# CARI

भाकृअनुप
ICAR

# वार्षिक प्रतिवेदन
# annual report

2012-13

CENTRAL AGRICULTURAL RESEARCH INSTITUTE
CARI
ICAR
तमसो मा ज्योतिर्गमय

# ANNUAL REPORT
# 2012 - 2013


## केन्द्रीय कृषि अनुसंधान संस्थान

पोर्ट ब्लेयर - ७४४ १०१, अंडमान एवं निकोबार द्वीप

## Central Agricultural Research Institute

**Port Blair – 744 101, Andaman & Nicobar Islands**

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# ANNUAL REPORT 2012-2013

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# प्राक्कथन

केन्द्रीय कृषि अनुसंधान संस्थान (के.कृ.अ.सं.) द्वीपों की कृषि के लिए समर्पित सेवा के साढ़े तीन दशकों मे एशियाई देशों में उष्णकटिबन्धीय द्वीप कृषि में अग्रणी भूमिका निभाने के लिए तत्पर है। के.कृ.अ.सं. ने द्वीपों के किसान समुदायों की सेवा करते हुए जो विस्तृत अनुभव प्राप्त किया है उसके आधार पर द्वीपों की पारिस्थितिकीय तंत्र एवं जैव विविधता के अनुकूल समस्याओं के समाधान के लिए तैयार है। द्वीपों की जैव सुरक्षा को 12वीं पंचवर्षीय योजना के अंतर्गत प्राथमिकता देना हमारा मुख्य लक्ष्य है। इस संदर्भ में इन द्वीपों में संयुक्त जैव सुरक्षा प्रयोगशाला की स्थापना करने का भी हमारा प्रयास है।

इस संस्थान का उद्देश्य फसल पश्चात होने वाली क्षति के प्रभावी प्रबंधन और इन द्वीपों की कृषि–पारिस्थितिकीय परिस्थिति के लिए जलवायु प्रत्यास्थी कृषि तकनीक का विकास, द्वीप कृषि मे प्रणालियों का प्रस्ताव, आनुवांशिकीय उत्कृष्ट किस्मों/नस्लों के विकास और द्वीपों के आनुवांशिक स्त्रोतों के विशेषीकरण और संरक्षण के माध्यम से उत्पादन वृद्धि है। द्वीप कृषि के क्षेत्र में संग्रहित अनुभवों और विशेषता के आधार पर हम हमारी आकांक्षित लक्ष्य **"उष्ण कटिबन्धीय द्वीप कृषि के क्षेत्र में उत्कृष्ट संस्थान के रुप में उभरने"** की दिशा में विस्तृत पग पसारने के प्रस्ताव रखते हैं ।

दो प्रमुख अनुसंधान विषयों–उष्णकटिबन्धीय द्वीपों के लिए समन्वित कृषि प्रणाली पर प्रस्तारित कार्यक्रम तथा संगरोध और जैव सुरक्षा सुविधाओं की स्थापना पर इस दौरान अनुसंधान आरंभ किए गए । निकोबार जिले तथा लिटिल अण्डमान में बसने वाले आदिवासियों के लाभ के लिए कृषि क्षेत्र में असंख्य तकनीकी हस्तक्षेप, कृषि, बागवानी, पशुपालन, फसल पश्चात तथा मूल्य संयोजन तकनीक के कार्यान्वयन के माध्यम से आदिवासी उप–योजना के अन्तर्गत विशेष ध्यान दिया गया है ।

यह एक गर्व का विषय है कि कुल 14 किस्में – चावल तथा शकरकंद की दो–दो, नारियल तथा नोनी की चार–चार, पोई और बैंगन की एक–एक किस्मों को अण्डमान निकोबार द्वीप समूह की राज्य कृषि व बागवानी बीज उप समिति द्वारा जारी किए जाने की सिफारिश की गई है।

वर्ष के दौरान संस्थान को आदिवासियों के लिए किये गए उत्कृष्ट कार्य के लिए प्रतिष्ठित **फखरुद्दीन अली अहमद पुरस्कार** तथा आई.सी.ए.आर. द्वारा **राजश्री टण्डन राजभाषा पुरस्कार** से सम्मानित किया गया । भारत सरकार तथा अन्य संगठनों से राजभाषा के उत्कृष्ट कार्यान्वयन के लिए संस्थान ने **तीन पुरस्कार** प्राप्त किए। इसके अतिरिक्त भारतीय विज्ञान कांग्रेस संघ (आई.एस.सी.ए) ने अपने शताब्दी वर्ष के दौरान के.कृ.अ.सं. को अण्डमान अध्याय की मान्यता प्रदान की ।

द्वीपों और मुख्यभूमि से इस संस्थान के दौरे पर आए कई विशिष्ट व्यक्तियों में सबसे प्रमुख भारत सरकार के कृषि तथा खाद्य संस्करण उद्योग राज्यमंत्री डॉ. चरण दास महन्त, माननीय उपराज्यपाल लेटिनेंट जनरल (अवकाश प्राप्त) भूपिन्दर सिंह, पी.वी.एस.एम., ए.वी.एस.एम तथा माननीय सांसद श्री बिष्णु पद राय का दौरा

था। इन सभी ने द्वीपों के उपयोगकर्त्ताओं की बेहतरी के लिए संस्थान के कर्मचारियों और वैज्ञानिकों के दल द्वारा किए जा रहे उत्कृष्ट कार्य की सराहना की ।

हमारी अनुसंधानात्मक प्राथमिकताओं को सुग्राही बनाने के लिए एस.एफ.सी. 12वीं योजना और अवलोकन 2050 तैयार किए गए और उन पर विभिन्न मंचों पर विचार-विमर्श किए गए। फलप्रद सिफारिशों के साथ क्यू.आर.टी. और आर.ए.सी. बैठकों का सफल आयोजन किया गया। दूसरे अनुसंधान व विकास संस्थानों के साथ शक्तिशाली समन्वय स्थापित करने के उद्देश्य से महत्त्वपूर्ण कार्यक्रम आयोजित किए गए, जिनमें मत्स्य उत्पादन/उत्पादन पश्चात तकनीक के माध्यम से अण्डमान निकोबार जनजातीय मात्स्यकी के पुर्नजीविकरण पर परामर्श/बैठक, एफ.एम.डी पर सुग्राहीकरण, आई.सी.ए.आर.-उद्योग दिवस, कृषि योजना, अण्डमान विज्ञान संघ का पुनर्गठन, बारहवीं योजना के लिए पशु-विज्ञान अनुसंधान, द्वीपीय जैव विविधता पर राष्ट्रीय संगोष्ठी, नगर राजभाषा कार्यान्वयन समिति की बैठक, द्वीप किसान मेला, के.वी.ए.एफ.एस.यू., बिदार के बोर्ड के सदस्यों का अनाश्रयता दौरा और नवोदितों का सम्मेलन शामिल था। इसके अतिरिक्त संस्थान ने कृषि तथा कृषि आधारित क्षेत्रों में अपने तकनीकों और शक्ति के प्रर्दशन हेतु राष्ट्रीय तथा द्वीप स्तर पर प्रदर्शनियों और मेलों मे भी भाग लिया।

मैं इस अवसर पर उभरते प्रतियोगिताओं से निपटने के मामलों में माननीय डॉ. एस. अयप्पन, सचिव, डेयर तथा महानिदेशक आई.सी.ए.आर. को उनके दूरदर्शी नेतृत्व, असीम समर्थन और मार्गदर्शन के लिए अपनी कृतज्ञता प्रकट करता हूँ। मैं उप महानिदेशक (बागवानी) डॉ. एन.के. कृष्ण कुमार का भी कृतज्ञ हूँ जो हमारे संस्थान के प्रशासनिक व अनुसंधान से जुडे मामलों में भविष्य की गतिविधियों पर हमें उपदेश देते रहे और हमारी प्रेरणा के स्त्रोत रहे। मैं डॉ. एस. एल. मेहता, अध्यक्ष, क्यू.आर.टी., डॉ. के. आर. प्रधान, अध्यक्ष, आर. ए.सी. तथा संबंधित समितियों के माननीय सदस्यों का धन्यवाद करता हूँ जिन्होंने द्वीपों की आवश्यकता से निपटने के लिए अभिविन्यासात्मक सुझाव प्रस्तुत किए ।

मैं माननीय उपराज्यपाल लेटिनेंट जनरल (अवकाश प्राप्त) भूपिन्दर सिंह, पी.वी.एस.एम., ए.वी.एस.एम, मुख्य सचिव, उत्तर दक्षिण व मध्य एवं निकोबार जिला के उपायुक्त, अण्डमान निकोबार प्रशासन के निदेशकों तथा अधिकारियों, आदिवासी परिषद व नाबार्ड के अध्यक्ष तथा सदस्यों का उनके सतत् सहायता तथा समर्थन के लिए धन्यवाद करता हूँ। अंत में, संस्थान के उन सभी वैज्ञानिकों तथा कर्मचारियों का हृदय से धन्यवाद देता हूँ जिन्होंने नई ऊंचाइयों को छूने में अपना उत्कृष्ट सहयोग प्रदान किया।

21 मई, 2013
पोर्ट ब्लेयर

**(शिबनारायण दाम राय)**
निदेशक

# PREFACE

Central Agricultural Research Institute (CARI) with its three and a half decades of dedicated services to the island agriculture is poised to take a lead role in tropical island agriculture in the Asian countries. CARI has garnered wide experience to serve the island farmers community and to address issues related to island ecosystem and agro-biodiversity. The primary focus in XII five year plan is on bio-security issues related to the islands. In this context our endeavour is to establish a Composite Bio-security laboratory in the Island.

The objective of the Institute 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. With the accumulated experience and expertise in island agriculture, it is proposed to make a major stride towards our cherished goal of emerging as the ***"Institute of Excellence on Tropical Island Agriculture"***.

Flagship programme on Integrated Agriculture System for Tropical Islands & Establishment of Quarantine and Biosecurity facilities, are the two major research issues initiated during the period. Special focus has been given under Tribal Sub Plan by implementing numerous technological interventions in agriculture, fisheries, horticulture, animal husbandry, post harvest and value addition technologies for the benefit of the tribal's in Nicobar District and Little Andaman.

It is a matter of pride that a total of 14 varieties *viz.,* two each of rice & sweet potato, four each of coconut & noni, one each of poi & brinjal have been recommended for release by the State Seed Sub Committee on Agriculture & Horticulture Crops in A & N Islands.

During the year the institute has been conferred with prestigious Fakhruddin Ali Ahmed Award for outstanding work for the tribal population and Rajshri Tandon award by ICAR, along with three more awards for superlative implementation of Rajbhasha in official use by GoI & Societies. In addition, Indian Science Congress Association (ISCA) on its centenary year has reposed responsibility of Andaman Chapter to CARI.

Many dignitaries both from island & mainland have visited the Institute of which the most prominent were the visit of Dr. Charan Das Mahant, Hon'ble Minister of State for Agriculture & Food Processing Industries Govt. of India, Hon'ble Lt. Governor, Lt. Gen. (Retd.) Bhopinder Singh, PVSM, AVSM and Shri Bishnu Pada Ray, Hon'ble Member of Parliament, A& N Islands, wherein they acclaimed the good work done by the team of Scientist and staff for the betterment of the islanders.

To sensitize our research priorities SFC XII Plan document and Vision 2050 were prepared and the same was discussed in different forum. QRT and RAC meeting were conducted successfully with fruitful recommendations. To strengthen the coordination with the other R&D institution a series of important events namely Consultation/meeting on Revitalizing A&N Tribal Fisheries through Fish Harvest/Post-harvest Technologies, Sensitization on FMD, ICAR- Industry Day, Agriculture Education Day, Reconstitution of Andaman Science Association, Animal Science Research for XII Plan, National Seminar on Island Biodiversity, TOLIC meeting, Island Kisan Mela, Farm Innovators Meet and exposure visit of Board Members of KVAFSU, BIDAR were also organized. Beside, Institute also participated in both National and Island level exhibitions/ melas to showcase its strength and technologies in agriculture and allied fields.

I take this opportunity to express my gratitude to Hon'ble Dr. S. Ayyappan, 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), who has been our source of inspiration and advising us on future course of action to address the research and administrative issues of the institute. I am thankful to Dr. S.L. Mehta, Chairman, QRT, Dr. K. Pradhan, Chairman, RAC and the 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.) Bhopinder Singh, PVSM, AVSM, Chief Secretary, 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 everyone for the good work done and express thanks to all my scientists and staff members, who have worked hard to meet the new challenges.

