthetic pyrethroids (SP) using a gas chromatograph equipped with electron capture and flame thermionic detectors. Pesticide residues were found in 14.5 % of the total samples analyzed which is lower than the reported contamination levels elsewhere in India and world. A total of only 3 compounds, covering OC, OP and SP compounds, were detected in this study (Fig. 3). The residues of OP compounds especially chlorpyriphos ethyl was found in almost all the samples detected with pesticide residues. The other compounds detected were dimethoate and acetamprid. The chlorpyriphos ethyl was found to the extent of 0.008 to 0.07 mg kg^{-1} with average level of 0.038 mg kg^{-1}.

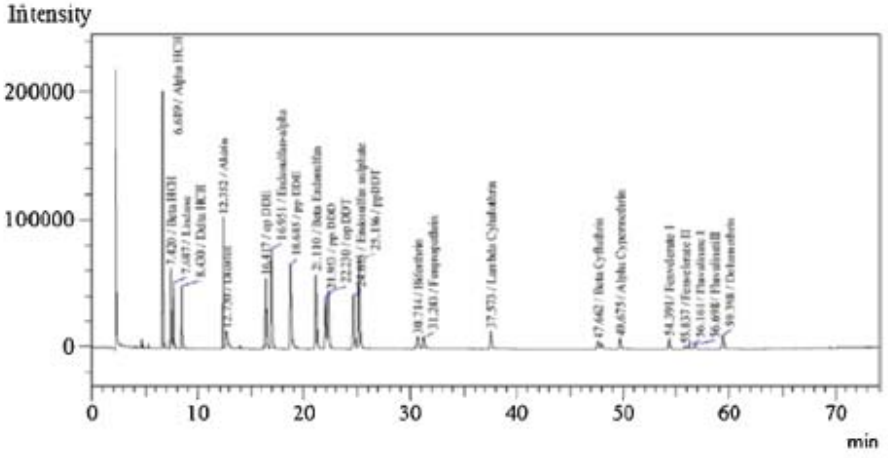


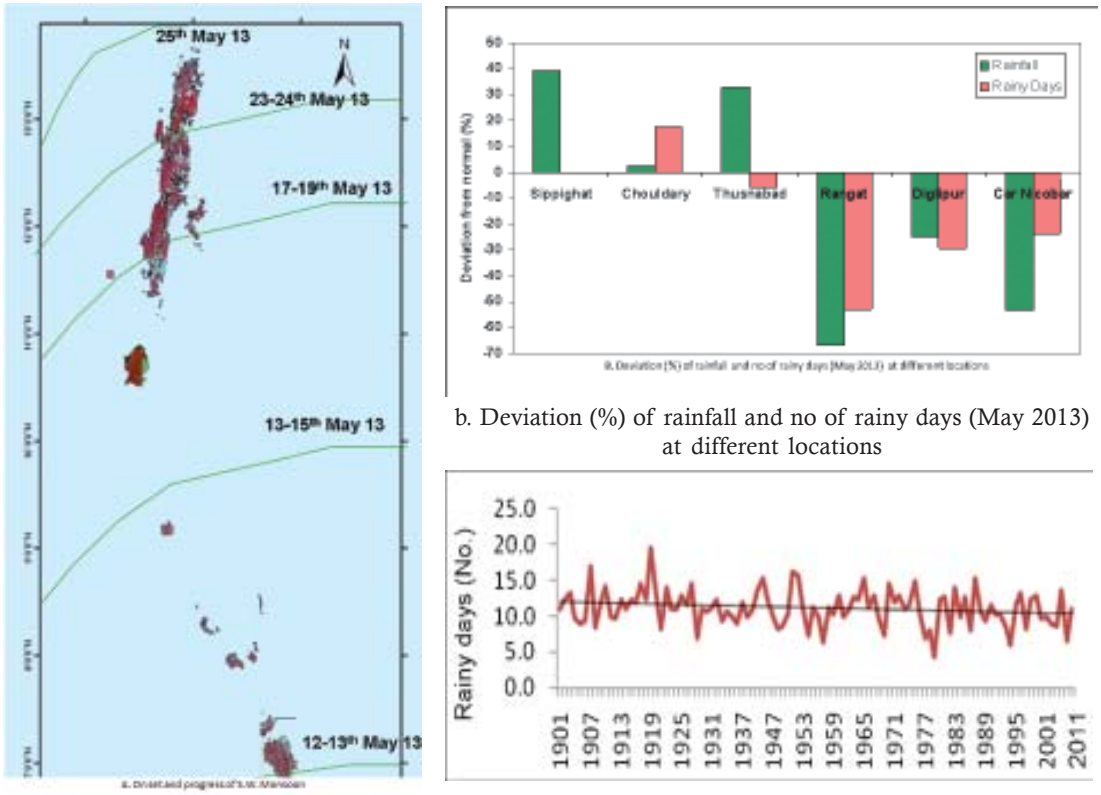
Fig. 3: Chromatogram of different pesticides found in the study area

Integrated Agromet Advisory Services

A. Velmurugan, T. Subramani, T.P.Swarnam, Krishna Kumar, P.K. Singh, Shrawan Singh, M.Sankaran, A. Kundu, R. Kiruba Sankar, Nagesh Ram S.K. Zamir Ahmed and *S. Dam Roy*

Agricultural production and water resources in Andaman and Nicobar Islands largely depend on the performance of monsoon. Therefore, the on-going Integrated Agromet Advisory Service (IAAS) started in 23rd June, 2008 provides districtwise weather based Agro advisory service to the farming community of Andaman and Nicobar Islands. It is aimed to receive and interpret the weather forecast to issue districtwise agro-advisories to minimize the production losses and aid in timely decision making in farm operations. During 2013-14 nearly 93 agromet bulletins in English and 64 in Hindi were issued through news papers *viz*. The Daily Telegrams, The Echo of India and Dweep Samachar. It was also broadcasted on AIR, and

telecasted on Doordarshan Kendra, Port Blair. In addition, advisories are regularly sent to KVK's and farmers group through SMS and feedback has been collected for improving the content and effective dissemination.



a. On set and progress of S.W. Monsoon

b. Deviation (%) of rainfall and no of rainy days (May 2013) at different locations

c. Trend in number of rainy days during post monsoon season

Fig. 4: Study of weather pattern and climate change

Verification of forecasted and observed values of rainfall was carried out for pre –monsoon, monsoon and post monsoon period. The results revealed that on an average forecasted and observed values of rainfall were matching to the tune of 69 % during pre monsoon period while 54 % in monsoon and 60 % in post monsoon period, respectively. Concurrently seasonal forecast (monsoon and post monsoon) and advisories were also issued for long term planning of agricultural activities especially land improvement works through mass media (Fig. 4).

A climatic data base of historical and current year has been created for the Islands. The results indicated that the post monsoon rainy days over the Islands is decreasing. The post monsoon weather variation was analysed and showed that during January to March in 2014 no rainfall was received making it one of the longest dry spell while in a normal year 81 mm is received in 6 rainy days. The major extreme weather events occurred during the period were deep depression in May (26-28th), 9th October, cyclonic storm in 24th November (LEHAR) and Deep depression on 6-7th December 13 developed into cyclonic storm (MADI). During the period suitable pre and post incidence agro-advisories encompassing all weather related aspects of agriculture were issued for the benefit of all the stake holders.

Post Harvest Management and Value Addition of Spices in the Island

Sachidananda Swain, Sharwan Singh and *Jai Sunder*

Evaluation of drying characteristics

Drying characteristic such as drying time and drying rate for spices such as cinnamon, clove and black pepper using sun drying, solar dryer and cabinet dryer were evaluated. The results indicated that solar drying took 11 hrs, 18 hrs and 26 hrs for drying of cinnamon, black pepper and clove respectively to safe moisture content of 4-7 % (w.b). In comparison to sun drying, solar drying saved 29 %, 31% and 28% of total drying time to reduce to final safe moisture content for clove, cinnamon and black pepper respectively. The maximum temperature inside the solar dryer reached up to 65.7°C at 11:15 am on January, 2014 compared to outside air temperature of 34.8°C. The minimum temperature was recorded to be 44.3°C on partially cloudy day.

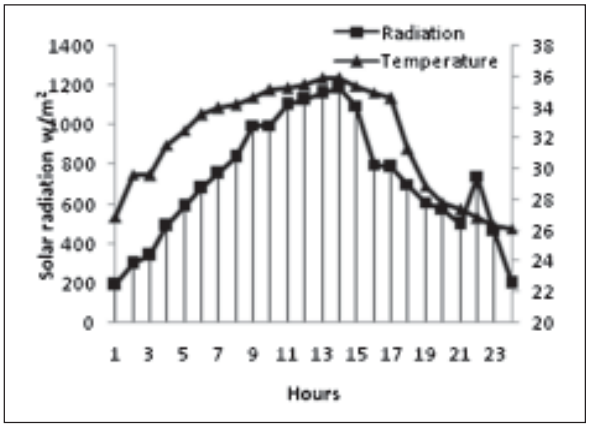
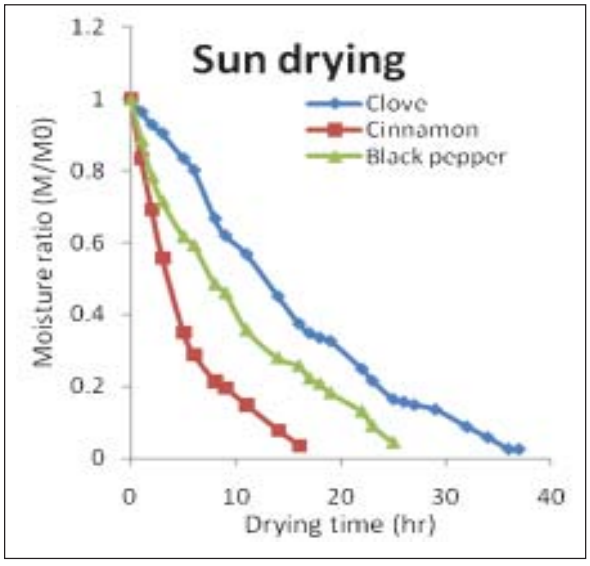


Fig. 5: variation of solar radiation and ambient air temperature



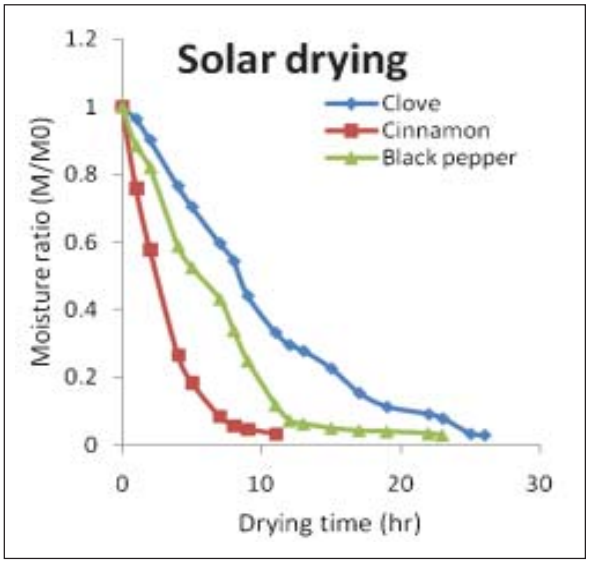


Fig. 6: Variation of moisture ratio with drying time in sun drying and solar dryer

In case of cabinet dryer, fresh mature cloves were dried in cabinet dryer at 40 °C, 55 °C and 70 °C at 50, 100 and 150 rpm of blower. The result indicated that it took 10 hrs to dry to safe moisture content of 4-5 % at 70°C whereas the same could take 16 hrs and 27 hrs at 55 °C and 40 °C respectively. For black pepper, the result indicated that it took 11 hrs approx. to dry to safe moisture content of 4-5 % at 70°C whereas the same could take 16 hrs and 25 hrs at 55°C and 40 °C respectively. Similar kinds of observations were also found for cinnamon. There were significant difference ($p<0.05$) of drying rate and drying time between 40 °C and 70 °C for all spices.

Estimation of bioactive compounds in clove and cinnamon oil

Composition of cinnamon oil and clove oil were estimated using GC/MS. The results indicated that there are 17 active compounds found in cinnamon oil where cinnamaldehyde is the major compound contributing about 40.41% followed by α-linalool (5.85%) and α-phellandrene (5.57%). Similarly, clove oil contained eugenol (74.03%) followed by Acetyleugenol (11.33%) and traces of other seven bioactive compounds. Similarly, piperine content of black pepper was found to be 41.06 % using HPLC analysis. It may be concluded that Andaman spices are no way inferior but having qualities at par with spices produced in the mainland.

उद्यान विज्ञान एवं वानिकी प्रभाग

Division of Horticulture and Forestry

Collection, Documentation and Bioprospecting of Perennial Vegetables of Andaman and Nicobar Islands

Shrawan Singh, D. R. Singh, Viveknand Singh and A. K. Singh

Estimation of lycopene in different sources

Total carotenoids and lycopene content were evaluated in seven different fruits *viz*. pulp fractions of red and yellow papaya (*Carica papaya*), tomato (*Lycopersicon esculentam*) and pink guava (*Psidium guajava*) and aril fraction of bitter gourd (*Momordica charantia*), gac (*M. cochinchinensis*) and kakrol (*M. dioica*). Among them, the highest lycopene (413.4 µg/g) and total carotenoids 553.07 µg/g) contents were estimated in *M. cochinchinensis* followed by *M. dioica* (354.9µg/g; 457.2µg/g, respectively). Guava had the lowest values for lycopene (19.8 µg/g) and total carotenoids (46.2µg/g) (Fig. 7). Thus, the *M. dioica* was found to be the potential source of lycopene for commercial use.

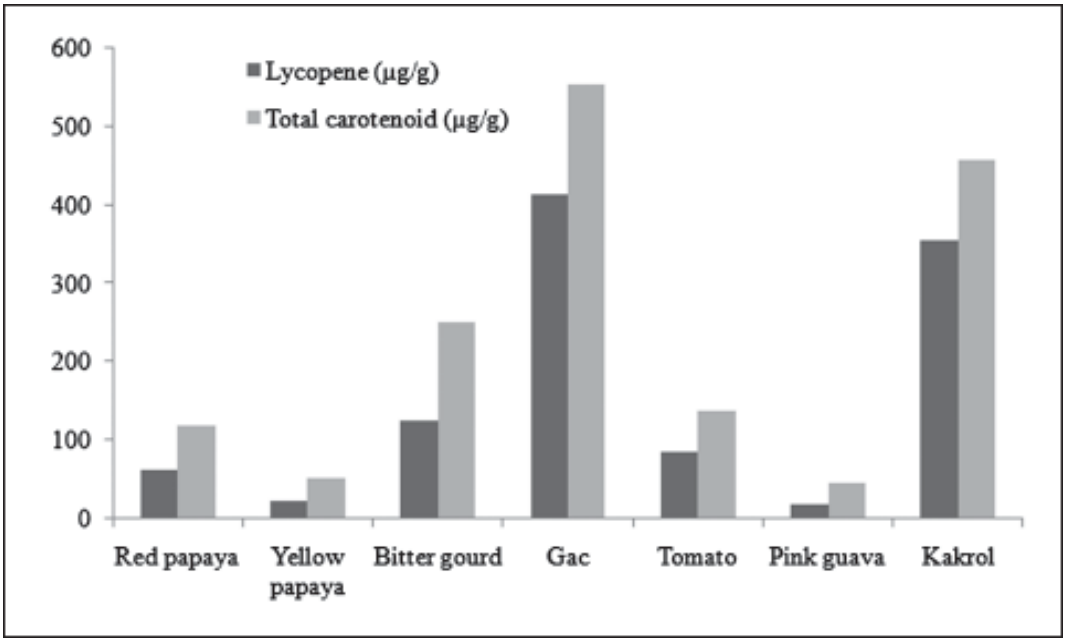
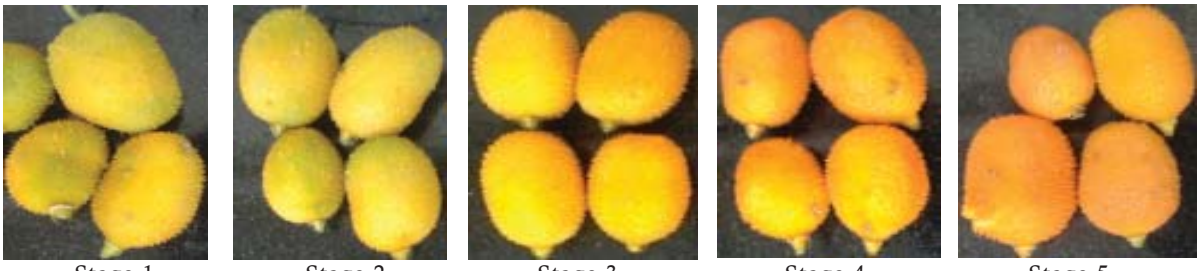


Fig. 7: Lycopene content in different fruits

Phytochemical changes during fruit development in *Momordica dioica*

The present study was aimed to investigate lycopene and total carotenoids in aril and pulp fractions of *Momordica dioica* fruit at five different maturity stages (Plate 7). The aril portion had high contents of lycopene (356.0µg/g) than pulp fraction.



Stage-1 Stage-2 Stage-3 Stage-4 Stage-5

Plate 7: *Momordica dioica* fruits at different stages (turning yellow to ripe red)

Total carotenoids, lycopene and xanthophylls in aril fraction increased from green mature to fully ripe stage by 205.0%, 524.5% and 303.7%, respectively while in pulp fraction the changes were 633.2%, 557.4% and 1113.2%, respectively. On the contrary, flavonoids (18.3%, 16.5%), tannins (24.4%, 26.8%), phenolic (20.2%, 19.5%), α-carotene (87.4%, 70.6%) and chlorophyll (55.1%, 82.0%) contents declined in aril and pulp fractions (Fig. 8a-b). The 2, 2'-azino-bis (3-ethylbenzthiazoline-6-sulphonic acid (ABTS) and 2, 2-diphenyl-1-picrylhydrazyl (DPPH) activities of aril and pulp fractions reduced from 75.3 to 40.2% and 80.7 to 44.0% to 68.3 to 39.6% and 77.0 to 41.0%, respectively with fruit ripening stages and showed strong correlation with antioxidants (Fig. 8a-b). The information on changes in phytochemicals during fruit stages would be useful for understanding the biochemical processes associated with synthesis and degradation of such antioxidants.

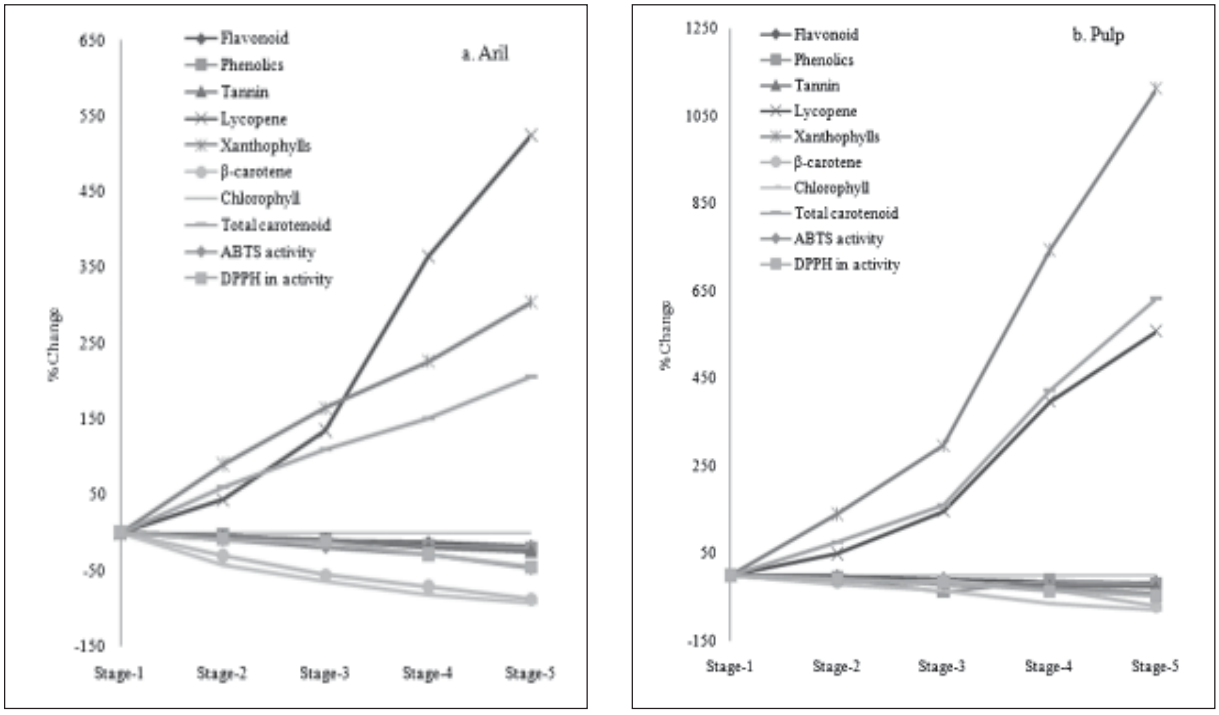


Fig. 8 a-b : Phytochemical changes during fruit development in *M. dioica* (a) aril and (b) pulp

Molecular diversity in drumstick collections

The extent of genetic diversity was analysed in 64 collections of *Moringa oleifera* L. from the Andaman and Nicobar Islands and four collections from mainland India using five RAPD and 28 ISSR markers. All five RAPD markers generated 987 bands, while 4190 bands were generated by 28 ISSR markers in 68 samples of the *M. oleifera* with 21.48 % and 38.09 % of polymorphic bands, respectively. The cluster analysis generated 8 groups while 7 clusters were formed by ISSR markers (Fig. 9). No separate cluster was reported for the genotypes from mainland India. The study revealed significant level of diversity by RAPD markers (51%) and by ISSR markers (71%). The study revealed significant level of molecular diversity for further utilization of drumstick germplasm of Islands.

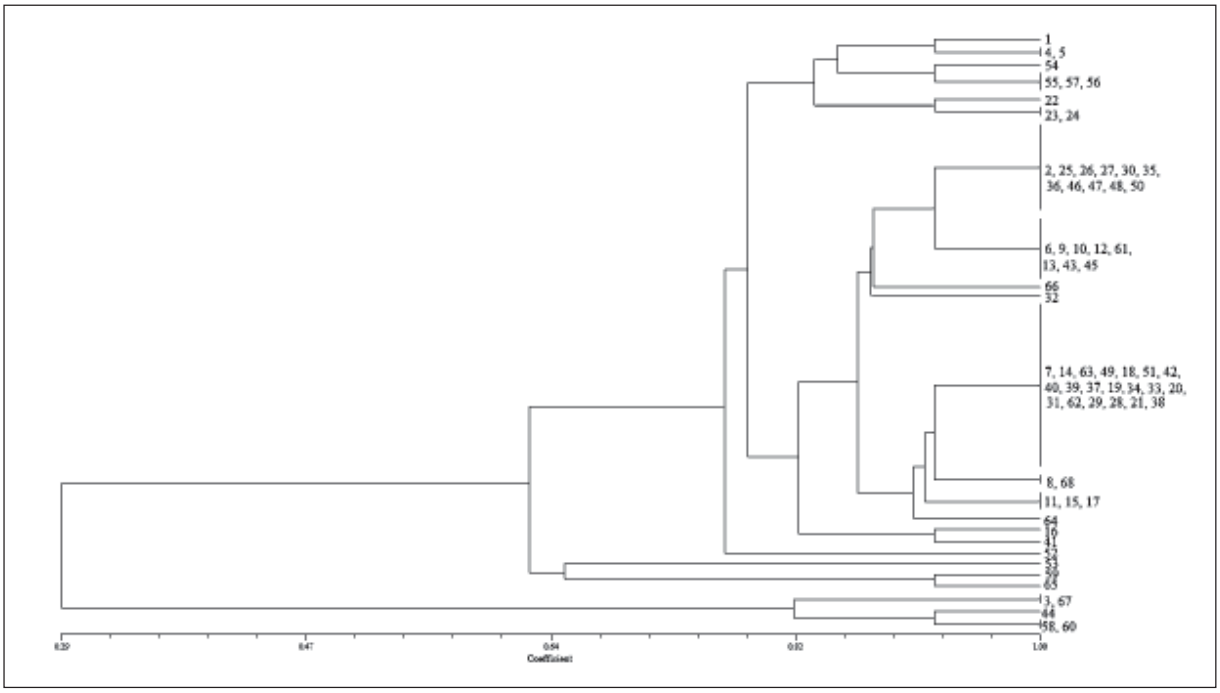


Fig. 9: UPGMA cluster analysis of 68 accessions of Drumstick using ISSR markers

Germplasm improvement

CARI Poi Red (Plate 8) is developed for high yield, uniformity in red colour, heart shaped glossy leaves and better adaptability in island conditions. This genotype has bright green leaves with purplish red prominent veins. The skin of the stem is light attractive red, while inner portion of the stem is green in colour. The recorded yield from 'CARI Poi Red' is 50-52 t/ha with multi-harvesting practice. Single harvest yield of CARI Poi Red 15-22 t/ha depending upon the soil and management practices.

Plate 8: CARI Poi Red

This genotype is rich in anthocyanin which is strong natural antioxidant for health. The improved genotypes of Amaranthus namely CARI AMA-Green (Plate 9a) and CARI-AMA-Red (Plate 9b) were found promising. The 'CARI-AMA-Green' is improved genotype with green coloured broad leaves, fast growing habit and high biomass yielding capacity with high acceptance among the consumers. The 'CARI-AMA-Red' is a mass selection from red coloured local amaranthus germplasm. It has better growth, yield performance and consumer acceptance than the local materials.

Plate 9a : CARI AMA-Green

Plate 9b : CARI AMA-Red

All India Coordinated Research Project (Vegetable Crops)

Shrawan Singh and D. R. Singh

Brinjal: During the period 2012-13, the bacterial wilt incidence was low and it ranged from 6.7% (IET 2012/BRBWRES-7) to 20.0% (10/BRLVAR-6) which might be due to use of new field for experimentation (Plate 10a). In IET trials, 2012/BRBWRES-1 (179.4 q/ha) and 2012/BRBWRES-6 (178.9q/ha); 10/BRRVAR-2 (115.3q/ha) and Swarna Mani (99.3q/ha) and in AVT-II, the 10/BRLVAR-3 (126.0q/ha) and Local (107.3 q/ha) entries were promising.

Chilli: Bacterial wilt incidence was high and ranged from 8.5 (2012/CHIVAR-9) to 40.0% (2012/CHIVAR-4). The promising entries were 2012/CHIVAR-5 (80.6 q/ha), Kashi Anmol (77.3 q/ha) and 2012/CHIVAR-2 (74.6 q/ha) in IET trial; 2011/CHIVAR-8 (82.0 q/ha), 2011/CHIVAR-9 (76.3 q/ha) and LCA-334 (76.3 q/ha) in AVT-I and 10/CHIVAR-7 (78.8 q/ha), 2010/CHIVAR-1 (73.2 q/ha) and Local (71.7 q/ha) of AVT-II trial (Plate 10b). Local chilli germplasm (17 collections) was evaluated for capsaicin content in ripe fruits by RP-HPLC which ranged from 26.6 (COL-1) to 698.6 µg/100 mg (Chilli-R1).

Plate 10a - b : Brinjal (a) and Chilli (b) varietal evaluation trials

Bitter gourd: The promising entries were Indra F_1 (93.5 q/ha), Palee F_1 (84.5 q/ha), Unnat LT 108 (82.5 q/ha) and Pusa Vishesh (82.0 q/ha). In Ridge gourd the Rama F_1 (100 q/ha), 2012/RGVAR-3 (93.5q/ha) and 2012/RGVAR-4 (91.5q/ha) were found promising. Seven (7) leafy vegetables were evaluated as potential intercrops in bitter gourd (Plate 11, Table 6) and highest yield was recorded from Indian spinach (160 q/ha) followed by that of amaranthus (130 q/ha) and Roselle (12.0 q/ha).

Plate 11: Performance of Bittergourd + Poi system

Table 6: Yield of intercrops in bittergourd

Crop	Yield (t/ha)	
	Main crop	Intercrop
Bitter gourd	6.0	-
Amaranth-Green	16.0	13.0
Amaranth-Red	14.5	11.2
Roselle	16.0	12.0
Poi	24.0	18.0
Palak	9.5	5.6
Radish	13.2	7.8
Green Onion	6.5	3.3

Cowpea: In cowpea, 15 entries were evaluated and the highest yield was recorded from AVT-I entries 2012/COPBVAR-5 (61.0 q/ha) and 2011/COPBVAR-6 (60.2 q/ha) and both the entries outperformed the checks Kashi Kanchan (46.8 q/ha) and Arka Garima (38.4 q/ha). The trial for tomato (29), chilli (30), brinjal (28) and ridgegourd (7) are under progress.

Hybrid Okra: The AICRP (VC) trial for 2013 -14 period was taken up (Plate 12) and out of 35 hybrid okra entries, 2011 /OKHYB- 7 (85.0 q/ha), 2011 / OKHYB- 11 (81.2 q/ha) in AVT-II; 2012/OKHYB-12 (107.0 q/ha) and 2012/OKHYB-8 (96.2 q/ha) in AVT-I and 2013/OKHYB- 9 (71.1 q/ha) outperformed the checks Arka Anamika (62.5 q/ha) and HOK-152 (56.0 q/ha).

Plate 12: Hybrid okra trial

Standardization of Technologies to Ensure Supply of High Value Vegetables to Defence Forces in Nicobar Islands

Shrawan Singh and *D. R. Singh*

Development of rainshelter technology for vegetables

During the year, the cost effective rainshelter technology was developed for vegetable cultivation during the rainy season. It integrates (i) frame of locally available construction material such as arecanut, bamboo or other trees, (ii) cladding materials of 35-50% ultra-violet (UV) stabilized agro-shadenet and (iii) temporary cover of UV stabilized 200 micron polysheet fixed on 0.5-1.0 inch GI pipes on both sides of the sheet with help of zig-zag spring. The polysheet is fixed only on one side of the structure and entire structure is covered only during the heavy rains to protect the crop. This technology maintains the required temperature (25-30 °C) and protects crop at required stages from heavy rain impact. It was demonstrated for cultivation of high value leafy vegetables palak and coriander in Campbell Bay (Plate 13). The calculated cost of 50 sq.m. rainshelter structure is around Rs. 16,400/- (Table 2) which might have slight variation in different islands. Ten rainshelter structures were made in Car Nicobar (6), Nancoary (2) and Hut Bay (2) under TSP scheme.

Plate 13: Inside view of rainshelter at Campbell Island

Table 7: Cost of Rainshelter (50 sq meter) construction for cauliflower cultivation

Materials	Approx. cost (Rs.)
Local frame materials (10 m long 7 no. bamboo; 6 m long arecanut 6 strips; 16 no. 2 m long wood poles; 9 no. 2.5 to 3 m wood poles)	2,000
[1]Cladding materials (agro-shadenet 50%) (130 sq meter)	4,000
[2]200 micron UV stabilized polysheet (60 sq meter)	3,900
HDPE rope for stitching of the shadenet	1,000
[3]Zigzag spring and fixing of Polysheet	3,500
Labour charges	2,000
Total	16,400

Development of round the year cauliflower cultivation technology

Cauliflower is a high value vegetable in the Andaman and its cultivation is restricted to dry season only due to heavy damage by high intensity rains in open condition during rainy season. Thus, the round the year production technology for cauliflower was developed by integrating the rainshelter to protect the crop against heavy rains, raised bed to accommodate more number of plants and to prevent the incidence of water logging, net house to protect the crop against heavy pest infestation and use of suitable variety for optimum yield. The rainshelter technology was demonstrated in South and North Andaman Islands and recorded mean yield of 158.0 q/ha and 142.0 q/

ha, respectively. Further, two varieties 'White Marble' (185.0 q/ha) and 'White Shot' (160.0 q/ha) were found suitable for rainy season. The polybag culture (80,000 plants/ha; 416.0 q/ha) and raised bed with double row method (66,660 plants/ha; 302.0 t/ha) are two planting methods which were found to be suitable for cauliflower in rainshelter and open islands. Net house (Plate 14) was successfully used to protect the crop from insect damage during late dry months *i.e.* March – April, when the insect population was quite high in open condition.

Plate 14: Cauliflower in rainshelter

Tomato production technology

Tomato is a challenging crop to be takenin tropical climate of Andamans due to high incidence of bacterial wilt and problems in open cultivation during heavy rains. Thus, grafting of tomato on bacterial wilt resistant rootstock CARI Brinjal-1 and use of growing media (cocopith: vermicompost: soil: lime in 1:1:1:1:0.01 ratio) were found to be the most promising options. Experiment on standardization of grafting technique was done with five tomato varieties and the highest yield was recorded from Ayush (2.3 kg/plant) followed by Arka Samrat (1.98 kg/ha), Arka Rakshak (1.70 kg/plant) and the lowest from Arka Vikash (1.50 kg/plant). While in another trial, 40 genotypes of tomato were evaluated in above described growing media and observed the wilt incidence was reported to be below 10%. Thus, both the techniques were found to be very promising to counter the bacterial wilt however, there is a challenge to supply enough grafted planting material of tomato or growing media for tomato cultivation in open conditions. Therefore, 16 varieties were evaluated and Ayush (1.9 kg/pl), Arka Alok (1.7 kg/pl) and Arka Ananya (1.5 kg/pl) were found promising. Cultivar Ayush also performed well in demonstrations held at farmer's field in Middle Andaman (220 q/ha) in open condition and North Andaman in polyhouse (320 q/ha) in rainy season.

Performance of legume vegetables in rainy season

The evaluation of four legume vegetables in mid rainy season (July- October months) exhibited poor performance of bush type varieties than that of pole types (Fig. 10). The performance of legume vegetables was poor in rainy season as observed with cowpea (3.6 t/ha), dolichos bean (3.0 t/ha), clusterbean (6.0 t/ha) and French bean (3.6-5.4 t/ha) than that during dry months (5-8 t/ha, 5-6 t/ha, 7.5 t/ha and 7-8 t/ha, respectively). The yield variation was also observed among the varieties of legume vegetables (Fig. 10) which might be due to low light availability, excess moisture in root zone, flower and fruit damage by heavy rains, loss to the crop stand by fungal diseases, particularly in French bean and the damage caused by insect-pests.

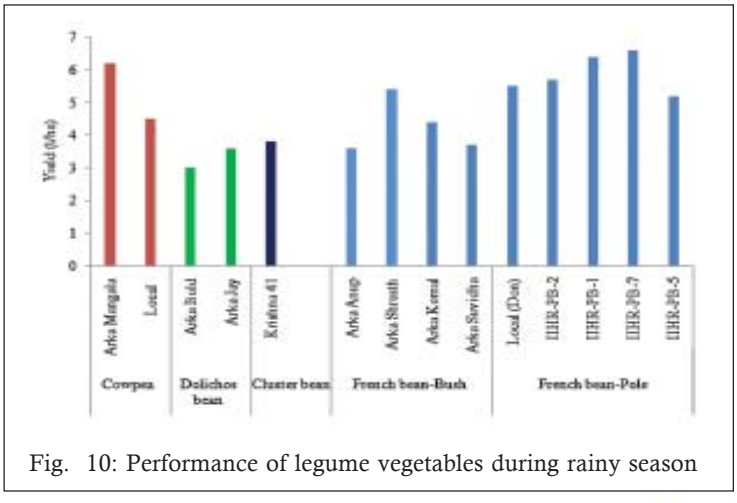


Fig. 10: Performance of legume vegetables during rainy season

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

D. R. Singh, Shrawan Singh and *A. K. Singh*

During the period, 14 morphological descriptors of fruits (Plate 15) *viz.*, fruit colour, skin texture, fruit shape, length, weight, width, bunching, branching, segmentation, shape of fruit base, colour of floral eye and peduncle positioning at fruiting, flowering and maturity from 33 accessions were analyzed. Whitish Green (65%) was predominant fruit colour while smooth skin texture was present in 45% of the accessions. Obovate elongate shape was the most common fruit shape and observed from 14 accessions. Maximal fruit length of 13.67 ± 0.171 cm was observed from Accession 5, whereas Accession 24 was found to have minimal length of 3.364 ± 0.42 cm. Fruits width ranged from 3.74 to 6.36 cm and was maximum in Accession 7, while minimum was recorded in Accession 31. Fruit weight was maximum in Accession 4 (111.46 ± 1.15 g), while minimum was recorded from Accession 17 (38.49 ± 1.71 g). Among the 33 accessions, bunching was observed in 8 (24%) accessions. Branching and segmentation have been observed in only 3 accessions *viz.*, 8, 11 and 33. A total of 24 accessions (72%) had cordate shaped fruit base, suggestive of their prevalent occurrence. Tapering fruit base was found in six accessions, while strongly depressed shape was observed only in 3 accessions. Two colour forms of floral eye outline *viz.*, brown and green were observed and the former has 84% intensity. With respect to the position of the peduncle, the sessile was the most common peduncle position at all stages.

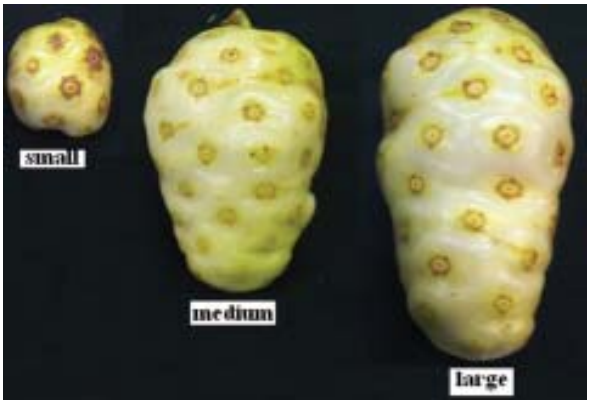


Plate 15: Noni Fruits

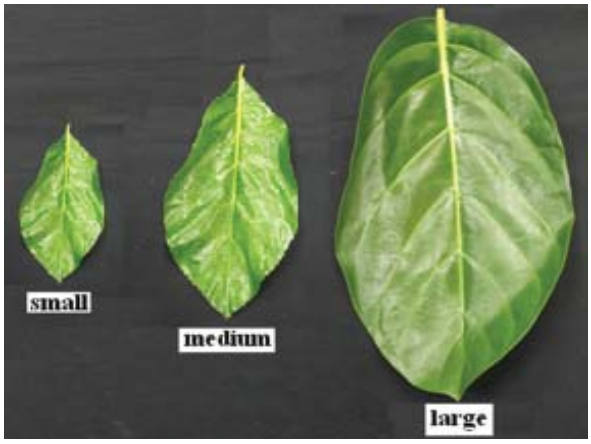


Plate 16: Noni leaves

Leaf shape is important trait (Plate 16) and for this, 13 descriptors were standardized in 33 accessions of Noni *viz.*, leaf shape, leaf apex shape, leaf margin, leaf laminar size, leaf lamina colour, leaf glossiness, leaf length, leaf width, leaf petiole length, young shoot foliage colour, no. of lateral veins and leaf petiole colour for morphological characterization of leaves of noni. Maximum leaf length was observed in Accession 13 (37.3 cm) and minimum in Accession 3 (21.0 cm). Leaf width ranged from 10.0 (Accession 12) to 19.1 cm (Accession 30). Elliptical leaf shape was found in majority of the collections except in case of Accessions 3, 17, 18 and 26, which have lanceolate shape. Length of leaf petiole ranged between 1.5-2.6 cm with maximum in Accession 4 and minimum in Accession 29.

The Noni seeds showed notable diversity in different characters and for this, seven descriptors were standardized for the Noni. These were seed length,

seed width, seed thickness, seed colour, presence of pulp plates on seed coat, seed wing, and average no. of seeds per fruit in 33 accessions.

The flower is an important part of Noni and hence, 12 floral descriptors were standardized in 33 accessions which included types of flower, sexuality of flower, heterostyly, anther position, anther no per floret, no. of corolla lobes per florets, corolla tube length, no. of opened florets, occurrence of floral bracts, length of filament, style length and presence of pistillate florets.

The geostationary hotspots of *Morinda* species were marked in South (Port Blair and Neil Island), North and Middle Andaman for large as well as small fruited types. Further, three genotypes *viz*. CARI Rakshak, CARI Sanjivini and CARI Sampada (Plate 17) of Noni were submitted for registration in NBPGR, New Delhi.

CARI Sampada | CARI Sanjivini | CARI Rakshak

Plate 17: Improved genotypes of Noni

Development of Suitable Pre and Post Harvest Technologies to increase the Shelf Life of Noni (*Morinda citrifolia* L.)

D.R. Singh and *K. Abirami*

Effect of organic coating on shelf life of Noni fruits

The perishable nature of Noni fruits is a major drawback for its transportation and storage. Noni fruits were harvested and coated with extracts from Cactus, *Aloe vera* and Noni fruit extract (Plate 18) to study their effect on shelf life and retention of phytochemicals in Noni fruits during storage. The seven post harvest treatments including control were T_0– Control, T_1–*Aloevera* gel coating – 100%, T_2 - Cactus mucilage coating – 100%, T_3 - Noni fruit extract coating – 100%, T_4 - $T_1 + T_2 + T_3$ (1:1:1), T_5 - $T_1 + T_3$ (1:1) and T_6 - $T_1 + T_2$ (1:1).