21st May, 2013
Port Blair

**(Sibnarayan Dam Roy)**
Director

# अधिशासी सार
# EXECUTIVE SUMMARY

## प्राकृतिक संसाधन प्रबंधन
## Natural Resource Management

- Plantation based farming system is predominant in Nicobar Islands with 2 major subsystems *viz.,* coconut + pig and coconut + pig + poultry, where 72% of farm income comes from coconut and 22% from pigs. However, mixed farming system predominates in North Andaman, where crops and livestock components equally contribute to the total farm income.
- CARI-Dhan 5 gave significantly higher yield of 5.18 t/ha with the spacing of 20cm x 15cm and fertilizer application of 80:40:50 NPK kg $ha^{-1}$, but economic yield was obtained with 60:40:50 of NPK $ha^{-1}$.
- Vermicomposting of rice straw with *gliricidia* and poultry manure was much faster (100 days) than other organic residues (150 days). The N content was significantly higher in rice straw compost (1.72%) followed by coconut leaf compost (1.64%) and coconut husk compost (1.36%).
- At North Andaman 15.7% of the farmers are not using any kind of fertilizers in crop production, whereas the average nutrient consumption among others was 90.6 kg $ha^{-1}$, 98.3 kg $ha^{-1}$ and 73.6 kg $ha^{-1}$ of N, $P_2O_5$ and $K_2O$ respectively. However, size of land holdings and type of crops had significantly influenced the nutrient consumption.
- Among different pesticides, triazophos and profenophos compounds were mainly used for green chilli and okra, monocrotophos for brinjal, chlorpyriphos for crucifers and cucurbit vegetables and cypermethrin was used for all vegetables.
- Yield forecast using linear regression model predicted rice yield more accurately ($R^2$ = 0.89) than trend analysis. The calibrated Decision Support System for Agro-technology Transfer (DSSAT) model predicted *kharif 2013* rice yield as 3100 kg/ha with the total production of 26009 MT for Andaman Islands.
- For long term storage of tapioca powder aluminium foil was found to be the best packing material as the microbial load was significantly less, when compared to others even after storage of 3 months period.
- Maximum head rice yield was found in CARI-5 variety followed by CSR36, CSR23, Ranjit, Jaya, Gayatri, White Swarna, C14-8 and Pagla Jaya, whereas degree of polishing and breakage was found more in C14-8 and Pagla Jaya. Grain length and aspect ratio have significant influences on degree of milling.
- 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 under NAIP in degraded coastal areas covering 37.0 ha. After one year of intervention the soil pH was observed to be in the range of 6.5 ± 1.0 and EC ($dSm^{-1}$) 1.0 ± 0.6.

- Among the 5 technologies demonstrated under FPARP-II, higher farm income and water use efficiency were recorded in IFS followed by BBF while the groundnut cultivation contributed comparatively low income but was suitable for use in the interspaces of coconut garden.
- Validation of 98 agromet advisories issued during 2012-13 revealed that forecasted and observed values of rainfall were matching to the tune of 67.1 % during pre monsoon period, 53.6 % in monsoon and 59.1 % in post monsoon period.

## उद्यान विज्ञान व वानिकी
## Horticulture & Forestry

- Fifty seven traditional vegetables were documented and nutritional profile of 16 predominant nicobari traditional vegetables were developed. They were found to be rich in micronutrients like Fe, Ca Zn Cu Mn, Mg and also rich in phenolics, ascorbic acid and flavonoids.
- 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.
- Tissue culture protocol was developed for micro-propagation of *M. cochinchinensis* using internodes on plain MS media.
- The seed membrane of *M. cochinchinensis* had rich lycopene content (523.4 to 810 mg/100g) than *M. dioica* (142.2 to 144.4 mg/100g)
- Nutrient analysis in 125 collections of drumstick showed significant ($p<0.08$) diversity for ca (10.7 to 25.1 mg/100 g), carotenoid (673.3 to 704.3 mg/100 g) and DPPH antioxidant activity (35.6 to 91.2%) respectively.
- Physico-chemical analysis of fruits of 59 accessions of papaya collected from different parts of the island showed variations in fruit shape, TSS, size, fruit weight, pulp thickness, petiole colour and flesh colour. The molecular diversity (41%) was also assessed using 24 ISSR markers.
- Growing media of soil: sand: vermicompost: coir compost in the ratio of 2:1:1:1 ratio was found best for growth, flowering and tuber yield of calla lily (*Zantedeschia ellotiana*).
- Fourty eight species of medicinal plants were added to the gene garden from different places of South Andaman. The ISSR analysis of 29 accessions of *Cassia alata* collected from different places of A & N Islands generated four clusters with only 39% diversity.
- The GC-MS analysis of seed oil of *Calophyllum inophyllum* revealed the fatty acid concentrations as palmitic acid (18.74 ±1.18), linoleic acid (21.02 ±0.87), oleic acid 44.51(±1.32) and stearic acid 15.51(±0.74) respectively.
- Tissue culture protocol was standardized for *Piper longum* using nodal segments as explants inoculated in MS media supplemented with growth regulators.
- The highest nut setting was recorded in CARI-Omkar x Andaman Ordinary Tall (67.4%) followed by CARI-Annapurna x Andaman Ordinary Tall (63.2%).
- During the period, 181 entries in different vegetables were screened and LCA -334 (13.7 t/ha), KA-2 (13.3 t/ha) of chilli 2010/OKHYB-4 (16.5t/ha) and HOK-152 (13.5t/ha) of

hybrid okra, Arka Garima (13.0 t/ha) and Kashi Kanchan (12.7t/ha) of cowpea and Arka Jay (9.0t/ha) and 10/DOLBVAR-4 (7.3t/ha), of dolichos bean were promising.

- PoP for high quality poi cultivation was developed for production in South Andaman and transport to Nicobar Islands. Rainshelter cauliflower technology was developed for rainy season cultivation of cauliflower in tropical islands condition.
- Among the turmeric varieties evaluated, Kedaram (13.4 t/ha) recorded higher yield followed by Zeodaric (11.7 t/ha) and the lowest yield was recorded in Prabha (1.9 t/ha).
- Four varieties namely CARI Sanjivini, CARI Sampada, CARI Samridhi and CARI Rakshak of *Morinda citrifolia* L and CARI Poi Selection of *Basella alba* L were developed for island conditions.
- Fatty acid profiles of seeds of 10 accessions of *Morinda citrifolia* was developed and the major fatty acids like linolenic, oleic and stearic acids were observed.
- HPLC analysis in different stages of *Morinda citrifolia* identified the major carotenoids as Lutein, Zeaxanthin, α-Crtyptoxanthin, Echinenone, α-Carotene and β-Carotene and phenolics as epicatechin gallate, syringic acid, epigallocate chin gallate, vanillic acid, naringin and cinnamic aci d. Cyndin-3-glucoside in anthocyanin and myricitin and rutin in flavonoid group were identified as major compound in *Morinda citrifolia* fruits.
- Coating on noni fruits with edible *Aloe vera* gel increased the shelf life and reduced the changes in physcio chemical paramters over the storage period of 7 days.

## क्षेत्रीय फसलें
## Field Crops

- Improved lines of long duration rice ANR 21 and ANR 37 were found promising for grain yield, milling percentage, head rice recovery and gave stable performance over the years and locations.
- Field day on farmers participatory variety selection in saline acid sulphate soils revealed maximum preference for CARI Dhan 5 and CSR36.
- Rice genotypes viz. IET 8585, PR 116 and CSR 34 were found highly resistant (with score 1) to bacterial blight disease, while genotypes viz. IR 28, MLT 12, IRBB 4, IRBB 21, CSR 24, CSR 28, CSR 1, STBN 21 and BMZ 1 were found moderate resistant (with score 3).
- Nucleus seed (8 kg), Breeder seed (188 Kg) and Truthfully Labelled Seed (4033 Kg) of rice varieties was produced during *Kharif*, 2012.
- About 2000 kg Truthfully Labelled Seed of rice were distributed to farmers/stakeholders.
- 4500 seedlings and 425gram seeds of CARI B-1 were distributed to the farmers of South, North & Middle Andaman and Nicobar Districts.
- IPM modules have been developed for the successful management of okra fruit and shoot borer and cucurbit fruit fly by using locally available leaf extracts. Adoption of IPM technology in okra resulted in reduction of number of pesticide sprays to only 2 from 5-6 in farmer's fields.

- The rodent infestation surveys in paddy fields were conducted in 15 villages of South Andaman and 3 villages of North Andaman, the results revealed that rodent infestations ranged from 3.66 to 22.50%. *Bandicota bengalensis* was reported as new rodent species record from Andaman.
- 140 Dahi nariyal (Macapuno) nuts were collected and the embryos were inoculated for embryo rescue and three new dahi nariyal palms were identified at Panighat and Chouldhari for future collection of nuts.
- Preliminary yield and varietal evaluation trials revealed consistently maximum yield performance of mung bean land race ANM-12-02 than other land races and checks.
- The studies on biovar identification of solanaceous bacterial wilt pathogen (*Ralstonia solanacearum*) isolates through sugar utilization tests revealed prevalence of biovar 3 and 4 in South, Middle and North Andaman Islands.

## पशु विज्ञान

## Animal Science

- Survey of villages of Car Nicobar and Little Andaman revealed the population status of Nicobari fowl as 2.98% with an average holding size of 1.33.
- Supplementation of 50 to 100 ppm zinc oxide to the basal diet improved the reproductive performance of Teresa goats.
- 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.
- The response of selection for short shank length on growing performance of F1 progenies was minimal in both black and white Nicobari fowl.
- Shank length (mm) in F1 progeny of Nicobari fowl was lower after selection based on segregation at age of sexual maturity.
- Iron feed supplementation in layer feed @ 200ppm improved iron content of egg yolk.
- Marigold feed supplementation in layer feed @ 3% improved the egg yolk pigmentation.
- Feeding of *Morinda citrifolia* fruit juice (Noni juice) in broilers improved the feed efficiency and saved the feed cost efficiency of Rs.10 per kg over the control.
- Combination of Noni juice and *Lactobacillus* supplementation in broiler improved the immune status.
- Herbal ointments prepared by using *Vitex trifolia* and *E.odoratum* plants were found to be efficient in acute wound healing in cows.
- Random sero surveillance of FMD in A&N Islands showed the protective antibody titre of 10.5% with Type 'O' and DIVA-ELISA test revealed 7.47% animals having the presence of 3rAB3 in the serum.
- The generous number of *Actinomycetes* genera were recorded along the coast of Andaman of which the streptomycetes species were dominated.

## मत्स्य विज्ञान
## Fisheries Science

- Total of 11 freshwater fishes including 7 introduced exotics have been recorded from South Andaman. Cyprinidae were dominant, followed by Cichlidae and Anabantidae. Diversity indices *viz.,* Shannon Weiner, species richness and species evenness correspond to 2.14, 1.91 and 0.86 respectively. A total of 24 species of freshwater phytoplankton have also been documented under 6 phyla.
- Exercise surveys on marine faunal diversity in South Andaman were conducted and survey methodologies for different faunal groups were standardized.
- More than 600 fishermen were sensitized on PFZ advisories with awareness campaigns. Catch per unit effort was increased by 34% for PFZ fishers and the advisories were found to have been adopted in various intensities across the islands ranging from 22% at Guptapara to 83.3% at Campbell Bay.
- 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.
- Under sponge barcoding project 58 species (166 specimens) identified so far of which, 43 are being 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.

## सामाजिक विज्ञान
## Social Science

- The demand of milk, mutton and chicken are income elastic, whereas the supply of these products has been found to be responsive to own prices and feed prices. The demand of chicken would be almost double in 2021 and will be four times in 2031. The supply will increase faster and will surpass the demand in 2021.
- Wide gaps will persist between local supply and requirements of major food commodities which will expand towards 2021 and 2031 as estimated. In 2021, tourists flow will be almost equal to local population but in 2031, it will be almost double than the local population of the islands, as shown by the growth rates and projection modelling.
- At Campbell Bay wide yield gaps exist, which can be increased by seven times in rice, four times in pulses and three times in vegetables through extension approach only. Almost similar levels of yield gain can be achieved if technological interventions are made to achieve potential yields in rice.
- 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 BBF (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. Non availability of inputs, technical know-how, labour, marketing and proper governance were the major constraints.

- Under ORC, in Kharif demonstrations CSR 36 gave an yield of 5.10 t/ha. 4 tons of truthfully labelled seeds produced through seed village concept under the technical guidance of Division of Field Crops were bought through buy back system. Eleven training programs were conducted, wherein 379 were trained, besides exposure visit, field visits and advisory services were given to sensitize farmers in agriculture and allied fields. Peking cross duck, satellite fish farming, seed village concept and dal mill were the technologies intervened for livelihood.
- Nicobari tribal follows their traditional farming system which is mostly dominated by plantation and livestock based. Joint family system is predominant and is very strong in terms of socio economics functions and responsibilities. Farm and non-farm assets possession indicates that each family possessed assets of one lakh rupee. Backyard gardening is contributing to production of vegetable and fruits to meet the requirement of family.