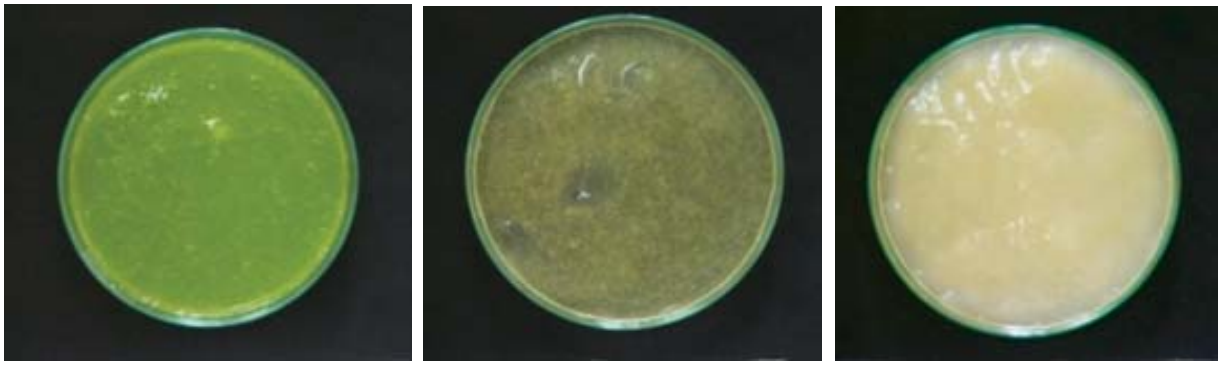


Plate 18: Different organic extracts used for extending the shelf-life of Noni fruits

The results showed that organic solvents improved the shelf-life of Noni fruits as compared to untreated fruits (Plate 19). Biochemical analysis was conducted at regular intervals. Carbohydrate was found to be the highest in T_1 (0.66 g/100 g), whereas minimum was in control (0.19 g/100 g). Phenol was maximum in T_1 (0.267 g/100 g) which was *on par* with T_2 (0.266 g/100 g) but was significantly higher than control (0.063 g/100 g). The storage period also affected the protein content in Noni but minimum changes were observed in T_1 (2.186 g/100 g), which was significantly better than the control (1.56 g/100 g). Antioxidant activity also exhibited difference between coated (60.76%) and uncoated (53.96%) fruits after five days of storage.

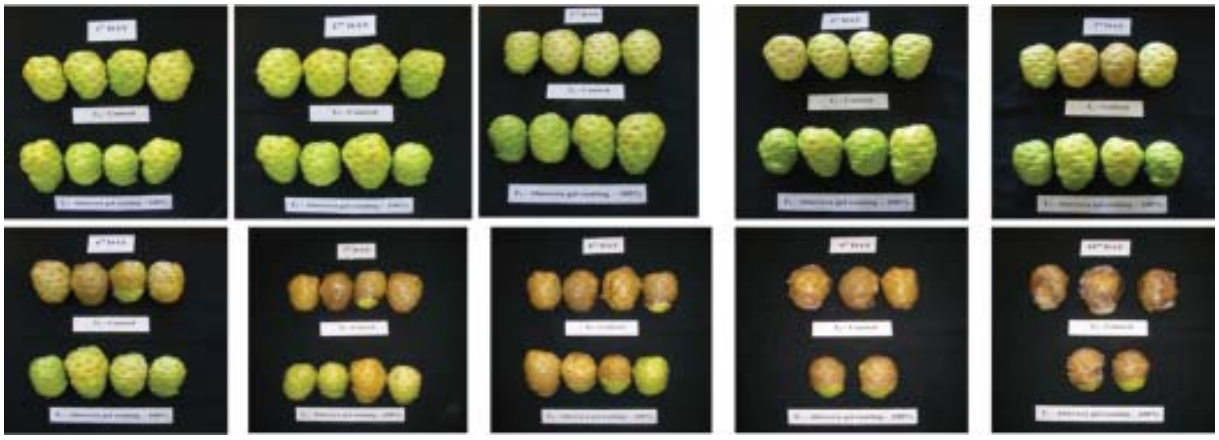


Plate 19 : Effect of different organic extracts on shelf-life of Noni fruits

Effect of chitosan coating on shelf life of Noni fruits

Noni fruits were harvested at full maturity for post-harvest study to improve the shelf life by coating the fruits with chitosan. The six treatments were T_0– Control, T_1 - 1% Chitosan, T_2 - 2% Chitosan, T_3 - 3% Chitosan, T_4- 4% Chitosan and T_5- 5% Chitosan. Carbohydrate content was found to be maximum in treatment involving 5% Chitosan (1103 mg/100 g) followed by 4% Chitosan (922 mg/100 g), whereas the minimum was found to be in Control (455mg/100g). Phenol was also found to be maximum in 5% chitosan (172.27 mg/100 g), followed by 4% Chitosan (127.07 mg/100 g). Estimation of protein also showed a higher amount of (2913.3 mg/100 g) and the lowest was found to be in control (1824.4 mg/100 g) (Fig. 10a). Antioxidant activity in terms of anthocyanin content also showed large variation among all the treatments in which 5% chitosan coated fruits exhibited higher amount (60.58%) and minimum was found to be in control (49.54%) (Fig.10b). This could be attributed to reduced ethylene production caused by modified atmosphere created by the coating material.

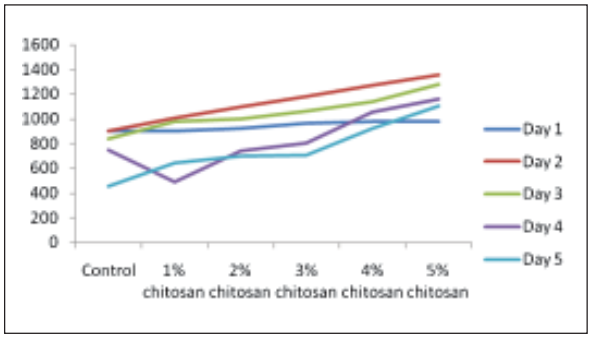


Plate 20 a : Changes in carbohydrate content as influenced by chitosan treatments

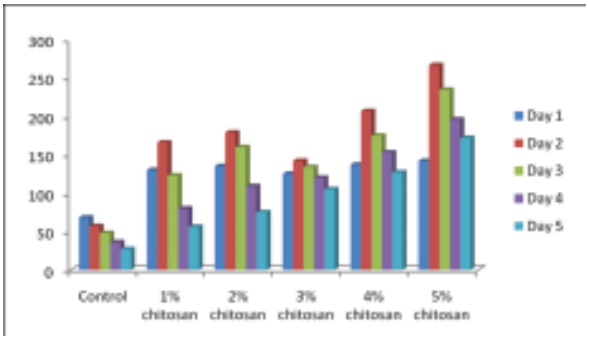


Plate 20 b : Change in phenolic content as influenced by chitosan treatments

Collection, Characterization and Agro-Techniques Standardization of Fruit Crops of Andaman & Nicobar Islands

D. R. Singh, R. Sudha, K. Abirami, Shrawan Singh, M. Sankaran, V. Damodaran and *Naresh Kumar*

Biochemical analysis of Khoon phal

Khoon phal (*Haematocarpus validus*) was collected from the field of Mr. Maninder Mistry, custodian farmer from Diglipur (Plate 21). Phytochemical profiling and estimation of anti-nutritional factors of three different fruit fractions *viz.* pulp, pericarp and seed were carried out and it was found that pulp invariably had the highest amounts of all the estimated phytochemicals; total polyphenol (400 GAE mg/100g), flavonoid (542 RE mg/100g), tannin (275.56 TAE mg/100g) and anthocyanin (203.77 C_3GE mg/100g). Among the anti-nutritional factors, pulp contained lower amounts of nitrate, phytate, saponin and oxalate. The RP- HPLC chromatogram revealed its richness in beta carotenoids (Plate 22 a & b).

Plate 21: Khoon phal fruits

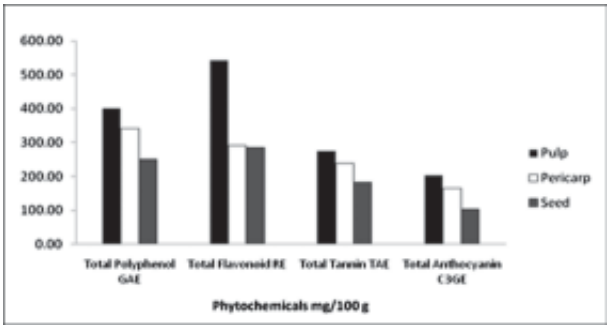


Plate 22 a : Phytochemicals in *Haematocarpus validus*

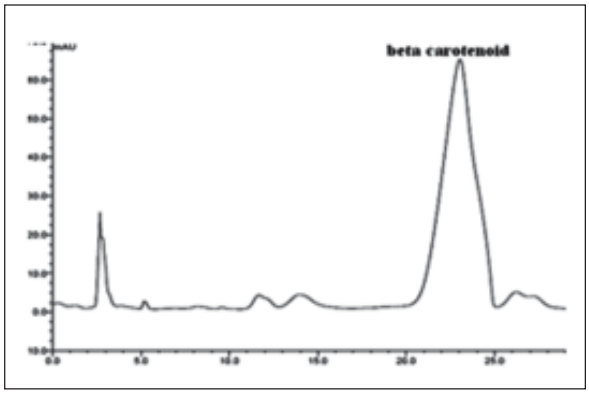


Plate 22 a : β-carotenoid content in *Haematocarpus validus*

Stages of *Haematocarpus validus*

The colour of fruits changes from light green to dark red during fruit development process (Plate 23). The green fruits are not consumed by the local people while dark red coloured ones fully ripe are tasty and most acceptable. At ripe stage fruits are highly rich in antioxidants and other phytochemicals. The unripe green fruits are rich in vitamin C and are used in the form of pickle and chutneys by the islands communities.

Plate 23: Khoon phal at different maturity stages

Collection and evaluation of *Carica papaya* L.

About 20 accessions of papaya, which were collected from Car Nicobar region were screened based on their morphological attributes such as vigorous nature of the tree, free from pest and diseases, free from branching habit, continuous fruiting column, productivity of the plant, marketable size of the fruit, uniformity of the fruit size and flesh colour. Diversity of the collected accessions was analysed using biochemical markers. Physico-chemical characterization of these accessions showed significant diversity within the cultivated papaya. Among the accessions, the fruit weight ranged from 250 g (Tapoimine) to 2.0 kg (Tamaloo) and pulp thickness ranged from 1.70 cm Tamaloo to 3.50 cm (Sawai). TSS content ranged between 6.2 °Brix and 13.2 °Brix (Tapoimine). Variations in fruit shape, size, and flesh colour was also observed in the evaluated accessions. Two red fleshed types observed are accessions from Tapoimine and Kakana (Plate 24).

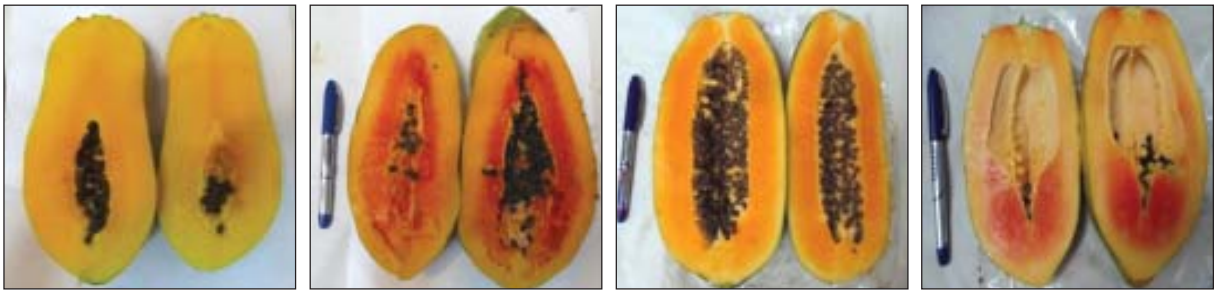


Plate 24: Different accessions of papaya viz. Acc. Tamaloo, Acc. Kakana, Acc. Sawai, Acc. Tapoimine

The level of genetic variation among the 48 papaya accessions collected from Middle and North Andaman was estimated by molecular markers (ISSR). Among the 30 ISSR primers screened against 44 papaya accessions, eleven primers produced polymorphic bands with an average polyphormic information index (PIC) of 0.30. The UPGMA analysis grouped the 44 papaya accessions at 31% similarity into two main clusters (Plate 35) namely cluster A and cluster B. The cluster B consisted of accessions collected from Kadamtala, Mayabunder and Varuntala, all from Middle Andaman. The cluster A consisted of the accessions collected from other parts of Middle and North Andaman. In the cluster B, two sub clusters

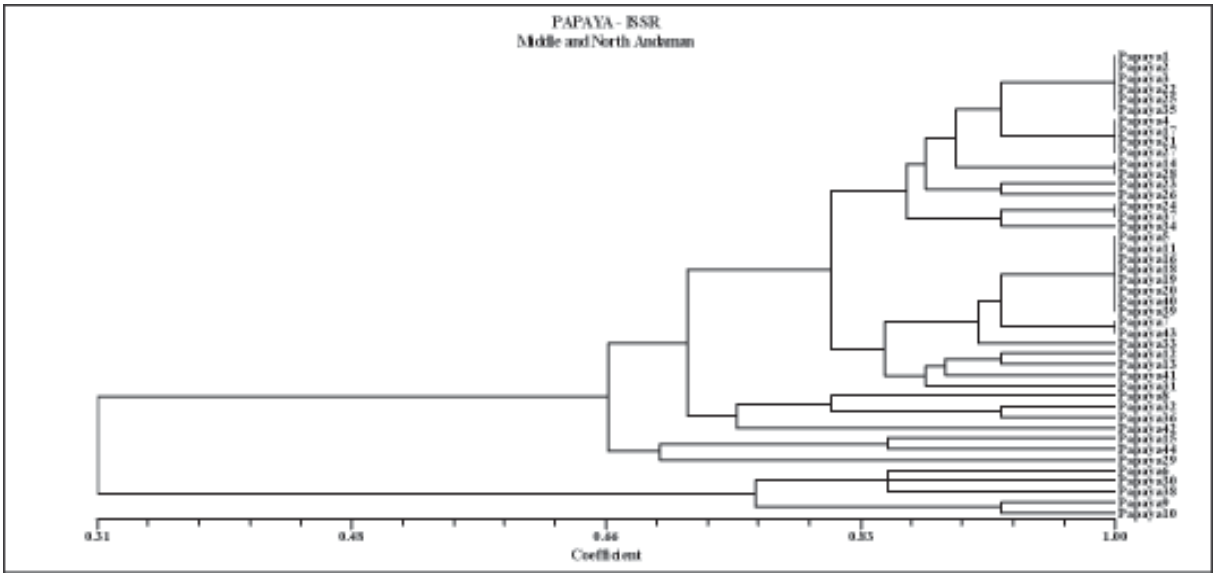


Plate 25 a: Genetic diversity in 44 accessions of papaya of Middle and North Andaman

were formed at the co-efficient value of 0.66. The sub cluster A I consisted of accessions collected from Nimbudera, Mayabunder and Mohanpura. The Sub cluster A II consisted of about 35 accessions, most of which were collected from Diglipur and the remaining accessions from other parts of Middle and North Andaman. Thus, the ISSR markers depict a good degree of genotypic diversity existing among the papaya accessions collected from different regions of Middle and North Andaman.

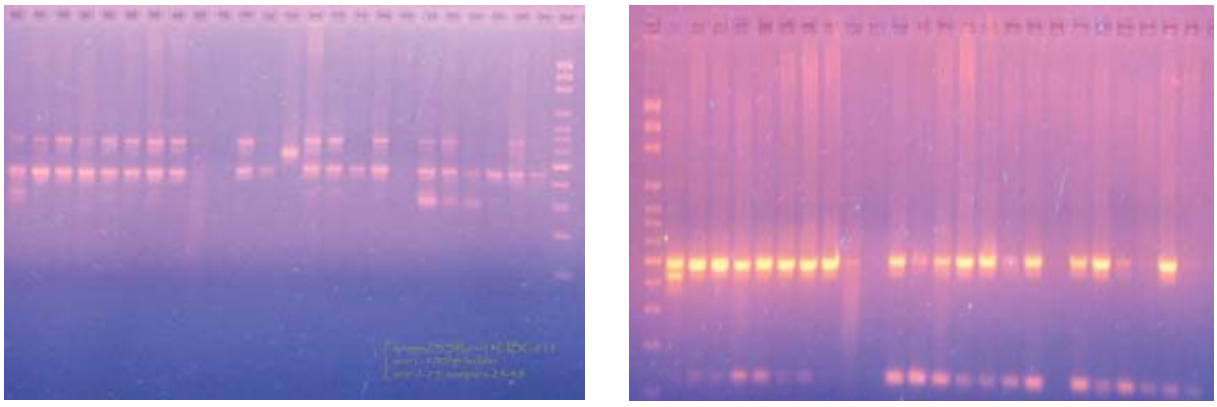


Plate 25 b: PCR profile of 44 papaya accessions with ISSR primers UBC 823 and UBC 842

Among the different accessions evaluated, it was found that the Acc. 3 (Bird line) and Acce. 4 (Rangachan) were dwarf in size (Plate 26 and 27). In the Acc. 3 (Bird line), the plant height recorded was 0.84 m with a stem diameter of 0.14 m. The height at first flowering was at 0.47 m. The next dwarf variety was Accession 4 (Rangachan), with an average plant height of 1.07 m and a stem diameter of 0.2 m. The height at first flowering for the Accession 4 was 0.61 m. With regard to the fruit yield and quality parameters, the accessions Bird line and Rangachan showed early fruiting when compared to other accessions. The pulp colour was yellow in both the accessions, however the number of fruits per tree (11.3), fruit size (21.80 cm length and 48.3 cm girth) and weight (1.85 kg) were maximum in the Accession 4 (Rangachan). The TSS recorded was also maximum (10.83°B) in the Accession 4 (Rangachan),whereas in the Accession 3 (Bird line), the TSS of the fruits was recorded to be 9.87 °B.

Plate 26: Dwarf accession (Birdline)

Plate 27: Dwarf accession (Rangachan) with maximum fruits per plant

Influence of organic sources of nutrients on growth and yield of banana

An experiment was conducted to study the effect of organic nutrients on growth and yield of local banana variety, Mitta Champa. There were eight different combinations of organic treatments consisting of FYM, vermicompost and poultry manure. The growth observations recorded in seven months old banana plants revealed that the treatment combination of FYM and vermicompost showed maximum plant height (162 cm), maximum plant girth (28.4 cm) and maximum number of leaves (8.7) per plant.

Collection and Evaluation of Medicinal Plants of Bay Islands

K. Abirami, D. R. Singh, V. Baskaran and V. Damodaran

Five species of *Zingiber* namely *Zingiber squarrosum Zingiber spectabilis, Zingiber odoriferum* (Plate 28), *Hedychium coronarium and Alpinia galanga* and four accessions of *Gloriosa viz.,* Accession 1 (Andhra local), Accession 2 (Tamil Nadu local), Accession 3 (Chidiyatapu) and Accession 4 (Rangat) were added to the germplasm collection of medicinal plants through exploratory surveys from South and Middle Andaman.

Six Rare, Endangered & Threatened species of medicinal plants like *Moringa oleifera, Oroxylum indicum, Holostemma adakodein, Celastrus paniculatus, Embelia tsejiamcottam* and *Decalphis hamiltonii* were collected from IIHR and conserved at CIARI.

Plate 28: Different species of *Zinziber viz. Z. squarrosum, Z. spectabilis* and *Z. odoriferum*

Propagation and evaluation studies in *Gloriosa superba* L.

Gloriosa superba L., commonly known as glory lily or Kalihari belonging to the family Liliaceae, is a herbaceous climber and is a native of tropical Africa. It is one of the major medicinal plants in India and is found growing naturally in different parts of the Island. Seeds and tubers of this medicinal plant contain valuable alkaloids *viz.,* colchicine and colchicosides which are used to treat gout and rheumatism. Due to the action of colchicoside on spindle fibre formation during cell division, the plant has been identified as a potent anti cancerous drug. The propagation of this medicinal plant is commonly done through 'V' or 'L' shaped tubers. The vegetative propagation is slow in this medicinal plant and hence, the effects of certain growth regulators (GA_3, BA and Kinetin) on the sprouting of tubers were assessed two months after planting. The results showed that GA_3 @ 300 ppm recorded maximum sprouting percentage (82.5%), earlier sprouting of tubers (18.92 days), maximum plant height (81.67 cm), plant girth (1.21 cm) and maximum number of leaves per plant (29.83).

Four accessions of *Gloriosa* collected from different

parts of the Island were evaluated for their growth and yield performance. The morphological observations revealed that Acc. 2 (Tamil Nadu) recorded maximum plant height (136.25 cm) with more number of leaves per plant (68.94) and minimum number of days taken for flower initiation (72.59). The number of flowers (17.86 per plant), pods (8.62 per plant) and seeds per pod (14.12) were maximum in the Acc. 3 (Chidiyatapu) (Plate 29).

Plate 29: *Gloriosa superba*- Acc. 3 (Chidiyatapu) and Acc. 2 (Tamil Nadu)

Evaluation of *Piper* spp. under plantation based cropping system

Long pepper (*Piper longum* L.) is a slender aromatic perennial climber distributed in the Island. Ripened green fruits and roots are used as the raw drug. The fruits are used as spice also. The crop is under cultivation in many parts of the country. *Piper sarmentosum* is another *Piper* species distributed in the Island and is used by the aboriginals for medicine and food. These two species of *Piper* are under evaluation in coconut and arecanut based planting systems under different spacing. There were no significant differences in growth parameters under different spacing in *Piper sarmentosum*. However, under coconut shade the plants showed good growth with maximum plant height (68.52 cm), number of branches (20.4) and number of berries per plant (53.61). The morphological observations were recorded in *Piper longum* six months after planting under coconut and arecanut shade. The results showed that maximum plant height (58.58 cm) and number of berries (13) were recorded under coconut plantation, when compared to arecanut plantation, wherein the plant height was 40.2 cm and number of berries was 4.3 per plant.

Phytochemical profile and antifungal activity of *Cheilocostus speciosus* and *Costus pictus*

Cheilocostus speciosus, known as '*Chanda'* or '*Kushta'* in Sanskrit and '*kebu'* or '*keyu'* in Hindi, is a succulent rhizomatous medicinal herb found widely distributed in the Island. The leaves and rhizomes of *Cheilocostus speciosus* have been reported to possess steroid – diosgenin, which is anti-diabetic in nature. *Costus pictus* is also an important species of the family Costaceae and is widely distributed in the Island. It is a native of South and Central America and newly introduced to India. *Costus pictus* is reported to have effects on renal functions, is anti-inflammatory, diuretic and has hypoglycemic actions. The plant contains flavonoids, saponins, reduced sugars and tannins.

The phytochemical analysis in different parts of the two species namely *Cheilocostus speciosus* and *Costus pictus* revealed that both the species are rich in phytochemical compounds. The phenolic content was maximum in the leaf of *Costus pictus* (101.38 mg/100 g). Maximum ascorbic acid was found in rhizome of *Cheilocostus speciosus* (98.53 mg/100g) followed by rhizome of *Costus pictus* (85.26 mg/100g). Maximum

flavonoid content was found in leaf of *Cheilocostus speciosus* (96.18 mg/100 g) and minimum was observed in roots of *Costus pictus* (48.77 mg/100g). The antioxidant activity was more in rhizome of the two species *Cheilocostus speciosus and Costus pictus* 51.45 and 53.41 respectively when compared to other plant parts.

Antifungal activity of different parts of the two species, *Cheilocostus speciosus and Costus pictus* were tested (Plate 30) against three bacteria *viz. Pythium aphanidermatum, Colletotrichum capsici* and *Sclerotium rolfsii* and the results are tabulated as mentioned in Table 8.

Table 8: Antifungal activity of the extracts of *Cheilocostus speciosus* and *Costus pictus*

Name of the Extract	Name of the Fungal Pathogen		
	Pythium aphanidermatum	*Colletotrichum capsici*	*Sclerotium rolfsii*
C speciosus stem	-	-	-
C speciosus leaf	+	-	-
C speciosus root	+++	-	-
C speciosus rhizome	++	-	-
C pictus stem	+	-	-
C pictus leaf	+	-	-
C pictus root	+++	-	-
C pictus Rhizome	+	-	-

'+' - 0.2-0.5 cm, '++' - 0.5-0.9 cm, '+++' - above 1.0 cm

Among the different fungi tested it was found that the extracts of the two species was effective against *Pythium aphanidermatum* than the two fungi *Colletotrichum capsici* and *Sclerotium rolfsii.* Among the different extracts root extracts of the two species were effective against fungal growth.

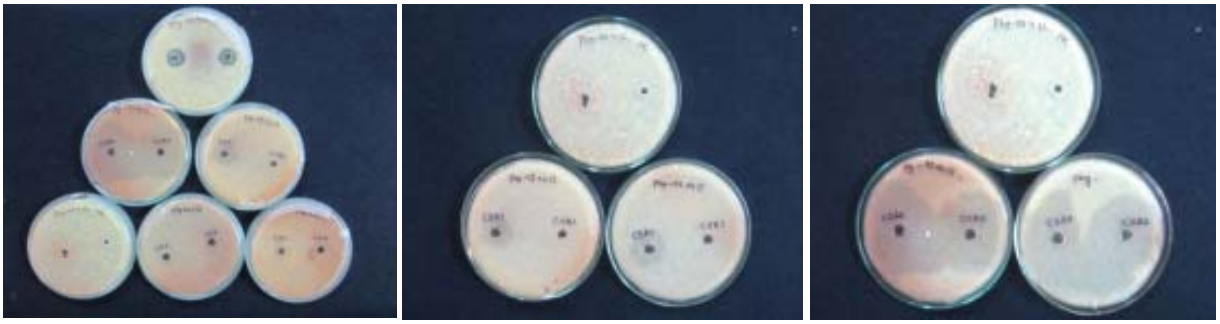


Plate 30: Zone of inhibition by the *Costus sp* against the pathogens

Micro-propagation of *Costus* spp.

The tissue culture experiment was standardized in *Cheilocostus speciosus* and *Costus pictus*. The nodal segments of *Cheilocostus speciosus* and *Costus pictus* were used as explants for the tissue culture experiment. The explants were inoculated in MS media supplemented with different concentrations of growth regulators NAA and Kinetin. The bud break and shoot development was early in *Cheilocostus speciosus* (28.5 days) when compared to *Costus pictus* (46.82) (Plate 31 and 32). Maximum shoot and root growth was observed in the MS media supplemented with 3 mg/L kinetin and 3 mg/L NAA in *Cheilocostus speciosus*.

Plate 31: Shoot growth of Costus pictus on MS media supplemented with 3 mg/L of kinetin and NAA, respectively

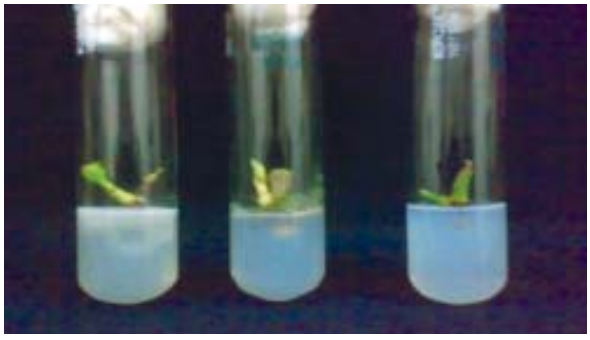
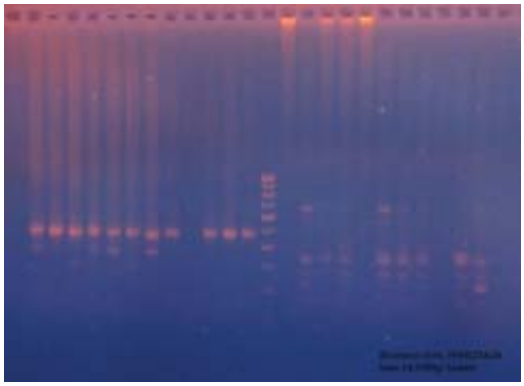


Plate 32 : Shoot, root and leaf development in *Cheilocostus speciosus* inoculated onto MS media

Molecular characterization of *Asplenium nidus*

Asplenium nidus is one of the most important terrestrial fern having great ornamental value (Plate 33). The present study was aimed to assess the inter-relationships among *Asplenium nidus* species collected from various parts of South Andaman forests. A total of 15 samples were collected, DNA was isolated and were screened using RAPD and ISSR markers. A set of 15 ISSR primers were taken for DNA fingerprinting, among 9 primers produced 222 amplicons out of which 60 were polymorphic having 27% polymorphism with 0.452 PIC value. The maximum discriminating bands were obtained from primers UBC 842 and UBC 809 (Plate 34). An assessment of genetic diversity among four *Asplenium nidus* species would assist in planning for future germplasm collection, conservation and domestication programmes.

Plate 33: Field view of *Asplenium nidus*



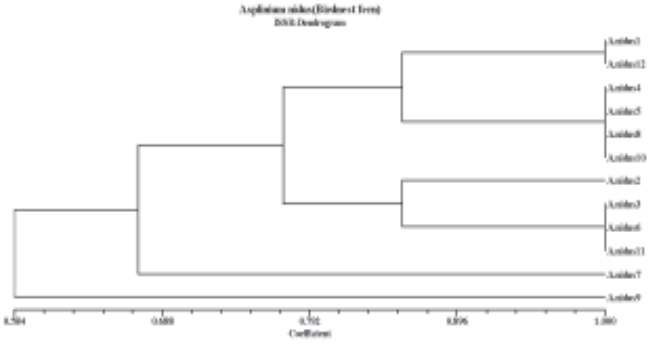


Plate 34: PCR profile of *Asplenium nidus* using ISSR primer (left) and dendrogram showing genetic diversity amongst 15 genotypes of Asplenium nidus by ISSR primers (right)

Development of Production Technology for Ornamental Crops in Bay Islands

V. Baskaran, D. R. Singh, A. Velmurugan and *K. Abirami*

Collection and evaluation of speciality flowers

Nineteen new genotypes were collected and added to the speciality flower germplasm block. At present, a total of about 65 genotypes of speciality flowers have been collected and conserved.

The growth performance of 46 genotypes of speciality flowers was evaluated (Plate 35). It was found that, maximum flower length was recorded in *Heliconia chartaceae* cv. Sexy pink (120 cm), whereas maximum stalk length was recorded *in Heliconia wagenaria* cv. Big Red (85.9 cm) followed by *Heliconia wagenaria* cv. Rainbow (80.5 cm). Cut flower standard *Heliconias* were *Heliconia rostrata, Heliconia wagenaria* cv Rainbow, *Heliconia sp.* cv Emerald Forest, *Heliconia lingulata, Heliconia wagenaria* cv. Shee, *Heliconia stricta, Heliconia chartaceae* cv. Sexy Pink, *Heliconia chartaceae* cv. scarlet orange, *Etlingera elatior* cv. Red, *Etlingera elatior* cv. Pink. Early flowering was recorded in *Heliconia psittacorum* cv. Guyana. Among all speciality flowers, maximum number of flowers per plant was recorded in *Calathea lutea* (82.4). *Heliconia indica* and *Heliconia Psittacorum* cv. Lady Di were found suitable for pot plant cultivation. For landscape gardening purpose, *Heliconia rostrata*, *Heliconia latispatha* cv. Red yellow kairo, *Heliconia latispatha* cv.scarlet orange kairo,*Heliconia psittacorum* cv. Guyana and *Heliconia psittacorum* cv. Petra Orange are highly suitable.

Effect of growth regulators on growth, flowering and tuber yield of calla lily

A pot culture experiment was conducted in Calla lily (*Zantedeschia ellotiana*) to evaluate the performance of growth, flowering and tuber growth by using different growth regulators like GA_3, Kinetin and BA, alone or in combination at different concentrations. The results revealed that the tuber soaking with GA_3 (100 ppm) alone gave best results in terms of early

flowering (65.7 days), stalk length (55.5 cm), number of flowers per plant (5.2) and flower diameter (18.3 cm). However, in terms of vegetative growth parameters, maximum plant height (58.5 cm) was observed in GA_3 @ 200 ppm. Early sprouting (7.5 days) was observed with Kinetin treatment @ 100 ppm. Maximum number of shoots (3.2) was recorded with GA_3 @ 150 ppm. Treatment comprising of BA @ 200 ppm recorded maximum number of leaves per plant (28 leaves/ plant), when compared to control (2.3 leaves /plant). Application of BA @ 200 ppm as tuber soaking overnight is best suited treatment for pot plant and cut foliage production purpose. Double flowering was observed in GA_3 treatment @ 200 ppm.

Plate 35: Speciality flowers germplasm collections maintained at CARI: *Etlingera elatior* cv. Red, *Maranta sp., H. chartacea* cv. Sexy Pink and *H. lingulata*

Propagation and evaluation of chrysanthemum

Terminal cuttings with two pairs of leaves were planted in root trainers with six different substrates like sand, perlite, coir dust, perlite + coirdust (1:1), sand + coirdust (1:1), sand + perlite + coir dust (1:1:1). The plants were kept under glasshouse condition and observed for their root growth and survivability. The results showed that maximum root length, number of rootlets and survivability (22.8 cm, 40.6 and 100%, respectively) were obtained by coir dust compared to all other substrates.

Plate 36 : Promising varieties of chrysanthemum Thaichen Queen, Calcutta Purple and Liliput

Thirty five varieties of chrysanthemum were collected from Indian Agricultural Research Institute, New Delhi to evaluate the growth performance under Island condition. The growth and flowering were good in all the varieties evaluated, which could be utilized for different purposes like cut flowers, pot mums, loose flowers and landscape gardening purpose (Plate 36). Among the cut flower varieties, early flowering, maximum flower diameter (10.2 cm) and maximum duration of flowering (32 days) was recorded in var. Thaichen Queen. In the pot mum varieties, early flowering was recorded in cv. Liliput. The best suited varieties for loose flowers are CO-1, Andaman White and Calcutta Purple. Among the loose flower varieties, maximum number of flowers was recorded in Calcutta Purple.

Development of Dwarf and High Yielding Varieties in Coconut for A & N Islands

M. Sankaran, K. Abirami and V. Damodaran

During 2013-14, the hybridization work was done in 4 different dwarf cross combinations such as CARI Annapurna × CARI Surya, CARI Surya × CARI Omkar, CARI Annapurna × CARI Omkar and CARI Omkar × CARI Annapurna. In D × T cross, a total of 36 female flowers (Andaman dwarfs) was pollinated with Sanraman Tall and with AOT will be taken up in April, 2014. The interse mating was carried out in 8 selected Pacific Ocean accessions and a total of 371 female flowers were interse mated. Selfing was carried out in 3 dwarf varieties (CARI Annapurna, CARI Surya and CARI Omkar) and a total of 183 female flowers were pollinated. Besides, surveyed and collected the seed nuts of 3 dwarf coconuts from Padmanabapuram village, Rangat, for characterization and conservation. Identified and collected the seednuts of a rare form of multiple spicata coconut from South Andaman and persistant petiole and bunch type coconut without vivipary from Lalaji Bay, Long Island, Middle Andaman (Plate 37, 38, 39 & 40).

Plate 37: Crossing in CARI-Annapurna

Plate 38: Rangat Yellow dwarf

Plate 39: Multiple spicata coconut in Andaman Islands

Plate 40: Long Island coconut with persistant petiole

AICRP on Tuber Crops

M. Sankaran and *V. Damodaran*

Collection, conservation, cataloguing and evaluation of genetic resources of tuber crops

During the year, 14 new collections were added to the tuber crop germplasm which now contains 71 accessions of different tuber crops after removing the duplicates through morphological characters (Plate 41 & 42).

Plate 41: Colocasia collections from Car Nicobar

Plate 42: Harminder Bay Collections

IET on Colocasia

An experiment was carried out at Garacharma farm to study the performance of colocasia varieties for growth and yield at Garacharma farm (Plate 43 & 44). Out of 14 varieties evaluated, the varieties such as Sree Kiran (16.0 t/ha), Sree Reshmi (15.8 t/ha), Sree Pallavi (15.5 t/ha) and Diglipur Local-3 (15.7 t/ha) were yielding high as compared to TTr- varieties obtained from CTCRI. With regard to colocasia blight, the entries, TTr-12-2 to TTr 12-8 were found to be resistant as compared to others.

Plate 43: DT-2

Plate 44: Sree Kiran

URT on Sweet potato

Out of 5 sweet potato varieties evaluated, the CARI-SP1 (20.1 t/ha) and CARI-SP2 (18.9 t/ha) were found high yielding as compared to var. Kisan (5.8 t/ha) followed by var. Pusa Safed (5.3 t/ha).

Effect of corm size and spacing in elephant foot yam under coconut plantations

An experiment was conducted with five different sizes of corms (500 g, 400 g, 300 g, 200 g and 100 g) and four spacing *viz*., (1 × 1 m, 90 × 90 cm, 90 × 75 cm

and 75 × 75 cm) and with three replications at Sipighat Farm, to standardize the spacing and size of corm in elephant foot yam for organic cultivation under coconut plantations in Island ecosystem. The result revealed that, planting at 90 × 90 cm spacing with corm size of 500 g recorded highest yield of 55.5 t/ha which was on par 75 × 75 cm with corm size of 500 g (53.9 t/ha) and 75 × 75 cm + 400 g size of corm (50.0 t/ha). Irrespective of spacing, the corm size of 500 g gave best yield of (50-55 t/ha). The spacing of 90 × 90 cm and 500 g corm may be recommended under coconut plantations.

Phenology of Cassava

Phenological study in cassava was carried out (Plate 45) on exploratory basis with the help of poultry feed bags filled with Soil: FYM in 1:1 ratio. It was found that the tuberisation starts 3 months after planting and bulking starts 5 after planting of both H-226 and Sree Jaya recorded the root yield of 2.35 kg/plant in H-226 and 1.80 kg/plant in Sree Jaya after 8 months of planting.

Plate 45: Study of phenology in cassava

Tribal sub plan activities under AICRP on Tuber Crops

An effort was made to impart scientific knowledge on tuber crops cultivation and utilization through participatory mode under All India Coordinated Project on Tuber Crops, funded by Indian Council of Agricultural Research. The model comprises of 300 m^2 of fenced area in the vicinity of the tribal settlement and integrated with backyard poultry and piggery unit at Harminder Bay, Little Andaman was established. Conducted two training programmes on "Cultivation of tuber crops" for Nicobari tribes at Car Nicobar and Harminder Bay. Initially, the planting materials of tuber crops were distributed to the farmers (4 farmers) and subsequently 21 piglets (weighing 2.5-3.0 kg/piglet) and 100 chicks (500-600 g chicks of 6 weeks old) were distributed during September, 2013. Harvested and recorded the yield data of tuber crops from tribal farmer's field after completion of the season. About 130 kg elephant foot yam, 48 kg greater yam and 62 kg colocasia yield were obtained from 300 sq.m. The average growths of piglets and chicks six months after distribution were ranged from 15-16 kg and 1.8-2.0 Kg, respectively.

CSS-National Horticulture Mission Scheme on Spices

M. Sankaran and *V.Damodaran*

Production and distribution of quality planting materials

Multiplied and produced the quality planting materials of black pepper (8000), clove (1000), cinnamon (2000), nutmeg (500) and ginger (500 kg) during 2013-14. About 2160 no. planting materials of Black pepper, clove, nutmeg and cinnamon and 275 kg of seed rhizome of ginger have been distributed to the farmers.

Evaluation of turmeric varieties under coconut plantations

Evaluated eight turmeric varieties for growth and yield under coconut plantations at Sipighat Farm during 2013-14, out of which the variety Zeodarick recorded highest yield of 11.2 t/ha, which was on par with var. Prabha (10.8 t/ha) and Alleppy Supreme Hybrid (9.7 t/ha).

Effect of size of ginger rhizome on growth and yield under coconut plantation

An experiment was conducted at Sippighat farm with different sizes off ginger rhizome (10 g, 20 g, 30 g, 40 g, 50 g and >50 g) with five replications at Sipighat Farm, to standardize size of rhizome for organic cultivation of ginger under coconut plantations in Island ecosystem. The result revealed that, planting of ginger mother rhizome (>50g) size recorded the highest yield (35.6 t/ha). However, the finger rhizome size of 40 and 50 g size were on par with each other with yield of 26.7 t/ha and 30.0 t/ha, respectively.

क्षेत्रीय फसलें प्रभाग

Division of Field Crops

Augmenting Rice Productivity through Varietal Purification of Popular Land Race

R. K. Gautam, P. K. Singh, S. K. Zamir Ahmed and *K. Devakumar*

Multi-location testing of selected C14-8 rice lines

A total of 13 selected lines of C 14-8 rice were evaluated across three locations (Bloomsdale Farm, Port Blair in South Andaman, Diglipur in North Andaman and Sundergarh, Middle Andaman) during *Kharif* 2013. Data were recorded for 15 qualitative and quantitative characters. At Port Blair C14-8-11-113 (3.83 t/ha) ranked first followed by C14-8-11-93 (3.25 t/ha), whereas grain yield of control (Mix) was 2.55 t/ha. At Diglipur, C14-8-11-118 (2.82 t/ha) ranked first followed by C14-8-11-93 (2.75 t/ha and C14-8-11-92 (2.72 t/ha), whereas control yielded 2.26 t/ha. In Middle Andaman, C14-8-11-113 gave maximum yield (2.88 t/ha) followed by C14-8-11-92, C14-8-11-60 and control (2.57 t/ha). The perusal of yield data across 3 locations revealed the overall top performance of C14-8-11-113 (2.93 t/ha) followed by C14-8-11-108 (2.66 t/ha) and C14-8-11-92 (2.60 t/ha) thus revealing the superiority of 19%, 6% and 5%, respectively as compared to control (2.46 t/ha). The above top two performing lines C14-8-11-113 (3.88 t/ha) and C14-8-11-108 (3.70 t/ha) also gave higher yield in OFT conducted by KVK, South Andaman. The post harvest hulling and milling of selected 13 lines revealed that C14-8-11-113 also showed maximum head rice recovery (71.13%) (Plate 46 a).

Evaluation and characterization of rice landraces

During *kharif* 2013, a total of 100 panicle to row progenies each of Black Burma and Khusbayya were transplanted each having 20 plants in each row by following a spacing of 20 X 15 cm at Bloomsdale Research Farm, CIARI, Port Blair. Recommended package of practices were followed. A total of 15 top yielding lines each of Black Burma and Khusbayya were selected for further testing. Besides, characterization for 60 DUS (distinctness, uniformity and stability) traits were completed for 7 rice land races.

We report rare occurrence of "open floret" trait in an indigenous rice germplasm ANR38 of A & N Islands. The variant is tall, photo-sensitive, has long, erect dark green leaves and can be used as a donor for parental line improvement of hybrid rice for achieving higher seed set (Plate 46 b).

Plate 46 a : Rice land races at Bloomsdale Farm

Plate 46 b:Open florets in ANR 38

Marker Assisted Introgression of Bacterial Blight Resistance in Popular Rice Cultivars of Andaman and Nicobar Islands

R. K. Gautam, Naresh Kumar, P. K. Singh, Krishna Kumar and Israr Ahmad

Disease reaction of the IRBB lines for native bacterial blight (BB) isolates

The reaction of 21 rice BB differentials possessing *Xa1* to *Xa21* genes individually and in different combinations were recorded against 14 isolates of pathogen collected from different islands. Pathological screening results revealed that among individual genes tested across two years, *Xa4, Xa7* and *Xa21* conferred resistance reaction across all isolates, whereas among combinations, IRBB50 (*Xa4+xa5*), IRBB52 (*Xa4+Xa21*) and IRBB60 (*Xa4+xa5+xa13+Xa21*) conveyed effective resistance against tested isolates. The nature of genetic diversity among four isolates selected on the basis of geographical isolation in the islands was studied through DNA finger printing. The RAPD primers S111, S119, S1117, S119, S1103, S109 and S105 were found to be better indicators of molecular diversity among isolates than JEL primers.

Plate 47: BB reaction after artificial inoculation

Plate 48: Parents and F1s growing in field

Back-crosses attempted

Back-crosses were attempted between F_1s [C14-8x IRBB 60 (*Xa* 4, *Xa* 5, *Xa* 13 and *Xa* 21) and CARI Dhan 5 x IRBB 60 (*Xa* 4, *Xa* 5, *Xa* 13 and *Xa* 21)] and the respective recurrent parents during kharif 2013. Seeds of BC_1F_{1s}, F_{2s} and selfed progenies were obtained for further resistance transfer.

Genotyping of the recurrent, non recurrent parents and F_{1s}

The gene linked primers associated with the resistance genes *Xa4, xa5, xa13* and *Xa21* were run on the recurrent parents (CARI Dhan 5 and C14-8), donor (IRBB60) and the F_{1s} generated (CARI Dhan 5 x IRBB60 and C14-8 x IRBB60). The genotyping of the material confirmed the hybridity of the F_{1s} through presence of resistance genes.

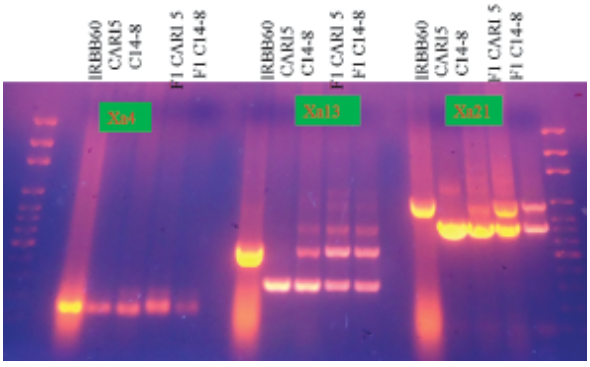


Plate 49: Presence of *Xa/xa* genes in the IRBB60 (donor) and the F_{1s} revealed through gene linked primers

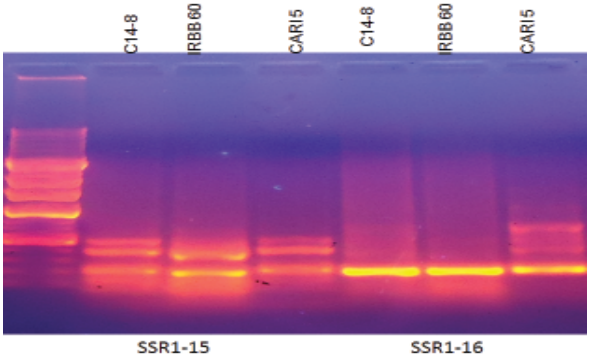


Plate 50: Parental polymorphism between donor and recipient parents

Similarly, parental polymorphism survey was done between donor and recipient varieties using 75 HvSSR markers to select polymorphic markers associated with the recipient parents for making background selection in later generations. Out of 75 SSR markers used 20 and 25 have exhibited parental polymorphism with C14-8 and CARI Dhan 5, respectively compared to IRBB60.

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

R. K. Gautam, P.K. Singh, A. K. Singh, S. K. Zamir Ahmed, A. Velmurugan and Naresh Kumar

Farmers Participatory Variety Selection in Salinity Tolerant Breeding Network Trial

A total 31 salt tolerant rice entries were evaluated in dual soil stress i.e. saline (ECe~4.5 dS/m) and acid sulphate soils (pH 5.5) at North Wandoor, Port Blair in replicated trials. The crop nursery were raised in the month of June, 2013 and one month old seedlings were transplanted in the main field at the spacing of 20 x 15 cm. with recommended dose of N, P, K @ 90:60:40 kg/ha. Data were recorded for 6 quantitative characters *viz*. days to 50% flowering, days to maturity, plant height (cm), number of effective tillers/hill, panicle length (cm), and grain yield (t/ha). The yield data revealed that two lines *viz*. NDRK 11-2 (2.35 t/ha) and RP4353MSC 28-43-6 (2.32 t/ ha) exhibited numerically higher yield than the best check variety

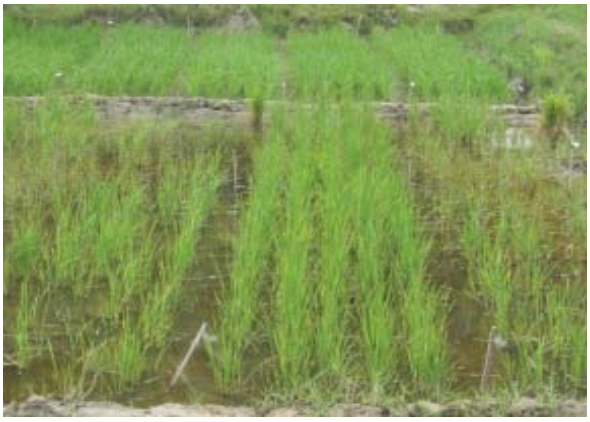


Plate 51: Salt tolerant rice varieties evaluation in North Wandoor

CST 7-1 (2.20 t/ha) under combined stress of salinity and acid sulphate soils. However, the farmers participatory variety selection at the tested site revealed that male farmers gave maximum votes (12) to the variety CSR-(D) 2-17-5 followed by CST 7-1 (6). On the other hand female farmers casted maximum votes (9) for CST 7-1 followed by CSR-(D) 2-17-5 (8). The participating scientists gave maximum votes (4) in favour of CST 7-1. Considering the yield superiority and farmers' preference, CST7-1 turned out to be the most promising variety for salt stress conditions in the islands.

Seed distribution of salt tolerant rice varieties

During 2013-14, four quintal seed of CARI Dhan 5 and CSR36 were distributed to farmers in Campbell Bay for increasing rice productivity in salinity areas in Great Nicobar. The demand of seed of salt tolerant rice varieties, CARI Dhan 5 and CSR36 were also been received from the farmers in the project areas for Kharif 2014.

ICAR Seed Project on Seed Production in Agricultural Crops

P. K. Singh and A. K. Singh

A total of 120 kg of Nucleus Seed of 5 rice varieties (CARI Dhan 1, 2,3,4, and 5) and 465 kg of Breeder Seed of 12 varieties were produced at CIARI Farm, Port Blair. In addition, 33.70 quintal Truthfully Labelled Seed of 5 rice varieties (CARI Dhan 3, 4, 5, CSR 36 and Gayatri) were produced under Farmers Participatory mode in four villages through Out Reach Centre at Diglipur during *Kharif*, 2013. Besides, three days training on "Quality Seed Production of Agricultural Crops" was conducted during 9 to 11 November, 2013 at ORC, Diglipur in which a total of 124 farmers were benefited. In addition a total of 7.5 kg breeder seed of bacterial wilt resistant brinjal variety "CARI Brinjal 1" was also produced during *Rabi* 2013 at Bloomsdale Farm.

Plate 52: Breeder and Truthfully Labelled Seed production of rice (left) and training (right)

Plate 53: Breeder Seed production of Brinjal variety CARI Brinjal-1

Varieties released

Three varieties (2 in rice and one in brinjal) developed by Division of Field Crops, CIARI, Port Blair have been released by Institute Variety Release Committee during 2013. The details of these varieties are given below:

CARI Dhan 6 (ANR 7)

It is a bacterial leaf blight resistant, medium duration (125 days), long slender grain, high yielding (5 to 5.5 t/ha) rice variety for rainfed lowland conditions of Andaman and Nicobar Islands. It is short statured (100 cm) and bears 7-8 effective tillers (panicle bearing) per plant with panicle length of 24 cm.

CARI Dhan 7 (ANR 12)

It is a medium duration (130 days), bacterial leaf blight resistant, medium slender grain, high yielding (5 to 5.5 t/ha) rice variety suitable for rainfed low land conditions of Andaman and Nicobar Islands. It is short statured (100 cm) and bears 6-7 tillers per plant with panicle length of 25 cm. It is resistant for lodging.

CARI Brinjal 1

It is a high yielding (25-35 t/ha fruit yield), bacterial wilt resistant brinjal variety for island conditions. Its plants are medium tall with profuse branching. Fruits are light green and oblong in shape with less seeds. This variety also exhibited drought tolerant ability during water stress situations and are suitable for growing in islands conditions during dry season (October to May).

Plate 54: a (CARI Brinjal 1 Fruits) b (Bacterial wilt susceptible variety Mukta Keshi) and c (Bacterial wilt resistant variety CARI Brinjal 1)

Genetic Improvement of Pulses for Andaman & Nicobar Islands Conditions

Awnindra K Singh, Naresh Kumar, P.K. Singh and R.K. Gautam

Collection of mungbean, urdbean and pigeonpea germplasm

A total 19 of mungbean, 23 urdbean and 27 accessions of pigeon pea local landraces were collected from the different Islands, IIPR, Kanpur and SAU's. A wild relative accession of *Vigna* spp. *Vigna marina* of pigeonpea was collected from Car Nicobar, Chidiyatapu and Manjery. The wild relatives exhibited tolerance against salt and drought stresses. The genetic relatedness of the wild relatives with landraces and cultivated varieties of mungbean, urdbean and cowpea was revealed using RAPD and ISSR markers (Plate 11).

Evaluation and characterization of local landraces of Mungbean and Urdbean

Mungbean and Urdbean (PGET and Preliminary Evaluation Trial)

Fourty eight local landraces along with 8 National checks of mungbean were evaluated in an augmented block design. The accessions ANM-12-02, ANM-11-12, ANM-12-01, ANM-11-08, ANM-11-15 and ANM-11-5 showed significant higher seed yield plant^{-1} over the best check Pusa Vishal, VBN-3 and IPM-02-3. Further evaluation of 18 selected lines of local landraces along with 6 National entries and 3 checks revealed significant superiority of landraces ANM-12-02 (24.76 g), ANM-12-01 (23.78 g), ANM-11-12 (22.96 g), IPM-02-14 (21.46 g) and ANM-11-08 (21.38 g) for seed yield per plant over the checks VBN-3 (17.48 g), HUM-16 (16.38 g) and Pusa Vishal (15.84 g).

A set of 68 local landraces along with 39 advanced lines and nine standard checks of urdbean were evaluated in an augmented block design. Twelve local landraces *viz*. ANU-11-05, ANU-11-10, ANU-11-11, ANU-11-13, ANU-11-22-1, ANU-11-29, ANU-11-31, ANU-11-40, ANU-11-43, ANU-11-45, ANU-11-50 and ANU-11-56 along with 7 advanced lines and checks NDU-94-3, PU-09-36, COBG-653, NDU-95-6, Vamban-7, Co-6 and IPU-02-43 showed tolerant against water logging and resistant against Powdery mildew, Cercospora leaf spot and Leaf curl virus diseases. Further, the 23 promising landraces of urdbean selected from previous year germplasm evaluation trial were evaluated in preliminary yield evaluation trial along with 4 National checks. The genotypes ANU-11-19, ANU-11-10, ANU-11-29, ANU-11-34, ANU-11-11 and ANU-11-22-1 showed significantly higher seed yield per plot as against the standard checksVBN-6, Uttara and IPU 02-43.

Evaluation of Advanced Breeding Lines of Mungbean and Urdbean

Eleven promising lines of mungbean along with 7 National checks were evaluated. The genotypes ANM-12-02 (21.92 q ha^{-1}), ANM-11-12 (21.19 q ha^{-1}) and ANM-11-08 (18.16 q ha^{-1}) showed significantly higher seed yield against the best checks Pusa Vishal (15.64q ha^{-1}), ML-1165 (15.37q ha^{-1}) and IPM-02-3 (15.17q ha^{-1}). The landraces ANM-12-02, ANM-11-12, ANM-12-01, ANM-11-05, ANM-11-08, ANM-11-15 and ANM-11-07-2 also showed resistant against Charcoal rot, Cercospora leaf spot and MYMV diseases of mungbean.

Further, 16 promising landraces of urdbean selected from previous year germplasm evaluation trial were evaluated in an advanced breeding trial during *Rabi* 2013-14 along with 7 standard check varieties. Five genotypes namely ANU-11-29 (14.02 q ha^{-1}), ANU-11-10 (13.82 q ha^{-1}), ANU-11-19 (13.78 q ha^{-1}), ANU-11-11 (13.38 q ha^{-1}) and ANU-12-01 (12.71 q ha^{-1}) showed significantly higher seed yield against standard checks *viz*. LBG-752 (11.74 q ha^{-1}) and ADT-3 (10.86 q ha^{-1}). The genotypes namely, ANU-12-01, ANU-

11-29, ANU-11-10 and ANU-11-19 also showed the resistant reaction against Leaf curl virus, Powdery mildew, Cercospora leaf spot and MYMV diseases.

Evaluation and characterization of Pigeonpea (Germplasm evaluation trial)

Twenty eight local landraces of pigeonpea along with18 advanced lines procured from IIPR were evaluated in germplasm evaluation trial. Among 46 entries 7 local landraces namely, ANP-13-03 (87.36 g), ANP-13-01 (83.57 g), ANP-11-13 (77.96 g), ANP-13-02 (77.96 g), ANP-12-02 (64.06), ANP-11-12-2 (61.26 g) and ANP-11-14 (61.26 g) while, two advanced breeding lines IPAC-68 (94.25 g) and IPAC-7-2 showed significant higher seed yield per plant over the best check NA-1. The entries ANP-13-03, ANP-12-02 and ANP-11-13 showed multiple resistance against insect-pest and diseases, besides significant better plant growth parameters including number of branches per plant and pod characteristics.

AICRP on MULLaRP (Rabi Mungbean & Urdbean trials)

Awnindra K. Singh

A total of twelve entries of mungbean along with 3 promising landraces ANM-11-12, ANM-11-08 and ANM-11-05 under Initial Varietal Trial (IVT) were tested for *Rabi* mungbean. The entries ANM-11-12 (9.58 q ha^{-1}), RM-13-125 (7.92 q ha^{-1}), ANM-11-05 (7.20 q ha^{-1}), ANM-11-08 (7.05 q ha^{-1}) and RM-13-126 (6.62 q ha^{-1}) were found best for seed yield and yield associated traits. The entries also exhibited resistance against Charcoal rot and Cercospora leaf spot diseases. In urdbean, IVT 7 entries including promising landraces namely, ANU-11-10 (11.74 q ha^{-1}), ANU-11-19 (11.67 q ha^{-1}), RU-13-112 (11.46 q ha^{-1}), RU-13-112 (10.74 q ha^{-1}), ANU-11-29 (10.38 q ha^{-1}), RU-13-110 (10.02 q ha^{-1}) and RU-13-114 (9.45 q ha^{-1}) exhibited significantly higher seed yield. While in AVT-1 genotypes ANU-11-19 (13.55 q ha^{-1}), RU-13-119 (13.40 q ha^{-1}), ANU-11-10 (12.04 q ha^{-1}) and RU-13-121 (10.46 q ha^{-1}) showed significant superiority for seed yield.

Plate 55: *Vigna marina* and its molecular relatedness with entries and landraces of mungbean, urdbean and cowpea using RAPD markers

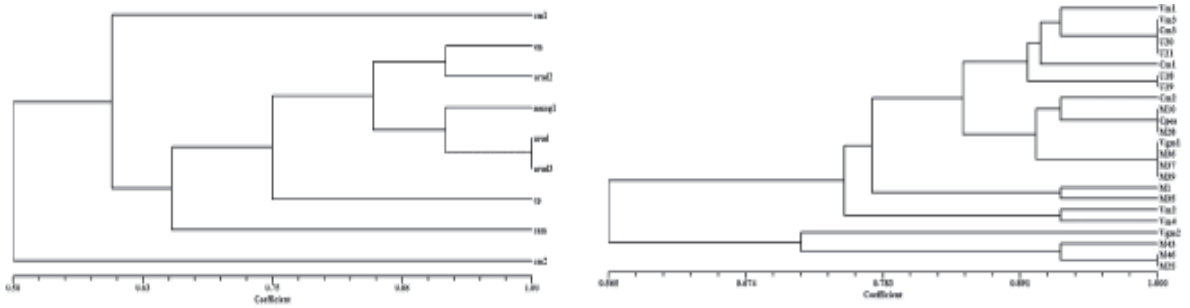


Plate 56: Dendrogram of RAPD and ISSR markers showing relatedness of *Vigna marina* with cultivated varieties

Plate 57: Mungbean landrace ANM-11-12

Plate 58: Urdbean landrace ANU-11-52

Plate 59: Promising mungbean landrace ANM-12-02

Plate 60: Promising mungbean landrace ANU-12-01

Plate 61: Promising Pigeonpea landraces

Plate 62: Promising pigeonpea advance lines IPAC-68

Plate 63 & 64: AICRP on MULLaRP mungbean and urdbean trials IVT& AVT

Monitoring of Pesticides Residue Analysis at National Level

Awnindra K. Singh

A total 264 different vegetable samples of bitter gourd, okra, brinjal, cowpea, tomato, cucumber, cauliflower and green chili were periodically collected at an interval of 10-15 days from vendors of South, Middle and North Andaman vegetable markets. Similarly water samples were collected from cultivation area of farmer's ponds of South, Middle and North Andaman. The vegetable and water samples were analyzed for Maximum Residue Limit at Regional Plant Quarantine Station (RPQS), Chennai. Results revealed that out of 264 vegetable samples analyzed only 2 of green chilli, 4 each of cauliflower and cowpea were found to have pesticide above Maximum Residue Limit (MRL).

Development of Biotic Stress Resistant Lines in Brinjal (*Solanum melongena* L.)

Naresh Kumar, Shrawan Singh, P.K. Singh and *Krishna Kumar*

Development of bacterial wilt resistant lines

Three brinjal lines (CARI Brinjal 2, CARI Brinjal 3 and CARI Brinjal 4) resistant to bacterial wilt have been developed. The lines are derived through pedigree selection from the cross CARI Brinjal 1 X Pusa Purple Long. The selection of resistant lines having recessive gene family for resistance against bacterial wilt was practiced under sick plot conditions up to F_6 level. During the advancement to F_7 level, the selected progenies from the single fruits of resistant plants were artificially challenged by the pathogen (*Ralstonia solanacearum*) @1× 10^7 cfu once at 21 days seedlings stage in pots and the same plants were again challenged after 21 days waiting period. No incidence of wilt was recorded up to 65 days of plants in pots. After this half of the challenged plants were transplanted in field at 65 days causing physical injury to roots. The plants survived the inoculum even after second transplanting which indicates that the selected lines are resistanct against bacterial wilt pathogen.

Plate 65: Brinjal lines after 21 days of inoculation with pathogen (*Ralstonia solanecearum)*

Wide cross (Solanum melongena X S. torvum) derivaties

The wide cross segregating population (F_2) of a local susceptible accession of cultivated brinjal (*S. melongena*) and wild relative *S. torvum* (highly resistant to all kinds of wilt) was transplanted in field and challenged with bacterial wilt pathogen. F_2 progeny rose from the single fruit of F_1 plant comprising of 110 plants. A set of 40 plants were inoculated with the *Ralstonia solanacearum* (1x 10^8 cfu) after 21days of transplanting. 31 plants died within 30 days after inoculation, while 9 plants survived suggesting a recessive inheritance of bacterial wilt. However, the mortality of plants was not sudden rather it happened over a period of time. The population showed a trend of recessive gene action with additive action.

Biotic stresses on wild relatives of brinjal

The accessions of *S. torvum* and *S. viarum* were raised in field for their maintenance and further utilization as genetic resources. No incidence of bacterial wilt was observed in *S. torvum* even after inoculation with the pathogen *Ralstonia solanacearum* (1x 10^8 cfu) and incidence of fruit and shoot borer was observed in *S. viarum* under field conditions.

Introduction and Evaluation of Maize Hybrids in Andaman and Nicobar Islands

Naresh Kumar

Introduction and evaluation

The hybrid maize technology has been introduced in Andaman and Nicobar Islands after the initial exploratory trials of eight hybrids during post paddy season 2011-12. Subsequently during 2012- 13 and 2013-14 the evaluation of QPM and baby corn was done. DHM 117 (8.0 t/ ha) gave the highest yield in normal maize category In case of quality protein maize HQPM 1, HQPM4, HQPM 7 and Vivek QPM 9 were found at par with average yield 6.8 ton/ ha. HM4 has consistently performed well for baby corn production with average production of five baby corns per plant and yield of 4 t/ ha.

AICRP results

Four trials of All India Coordinated Research Project on maize improvement comprising of QPM, Early,

Medium and Late maturity group were conducted as per the guidelines of DMR, New Delhi. QPM trial was conducted at Garacharma farm and maturity group trials were conducted at Bloomsdale farm.

Eight Hybrids were tested in three replications under QPM category in which DMR101 gave the highest yield (6.93 t/ha) followed by DMR 805 (6.39 t/ha). In early maturity group, 11 hybrids were tested in which DMR 302 gave highest yield (5.4 t/ha) followed by DMR 310 (4.86 t/ha) and DMR309 (4.5 t/ha). In case of IET medium duration 25 entries were tested wherein DMR 220 (7.3 t/ha), DMR 223 and DMR 206 (6.4 t/ha) gave better yield. In IET late maturity group 31 entries were tested in which DMR 140 gave highest yield (10.3 t/ha) followed by DMR 117 (10.03 t/ha) and DMR 147 (9.36 t/ha) respectively.

Induction of Systemic Resistance through Application of Potential Antagonistic Microorganisms against *Ralstonia Solanacearum* causing Bacterial Wilt of Solanaceous Crops

K. Sakthivel

Identification of phylotype and race

The fourteen isolates of *Ralstonia solanacearum* were collected from different locations of Andaman Islands from four different solanaceous vegetables (tomato, brinjal, chillies and capsicum) and were subjected to Phylotype identification using multiplex PCR. The specific amplification of 289 bp and 150 bp DNA fragment by all the isolates confirmed the presence of Phylotype I among Andaman bacterial wilt pathogen. All fourteen isolates were also tested for race identification using "injection infilteration technique" on tobacco plants. The appearance of necrotic spots in the infilterated region on fourth day, systemic infection and wilting of whole plant within one week by all the isolates confirmed the presence of race 1 among Andaman isolates.

Cross infection studies

All the bacterial wilt pathogen isolates collected from different hosts were tested for their cross infection ability under glass house conditions by inoculating each in three solanaceous plants (tomato, brinjal and chillies). The results revealed that all isolates from different hosts could infect other two hosts and could induce wilt symptoms within 4- 21 days interval.

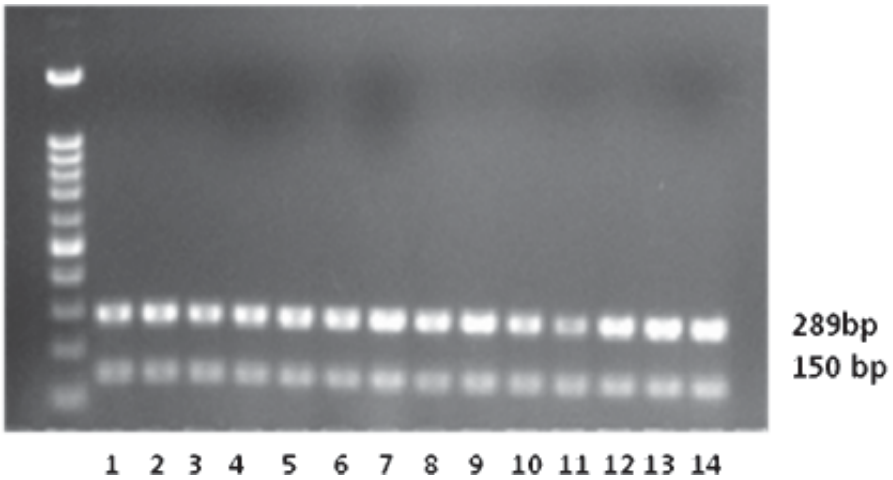


Plate 66: Phylotype identification using multiplex PCR technique

0 days after inoculation | 4 days after inoculation | 1 week after inoculation

Plate 67: Race confirmation of bacterial wilt pathogen isolates through "injection infilteration technique" on Tobacco plants.

Exploration of Plant Pathogenic and Antagonistic Microbial Resources Associated with Vegetable and Spice Crops of Andaman and Nicobar Islands

Krishna Kumar* and *K. Sakthivel

Among 58 multi potential Plant Growth Promoting Rhizobacteria (PGPR's) tested against virulent isolates of rice bacterial blight pathogen *(Xanthomonas oryzae pv oryzae*) under *in-vitro* conditions revealed that six isolates (SA1, SA2, SA3, SA8, SA12 and SA29) were found best in inhibiting the pathogen growth. The molecular characterization of the screened isolates using 16SrDNA amplification revealed that all the isolates belong to the genera *Bacillus* and *Psuedomonas.*

Thirty five *Trichoderma* isolates from different locations of South Andaman were characterized for their morphological, biochemical and antagonistic activities against three plant pathogens (*Sclerotium oryzae, Fusarium oxysporium* and *Pythium aphanidermatum*). The isolates TDK2, TRC3, TNB6 and THB3 were the most efficient in percent inhibition of mycelial growth of test pathogens. TRV1 and TRC3 showed highest chitinase, whereas TDK2 was recorded with highest cellulase and protease activities. The ITS and tef gene characterization showed that four species (*T. harzianum, T. aureoviride, T. asperellum* and *T. koningiopsis*) were more prevalent among all the isolates.

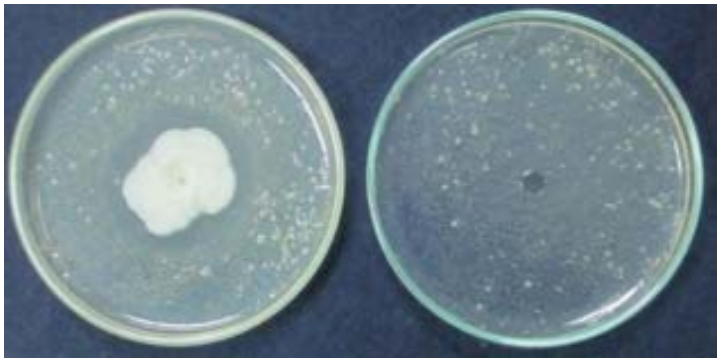


Plate 68: *In vitro* antagonism of *Bacillus sp* against rice BB pathogen (*Xanthomonas oryzaepv oryzae)*

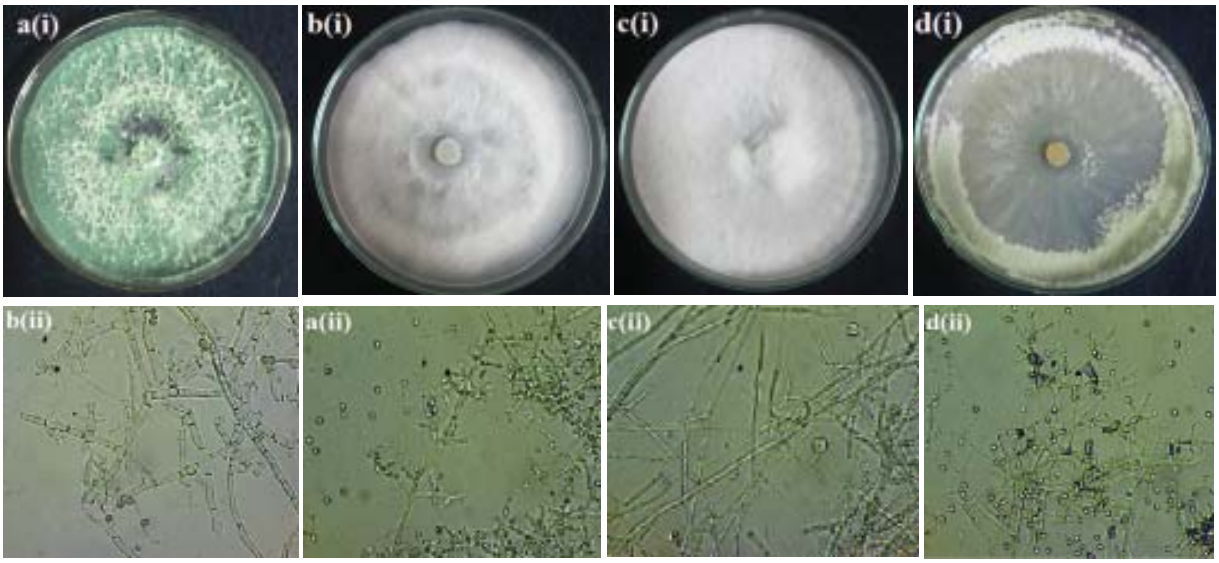


Plate 69: Morphological and microscopic characteristics of *Trichoderma* species.
a - *T. harzianum*, b - *T. asperellum*, c - *T. konigiopsis*, d - *T. aureoviride*.

All India Network Project on Rodent Control

K. Sakthivel* and *T. Bharathimeena

Three villages from South Andaman viz Rangachang, Burmanallah and Calicut with high rodent infestation of about 71%, 78% and 81% respectively and with the nut damage ranging from 12.81 to 27.51 % were selected to test the effect of two new generation rodenticides (Flocumafen and Difenacoum). Two trials were conducted in two different seasons (April-May and August-September) during 2013.

In Difenacoum treated plots, rodent infestation rate was decreased dramatically and the rodent control success after 15 days of pulsing ranged from 76.92% to 84.5% in all three fields, whereas control success in nut damage was 94.91% to 97.59% respectively. In Flocumafen treated plots, rodent infestation rate was decreased dramatically and the rodent control success after 15 days of pulsing was recorded about 89.74% to 97.18% whereas 100 % control success in nut damage was obtained in the experimental fields.

Besides both the rodenticides were effective up to 2 months in controlling rodents in coconut plantations even with single pulsing. In the present study, crown application of Flocumafen readymade rodenticide cakes to the coconut palm was found more effective as its rodent control success was recorded higher than the Difenacoum rodenticide cakes.

Plate 70: a & b) Rats on the coconut trees in experimental field. c) Rodent damaged fresh coconuts. d) Crown baiting of rodenticide. e) Rat eaten rodenticide piece. f) Dead rat in the experimental field.

पशु विज्ञान प्रभाग

Division of Animal Science

Rejuvenation and Improvement of Endangered Nicobari Fowl through Collection, Propagation, Selection and Conservation

A. Kundu, T. Sujatha, Zachariah George and N.C. Choudhuri

A total of 50 number of Nicobari fowls were collect from Nicobar group of Islands mostly from the field of Car Nicobar. The birds were reared, multiplied and propagated at Institute farm. The black variety of Nicobari fowl were subjected to selection for short shank length from the population maintained at farm as well as from the population collected from field. Based on segregation for short shank length at sexual maturity, base population of 200 were selected. F_1 progeny from the selected population was propagated to 1000 numbers. F_2 progeny were produced from F_1 population that segregated for short shank length at sexual maturity. A total of 1500 F_2 were evaluated for production performance.

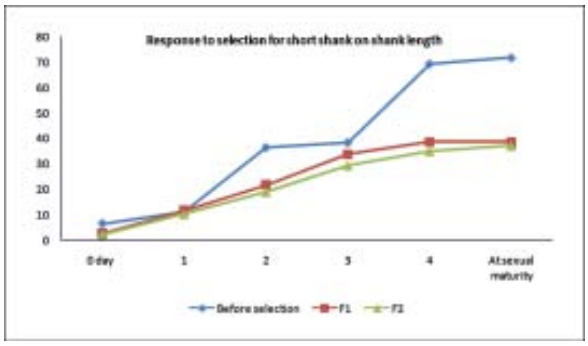


Fig. 10: Response to selection for short shank length on Shank length in black Nicobari Fowl

Table 9: Effect of selection for short shank length on shank length of Nicobari fowl

	Shank length (mm)					
Age in months →	0 day	1	2	3	4	Age at sexual maturity(ASM)
Generations ↓						
Before selection	$6.56^{b} \pm 0.56$	$11.5^{b} \pm 1.29$	$15.57^{b} \pm 2.37$	$20.33^{b} \pm 1.75$	$25.21^{b} \pm 4.18$	$44.28^{b} \pm 5.23$
F_1	$2.8^{a} \pm 0.80$	$11.76^{a} \pm 1.50$	$24.57^{a} \pm 2.00$	$33.85^{a} \pm 2.63$	$38.71^{a} \pm 3.46$	$38.62^{a} \pm 4.13$
F_2	$2.39^{a} \pm 0.55$	$10.43^{a} \pm 0.68$	$21.8^{a} \pm 0.94$	$29.47^{a} \pm 1.99$	$35.07^{a} \pm 2.01$	$37.25^{a} \pm 1.98$

Values in the same column with different superscripts differ significantly ($p<0.01$)

Table 10: Effect of selection for short shank length on growth performance of Nicobari fowl

Age in months →	0 day	1	2	3	4	Weight at sexual maturity
Generations ↓						
Before selection	30.96±0.67	172.0±0.80	343.2±41.0	512.4±36.2	$702.6^{b} \pm 45.1$	$1196.2^{b} \pm 50.2$
F_1	30.13±20.2	188.6±40.1	492.7±44.7	792.6±55.5	$980.3^{a} \pm 68.5$	$1201.6^{b} \pm 70.2$
F_2	28.83±20.3	200.5±35.7	384.6±41.7	632.4±43.1	$1006.5^{a} \pm 50.1$	$1327.9^{a} \pm 66.3$

Values in the same column with different superscripts differ significantly ($p<0.01$)

From Table 9, it is evident that there was gradual shorter shank length in F_1 and F_2 as compared to before selection group from zero day upto age at sexual maturity. Shank length (mm) in the F_1 progeny of Nicobari fowl was found to be low due to selection for short shank length based on segregation at age of sexual maturity as compared to population before selection for short shank. While, response to selection for short shank in F_2 progeny was less as compared to F_1.

Selection for shank length influenced body weight during the growing phase. There was gradual increase of body weight in F_1 and in F_2 generation in all the ages of measurements except 2nd and 3rd month of age. The adult body weight at sexual maturity was higher in F_2 as compared to both F_1 and before selection.

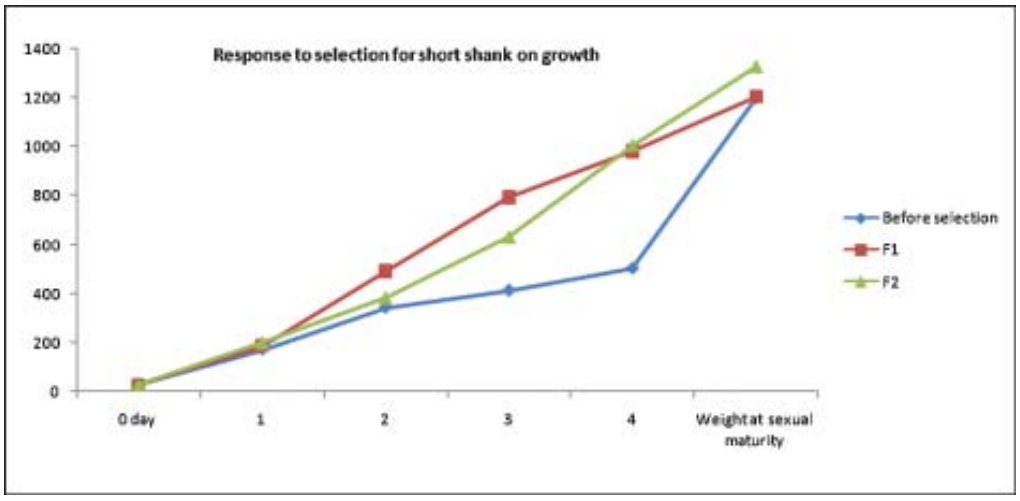


Fig 11: Response to selection for short shank length on growth in Nicobari fowl

Table 11: Effect of selection for short shank length on egg production performance of Nicobari fowl

Traits	Before selection	F1
Age at sexual maturity	150 days	145 days
HDEP at 24 week of age	$12.22^{b}\pm 5.75$	$23.88^{a}\pm 2.70$
HDEP EP at 28 weeks of age	$61.55^{a}\pm 4.77$	$52.83^{b}\pm 1.77$
HDEP at 32weeks of age	$70.44^{b}\pm 3.36$	$82.22^{a}\pm 3.92$
HDEP at 36weeks of age	$53.33^{b}\pm 3.48$	$76.13^{a}\pm 2.93$
HDEP at 40weeks of age	$47.33^{b}\pm 3.17$	$66.18^{a}\pm 1.85$
HDEP at 44weeks of age	$51.77^{b}\pm 3.28$	$70.65^{a}\pm 3.28$

Values in the same column with different superscripts differ significantly ($p<0.01$)

Selection for shank length improved the laying performance in Nicobari birds. The onset of sexual maturity was five days earlier in F_1 as compared to the groups before selection. Though the peak egg production was comparatively delayed with F_1, its higher hen day egg production was sustained till 44 weeks of age. In both groups F_1 and before selection, there was reduction in egg production between 36 and 40 weeks of age and again increased thereafter upto 44 weeks of age.

Fig12: Response to selection for short shank length on egg production in Nicobari Fowl

Table 12: Effect of selection for short shank length on Egg parameters and feed efficiency of Nicobari fowl

TRAITS	Before selection	F1
Hatchability	55.39 ± 2.39	56.18 ± 4.90
Egg weight (g)	47.56 ± 9.48	48.13 ± 8.89
Egg mass (g / hen /day	23.51^{b} ± 7.35	29.83^{a} ± 6.56
Feed intake (g/bird/day)	123.33 ± 13.5	116.13 ± 12.9
Feed efficiency per g egg mass	5.24^{b} ± 5.27	3.89^{a} ± 5.95

Values in the same column with different superscripts differ significantly ($p<0.01$)

Selection for shank length did not influence hatchability and egg weight; where as egg mass and feed efficiency were improved with F_1 as compared to groups before selection. Higher hen day egg production and better utilization of feed might have attributed to this higher egg mass and better feed efficiency.

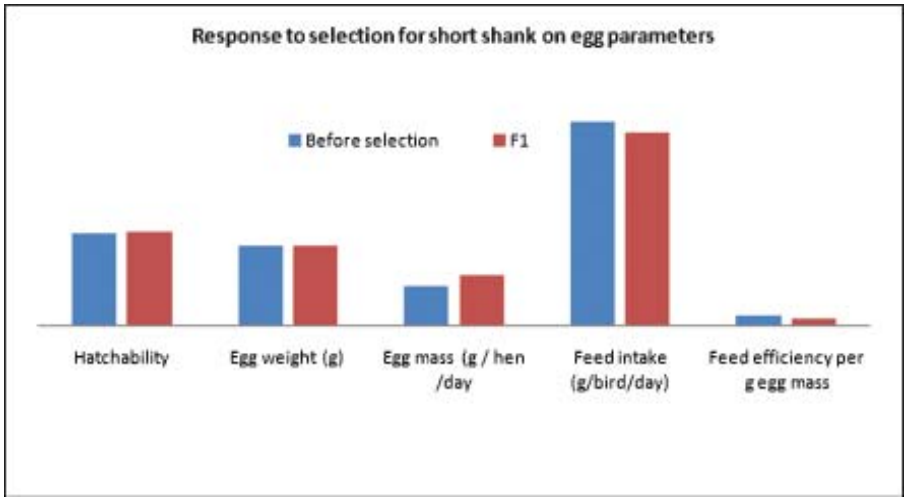


Fig 13: Response to selection for short shank length on egg productivity

Table 13: Humoral antibody response to the F1 progeny of selected Nicobari Fowl

Generations	HA titre			
	0 dayNS	7th day	14th day	21st day
Before selection	0.55 ± 0.17	1.01^{b} ± 0.23	0.90^{b} ± 0.21	0.60^{b} ± 0.35
F_1	0.54 ± 0.16	3.51^{a} ± 0.27	2.91^{a} ± 0.36	2.02^{a} ± 0.19

Values in the same column with different superscripts differ significantly ($p<0.01$)

Table 14: Present Stock of Nicobari Fowl Population

Types of bird	Chicks	Grower	Adults	Total
Varieties of Nicobari Fowl				3
Black	600	300	200	1100
White	300	200	75	575
Brown	100	70	50	220

Dietary Supplementation of Micronutrient to Improve the Productivity of Livestock

M.S. Kundu, Jai Sunder and *A. Kundu*

Effect of mineral mixture supplementation on the reproductive performances of anoestrous cows

A total of ten anoestrous cows were divided into two groups of 4 and 6 cows each. Group 1 was kept as control and was fed with basal diet consisting of concentrate mixture. Group 2 was fed the basal diet supplemented with 25 g of mineral mixture (Mineral mixture containing Cobalt chloride (55 g), Copper sulphate (265g), Ferrous sulphate (500g) and Zinc sulphate (750g). The supplemented group showed significantly higher on set of oestrous (23.33%), pregnancy rate (41.66%), calving rate (25.00%) than control. It is inferred that the supplementation of mineral mixture to the basal diet of cows significantly improved the reproductive performance by enhanced incidence of oestrus, pregnancy, calving rates.