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

- Fourty one trainings covering South Andaman, Neil, Havelock and Hut Bay were conducted, wherein 1,384 beneficiaries got benefited in agriculture and allied sector. In North and Middle Andaman district eight trainings were conducted, wherein 390 trainees were benefited. Beside, four trainings sponsored by NGOs could benefit 75 farmers.
- Under TSP 4 trainings were imparted exclusively for the tribal population of Car Nicobar district and a total of 79 tribal people were trained in livelihood options through agriculture and allied sectors. Ten numbers of On Farm Trial (OFT) at farmers field were conducted to assess and refine the selected technologies in agriculture and allied fields.
- Ridge and furrow cultivation, aerial vegetable cultivation for moisture conservation and to check soil erosion in hilly slope, fodder cultivation, composite fish culture, backyard poultry, nutritious kitchen garden and mulching in plantation and field crops for moisture conservation were the technologies intervened in the NICRA village for mitigation and adaptation due to climate change.

## कृषि विज्ञान केन्द्र, निकोबार
## Krishi Vigyan Kendra, Nicobar

- Thirty one trainings were conducted wherein, a total of 870 beneficiaries participated. Under TSP 10 trainings were imparted, wherein a total of 240 tribal people got trained in livelihood options in agriculture and allied sectors. To assess and refine the selected technologies in agriculture and allied fields, nine OFT at farmers field were conducted.

# INTRODUCTION

## ORGANIZATION

Central Agricultural Research Institute (CARI) located in the Union Territory of Andaman and Nicobar 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 situated in Andaman Nicobar Islands. The institute has four research farms, main campus at Garacharma of 62 ha area, wherein research related work on field crops, horticulture, animal sciences and fresh water fisheries are carried out. Another farm is at Sippighat is spread over 32 ha ,where research work on horticulture and brackish water fisheries are conducted. Third farm is located at Bloomsdale, which has a flat lands of 3.5 ha, is used for research work on field crops and natural resource management. The fourth farm is at Marine Hill, wherein state of the art multipurpose hatchery and fisheries informatics lab has been established. The institute has adequate laboratory facilities for all divisions in addition to a Instrumentation Facility, which is well equipped with sophisticated instruments and is accessible to every one.

To accomplish the mandate, the research activities are carried out under five divisions namely, Natural Resource Management, Horticulture & Forestry, Field Crops, Fisheries Science, Animal Science and one Social Science Section.

For the last three and half decades the Institute has been conducting research for providing livelihood security to the island farmers/fishers through development of technologies and their implementation in the farmers' field. To reach the farmers of different Islands and transfer the technologies developed by CARI, the Institute is having three KVKs, one at South Andaman established in 1993, another at Nicobar established in 2010 and at Nimbudera (i.e. in North and Middle Andaman district) established in 2012, beside an Out Reach Centre funded by NABARD has been established at Diglipur which is operational from 15th July, 2009.

## 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 fisheries including coastal aquaculture.
- ✓ First line transfer of technology and training to the relevant State Departments.

## Vision

Sustainable development in agri-horticulture, livestock and fisheries sector in the changing climatic scenario to ensure decent livelihood in the fragile island ecosystem

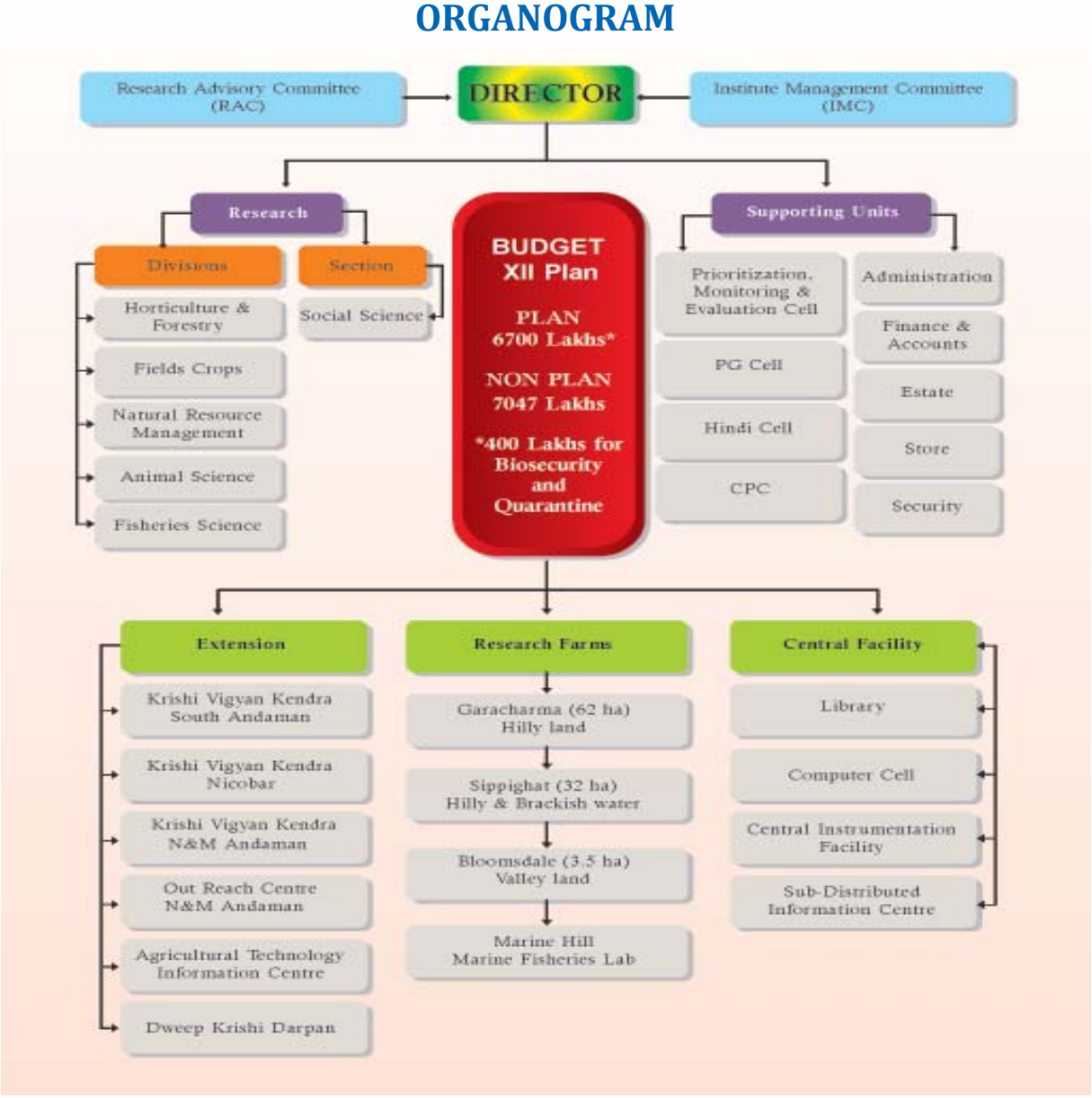
## Mission

Providing decent livelihood to farm youth from agriculture in a fragile island ecosystem on sustainable basis.

## 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



## THRUST AREAS FOR XII PLAN

**The broad research programmes for the 12th plan are as under:**

(a) Characterization and bioprospecting of natural island bio-resources
(b) Climate proofing island agriculture for improving productivity
(c) Development of harvest - post-harvest management practices and value addition
(d) Policy support research for agriculture development in the islands

It is envisaged that this strategy will help to improve the adaptive capacity of island farmers / fishers to changing climate

## STAFF POSITION

| Sl. No. | Category | Sanctioned | Filled |
|---|---|---|---|
| 1. | Scientific | 50 + 1 | 29 |
| 2. | Technical | 43 | 37 ( 3 Nos. court case & 3 retired) |
| 3. | Administrative | 25 | 26 (due to cadre revision) |
| 4. | Skilled Supporting Staff | 78 | 70 |

* Excess of Jr. Steno due to cadre revision

## BUDGET UTILIZATION DURING 2012-2013

| Head of Account Particulars | Plan (In Lakhs) | | Non-Plan (In Lakhs) | |
|---|---|---|---|---|
| | RE 2012-13 | Expt. 2012-13 | RE 2012-13 | Expt. 2012-13 |
| Establishment Charges | - | - | 1067.60 | 1058.28 |
| Travelling Allowances | 40.00 | 39.98 | 13.50 | 13.49 |
| Recurring Contingencies | 190.70 | 190.71 | 59.87 | 59.84 |
| Works | 151.25 | 151.25 | 22.80 | 22.80 |
| Equipment, furniture & livestock | 28.75 | 28.75 | - | - |
| Books (Library) | 20.00 | 19.99 | - | - |
| HRD/Fellowships | 9.24 | 9.19 | - | - |
| Overtime Allowance | - | - | .50 | .50 |
| TSP | 60.00 | 59.73 | - | - |
| Pension | - | - | 89.73 | 78.41 |
| **Total** | **500.00** | **499.60** | **1254.00** | **1232.95** |

# अनुसंधान कार्यक्रम
# Research Programmes

# प्राकृतिक संसाधन प्रबंधन प्रभाग

# Division of Natural Resource Management

# Water and Nutrient Management in Capsicum through Drip System under Protected Cultivation

*T. Subramani* and *A. Velmurugan*

Field experiments were conducted to optimize the water and nutrient requirement of capsicum under protected cultivation. The results of experiment on water management (Table 1) revealed that among the irrigation regimes (IW/CPE ratio of 0.25, 0.50, 0.75 through drip irrigation and 0.75 through surface irrigation) drip irrigation at IW/CPE of 0.75 recorded higher yield (20.7 t/ha), net return (Rs. 30,600/250 $m^2$) and B: C ratio (2.42) and it was at par with drip irrigation at IW/CPE of 0.50. However, higher water productivity (7 kg of capsicum/ $m^3$ of water) was recorded for drip irrigation at IW/CPE of 0.50. Application of 100 % recommended dose of water soluble fertilizer recorded higher capsicum yield (21.6 t /ha) and net return. However, it was at par with application of 50 % vermicompost + 50 % water soluble fertilizer + vermiwash spray. This suggested that requirement of water soluble fertilizer up to 50 % can be substituted by vermicompost without significant reduction in yield of capsicum. It can be concluded that drip irrigation at IW/CPE of 0.50 and soil application of 50 % RDF as vermicompost + fertigation of 50 % RDF as water soluble fertilizer + vermiwash is the optimum water and nutrient management for getting higher yield, net return and water productivity of capsicum under protected cultivation in bay islands.

**Table 1. Effect of nutrient management on yield and economics of capsicum (mean)**

| Treatments | Yield (g/plant) | Yield (t/ha) | Net Return (Rs./250$m^2$) | B: C ratio |
|---|---|---|---|---|
| T1 - 100 % RDF as V.C + V.W | 596 | 16.6 | 19596 | 1.90 |
| T2 - 100 % RDF as N. F | 639 | 17.8 | 25552 | 2.36 |
| T3 - 100 % RDF as WSF | 777 | 21.6 | 31252 | 2.38 |
| T4 - 50 % RDF as V.C + 50 % RDF as N. F + V.W | 640 | 17.8 | 24182 | 2.20 |
| T5 - 50 % RDF as V.C + 50 % RDF as WSF + V.W | 731 | 20.5 | 29619 | 2.40 |
| T6 - 50 % RDF as N. F + 50 % RDF as WSF | 708 | 19.7 | 28897 | 2.43 |
| T7 - 50 % V.C + 25 % N. F + 25 %WSF+ V.W | 643 | 19.2 | 23582 | 2.12 |
| SEd | 41 | 1.0 | - | - |
| *CD (0.05)* | 89 | 2.2 | - | - |

V.C- Vermicompost; V.W-Vermiwash; N.F- Normal fertilizer; WSF-Water soluble fertilizer
RDF – Recommended dose of fertilizers

# Post Harvest Management of Rice and Pulses in the Islands

*Sachidananda Swain* and *P.K. Singh*

Nine paddy varieties selected from different parts of Andaman Islands were sun dried to 13% of moisture content (weight basis) for milling. 250g of each paddy variety was shelled using two passes with a laboratory scale rubber roll type test husker. The brown rice so obtained was subsequently milled using a laboratory polisher for whitening of the kernels. After milling the biochemical parameters were measured (Table 2) by standard procedures. The results indicated that total phenols and radical scavenging activity (RSA) was highest in CSR-36 and lowest in Jaya variety. However, carbohydrate content was highest in Ranjit (43.34%) which was at par with CSR-36 (43.01%).