Effect of Iron lactate supplementation on blood profile of piglets in post natal period

Study was conducted to determine the effect of oral supplementation of iron lactate on post natal blood profile of piglets with an objective of preventing piglet anaemia. Twenty four piglets from three litters were subjected into treatments i.e Control (without Iron), Treatment 1, 100 mg Fe, Treatment 2, 200 mg Fe and Treatment 3, 250 mg Fe as Ferrous lactate fed orally on day 3 and 10th day after birth. After 7th days of the initiation of the treatment (3rd day of birth) all the treatment groups Hb, PCV and MCHC values were found to be higher than the control (Table-15) . However there was gradual decline of all the three traits (Hb, PCV and MCHC) were observed from 3rd day of birth upto end of the experiment in control group. However no significant difference was found among the Fe lactate groups. In control group piglets develop anaemia on day 10 after birth. The oral supplementation of Fe lactate on days 3 and 10 of life, positively influenced hematolological values in the 1st three week of piglets' life.

Table 15: Effect of Fe lactate and timing of administration on haematological parameters of piglets (mean ± SE)

Parameters	Group	Day			
		3	10	17	24
Haemoglobin *concentration* (g/dl)	Control	8.23 ± 0.04 [a]	7.88±0.18 [a]	7.21±0.26 [a]	6.79±0.25 [c]
	Treatment -1	8.45± 0.08 [a]	10.24±0.21 [b]	9.54±0.18 [b]	9.74±0.18 [b]
	Treatment -2	8.63±0.11 [a]	10.89±0.10 [b]	10.07±0.27 [b]	9.87±0.13 [b]
	Treatment -3	8.72±0.14 [a]	10.27±0.22 [b]	9.76±0.29 [b]	9.24±0.24 [b]
Pack cell volume (%)	Control	29.56 ± 0.31 [a]	29.05 ± 0.45 [a]	28.42 ± 0.42 [a]	28.31 ± 0.46 [c]
	Treatment -1	29.83 ± 0.17 [a]	30.92 ± 0.47 [b]	30.42 ± 0.49 [b]	30.47 ± 0.40 [b]
	Treatment -2	29.86 ± 0.18 [a]	30.44 ± 0.68 [b]	30.27 ± 0.35 [b]	29.42 ± 0.47 [b]
	Treatment -3	29.74 ± 0.46 [a]	30.22 ± 0.38 [b]	31.48 ± 0.90 [b]	28.83 ± 0.68 [b]
MCHC concentration(g/dl)	Control	27.87 ± 0.33 [a]	27.20 ± 0.91 [a]	25.39 ± 1.01 [a]	24.06 ± 1.11 [c]
	Treatment -1	23.90 ± 4.73 [a]	33.16 ± 0.80 [b]	31.38 ± 0.37 [b]	31.97 ± 0.45 [b]
	Treatment -2	28.91 ± 0.39 [a]	35.90 ± 1.07 [b]	33.30 ± 1.16 [b]	33.58 ± 0.58 [b]
	Treatment -3	29.34 ± 0.49 [a]	33.98 ± 0.68 [b]	31.08 ± 0.95 [b]	32.13 ± 1.04 [b]

Values in the same column with different superscripts differ significantly ($p<0.01$)

Performance evaluation of Nicobari pig under intensive management

A pair of Nicobari pigs were brought from the breeding track of Car Nicobar and maintained at the Institute farm with normal feeding to study its adaptability for intensive management. It was observed that pigs adapted to the concentrate feed after two months of feeding. It consumed comparatively less feed (2.1 Kg daily) as compared to Large White Yorkshire pigs. The reproductive traits of Nicobari pigs such as age at puberty, age at first farrowing , litter size at birth and litter weight at birth were observed as 106 days, 270 days, 6 number and 4.5 kg respectively. Piglets survived till 3rd day since its birth (Plate 71).

Plate 71: Nicobari Pig under intensive management

Development of Enriched Chicken Egg and Meat

T.Sujatha, M.S. Kundu and *A. Kundu*

Quantification of iron in meat and egg and standardization of production technology for enriched egg and meat

Iron was supplemented in the form of Fe-Soy proteinate at 200 (T_1), 400 (T_2) and 600 (T_3) ppm levels in layer pullet feed and one group was kept as control (T_4). The body weight at 8, 12, 16 and at sexual maturity were 329.68, 639.84, 920.17, 1327 for T_1; 247.5,703.6,1060.5,1280.9 for T_2; 284.36, 666.2, 870.9, 1189.2 for T_3 and 307.9,640.8,1946.2,1119.8 for T_4. Body weight of iron supplemented groups did not differ from control groups. Iron supplementation in the form of Fe-Soy proteinate at 200, 400 and 600 ppm levels in growing pullets did not adversely affect weight gain and did not influence enrichment of iron in meat significantly unlike enrichment of iron in egg yolk.

Kalmegh (*Andrographis paniculata Nees)* feeding in Nicobari fowl as immune enhancer

Andrographis paniculata (AP) a promising medicinal plant its commonly used in humans as an immune system booster in which main bioactive compounds are Andrographolide and Diterpenoid lactone. It has been scientifically validated to inhibit lipid peroxidation and free radical activities. Herbal feed additives as an alternative to antibiotic growth promoters have been indicated to exert immunomodulatory action, which confers birds with greater general immunity from various diseases. In view of the above facts, the present investigation was undertaken to study the efficacy of kalmegh powder as feed additive on the immunity and performance of Nicobari birds. Sixty Nicobari fowls chicks belonging to same batch were managed under deep litter system standard management. All birds were fed *ad libitum* feed as per Bureau of Indian Standards (BIS, 2007) recommendation. Thirty chicks were assigned to each of following two dietary treatments with three replicates of 10 birds in each replicate, T_1: Breeder diet supplemented with Kalmegh powder at the rate of 1 g per bird per day, T_2: Control diet with out Kalmegh supplement. Experimental feed was fed till sexual maturity.

Table 16: Effect of Kalmegh feeding on growth performance

Treatments	Body weight (g)/Age in months			
	2 NS	3 NS	4 NS	Age at sexual maturity NS
1 g / bird/day	303.5 ± 10.25	583.5 ± 25.66	1094 ± 45.60	1198.9 ± 51.33
Control	313.2 ± 20.09	530.0 ± 25.71	1191.6 ± 44.98	1188.8 ± 98.98

NS - Nonsignificant

The supplementation of Kalmegh did not reduce the growth rate of treated groups. The adult body weight of control group is at par with the Kalmegh supplemented groups. The result revealed that Kalmegh reduced neither feed intake nor impaired growth.

Kalmegh feeding in breeding fowls

Materials and Methods

Two hundred seventy breeding Nicobari fowls of 35 weeks old belonging to same batch were selected. Optimal male female ratio was maintained. Birds were managed under deep litter system and 16 hours light with 3 lux of intensity per sqft. All birds were fed with *ad libitum* feed as per Bureau of Indian Standards (BIS, 2007) recommendation. Thirty six breeders were assigned to each of following dietary treatments in a completely randomized design with three replicates of 30 birds in each replicate, T1: Breeder diet supplemented with Kalmegh powder at the rate of 1 g per bird per day, T2: Breeder diet supplemented with Kalmegh powder at the rate of 3 g per bird per day. T3: Control diet with out Kalmegh supplement. Experimental feed was fed for a period of 60 days. The laying performance was evaluated throughout the experimental period. At 15th day of feeding, humoral immunity of breeders was assessed through haemagglutination test (HAT) using goat red blood cells (GRBC) as an antigen as per the method described by Siegel and Gross (1980). The titer was expressed as the log2. Chicks were hatched out from experimental birds. The duodenal morphology of progeny from experimental birds was measured at the age of eight weeks and their immunity was assessed at 12 and 16 weeks of age. Chicks were slaughtered by humane method at the age of 8 weeks. Duodenal tissue samples were carefully cleansed and fixed in 4% buffered formalin for two days. Tissue was processed through dehydration in Phosphate buffer saline and graded ethanol solutions, clearing with xylene and embedding in paraffin. Tissue samples were deparaffinised, rehydrated and stained with

hematoxiline-eosine according to the method described by Bancroft and Marilyn (2008). Sections of 5 ìm were prepared and placed on glass slides.The villi heights and crypt depth of duodenam was examined by photomicroscope. A total of 12 intact well-oriented villus-crypt units were randomly selected at each tissue sample. Villus height was measured from the tip of the villus to the villus-crypt junction and crypt depth was measured as the extent of invagination between two villi. Statistical analysis of measurements was carried as per Snedecor and Cochran (1994). The significance of the difference among the groups was determined by Duncan's multiple range tests (Petrie and Watson, 1991).

Laying performance of birds such as egg production, egg weight, egg mass, feed consumption, feed efficiency and hatchability was not hampered due to Kalmegh supplementation. Further, improved feed efficiency was recorded with Kalmegh feed additive. Active principles such as Andrographolides responsible for nutrients digestion and absorption present in Kalmegh might have attributed to improved feed efficiency for egg mass production in Kalmegh groups.

Table 17: Effect of Kalmegh feeding on Laying performance of breeders

Laying parameters	1 g / bird/day	3 g/bird/day	Control
Age at sexual maturity	23 weeks	22 weeks	25 weeks
HDEP%	42.92 ± 1.41	45.33 ± 2.16	40.00 ± 4.39
Egg weight (g)	42.2 ± 0.31	43.33 ± 2.16	41.4 ± 0.29
Egg mass (g/hen/day)	18.1 ± 0.81	19.35 ± 2.31	16.4 ± 3.61
Feed consumption (g) / bird / day	108.18 ± 1.40	110.1 ± 3.65	111.8 ± 14.53
Feed efficiency per g egg mass	5.96 ± 1.21	5.68 ± 3.11	6.82 ± 2.21
Hatchability %	69.73 ± 5.23	71.03 ± 7.61	69.98± 8.59

Effect of Kalmegh in breeder feeding on immunity and duodenal morphology of progeny

A highly significant difference was recorded in the HA titre of breeder fowls treated with Kalmegh powder of 3 g (1.81) and 1 g (1.51) as compared to control group (1.2) on 1st week post inoculation of Goat RBC and the immune response was found to sustained till 3rd week with 3 g. The progeny of breeders fed with 3 g of Kalmegh, showed a significantly higher HA titre at the age of 12 weeks (0.55) and 16 weeks (0.38); this higher humoral response was recorded till 3rd week of inoculation as compared to control. Significant microscopical changes occurred in crypt depth and villi height at the level of duodenum in layers of the intestinal wall of progeny from breeders fed with Kalmegh feed additive. The villi height (µm) and crypt depth (µm) varied significantly and were better in the progeny of breeders fed with Kalmegh than the progeny from control group. The control group mucosa contained villi with a height of approximately 269.28 ± 18.48 that was significantly lower than the 1 g (323.11 ± 16.48) and 3 g (365.06 ± 16.0). The crypt depth of progeny from 3 g (54.42 ± 4.8) and 1 g (58.15± 3.42) were significantly lower than the progeny of control group

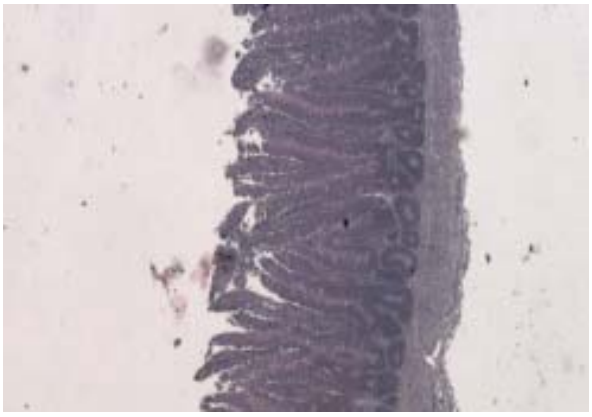


Plate 72: Duodenal morphology of kalmegh group @ 3g/bird/day

(63.79 ± 1.72). Intestinal glands attached to the villi of control chicks consisted of a small lumen and epithelium as well as a small number of leukocytes. Lax connective tissue from the villi and interglandular corrion connect both the lymphatic and capillary network and was loaded with many infiltrate cells. The capillary network showed evidence of hyperplasia and hypertrophy, whereas the chicks from Kalmegh fed breeders had a villi with intestinal glands of the duodenum having a large lumen and were surrounded by thin interglandular spaces, with the interglandular villi containing collagen fibres, fibroblasts and leukocytes infiltrate. A large number of leukocytes were in transit between the glandular epithelial and villi. The interior muscular layer made up of circular muscle fibres in the endomysium and perimysium capillary ectasia and leukocytes infiltrates were recorded. The arteries, veins and capillaries present in external perimysium contained large lumens. These images through the duodenum suggest that the angiogenesis process has been stimulated judging by the presence of the capillary ectasia in the main villi and interglandular villi.The results of duodenal morphometry of 8 weeks old progeny of breeders treated with 3 g Kalmegh showed the lowest crypt depth (54 µm) and highest villi height (365 µm) as compared to control (63 µm & 269 µm respectively). The higher villi height indicated the increased surface area for more nutritional absorption and the lower crypt depth for favorable microbial environment of intestine in the progeny of treated breeders. The significant efficacy of *Kalmegh feed additive* was evident at the duodenal morphology which is primary site for the development of immune response and where nutrient uptake takes place. Based on this study, it is inferred that Kalmegh feed additive at the rate of 3 g per bird per day for breeder fowl improves the immunity and gut health of progeny.

Table 18 : HA titre of Nicobari breeding fowl at various intervals

Treatments	0 day	7th day	14th day	21st day
1 g / bird/day	0.35 ±0.09	1.51^{b}±0.12	0.90^{b}±0.17	0.60^{b}±0.43
3 g/bird/day	0.34 ±0.07	1.81^{a}±0.32	1.81^{a}±0.56	1.20^{a}±0.81
Control	0.36 ±0.06	1.20^{c}±0.54	0.90^{b}±0.85	0.60^{b}±0.92

*- Significant (P<0.05) Mean values having different superscript differ significantly

Table 19 : Cell mdiated immune response of Kalmegh supplementation at various levels in Nicobari breeding fowl

Treatments	Foot pad thickness (mm)
1 g / bird/day	0.70^{b}± 1.17
3 g/bird/day	0.91^{a}±2.12
Control	0.17^{c}± 2.15

*- Significant (P<0.05) Mean values having different superscript differ significantly

Cell mediated immune response in terms of foot pad thickness was found to be significantly higher with Kalmegh supplementation @ 3 g/bird/day

Table 20 : HA titre of progeny of Nicobari breeding fowl fed with Kalmegh supplement

Treatments	At 12 weeks of age				At 16 weeks of age			
	0 day	7th day	14th day	21st day	0 day	7th day	14th day	21st day
3g /bird /day	0.11 ± 1.17	0.55^{a} ± 1.12	0.20^{a} ± 1.08	0.23^{a} ± 0.17	0.10 ± 1.31	0.38^{a} ± 1.17	0.26^{a} ± 0.81	0.25^{a} ± 1.21
Control	0.13 ± 0.27	0.3^{b} ± 1.02	0.10^{b} ± 0.17	0.10^{b} ± 0.07	0.11^{b} ± 0.09	0.20^{b} ± 0.48	0.10^{b} ± 0.27	0.10^{b} ± 0.16

*- Significant (P<0.05) Mean values having different superscript differ significantly

Table 21 : Duodenal morphometry of progeny of Nicobari breeding fowl fed with Kalmegh supplement

Duodenal parameters	1 g /bird/day	3g /bird /day	Control
Crypt depth (µm)	$58.15^{b} \pm 3.42$	$54.42^{a} \pm 4.81$	$63.79^{c} \pm 1.72$
Villi Length (µm)	$323.11^{b} \pm 16.48$	$365.06^{a} \pm 16.0$	$269.28^{c} \pm 18.48$

*- Significant (P<0.05) Mean values having different superscript differ significantly

Development of Therapeutics & Supplements by using Indigenous Herbs and Beneficial Microorganisms for Livestock Health and Production

Jai Sunder, M.S.Kundu and *A.Kundu*

Effect of feeding of *Morinda citrifolia* and Kalmegh (*Andrographis paniculata* Nees) on growth, production and immunity in Nicobari fowl

A total of 125 day old Nicobar chicks were selected and were equally divided into 5 groups with 25 birds in each group. The birds were provided with standard feeding and mangagemental practices. The experiment was conducted with the following treatment.

T1	10 ml *Morinda citrifolia* juice + 200 mg Kalmegh powder per bird per day
T2	15 ml *Morinda citrifolia*+ 400 mg Kalmegh powder per bird per day
T3	Commercial tonic 4 ml/bird/day
T4	Control (no tonic)
T5	Alternate days: 10 ml *Morinda citrifolia*+ 200 mg Kalmegh powder per bird per day

The parameters viz growth, body weight gain, mortality and immune response were recorded and calculated.

Growth and egg production performance

The T1 group showed highest body weight gain after the feeding of *Morinda* and Kalmegh. All the treatment groups showed similar trend in terms of body weight gain after the feeding of *Morinda* and Kalmegh as compared to control. Body weight gain at age of sexual maturity was found to be better in T3 followed by T1, T2 & T5 respectively. No significant difference was

Table 22 : Growth performance and egg production performance

Treatments	Weight gain after treatment at 16 weeks	Weight gain at ASM	HDEP % NS	HHEP% NS
T1	$253.00^{a} \pm 12.67$	$208.90^{b} \pm 17.06$	33.11 ± 2.77	33.33 ± 7.77
T2	$238.43^{a} \pm 20.04$	$189.53^{b} \pm 20.15$	31.64 ± 2.45	31.74 ± 9.45
T3	$233.53^{a} \pm 26.78$	$240.41^{a} \pm 27.18$	33.75 ± 2.25	33.96 ± 9.15
T4	$180.54^{b} \pm 35.05$	$138.20^{c} \pm 26.34$	31.17 ± 2.26	31.11 ± 4.46
T5	$247.36^{a} \pm 21.06$	$198.64^{b} \pm 32.67$	32.38 ± 3.15	32.69 ± 8.25

ASM: Age at sexual maturity; HDEP: Hen day egg production; HHEP: Hen housed egg production

obtained with the alternate feeding of *Morinda* and Kalmegh compared to the other groups of *Morinda* and Kalmegh. No significant difference was obtained in terms of egg production both for hen day egg production and hen housed egg production. However, the treatment group showed better production than the control group. So based on the growth performance it is inferred that the feeding of *Morinda citrifolia* @ 10 ml per day + 200 mg Kalmegh on alternate days in the Nicobari fowl showed better body weight gain and egg production compared to the commercial tonic.

Feed efficiency

Feed efficiency with respect to the body weight gain was found to be significantly better ($p<0.05$) in T1 followed by T2, T5, T3 and T4 respectively. The control group showed least feed efficiency compared to other groups. However, at the time of puberty the feed efficiency was found to be high with growiplex compared to other groups.

Table 23: Feed efficiency of Kalmegh and Morinda feeding

Treatments	Feed efficiency for weight gain after treatment at 16 weeks	Feed efficiency at ASM
T1	$6.16^{a}\pm2.67$	$7.29^{b}\pm7.06$
T2	$6.47^{a}\pm0.04$	$6.98^{b}\pm2.15$
T3	$7.24^{b}\pm6.78$	$7.46^{a}\pm7.18$
T4	$7.66^{c}\pm5.05$	$7.87^{c}\pm6.34$
T5	$6.51^{a}\pm2.06$	$7.43^{b}\pm3.67$

Immune response

Effect of feeding of Morinda and Kalmegh was evaluated for humoral immune response and cell mediated immune response. The humoral immune response was studied by conducting haemagglutination test with Goat RBC (GRBC) while cell mediated immune response was studied by injecting phytohaemagglutinin- P in foot pad of the birds. The result of the humoral immune response showed that the feeding of Morinda and Kalmegh enhanced the B cell immunity and is at par with the commercial tonic. In all the groups the immune response was found to be high compared to control. Similar trend was obtained with the cell mediated immune response. The immune response increased with the increase in dose of the Morinda and Kalmegh. Based on the immune response, it is inferred that the feeding of Morinda and Kalmegh with alternate day is sufficient to boost the immunity and may be used as a replacement to the commercial tonic.

Table 24: HA titre value at different days of post immunisation

Treatments	7th day	14th day	21st day
T1	$1.33^{a}\pm0.07$	$0.90^{a}\pm0.06$	$0.84^{a}\pm0.02$
T2	$1.50^{a}\pm0.04$	$0.99^{a}\pm0.15$	$0.89^{a}\pm0.07$
T3	$1.53^{a}\pm0.07$	$1.03^{a}\pm0.08$	$0.98^{a}\pm0.05$
T4	$1.09^{b}\pm0.05$	$0.48^{b}\pm0.08$	$0.33^{b}\pm0.03$
T5	$1.36^{a}\pm0.06$	$0.93^{a}\pm0.10$	$0.86^{a}\pm0.09$

Table 25 : Cell mediated immune response in chicken

Treatments	Foot pad thickness (mm)
T1	$0.84^{a}\pm0.17$
T2	$0.88^{a}\pm0.12$
T3	$1.00^{a}\pm0.15$
T4	$0.39^{b}\pm0.08$
T5	$0.96^{a}\pm0.14$

Effect of feeding of *Morinda citrifolia* fruit juice and *Lactobacillus acidophilus* on broiler duodenal morphology

A total of 124 day old commercial broiler chicks were randomly divided into four groups in completely randomized design with three replicates of 12 birds in each replicate. Chicks were vaccinated for Ranikhet disease and Marek's disease at the hatchery. The experiment was conducted for 49 days. The birds were kept under deep litter system of rearing and provided with standard starter, finisher ration and water *ad-lib*. No medication and deworming was given throughout the experiment. The starter feed was given to the birds till 3rd week of age and finisher feed was given to the birds from 4th week of age till 7th week. Broilers were assigned to each of four treatment groups.

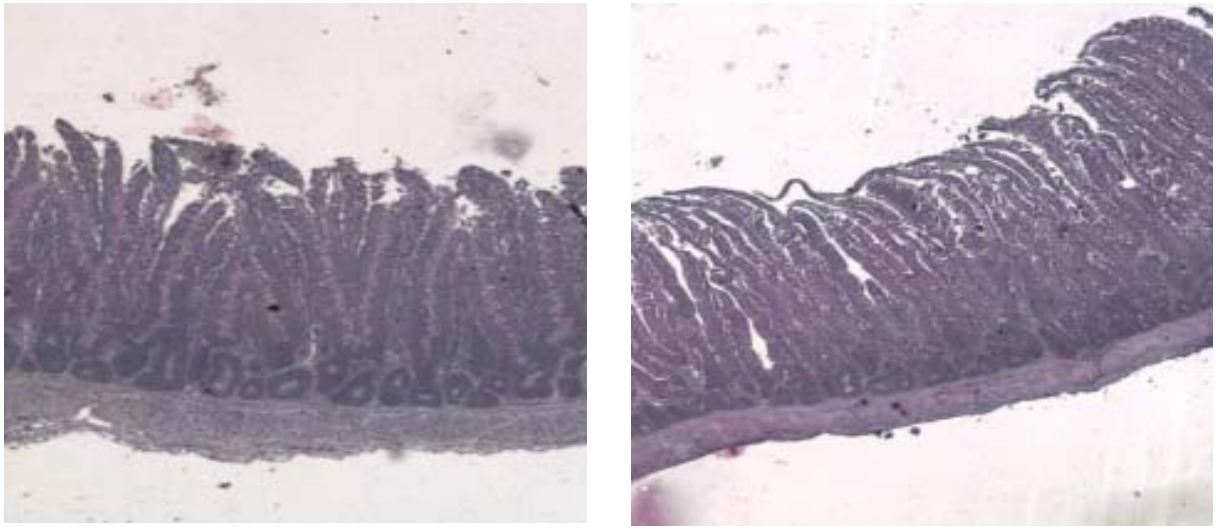
T_1 *Morinda citrifolia juice* (Noni)	T_2 *Lactobacillus acidophilus* (LAB)	T_3 (Noni+LAB)	T_4 (Control)
Basal diet with 5ml juice/bird/ day in water	Basal diet with 5ml LAB/bird/ day in water ($1x10^8$ cfu/ml)	Basal diet with 2.5 ml Noni + 2.5 ml LAB/bird/ day in water ($1x10^8$ cfu/ml)	Basal diet with water only

Broilers were sacrificed by humane method at the age of 3 weeks. The histological examination of intestinal wall was made by sampling the duodenum, washing, inclusion, cutting and staining with hematoxiline-eosine, respectively Mallory trycromic coloration. The villi height and crypt depth varied significantly and were better with treatment groups than the control group. The control group mucosa contained villi with a medium height of approximately 323.75 µ that was statistically comparable with noni (T1) and noni and lactobacillus (T3) groups. The crypt depth (43.60 µ) of control group was significantly lowest. Intestinal glands attached to the villi consisted of a small lumen and epithelium as well as a small number of leukocytes. Lax connective tissue from the villi and interglandular corrion connect both the lymphatic and capillary network and was loaded with many infiltrate cells. The capillary network showed evidence of hyperplasia and hypertrophy. The birds from noni and combined noni and lactobacillus group had a villi of significantly medium height with comparatively better crypt depth as compared to control group (Fig.14). The intestinal glands of the duodenum had a large lumen and were surrounded by thin interglandular spaces, with the interglandular villi containing collagen fibres, fibroblasts and leukocytes infiltrate. A large number of leukocytes were in transit between the glandular epithelial and villi. The interior muscular layer, made up of circular muscle fibres in the endomysium and perimysium capillary ectasia and leukocytes infiltrates were recorded. The arteries, veins and capillaries present in external perimysium contained large lumens.

The intestinal mucous villi and crypt depth of lactobacillus fed broilers, were of significantly very high approximately 439.64 µ and 51.39 µ respectively having ridges in base. The enterocytes contained oval nuclei, placed in the basal third of the cell, with many calceiform cells dispersed among them. The duodenal villi had been made up of a lax connective tissue and hyperplastic capillary network and many migrating leukocytes. These images through the duodenum suggest that the angiogenesis process has been stimulated judging by the presence of the capillary ectasia in the main villi and interglandular villi. The capillary network underwent both hyperplasia and hypertrophy and seen to be powerfully stimulated by the lymphoid infiltrate. The muscle of the mucosa is formed from two thin layers of flat muscular fibres, and in the submucosa, the sanguine vessels have a large lumen. The significant efficacy of *Lactobacillus* followed by *Morinda juice* was evident at the duodenal morphology which is primary site for the development of immune response and where nutrient uptake takes place.

Table 26: Duodenal morphometry of broilers as influenced by LAB and noni groups

	T_1 *Morinda citrifoliajuice* (Noni)	T_2 *Lactobacillus acidophilus* (LAB)	T_3 (Noni+LAB)	T_4 (Control)
Crypt depth	$52.42^{a} \pm 2.23$	$51.39^{a} \pm 1.98$	$51.07^{a} \pm 2.20$	$43.60^{b} \pm 1.36$
Villi Length	$357.98^{ab} \pm 32.37$	$439.64^{a} \pm 29.79$	$390.63^{ab} \pm 18.78$	$323.75^{b} \pm 12.49$



A B

Fig 14 : Villi height and crypt depth of the duodenum of broiler fed with diet containing noni+LAB (A- Morinda group, B- control)

Field evaluation of feeding of *Morinda citrifolia* on immune response in Nicobari fowl

Feeding of *Morinda citrifolia* (10ml/day) was evaluated in Nicobari fowl in the farmers field. A total of 20 birds were fed with Morinda juice and the other group was kept as control. Blood samples were collected at weekly interval to assess the humoral immune response. Cell mediated immune response was assessed by injecting PHA-P on the foot pad of the birds. The humoral immune response revealed significantly high titre at 7,14 and 21 days of post inoculation in the Morinda fed birds compared to control birds (Table 27). Foot pad thickness also showed significantly higher response in the Morinda fed group (0.12±0.04) compared to the control group (0.02±0.01).

Table 27 : Humoral immune response of Nicobari fowl at farmers field

	Treatment	Control
7th day	$1.75^{a} \pm 0.12$	$1.20^{b} \pm 0.05$
14th day	$1.38^{a} \pm 0.04$	$0.57^{b} \pm 0.03$
21st day	$1.02^{a} \pm 0.05$	$0.30^{b} \pm 0.00$

Farmer 1: Bichitra Biswas

Farmer 2: Sandha Biswas

Sero-Surveillance and Monitoring of FMD in Andaman and Nicobar Islands Under FMDCP

Jai Sunder and Arun Kumar De

The sero-surveillance of cattle and buffaloes were conducted during the year. A total of 593 paired sera samples were collected from cattle of 14th round of FMD vaccination. The sero monitoring of post vaccinal antibody titer revealed the protective titre of 47.04% (Type O), 36.08 % (Type A) and 32.71% (Type A-1) respectively. The sero-monitoring of 15th round vaccination showed post vaccinal antibody titer of 52.54% (Type O), 71.7 % (Type A) and 93.02% (Type A-1) respectively. A total of 1139 samples were screened for presence of 3 rAB3 in the serum by DIVA-ELISA of which 9.21 % samples showed positive.

Besides FMD, the cattle sera were also screened for brucellosis and IBR by ELISA. The result revealed the prevalence of IBR (10.2%) and Brucellosis (12.24%). A total of 6 awareness cum sensitization programmes were also conducted for the farmers, SVOs and paravet staff.

Plate 73 a: Sensitization programme for Paravet staff

Plate 73 b: Awareness programme at Badmashpahar village

Sustainable Rural Livelihood for Rural Women through Enhanced Rural Poultry Farming Techniques in Andaman Islands

T.Sujatha , A.Kundu, M.S.Kundu and *N.C.Choudhuri*

The preliminary survey was conducted to select the farm women in the area of Ferrargunj. A total of 40 farm women were interviewed and the results analysed and depicted below :

Average land holding	30 Bigha
Type of birds	Desi birds
Average size of family	4 numbers
Education status	VIII – XII
Average No. of hatchings per year	5
Male female ratio	1:5 (1 to 15)
Average egg production %	80 eggs / hen / year
Hatchability %	40 - 70% / 3 hatches per hen per year

Feeding to poultry	Rice & Wheat only
Feeding and watering management	No knowledge on essentiality of water for poultry. Feeding was being practiced on the ground level without feeder.
Brooding	Natural brooding
Housing	Crude type / no housing
Mortality	Severe mortality by outbreak of diseases 2-3 times in a year
Knowledge on vaccination	Awareness was there but it was not being practiced due to many practical problems.
Utilization pattern of eggs	Hatching/household consumption/few eggs are sold
Income from poultry	Very meager amount

Based on the report from baseline survey, the major areas were identified for the following scientific interventions *viz*. elevated housing, balanced feeding, feeding management, knowledge on artificial incubation & vaccination.

Capacity building, establishment of initial units and mini Incubator.

Hands on training was conducted for a total of 40 farm women on various scientific packages of technologies suitable for rural poultry rearing to the targeted farm women to make rural poultry as a viable resource to enhance the nutritional security. Demonstrations were made on brooding, feeding and watering using locally made feeder waterer and incubator operation. Based on the interest showed by the women farmers in adoption of package of practices particularly hatchery operation, 10 farmers were selected to whom the input units such as subsidization in construction of low cost poultry shelters and Nicobari fowls were distributed. Subsequently, a total of 10 units were established and 250 Nicobari fowls were distributed. How to prepare local feed was demonstrated to them using rice, wheat, fish, used bone and egg shells and coconut. Mini incubator was established and demonstration on incubator operation was conducted among farm women.

Adoption of scientific package of technologies by farm women

Package of practices	Before intervention	After intervention
Elevated Housing		
Feeding management using locally made feeder and waterer		

Hatching		
Vaccination	Not practiced	Regularly being done by themselves as a group once in three months

मत्स्य विज्ञान प्रभाग

Division of Fisheries Science

Marine Faunal Biodiversity of the Nicobar Group of Islands

R.Kiruba Sankar and *S. Dam Roy*

Marine faunal biodiversity surveys have been carried out at Nicobar Islands (Nancowrie group of Islands, Great Nicobar and Car Nicobar) through snorkelling in the sub-tidal and rocky shore in the intertidal zones during low tides. The major objective of the project is to document and prepare inventory of marine fauna available in Nicobar group of Islands. Altogether, a total of 26 sites were covered under 18 locations (Table 27).

Table 27. Survey sites covered under each region

Island group	Survey Locations
Nancowrie group of Islands	Champin, Kardip, Trinket, Langta Khadi, Western Entrance, Hitui and Kamorta (West)
Great Nicobar	B. Quarry, Pigeon Island, Laxman Beach , Gandhi Nagar, Afra Bay and Shastri Nagar
Car Nicobar	Arong, Kimious Bay Malacca, Passa and Sawai

A total of 64 molluscan species were identified *in situ* from Nancowrie group of Islands whereas a total of 53 species distributed under 8 phyla *viz.*, Cnidaria (30), Echinodermata (7), Mollusca (5), Vertebrata (4) and Porifera (4) and Urochorata, Crustacea and Annelida representing one species each were recorded from Great Nicobar Islands. From Car Nicobar Islands, a total of 70 species distributed under 6 phyla *viz.*, Vertebrata (Pisces) (33), Cnidaria (28), Mollusca(3) and Porifera (3) species each, Crustacea (2) and Echinodermata (1) were recorded and the selected photos of which are given in Plate 74.

Thelenota ananas (Jaeger, 1833)

Didemnum molle (Herdmann, 1886)

Phyllidia varicosa (Lamarck, 1801)

Echidna xanthospilos (Bleeker, 1859)

Echidna nebulosa (Ahl, 1789)

Acropora loripes (Brook, 1892)

Plate 74 : Marine faunal biodiversity of Nicobar Group of Islands

Three Opisthobranchs representing new additions to the Molluscan fauna *viz*., *Dolabrifera dolabrifera* (Cuvier, 1817), *Herviella mietta* Marcus and Burch 1965 and *Phanerophthalmus smaragdinus* (Ruppell & Leuckart, 1828) and a Pomacentrid, *Neopomacentrus cyanomus* (Bleeker, 1856), commonly called as Regal Demoiselle were recorded during the period. (Plate 75).

Neopomacentrus cyanomus (Bleeker, 1856)

Dolabrifera dolabrifera (Cuvier, 1817)

Herviella mietta (Marcus and Burch, 1965)

Phanerophthalmus smaragdinus (Ruppell & Leuckart, 1828)

Plate 75: New distributional records from Nicobar Islands

Identifying Critical Habitats of Dugong (*Dugong dugon*) using Satellite Data

R. Kiruba Sankar, Beena Kumari and Mini Raman

Dugongs (*Dugong dugon* Müller, 1776*),* also known as Sea cows, are herbivorous marine mammals. They are distributed in the Indo-Pacific region and their diet consists mostly of Sea grasses of the genera *Cymodocea*, *Halophila*, *Thalassia* and *Halodule*. Dugong was once abundant in Indian waters and is now reduced to about 200 individuals and it is believed to be continuously declining in its number and range. Dugongs have slow reproduction rate and a female will raise one calf every 3-7 years which makes their population more vulnerable/endangered. This project has been initiated with an objective to identify the critical habitats of Dugong, their vulnerability to climatic changes and their probable habitats (Sea grass meadows) in Andaman and Nicobar waters.

Surveys were conducted in 14 sites under five

locations *viz.*, Burmanallah, Havelock, Kodiyaghat and Neil in South Andaman and Champin in Nancowrie group of Islands. Underwater Hyperspectral radiometer surveys have been conducted at Burmanallah and Havelock for developing spectral signatures for different life forms *viz.*, sea grass area, non-sea grass area at different depth zones (Plate 76).

Plate 76: Satlantic Hyper spectral Radiometer in Operation

Optical Measurements:

Water leaving radiance (L_W) describes apparent optical property of the water and it is the signal that contains information about water constituents. Therefore, most of the empirical approaches for retrieval of oceanic constituents from satellite data require this parameter. Reflectance (R_{rs}), which is essentially radiance/ irradiance ratio, has become very popular lately amongst developers of empirical algorithms. Even for calculating reflectance, knowledge of L_W is required. L_W is also used to compute top of the atmosphere (TOA) radiance for sensor validation. Thus L_w is the basic and important parameter for any ship campaign to complement remote sensing technique development. For this study we used a hyper spectral radiometer having 1.2 nm resolution to obtain spectral information of water constituents. This profiler (i) allows to collect the data with a high spatial resolution in regions around a field station on a typical oceanographic cruise and (ii) collects data in case-2 waters that are often found in the near-shore and littoral environments.

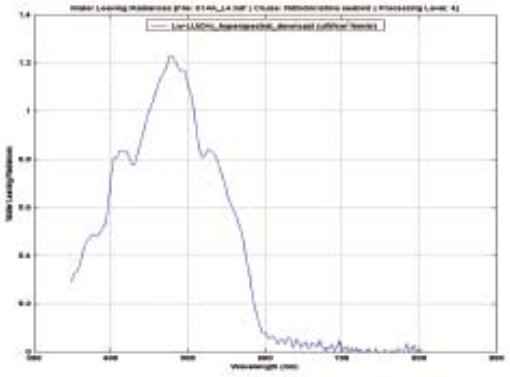


Figure 15: Spectral signature of above water radiance Lu (0+) in Burmanallah coastal waters (station depth-10m)

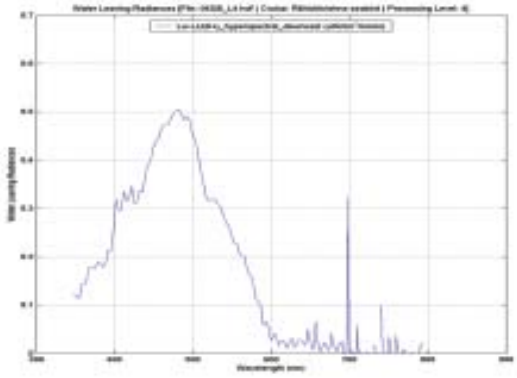


Figure 16: Spectral signature of above water radiance Lu(0+) in Havelock coastal waters (station depth-30m)

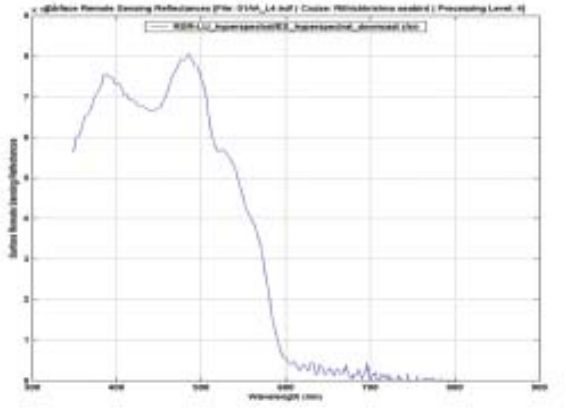


Figure 17: Spectral signature of remote sensing reflectance (Rrs) in Burmanallah coastal waters (station depth-10m)

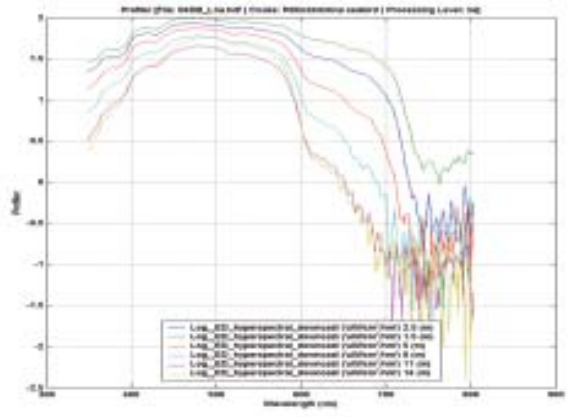


Figure 18: Spectral signature of depth wise downwelling irradiance in Havelock coastal waters (station depth-30m)

Using the Prosoft software, Water leaving radiances and remote sensing reflectance in different wavelengths in two locations (Burmanallah and Havelock Island) was computed. Spectral signature of sea grass observed in one location in Havelock was measured with radiometer. Figures 15-18 shows spectral signatures of coastal regions in Burmannallah and Havelock Island

A total of 6 sea grass species distributed under 2 families viz., Hydrocharitaceae and Cymodoceaceae are recorded so far of which 4 species belong to the family Hydrocharitaceae (Plate 77). Sea grass were found to be distributed on both sandy and rocky substrates in varying depths from intertidal zones to 21 m. Sea grass meadows are considered as most probable sighting zones of Sea cow considering their habitat. Hence mapping sea grass beds will probably provide their possible areas of availability.

Halophila ovalis (R. Brown) Hooker

Halophila ovata Gaudichaud

Thalassia hemprichii (Ehren.) Aschers

Enhalus acoroides (L.f.). Royle

Cymodocea serrulata (R. Br.) Asch. & Magnus

Halodule sp.

Plate 77: Sea grass diversity from the study area

Location-Specific Augmentation of Potential Fishing Zones (PFZ) using Satellite Altimetry and Fishing Ground Database

S. Dam Roy, R. Kiruba Sankar, P. Krishnan and *A. Anand*

Potential fishing zones(PFZ)advisories based on chlorophyll and sea surface temperature(SST) have major limitation in Andaman and Nicobar Islands since the advisories are discontinuous and interrupted under cloud cover where Andaman receives abundant rainfall over 6 months. This led to the discontinuity in advisories which were unavailable/scanty during rainy season. Sea surface height(SSH) is another important parameter like chlorophyll and SST to detect fishing ground using altimetry based data on locating eddies and upwelling regions. Unlike SST and chlorophyll altimeter readings are not influenced by cloud cover. The relationship between eddies, fish catch and chlorophyll maps were studied to augment the PFZ advisories using altimetry data from SARAL ALTIKA. Under the project, 12 major fish landing centers (6 from South Andaman; 2 from Middle Andaman and 4 from North Andaman) were covered during the reporting period periodically and data with respect to crafts and gears employed, baits used, major landings and economics of operation were collected within and outside PFZ. There are 6 types of major gears i.e. Ring net, Gill net (Drift and Bottom), Anchor net, Trawl net, Hand line and Long line operated by the fishermen of these Islands. The Gear-wise mean monthly catch details (kg/boat) during the reporting period are summarized as under the table (Table 28).