**Table 2. Biochemical parameters of brown rice**

| Varieties | Biochemical parameters | | |
|---|---|---|---|
| | Phenols (mg/100gm) | Carbohydrate (%) | RSA (µM Trolox) |
| Ranjit | 75.66 | 43.34 | 234.12 |
| Gayatri | 64.24 | 41.61 | 199.43 |
| Pagla Jaya | 83.91 | 37.18 | 278.01 |
| Jaya | 32.12 | 41.28 | 71.65 |
| C14-8 | 52.45 | 42.57 | 132.54 |
| CSR-23 | 58.12 | 41.86 | 156.47 |
| CARI-5 | 43.88 | 42.39 | 87.91 |
| CSR-36 | 95.32 | 43.01 | 318.32 |
| White Swarna | 47.39 | 32.62 | 100.38 |
| Mean | 61.45 | 40.65 | 175.43 |
| C.V (%) | 33.15 | 4.33 | 49.87 |

The correlation coefficient among biochemical parameters and physical properties is given in table 3. In general, the phenolic content had a positive correlation with the antioxidant capacity ($P<0.001$) and negatively correlated and aspect ratio however, there was no significant correlation with grain width and thickness. At the same time phenolic content was negatively correlated with 100 grain weight which was positively correlated grain length and 100 grain weight. So, the phenolic content could be indirectly predicted by grain length and 100 grain weight. RSA was positively correlated with phenolic content, grain width and negatively correlated with length, thickness, aspect ratio and 100 grain weight. Hence, it may be concluded that rice varieties high in antioxidant levels could be achieved by producing larger grain width.

**Table 3. Correlation coefficients among biochemical parameters and physical properties of rice**

| | PC | TC | RSA | L | W | T | AR | 100GW |
|---|---|---|---|---|---|---|---|---|
| **PC** | 1 | 0.148 | 0.991*** | -0.96*** | 0.453 | -0.201 | -0.8** | -0.708** |
| **TC** | | 1 | 0.179 | -0.056 | -0.195 | -0.365 | 0.073 | 0.058 |
| **RSA** | | | 1 | -0.951*** | 0.415 | -0.234 | -0.76** | -0.77** |
| **L** | | | | 1 | -0.59 | 0.06 | 0.89** | 0.82** |
| **W** | | | | | 1 | 0.331 | -0.88** | -0.32 |
| **T** | | | | | | 1 | 0.161 | 0.028 |
| **AR** | | | | | | | 1 | 0.63 |
| **100GW** | | | | | | | | 1 |

Correlation is significant at ** 5% and ***1%level

# Post Harvest Management and Value addition of Spices in the Island

*Sachidananda Swain, Shrawan Singh* and *Jai Sunder*

A survey was conducted among spice growing farmers of A&N Islands and the results indicated that sun drying is the common practice (95%) for selling in the open market. However, the sun dried spices are prone to attack by fungus and molds due to long drying time, high humidity (>80-85%) and instant rain during drying. During the year, locally produced spices from farmers as well as domestic markets were purchased and tested for their quality conforming to Agmark standard based on colour, size, moisture content, insect damage, broken berries, broken heads, mold growth and extraneous matter etc. The results indicated that all the spices are under B-grade that requires mechanical drying for quality products. Then, spices were subjected to sun as well as oven drying and observed for drying time to reduce initial moisture content of 60% to final safe moisture content of 6-7%. The result indicated that oven drying at 65°C saved 53% of the total drying time as compared to natural sun drying (Fig 1).

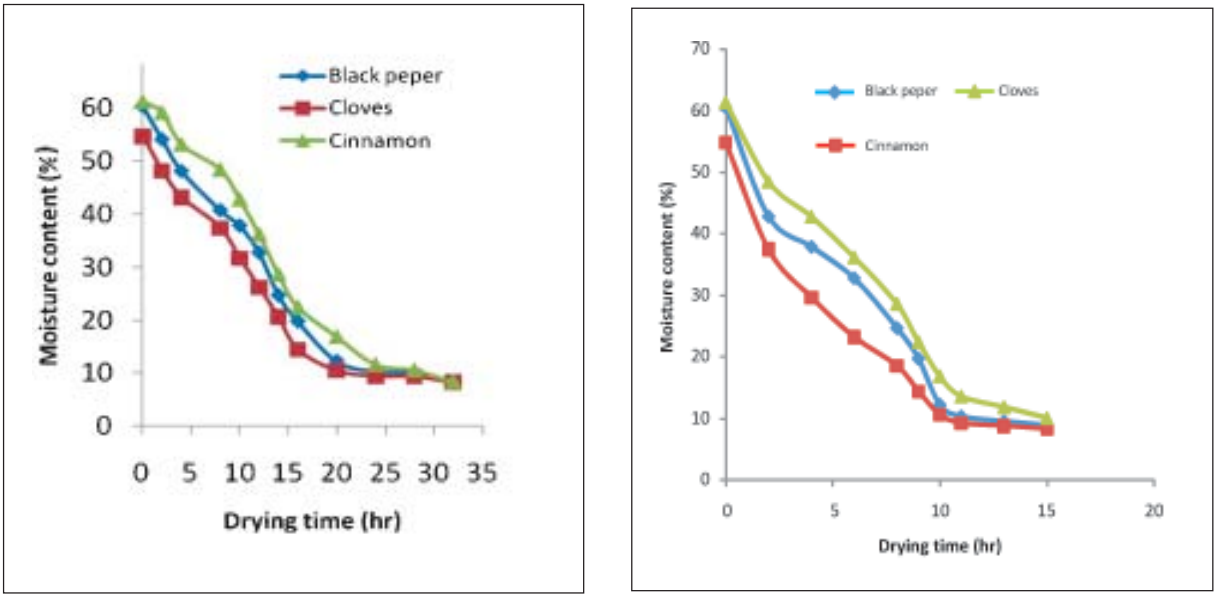



Fig. 1. Effect of sun (A) and oven (B) drying methods on total drying time

# Forecasting Agricultural Output using Space, Agro-meteorology and Land Based Observations (FASAL)

*A.Velmurugan* and *T.Subramani*

Crop production in Andaman and Nicobar Islands is highly vulnerable to inter-annual and sub-seasonal climate variability. Hence reliable and timely crop production forecast has become a very essential component in understanding the impact of weather on crop yields apart from timely availability of production information to support policy decision at national level.

During 2012-13 regression and crop simulation yield forecast models were developed for Kharif rice using meteorological and crop data and

validation of the same was carried out. These models were used to estimate the dependency of rice yield on the weather parameters (1981 to 2011) such as maximum and minimum temperature, rainfall, maximum and minimum relative humidity. It was observed that linear regression model predicted rice yield more accurately ($R^2$ = 0.89) 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. The observed and predicted yield of rice is presented in Fig. 2. The models predicted the average rice yield for kharif 2013 as 3100 kg/ha with the total production of 26009 MT for Andaman Islands.

The correction factor used for validation was calculated from the liner equation as follows;

**Y= aX + b**

Where, Y= Simulated Yield- Trend Yield

X= Time (year)

'a' and 'b' are constant value

Validated Yield = Simulated Yield- Correction Factor

**Table 4. Crop yield forecast for Andaman Island (2012-13)**

| Method | Model | $R^2$ | Forecast |
|---|---|---|---|
| | **Rice (kg ha-1)** | | |
| Trend Analysis | Y=45.279x-87906 | 0.580 | 3179 |
| Linear Regression | Y=3076.875+ 2.832*(Z251) + 0.853* (Z141)) | 0.898 | 2994 |
| DSSAT model | | | 3100 |
| | Maize (kg $ha^{-1}$) | | |
| Trend Analysis | y = -39.97x + 82817 | 0.324 | 2357 |
| Linear Regression | Y=2536.797 + 0.512*(Z451) +3.777*(Z241) | 0.840 | 3392 |


Fig 2. Trend analysis of historical productivity data of rice in Andaman Islands

Similarly crop yield forecast for rabi maize was developed with regression model which indicated that the productivity of maize is static over time ($R^2$ = 0.32). Weather integrated linear model forecast for maize was calculated as 3392 kg/ha ($R^2$ = 0.84). Field experiment is in progress and after the end of the experiment DSSAT model will be calibrated and used for yield prediction

# 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. Kiruba Sankar, B.K. Nanda* and *Ajmer Singh*

A survey was conducted to identify the existing farming systems based on percent contribution of various farm enterprises to total farm income in Nicobar Islands. The results showed that plantation based farming predominately exist with 2 major subsystems *viz.*, coconut + pig and coconut + pig + poultry. Coconut occupies 78% of the area under crops followed by arecanut (18%). Pig is the major farm animal accounting 67% followed by goat (30%). This was reflected in income contribution of different enterprises to total farm income as 72% is derived from coconut and 22% from pigs. The expenditure pattern indicated that other than food, major income goes to religious ceremonies and children's marriage. Lack of technical know how on various farming activities, remoteness were the major constraints identified in these Islands.

Mixed farming system predominates in North Andaman district where crops and livestock components equally contribute to the total farm income. Among the crops vegetables accounted for 50% of the income as compared to rice and pulses. The results indicated that 44.3% are medium holdings with average land holding of 4.79 ha. Majority of the areas is under field crops like rice, pulses and vegetables varying from 57.9 to 75.5% among different farm categories followed by plantations. The cattle and goat accounted for 91.6% of farm animals, while pigs form only 8.4% across different categories of farmers.

Different cropping sequences were evaluated for growing in the beds of broad bed and furrow system. The results indicated that cauliflower- amaranthus-amaranthus- bhendi recorded highest net return as well as B: C ratio followed by amaranthus- bhendi (Table 5).

**Table 5. Evaluation of cropping sequences in beds and furrows of BBF (Rs. in lakh)**

| Cropping Sequences | Crop Yield (Mg ha$^{-1}$) | | | | Gross Return | Total Cost | Net Return | B:C ratio |
|---|---|---|---|---|---|---|---|---|
| | 1st | 2nd | 3rd | 4th | | | | |
| Amaranthus-bhendi | 1.96 | 5.6 | - | - | 1.18 | 0.52 | 0.65 | 2.25 |
| Cauliflower-amaranthus-amaranthus-bhendi | 14.06 | 1.23 | 0.57 | 6.2 | 4.14 | 1.13 | 3.00 | 3.65 |
| Okra-amaranthus-coriander/vegetable cowpea | 4.43 | 0.36 | 2.1 | - | 1.11 | 0.64 | 0.47 | 1.73 |
| Marigold-amaranthus- brinjal | 1.75 | 0.53 | 0 | - | 0.73 | 0.51 | 0.22 | 1.43 |

The effect of spacing and fertilizer application on yield of CARI 5 was evaluated to optimize the crop production under coastal valley areas. Three levels of spacing (15 x 15cm, 20 x15 cm and 20 x 20cm) and four levels of fertilizer application were evaluated in split plot design with three replications. The application of 80:40:50 NPK ha$^{-1}$ recorded significantly higher yield (4.05 Mg ha$^{-1}$) which was on par with that of 60:40:50 of NPK application at all levels of spacing. Similarly spacing of 20 x 15 and 20 x 20cm recorded on par yield of 4.14 and 3.62 Mg ha$^{-1}$ respectively (Fig. 3). The interaction effect of fertilizer

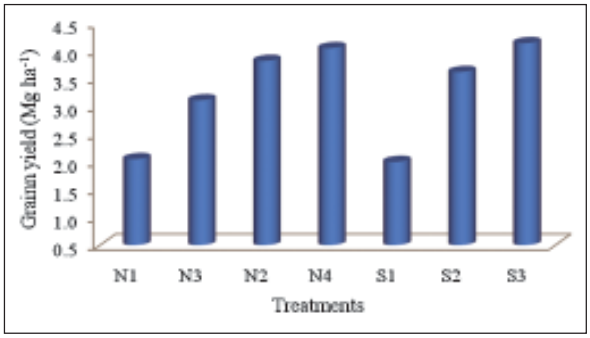



Fig 3. Effect of levels of fertilizer application and spacing on grain yield of CARI 5
N1: 60:30:40, N2: 60:40:50, N3: 80:30:40, N4: 80:40:50
S1: 15 x 15, S2: 20 x 15, S3: 20 x 20

application and spacing showed no significant influence on the grain yield. The spacing of 20 x 15 or 20 x 20 cm with fertilizer application of 80:40:50 NPK kg $ha^{-1}$ recorded higher yield of 5.18 and 4.71respectively but economic yield can be obtained even by application of 60:40:50 of NPK $ha^{-1}$.

Different packaging materials viz. Poly Propylene (PP), Low Density Poly Ethylene (LDPE), Medium Density Poly Ethylene (MDPE) and aluminum foil were evaluated for long term storage of tapioca powder. Aluminium foil was found to better packing material as the microbial load was significantly less after 3 month storage period.

Plate 1. Marigold cultivation in BBF and Tapioca in terraces

Vermicomposting of various crop residues like coconut husk, coconut leaves, and rice straw with 20% poultry manure was studied. The results indicated that vermicomposting of rice straw with gliricidia and poultry manure was much faster than in other substrates, where the composting was completed within 100 days, whereas it took more than 150 days for coconut husk compost. In all the compost the microbial population increases up to 30 days and decreased thereafter mainly due to heat generated during the process of composting. The nutrient concentration increases over the composting period in all the composting methods. 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%).