Table 28: Gear-wise mean monthly catch (kg/boat)

Gear	Mean (± SD) monthly catch (kg/boat)	Dominant species caught
Ring net	1146.17 ± 247.18	*Rastrelliger kanagurta, Sardinella albella, Sardinella longiceps, Sardinella sirm, Atule mate, Decapterus* sp, *Selar* sp.,
Gill net (*Drift gill net)*	302.45 ± 160.64	*Scomberomorous* spp, *Thunnus* spp, Marlins, Carcharhinids and Mylobatids, Carangids, Sphyraenids
Gill net (*Bottom gill net)*	34.62 ± 25.09	*Sardinella* spp, *Rastrelliger* spp, Carangids, *Leiognathus* spp, Carangids, Sphyraenids, Serranids, Lutjanids, Channids and Mullets
Trawler	1288.37 ± 97.46	*Leiognathus* spp, *Pristipomoides* spp, *Upeneus* spp, *Lutjanus* spp, *Carangoides* spp, *Pomadaysis* spp, *Bothus* spp, Carcharhinids, Mylobatids
Hand-line	352.92 ± 336.48	*Epinephelus* spp, *Lutjanus* spp, *Lethrinus* spp, *Carangoides spp Plectropomus spp.,*
Long-line	1776.02 ± 517.14	Carcharhinids, Lamnid sharks, *Epinephelus* spp

Validation of PFZ forecasts

Altogether 133 advisories received in which 42 validated from South, Middle and North Andaman with one controlled experiment at South Andaman. On an average, 31.58% of the received forecasts were validated during the reporting period. The fish catch quantity is always high in PFZ area than Non-PFZ area.

The mean fish catch (kg/trip) (mean ± SD) from PFZ and non-PFZ regions are summarized in Table 29.

Table 29: Mean fish catch (kg/trip) (mean ± SD)

Vessel Type	Experiments	Mean fish catch (kg/trip) (mean ± SD)	
		PFZ	Non-PFZ
Gillnetters (Drift net)	12	600.58 ± 375.55	238.5 ± 160.85
Ring-netters	24	2800 ± 1304.84	1056.25 ± 680.36
Hand-liners	04	727.5 ± 58.52	302.5 ± 118.98
Long-liners	03	1433.33 ± 115.47	376.66 ± 196.55

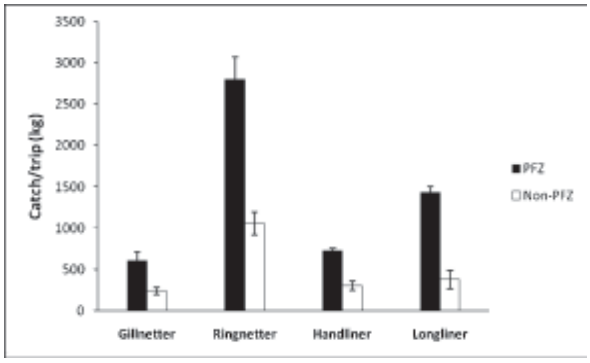


Fig. 19: Mean ± SE catch/trip (kg): PFZ vis-avis Non-PFZ

Maps of Sea Level Anomaly (MSLA) and geostrophic current data (u and v) from AVISO used. Positive anomalies (Anticyclonic/warm core eddies) and negative anomalies (Cyclonic/cold core) were identified by contouring the SLA maps. Commercial catch-effort data from gillnet, ring seine and long lines were plotted on SLA maps. Contemporary MODIS Aqua 8 day Chlorophyll maps were used to examine increased primary productivity in terms of chlorophyll. The following are preliminary observations made under the study as, Eddies, mostly anti-cyclonic / warm core, are seen regularly in the vicinity of ANI. The Productive regions are Warm Core (WC) eddy peripheries, Cold Core (CC) eddies and Eddy interaction areas (CC-CC; CC-WC; WC-WC). Consistency in increased chlorophyll is being studied along Eddy Regions as Warm Core (WC) eddy peripheries, Cold Core (CC) eddies and Eddy interaction areas (CC-CC; CC-WC; WC-WC) (Fig 20)

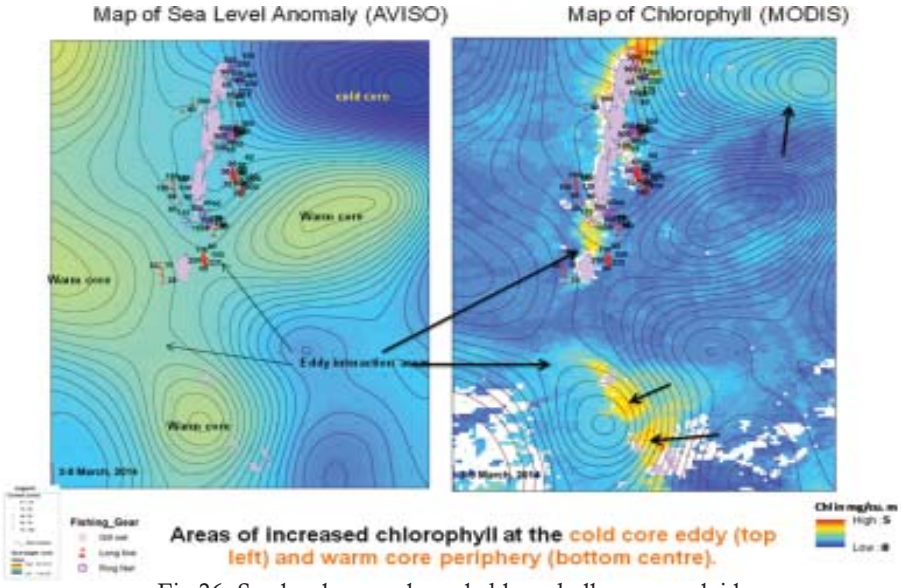


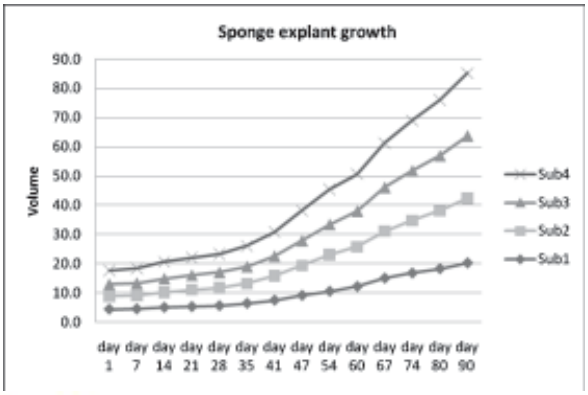
Fig 26: Sea level anomaly and chlorophyll map overlaid

Awareness campaigns played catalytic role in elevating the number of users and serve as a platform for effective use of PFZ forecasts. During 2013-14, a total of 12 small/medium awareness campaigns and sensitization programmes have been conducted at North, Middle and Little Andaman. A total of 114 beneficiaries have been sensitized on PFZ technology

Mariculture of Marine Fin Fishes and Shell Fishes of Andaman Waters

R.Kiruba Sankar, Benny Varghese and S. Murugesan

Marine sponges were cultured *insitu* and *exsitu* with an objective to study their regeneration from explants. Marine sponges were collected from North Bay and Chidiyatapu using SCUBA and transported to Marine hill lab. Using sterile knife the sponges were cut vertically and horizontally of size (1.5 x 1.5x 1.5 cm) and fixed to the substratum (Concrete, tile, , ropes, coral rock). *In situ* experiments conducted with13 nos of iron meshed cages of size 0.6 x 0.6 x 0.2 m were deployed at sea in Marine hill area at 5 m depth for cultivation of sponge explants. Sponges were placed in three substrates for growth and survival studies under institute funded project. *Sylissa massa* was placed in 7 cages and *Lyosina paradox* was placed in 6 cages. The cages were moored in sea using ropes and heavy sinkers. Growth was monitored using dimension measurement using vernier caliper and scale. The same species was cultured in aquarium tanks(20 nos) of (75 × 35 × 35 cm) with explant cuttings of sponges placed on 4 different substrates *viz.* concrete, tile, rope and dead polished coral rock replicated 6 times for each species of sponge. Attachment and survival was to be faster and higher in *Liosina paradoxa* in comparison with *Stylissa massa.* The sponges were found to be attached within first three days of transfer. *Neopetrosia exigua* was also cultured in addition with *S. massa* and *L. paradox* however mortality rates were much higher in *N. exigua* with low survival and attachment rates.



Sylissa massa fragments grown better on coral rock substrate with increase in mean initial and final volume. The other substrates concrete, tile and suspended ropes were also showing increase in volume. The experiment results are preliminary and still in progress

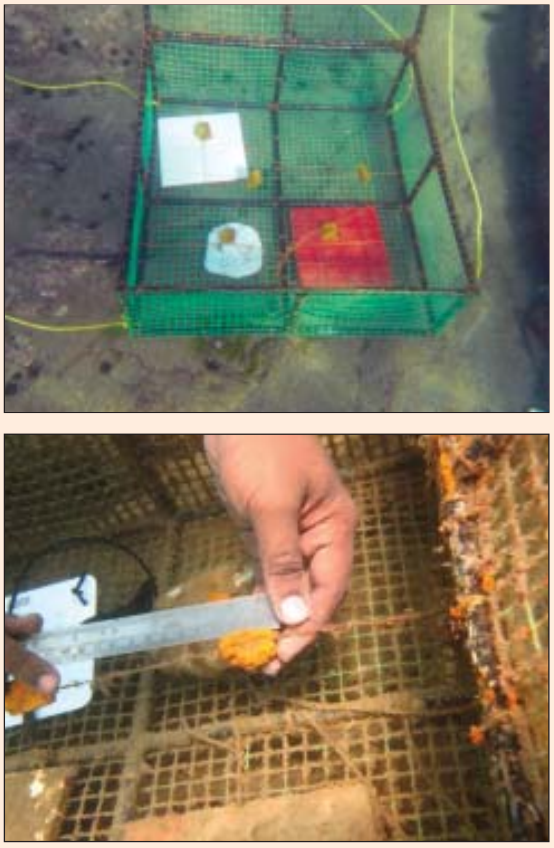


Plate 78: Marine sponges kept in different substrates in cages underwater

The length, breadth and height increase was traced with caliper since weighing is not possible for sponges as sponges are always to be kept in water. Various methods like photography, morphomtery are tried to show the growth or increase in volume and are to be standardized.

Integrated Coastal Zone Management

R.Kiruba Sankar and *S. Monalisa Devi*

Integrated coastal zone management (ICZM) or integrated coastal management (ICM) is a process for the management of the coast using an integrated approach, regarding all aspects of the coastal zone in an attempt to achieve sustainability. ICZM is a dynamic, multidisciplinary and iterative process to promote sustainable management of coastal zones. It covers the full cycle of information collection, planning (in its broadest sense), decision making, management and monitoring of implementation, which includes the following goals of maintaining the functional integrity of the coastal resource systems, reducing resource-use conflicts; maintaining the health of the environment and facilitating the progress of multisectoral development. Major Objective is to develop GIS based model for integrated coastal zone management at pilot level along selected parts of Indian coast (addressing region specific coastal issues).

The data collected for study area from Resourcesat-1 & 2 LISS-IV (Two season data per year), CARTOSAT-1 (Stereo and mono) and CARTOSAT-2, High resolution DEM. Conceptual model for Integrated Coastal Zone Management (ICZM) will be developed in consultation of various stake holders and concerned state forests and environment departments. Model shall be based on region specific needs and permissible CRZ frame work. Database will be generated on regional and cadastral level using satellite data, ancillary data and sea truth/ground truth. Different models of proposed developmental activities will be generated using the database generated and Coastal Zone Information System (CZIS) available at SAC. Query shells shall be developed for ICZM as per specific requirements of study areas. Monitoring will be done for the impact analysis of developmental activities on the various coastal ecological systems. Based on feedback mechanism improvements in query shells and action plan maps of ICZM shall be carried out.

Study on Stock Assessment and Biology of *Pristipomoides typus*, Bleeker 1852 from Andaman Water

Sukham Monalisha Devi, S. Dam Roy and *R. Kiruba Sankar*

Snappers of the family Lutjanidae are one of the important food fishes in Andaman and Nicobar Islands It also fetches high export value and local market demand. *Pristipomoides typus* also known as sharp tooth Jobfish are found in shallow inshore water inhabiting in rocky and coral reef areas where they usually caught using hand line/long lines. Snappers being coral inhabitants are prone to fishing pressure since demersal fishery particularly Groupers and Snappers are targeted intensely in Andaman Islands considering their economic value. Stock assessment study is important for proper management and sustainable exploitation of any species. Many workers has worked on snappers from Andaman water but exclusively work on stock assessment for proper management has not been studied in detailed from Andaman water for *P. typus*. As there is no account of growth and mortality parameters which is essential for stock management. The project has been initiated before three months and presently morphometric data is being collected. The data collection will involve landing centres from North, middle and South Andaman. Accurate information on biological parameters such length frequency data, age, growth, fecundity data will be collected for proper stock assessment and management of the fishery.

सामाजिक विज्ञान अनुभाग

Social Science Section

Impact Assessment of Technological Interventions in Andaman

S.K. Zamir Ahmed, Ajmer Singh and *Nagesh Ram*

A cross sectional analysis of the parameters available with the technology, the Composite Fish culture on better governance and input provider (fish seeds & other logistic) indicated that the A & N Administration has been instrumental in providing fish seeds of IMC every year i.e. 4.5 Lakhs in the year 2000, which has up scaled to 11.51 Lakhs in 2013, to around 1500 pisciculturist. Beside CARI, private entrepreneurs and progressive farmers are also producing and providing fish seeds to the fishers, which fulfills the requirement of fish seeds. On the other hand, the Government schemes of providing financial assistance for renovation of fish ponds @Rs.5000/pond under UT plan ,50% subsidy for construction of nursery ponds, purchase of breeding material for fish seed production through RKVY (Rs. 15000 to 25000/-) and purchase of fish harvesting net amounting to Rs, 8000 to 10,000 from Dept. of Fisheries, has given a good governance support to the technology.

The occurrence, consumer price and the marketing efficiency of fresh water fishes were studied at Diglipur , North Andaman for 21 months starting from July 2013 to March 2014, and grouped into three category based on the consumer price i.e. Group I, (more than Rs. 150/-) wherein Singhi, Magur, Pungas, Putti, Silver carp, Catla and Rohu except Common carp and Mrigal had cent percent occurrence . The average consumer price of the target fish Catla was more (Rs. 197.47/- followed by Rohu (Rs.169.59/-) & Mrigal (Rs. 152.80) , non of the fishes could be grouped in Rs. 100 to 150 , whereas Grass carp and Tilapia occupied Group III having price of less than Rs. 100/- . The market efficiency for these group was 92 & 94% which indicates stable and good market Table 30 & 31. Data on the total fresh water fishes catch and sale accounts for an average of 188 MT (2010-2013) @ Rs. 70/- kg. which fetches an economy of Rs. 131,60,000/- of which Catla, Rohu & Mrigal contributes 86.66 MT (47%) i.e.Rs.60,66200/ year. This speaks of the marketing opportunities available for the technology.

All the above factors have fostered horizontal spread of the technology to many cluster of villages in South, Middle and North and also has led to off shoot development, like farmers have started production of fish seeds and earning not less than Rs.1.50 to 2.00 lakhs in a span of 4 to 5 months as an additional income. The quality of life has improved and also the purchasing power of the farmer, thus getting social recognition in the society. Finally we conclude that, Composite Fish Culture technology was found to be encapsulated with all the four major ingradients i.e. technology back up , input provider, good governance and the market which is needed for acceptance, adoption, spread and making it a market led technology for the Islanders.

In addition information on goat and pork meat sold for 15 months since January 2013 till March 2014 indicated that a total of 451 goats amounting to 4000 kgs of meat were consumed by sale of goat meat.The average profit from the sale of per kilogram of goat meat ranged from Rs.138 /- to Rs. 166/-. In the case of pork 1247 were sold accounting to 59910 kgs. of meat. The average profit from the sale of per kilogram ranged from Rs. 36/- to Rs. 60/- comparatively. The market efficiency was found to be 63% for goat and 64 % for pork meat, which indicates good and stable market. The only lacunae in both these technologies were the lack of proper governance and non-availability of inputs in the form of kids and piglets inclusive of the logistic, which acts as a major bottleneck on its up scaling.

Table 30: Consumers price of fresh water fishes at Diglipur Market during the period (April 2012 - March 2014)

Local Name	Scientific	Qrt. III 2012	Qrt. IV 2012	Qrt. I - 2013	Qrt. II - 2013	Qrt. III 2013	Qrt. IV 2013	Qrt. I 2014	Avg. price (Rs.)	Availability in the Market (%)
Group I (Rs. > 150)										
Singhi	*Heteropneustes fossilis*	170.01	180.00	258.33	1272.72	252.17	204.54	210.00	239.55	100
Magur	*Clarias batrachus*	160.91	175.00	221.35	300.00	275.00	249.16	283.33	237.82	100
Pungas	*Pangasius pangasius*	117.71	106.25	228.33	225.00	200.00	250.00	212.5	191.39	100
Putti	*Puntius japanicus*	124.28	133.75	193.33	183.73	170.00	216.66	183.33	172.15	100
Catla	*Catla catla*	142.19	147.25	216.66	190.00	223.75	212.5	250.00	197.47	100
Rohu	*Labio rohita*	113.18	120.00	190.00	168.33	194.00	195.00	206.66	169.59	100
Silver Carp	*Hypophthalmichthys molitrix*	118.91	135.50	158.33	155.83	160.00	190.00	175.00	156.22	100
Common Carp	*Cyprinus carpio*	118.26	127.50	156.66	165.00	170.00	NR	200.00	156.23	80
Mrigal	*Cirrhinus mrigala*	120.79	112.50	175.25	180.5	NR	NR	175.00	152.80	70
	Average (Rs.)	131.80	137.52	199.80	315.67	205.61	216.83	210.64	185.91	94.44
Group II (Rs. 100-150)										
		-	-	-	-	-	-	-	-	-
	Average (Rs.)	-	-	-	-	-	-	-	-	-
Group III < 100)										
Grass Carp	*Ctenopharyngodon idella*	80.00	A	A	A	A	A	A	80	16
Tilapia	*Oreochromis sp.*	62.06	51.25	104.16	97.5	104.54	85.83	140.00	92.19	100
	Average (Rs.)	71.03	51.25	104.16	97.5	104.54	85.83	140.00	86.09	58

Table 31 : Market efficiency of fresh water fishes in Diglipur North Andaman (2012 - 2014)

Local Name	Scientific	Availability in the Market (%)	Average Consumer price (Rs.)	Average Farmers price(Rs.)	Average Marketing cost+ Margin (Rs/kg)	Marketing expenditure as expenditure % of consumer price	Market Efficiency
Group I (>Rs. 150)							
Singhi	*Heteropneustes fossilis*	100	239.55	194.00	45.55	19.01	
Magur	*Clarias batrachus*	100	237.82	236.07	1.75	0.73	
Pungas	*Pangasius pangasius*	100	191.39	180.83	10.56	5.51	
Putti	*Puntius japanicus*	100	172.15	156.95	15.2	8.82	
Catla	*Catla catla*	100	197.47	174.34	23.13	11.71	
Rohu	*Labio rohita*	100	169.59	160.38	9.21	5.43	
Silver Carp	*Hypophthalmichthys molitrix*	100	156.22	142.04	14.18	9.03	
Common Carp	*Cyprinus carpio*	80	156.23	143.42	12.81	8.19	
Mrigal	*Cirrhinus mrigala*	100	152.80	152.43	0.37	0.24	
Average		97.77	185.91	171.16	14.75	7.93	0.92
Group II (Rs. 100-150)							
-	--	-	-	-	-	-	-
Average		-	-	-	-	-	-
Group III (<Rs. 100)							
Grass Carp	*Ctenopharyngodon idella*	100	80	-	80.00	1.00	
Tilapia	*Oreochromis sp.*	100	92.19	83.05	9.14	9.91	
Average		100	86.09	83.05	44.57	5.45	0.94

Establishment of Out Reach Centre for North & Middle Andaman District by CARI & NABARD Under Farmers Technology Transfer Fund

S. Dam Roy (PL) and S.K. Zamir Ahmed

Need based technological intervention in the mode of training & demonstration was carried at Diglipur cluster of villages following group and participatory approach. Twenty five trainings were conducted,wherein 858 stakeholders got trained in agriculture and allied fields, of which 615 were men & 243 women with total trainee days of 1114.

Under HYV of rice, a total of 54 Kharif technological demonstrations with seven recommended HYVs of rice were demonstrated in 12.28 ha , in 17 clusters of villages at Diglipur, North Andaman. Among all rice varieties , CARI Dhan 4 performed well and gave a mean yield of 6.72 t/ha, with 81.16%, increase in yield against the local check Jaya (3.70t/ha), followed by Ranjeet (6.29t/ha), CARI 3(6.25 t/ha), CSR36 , Gayatri (6.06t/ha) ,CARI Dhan 5 (5.9t/ha) and CSR23 (5.20 t/ha) .

Seed village production of paddy was carried out for the third consecutive year with five HYVs of rice in participatory mode in farmers field to produce Truthfully Labelled Seeds (TLS) under the technical guidance of Division of Field Crops . Total area covered were 2.60 ha in seven cluster of villages wherein 5.0 tonnes of seeds were produced and facilitated to buy back of the same amongst the farmers & NGOs.

Beside 39 demonstrations with CARI Brinjal-1, 54 with Maize *var*. HQPM-1 covering 5.58 ha., Baby Corn *var*. HM-4 in 1.42 ha, on Arecanut (60) & 15 each on clove and pepper were conducted. The harvested brinjal (4950 kg) from 0.02 ha was sold @ Rs 15 to 50/-, Maize HQPM (1050 kg) @Rs 25 to 60/- and Baby corn (200kg) @Rs 50 to 100/-.

Custodian farmer Shri Manidra Mistry of D.B. Gram for Khoon Phal and Shri Tapas Biswas of R.K. Gram for his innovative low cost paddy thresher were recognised from the operational area.

Impact of Technological Interventions at North Andaman

HYV of Rice of CARI

A total of 181 FLDs on rice conducted in 51.43 ha. of areas from 2009 to 2013 has given farmers convincing attitude which has led to replacement of farmers variety with institute varieties at Diglipur., in North & Middle Andaman. Beside the seed village production of TLS in participatory mode from 2011 onwards could also reinforce the confidence level of the individual farmers, who could see for themselves the performance of the varieties, select them and finally adopt for higher yield. In 2003, a total of 12.28 ha. area has been replaced by 52 farmers with seven HYVs of paddy namely CSR 23, CARI Dhan 3,4,5, CSR36, Gayatri & Ranjit recommended by CIARI. This has led to increase of yield to tune of 31.25% against the famers variety Jaya. The economic return by selling the variety at the rate of Rs. 10/kg for the seed purpose will bring an additional income of Rs. 26000/ha. against 16000/ha. from the farmers variety. In nutshell an additional income of Rs. 1,22,800/- is derived by cultivating HYVs of CARI against the farmers variety from an area of 12.28 ha.

Peking cross duck under backyard

Introduced in June 2010 with three ducklings in Ganesh Nagar village has spread across 10 villages and adopted by 34 farmers. Against the desi duck, which is sold at the rate of Rs. 6/ egg , Rs.10-15/ duckling and Rs. 200/ adult duck, the peking cross is sold at the rate of Rs. 16/ egg, Rs.50/duckling and Rs. 400/ adult duck . Added advantage is low level of mortality and gains good weight comparatively. Mr. E.D.Menon and Mr. Bikas Gayen both progressive farmers of Kerelapuram & R.K.Gram who after seeing the potential of the technology have become the seed bank for providing peking cross duck eggs

or ducklings to the farmers , with the institutional support of ORC.

Satellite Nursery for Fresh Water Fish

Technical support on the concept of satellite nursery from FSD of CARI in association with KVK and ORC and logistics jointly by Department of Fisheries and CARI motivated Mr. Sajib Kumar to start the venture in 2012 . He started selling first installment of fish seeds at the price ranging from Rs. 1.00 to 8.00 of various sizes. He earned an additional income of Rs. 70,000/-. On knowing about the availability of the quality fish seeds by the peer group from Kalipur to Keralapuram, 20-25 farmers placed their demand of fish seeds i.e., around 40,000 seeds which he sold at the rate of Rs. 5.00 per seed. Finally, an additional income of Rs. 2,00,000/- was earned by him.

Within a span of 6 months, he earned Rs. 2,70,000/- as additional income by adopting satellite nursery technique for production of fresh water fishes. Simultaneously another group of four farmers by practicing the technology could earn Rs. 70,000/ head as a profit in the span of three months. Subsequently, Mr.Laxman Das from Kalipur in 2013 was able to sell three lakhs seed at the rate of Rs.1-3/seed of catla, rohu and mrigal and earned net profit of Rs.200000/- in a span of four months. Presently, six farmers are practicing the venture as livelihood option and many more youth have come forward to adopt the technology.

KRISHI VIGYAN KENDRA, SOUTH ANDAMAN

Training

Krishi Vigyan Kendra, Port Blair has conducted 43 training programmes covering the area of South, North and Middle Andaman and Hut Bay for the benefit of practicing farmers, Rural youths and extension functionaries included 960 beneficiaries in agriculture and allied disciplines. Besides the regular trainings, one training sponsored by NGO has also been conducted wherein 14 farmers have been benefited. Under TSP of CARI 3 trainings were imparted exclusively for the tribal population of Car Nicobar district and one training was conducted at Tripura under NEH components wherein a total of 137 tribal people were trained for their livelihood option through agriculture and allied sectors.

Glimpses of Training

Preparation of mango jelly

Demonstration on seed treatment

Training on rural poultry for livelihood under NEH components

TSP training on IFS for sustainable livelihood

Tailoring for farm women

Balanced diet for rural women and children

Plantation based cropping system at Basantipur

Value addition on surplus agricultural produce

Front Line Demonstration [FLD]

Sixteen Front Line Demonstration in agriculture and allied disciplines *viz.* paddy, Maize, Green gram, Black gram, Indian spinach, Spinach, Backyard poultry, Pig, Khaki Campbell duck, Green fodder, Cat fish culture and Lining of tanks for effective rain water harvest and storage were conducted.

- Demonstration on paddy cum daincha was done in two farmers field in an average area of 0.5 ha/ farmer. Results indicated an average grain yield of 45.7q/ha which was 23.7% higher grain yield as compared to local check.
- FLD on hybrid Maize (Var. HQPM5) was conducted and an average yield of 28.5q/ha was recorded which was 41.1% higher grain yield than local check.
- Demonstration on Black gram was conducted in five farmers field in an average area of 0.4 ha/ farmer. Results indicated an average yield of 6.2 q/ha as compared to local check(4.8q/ha).
- Demonstration on Green gram was conducted in five farmers field in an average area of 0.4 ha/ farmer. Results indicated an average yield of 6.7q/ha which was 26.4% higher than local check(5.3q/ha).
- In Indian spinach demonstration, yield of 54 q/ ha was obtained as compared to the local check (36 q/ha).
- FLD on Spinach was conducted & the yield of 78 q/ha was obtained as compared to the yield of 39 q/ha from local variety.
- FLD on pig farming for Large White Yorkshire breed conducted in Ferrargunj, Habdipur and Collinpur village reveled that improved large White Yorkshire pigs attained an average body weight of 120 kg per animal over the local check

(non descriptive) of 75 kg per animal in a period of one year.

- Result of FLD on duck farming with Khaki Campbell in Chouldari, Collinpur, Ferrargunj villages of South Andaman indicated that the improved duck recorded egg production of 210 eggs / annum compared to its counterparts of local desi duck 110 eggs/ annum.
- FLD on improved variety of fodder cowpea (Co FC-8) conducted in Collinpur, Rangachang, Indira Nagar and Port Mout villages of South Andaman gave average yield of green matter of 280q/ha as compared to local check (180q/ha.).
- FLD on fodder Sorghum CoFS-29 conducted in the Indira Nagar village gave an yield of 170q/ ha of green matter.
- FLD on livestock based farming system conducted at Chouldari village with Nicobari, Vanraja, Broiler, Khaki Campbell and Crossbred dairy cattle recorded an BCR of 1.63, 1.8, 1.78, 2.08 and 2.54 respectively for each animal component.

Field Day on Spinach

FLD on Fodder cowpea (COFC8)

FLD on Backyard poultry

FLD on Lined tank

FLD on Khaki Campbell Duck

FLD on Green gram

ON FARM TRIALS [OFT]

Twelve numbers On Farm Trial at farmers field were conducted to assess and refinement of the selected technology on agriculture and allied fields.

- Evaluation of medium duration cultivars of rice on growth, yield attributes and economics of rice were conducted in 5 locations with 4 weed management practices. The results revealed that different cultivars brought significant variation on growth and yield attributes of paddy. CARI Dhan 3 produced significantly taller plant than other cultivars. Significantly higher No. of productive tillers/m^2 was produced by CARI Dhan 7 compared to others besides significantly higher panicle length and more of filled grains/ panicle. CARI dhan 7 proved superior in respect of higher dry matter production and also recorded more grain yield of 47.9 q/ha with straw yield of 73.9 q/ha followed by CARI dhan 7(45.6 q/ha). CARI Dhan 7 also gave highest net return and B: C ratio (Rs. 26,945/- and 2.09) while Jaya was least profitable (Rs.15900/- and 1.65).

- Evaluation of long duration cultivars of rice on growth, yield attributes and economics were conducted at farmers field and the results indicated that among cultivars tested plant height not varied significantly but numerically more in Ranjit (148.4 cm) followed by CARI Dhan 9 (145.9 cm). CARI Dhan 9 recorded significant more root dry weight of 21.3 g/hill which on par with CARI Dhan 8 (19.8 g/hill). Number of productive tillers and no. of filled grains per panicle exhibited significant variation among the paddy varieties. CARI Dhan 8 recorded higher number of 348 productive tillers/m^2 followed by CARI Dhan 9 which recorded 324 productive tillers/m^2. Among rice cultivars, CARI Dhan 8 recorded higher grain yield of 48.2 q/ha and straw yield of 64.9 q/ ha which was 21.9% and 18.4% higher grain yield compared to other cultivars. The Ranjit Dhan registered the lowest grain yield of 39.54 q/ha. The highest net returns of Rs. 27,996/- was recorded in CARI Dhan 8 with B C ratio of 2.19.

- Evaluation of salt tolerant cultivars rice on growth and yield attributes was conducted at farmers field and the results indicated that among varieties, plant height not varied significantly between the varieties. No of productive tiller/m2, filled grains/panicle was more in CSR 36 than CARI Dhan 5. However, test grain weight was lesser as compared to CARI Dhan 5. The highest grain

yield and straw yield of 43.5 q/ha and 64.7 q/ha was registered by CSR 36 which is at par with CARI Dhan 5. CSR 36 recorded higher gross and net return and B:C ratio as compared to CARI Dhan 5 and JGL 24.

- The infestation of fruit fly (*Dacus cucurbitae*) in bitter gourds was tested in the farmers field with regard to flies catch and to minimized its populations. Trials carried out in two different location (Collinpur and Rangachang village) revealed that on average, weekly fruit flies catch /trap ranged between 75.6 to 95.2 during February – March at Collinpur village. The flies catch/trap at Rangachang ranged between 42.4 to 53.3 during January–February. The rate of the fruit flies catch /trap was relatively high during the month of March. It is also reflected in the yield with an average production of 6.8 t/ha (Farmers practice, Untreated); 7.9 t/ha (IPM module) and 8.6 t/ha (Bio Intensive module) with the B C ratio of 2.1; 2.4 and 2.5 respectively.

- Performance validation of birds supplemented with extract of *Morinda citrifolia* in comparison with the commercial available probiotics as growth promoter and immune response conducted at farmers field, indicated that the supplementation of the probiotics group and the extract of *Morinda citrifolia (Grommune)* resulted in the low mortality percentage as well as the higher growth rate as compared to the farmers practice. The data related to the major parameter addressed being the control of mortality rate in

the chicks by supplementing different additives. The mortality percentage was recorded 32.5% in farmers practice group which is devoid of any feed additives followed by 7.5% mortality in group fed with Kalmegh powder, 5.0% in Grommune supplementation group and the lowest in the probiotics fed group which was recorded in the tune of 2.5%. However, the trend for growth rate recorded among the treatment groups is not much pronounced but there exist a quite variation between the control and treatment groups. The highest body weight at 10th week was recorded in the group fed with Grommune(670g), followed by the group fed with the commercial probiotics (650g) and Kalmegh group (640g) and the lowest was recorded in the control group of (560g). The result of the present trial revealed that it is quite essential to use the additives which improves the immune response of the birds as well improve the production performance thereby reducing the incidence of infection.

- Performance evaluation of milk production through mineral mixture and probiotics supplementation in cattle conducted at farmers field revealed that the average milk yield (lit.) recorded highest in the group fed with Mineral mixture + Probiotics fortified with bypass fat in the tune of 5.60±0.004/ day /animal followed by group fed with mineral supplementation (Ca and P) 5.20 litres of milk yield/day/animal. The lowest milk yield was recorded in the group fed with probiotics fortified with the bypass fat

of 4.90 litres /day /animal. However, on average the milk yield characteristic is recorded to 4.05 litres/day /animal which is quite low to their potential yield which might be due to no 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 crossbred dairy cattle.

- Evaluation of growth performance of carps (C:R:M)and freshwater prawn (*M.rosenbergii*) was conducted in seven different locations with three treatments. The technical option two (Fish Seed (C:R:M) + Prawn seed (150 nos) + Feed (RB + GOC) + lime (@ 70 kg/pond) + pond management practices) performed well, cost of rearing was (Rs.115000/ ha) and the increased yield was from 7.0 q/ha to 24.5 q/ha over the farmers practices. Net return (Rs. 326000/ha) with BC ratio of 3.83 was obtained.

- Evaluation of growth performance of freshwater carp (Catla) in monoculture was conducted in four locations with three treatments compared with farmers practice. Results of the trial indicated that Technical option 3 (Fish seed + feed + lime + pond management practices) performed well ,

cost incurred towards management was (Rs.73, 000/ ha) and increased in yield was from 0.875 t/ha to 2.62 t/ha over the farmers practices.

- OFT on performance and evaluation of gravity fed drip irrigation for areca nut plants was conducted at Port Mout and Dundus Point. Results of the trial indicated that the uniformity coefficient of irrigation in gravity fed drip irrigation is less as compared to other methods. This is due to the head loss in the system and wide pressure fluctuations. But the water saving in irrigation and equivalent energy cost parameters are better in gravity fed drip irrigation system. Considering irrigation during the 5 months of dry period, the yield of the arecanut plants enhanced marginally over the other three methods. The benefit of 1.063 times that of rainfed was obtained for gravity fed drip irrigation system which is higher than the Benefit obtained from other methods of irrigation.

- Performance and evaluation of different soil conservation measures was conducted at Bimbliton and Habdipur on overland slope of 12% and 10 % respectively. Based on the contour map prepared for the two locations, the top flat land of the hillock (1-2%) was used for vegetative cover as treatment – 1 under OFT and Napier grass was planted for soil moisture conservation. The middle high sloppy area (13-23%) is utilized for making of contour trenches and bunds of size 12m (l) X 0.3m (w) X 0.5m (depth) under treatment – 2. The bottom of the hillock being less sloppy (10-12%) is utilized for making of inward slope terraces of sizes 15m X 12m with a drop of 1.2 m under treatment – 3. The bed slopes of the terraces are being kept at an inward slope of 0.5 %. The sediment concentration of the runoff collected by the multi slot divisor indicates that the sediment concentration reduced considerably in T1 and T2 but a minimal decrease in the sediment concentration observed in T3. This happened due to the occurrence of high intensity of rainfall and non stabilization of the terrace area.

- Performance of low cost supplementary food for pre-school children was conducted Anganwadi Centres, Badmas Pahar and Anganwadi Centre, Nimbu bagicha of South Andaman. A total of 18 Pre –school children in the age group of 2- 3.5 years were selected. (Control group- Six, Technical Option-1- Six, Technical Option 2- Six Children). The nutrient compositions of the developed supplementary food were calculated and the anthropometric measurements were taken before and after feeding trial. Besides their routine diet, the developed supplementary food was fed to the Pre-school children continuously. After 15 days of feeding, it was found that the children did not like to take the food every day. It may be due to monotony in food habit. Hence, the food supplement trial was carried out thrice in a week, which was very well accepted by the children. The feeding trial was continued for a period of 3. 6 months. The weight for age of the Pre-school children were accessed before and after feeding trial and the growth trend analysis were compared with the ICDS/WHO Standard growth curve.

- Promotion of scientific kitchen garden towards nutritional security at household level (Kharif) was conducted in three villages of South Andaman in Kharif season. The inputs i.e.Vegetable seeds (Amaranthus, spinach, french bean, cow pea, okra, bottle gourd, bitter gourd and cucumber) were given to the farmer. The result showed that the consumption pattern of vegetables of households increased significantly over the conventional kitchen garden. The net return was high, in scientific kitchen garden than the conventional practice.

Extension Activities

Different extension tools like exhibition, field days, Kishan Ghosti, farmers visit, TV shows, diagnostic visit, Scientist farmers' interaction, radio talks, were used to popularize the technologies through Krishi Vigyan Kendra, South Andaman (Table 32).

Table 32. Extension Activities

Nature of Extension Activity	Number	Farmers			Extension Officials			Total		
		M	F	Total	M	F	T	M	F	T
Field Day	05	70	64	134				70	64	134
Kisan Ghosthi	3	49	38	87	-	-	-	49	38	87
Exhibition	2	489	236	725	-	-	-	489	236	725
Film Show	29	239	144	383	-	-	-	239	144	383
Method Demonstrations	6	77	36	113	2		2	79	36	115
Group meetings	4	48	25	73	-	-	-	48	25	73
Lectures delivered as resource persons	22	274	110	384				274	110	384
Advisory services	72	63	22	85	13	8	21	76	30	106
Scientific visit to farmers field	330	428	113	541				428	113	541
Farmers visit to KVK	164	121	69	190				121	69	190
Diagnostic visits	123	119	62	181	-	-	-	119	62	181
Exposure visits	09	123	75	198	-	-	-	123	75	198
Animal health camp	02	24	18	42				24	18	42
Awareness camp on animal diseases	02	21	16	37	09	12	21	30	28	58
SHGs conveners meetings	01	0	18	18				0	18	18
Mahila Mandals conveners meetings	03	0	63	63				0	63	63
Celebration of National Science day	01	14	28	42				14	28	42
Hindi fortnight	01	0	31	31				0	31	31
Total	**779**	**2159**	**1168**	**3327**	**24**	**20**	**44**	**2183**	**1188**	**3371**

National Initiative on Climate Resilient Agriculture (NICRA)

Nagesh Ram, L.B. Singh, A. K. Singh, B.K. Nanda, N. Bommayasamy and *N.C. Choudhuri*

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.

Significant achievement

Natural Resource Management

- Tank cum well system has been utilized for irrigation purpose.
- Mulching with coconut husk, paddy stubble and banana leaf on vegetable and plantation crops (Coconut) was initiated for soil moisture conservation.
- Three ponds have been desilted and repaired for irrigation purpose and ground water recharge.
- Land manipulation and water harvesting through Broad bed and furrow (BBF) system.

Crop Production

- **Drought tolerant paddy (Sahbhagi dhan) :** Higher grain (4570 kg/ha) was recorded with Sahbhagi dhan followed by farmers variety which led to 18.7 % higher yield than other cultivar. Higher grain (4570 kg/ha) was recorded with Sahbhagi dhan followed by farmers variety which led to 18.7 % higher yield than other cultivar. Higher gross return (Rs. 45700 ha^{-1}) and net return (Rs. 20950ha^{-1}) with B: C ratio of 1.85 was recorded in Sahbhagi dhan is mainly due to numerically higher grain and straw yield. Performance of sahbhagi dhan is more acceptability by the farmers.
- **Salt tolerant paddy varieties (CSR 36) :** CSR 36 recorded more grain yield of 4620 kg/ha which was 11.3 % higher yield as compared to local check (Bhavani). CSR 36 gave highest net return and B:C ratio (Rs. 24015/- and 1.94) while Bhavani was least profitable (Rs.15850/- and 1.62).
- **Brown manuring:** The yield increase was to the tune of 13.0 %. Growing daincha along with rice and its subsequent incorporation thus can reduce the use of nitrogenous fertilizers approximately by 25%, without affecting grain yield which is due to biomass addition and subsequent increase in the availability of nutrients in the soil.
- **CARI Poi selection for saline soil** : CARI Poi selection recorded yield of 5.4t/ha which gave 32% higher yield as compared to local check (green pole type).
- **CARI AMA-Green and CARI-AMA-Red drought tolerant leafy vegetables :** CARI AMA-Green recorded yield of 7.2t/ha followed by CARI-AMA-Red 7.0t/ha which gave 21% higher yield as compared to local check.

Livestock and Fisheries

- **Fodder cultivation for sustainable livestock production** : To meet the requirement during acute shortage of green fodder, fodder cowpea, maize and Hybrid Napier grass were promoted in the area. The fodder enhances milk production of livestock through satisfying its nutritional requirement. Agathi as a fodder for goatry has also been demonstrated in the Port Mout village for fodder availability and harnessing the maximum production potential of the animal.

- **Mineral supplementation to dairy cattle based farmers for higher milk production:** The present intervention was done in lactating dairy animals by supplementation of the exogenous source of Ca and P @ 1650mg and 850 mg per 100 ml/ animal / day respectively. The treatment was given to four milch animals for 30 days and the result revealed increase in the milk yield to a tune of about 1.20 litres per animal.
- **Improved shelter management practices with well ventilated system as a means to resist extreme climatic variables for poultry, goatry and dairy animal:** Improved poultry shed with well ventilated system enabling low mortality rate. Developing improved sheds in shady area reduces heat stress. Recommended spacing area in improved shed results better performance in poultry and dairy animals.
- **Backyard poultry production with improved Nicobari and Vanraja birds:** The Nicobari birds regarded as one who possess some resistant to common diseases of the bird is suitable under backyard. The production characteristics revealed that the bird can well thrives in this condition and performed better in terms of egg production as compared to other indigenous bird. The rearing of Vanraja was also initiated to improve the condition of the farmer. The bird is of dual purpose and can also attain higher bodyweight if provided the supplemental feed apart from scavenging during daytime.
- **Awareness on status & control of FMD and Animal Health Camp in Badmaspahad Village:** A total of two numbers of animal health camp were organized with the collaboration of AH&VS of A&N Administration. During the camp a total of 65 animals including cow, goat and 168 poultry birds were thoroughly diagnosed and treated.
- **Farm pond cleaning for storage of water and ground water recharge :** Due to increase in water storage capacity in farm ponds, moisture in the adjacent field increased and good amount of greenery have been developed, which is available for animals in summer day.