## 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 Andaman to study the fertilizer use pattern among different categories of farmers. The study revealed that at least 15.7% of the farmers are not using any kind of mineral fertilizers for raising crops. The non users has increased to 47.6% among marginal farmers as they are having only plantations of coconut or areca nut and not raising any annual crops like rice, vegetables etc. In terms of nutrients almost equal percent of farmers are using N and P fertilizers which are ranging from 4.5 among small farmers to 47.6 % among marginal categories. Almost 80.0 % of farmers did not use K fertilizer. The major fertilizers used in these areas are urea, DAP, SSP and MOP besides some amount of neem cake. The average consumption of neem cake by all farmers was 130.0 kg ha-1 with values ranging from 93.6 to 152.4 kg $ha^{-1}$.

**Table 6. Average consumption of major plant nutrients between different categories of farmers**

| Category of farmers | Per cent farmers using no fertilizer (%) | | | Mean consumption of nutrients (kg ha$^{-1}$) | | |
|---|---|---|---|---|---|---|
| | N | $P_2O_5$ | $K_2O$ | N | $P_2O_5$ | $K_2O$ |
| **Marginal ( < 1 ha)** | 47.6 | 47.6 | 90.5 | 41.0 + 24.7 | 43.8 + 20.2 | 30.0 + 0.0 |
| **Small (1-2 ha)** | 4.5 | 4.5 | 86.4 | 50.2 + 35.7 | 56.8 + 32.2 | 40.0 +17.3 |
| **Semi Medium(2-4ha)** | 19.0 | 19.0 | 81.0 | 91.5 + 37.5 | 102.3 + 50.2 | 63.0 + 58.3 |
| **Medium (4-10 ha)** | 5.9 | 5.9 | 72.5 | 119.8 + 23.7 | 127.9 + 33.6 | 90.0 + 31.1 |
| **Average** | 15.7 | 15.7 | 80.0 | 90.6 + 43.7 | 98.3 + 48.9 | 73.6 + 39.5 |

Among the farmers using some kind of fertilizers the average nutrient consumption was 90.6, 98.3 and 73.6 kg ha$^{-1}$ of N, $P_2O_5$ and $K_2O$ respectively in North Andaman (Table 6). However significant differences in nutrient consumption were found between the size of land holdings as well as crops. The nutrient consumption increases with increasing size of land holding with values ranging from 41.0 kg ha$^{-1}$ N in marginal holding to 119.8 kg ha$^{-1}$ N in medium holdings. The same trend was observed for other nutrients as well. It was found that irrespective of land holding the use of potassium was less as compared to nitrogen and phosphorus, where the average consumption of potassium was only 73.6 kg ha$^{-1}$ as against 90.6 and 98.3 kg ha$^{-1}$ of N and P. This imbalanced fertilizer application in a long run may lead to nutrient imbalances resulting in poor nutrient use efficiency and reduced crop yield.

The study on pesticide use pattern indicated that these chemicals are mainly applied for vegetable crops and synthetic pyrethroids, organo phosphorus compounds accounts 57% of pesticide use in North Andaman district. The pesticides were applied mostly for cole crops, brinjal, green chilli and gourds. Besides, farmers were found to use growth promoters to increase the fruit size and yield. Representative vegetable samples were collected from farmer's field and analysed for the presence of pesticide residues. The results showed that 34% of samples found to have pesticide residues ranging from 0.008 to 2.099 ppm. Among the vegetables, green chilli (29%) followed by crucifers and cucurbits (Fig. 4) accounted for the maximum number of positive samples in which 15.3% were found to contain residues exceeding the prescribed maximum residue limit (MRL). It was found that triazophos and profenophos compounds were mainly used for green chilli and okra, monocrotophos for brinjal, chlorpyrifos for crucifers and cucurbit vegetables and cypermethrin was used for all vegetables.

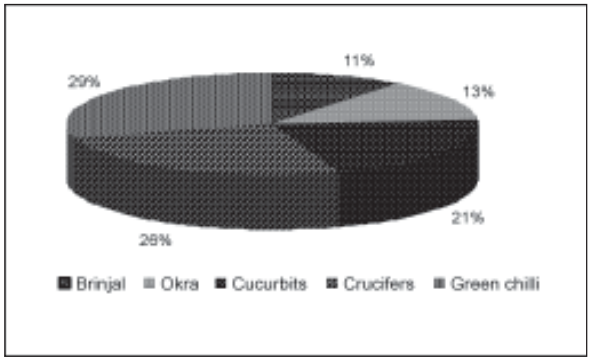



Fig 4. Percent contribution of different vegetables to samples with detected residues

Plate - 2

# 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***

The coastal degraded areas at four selected clusters of Andaman Islands suffers from water logging, salinity and sea water ingress apart from coastal and stream bank erosion in several places. Under NAIP systematic, need based integrated approach is being followed in which land improvement 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 being made as a means of reclaiming these areas and bring them under cultivation. Nearly 37.0 ha of degraded land spread over several villages have been brought under intensive cultivation of rice, vegetables, plantation crops and fish culture.

After the intervention, during rainy season salts and toxic substances from the raised beds have been slowly removed resulting in favorable soil conditions for crop growth. In general the soil pH was observed to be in the range of 6.5 ± 1.0 and EC ($dSm^{-1}$) 1.0 ± 0.6. With in a year nearly 831$m^3$/0.2ha, 1200$m^3$/0.2 ha, 1080$m^3$/0.2ha and 8000$m^3$/0.09ha of fresh water was harvested for multiple uses through BBF, paddy - fish, 3-tier farming and farm pond, respectively. During the implementation process all the beneficiaries were imparted with practical training and provided with

Degraded land before intervention | Paddy cum Fish intervention | Rice+fish+vegetable cultivation

Plate 3. Glimpses of land shaping activities at farmers field

critical inputs. The net farm income from approximately 0.2 ha area through different interventions was in the range of Rs. 35,000 to 80,000.

Salt tolerant high yielding varieties of rice (CSR-36, 23 and CARI Dhan-5) and varieties of arecanut (Mangla, Samrudhi and Calicut 35), coconut (Andaman green and yellow dwarf) and black pepper (Panniyur) have been introduced with package of practices in the intervention areas. Due to the introduction of salt tolerant high yielding varieties of rice the average yield increased to 3.5 ± 0.4 MT $ha^{-1}$ with a yield gain of 1.1 ± 0.4 MT $ha^{-1}$. A total of 400 farm families have been directly benefited by NAIP interventions, besides 14 farmers groups have been formed and interlinked for benefit and knowledge sharing.


Plate 4. NAIP technological intervention sites at Chouldhari, South Andaman

## Farmers Participatory Action Research Programme-Phase II

*T. Subramani, S. Jeyakumar, R. Kiruba Sankar, B.K. Nanda* and *Ajmer Singh*

The FPARP programme was initiated with the objective of demonstrating location specific water saving technologies to increase farm production and water use efficiency at farmer's field. Five technologies viz. broad bed and furrow system (BBF), micro irrigation, pond and land based integrated farming system (IFS), moisture management in table purpose groundnut were demonstrated at farmer's field in South, Middle and North Andaman. A total of 90 demonstrations covering 18 ha in 50 villages were carried out.

Under this programme, 25 Broad Bed and Furrow Systems each of 0.2 ha size were made in the water logged low lying areas, from which average income of Rs. 45,000 /year and water use efficiency of Rs. 15/ $m^3$ were recorded. IFS at 30 farmers field were demonstrated from which an average income ranging from Rs. 50,000/- to Rs.62,000/0.2 ha/year was obtained. Ground nut cultivation was demonstrated at 25 farmer's field and an average income of Rs. 8,000/- was recorded. Demonstration of drip irrigation for vegetables, coconut, arecanut and banana has been done at 10 farmer's field to improve the water use efficiency during dry season. Among the technologies, higher farm income and water use efficiency were recorded in IFS followed by BBF while the groundnut cultivation contributed comparatively low income but suitable for use in the interspaces of coconut garden.

Broad Bed and Furrow System at South Andaman

Integrated Farming System at North Andaman

## 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* and *S.K. Zamir Ahmed*

Agromet Advisory Bulletin (AAB) has been issued since 23rd June 2008 with the objective to receive and interpret the weather forecast to issue districtwise agro-advisories to minimize the losses and aid in timely decision making in farm operations. During 2012-13 nearly 50 bulletins for Andaman district and 48 bulletins for Nicobar districts 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 sent to nearly 50 farmers using SMS and feedback has been collected for effective dissemination.

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 67.1 % during pre monsoon period while 53.6 % in monsoon and 59.1 % in post monsoon period, respectively. Throughout the year 67.3% of second day forecast matched with observed value followed by third day forecast and first day (Fig. 5). The highest correctness was observed in the third day of premonsoon season (76.4%) and in general it decreased from fourth day on wards. The correlation drawn between predicted and observed data for the first day of premonsoon, monsoon and post monsoon period indicated a correlation coefficient ($R^2$) of 0.73, 0.58 and 0.76, respectively.

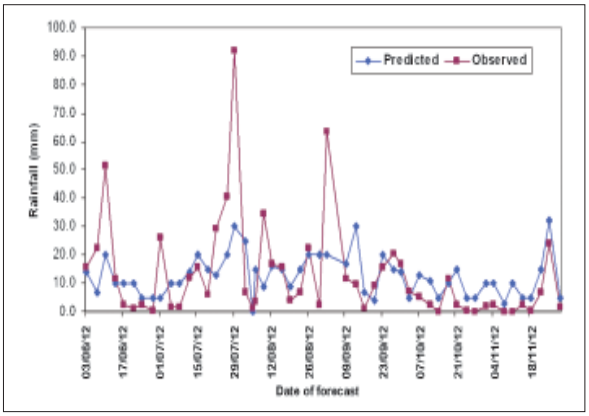



Fig. 5. Verification of rainfall (mm) forecast for first day (Jun to Nov 2012)

# उद्यान विज्ञान एवं वानिकी प्रभाग

# Division of Horticulture and Forestry

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

*Shrawan Singh, D. R. Singh, Dipak Nayak* and *Vivekanand Singh*

## Germplasm collection and documentation

In the line of research on indigenous vegetables of Andaman and Nicobar Islands, around 57 traditional vegetables including 37 perennials were documented with their food, culinary and health uses. They belong to 33 families and predominant are Fabaceae, Cucurbitaceae, Moaraceae, Amaranthaceae and Caesalpinaceae. Two new leafy vegetables, *Mukia maderaspatana* (L.) M. Roem (Plate 6) and *Limnophila chinensis* (Osbeck) Merr. were also identified and conserved. The herbs are mostly rich in Ca, Fe, polyphenol, carotenoids and vitamin C.

Plate 6. *Limnophila chinensis* (Osbeck) Merr.

*M. cochinchinensis* is a d*ioecious* plant and it is difficult to get exact type of material through seeds, therefore, the tissue culture protocol was developed for micro-propagation of *M. cochinchinensis* using internodes on plain MS media.

## Bioprospecting of vegetables

*Momordica spp.* are rich in neutraceuticals, the lycopene content was estimated in seed membrane of ripe fruits of *M. dioica* and *M. cochinchinensis* collections. *M. cochinchinensis* collections are found to be rich in lycopene (523.4 to 810 mg/100g) than *M. dioica* (142.2 to 144.4 mg/100g), however, both species contain very high amount of lycopene than tomato.

Biochemical analysis of leaf, flower and green fruits of 15 drumstick collections using standard procedures revealed that the leaves were rich source of Ca (10.7 to 25.1mg/100g), Mg (10.0 to 16.8mg/100g) and Fe (0.1 to 0.5mg/100g) (Table 7). Flowers were also rich in Mg (10.1 to 18.9mg/100g) and iron (0.3 to 0.5mg/100g). The drumstick Acc. No. 12 was found to be very rich in Mg content (63.6mg/100g) followed by Acc. No. 7 (8.9mg/100g).

**Table 7. Micronutrient content in different parts of drumstick***

| *Part* | *Micronutrients (mg/100g)* | | | | | | |
|---|---|---|---|---|---|---|---|
| | Zn | Al | Fe | Co | Ca | Mg | Mn |
| **Leaf** | 0.1-0.4 | 0.18-0.28 | 0.1-0.5 | 0.01-0.1 | 10.7-25.1 | 10.0-16.8 | 0.1-0.2 |
| **Fruit** | 0.02-0.3 | 0.27-3.0 | 0.1-0.3 | 0.06-0.2 | 0.1-2.0 | 0.05-63.6 | 0.5-0.7 |
| **Flower** | 0.06-0.2 | 0.29-0.34 | 0.3-0.5 | 0.14-0.2 | 0.1-2.8 | 10.1-18.9 | 0.4-0.7 |

*Range in 15 collections of drumstick

The drumstick leaf samples from mainland (Acc. No. 1, 2, and 4) showed significantly ($p<0.05$) higher mean values for contents of phenolics, tannin, flavonoids and carotenoids while ascorbic acid was more in island samples (Table 8). The antioxidant activity was estimated with DPHH (2,2-Diphenyl-1-picrylhydrazyl) and ABTS (2,2'-azino-bis (3-ethylbenzothiazoline-6-sulphonic acid) methods and no significant differences were observed in both groups of samples. Micronutrient and phytochemical analysis indicated great extent of diversity in drumstick collections from islands which showed low level relatedness to the mainland drumstick.