KRISHI VIGYAN KENDRA, NICOBAR

Krishi Vigyan Kendra, Car Nicobar has conducted 19 training programmers in Nicobar district for the tribal population wherein, a total of 524 tribal people were trained for providing livelihood option through agriculture and allied sectors. Under TSP of CARI 17 trainings were imparted exclusively for the tribal population of Car Nicobar district wherein, a total of 674 tribal people were trained.

Preparation of good quality copra

Gill net fabrication

Scientific pig farming


Copra drying


Value addition for fruits and vegetables


Preparation of handicrafts

Front Line Demonstrations [FLD]

- In Okra (*var.* Arka Anamika) demonstrated at Car Nicobar, results showed an average yield of 78 q/ha.
- In Poi cultivation cv. CARI- Poi was conducted and an average yield of 108.0 q/ha was recorded.
- Elephant Foot Yam cultivation cv. Gajendra gave the average yield of 71.3 q/ha.
- Popularization of Ginger cultivation cv. Jorhat Local gave an average yield of 30.0 q/ha
- Popularization of Turmeric cultivation was conducted and an average yield of 26.0 q/ha was recorded.
- Performance of cowpea cv. Pusa Komal was conducted and an average yield of 45.0 q/ha was recorded.
- Popularization of Jack bean cultivation cv. Local Collection gave the average yield of 60.0 q/ha.
- Performance of Radish cv. Japanese White was conducted and an average yield of 117.3 q/ha was recorded.
- FLD on maize (*var.* Vivek-9) was conducted and an average yield of 112.0 q/ha was recorded.
- A total of ten units of FLD on Low cost poultry sheds for backyard conditions was conducted and results revealed that net return is higher as compared to local check.
- Azolla cultivation was conducted and results indicated that the net return and BC ratio was Rs. 1048 and 5.4 respectively.

FLD on low cost poultry shed

FLD on CARI Poi

FLD on okra var. Arka Anamika

FLD on Ginger (c.v. Jorhat Local)

FLD on maize (Vivek-9)

FLD on Cowpea (Pusa Komal

On Farm Trials [OFT]

Five numbers of On Farm Trial (OFT) at farmers field were conducted to assess and refinement of the selected technology on agriculture and allied fields.

- Evaluation and assessment of sweet potato cultivars under rainfed conditions of Nicobar district with scientific cultivation techniques at four farmers' field of Car Nicobar Island in a participatory mode was done. In the experiment conducted under randomized block design using five cultivars *i.e.* three local cultivar used by farmers for long time and two released from CIARI, Port Blair with four replication. The results revealed that, the sweet potato Local Cultivar-2 (Technical Option-1) produced higher

yield (160.6 q/ha) and fetches higher net return per hectare (Rs 2,40,562.5) and benefit cost ratio (1:1.5) as compared to Local Cultivar-1, Local Cultivar-3, CARI-SP-1 and CARI-SP-2.

- Evaluation of different Growth Promoter in Backyard Poultry was conducted at farmers field and result showed that at 10th week of age, the weight gain was found best in TO-3 followed by TO-2 and TO-1. Mortality percentage was found to be highest in the case of TO-0 followed by TO-1, TO-2 and TO-3.

Extension Activities Conducted

Different extension tools like exhibition, field days, Kisan gosthi, exposure visits farmers visit, TV shows, diagnostic visit, Scientist farmers' interaction, radio talks were used to popularize the technologies through Krishi Vigyan Kendra, South Andaman and Nicobar (Table 33).

Table 33: Extension Activities

Nature of Extension Activity	No.	Farmers			Extension Officials			Total		
		M	F	T	M	F	T	M	F	T
Field Day	6	89	34	123	-	-	-	89	34	123
Kisan Mela (ITF Carnic)	1	-	-	2000 (approx.)				-	-	2000 (approx.)
Kisan gosthi	3	31	32	63				31	32	63
Method dmonstrations	6	65	55	120				65	55	120
Lectures delivered as resource persons	21	533	434	967	22	8	30	555	442	997
Scientific visit to farmers field	335	340	234	674	-	-	-	340	234	674
Diagnostic visits	81	104	45	149	-	-	-	104	45	149
Exposure visits	3	13	14	27	-	-	-	13	14	27
Water test campaign	1	84	116	200				84	116	200
Fishermen groups	8	100	0	100				100	0	100
Farmer-Scientist Interaction Meet	1	15	8	23				15	8	23
Total	**466**	**1374**	**972**	**4446**	**22**	**8**	**30**	**1396**	**980**	**4476**

M : Male, F: Female & T: Total

KRISHI VIGYAN KENDRA, NORTH & MIDDLE ANDAMAN DISTRICT

Krishi Vigyan Kendra situated at Nimbudera in North & Middle Andaman district has conducted 14 training programmes for the farmers, farm women and rural youth wherein, a total of 476 people were trained in livelihood option through agriculture and allied sectors.

On station demonstration was conducted at KVK farm, Nimbudera for paddy cultivation with CARI Dhan 5 variety and a total of 0.75 quintal of paddy seed was produced with an objective to provide to the farmers on nominal charges and its popularization amongst the farming communities. A field visit was made in N&M Andaman with the entomologist for seeking diagnostic advise on attack of pest and insect in the field crop reported by the farmers.

Training inauguration by Pradhan, Basantipur

Plant propagation methods

CARI Dhan 5 : Seed multiplication

Scientist interacting with farmers

Tribal Sub Plan & NEH Activities

Under TSP & NEH plan, empowerment of tribal's through training cum sensitization and carrying out improvements in the existing practices of agriculture and allied sectors with a view to improve production, provide income generation and improving quality of life was taken up with the allocated budget. Knowledge Share Meet (KSM) at ICAR Complex NEH Barapani and Farmers-Scientists Interaction meet in Bali Island along with Zonal Project Directorate (Zone-II), Kolkata were platform for deciding programmes for the tribal farmers of NEH and Bali Island of Sunderbans.

Intervention &Activities

Input Distribution

- One thousand vegetable seed kit comprising of tomato, brinjal, chilli, amaranths, cowpea, okra, french bean and pumpkin were distributed to tribal farmers of Mandwi, South Tripura, Bali Island, Hut Bay & Car Nicobar.
- Nine quintal seed of improved rice varieties (CARI Dhan 5 and CSR 36) were distributed to the farmers of Campbell Bay and Little Andaman.
- Fifteen quintal seed of quality protein maize and baby corn were distributed to farmers in Andaman and Nicobar Islands.
- Ten quintal seed of quality protein maize (QPM) and baby corn hybrids were given to farmers of NEH regions.
- 70 Kg seed of high yielding mungbean (Vamban-3, HUM-16, LGG-460, TM-96-2, IPM-02-3, Samrat), 50 Kg urdbean (IPU-02-43, Uttara, VBN-4,VBN-5, ANU-11-29, LBG-645), 15 Kg

Cowpea (VBN-1, VBN-2), 40 Kg Lentil (HUL-57, IPL-406, IPI-81, DPL-62) and 10 Kg Pea (HUDP 15, Prakash) were distributed to farmers of Teetop Village, Car Nicobar.

- Planting material such as coconut (100 nos), pineapple (4000 nos), elephant foot yam (2000 kg), banana (100 nos), black pepper (300 nos), clove (50 nos) and nutmeg (50 nos) were distributed to farmers of Car Nicobar.
- Planting materials such as tuberose bulbs (1000 kgs), jasmine plants (3000 nos), black polythene mulching sheet (90kgs), suckers of nendran variety of banana (1000 nos) distributed to farmers of Car Nicobar and Kamorta.
- Distributed planting materials such as coconut (55 nos.), arecanut (3000 nos.), black pepper (2000 nos.) and cinnamon (1000 nos.) from CPCRI, Kahikutchi, for tribal farmers of NEH region.
- Distributed planting materials such as gerbera (400 nos.), banana (300 nos.) & Pine apple (300 nos.) to the tribal farmers of NEH.
- Livestock inputs namely 13 goats, 10 piglets, 500 chicks, feed and medicines were distributed to the beneficiaries. Physical assets like two units of goat sheds and three units of poultry sheds were established at Small Lapathy and Tamaloo village of Car Nicobar.
- Sprayer machines (10 nos.) were distributed to the farmers of Campbell Bay, Great Nicobar.
- Cono weeder (5 nos.) were distributed to the farmers of Campbell Bay, Great Nicobar.
- Two fishing boats (32 Feet and 30 feet OAL) were distributed to fishermen of Car Nicobar to enhance their fishing activities.
- Insulated ice box, life jackets were distributed to the fishermen of Nancowry as fishing inputs to promote fishing activities.

- 16 nos. of Deep freezers were provided to tribal fishermen of Hut Bay for fish storage and consumption.
- Beside, KVK, South Andaman facilitated distribution of 300 nos. of vegetable seed kits, 15 goats, 330 chicks, 35 pigs, 50 ice box, 7 deep freezer, 50 life jackets and 2 ring buoy to the farmers of Car Nicobar.

Demonstration & Asset creations

- Community based On-Farm field demonstration of high yielding mungbean, urdbean and cowpea varieties were conducted at community village garden of Big Lapathy and Mus Village of Car Nicobar.
- Two low cost goat shed for two families.
- Three low cost poultry shed for three families.
- Four mini incubator for one village.
- Ten rain shelter for vegetable cultivation in off season.
- Developed home garden of 50 m^2 each for thirty beneficiaries of seven villages.

Exposure Visit

- 23 tribal farmers from Car Nicobar were given exposure on goat and breeder management and hatchery operation at CARI, Port Blair and DAH&VS, A& N Administration.

Table 34 : Capacity building programmes

Title	Date	Location	Participants (No.)
Tuber crops cultivation in A&N Islands	18th May, 2013	Sawai Village, Car Nicobar	25
	17th Aug., 2013	Harminder Bay, Little Andaman	30
Protected cultivation of high value vegetables	20th Aug., 2013	Campbell Bay	20
Production management of vegetable in tribal region	21st Aug., 2013	Campbell Bay	30
Scientific pig farming	5th - 7th Oct., 2013	Car Nicobar	25
Breeder management and hatchery operation at backyard level	7th - 9th Oct., 2013	Car Nicobar	22
Scientific goat farming	12th – 14th , Oct., 2013	Car Nicobar	20
Efficient resource management and value addition in major agricultural produces for enhancing farm income	13th - 15th Nov., 2013	Kokrajhar , Assam	67
IFS models for Nicobar Islands	20th - 21st Nov., 2013	Car Nicobar	25

Natural resource management for improving farm production in Nicobar Islands	22nd - 23rd Nov 2013	Car Nicobar	25
Nutritional security of tribal farming community through rural poultry farming	3rd - 5th Dec., 2013	Assam	25
Scientific pig farming	3rd - 5th Dec., 2013,	Assam	25
Scientific goat farming	3rd - 5th Dec., 2013	Assam	20
Scientific interventions on fish farming	5th -6th Dec 2013	Basar, Arunachal Pradesh	22
Scientific intervention for enhancing of pulse production	5th -11th , Dec., 2013	Balramchoudhary & Gancha Kobra Pada village, Meghalaya	15
Livelihood opportunities through horticulture	20th Dec.,2013	Mandawi, West Tripura	16
Livelihood options with emphasis on nutritious kitchen garden	20th Dec., 2013	Mandwai, South Tripura	15
	21st Dec., 2013	KVK, South Tripura	33
Management on nutrition garden application of gender agriculture implements for drudgery reductions.	23rd Dec., 2013	KVK, Nimpith for Bali Island farmer	32
Scientific cultivation of rose, anthurium and khasi mandarin	7th Jan., 2014	Nongrim Nongladew village, Ri-Bhoi district of Meghalaya	37
	8th Jan., 2014	Madanritiang village, Ri-Bhoi District , Meghalaya	35
Promoting fisheries technologies for entrepreneur development	20th Jan., 2014	Goalpara, Assam	43
Scientific interventions on fish farming	22nd Jan 2014	Agartala, Tripura	51
Water harvesting and its efficient utilization for enhancing farm income in tribal areas	22nd -24th Jan., 2014	Kamorta Island	62
Cultivation of flower crops as livelihood option	28th Jan.,2014	Kakana village, Car Nicobar	31
	29th Jan., 2014	Perka village, Car Nicobar	33
Vegetable production in tribal home gardens	6th - 7th Feb., 2014	Hut Bay, Little Andaman	52
Maize and vegetable production	6th - 8th Feb., 2014	Hut Bay, Little Andaman	60
Vegetable production in tribal home gardens	10th - 11th Feb., 2014	Car Nicobar	30
Scientific cultivation of commercial flower crops as livelihood option	11th -12th Feb., 2014	Kamorta	76

Livelihood options with emphasis on nutritious kitchen garden	17th Feb., 2014	Small Lapathy, Car Nicobar	34
Improving the livelihood security of tribal dominated areas of bay Islands through introduction of pulse cultivation	17th -19th Feb., 2014	Big Lapathy, Car Nicobar	51
	22nd, 24th & 25th Feb., 2014	Mus, Car Nicobar	68
Multistoried cropping system under coconut plantation	18th Feb., 2014	Car Nicobar	37
Introduction of pulse cultivation for livelihood security	21st Feb., 2014	Teetop village, Car Nicobar	31
Water harvesting and its efficient utilization for enhancing farm income	22nd -24th Feb., 2014	Kamorta Island	62
Multistoried cropping system under coconut plantation	24th Feb., 2014	Harminder Bay, Hut Bay	30
Agro-techniques of Brinjal cultivation CARI Brinjal- 1	26th Feb., 2014	Campbell Bay	40
Scientific cultivation of rice and maize in Nicobar Islands	27th - 28th Feb., 2014	Campbell Bay	70
Bio control agent (*Trichoderma*) for better crop health management in Islands condition	4th- 6th March, 2014	Kinmai, Big Lapathy & Sawai village,Car Nicobar	97
Livelihood options with emphasis on nutritious kitchen garden	06th March 2014	Harmider Bay, Hut Bay	59

Glimpses of Interventions in Agriculture and Allied Field in Tribal areas of North East, Bali, Nicobar & South Andaman


TRIBAL SUB PLAN

Women Participation (SC/ST)

Institute has taken major thrust for empowering women specially the SC/ST by conducting various capacity building and technological demonstration in agriculture and allied fields under TSP & NEH programmes. The overall participation of the women were 1881 in the category of ST, 86 in SC and 310 in other than SC& ST category.

An overview of women participation

TECHNOLOGIES DEMONSTRATED & TRANSFERRED

- Rice varieties (CARI Dhan 3, 4, 5, CSR 36, Ranjit, Gayatri) and Brinjal CARI Brinjal 1 were demonstrated and transferred at South and North Andaman.
- High yielding varieties of mungbean (Vamban-3, HUM-16, LGG-460, TM-96-2, IPM-02-3, Samrat) were demonstrated.
- High yielding lentil (HUL-57, IPL-406, IPI-81, DPL-62) and pea varieties (HUDP 15, Prakash) were demonstrated.
- Large scale demonstrations have been done on baby corn (HM4) and QPM (QPM1) hybrids in Andaman and Nicobar Islands.
- Rodent Pest Management in Paddy at Subash Gram and Madhupur of Diglipur, North Andaman were demonstrated & transferred.
- 55 Kg Breeder seed of CSR36 and CARI Dhan 5 were given to Directorate of Agriculture, A &N Islands.
- Rainshelter technology for vegetable cultivation in rainy season was demonstrated and transferred to farmers in Nicobar Islands.
- New variety CARI Poi Selection of Indian spinach were transferred to Island farmers.
- Demonstrated & transferred vegetable enriched homegarden in tribal region of Nicobar.
- Sweet potato varieties such as CARI SP1and SP2 in South, N&M Andaman & Car Nicobar were transferred.
- Demonstrated organic ginger production under coconut plantation in South Andaman.
- Demonstrated potential intercrops such as elephant foot yam and ginger in Coconut and Arecanut plantations in South Andaman.
- Improved varieties of Amaranthus CARI AMA-Green , CARI AMA-Red and CARI Poi Red were demonstrated.
- Grafting technique for bacterial wilt management of tomato using brinjal as root stock for protected cultivation were demonstrated.
- Grafting technique for sapota using Poonphal (*Callophyllum inopyllum*) and Sea mahua as rootstock for salinity tolerance has been standardized.
- Demonstrated heliconia as intercrop in coconut and arecanut plantations.
- Demonstrated Jasmine production in South Andaman.
- Herbal tonic (Grommune-*M. citrifolia* based tonic) technology for the backyard poultry.
- Low cost poultry feeder and waterer were demonstrated.
- Artificial hatching using mini incubator were demonstrated.
- Improved Nicobari crosses for backyard farming.
- Potential Fishing Zone advisory based fishing for improving net income of fishers.
- Introduction and popularization of Jayanthi rohu culture in Andaman Islands.
- Designed, developed, evaluated and transferred the forced convection type solar dryer through public private partnership.
- Developed, evaluated and demonstrated homestead based IFS model for Nicobar Region in participatory mode.
- Demonstrated and evaluated rainwater harvesting techniques through different land shaping methods in degraded coastal areas.
- Designed and demonstrated rainwater harvesting technique in hill top through lined tanks and its multiple uses in an integrated farming system model.
- Evaluated and demonstrated different composting techniques for organic waste recycling.
- Peking cross duck under backyard at Diglipur, North Andaman were demonstrated and popularized.
- Satellite Fish Nursery technique at Diglipur, North Andaman were demonstrated and transferred.

VARIETIES DEVELOPED FOR ISLAND CONDITION

A total of ten varieties in the crops such as rice, brinjal, poi, coconut & sweet potato, developed over the years have been released by the Institute Variety Release Committee for the benefit of the farmers /stakeholders of the Island. Brief of the varieties is given below:

◆ In Rice

(1) CARI Dhan 6 (ANR7): It is a medium duration (125 days) rice variety with long slender grains, resistant to Bacterial Leaf Blight and yields 5.04t/ha as compared to local check Jaya (3.87 t/ha) .

(2) CARI Dhan 7 (ANR12): It is a medium duration (130 days) rice variety with medium slender grains, resistant to Bacterial Leaf Blight and yields 4.86t/ha as compared to local check Jaya (3.87 t/ha) .

Developed by the team: P. K. Singh, Krishna Kumar, Ajanta Birah, R. K. Gautam,Naresh Kumar,T.V.R.S. Sharma,A. K. Singh,S. K. Zamir Ahmed & S. Dam Roy

◆ In Brinjal

(3) CARI Brinjal 1: The variety has green oblong fruits, resistant to bacterial wilt with yield potential of 25-30 t/ha under Island conditions.

Developed by the team : Krishna Kumar, P.K. Singh, Ajanta Birah, Shrawan Singh, Naresh Kumar, A. K Singh, D. R. Singh, R. K. Gautam & L. B. Singh

◆ In Poi

(4) CARI POI 1 : The variety has green stem with dark green leaves of ovate to cordate shape, possess high nutritional properties as compared to local cultivars and it has got the yield potential of 45-50 t/ha under A&N conditions.

Developed by the team: Shrawan Singh, D. R. Singh, Krishna Kumar, Ajanta Birah, L. B. Singh, S. K. Zamir Ahmed & S. Dam Roy

◆ In Coconut

(5) CARI Annapurna

- It is dwarf coconut variety with green coloured nuts having an average copra content of over 240 g under rainfed conditions of Andaman. It is a selection from introduced germplasm from Fiji.

(6) CARI Surya

- It has dwarfness coupled with round orange coloured fruits, higher nut yield of 104 nuts/palm/ year under rainfed conditions. It is mainly for ornamental purpose.

(7) CARI Omkar

- The variety has dwarfness coupled with pear shaped yellow coloured fruits with yield of >100 nuts/palm/year under rainfed conditions. It is mainly for ornamental purpose.

(8) CARI Chandan

- It is dwarf coconut variety with sandal coloured oblong to round shaped fruits, gives higher nut yield of > 100 nuts/palm/year under rainfed conditions. It is mainly for ornamental purpose.

Developed by the team: M.A. Suryanarayana, M.Sankaran, V.Damodaran, D.R.Singh, S.Dam Roy, T. Damodaran, R.P.Medhi, E.V.V.Bhaskar Rao, P.K.Khosy, B.C. Virakthamath, Joshi Joseph, S.Chander Rao, R.Dhanapal, B.Augustine Jerard, P.M.Kumaran, M.J.Rathnambal, R.V.Nair, P.M. Jacob, V.Arunachalam, S.K.Rizal, K.U.K. Nampoodhiri & George V.Thomas

◆ In Sweet Potato

(9) CARI SP 1 (Swarna)

- It is a selection from the South Andaman. The plants are spreading type , emerging leaves are

light purple and petiole colour is purple. Tubers are light pink coloured, and orange fleshed. It has yield potential of (20-25t/ha) in duration of 110-120 days.

(10) CARI SP 2 (Aparna)

- It is a selection from the South Andaman. The plants are semi spreading type , emerging leaves are light purple and petiole colour is greenish pink. Tubers are light pink coloured, and white fleshed. It has yield potential of (20-25t/ha) in duration of 110-120 days.

Developed by the team : M.Sankaran, V.Damodaran, D.R.Singh, T.Damodaran, R.Sudha, Shrawan Singh, L.B.Singh, R.P.Medhi & S.Dam Roy.

Patent and Trade Mark

- **Patent Filed**:

  Low Cost Technology for Prevention and Treatment of Sub-Clinical and Clinical Mastitis in Bovines.

  Team: R.B.Rai, T. Damodaran, Jai Sunder, V.K. Gupta, Balvir Singh, Sweta Rai, Hamid Ali & R.A. Ram. Vide application No. 1154/DEL/2013, dated 18th April, 2013.

- **Trade Mark of the Products/Technology**:

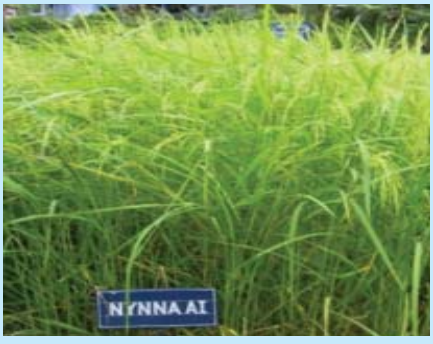
  Morical, Grommune, Nicorock, Nishibari & Dweepika registered with Trade Marks Registry, Intellectual Property Bhawan, New Delhi. Vide application No. 2625165-2625169, dated: 11th November, 2013.

Custodian Farmers of Andaman & Nicobar Islands

Custodian Farmers Meet under the theme "Role of custodian farmers in conservation, use and dissemination of agricultural biodiversity" was held at Central Island Agriculture Research Institute (CIARI), Port Blair on 19th March, 2014 in collaboration with Bioversity International. The purpose was develop understanding of the roles of custodian farmers in conservation, use and dissemination of agricultural biodiversity in Island ecosystem and to highlight their contribution to the National repositories of genetic resources system and overall sustainable agricultural development including traditional knowledge and to raise their visibility and recognition in the genetic resource management field.

Custodian farmers and communities of biodiversity conservation and utilization in Andaman & Nicobar Islands were identified for cultivar/ germplasm/ land races *viz.,* Andaman Coconut, Nicobari Aloo, Khoon Phal, Blue mango, Noni, Khushbayya rice, Black Burma, Mushley, Nyawin, White Burma, Nicobari fowl, Nicobari pig and Teressa goat and recognised for the first time.

Name of Farmer/ Community Leader	Commodity	Brief Description
Rev. Saw Sathya, President, Karen Welfare Association, Webi, Mayabunder, North Andaman	Khushbayya Rice 	◆ It is medium duration, mildly aromatic, nutritive and gives high yield among all Karen rice varieties. ◆ It grows about 140 cm tall and matures in about 120 days. ◆ It has long, clustered and droopy panicles and yields about 2.5 t ha^{-1} .
	Black Burma Rice 	◆ It has dark green leaves with conspicuous purple pigmentation of coleoptiles, leaf sheath, auricles, stigma and apiculus. ◆ It grows quite tall (174 cm) and matures in 135 days. ◆ It yields about 2.0 t ha^{-1}.

	White Burma Rice 	◆ It has light purple stigma with purple grain tip. ◆ It grows quite tall (174 cm) and matures in 135 days. ◆ It yields about 2.3 t ha^{-1}.
	Mushley Rice 	◆ It possesses bold and creamy white grains. ◆ It is tall (132 cm) with long duration (175 days for maturity) and gives higher yield (about 2.5 t ha^{-1}).
	Nyawin Rice 	◆ It has medium height (140 cm), light purple colouration of leaf auricles, thin stems with very long panicles. ◆ It yields about 2.0 t ha^{-1} .

Shri N. K. Unnin, President , Malabar Co-operative Coconut Farming Society, Kurmadera, South Andaman

Andaman Ordinary Tall

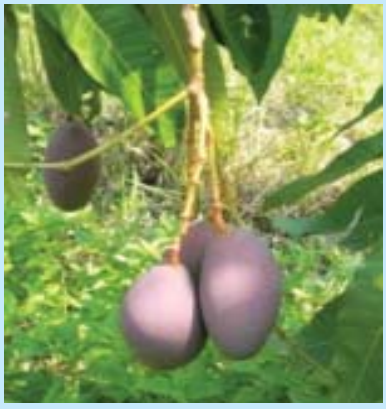
- AOT is regular bearer and produces high yield under rainfed condition.
- It is resistant to leaf spot and free from other major diseases.

Andaman Giant Tall

- This variety produces big size fruits. No. of nuts are very low (20-40 nuts/ year).
- It is drought tolerant.

Andaman Dwarf

- There are 3 dwarfs (Orange, Yellow and Green colour) with high quality tender nut and extremely dwarf in nature.

The Chairman, Tribal Council, Car Nicobar, Nicobar District	Nicobari Aloo  	◆ Achin- purple flesh and produces good size tubers. It is a female. ◆ Paltu- white flesh and good cooking quality.
Shri Maninder Mistry Desbandhugram, Diglipur, North Andaman	Khoon Phal 	◆ It is a climber and fruits are highly rich in Iron and other phytochemicals. ◆ Fruits are ovoid in shape and dark red colour.
Shri Chintaharan, Neil Island, South Andaman	Blue Mango 	◆ Purple colour mango
Shri Aubeary James, Hongkahula, Kinmai, Car Nicobar, Nicobar District	Kewadi (Pandanus) 	◆ Red colour Pandanus bearing fruit round the year. ◆ It was a staple food and propagated by seed, side suckers and roots.

The Chairman, Tribal Council, Car Nicobar, Nicobar District	Noni (Lurang) 	◆ Achin- purple flesh and produces good size tubers. It is a female. ◆ Paltu- white flesh and good cooking quality.
Shri Berack Johnson, S/o Shri Johnson , Tuhet Othangtin, Kinmai, Car Nicobar, Nicobar District	Nicobari Fowl 	◆ It is a brownish matty coloured hardy bird with short legged, medium sized and compact body. ◆ These fowls are mostly single combed with pinkish wattles and ear lobe. ◆ They have short and thick neck, black plumage tipped with brown shade, breast bulging in front, medium sized tail and long saddle feathers fitting well with tail.
Shri Benjamin John, S/o Shri John, Tuhet, Taira, Mus, Car Nicobar, Nicobar District	Nicobari pig 	◆ Indigenous pigs of Nicobar Islands. ◆ They are sturdy and short with long body and red-brown, black, grey, brown, blackish brown and fawn skin colour. ◆ Marked bristle crest (mane) on the back of the pig extending from mid head/shoulder to base of the tail. ◆ Facial profile varied from flat to concave. Slightly downward arch/ curvature of the low back. Short neck with very large jowl. characteristic feature of the tail is having no curling. They are fast runner.

Shri Rufus Mark,
S/o Shri Mark,
Tuhet, Chuomiyam,
Kinyuka,
Car Nicobar,
Nicobar District

Teressa goat

- Tall, sturdy, brownish or dark tan or black or white in colour with white and black patches.
- Black hairs on dorsal midline up to the tail. Black coloured muzzle, eyelids and hoofs.
- Peculiar white patch/line starting from inner canthus of both eyes or from eye brows and extending up to nostrils or mouth.
- Height ranges from 24 to 27 inches. Head length of male and female is 8.86±0.10 and 7.5±0.27 inches. Tail is medium to long. Large horn with flat base. Erected ears directing downwards.

INFORMATION ON OTHER SECTION

Prioritization, Monitoring and Evaluation (PME) Cell

The PME works as nodal point for prioritization, monitoring and evaluation of the projects of the institute. Besides, it has facilitated the conduct of IRC from 2nd to 4th April, 2013 under the Chairmanship of Dr. S.Dam Roy, Director & Chairman IRC 2013 in the presence of Dr. K.U.K. Nampoothiri, Former Director, CPCRI, Kasargod & Director, MSSRF, Odisha, Dr. R. Soundararajan, Ex-Pr. Scientist, NBFGR, Lucknow & Dr. N.P. Singh, Joint Director (AH & VS), Port Blair as an experts in the field of Plant Breeding & Genetics, Fisheries & Poultry Science respectively. Fifty five ongoing (both institute and external) and six new projects totalling to sixty one were presented. The Mini IRC was conducted on 7th December, 2013. Coordinated submission of online HYPM, Performance Indicator & Result Frame Work Document (RFD) in stipulated time. Deals with all project related matters and aids in compilation and publication of important documents of the Institute *viz.*, Annual Report, News Letter, preparation of reports to the council like Cabinet, PMO, QPR, HPR and DARE, along with publishing of research articles, technical bulletins, folders, books, newsletter, farmer's data base in time frame. Showcasing of activities and achievement of the institute both at Island and National level has been done successfully. 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.

Library

Our library acts as a centre for knowledge and information related to the institute's mandate. It serves to fulfil the need of the scientists, research workers, students from local research and educational institutes of these Island and Mainland. It has the facilities for on and off line information retrieval, networking and other accessories. The existing collection of books has extensive collection of resource materials in the fields of Horticulture, Field Crops, Natural Resource Management, Animal Sciences, Biotechnology, Fisheries Science, Social Science and many other related areas which are regularly enriched by adding current, important scientific and technical books, journal through subscription gifts and on exchange basis. The library has been enriched with 6839 books, 2710 miscellaneous publications in addition to journals by subscription, gratis, on exchange basis and technical books. During the report year the library procured 266 books, and 55 Indian journals were subscribed. Gratis publications such as Annual Report, Newsletter and Research Bulletin received from India and Foreign Institutes as exchange relationship is also maintained. Internet services via VSAT connection are also available for easy access to this information. Special collection of Island related

books, Hindi books, Audit and Accounts and Office Administration related books along with reprographic facility is also available. Besides, efforts have been made to acquire non-conventional literatures such as technical reports, reports on socio-economic study and annual reports from various sources to be kept as a ready reckoner for the users. It has well furnished conference room, wherein a total of 22 meeting were conducted.

HINDI CELL

Various steps were taken to create a conducive atmosphere for working to popularize official language among the staff and to promote the use of Hindi in the official work of the institute.

- For the extension of new technologies developed by the Institute, All India Radio & Doordarshan, Port Blair is broadcasting/telecasting agricultural article/programme for the Island farmers.
- Achieved targets of using Hindi in the field of transfer of technology.
- Hindi Fortnight was conducted from 17th September to 07th October, 2013 in the institute for extension and maximum use of Hindi in official works. Various programmes like quiz, extempore, essay, letter writing, noting, drafting, vocabulary 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.
- One day Rajbhasha Seminar was conducted on 17th September, 2013.
- Scientific bulletins in Hindi were printed and distributed among the farmers of these islands.
- With a view to accelerate the pace of implementation of Hindi, bilingual bulletins/ pamphlets for farmers and half yearly bilingual newsletter 'Dweep Krishi' were published.
- Institute library has purchased scientific and literature books in Hindi.
- Half yearly meeting of Town Official Language Implementation Committee, Port Blair was conducted on 29th July, 2013 and 25th January, 2014 under the Chairmanship of Director, CARI.

- Seventeen officers and staff of TOLIC members were awarded for their contribution and co-operation in implementation of the official language programme for the year 2012-2013 in the half yearly meeting of Town Official Language Implementation Committee, Port Blair on 29th July, 2013.

Establishment of Sub-Distributed Information Centre

Bioinformatics Centre of CARI serves as an active site for bioinformatics research (mainly documentation of island biodiversity) and development in the remote union territory of Andaman and Nicoabr Islands, India. It provides computational support and training to the scientists, students & also offers traineeships and studentship to deserving bioinformatics students. The databases were developed using PHP, MySql and Xampp server which provides information on all bioresearches available in the Islands, which is user friendly and provides all the information about database to the end users like researchers, academician and development departments. The centre has successfully completed the following databases:

Development of Database on Butterflies of Andaman and Nicobar Islands

Database consists of information about 215 species of butterflies classified into two super families and five families in Andaman and Nicobar islands. This database was released during 35th Foundation Day which was celebrated on 23rd June, 2013.

Database on 35 years of dedicated services of CARI to the Islanders (compilation of 35 years research work of CARI)

Database consists of information of research work for the last 35 years. It includes five division and one section research work and year wise research paper publications. This database was releases during 35th Foundation Day which was celebrated on 23rd June, 2013.

Database on Horticulture Biodiversity of Andaman and Nicobar Islands

Database consists of information of horticultural crops of Andaman and Nicobar islands. It has the detailed record of 97 species of orchids, 6 species of spices, 18 species of underutilized fruits, 72 species of underutilized vegetables, 104 species of medicinal plants, 5 varieties of Arecanut and 7 varieties of Coconut.

Institute Technology Management Unit (ITMU)

Technology profiles of most promising technologies/ varieties developed were presented in the Agri Investors meet held on 27th September, 2013 at NIRJAFT, Kolkata. Banners displaying different commercializable technologies were presented in Agribusiness Camp held at CARI, Port Blair on 27th July, 2013. Training cum workshop on Protection of Plant Varieties and Farmers Rights Act, 2001 was conducted on 16th December 2013 at Institute. Three plant varieties and germplasm *viz*. CARI Broad Dhaniya, CARI Poi selection and germplasm of Alligator Apple were registered at NBPGR. Animal germplasm *viz*. Nicobari pig and Teressa goat were registered at NBAGR for breed registration. Five trademark applications for Morical, Grommune, Nishibari, Nicorock and Dweepika were submitted. Beside a website for ITMU was developed and linked with Institute website.

Post Graduate Cell

The Cell has been established to facilitate the post graduate research work undertaken at CARI in collaboration with the other research Institutes. Three students as per detail given below have registered for undertaking implant training for duration of two weeks to one month.

Synopsis of twelve students registered for Ph.D with PRIST University, Thanjavur has been submitted for approval.

S.No.	Name of the Student	Degree	Duration	College/University	Supervisor
1.	Mr. M. Mahesh	B.Sc. Chemistry	1 Month	Loyola College, Chennai	Dr. Jai Sunder
2.	Ms. V. Shradha	B.Tech (Biotechnology)	15 Days	Sathyabama University, Chennai	Dr. Jai Sunder
3.	Ms. Himani Bepari	B. Tech (Biotechnology)	15 Days	Sree Sastha College, Chennai	Dr. Israr Ahmed

Estate Section

The estate consists of Workshop and Instrumentation Centre, which takes up works related to infrastructure development of the institute to support its research activities. It also takes up repairs and maintenance of residential and non residential buildings of the Institute. The power supply plays an important role for laboratory research works. A 320 KVA Generator set is kept as stand by for restoration of power supply during power cuts and exigency. The water supply system to residential & non – residential buildings is operated by the section which also ensures water supply during dry spells through pumping from wells, ponds, reservoirs to non – residential, experimental blocks, livestock and plantation crops.

Repair and Infrastructure Development: An amount of Rs 53.00 lakhs (approximately) has been utilized for repair and maintenance of residential and non – residential buildings and development of new infrastructures. Under infrastructure development, two numbers of Walk in Tunnel has been constructed (each covering an area of 60 Sqm) to facilitate research activity for H & F Division including one abandoned transgenic house which has been renovated/modified into Food Processing Engineering Lab to facilitate Post Harvest Processing activity for NRM Division. The existing scooter shed near Phase – I office building has been modified/renovated into car shed. Cubical chamber and particle board partition were made in the Computer Cell to function as ARS NET examination cell of the Institute. A temporary pandal for accommodating about 900 person was constructed in the Mela ground for celebration of Institute Foundation day, which was a grand success.

In addition to the above works of floriculture experiment plot and pulse germplasm block with PVC coated chain link have been done to protect the experiment from animals/cattles. False ceiling and renovation of exiting mosaic floor with vitrified tiles have been made in the CARI Guest House. Boundary

wall at Bloomsdale farm which was damaged by the cyclone 'Leher' has been re – constructed to protect the experimental plots from grazing by animals. Besides the above repair, miscellaneous works like, electrical repair, carpentry repair, masonry repair, roof leakage repair, painting and replacement of plumbing/sanitary/electrical installation were done in several office/lab building as and when required to facilitate research activity. The section also acts as the Nodal Agency for the works executed by CPWD, Port Blair for CARI, Port Blair and electricity department of A & N Administration.

Workshop: Regular school trips, arrangement and management of vehicles during major events of the Institute were done. The repair works related to 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: Repairs and maintenance of scientific equipments, refrigerator, air conditions etc installed in the Central Laboratory and other building were carried out to keep it in good condition. Uninterrupted power supply was also provided through Generator during important meetings and functions of the Institute to cater to the need of the scientists.

Women Cell

Women Cell was formed in the year 1998 to look after the welfare, act as counselling cell and caters to the issues/ grievances pertaining to the women employees of the Institute.

Under this women cell, regular meetings were conducted and various issues have been resolved.

On the occasion of International Women's Day, several events were organized from 11th to 18th March, 2014 like poster presentation, flower arrangement, rangoli and recipe contest for the women staff, house wives and farm women.

As part of the programme, lectures were arranged on 12th March, 2014 under the Chairmanship of Smti. Ranjitha Dam Roy, Ladies Club of CARI. First lecture on Women and Domestic Violence was delivered by Smti. Jennifer, Inspector, Women Complaints

Cell, A&N Police, Port Blair. Second lecture was given by Smti. Pooja Kapoor, Guest Lecturer, JNRM on Balance Diet. The participants were enlightened on the information and appreciated the conduct of such programmes.

The main attraction of the International Women's Day celebration was recognizing eleven female supporting staff of the Institute with trophy for their support in official work.

Smti. Ratna Kannan, Chairperson, Social Welfare Board was the Chief Guest during valedictory function on 18th March, 2014 and Smti. Ranjita Dam Roy, Chairperson, Ladies Club, CARI and Smti. Seema Bammi, Senior PPS of Horticulture Science Division New Delhi were Guest of honour.

Smti. Shanti Murugesan, Sr. Manager, PRAYAS, Port Blair gave lecture on Child Protection and Domestic Violence. The programme was coordinated by Women Cell Committee under the leadership of Dr. S. Dam Roy, Director, CARI.

Games and Sports

The annual sport meet of the institute was conducted at Institute play ground. All the staff members of different houses *viz*. Shompen, Jarawa , Onge and Sentinalese participated in various track & field events in large numbers. The house championship was won by Jarawa house while Sentinalese, Onge and Shompen stood 2nd , 3rd and 4th respectively. Shri A. Babuswamy of Jarawa house was declared as the "Best Athlete" for the year. Our Institute has also represented in the ICAR Zonal meet for Eastern region and won two gold medal, one each of silver and bronze medal. The Institute also bagged first prize in the annual sports events organised by the Central Government Employee Welfare Coordination Committee (CGEWCC). Beside the facilities for indoor sports like TT, multi gym have been upgraded for staff and family members.

Institute Joint Staff Council

After the expiry of the tenure of the Joint Staff Council on 3rd November, 2013, fresh election were held and the new Institute Joint Staff Council Committee (IJSC) was constituted on 7th December, 2013. The first meeting of the newly constituted IJSC was held on 8th January, 2014. On 11th January, 2014, the follow up action committee members from official side of the Council comprising of Shri S. K. Behara, Deputy Secretary (GAC), Shri P. Sakthivel, Deputy Secretary (Tech & WS), Shri K.N. Choudhury, Deputy Secretary (Admn) and Shri J.N. Bhagat, Under Secretary (GAC) as well as staff side members from Council comprising of Shri Chandrashekar, Secretary and seven other Joint Staff Council members visited the institute and noted that there was a very harmonious relationship prevailing in the institute. The institute IJSC members have been provided with a furnished dedicated room with all facilities.

AWARD AND RECOGNITION

Scientist	Award / Recognition	Awarding Agency / Organization Society
A.K. Singh	Fellowship	Indian Society of Pulses Research & Development, IIPR (ICAR), Kanpur
	Best Research Paper Award of Association for the Advancement of Biodiversity Science	University of Karnataka, Dharwad International Conference on Biodiversity, Bioresources and Biotechnology, Mysore, 30th -31st January 2014
D.R. Singh	Limca Book of National Records for recording longest spike of *Eulophia andamanensis*	Limca Book of National Records
	Best Research Paper	Noni in Noni Search 2013, GKVK Campus, Bangalore
	Best Oral Presentation	Eighth National Symposium on Noni for Sustainable Wellness, Noni Search 2013, GKVK Campus, Bangalore
M. Sankaran	Institution Building Award-2013	CARI, Port Blair
	Appreciation Certificate	Deputy Commissioner, Nicobar Islands, for registration of farmer's Greater yam variety
	Appreciation Certificate	Project Coordinator (AICRP on Tuber Crops) for transfer of technologies in Tribal areas of Nicobar Islands
	Appreciation Certificate	1st Captain, Tribal Council, Harminder Bay, for successful demonstration of Tuber crops technologies at Harminder Bay
	Editorial Board Member	International Journal of Biodiversity and Conservation (Academic Journals)
	Peer Reviewer	Indian Journal of Agricultural Sciences, Indian Journal of Horticulture, Acta Botanica Gallica & Sky Journal of Agriculture (SJAR)
S. Jeyakumar & Jai Sunder	Best Poster Presentation	In 13th Indian Veterinary Congress & XX Annual Convention of Indian Association for Advancement in Veterinary Research held from 16th -17th April 2013 at Bangalore
Jai Sunder, T.Sujatha, A.Kundu & M.S.Kundu	Best Poster Presentation	IAVMI Conference, Lucknow on 15th Dec., 2013
S.Jeyakumar, A.Kundu, Jai Sunder, S.P.Yadav, M.S.Kundu, S.K.Zamir Ahmed, Subhash Chand and R.C.Srivastava	Merit of Excellence	Best Publication of the Year (2012-2013) by CARI, Port Blair
Nagesh Ram	Best Extension Scientist Award 2013	CARI, Port Blair
R.K.Gautam and team	Best Division Award 2013 to Division of Field Crops	CARI, Port Blair

ON GOING RESEARCH PROJECTS

External Funded

Title	Principal Investigator	Budget (lakhs)	Year of Start	Year of Completion
DASD, Calicut				
CSS-National Horticulture Mission Scheme on Spices	M.Sankaran	10.55	2012	2017
ICAR				
AICRP on Tuber Crops	M.Sankaran	16.25	2012	2017
Intellectual Property Management and Transfer/Commercialisation of Agricultural Technologies	M.Sankaran	41.72	2012	2017
AICRP on Vegetable Crops	Shrawan Singh	-	2005	Continued
ICAR Seed Project: Seed Production in Agricultural Crops	P. K. Singh	39.72	2006	2016
Exploration of Plant Pathogenic and Antagonistic Microbial Resources associated with Vegetable and Spice Crops of Andaman and Nicobar Islands (AMAAS)	Krishna Kumar/ K. Sakthivel	25.60	2007	2014
All India Network Project On Rodent Control	K. Sakthivel	--	2009	2017
Sero-Surveillance of FMD in Andaman and Nicobar Islands	Jai Sunder	6.50	2011	Continued
PDFSR (ICAR)				
All India Coordinated Research Project on Integrated Farming Systems	T.P.Swarnam	85.0	2010	2017
IMD (MoES)				
Integrated Agromet Advisory Services for A&N Islands	A.Velmurugan	60.0	2008	2017
DAC (MoA)				
FASAL (Forecasting Agricultural Output using Space, Agro-Meteorology and land Based Observations)	A. Velmurugan	17.0	2011	2015
RKVY, A&N Administration				
Base Line Survey to Ascertain the Present Status of Chemical Residues in Soil, Water and Agricultural Products and its Regular Monitoring	T.P. Swarnam	26.0	2012	2015
DBT				
Establishment of SUB-DIC	M.Sankaran	75.00	2012	2017
Marker Assisted Introgression of Bacterial Blight Resistance in Popular Rice Cultivars of Andaman and Nicobar Islands	R. K. Gautam	69.00	2013	2017

NAIP				
Developing, Commissioning and Establishment of ASRB Online Examination Facility	M.Sankaran	19.50	2010	Continued
Strategies for Sustainable Management of Degraded Coastal Land and Water for Enhancing Livelihood Security of Farming Communities	A.Velmurugan	280.7	2009	2014
LSRB-DRDO				
Standardization of Technologies to Ensure Supply of High Value Vegetables to Defence Forces in Nicobar Islands	Shrawan Singh	55.45	2011	2014
WNRF				
Development of Suitable Pre- and Post- Harvest Technologies to Increase the Shelf Life of *Morinda citrifolia*	D. R.Singh	12.95	2012	2015
PPVFRA				
Development and Standardization of DUS Characteristics Procedures for Noni (*Morinda citrifolia* L.)	D. R.Singh	22.57	2013	2016
IRRI, Philippines				
Stress Tolerant Rice for Africa and South Asia (STRASA)	R. K. Gautam	7.00	2011	2015
Ministry of Agriculture, Government of India				
Monitoring of Pesticides Residue Analysis at National Level	A. K. Singh	10.50	2011	2017
NABARD				
Sustainable Rural Livelihood through Improved Rural Poultry Farming Techniques in Andaman Islands	T.Sujatha	8.99	2013	2016
Establishment of Out Reach Centre at Diglipur, North & Middle Andaman District	S.Dam Roy (PL)/ S.K. Zamir Ahmed	79.69	2009	2015
INCOIS-Hyderabad				
Location Specific Augmentation of PFZ Advisories using Satellite Altimetry and Fishing Ground Database	S. Dam Roy	75.00	2013	2017
SAC, Ahmedabad				
Identifying Critical Habitats of sea cow dugong (*Dugong dugon*) using Satellite Data	Kiruba Sankar, R	11.00	2013	2015
Integrated Coastal Zone Management	Kiruba Sankar, R	20.0	2013	2017
CMLRE (MoES), Cochin,				
Marine Faunal Biodiversity of the Nicobar Group of Islands	Kiruba Sankar, R	75.00	2013	2017
National Initiative on Climate Resilient Agriculture	Nagesh Ram	--	2010	2015

Institute funded

Division/ Section	Project Title	PI
Natural Resource Management	Post Harvest Management and Value Addition of Spices in the Island	S.Swain
	Assessment and Utilization of Soil Biodiversity for Improving Soil Health under Tropical Island Condition	A.Velmurugan
	Evaluation of Feasibility of Pulse Cultivation and Resource Optimization under Coconut Based Cropping System	T.Subramani
	Assessing the Status of Pesticide Residues in Sediments and Aquatic Biota in Neil Island	S. Dam Roy
Field Crops	Augmenting Rice Productivity through Varietal Purification of Popular Land Races	R. K. Gautam
	Genetic Improvement of Pulse Crops for Andaman & Nicobar Islands Conditions	A.K. Singh
	Development of Biotic Stress Resistant Lines in Brinjal (S. melongena L.)	Naresh Kumar
	Induction of Systemic Resistance through application of Potential Antagonistic Microorganisms against *Ralstonia solanacearum* causing Bacterial Wilt of Solanaceous Crops	K. Sakthivel/ Krishna Kumar
Horticulture & Forestry	Development of Dwarf and High Yielding Varieties in Coconut for A & N Islands	M. Sankaran
	Collection, Bioprospecting and Documentation of Perennial Vegetables of A & N Islands	Shrawan Singh
	Development of Production Technology for Ornamental Crops in Bay Islands	V. Baskaran
	Collection and Evaluation of Medicinal Plants of Bay Islands	K. Abirami
	Collection, Characterization and Agro-technique Standardization of Fruit crops in A&N Islands	K. Abirami
Animal Science	Rejuvenation and Improvement of Endangered Nicobari Fowl through collection, Propagation, Selection and Conservation	A. Kundu
	Dietary Supplementation of Micronutrient to Improve the Productivity of Livestock	M. S. Kundu
	Development of Therapeutics & Supplements by using Indigenous Herbs and Beneficial Microorganisms for Livestock Health and Production	Jai Sunder

Division/ Section	Project Title	PI
	Development of Enriched Chicken Egg and Meat	T. Sujatha
Fisheries	Mariculture of Selected Marine Fin Fishes and Shell Fishes of Andaman Waters	Kiruba Sankar, R,
	Studies on Stock Assessment and Biology of *Pristipomoides typus*, Bleeker 1852 from Andaman Water	S. Monalisa Devi
Social Science Section	Impact Assessment of Technological Interventions in Andaman	S.K. Zamir Ahmed
Flagship Programme	Integrated Agriculture System for Tropical Island	S.Dam Roy/A. Velmurugan

PUBLICATION

Research Article

Abirami, K., Rana, V. S., Baskaran, V., and Maiti, S. (2014). Effect of plant spacing on herb, essential oil and artemisinin yields in the anti malarial herb (*Artemisia annua* L.). *Indian Journal of Agronomy*, 59 (1): 96-100.

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In addition to above 35 papers were presented in the Conference/ Symposiums/ Workshop.

PEER RECOGNITION TO DR. S. DAM ROY, DIRECTOR CIARI

Honour's to the Institute and the Island for implementation of Official Language

- Town Official Language Implementation Committee, Port Blair was awarded III prize for the year 2012-2013 for best implementation of official language policy in Andaman and Nicobar Islands by Govt. of India, Ministry of Home Affairs, Dept. of Official Language on 7th March, 2014 at Bhubaneswar.
- Institute was awarded with Karyalaya Jyoti Smriti Chinah for performance in use of Official Language in official work by Rajbhasha Sansthan, New Delhi on 10th October, 2013 at Nainital.

Training undergone

- Executive Development Programme on Leadership Development at NAARM, Hyderabad from June 25th to29th, 2013.
- Authentic Leadership Development at Harvard Business School, USA from February 2nd to 7th, 2014.

Special deliberations

- To B.Ed, students on "Environmental Awareness *vis-a-vis* Island Ecology" under the aegis of C.P. Ramaswamy Education Centre at Port Blair, on 14th March 2013.
- To selected students of Andaman and Nicobar Islands on "Research prospects of agriculture and allied sectors in shaping the Nation" under INSPIRE of DBT at Port Blair, on 25th Oct. 2013.
- On Island Biodiversity in workshop on "Value of biodiversity in Island biodiversity reserve" organized by Zoological Survey of India at Port Blair, on 13th& 14th Sept. 2013.
- On "Biodiversity and socio economic conservations" during the National Conference on Agro biodiversity management for sustainable rural development at NAARM, Hyderabad on 15th Oct. 2013.
- On "Prospects of Agriculture for the students of A & N Islands" on Education Day organized by Department of Education, Andaman & Nicobar Administration.
- On "Fisheries development and the scope in water deficient region of Andaman" during National Seminar on Development of fisheries in water deficient regions organized by Fisheries Technocrat Forum, Chennai , from 25th to 26th February 2014.
- On "Ecological threat to Island ecosystem under changing climatic condition" during Seminar organized by Indian Society of Coastal Agricultural Research, at Bharuch, from 11th to 12th Dec. 2013.

Peer recognition

- Member, UT Coordination Committee, A & N Administration, Port Blair
- Member, Society for Science Centre, A & N Islands, Port Blair
- Member, State Level Environment Council, A & N Islands, Port Blair
- Member, Executive committee of SOC, Andaman Nature Club, Port Blair
- Member, State level water quality review committee, A & N Island, Port Blair
- Member, State Board for Wildlife, A & N Islands, Port Blair
- Member, Andaman & Nicobar Science and Technology Council, A & N Islands, Port Blair
- Member, State Level Sanction Committee for Rashstriya Krishi Vikas Yojana, A & N Islands
- Member, State Level Advisory Committee for narrow casting project under the scheme mass media support for agril. extension, A & N Islands

- Member, State Seed Sub-Committee for agricultural & horticultural crops, A & N Islands
- Member, Inter departmental working group to monitor and oversee the functioning of KISAN CALL CENTRE, A&N Islands
- Member, UT Level Monitoring committee to monitor the implementation of programme relating to rehabilitation of Animal Husbandry
- Member, State Level Watershed Development Committee under watershed development project for rain-fed areas in A&N Islands
- Member, High Value Agriculture Development Agency for the UT of A & N Islands
- Member, Governing Council of Coconut Mission, Andaman & Nicobar
- Member, UT level Task Force Committee for A & N Islands
- Member, Agriculture Technology Management Agency Governing Body of A & N Islands
- Member , Scientific Advisory Committee at UT level
- Member, Steering Committee at the UT level for documentation of traditional knowledge of ethno medicine used by the tribal people of A & N Islands
- Member, Inter-departmental committee on encouraging investments in supply chains including provisions for cold storage for more efficient distribution of farm produce
- Member, Coordination Committee of A & N Administration.
- Chairman, Town Official Language Implementation Committee, Port Blair.
- Member, Project Appraisal Committee of A & N Administration, Directorate of Industries, Port Blair.
- Member, Panel for Fish and Fisheries Products, Food Safety & Standards Authority of India, Ministry of Health & Family Welfare, New Delhi.
- Member, State Level Monitoring Committee (SLMC) for UT of A & N Islands to monitor periodically the Operationalisation of National Policy for Farmers, 2007.

Participation in important meeting, symposium and workshop

- First meeting of scientific panel on fish & fisheries products at New Delhi on 2nd July, 2013.
- Knowledge share meet at ICAR Research Complex for NEH Region, Meghalaya, on 9th July, 2013
- 85th Foundation and Directors Conference at ICAR, New Delhi from 15th to 17th July, 2013.
- Chaired Town Official Language Implementation Committee – Half Yearly meeting on 29th July, 2013 and 27th March, 2014.
- Annual Review Meeting of ICAR Seed Project – seed production in agricultural crops" at BPGR, New Delhi from 26th to 27th August, 2013
- Maiden meeting with the Lt. Governor of Andaman & Nicobar Islands, Lt. Gen (Retd) A. K. Singh, PVSM, AVSM, SM, VSM on 21st September, 2013.
- CARI and NABARD Interaction Meet on 5th October, 2013
- 3rd All India Coordinated Research Project (AICRP) on MULLaRP (ICAR) for Spring, Summer and Rice Fallow Cultivation on Mung and Urdbean from 25th – 26th October, 2013
- 1st, and 2nd Quarterly Coordination Committee meeting between UT, Admn. And CARI, Port Blair under the Chairmanship of Secretary, Agriculture/Animal Husbandry/Fisheries, Andaman & Nicobar Administration on 28th October, 2013 and 17th February, 2014.

- National Science day from 28th October to 1st November, 2013
- First Dr. T.R. Dutta lecture by Professor K.L. Chadha on 3rd December, 2013.
- Selection Committee Meeting under Career Advancement Scheme for Sr. Scientist held at ASRB. New Delhi and SFC meeting at Krishi Bhavan, New Delhi from 10th to11th December, 2013.
- Training & Workshop on "Protection of Plant Varieties and Farmers Rights Act -2001" on 16th December, 2013 and 28th March, 2014 .
- Directors Conference held at NIASM, Baramati and Mid Term Review Meeting of ICAR Regional committee held at CIFRI, Barrackpore from 19th to 20th January, 2014.
- Model Training course on Water Resource Management for Sustainable Agriculture for Livelihood Improvement sponsored by Ministry of Agriculture, Directorate of Extension, New Delhi from 6th to 13th March, 2014.
- Five days hands-on training on Enzyme Linked Immuno Sorbent Assay (ELISA) for diagnosis of Animal Diseases for Senior Veterinary Officers from Directorate of Animal Husbandry and Veterinary Services 10th - 14th March 2014.
- International Women Day 11th to 18th March, 2014.
- Meeting of Stakeholders: Roles of Custodian Farmers in Conservation, Use and Dissemination of Agricultural Biodiversity jointly by Bioversity International on 19th March, 2014.
- Workshop on Conservation of Water Resources in Andaman & Nicobar Islands: Issues and Challenges in association with Central Ground Water Board, Ministry of Water Resources, Govt. of India on 27th March, 2014 .

Facilitated salient research, development & extension activities

- Ten varieties namely two rice vareties CARI Dhan – 6 & 7, one brinjal CARI-Brinjal-1, four coconut – CARI-Anapurna, CARI Surya, CARI-Omkar, CARI – Chandan , two sweet potato, CARI-SP-1 and SP-2 and CARI Poi-1 of Basella were released by Institute variety release committee for the benefit of the Island farmers and other stakeholders.
- Two new leafy vegetables viz. *Mukia maderaspatana* (L.) *M. Roem* and *Limnophila chinensis* (Osbeck) Merr. and two tuber crops i.e. pink fleshed greater yam and *Tacca leontopetaloides* were reported.
- Fifty seven traditional vegetables were documented and nutritional profile of 16 predominant nicobari traditional vegetables were developed, which were found to be rich in micronutrients like Fe, Ca Zn Cu Mn, Mg and also rich in phenolics, ascorbic acid and flavonoids.
- Improved lines of long duration rice ANR 21 and ANR 37 have been found promising for grain yield, milling percentage, head rice recovery and stable performance over the years and locations.
- Fifty nine species of sponges were identified of which, 44 are reported for the first time from Andaman and Nicobar Islands, including 25 new distributional records for India. 54 Voucher specimens of identified sponges were registered and maintained at the A&N Regional Centre of ZSI.
- Live coral cover (%) was found to be increased from 40.5-44.4 at North Bay and 32.76-42.13 at Chidiyatapu with a mean recovery rate (%) of corals of 24.19 and 33.51 respectively over 2011-12. Porites spp was invariably dominant from the survey sites (above 60%) with a comparatively higher resistance to bleaching.

- A total of 20 bacterial isolates were isolated from vermicompost unit, farmers' field and forest areas, which were identified using 16S rDNA and BLAST. Among them *Bacillus subtilis*, *Bacillus cereus* and *Bacillus megaterium* were identified as phosphate solubilizers having maximum phosphate solubilization of about 46, 40 and 38 ìg/ml respectively.
- Supplementation of developed mineral mixture named CARIMIN to basal diet significantly increased the incidence of oestrous (9.66%) pregnancy rate (16.67%) and farrowing rate (16.67%) of sows. Beside, herbal ointments prepared by using *Vitex trifolia* and *E.odoratum* plants were found to be of efficient in acute wound healing in cows.
- Three indigenous new collections namely *Scindapus officinalis* (Roxb.) Schott (1), *Bacopa monnieri* (L.) Wettst (1) and one wild collection of *Canavalia cathartica* Thouars was done. Beside, Germplasm of Capsicum spp. (10) Chilli (10), Cowpea (1) and unknown legume vegetables (2) were collected from North Andaman and one each of wild germplasm of vegetables namely *Canavalia cathartica Thouars*, *Trichosanthes tricuspidata* Lour and *Scidapus officinalis* were also collected from Middle Andaman

20 bacteria were isolated and 12 were identified through 16S r DNA sequencing of which 9 showed chitinase activity and 4 siderophore production. Among the isolates *Bacillus cereus* produced maximum quantity of cellulase (1.2 units/ml) and B. flexus produced protease (120.7 units/ml), which are potential microbes for compost production.

Two Opisthobranchs namely *Dolabrifera dolabrifera* (Cuvier, 1817) and *Herviella mietta Marcus* and *Burch* 1965 representing new additions to the Molluscan fauna of Andaman and Nicobar Islands were recorded from Car Nicobar Islands.

- The geostationary hotspots of *Morinda* species were marked in South (Port Blair and Neil Island), North and Middle Andaman and submitted CARI Rakshak, CARI Sanjivini and CARI Sampada genotypes of Noni for Registration in NBPGR.
- A total of 120 kg Nucleus, 465 kg Breeder seed and 3370 kg Truthfully Labelled Seed of five rice varieties was produced through farmers' participatory approach.
- Using PFZ advisories it was found that out of 47 advisories validated there was an increase in 50.34% catch in PFZ compared to non PFZ areas from gill nets, long liners, ring netters and hand lines.
- Need based integrated land improvement approach comprising of six different methods viz. broad bed and furrow, rice-fish, three tier farming, farm pond, paired bed and furrow and pond-nursery systems were implemented in degraded coastal areas covering 37.0 ha.
- Two lakhs of Jayanthi rohu spawns were distributed and reared in six farmers field from South Andaman (Wandoor and Bimblitan) and nursery ponds at Bloomsdale farm. The spawn to fry survival was 10-15% with average weight of 30gms harvested from farmer field. The fry were fed with rice bran and ground nut cake mixture.
- Fifteen quintal seeds of tested hybrids of specialty corns including baby corn and quality protein maize were distributed among Island farmers which has potential to yield 10- 12 tons/ ha under proper package of practices. Among the pulses, pigeon pea performed well under coconut plantation as compared to mung bean & urd bean. The red gram variety CO 6 performed well and recorded higher yield (544.0 kg/ha) followed by ANP-12-02 (528 kg /ha).
- Seed village production of Paddy in the third consecutive year with five HYVs of rice in

participatory mode in farmers field could produce 5.0 ton Truthfully Labelled Seeds in 2.60 ha at Diglipur. A total area of 12.28 ha. has been replaced by 52 farmers with seven HYVs of paddy namely CSR 23, CARI Dhan3,4,5, CSR 36, Gayatri & Ranjit recommended by CIARI, which led to increase the yield to tune of 31.25% against the famers variety Jaya. The economic return by selling the variety at the rate of Rs. 10/ kg for the seed purpose will bring an additional income of Rs. 26000/ha. against 16000/ha. from the farmers variety. In nutshell an additional income of Rs. 1,22,800/- was derived by cultivating HYVs of CARI against the farmers variety from an area of 12.28 ha.

- Developed Homestead based Integrated Farming system model for tribal farmers of Nicobar district considering their physical, social and economic constraints and 25 such models comprising Homegarden, goat and backyard poultry were implemented at Kinmai, Kimios, Big and Small Lapathy villages of Car Nicobar in participatory approach. The farmers have started harvesting the produce and expressed happiness in sharing and consuming. Beside, five tribal farmers at Harminder bay, Little Andaman have been adopted under Tuber crop based demonstration with piggery and poultry as a livelihood options.
- Under TSP and NEH Component, the Institute has taken initiative to share knowledge and skill by conducting capacity building programme and technological demonstrations in agriculture and allied fields. Inputs like poultry, vegetable kits, seed and seedlings of spices, coconut, arecanut, fruit crops, flowers, fishnets and creation of assets like deep freezer, GPS, ice box, life jacket, coconut driers, agriculture implement in the tribal areas of Nicobar district , South Andaman and North Eastern Hill Region . Special emphasis has also been undertaken for socio -economic upliftment of farmers of the Bali Island of Sunderban through need based technological interventions.
- Six land races of Karens rice, one coconut and one Nicobari aloo have been sent to PPVFRA for registration in farmers name.
- Custodian farmers and communities of Biodiversity conservation and utilization in Andaman & Nicobar Islands were identified for cultivar/ germplasm/ land races *viz.,* Andaman Coconut, Nicobari Aloo, Khun Phal, Blue mango, Noni, Khushbayya rice, Black Burma, Mushley, Nyawin, White Burma, Nicobari fowl, Nicobari pig and Teressa goat from A & N Islands.
- Farm household survey conducted in North, Middle and South Andaman district covering 300 farm households to assess the chemical fertilizer use pattern indicated 30.9%, not using any kind of chemical fertilizers for growing crops. Pesticide residues viz., chlorpyriphos ethyl, dimethoate and acetamprid were found in 14.5 % of the total samples analyzed. The chlorpyriphos ethyl was found to the extent of 0.008 to 0.07 mg kg-1 with average level of 0.038 mg kg^{-1}.
- During the period 93 agromet bulletins in English and 64 in Hindi were issued through print and electronic media, apart from conduct of farmers awareness programme. Verification of agromet bulletin indicated that on an average forecasted and observed values of rainfall were matching to the tune of 69 % during pre monsoon period while 54 % in monsoon and 60 % in post monsoon period, respectively.
- Out Reach Centre has taken technological intervention in Diglipur cluster of villages following group and participatory approach. Horizontal spread of technology i.e. peking cross duck, satellite nursery for fresh water fish and HYV of rice was reflected in the operational area.

- The economic feasibility study indicated that by adoption of Composite fish culture with CRM in the ratio of 4:3:3 could give a net return of Rs.22,950/- followed by Broad Bead Furrow (Rs.21,250/-), HYV of rice (Rs.9,400/-), Improved Nicobari fowl (Rs. 7,100/-) and Peking cross duck (Rs. 3,210/-). The acceptance and adoption level was more in Composite fish culture, as it was found to be encapsulated with all the four major ingredients i.e. technology back up , input provider, good governance and the market which is needed for acceptance, adoption, spread and making it a market led technology for the Islanders. The lacunae identified in goat and pig farming was lack of proper governance and non-availability of inputs in the form of kids and piglets inclusive of the logistic, which acts as a major bottleneck for its up scaling.

Administration, management and co-ordination

- As the Director of the Institute has been engaged in day to day Administration, monitoring the progress of research by interacting with the Head of Divisions, Scientists and KVK personnel , conducting visit to experimental plots, visiting farmer's field and getting their feedback. Attending most of the programmes conducted by the KVK's.
- Facilitating the implementation of QRT recommendation, formation of new RAC, and conduct of IRC meetings .

Infrastructure developed

- Food processing plant was established.
- Feed analysis facility has been developed.
- Land for establishment of Bio-security laboratory for conservation of flora and fauna and Biodiversity park has been identified.
- ARIS cell and ASRB online examination centre was established.
- Library has been strengthened by procurement of books & journal with a separate section for Hindi books.
- Sports facilities like development of sports ground for athletic, football and cricket. The Gymnasium of the campus was strengthened.
- Under Tribal Sub-Plan (TSP), a good number of assets have been created for the tribal farmers / fishers which will provide direct benefit to the beneficiaries / communities.
- Website of the Institute and KVK was revamped and launched .

Resource generation

- An amount of Rs. 937.25 lakhs from externally funded projects were approved during the period from different funding agencies.
- Revenue of Rs. 10.61 lakhs was obtained from farm produce of Sippighat, Garacharma, Bloomsdale farm and Animal Science Division, beside Rs. 3.89 lakhs was generated from guest house.

Budget utilization

Out of allotted Rs. 544.69 lakh of Plan budget Rs. 539.33 lakh was utilized (99.01 %) and in Non-Plan of Rs. 1473.60 lakh, Rs. 1452.70 lakh was utilized (98.58%).

PARTICIPATION OF SCIENTIST IN CONFERENCE/ SEMINAR/ SYMPOSIUM/ MEETINGS & TRAINING

Scientist	Program	Venue	Date/Duration
Naresh Kumar	56th Annual Workshop of AICRP on Maize	ANGRAU Hyderabad	6th - 8th April, 2013
R K Gautam	Annual Review and Planning Workshop of IRRI-ICAR STRASA project	NASC, New Delhi	8th -11th April, 2013
Jai Sunder	Visit to Institutes to study the facility to establish biosecurity and quarantine facility	ACQS, Chennai, HSADL, Bhopal, NBAII, IVRI, PDADMAS, Bengaluru	9th -14th April, 2013
D.R. Singh	Governing Council Meeting on Coconut Mission & HVADA	Port Blair, A&N Administration	12th April, 2013
P. K. Singh	48th Annual Rice Research Meeting	Sher-e-Kashmir University of Agricultural Science & Technology, Srinagar	13th - 16th April, 2013
D.R. Singh, A.Kundu & Shrawan Singh	Meeting with Director NBPGR New Delhi, CCS, NIAH, Bagpat and NRC, Hissar for the establishment of quarantine Laboratory	IARI, New Delhi, NBPGR, NBAGR, PDER Hissar, National Institute of Animal Health, Bagpat	23rd - 25th April, 2013
M. Sanakaran	AGM of AICRP on Tuber Crops	AAU, Jorhat	26th -28th April, 2013
A.Kundu, M.S.Kundu, Jai Sunder & T.Sujatha	Farmers Meet during World Veterinary day	Port Blair, A&N Admn.	27th, April, 2013
A K Singh	Annual Group Meeting of MULLaRP and Pigeonpea	TNAU, Coimbatore	12th - 13th May, 2013
D.R. Singh	8th State level sanctioning committee for RKVY.	Port Blair, A&N Admn.	21st May, 2013
Shrawan Singh	National Seminar on Horticulture Biotechnology	IIHR, Bangalore	14th June, 2013
A.Velmurugan & T.Subrammani	Organic Farming Conference with field training organized by NABARD and PSNF-Trust	South Andaman	24th - 26th June, 2013
A.Velmurugan	National Workshop on micronutrients in horticultural crops	IIHR, Bangalore	29th June, 2013
D.R. Singh	Meeting for preparation of sectoral road map for agril & allied, scientific & industrial research development	Port Blair, A&N Admn.	1st July, 2013
R.K.Gautam , A.Kundu, S.K. Zamir Ahmed, Jai Sunder, M. Sankaran, A.Velmurugan & Nagesh Ram	Knowledge Sharing Meet	ICAR Research Complex for NEH Region, Barapani, Meghalaya	9th July 2013
P. K. Singh	Agricultural Research Management for Directly Recruited Scientist	NAARM, Hyderabad	15th -27th July, 2013

Scientist	Program	Venue	Date/Duration
M. Sankaran	AGM of AICRP on Palms	IGKV, Raipur	22nd - 25th July, 2013
A.Velmurugan	Performance Review Workshop of NAIP	New Delhi & Kolkata	July 2013 & March 2013
R K Gautam	Management Development Program on Consultancy Project Management	NAARM, Hyderabad	1st - 7th Aug., 2013
B.K. Nanda, N.Bommayasamy, N. C. Choudhri	Behavioural skills for personality Development by Extension Education Institute, Hyderabad & ATMA	Port Blair	19th - 22nd Aug., 2013
T.Sujatha	Principles of HPLC for Residue analysis	Pharmacovigilance Laboratory for Animal Feed and Food Safety, DCAHS, TANUVAS, Chennai	19th - 23rd, Aug., 2013
A. Velmurugan	Awareness Workshop of NFBSFARA	NIRJAFT, Kolkata	23rd - 24th Aug., 2013
Jai Sunder	Review Meeting of FMD-CP	PD,FMD, Mukteshwar	23rd - 24th Aug., 2013
P. K. Singh	VIII Annual Review Meeting of ICAR Seed Project	NAAS, New Delhi	26th - 27th Aug., 2013
S. Monalisha Devi	DBT Task Force Meeting on Value Added Biomass and Products from Natural Resources	DBT, New Delhi	29th - 30th Aug., 2013
Jai Sunder	13th Annual Review Meeting of AICRP on Goat Improvement	MPKV, Rahuri, Maharastra	6th -7th Sept.,2013
Viveka Nand Singh & Sanjay Kumar Pandey	Certificate Course on Organic Farming	National Centre of Organic Farming, Ghaziabad, Uttar Pradesh	2nd Sept., - 1st Oct., 2013
V. Baskaran	4th International Conference on Landscape and Urban Horticulture	Kolkata, West Bengal	12th - 14th Sept., 2013.
M. Sankaran	Scientist-Farmers Interface Meet	Bali Islands, West Bengal	13th Sept.,2013
Jai Sunder	Annual Review Meeting of AICRP on FMD	RIVER, Pondicherry	21st -22nd Sept., 2013
N.Bommayasamy	Lunching workshop cum training of National Initiative on Fodder Technology Demonstration (NIFTD)	IGFRI, Jhansi	22nd - 23rd , Sept.,2013
M. Sankaran	Annual ITMU Workshop Meeting	NIRJAFT, Kolkata	26th Sept.,2013
M. Sankaran	Agri-Investors Meet	Kolkata	27th Sept. 2013
K. Sakthivel	Understanding the Mechanism of Host–Pathogen Bio-agent Interaction and Sustainable Bio-Management Strategy for Threatening Crop Diseases	IARI, New Delhi	3rd - 23rd Oct., 2013

Scientist	Program	Venue	Date/Duration
T. Bharathimeena	Insect Systematics	National Bureau of Agriculturally Important Insects, Bangalore	9th Oct., 2013 - 9th Jan., 2014
M. Sankaran	State Level Workshop on strategies for productivity enhancement, value addition and marketing of coconut in A&N Islands	Directorate of Agriculture, A&N Administration	10th Oct., 2013
Zachariah George, Sanjay Kumar Pandey, Chandrika Ram & Viveka Nand Singh	Participatory guarantee system for organic certification	Department of Agriculture, Car Nicobar	22nd - 23rd Oct., 2013
T. Bharathimeena	Taxonomy of Insects and Mites	GKVK, Bangalore	6th - 26th Nov., 2013
M. Sankaran	Meeting on Implementation of National Mission Food Processing	Port Blair, A&N Administration	8th Nov., 2013
S. Monalisha Devi	Advances in molecular and serological tools for fish disease diagnosis	CIFA, Bhubaneswar	9th - 29th Nov., 2013
N.Bommayasamy	Protected cultivation in vegetables	Centre of Excellence for Vegetables, Gharaunda, Karnal, Haryana	20th - 22nd Nov., 2013
M. Sankaran Ani Dath & Dibakar Khan	Developing, Commissioning, Operating and Managing an Online System for NET/ARS-PRELIM Examination in ASRB, ICAR	IARI, New Delhi	21st - 22nd Nov.,2013
A.Kundu	XXX Conference of Indian Poultry Science Association and National Symposium on Poultry Production: Feed, Food and Environmental Safety	CARI, Izatnagar Bareilly, UP	22nd - 23rd Nov., 2013
V. Baskaran	4th National Advisory Board on Management of Genetic Resources (NABMGR)	NRC for Grapes, Pune	29th Nov., 2013
K. Sakthivel	4th International Conference on Bacterial Blight of Rice	CCMB, Hyderabad	2nd - 4th Dec., 2013
A.Velmurugan & T.P.Swarnam	Biennial Workshop of AICRP on Integrated Farming Systems	ICAR-RC for NEH, Umiam	2nd- 4th Dec., 2013
Jai Sunder	SFC presentation meeting at Council	Krishi Bhawan, New Delhi	11th -12th Dec., 2013
M.S.Kundu	Committee Meet for selection of Subject Matter Specialist –Animal Science/Veterinary Sciences at Ramakrishna Mission Vivekananda University	Belur, Howrah, West Bengal	12th Dec., 2013.

Scientist	Program	Venue	Date/Duration
Jai Sunder	IAVMI conference	Lucknow	13th - 15th Dec., 2013
K.Abirami	National Seminar on Non Timber Forest Produce, Medicinal, Aromatic Plants and Spices: Innovation for Livelihood Security	Indira Gandhi Krishi Vishwavidyalaya, Raipur, Chhattisgarh	23rd - 24th , Dec.,2013
A.Kundu	Meeting of ANUT Veterinary Council	Directorate of Animal Husbandry and Veterinary Services, Port Blair	24th Dec., 2013
L.B. Singh, N.C.Chouduri & Haripriya	Primary Agricultural Credit Society & JLG	Rajiv Gandhi Cooperative College, Port Blair	17th - 18th Jan., 2014
M. Sankaran	QRT meeting of AICRP on Tuber Crops	CTCRI, RC, Bhubaneshwar	22nd - 24th Jan., 2014
S.K. Zamir Ahmed	Task force on Sub-group Committee on Promotion of Alternative Agriculture along with India's Coast and in the Sea as a Member	DBT, CGO Complex, New Delhi	23rd Jan., 2014
A .K .Singh	International Conference on Biodiversity, Bio-resources and Biotechnology	Mysore	30th - 31st Jan., 2014
A .K .Singh	2nd International Conference on Agricultural & Horticultural Sciences	Hyderabad	3rd - 5th , Feb., 2014
B. K. Nanda	India Geospatial Forum - 2014	Hyderabad	5th - 7th Feb., 2014
R. K. Gautam	Phenot 3rd International Plant Phenotyping Symposium	MSSRF, Chennai	17th -19th Feb., 2014
Jai Sunder	Hands on training on sdLPBE	PDFMD Mukteswar	17th - 21st Feb., 2014
S. Swain	48th Annual Convention of Indian Society of Agricultural Engineers (ISAE)	Udaipur, Rajasthan	21st - 23rd Feb., 2014
A.Kundu	Sensitizing Workshop on Poultry Seed Project	DPR, Rajendra Nagar, Hyderabad	21st - 26th Feb., 2014
K. Sakthivel	49th All India Coordinated Rice Improvement Programme	DRR, Hyderabad	22nd - 23rd Feb., 2014
K.Abirami	Brainstorming Meeting and Training cum demonstration on Cryopreservation and in vitro conservation in Horticultural Crops	IIHR, Bangalore	21st - 22nd Feb., 14
K.Abirami	Training on sexual harassment of women at work place (prevention, prohibition and redressal) Act 2013	Institute of Public Administration, Bangalore	24th - 25th Feb., 2014

Scientist	Program	Venue	Date/Duration
M. Sankaran	BTIS net Coordinators meet	NIO, Goa	27th - 28th Feb., 2014
R. Kiruba Sankar,	Annual Review/Progress Meeting	INCOIS , Hyderabad	19th March, 2014
D.R. Singh	Meeting on Noni Germplasm registration as an Expert.	WNRF, Chennai	22nd - 23rd March, 2014
Jai Sunder,M.S.Kundu & T.Sujatha	Presentation on animal diseases in A & N Islands for the SVOs organized by ANUVTC.	DAH&VS, A & N Administration, Port Blair	27th - 28th March, 2014

Deputation Abroad

- Dr.S.Dam Roy, Director, attended overseas training on Authentic Leadership Development Programme at Harvard Business School, Boston, USA from 2nd - 7th Feb., 2014.
- Dr. R. K. Gautam and Dr. P K Singh participated in the 7th International Rice Genetics Symposium at Manila, Philippines from 5th -8th Nov., 2013.

HUMAN RESOURCES DEVELOPMENT FOR STAKEHOLDERS

Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
Training to stakeholders					
Improved rice cultivation	27th June 2013	20	Farmers	Kerelapuram	FCD & ORC
Improved rice cultivation practice	1st - 2nd July 2013	30	Farmers	R.K.Gram	FCD & ORC
Women empowerment on rural poultry by enhanced rural poultry farming techniques	23rd - 25th July 2013	40	Rural women	Ferrargunj	ASD & NABARD
Protected cultivation of high value vegetables	29th - 30th July, 2013	25	Farmers	Neil Island	H& F
Rodent pest management	11th -12th Sept., 2013	153	Farmers & Rural youth	R.K. Gram, Subashgram, Madhupur & Keralapuram	FCD, AINPR & ORC
Quality seed production in agriculture crops	12th Sept., 2013	58	Farmers	Keralapuram	FCD & ORC
CARI Brinjal-1 cultivation technique	15th - 16th Sept. 2013	35	Farmers	Keralapuaram	FCD & ORC
Integrated Farming Systems	27th Sept.,2013	25	Farmers	Garacharma	NRM
Quality protein maize (QPM) and baby corn production	28th Sept. 2013	20	Farmers	Baratang	FCD & ORC
Popularization of maize	7th - 8th Nov., 2013	40	Farmers	Wandoor and Guptapara	FCD & KVK
Quality seed production of agricultural crops	9th - 11th Nov., 2013	124	Farmers	Keralapuram	FCD & ORC
Maize for livelihood	12th -14th Nov., 2013	103	Farmers	Baratang, Keralapuram & Webi	FCD & ORC
Cultivation of spices and value addition	10th -11th Dec.2013	218	Farmers	Keralapuram & Mayabunder	H&F & ORC
PoP of paddy, vegetables & fruit crops	16th - 17th Jan., 2014	22	Farmers	Garacharma	ACANI & SSS
Pest identification and control in brinjal, tomato, chilli & bitter gourd	19th - 20th Jan ., 2014	42	Farmers	R.K.Gram & Madhupur	KVK, IIHR & ORC

Title	Period	Participants (No.)	Type of participants	Venue	Conducted by
Mixed carp farming	21st - 23rd Jan., 2014	59	Farmers	Kishorinagar	KVK & ORC
Scientific vegetable production technologies for Island conditions	21st - 22nd Jan., 2014	72	Farmers	Rangat & Diglipur	H&F
Improved technique of vegetable production in Islands	22nd Jan., 2014	12	Farmers	Keralapuram	FCD & ORC
Exposure on livelihood options	24th Feb., 2014	53	Farmers & Rural youth	Garacharma	ORC
Water resource management for sustainable agriculture and livelihood improvement	6th - 13th March, 2014	15	In-service personnel	Garacharma	NRM
Hands training on ELISA for diagnosis of animal diseases	10th - 14th March, 2014	6	SVOs, DAHVS, A&N Admn	Garacharma	ASD
Rodent and pulses crop management	21st - 22nd March,2014	38	Farmers& Rural youth	Nabagram & Khudirampur	FCD, AINPR & ORC
Promotion of nutritious kitchen garden and value addition	23rd March, 2014	30	Rural youth	Garacharma	ACANI & SSS
Scientific cultivation of rice	27th March 2014	70	Farmers	Diglipur & Kishorinagar	FCD & ORC
Improved technologies in agricultural for better income	27th March 2014	15	Farmers	Madhupur	ORC & CPTL
Scientific cultivation of rice	27th March 2014	25	Farmers	Nabagram	FCD & ORC

FCD : Field Crop Division, NRM: Natural Resource Management, H&F: Horticulture & Forestry Division, ASD: Animal Science Division, FSD: Fisheries Science Division, SSS: Social Science Section, CPTL: Centre for Participatory Training and Learning

Seminar / Workshop/Meeting

Knowledge Sharing Meet at ICAR Research Complex for NEH Region, Barapani, Meghalaya	9th July, 2013
Agribusiness Camp at Port Blair	27th July,2013
Scientist-Farmers Interface Meet at Bali Islands, West Bengal	13th Sept., 2013
Workshop on Maize for livelihood at Port Blair	29th Sep. 2013
All India Group Meeting of *MULLaRP* on Summer/ Spring and Rice- Fallow Cultivation of mungbean and urdbean at Port Blair	25th to 26th Oct., 2013

Extension Activities

Title	Period	Participants (No.)	Type of Participants	Venue	Conducted by
Awareness camp on FMD	26th , July 2013	47	Livestock farmers	Badmashpahar	DAH & VS, A & N Admn.
Awareness on status and control of FMD in cattle	30th , July 2013	33	Livestock farmers	Collinpur	KVK, Sippighat & DAH & VS, A & N Admn.
Sensitization on control of FMD	6th Aug., 2013	20	Paravet staff, DAHVS, A&N Admn	Garacharma	DAHVS, A&N Admn
Exposure visit on operation of incubator for tribal farming community of Car Nicobar	15th – 20th , Nov., 2013	5	Tribal farmers of Car Nicobar	Garacharma	ASD
Exposure visit on scientific goat farming for tribal farming community of Car Nicobar	15th – 20th , Nov., 2013	12	Tribal farmers of Car Nicobar	Garacharma	ASD
Awareness on control of FMD in A&N Islands	3rd, Feb., 2014	29	Livestock farmers	Bimblitan village	DAH & VS, A & N Admn.
Sensitization on effective vaccination and control of FMD in A&N Islands	4th Feb., 2014	32	SVOs & Para Vet staff	Goalghar, DAH&VS.	DAH & VS, A & N Admn.
Awareness on effective vaccination of FMD	8th Feb., 2014	34	Livestock farmers	Rangachang	DAH & VS, A & N Admn.
Awareness on maize cultivation	8th -9th March 2014	110	Farmers	Car Nicobar	FCD& KVK
Awareness on Potential Fishing Zone advisories	April 2013-March 2014	200	Fisherman	20 locations in Andaman	INCOIS, Hyderabad
Demonstration on functioning of mini incubator	20th Feb., 2014	12	Rural Women	Garacharma	ASD& NABARD
Video films on quality seed production and maize cultivation	11th and 29th Sept., 2013	77	Farmers	Kerlapuram	FCD & ORC

DAH&VS: Directorate of Animal Husbandry and Veterinary Sciences

Field Day

Title	Period	Participants (No.)	Type of Participants	Venue
Seed production of TLS	10th Sept., 2013	40	Farmers & extension personal	D.B.Gram , North Andaman
High yielding varieties of rice	19th October, 2013	65	Farmers & extension personal	Bloomsdale farm, South Andaman & KVK personal
Farmers participatory selection of salt tolerant rice varieties	31st October, 2013	43	Farmers & extension personal	North Wandoor, Port Blair
Farmers participatory seed production of rice	11th Nov., 2013	53	Farmers & extension personal	Diglipur, North Andaman
Improved varieties of chrysanthemum	15th Feb., 2014	35	Scientist & KVK personal	Garacharma, South Andaman
Palak cultivation in coconut garden	4th Feb., 2014	15	Farmers	Rangachan, South Andaman
CARI Poi selection and Amaranthus genotypes	5th Feb., 2014	20	Farmers	Collinpur, South Andaman
Bacterial wilt resistant Brinjal variety (CARI-Brinjal-1)	28thMarch, 2014	50	Farmers	D.B.Gram , North Andaman

Radio Talks

Title	Date of Broadcast	Expert
द्वीपों में बेबीकॉर्न की खेती	9th May, 2013	Naresh Kumar
Role of outreach centre in transfer of technologies to farming community	15th July, 2013	S.K. Zamir Ahmed
द्वीपों में मक्का उगायें	31st Aug., 2013	Naresh Kumar
बुवाई से पहले बीज परिक्षण व बीजोपचार	7th Sept,2013	P. K. Singh
द्वीपों की स्थानीय नस्ल : निकोबारी मुर्गी	18th Sept., 2013	A.Kundu
Suitable polyhouse structures	19th Sept., 2013	D.R. Singh
Broad Dhaniya ki kheti	Sept. 2013	Shrawan Singh
द्वीपों में मूंग की खेती - कुछ सुझाव	11th Oct., 2013	A.K. Singh
Sabjiyon ke utpadan he liye unnant taknikiya	Dec., 2013	Shrawan Singh
Rejuvenation of old senile orchard	11th Dec., .2013	L. B. Singh
Duck cum fish farming	13th Dec., 2013	N.C. Choudhuri

Doordarshan Interview

Title	Date of Broadcast	Expert
Popularization of baby corn among farmers	9th May, 2013	Naresh Kumar
Nicobari fowl and its importance	17th May, 2013	A.Kundu
Role of KVK in promotion of agriculture and allied sector in A & N Islands	20th June, 2013	Nagesh Ram
Rice breeding and varieties for Andaman & Nicobar Islands	Sept., 2013	R. K. Gautam and team
धान की उन्नत किस्मों का विकास व बीज उत्पादन का महत्वा	25th Sept.,2013	P. K. Singh
Integrated Farming System	Oct., 2013	S.Dam Roy, A.Velmurugan, T.P.Swarnam, T.Sujatha, Nagesh Ram & B.K.Nanda
IFS for prosperity and stability	Nov., 2013	S.Dam Roy A.Velmurugan, T.P.Swarnam & T.Sujatha
द्वीपों में अरहर की खेती की संभावनाएँ एवं द्वीपों में मूंग की खेती – तकनिकी सुझाव	23rd Dec.,2013	A.K. Singh
Home garden based IFS for Nicobar	6th Feb., 2014	S.K.Pandey, A.Velmurugan & T.P.Swarnam

ROUND UP OF INSTITUTE ACTIVITIES

Celebration of Independence Day and Republic day

Independence Day and Republic Day were celebrated in the institute with gaiety and fervor. Dr. S. Dam Roy, Director, CARI hoisted the National flag and thereafter he appreciated the efforts and dedication of all the staff members of this Institute in accomplishing the research, development and extension activities. Various functions like quiz, drawing competition for children's, fun games for ladies were arranged in the forenoon. On the occasion of Republic Day celebration the Director, CIARI gave away the Best worker award in the Technical, Supporting, Administrative and TSM category.