**Table 8. Antioxidant activity of methanol extract of drumstick leaves**

| Compounds | Mainland samples | Island samples |
|---|---|---|
| Phenolics | 485.0±32.5 | 295.9±117.4 |
| Tannin | 165.7±36.2 | 151.8±10.5 |
| Flavonoids | 181.0±25.6 | 158.0±18.5 |
| Carotenoids | 688.8±15.5 | 594.8±35.0 |
| Ascorbic acid | 114.0±13.4 | 130.0±4.3 |
| DPPH Antioxidant activity (%) | 63.4±27.8 | 62.9±16.2 |
| ABTS Antioxidant activity (%) | 73.3±14.9 | 67.0±14.9 |

## Nutritive profile of nicobari vegetable sources

Nutritional value of 16 predominant traditional vegetables of Nicobari tribes was evaluated and it was observed that these vegetables are rich in Fe (9.5 to 115.8mg/100g), Ca (69 to 234 mg/100g), Zn (1.4 to 71.8mg/100g), Cu (0.5 to 16mg/100g), Mn (1.6 to 69mg/100mg) and Mg (47 to 76mg/100g). These vegetables are also rich in phenolics (123.7 to 234mg/100g), ascorbic acid (74.4 to 131.5mg/100g) and flavonoids (134 to 246mg/100g).

## Germplasm improvement

The 'CARI Poi Selection' (Plate 7) was performed better than other collections for yield (60.5t/ha) (Fig. 6) and overall consumer preference scale (4.09) on 1-5 scale.

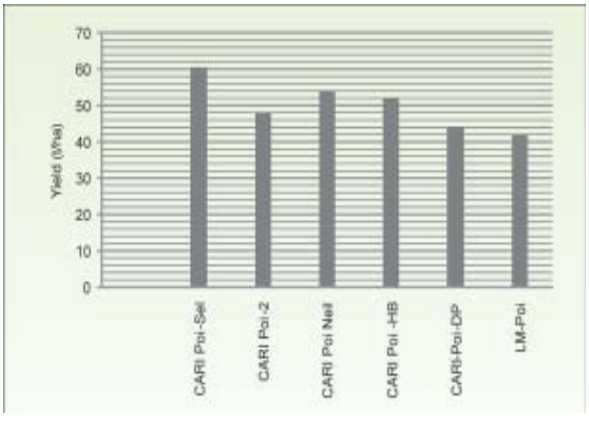



Fig. 6. Performance of Poi genotypes

Plate 7. Plant View of 'CARI Poi-1'

# Collection, Characterization and Agro-Technique Standardization of Fruit Crops of Andaman and Nicobar Islands

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

## Collection and evaluation of papaya diversity

Papaya is one of the major fruit crops of in islands and has considerable variations in morphological and horticultural traits that can be utilized in its genetic improvement. Hence, an exploration survey was made in different parts of Andaman Islands and collected 59 accessions from South Andaman (25 accessions), Middle Andaman (20 accessions) and North Andaman (14 accessions) based on preliminary criteria such as tree vigour, pest and diseases incidence, branching habit, fruiting column, fruit parameters and flesh colour. Collected accessions were analysed using biochemical and molecular markers which further substantiated phenotypic diversity in papaya collections. Among the accessions, fruit weight was ranged from 0.350 kg (Acc.No.5) to 2.15 kg (Acc. No. 37) and pulp thickness ranged from 1.50 cm (Acc.No.5) to 3.50 cm (Acc. No. 37). TSS ranged between 6.50 oBrix (Acc. No. 15) to 13.90oBrix (Acc.No.46). Variations in fruit shape, size, petiole colour and flesh colour was also observed in the collected accessions (Plate 8-13). Six red fleshed genotypes were also collected viz., Acc.No 6, Acc.No. 9 and 12, Acc.No. 15 and 18, Acc.No. 51. One genotype Acc.No. 36 with purple petiole was also collected and conserved. It was observed that all the papaya plants which were collected are free from PRSV (Papaya Ring Spot Virus). Seedlings of each accession were planted in the papaya germplasm block for further evaluation.

Molecular diversity was assessed in 73 accessions of papaya using 24 ISSR primers. Only six markers produced polymorphic bands with an average polymorphic information index (PIC) of 0.30. Marker $(AG)_8$YA had the highest PIC value of 0.44. The number of alleles per locus ranged from 2 for $(GA)_8$G to 6 for (AG) with an average of 4.17. The UPGMA analysis grouped the 73 papaya accessions into three main clusters (Fig. 7) namely A, B and C at the coefficient value of 0.37. Cluster 'A' had 70 accessions mostly from South Andaman. Cluster 'B' comprised of two accessions Acc.No.14 and 19 from Bloomsdale and Cattlegunj, respectively. Cluster 'C' had only Acc. No. 49 from Hut Bay. Generally, the relationships among accessions in the cluster could be attributed to their diversity, geographical locations and also due to exchange of papaya seeds among farmers.

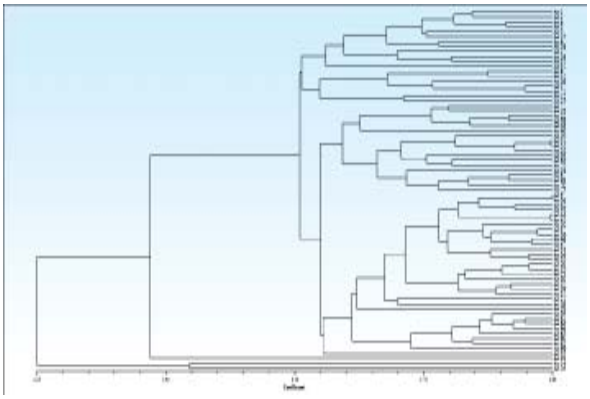


Fig. 7. ISSR based dendrogram of 73 papaya germplasm

Plate 8. Acc.No. 36 (Nimbudera, M. Andaman)

Plate 9. Acc.No. 27 (Bakultala, M. Andaman)

Plate 10. Acc.No. 3 (Birdline, S. Andaman)

Plate 11. Acc.No.37 (Jaipur, M. Andaman)

Plate 12. Acc.No.12 (Laxmipur, Neil Island)

Plate 13. Acc.No.11(Barathpur, Neil Island)

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

An experiment was initiated to study the growth and yield of banana (var. Grand Naine) by application of different organic sources of Vermicompost, Poultry manure and Farm yard manure. The experiment was laid out in Randomized Block Design with 8 treatments and three replications.

# Development of Production Technology for Ornamental Crops in Bay Islands

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

## Germplasm collection and evaluation

During the year, 22 new genotypes of specialty flowers were collected and planted in germplasm block which now having 46 collections of different specialty flowers (Plate 10) including *Heliconia sp.* (34), *Calathea lutea* (01), *Maranta sp.* (01), *Musa coccinea* (01), *Alpinia sp.* (03), *Etlingera sp.* (04) and *Sterlitzia sp.*(02).

Growth parameters were recorded from previous year collection of *Heliconia spp.* (22 genotypes) and maximum stalk length was recorded in *H. wagenaria* cv. Big Red (85.9 cm). Early flowering was recorded in *H. psittacorum* cv. Guyana. However, maximum numbers of flowers (82.4) were produced by *Calathea lutea* in total collection of speciality flowers.

*Etlingera elatior* cv. Pink

*Heliconia wagenaria*

*Heliconia wagenaria* cv. Shee

Plate 14. Speciality flowers in Germplasm block

## Standardization of growing media for growth and flowering of *Calla lily*

Nine treatment combinations of soil, sand, saw dust, coir compost, rice husk, vermicompost, farm yard manure and poultry manure were tested for calla lily. Maximum plant height (72.1 cm), maximum number of shoots per plant (3.9.), early sprouting (8 days), early flowering (72.02 days), maximum stalk length (52.02 cm), maximum number of flowers (4.32/plant), maximum flower diameter (16 cm), maximum number of tubers (3.27) and tuber size (14.25 cm) were recorded from $T_5$) (Fig. 8). Thus, it is concluded that growth, flowering and tuber yield parameters of calla lily were highest with $T_5$ (soil: sand: vermicompost: coir compost in 2:1:1:1 ratio) which can be taken as growing media for calla lily in islands.

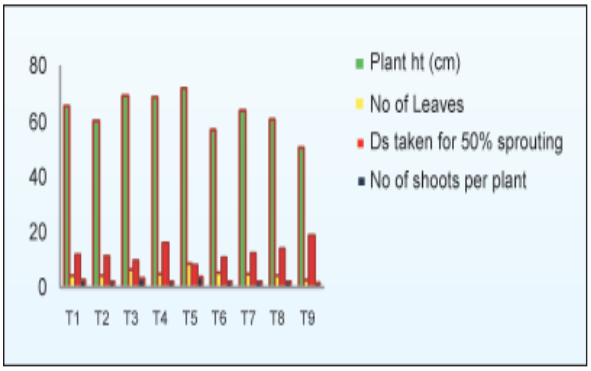



Fig. 8 Influence of media on vegetative parameters of *Calla lily*

### Effect of growing media on growth performance of gerbera

Among the effect of twelve growing media combination on growth and flowering of gerbera it was found that the treatment combination $T_6$ (Soil: sand: Coir Compost: Vermicompost in the ratio of 2:1:1:1) was best in terms of number of leaves (16.60), early flowering (82 days), number of flowers per plant (21), maximum flower diameter (10.40 cm). Maximum stalk length (63 cm) was recorded in the treatment T9 (Soil: Poultry manure: Vermi.: Saw dust: Rice husk in the ratio of 2:1:1:1:1:1) (Table 9).

**Table 9. Effect of growing media on growth and yield parameters of gerbera**

| Treatments | No of Leaves | Plant spread (cm) | Days to I$^{st}$ flower | Stalk length (cm) | Flower diameter (cm) | Flowers /plant |
|---|---|---|---|---|---|---|
| T1 | 8.60 | 39.00 | 88.6 | 58.4 | 8.21 | 15.8 |
| T2 | 9.00 | 41.50 | 88.0 | 59.0 | 8.70 | 16.1 |
| T3 | 7.40 | 35.90 | 90.2 | 55.2 | 7.50 | 15.1 |
| T4 | 9.70 | 43.12 | 91.0 | 57.6 | 8.30 | 16.2 |
| T5 | 11.00 | 47.58 | 85.3 | 60.8 | 8.90 | 17.2 |
| T6 | 16.60 | 55.56 | 82.0 | 65.2 | 10.40 | 21.0 |
| T7 | 8.10 | 37.85 | 86.8 | 57.3 | 8.13 | 15.7 |
| T8 | 7.60 | 36.50 | 89.4 | 54.6 | 7.60 | 15.5 |
| T9 | 13.10 | 52.80 | 84.0 | 63.0 | 9.50 | 19.6 |
| T10 | 10.60 | 46.64 | 84.7 | 60.1 | 8.40 | 16.8 |
| T11 | 11.70 | 51.69 | 85.0 | 61.5 | 9.10 | 18.0 |
| Control | 6.20 | 24.30 | 99.0 | 51.0 | 7.30 | 13.0 |

## Collection and Evaluation of Medicinal Plants of Bay Islands

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

A germplasm bank 64 species of medicinal plants was maintained and 48 more medicinal plant species from South Andaman villages such as Siphighat (08), Shoal Bay (09), Garacharma (09), Little Andaman (10), Ferrargunj (06), Chidiyatapu (01), Manpur (01), Jirkatang (01), Bambooflat (01), Tirur (02).

### Molecular characterization of *Cassia alata* genotypes

*Cassia alata* (Plate 15) is used as anti-fungal for treating ringworm and other skin diseases. The Islands have varied diversity in *Cassia alata*. Altogether, 29 accessions were collected during 2012-13 from South Andaman. PCR analysis of their genomic DNA using 7 ISSR markers amplified 194 bands. The UPGMA analysis of amplicons generated four clusters with only 39% diversity (Fig. 9). The dendrogram showed high degree of similarity among the collections which indicate for nar-row genetic base of *Cassia alata*.