Central Agricultural Research Institute Employees Welfare Association (CARIEWA)

CARIEWA, the welfare arm of the institute was engaged in organizing different welfare activities for the employees of the institute namely:

- Blood donation camp in collaboration with G.B.Pant Hospital, Port Blair, wherein a total of 26 staff members donated blood.
- De addiction camp for the staff.
- CARIEWA scholarship to the wards of staff for excelling in the class XII.
- Facilitated selection of best workers of Institute for the year 2013 among the staff from T.S.M to technical category (T-5).
- Coordinated conduct of meeting of the Central Government Employee Welfare Association at CARI in which all the heads of the central government offices at Port Blair participated.
- Organized farewell & welcome functions.
- Running of canteen at CARI campus.
- Drawing and painting competition for the wards of the staff on the eve of Independence day and Republic day.

Members donating blood and the Patron CARIEWA is appreciating the efforts of the members

Deaddiction camp organized by CARIEWA on 9th Dec. 2013

Major Events (April 2013 to March 2014)

Sl. No.	Event	Duration
April, 2013		
1.	IRC-2013 meeting	2nd -4th April, 2013
2.	Visit of Director to different laboratories (at Bhopal, Bangalore, Chennai) for establishment of bio-security and quarantine facilities at Port Blair	9th - 15th April, 2013
3.	TSP and NEH component meeting	15th April, 2013
4.	Doctoral meeting for PhD students	16th April, 2013
5.	All India Entrance examination for UG & PG studies	20th - 21st April, 2013
6.	Director & Asstt. Director (OL) attends Raj Bhasha Sammelan Avam Purushkar Vitaran Samaroha by Deptt. Of Official Language, Home Ministry, GOI to receive III prize to TOLIC, Port Blair	18th April, 2013
7.	Visit of team of scientists (06 members) to different laboratories (at Delhi, Bagpat) for establishment of bio-security and quarantine facilities at Port Blair	22nd – 26th April, 2013
8.	Review Meeting of Bio-security and quarantine facilities with team	30th April, 2013
May, 2013		
9.	Director & team visited Neil Island	1st May, 2013
10.	Exposure visit of Members, Board of Management, UAS, GKVK, Bangalore to Port Blair	16th May, 2013
June, 2013		
11.	Visit of DDG (Horticulture Science)	21st - 23rd June, 2013
12.	35th Foundation Day	23rd June, 2013
July, 2013		
13.	Knowledge Sharing Meet at ICAR Research Complex for NEH Region, Barapani, Meghalaya under NEH component	9th July, 2013
14.	Agri Business Camp of ICAR Institute of Eastern India in association with ZTMBPDU of NIJAFT, Kolkata and CARI, Port Blair	27th July, 2013
15.	Town Official Language Implementation Committee (half yearly) Meeting	29th July, 2013
August, 2013		
16.	Revival and release of Journal of the Andaman Science Association after 2002	19th Aug., 2013
17.	Director attended Mega Seed project meeting at New Delhi.	25th - 29th Aug., 2013
18.	Visit of Project Coordinator AICRIP on Tuber Crops to Hut bay and Nicobar	26th - 30th Aug., 2013
September, 2013		
19.	Director visits Car Nicobar to review TSP &KVK interventions	3rd Sept., 2013
20.	Lt. Governor of Andaman & Nicobar Islands, Lt. Gen (Retd) A. K. Singh, PVSM, AVSM, SM, VSM, visits CARI	21st Sept., 2013,

Sl. No.	Event	Duration
October, 2013		
21.	Director visits Bali Island to attend scientist farmers interaction	3rd Oct., 2013
22.	CARI and NABARD Interaction Meet	5th Oct., 2013
23.	Director participated in National Conference on Agro-Biodiversity Management for Sustainable Rural Development at NAARM, Hyderabad	15th - 16th Oct., 2013
24.	Institute Variety Release Committee meeting	23rd Oct., 2013
25.	3rd All India Coordinated Research Project (AICRP) on MULLaRP (ICAR) for Spring, Summer and Rice Fallow Cultivation on Mung and Urdbean	25th – 26th Oct., 2013
26.	ARS Exam (Prelims)	27th Oct., 2013.
27.	1st Quarterly Coordination Committee meeting between UT, Admn & CIARI, Port Blair under the Chairmanship of Secretary, Agriculture/Animal Husbandry/Fisheries, Andaman & Nicobar Administration	28th Oct., 2013
28.	Vigilance Awareness Week	28th Oct. - 1st Nov., 2013
November, 2013		
29.	Sensitization programme on High Quality Protein Maize	12th - 14th Nov., 2013
30.	Exposure visit of Tribal farmers of Car Nicobar to CARI, Port Blair	14th - 18th Nov., 2013
December, 2013		
31.	First Dr. T.R. Dutta lecture at CARI, Port Blair by Professor K.L. Chadha	3rd Dec., 2013
32.	Mini IRC-2013	7th Dec., 2013
33.	Awareness on De-addiction and Alcoholism	9th Dec., 2013
34.	Director participated to finalize SFC and CAS interview at New Delhi	8th - 13th Dec., 2013
35.	Training & Workshop on Protection of Plant Varieties and Farmers Rights Act -2001	16th Dec., 2013
36.	ARS Examination	29th Dec., 2013
January, 2014		
37.	Blood Donation Camp by CARIEWA	9th Jan., 2014
38.	Annual Sports Meet-2014	15th Jan., 2014
39.	Probation clearance of 11 staff	17th Jan., 2014
40.	ARS online installation and audit completion	17th Jan., , 2014
41.	Director's Meet at National Institute of Abiotic Stress Management, Baramati, Puna	19th - 20th Jan., 2014
42.	Regional Committee Meeting at CIFRI, Barrackpore, West Bengal	24th Jan., 2014
43.	Half yearly TOLIC Meeting	25th Jan., 2014
February, 2014		
44.	Director attends overseas training on Authentic Leadership Development Programme at Harvard Business School, Boston, USA	2nd - 7th Feb., 2014
45.	2nd Coordination Committee meeting of CARI with A & N Administration	17th Feb., 2014
46.	National Science Day	24th - 28th Feb., 2014

Sl. No.	Event	Duration
March, 2014		
47.	Model Training course on Water Resource Management for Sustainable Agriculture for Livelihood Improvement sponsored by Ministry of Agriculture, Directorate of Extension, New Delhi	6th-13th March, 2014
48.	International Women Day	11th to 18th March, 2014
49.	Institute Management Committee Meeting	15th March, 2014.
50.	Five days hands-on training on Enzyme Linked Immuno Sorbent Assay (ELISA) for diagnosis of Animal Diseases	10th - 14th March 2014
51.	Meeting of Stakeholders: Roles of Custodian Farmers in Conservation, Use and Dissemination of Agricultural Biodiversity jointly by Bioversity International	19th March, 2014
52.	ARS Net online exam	25th March to 2nd April, 2014
53.	Workshop on Conservation of Water Resources in Andaman & Nicobar Islands: Issues and Challenges conducted by Central Ground Water Board, Ministry of Water Resources, Govt. of India at CARI	27th March, 2014
54.	Awareness-cum-training on Protection of Plant Varieties and Farmers' Rights Act – 2001 at Car Nicobar	27th March, 2014
55.	Awareness-cum-training on Protection of Plant Varieties and Farmers' Rights Act – 2001 at KVK, Port Blair	28th March, 2014




IMPRESSION OF DELEGATES

"A wonderful jewel in the crown. So nice, scientifically rich & valuable. Proud to be part of it"

N.K.Krishna Kumar
DDG (Horticulture Science), ICAR on 22nd June, 2013

Delegates	Impression
S.K. Malhotra, ADG (Hort.II), ICAR, New Delhi on 14th May, 2013	A very good showcasing of technologies – highly impressed.
M. Shekhangoda , Chairman, EPCB & Member Board of Management, UAS, Bangalore on 18th May, 2013	The work on coconut germplasm and *T*sunami reclamation is very good. The Scientists are well and they need to encourage by ICAR. We all wish them very good in the ir endeavour.
P.C. Agarwal, NBPGR, New Delhi on 1st July, 2013	Extremely impressed with the activities undertaken by the CARI and the role played in development of state.
D. Rama Rao, ND, NAIP, New Delhi on 26 th July, 2013	The items depict local flora and fauna and the research challenges well.
Madhumita Mukherjee, Ex-Director, NFDB on 23rd August, 2013	Excellent collection and excellent project work. I wish every success of this Institute.
Balakrishna Pisupati, National Biodiversity, Chennai on 13th September, 2013	Impressive facilities and work that is locally relevant and nationally important. Would like partner with CARI for implementation of the Act in the Islands.
Sain Dass, Ex-Director, Maize (DMR), New Delhi on 1st October, 2013	An excelent work in difficult area reflects the hard work of the scientists.
A.K. Bhardwaj, PPS to Secretary, ICAR on 24th October, 2013	This is a wonderful work and maintained very systematically.
K. Marcus, IInd Headman, Car Nicobar on 16th November, 2013	During our visits in the museum I really impressed to the varies collection of different works of CARI on different development and research on the development works for the general people.
S.L. Goswami, Director, NAARM, Hyderabad on 29th January, 2014	Excellent work, dedicated wishes to improve and sustain the Island Agriculture in view of the valuable ecosystem. Best of luck. Keep it up.
Sophie Blackburn, PhD Student, KINGs College, London, UK on 5th February, 2014	Fascinating work. Very clear displays.
S.B. Dandin, Vice Chancellor, CIHS, Bagalkot, Karnataka on 18th March, 2014	An excellent arrangement to display all the activities as well as strength of the island and Institute. Impressed very much on the information provided.

LINKAGE AND COLLABORATION WITH OTHER DEPARTMENTS

- International Rice Research, Manila, Philippines
- Bioversity International, New Delhi
- Directorate of Rice Research, Hyderabad,
- Department of Biotechnology, New Delhi
- Directorate of Seed Research, Mau, UP
- Department of Nuclear Agriculture, BARC, Trombay, Mumbai
- Indian Institute of Pulses Research, Kanpur
- Banaras Hindu University, Varanasi
- ANGRAU (RARS, Lam Centre), Hyderabad (AP)
- TNAU (NPRC, Vamban), Coimbatore
- Directorate of Maize Research, New Delhi
- National Seed Corporation
- ICAR Research Complex for NEH, Barapani, Meghalaya
- AICRIP on Rodent Control, CAZRI, Jodhpur.
- NBAIM, Mau, U.P.
- PPV&FRA, New Delhi
- DST, New Delhi
- RMRC, ICMR, Port Blair
- ICAR Institutes; IVRI, NDRI, PD_ADMAS, CIRG, CSWRI, IGFRI, PDP, CARI.
- TANUVAS, Tamil Nadu
- NABARD, Port Blair
- ZSI, BSI, ASI,FSI, Port Blair
- Directorate on Poultry Research, Hyderabad
- CARI Regional Centre, Bhubaneshwar
- Space Applications Centre, Ahmedabad
- Indian National Centre for Ocean Information Services, Hyderabad
- Regional Remote Sensing Centre (ISRO), Nagpur
- CMLRE, Ministry of Earth Science, Cochin
- SRRA, Centre for Wind Energy Technology, MoNRE
- Dept. of Industries, A&N Administration
- Dept. of Agriculture, A&N Administration
- Dept. of Animal Husbandry and Veterinary Services, A&N Administration
- Dept. of Fisheries, A&N Administration
- Tribal Council, Car Nicobar and Nancowry
- Andaman Chamber of Commerce
- Zilla Parishad, A&N Administration
- Shri Hari Fabricators, Industrial Estate, Port Blair
- ACANI, NGO, Port Blair
- CPTL, NGO, Port BLAIR
- Akashvaani, Port Blair
- Door Darshan, Port Blair

PERSONNEL

Director	**Dr. S.Dam Roy**
Head / Incharge Divisions / Section / KVK	
Head, Division of Horticulture & Forestry	Dr. D.R. Singh
Head, Division of Field Crops	Dr. R.K. Gautam
Head I/c, Division of Animal Science	Dr. A. Kundu
Head I/c Division of Natural Resource Management	Dr. A.Velmurugan
HeadI/c, Division of Fisheries	Shri R. Kiruba Sankar
Incharge, Social Science Section	Dr. Subhash Chand till 31st Dec., 2013 Dr.S.K.Zamir Ahmed w.e.f 1st Jan., 2014
Chief Administrative Officer	Shri Debasis Moitra
Finance & Accounts Officer	Shri Gauranga Ghosh
Incharge, Prioritization, Monitoring & Evaluation Cell	Dr. S.K. Zamir Ahmed
Incharge, Computer Cell	Dr. M. Sankaran
Incharge, Library	Dr. M.S. Kundu
Incharge, Central Instrumentation Facility	Dr. Jai Sunder
Incharge, Legal Cell	Dr.S.K.Zamir Ahmed
Incharge, Garacharma Farm	Dr. K.K. Singh (till 31st Dec., 2013)
Incharge, Sippigaht Farm	Dr. M.Sankaran
Incharge, Bloomsdale Farm	Dr.P.K.Singh
Incharge Estate Section,	Er. S.L. Paik
Overall Incharge,	Er. S.L. Paik
Security & Sanitation	
Incharge, Guest House	Dr. V.B. Pandey
Incharge Security Officer	Dr. S. Murugesan
Programme Coordinator, KVKs	Dr. Nagesh Ram
(South, N& M Andaman & Nicobar)	
Coordinator, Bio-Informatics Centre	Dr. M. Sankaran
Incharge, ITMU	Dr. M.Sankaran
Coordinator, Out Reach Centre	Dr. S.K. Zamir Ahmed
Incharge PG Cell	Dr. Jai Sunder
Coordinator TSP/ NEH	Dr. Jai Sunder
Assistant Director (OL)	Mrs. Sulochana
Farm Managers	
Garacharma	Dr.V.B.Pandey
Sippighat	Dr.V.Damodaran
Bloomsdale Farm	Shri A.K.Tripathi

Vigilance Officer	Dr. R.K. Gautam
Transparency Officer	Dr. R.K. Gautam
Central Public Information Officer	Dr. Shrawan Singh
Nodal Officer online HYPM & RFD	Dr.S.K.Zamir Ahmed
Nodal Officer, PIMS, PERMISnet & ASRB Online	Dr. M.Sankaran
Nodal Officer, Court Case Monitoring System	Shri Amit Srivastava

List of Scientific Staff

Division of Natural Resource Management

Dr. A. Velmurugan, Senior Scientist (Soil Science: CF&M) & Head I/c
Dr. T.P. Swarnam, Senior Scientist, (Agronomy)
Shri T. Subramani, Scientist (Agronomy)
Dr. Sachchidanand Swain, Scientist (ASPE)

Division of Field Crops

Dr. R.K. Gautam, Principal Scientist & Head
Dr. Krishna Kumar, Senior Scientist (Plant Pathology) till 31st December, 2013
Dr. Pankaj Kumar Singh, Senior Scientist (Plant Breeding)
Dr. K. Deva Kumar, Senior Scientist (Biotechnology-Plant Science) till 18th July, 2013
Dr. Awnindra Kumar Singh, Senior Scientist (Plant Breeding)
Dr. Israr Ahmed, Scientist (Biotechnology)
Dr. Naresh Kumar, Scientist (Plant Breeding)
Shri K.Sakthivel, Scientist (Pathology)
Ms. T. Bharathimeena, Scientist (Entomology) w.e.f. 30th August, 2013

Division of Horticulture & Forestry

Dr. D.R. Singh, Principal Scientist & Head
Dr. M. Sankaran, Senior Scientist (Horticulture)
Dr. V. Bhaskaran, Senior Scientist (Horticulture)
Ms. R. Sudha, Scientist (Horticulture) till 16th August, 2013
Shri I. Jaisankar, Scientist (Forestry) on study leave
Dr. Shrawan Singh, Scientist (Vegetables)
Dr. K. Abirami, Scientist (Fruit Science)

Division of Fisheries Science

Shri R. Kiruba Sankar, Scientist (Fish & Fishery Science) & Head I/c
Ms. S. Monalisha Devi, Scientist (FRM)

Division of Animal Science

Dr. A. Kundu, Principal Scientist (Livestock Production & Management) & Head I/c

Dr. Madhu Sudan Kundu, Senior Scientist (Animal Nutrition)

Dr. Jai Sunder, Senior Scientist (Veterinary Microbiology)

Dr. T. Sujatha, Scientist (Poultry Science)

Dr. Arun Kumar De, Scientist (Animal Biotechnology) on study leave

Social Science Section

Dr. Subhash Chand, Senior Scientist, (Agriculture Economics), Head I/c till 31st December, 2013

Dr. S.K. Zamir Ahmed, Senior Scientist, (Agriculture Extension)

Krishi Vigyan Kendra, South Andaman

Dr. Nagesh Ram, Programme Coordinator

Shri L.B. Singh, Subject Matter Specialist (Horticulture)

Dr. Abhay Kumar Singh, Subject Matter Specialist (Animal Science)

Er. Bijaya Kumar Nanda, Subject Matter Specialist (Agri. Engineering)

Ms. Haripriya Nayak, Subject Matter Specialist (Home Science)

Shri N.Bommayasamy, Subject Matter Specialist (Horticulture)

Dr. N.C. Choudhuri, Asstt. Chief Technical Officer (Animal Science)

Krishi Vigyan Kendra, Nicobar

Dr. Nagesh Ram, Programme Coordinator I/c

Shri Sanjay Kumar Pandey, Subject Matter Specialist (Agronomy) on study leave

Dr. Zachariah George, Subject Matter Specialist (Animal Science)

Dr. Viveka Nand Singh, Subject Matter Specialist (Horticulture)

Er. Chandrika Ram, Subject Matter Specialist (Agri. Engineering)

Shri Ravi Kumar, Subject Matter Specialist (Fisheries)

Committees of the Institute

Foreign Deputation Committee

Director	:	Chairman
Dr. R.K. Gautam	:	Member
Dr. A. Kundu	:	Member
Dr. A. Velmurugan	:	Member
CAO	:	Member Secretary

Award Screening Committee

Dr. R.K. Gautam	:	Chairman
Dr. A. Kundu	:	Member
Dr. M. Sankaran	:	Member
Dr. A. Velmurugan	:	Member
Shri Kiruba Sankar	:	Member
I/c PME Cell	:	Member Secretary

Works Committee

Dr. M.S. Kundu	:	Chairman
Shri Debasis Moitra	:	Member
Er. S.L. Paik	:	Member
FAO	:	Member
Dr. Jai Sunder	:	Member
Er. S. Selvam	:	Member Secretary

Purchase Advisory Committee

Dr. R.K. Gautam	:	Chairman
Dr. M.S. Kundu	:	Member
Dr. M. Sankaran	:	Member
Shri D. Moitra	:	Member
Shri Kiruba Sankar	:	Member
FAO	:	Member
Shri R.N. Mazumder , AAO	:	Member Secretary

Tender Opening Committee

Dr. P.K. Singh	:	Member
Dr. T. Sujatha	:	Member
FAO	:	Member
Shri R.N. Mazumder, AAO	:	Member Secretary

Local Purchase Committee

Dr. M. Sankaran	:	Chairman
Er. S.L. Paik	:	Member
Shri K. Sakthivel	:	Member
FAO / Representative	:	Member
Shri R.N. Mazumder, AAO	:	Member Secretary

Library Management Committee

Dr. M.S. Kundu	:	Chairman
Dr. T. Sujatha	:	Member
Dr. T.P. Swarnam	:	Member
Shri Kiruba Sankar	:	Member
Dr. Shrawan Singh	:	Member
Librarian	:	Member Secretary

Condemnation & Auction Committee

Dr. Jai Sunder	:	Chairman
Dr. A.K. Singh	:	Member
Dr. T. Subramani	:	Member
Er. S.L. Paik	:	Member
FAO	:	Member
Shri R.N. Mazumder, AAO	:	Member Secretary

House Allotment Committee

Dr. R.K. Gautam	:	Chairman
Dr. Subhash Chand	:	Member
Dr. A.K. Singh	:	Member
Secretary, IJSC	:	Member
FAO/ Representative	:	Member
Er. S.L. Paik	:	Member Secretary

Price Fixation Committee

Dr. Jai Sunder	:	Chairman
Dr. P.K. Singh	:	Member
FAO/ Representative	:	Member
Dr. V. Damodaran	:	Member
Shri A.K. Tripathi	:	Member
Secretary, IJSC	:	Member
Dr. V.B. Pandey	:	Member Secretary

Women Cell

Dr. K. Abirami	:	Chairperson
Dr. T.P. Swarnam	:	Member
Dr. T. Sujatha	:	Member
Dr. R. Sudha	:	Member
Ms. Sibani Sengupta	:	Member
Ms. S.Monalisa Devi	:	Member
Ms. Sulochana	:	Member Secretary

Landscape & Beautification Committee

Dr. V. Bhaskaran	:	Chairman
Shri A.K. Tripathi	:	Member

Shri N. David	:	Member
Shri. Shyam Sunder Rao	:	Member
Dr. V. Damodaran	:	Member
Dr. V.B. Pandey	:	Member Secretary

Cultural Programme Committee

Dr. M.S. Kundu	:	Chairman
Dr. K. Abirami	:	Member
Dr. V. Bhaskaran	:	Member
Dr. R. Sudha	:	Member
Shri Amit Srivastava	:	Member
Secretary, IJSC	:	Member
Ms.S. Monalisa Devi	:	Member
Dr. Jai Sunder	:	Member Secretary

Sports Committee

Shri Debasis Moitra	:	Chairman
Dr. Subhash Chand	:	Member
Shri Kiruba Sankar	:	Member
Dr. N.C. Choudhuri	:	Member
Ms. S. Monalisa Devi	:	Member
Smt. Shibani Sengupta	:	Member
Shri Ashish Singh Yadav	:	Member
Shri A. Babuswamy	:	Member
Shri Norman David	:	Member
Secretary, IJSC	:	Member
Dr. Jai Sunder	:	Member Secretary

Technical Evaluation Committee

Dr. A.Kundu	:	Chairman
Dr. A.K. Singh	:	Member
Shri R. Kiruba Sankar	:	Member
Shri K.Sakthivel	:	Member
Shri R.N. Mazumder, AAO	:	Member Secretary

Website Management Committee

Dr. A. Velmurugan	:	Chairman
Dr. M. Sankaran	:	Member
Shri R. Kiruba Sankar	:	Member
Ms. Ani Dath	:	Member
Dr. Shrawan Singh	:	Member
Shri Dibakar Khan	:	Member
Shri K. Gopal Nath	:	Member Secretary

Official Language Committee

Director	:	Chairman
Dr. R.K. Gautam	:	Member
Dr. M.S. Kundu	:	Member
Dr. S.K. Zamir Ahmed	:	Member
Dr. A.K. Singh	:	Member
Dr. A. Velmurugan	:	Member
Shri Amit Srivastava	:	Member
Shri Abhay Srivastava	:	Member
Shri Ashish Singh Yadav	:	Member
Shri Shyam Sunder Rao	:	Member
Ms. Sulochana	:	Member Secretary

Institute Joint Staff Council Committee

Staff Side (Technical)

Shri K. Babu Rao, Sr. Technician	:	Member (CJSC)
Shri Dibakar Khan, Sr. Technical Assistant	:	Member

Administrative

Shri M.S.R.C. Murthy, Jr. Clerk	:	Member
Shri P. Karapaya, Assistant	:	Member

Supporting

Shri K. Ali, S.S.S.	:	Secretary (IJSC)
Shri K. Ramachandran, S.S.S.	:	Member

Official Side (Nominated by the Director)

Chief Administrative Officer	:	Member Secretary
Finance & Accounts Officer	:	Member
Estate Officer	:	Member
Dr. Pankaj Kumar Singh, Sr. Scientist	:	Member
Dr. A. Kundu, Pr. Scientist	:	Member
Dr. (Mrs.) K. Abirami, Scientist	:	Member

NEW ENTRANTS/TRANSFER/ PROMOTION/ RETIREMENT/DEATH

New Entrants

- Ms. S. Monalisa Devi, Scientist (Fisheries) on 22nd April, 2013 from CIFRI, Barrackpore
- Ms. Bhartathi Meena T, Scientist (Agrl. Entomology) on 30th August, 2013 from IIVR, Varanasi
- Shri Abbubaker, T-2 on 8th July, 2013 from DSR, Mau

Transferred

- Dr. K. Devakumar, Sr. Scientist on 18th July, 2013 to CPCRI, Kasaragod
- Dr. Ajmer Singh, Sr. Scientist on 7th August, 2013 to ZPD, Ludhiana
- Dr.(Ms.) R. Sudha, Scientist on 16th August, 2013 to CPRS, Ooty
- Shri Krishna Gopal Nath, T-4 (Programme Assistant) on 19th September, 2013 to CRIZAF, Kolkata
- Dr. Subhash Chand, Sr. Scientist on 31st December, 2013 to NCAP, New Delhi
- Dr. Krishna Kumar Sr. Scientist on 31st December, 2013 to IARI, New Delhi
- Shri Ashish Singh Yadav, T-3 on 4th February, 2014 to IISR, Lucknow

Promotion

A. Scientist

- Dr. A. Velmurugan, Senior Scientist (Soil Science) w.e.f 03rd October, 2013 from RGP 8000 to 9000
- Dr. T. Subramani, Scientist (Agronomy) w.e.f 26th June, 2012 from RGP 6000 to 7000
- Dr. S.Jeyakumar, Senior Scientist (Animal Rep. & Gyne) w.e.f 16th August, 2009 from RGP 7000 to 8000
- Dr. R. Sudha, Scientist (Horticulture) w.e.f 14th September, 2012 from RGP 6000 to 7000
- Dr. Shrawan Singh, Scientist (Vegetables) w.e.f 08th January, 2012 from RGP 6000 to 7000
- Dr. T. Sujatha, Scientist (Poultry Science) w.e.f 26th June, 2010 from RGP 6000 to 7000
- Dr. Grinson George, Scientist (Fish & Fishery Science) w.e.f 27th June, 2010 from RGP 6000 to 7000
- Er.P.S.Deshmukh, Scientist (Farm Machinery & Power) w.e.f 20th March, 2008 from RGP. 6000 to 7000

B. Technical

- Shri U.Bhaskar Rao from T-2 (Retd.) to T-3
- Shri K.C.Debnath from T-2 to T-3
- Shri K.Narayanam from T-2 to T-3
- Shri T.Ravi from T-2 to T-3
- Shri A.Babu Swamy from T-2 to T-3
- Shri Kishore Tete from T-2 to T-3
- Shri Norman David from T-3 to T-4
- Shri Hari Sankar Prasad from T-3 to T-4

- Shri Bipul Chandra Ray from T-4 to T-5
- Ms. Ani Dath from T-5 to T-6

C. MACPs of Administrative Staff

- Ms. Lucy Thomas, P.S
- Shri Abraham, Assistant
- Shri D.K.Saha, Assistant
- Ms. Saida Bibi, PA
- Ms. Florence Toppo, Jr. Stenographer
- Ms. Reena Saha, Junior Stenographer
- Shri B.Dhanaraju, Sr. Clerk
- Shri M.S.R.C. Murthy, Jr. Clerk

D. Administration

- Shri R.N. Mazumder , AAO on 6th July, 2013

Retired

- Shri M. Alagar, T-6 (Sr. Technical Officer) on 31st May, 2013
- Shri K. Narayanan, T-3 (Technical Assistant) on 1st November, 2013 (VRS)
- Shri D. Mohan Rao, Asstt. on 30th Jun, 2013
- Shri E. Yadav Rao, SSS on 30th April, 2013
- Shri A. Vellachamy, SSS on 31st December, 2013
- Shri T. Madhav Rao, SSS on 31st July, 2013

Left to heavenly abode

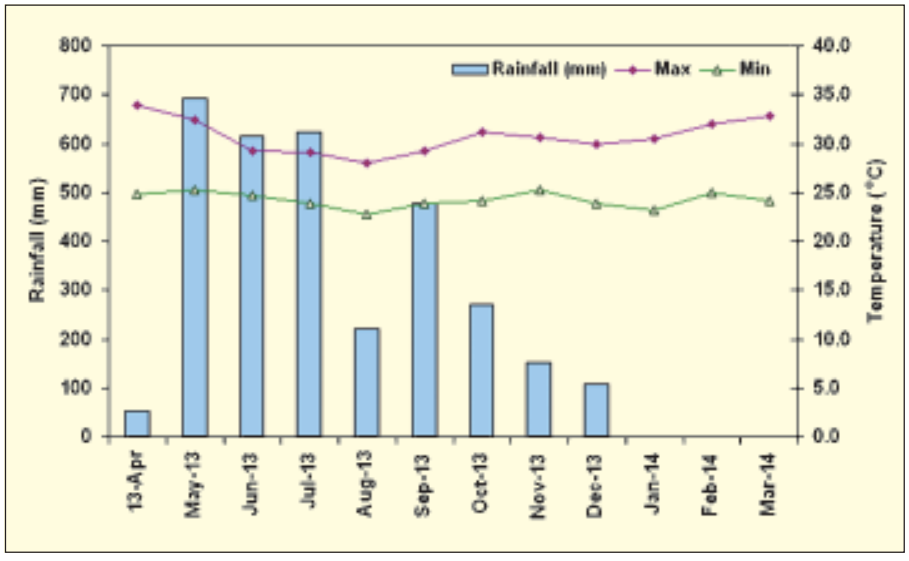
- Shri S.K. Biswas, Assistant on 14th July, 2013

CARI in News


CARI is now CIARI
CARI arranges exposure trip for Carnic farmers
Various trainings under TSP to benefit farmers: Dr Roy
National Science Day gets underway at CARI
CARI holds Mini Science Quiz for students
जैविक खेती के प्रोत्साहन पर बल
Trng-cum-exposure on NKG held at CIARI
Model trng on water resource mgmt
ELISA trng for SVOs concludes at CARI
कृषि विकास का उत्कृष्ट संस्थान
CARI holds sensitization prog on HQPM
Journal of Andaman Science Association released
ASA a platform for young researchers to showcase their research findings
CARI training on flowers and Mandarin in Meghalaya
CARI trng. on Coconut Multistoried Cropping held for Carnic farmers
Benefits of CARI's research should reach farmers and fishermen: LG
KVK in-service trng on organic farming benefits
PB TOLIC awarded in Eastern Region
CARI trains tribals of NE region on scientific farming
Maiden launch of Rural Poultry Mini-Incubator

CARI Highlights in ICAR website

CLIMATIC PARAMETERS OF ANDAMAN AND NICOBAR ISLANDS (2013-14)



Decadal Longer Spell of Dry Period-El Nino Effect

In A & N Islands on an average 3100 mm of rainfall is received spread over 136 rainy days during May to December both in South West and North East Monsoon seasons. During January-April evaporation exceeds rainfall leading to moisture deficit conditions. The South West Monsoon starts around 15th-20th of May and during April summer showers are received.

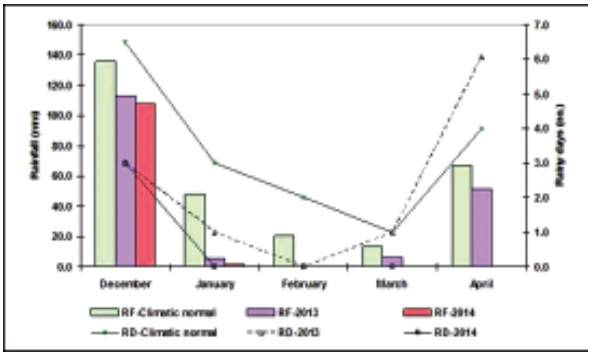
Table 35: Average 48 years of Climatic Parameters of Andaman & Nicobar Islands

Month	Rainfall [a] (mm)	Temperature (^{0}C)[e]		Rainy days[b]	Relative Humidity[c] (%)		Wind Speed[d] (kmph)
		Maximum	Minimum		08.30	17.30	
January	47.7	29.7	22.1	3	72	75	6.5
February	20.2	30.5	21.8	2	71	72	5.5
March	13.5	31.5	22.4	1	69	72	5.0
April	67.0	32.5	23.4	4	68	73	5.5
May	378.0	31.1	21.1	17	78	82	10.2
June	489.9	29.5	23.9	20	83	84	17.5
July	456.4	29.1	23.5	21	84	85	15.3
August	450.9	29.0	23.5	21	84	85	17.0
September	474.2	29.0	22.6	19	84	86	11.3
October	303.4	29.6	23.0	15	78	81	7.5
November	237.1	29.7	23.2	13	78	81	7.0
December	136.0	29.5	22.8	7	73	77	7.7
Total	3074.2			143			
Average		30.1	23.0		77	80	9.7

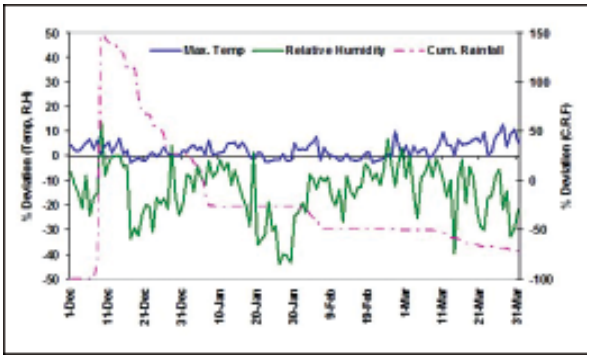
[a] Average of 48 years i.e. from 1949 to 1996; [b] Average of 26 years i.e. from 1961 to 1986; [c] Average [d] Average of 22 years i.e. from 1975 to 1996; [e] Data for 1986 only

Source : Directorate of Economics and Statistics, A & N Administration, Port Blair.

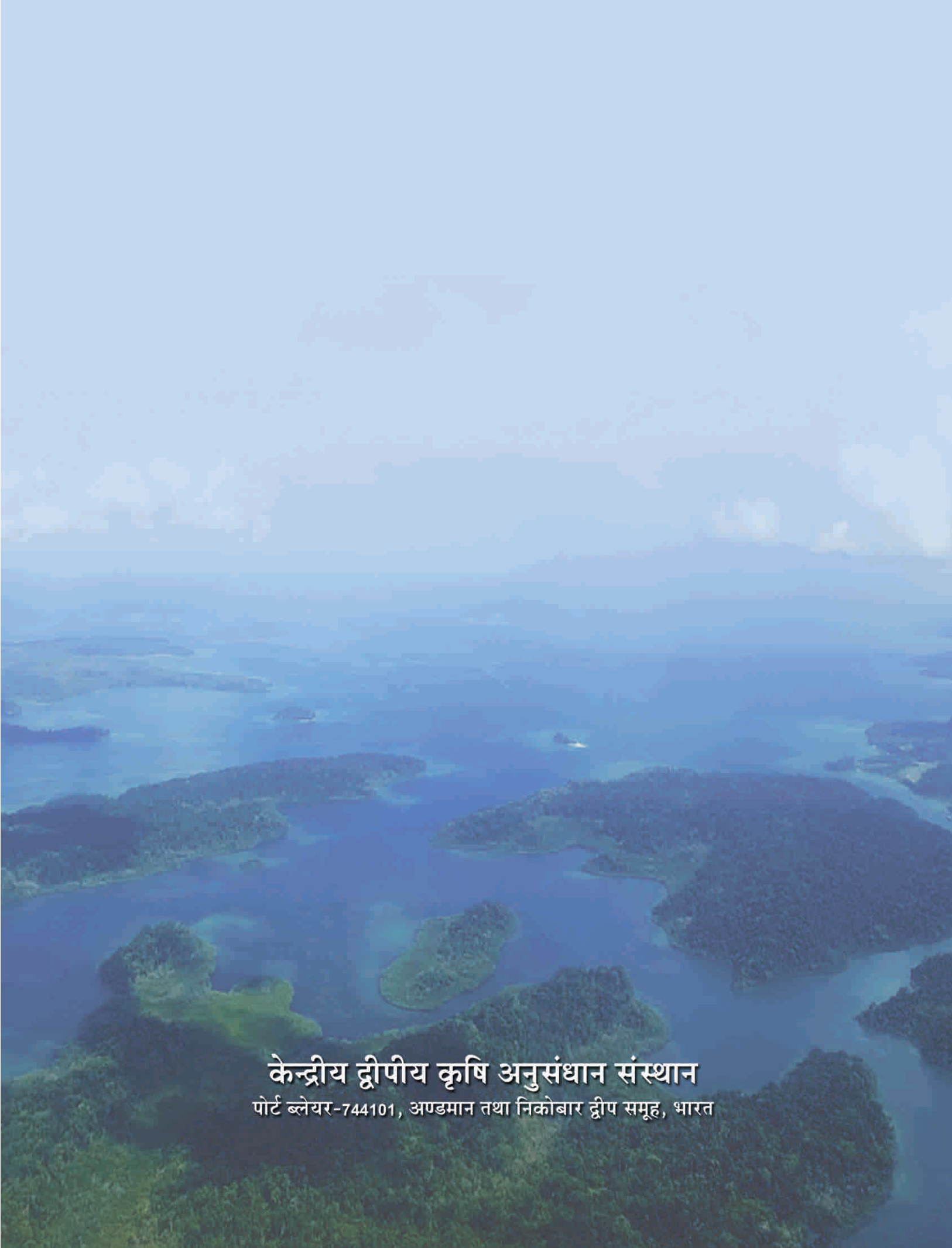
This year the last rainy days was on 15th December, 2013 and continuously for more than 110 days there were no rainfall at all, making it one of the longest dry spell . On an average 22% deviation in post monsoon rainfall, higher temperature (i.e.1.2°C) and low relative humidity was seen . The sea surface temperature and the Ocean Nino Index (ONI) is higher than +0.5, therefore more possibility of El Nino effect in this year (ref: NOAA), which is due to long dry spell and late onset of monsoon.



Recent changes in rainfall and number of rainy days over Andaman Islands



Deviation of some weather parameters in 2014 over Andaman Islands



केन्द्रीय द्वीपीय कृषि अनुसंधान संस्थान
पोर्ट ब्लेयर-744101, अण्डमान तथा निकोबार द्वीप समूह, भारत