Plate 15. Flower of *Cassia alata*

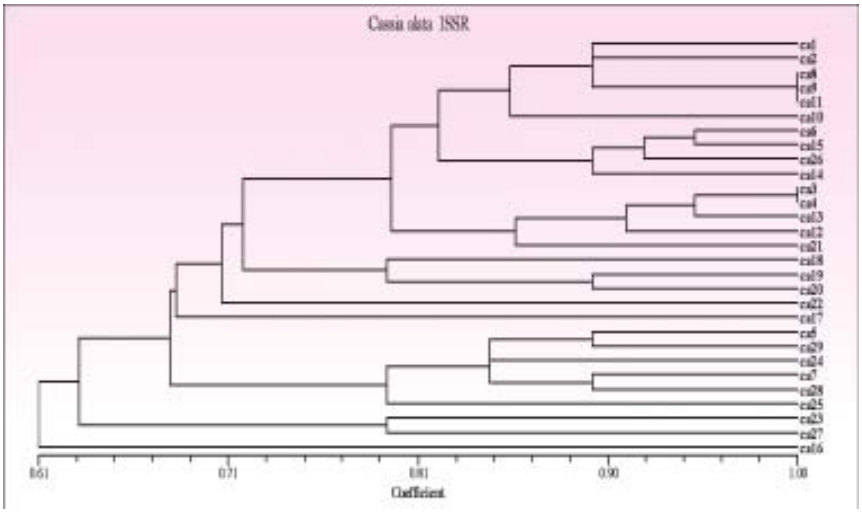



Fig. 9. Dendrogram based on UPGMA cluster analysis of 29 accessions of *Cassia alata* using ISSR markers

### GC-MS analysis of oil of *Calophyllum inophyllum*

*Calophyllum inophyllum* is an important medicinal tree distributed throughout the Islands. Oil from the nuts is traditionally used for medicinal purposes to cure rheumatism and skin problems. The GC-MS analysis of seed oil of *Calophyllum inophyllum* was done. It was observed that the predominant fatty acids were palmitic acid (18.74 ±1.18), linoleic acid (21.02 ±0.87), oleic acid 44.51(±1.32) and stearic acid 15.51(±0.74).

### Micro-propagation of *Piper longum* L

The tissue culture protocol for *Piper longum* was developed using nodal segments (Fig. 10). *Piper longum* were inoculated in different concentrations of BA and IAA, differential response was observed like multiple shoots, callus formation and shoot + callus formation. Maximum number of shoots per plant was observed with media added with BA @ 2.0 mg/l and IAA @ 0.05 mg/l (6.8) followed by BA @ 2.0 mg/l and IAA @ 0.01 mg/l (4.5).

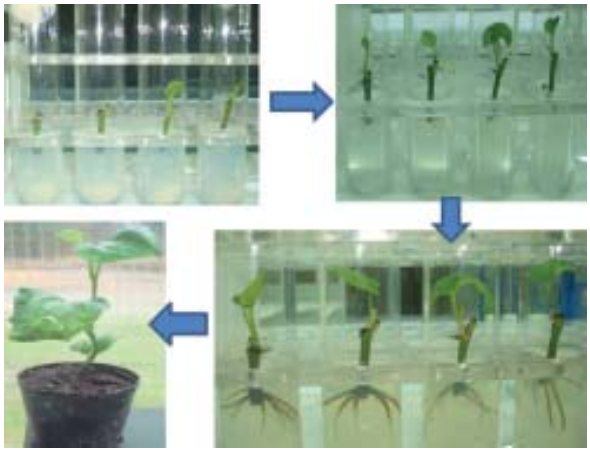


Fig.10. Tissue culture protocol of *Piper longum*

## Development of Dwarf Coconut Varieties for Andaman and Nicobar Islands

***M. Sankaran, V. Damodaran* and *K. Abirami***

During 2012-13, the hybridization work was done in Dwarf x Dwarf coconut genotypes with seven different cross combinations. The percentage of nut set was found to be highest (85.7%) in the cross combination of CARI-Chandan x CARI-Annapurna followed by Andaman Orange Dwarf X CARI-Annapurna (71.0%) while minimum nut set (57.7 %) was recorded in CARI-Surya x CARI-Annapurna.

Four Dwarf x Tall cross combinations were attempted and highest nut setting was recorded in CARI-Omkar x Andaman Ordinary Tall (67.4%) followed by CARI -Annapurna x Andaman Ordinary Tall (63.2%) whereas only 55.4% nut set was recorded in CARI-Chandan x Andaman Ordinary Tall.

# All India Coordinated Research Project on Tuber Crops

*M.Sankaran* and *V.Damodaran*

## Germplasm collection and conservaton

The islands are rich centre of diversity of tuber crops and their wild relatives. During the year, 10 new collections were added to 'Tuber crops germplasm' at CARI which now contain around 66 collections of different crops like Tapioca (10 varieties), Sweet potato(10 varieties), Elephant foot yam(6 varieties), Greater yam (13 varieties), Colocasia (14 varieties), Swamp taro (1 variety), Coleus (1 variety), Arrow root (1 variety), Tannia ( 6 varieties), Yams (2), Typhonium spp.(1variety) and Tacca leontopetaloides (1 variety) (Plate 16).

*Tacca leontopetaloides*

Pink flesh greater yam from Car Nicobar

Plate 16. New tuber crop species from Islands

## Evaluation of sweet potato and cassava varieties

Among the 9 varieties evaluated, the highest yield was recorded from CARI-SP1 (21.3t/ha) followed by CARI-SP2 (20.4 t / ha). The highest individual tuber weight (124.0g) was recorded in the var. Kisan. In cassava, 10 varieties were evaluated and var. Vellayani Hriswa produced highest tuber yield (42.9 t / ha) followed by Sree Prakash (34.5 kg) as compared to H-226 (25.5 t / ha).

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

The experiment was conducted with 4 spacing levels *viz*., (1 x 1 m, 90 x 90 cm, 90 x 75 cm and 75 x 75 cm) and 5 different sizes of corms (500g, 400g, 300g, 200g and 100g) with 3 replications at Horticultural Research Farm, Sipighat, CARI, to standardize the spacing and size of corm in Elephant foot yam under coconut plantations in Island ecosystem. The results revealed that the higher corm weight/plant (1.5 -1.8 kg) was recorded with spacing of 1 x 1 m and 90 x 90cm with the size of 400-500g. Irrespective of the spacing and size of corm, the highest corm weight/ plant (2.3 kg) was recorded with the combination of 90 x 90cm spacing and 300g size of corm. The total corm yield/ha was on par for the spacing of 90 x 90 cm (30.6 t/ha) and 90 x75 cm (30.8 t/ha) with corm of 300g as compared to 1x1M spacing. Among the corm size, the corm size of 300g out yielded (34.8 t/ ha) followed by 400g (31.30t/ha). Hence, elephant foot yam can cultivated under coconut plantations with the spacing of 90 x 90cm and 300g of corm size instead of conventional practice of 1 x 1 m and 500g corms.

## Production and distribution of planting material

Multiplied and distributed 1 ton. of planting materials of elephant foot yam corms to farmers for cultivation. Conducted 3 FLD on Elephant foot yam cultivation under coconut plantations in farmers filed in South Andaman and farmers obtained an average yield of 2.0-2.5 kg/plant. Multiplied and supplied about 2000 no. vine cuttings and 3000 no. of cassava setts for cultivation.

# All India Coordinated Research Project on Vegetable Crops

*Shrawan Singh* and *D. R. Singh*

During the year, 181 entries in different vegetables viz., tomato (49), Hybrid okra (35), chilli (28), brinjal (27), ridge gourd (20), bittergourd (15), cowpea (6) and dolichos bean (6) were evaluated.

## Chilli (2011-12)

The ongoing trial of chilli for 2011-2012 period was completed and in IET trial (11 entries), LCA-334 (13.7t/ha), KA-2 (13.3t/ha), Local (12.9t/ha), CHIVAR-6 (11.3t/ha) were found promising. In AVT-I trial (9 entries), the KA-2 (10.8t/ha), 10/CHIVAR-4 (10.2t/a), LCA-334 (10.0t/ha), Local (9.7t/ha) and 10/CHIVAR-5 (9.3t/ha) were promising genotypes. In AVT-II trial (9 entries), the 09/CHIVAR-3 (11.6t/ha), 09/CHVAR-5 (10.2t/ha), KA-2 (9.8t/ha), 09/CHIVAR-7(9.54t/ha) were promising entries. The wilt incidence was ranged from 14.7 to 55.3% in the entries.

## Hybrid okra

Out of 35 entries of okra the promising entries were identified as 2012/OKHYB-13 (13.0t/ha) and 2012/OKHYB-2 (12.6t/ha) in IET; 2011/OKHYB-4 (12.0t/ha) and HOK-152 (11.3t/ha) in AVT-I and 2010/OKHYB-4 (16.5t/ha), HOK-152 (13.5t/ha) in and Arka Anamika (12.4t/ha) in AVT-II (Plate 17).

## Cowpea

Out of 18 entries, Arka Garima (13.0t/ha), Kashi Kanchan (12.7t/ha) and COPBVAR-5 (11.7t/ha) of

Plate 17. Hybrid Okra trials

Plate 18. Cowpea trial

IET and Arka Garima (14.0t/ha), Kashi Kanchan (12.3t/ha) and COPBVAR-5 (11.3t/ha) of AVT-1 were found promising (Plate 18).

## Dolichos bean

Out of six entries, the Arka Jay (9.0t/ha), 10/DOLBVAR-3 (7.8t/ha) and 10/DOLBVAR-4 (7.3t/ha) were promising.

## Chilli, Brinjal and Tomato (2012-13)

28 entries of chilli (9 of IET, 11 of AVT-1 and 8 of AVT-II) and 27 entries of brinjal (8 of IET, 9 of AVT-I and 9 of AVT-II) are transplanted in field for evaluation. In tomato, 49 entries were transplanted and very high incidence of bacterial wilt is observed in all the entries which ranged from 60 % (BT-1) to 80% (2011/TODVAR-6).

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

*Shrawan Singh* and *D. R. Singh*

During the year, the selection of famers was done in different parts on Nicobar Islands. Sixteen varieties of cauliflower were tested in late rainy season and White Marble (18.5t/ha) and White Shot (15.5t/ha) were found promising. 'Rainshelter cauliflower' technology was developed for rainy season cultivation of cauliflower in tropical islands condition. In this technology, the identified varieties ('White Marble' and 'White Shot') were grown in staggered planting at 30 days interval. The plants are protected from heavy rains by covering with portable rainshelters during curding stage only.

Plate 19. Raised bed cultivation of Palak in rainshelters and in coconut plantations

Green onion performed well in growing media (coco peat + FYM in 1:1 ratio) (7.5t/ha) than normal soil (4.5t/ha). Root formation was not proper in media due to partial decomposition during trial period.

Raised bed cultivation technology with paper packaging of *Palak* was found better (28.0t/ha) than conventional (bed system) (9.5t/ha) due to multi-harvest and higher recovery of marketable leaves (90%) in rainshelters. Similarly, raised bed cultivation of palak in coconut plantation also produced 74% higher yield than conventional bed system in open condition (Plate 19).

POP for high quality Poi cultivation was developed for production in South Andaman and transport to Nicobar Islands. (Plate 20)


Plate 20. Package of practices for 'high quality poi'

# Central Sector Scheme-National Horticulture Mission on Spices

*M. Sankaran* and *V. Damodaran*

### Evaluation of turmeric varieties under coconut plantations

Seven varieties were evaluated including one local collection from Diglipur under coconut plantation. Among the varieties, Kedaram recorded higher yield (13.4 t/ha) followed by Zeodaric (11.7 t/ha).The lowest yield (1.9 t/ha) was recorded in Prabha.

### Planting material distribution

Quality planting materials of black pepper (729 no.), clove (66 no.), cinnamon (1009 no.), nutmeg (176 no.) and 4140 of other spcies were distributed to farmers. About 2.6 q of seed rhizome of ginger (var. Jorhat) were distributed to the selected progressive farmers of South Andaman and yield at farmer's field was recorded to be 7.25 to 7.5 t /ha.

# Technological Innovations for Commercial Exploitation of *Morinda Citrifolia* as a Livelihood Option for Island Farmers

*D. R. Singh, Shrawan Singh, Jai Sunder, Krishna Kumar* and *Subhash Chand*

### Germplasm management

During the year, 41 accessions of *Morinda citrfolia* were maintained in 'Noni Germplasm Block' at CARI. Four varieties namely CARI Sanjivini, CARI Sampada, CARI Samridhi and CARI Rakshak were developed for island conditions (Plate 21). The yield observations from 22 genotypes in 4$^{th}$ year - best are TRA-1 (24.8kg/plant), TRA-II (23.0kg/plant), HD-6 (21.0kg/plant) and JGH-5 (20.5kg/plant).

CARI Samridhi CARI Sanjivini CARI Sampada CARI Rakshak

Plate 21. New varieties of Noni (*Morinda citrifolia* L.)

### Plant geometry

Out of three treatments, the highest fruit yield was observed from Noni plants trained with $T_3$ (5 primary branches) (22.38 kg/plant/year) which is significantly ($p<0.05$) higher than control (17.30 kg/plant/year).

### Intercropping system

The highest fruit yield was recorded from Arecanut + Noni system (26.2kg/plant/yr) followed by Coconut + Noni system (23.5 kg/plant/yr) while Noni fruit yield was low in open condition (18.2 kg/plant/yr).

### Canopy architecture

Out of six treatments, $T_4$ (Removal of main stem tip + cutting of 50% of leaves) (25.2kg/plant/year) observed to be significantly better than contol (16.5kg/plant/year).

### Intercropping and plant geometry

In coconut + noni system, the noni performed well (28.2kg/plant/tree) with 5 primary branches while

in Noni plants trained with 4 primary branches performed well in Coconut+ Noni system (25.2kg/plant/year). However, the performance of Noni as intercrop in both system was better than open condition.

### Crop geometry

The noni plants showed better growth and yield response at 4x4 m (27.0kg/) spacing level than 3x3m (23.0kg/plant/year) . However, more number of plants in unit area resulted in better yield from 3x3 m (1111 plants; 25.5t/ha) than 4 x 4 m (16.8t/ha).

### Evaluation of noni in saline lands

Evaluated three genotypes (Noni Saline-1, Noni Saline-2 and Noni Saline-3) for sea water affected lands and better performance was observed for Noni Saline-1 (CARI Rakshak) (9.6kg/plant/year). The observation from experiment on Noni in sea water challenged situation was also recorded which showed that noni produced 10.5kg fruits/plant/year) than normal soils (18.2 kg/pl/yr), but it provide opportunity to utilize the sea water affected lands economically.

### Location effect on micronutrients content in noni

Five nutrients were estimated in noni plant parts from six locations and it was observed that the Ca content is high in Noni fruits harvested from normal soils (56.0mg/100g) than from sea water challenged soils (9.6 mg/100g) while Mg content showed reverse trend (7.2mg/100g from normal soils and 10.1mg/100g from sea water challenged soils). Fe and Zn content were also high in Noni fruits from sea water affected soils (0.475mg/100g; 0.57mg/100g) than normal soil (0.0253mg/100g; 0.16mg/100g).

### Development of fatty acid profile

Fatty acid profiles of seeds of 10 accessions of *Morinda citrifolia* was developed and observed the major fatty acids are linolenic, oleic and stearic acids. Stearic acid ranged from 0.52 to 4.98 mg/100. The seeds were also rich in both of the essential fatty acids i.e. oleic (0.352 to 4.031mg/lt) and linoleic acids (0.632 to 6.459 mg/lt).

### HPLC analysis of noni fruits

HPLC analysis in different stages of *Morinda citrifolia* was done and observed the major carotenoids as Lutein, Zeaxanthin, $\alpha$-Crtyptoxanthin, Echinenone, $\alpha$-Carotene and $\beta$-Carotene and phenolics as epicatechin gallate, syringic acid, epigallocate chin gallate, vanillic acid, naringin and cinnamic acid. Cyndin-3-glucoside in anthocyanin and myricitin and rutin in flavonoid group were identified as major compound in *Morinda citrifolia* fruits.

## Development of Suitable Pre and Postharvest Technologies to Increase the Shelf Life of Noni (*Morinda Citrifolia* L.) Fruits

***D.R. Singh* and *K. Abirami***

### Harvesting method influence shelf life of *Morinda citrifolia* fruits

Noni fruits were harvested with pedicel ($T_1$) and without pedicel ($T_2$) and evaluated for shelf-life at room temperature. The $T_2$ fruits had better performance for shelf life parameters than $T_1$ upto 7 days of storage.

### Fruit development influences physio-chemicals constituents in noni

Physico-chemical analysis of Noni fruits during different maturity stages (from 60 to 120 days of fruit setting) revealed a significant increase in fruit weight (90.0%), fruit length (18.4%) and fruit width (26.8%). Further, significant increase in acidity content (%) from 0.03 to 0.16, TSS (°Brix) from 7.3 to 12.4, lipid (mg/g) from 0.13 to 0.22 was observed for stage I and IV respectively. Carbohydrate content was found to be maximal in fruits belonging to stage III (670mg/100g). Chlorophyll content (mg/g) decreased from 2.75 in stage I to 0.81 in stage IV; on the other hand, carotenoids (mg/g) increased from 121.3 in stage I to 456.0 in stage IV.

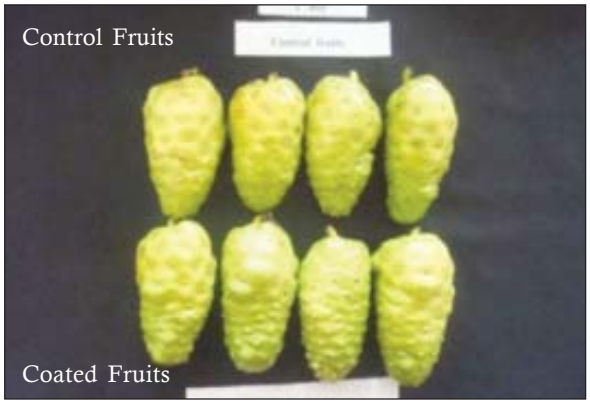
### Physico-chemical changes in noni fruits during storage

The physico-chemical changes of Noni fruits were observed during storage (1-10 days) of different maturity stage fruits. The stages were stage I (dark green), stage II (light green), stage III (greenish white) and stage IV (white). Stage I fruits had maximum shelf-life (7days) followed by stage II fruits (6.5 days) and stage III fruits (4.5 days). The white fruits (stage IV) showed minimal shelf-life of 2.5days.

Acidity in fruit extracts increased during storage from 0.03, 0.05, 0.09 and 0.16% (on day 1) to 0.14, 0.17, 0.25, 0.31% (on day 10) in stage I, stage II, stage III and stage IV respectively. Carbohydrate content increased upto 7$^{th}$day of storage while decreased afterward. Chlorophyll content also decreased from day 1 (0.07, 0.08, 0.11 and 0.05mg/g) to day 10 (0.062, 0.07, 0.026, 0.028mg/g) in stage I, stage II, stage III and stage IV, respectively.

### Effect of organic coating of aloe-vera gel on shelf-life of noni

Coating on Noni fruits with edible organic aloevera gel increased the shelf life (Plate 22) and reduced the changes in physico-chemical parameters over the storage period of 7 days. The coated fruits showed less weight loss (20.58%) than control fruits (23.28%). Protein and carbohydrate contents were decreased in both sets with increasing storage period but losses are more in coated (1.7%; 680mg/100g) than the control fruits (1.5%, 650g/100g), respectively. Antioxidant activity increased with storage period in both coated (66.0%) and control fruits (62.9%). Similarly, TSS content was more in coated fruits (11.8°Brix) and control (9.5°Brix) fruits. Carotenoid content was also more in coated fruits (90.01mg/g) than that of control fruits (80.75mg/g). The study indicates that Aloe-vera coating can be used for coating of Noni fruits for extending the shelf-life and facilitate the transport of the fruits.




Fruits on 1$^{st}$ Day of storage


Fruits on 7$^{th}$ day of storage

Plate 22. Effect of fruit coating with Aloe-vera gel

## Collection, Characterization, Documentation and Identification of Superior Genotypes of Karanja & Jatropha

***M. Sankaran* and *I. Jaisankar***

Twenty five accessions of karanja were planted in the field gene bank for the conservation and multiplication. The seeds of two accessions of *Pongamia pinnata* (IC-0589037 and IC-0589042) were sent to the networking centres for testing across the country.

### Diversity analysis in *jatropha curcus* by RAPD and ISSR markers

The genomic DNA of 25 local genotypes of *Jatropha curcus* from Andaman and Niocbar Islands were analysed using 7 RAPD and 8 ISSR markers. Around 589 fragments were generated by RAPD markers in 25 genotypes and out of 61 amplified bands, 34 were

polymorphic. Similarly, ISSR oligonucleotides generated 614 fragments in 25 genotypes and out of 46 amplified bands, 20 were polymorphic. The levels of polymorphism generated among the genotypes were 54.21%.

### Cluster analysis of RAPD and ISSR

The UPGMA cluster analysis of combined data from PCR analysis of 25 genotypes with 7 RAPD and 8 ISSR markers analysis gave three major clusters with 37% diversity and Jaccard's similarity coefficient ranging from 0.63 to 0.91 (Fig. 11).

### Evaluation of karanja accessions under National trial

Seven accessions of *Pongamia pinnata* from different universities/institutes namely TCR-CL-1(KAU, Kerala), Acc.13 and Acc.16 (CRIDA, Hyderabad), PT-01 and PT-02 (UAS, Dharwad ), RHRAK-47 and RHRAK-50 (MPKV, Rahuri) were evaluated for seed germination studies. The sprouting occurred within 6-7 days in six genotypes while no germination was observed in TCCR-CL-1.

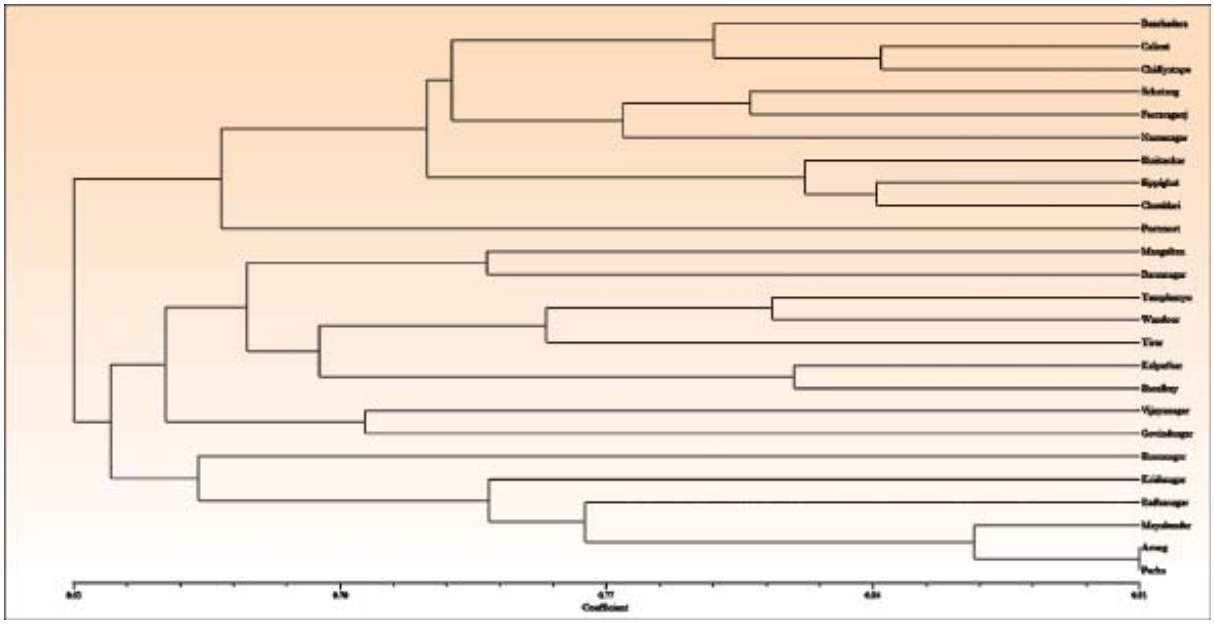


Fig. 11. Dendrogram showing the phylogenetic relationship of *Jatropha curcus* by using RAPD and ISSR markers

# क्षेत्रीय फसलें प्रभाग

# Division of Field Crops

# Augmenting Rice Productivity through Varietal Purification of Popular Land Races

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

A total of 144 individual plant panicles of popular C14-8 (*Aath number dhan*) cultivar, collected from North & Middle Andaman and South Andaman Districts were grouped into 4 groups based on grain husk color. The grains having light purple furrows on husk (Group I), yellow husk with black apiculus (Group II), yellow husk (Group III) and golden furrows on golden husk (Group IV) were thus classified into four groups. These were planted in 144 panicle to row progenies during kharif 2011 and grown till maturity with an objective to know the extent of variability for important traits. Sixty DUS traits were also employed to characterize the progeny lines. The highest average grain yield performance/ plant was recorded by group I (23.1 g/plant) followed by group II and group IV (17.5) and group II (16.5). In group I, progenies C14-8-11-91 and C14-8-11-1 were top yielders (>31g/plant) whereas in group II, C14-8-11-60 and C14-8-11-31 were top yielders (>22 g). In group III, C14-8-11-61 was the top yielder (30.0g) followed by C14-8-11-90. In group IV, C14-8-11-114 exhibited maximum yield (31.0 g) followed by C14-8-11-118.

During kharif 2012, promising 20 lines (5 high yielding lines from each group) were evaluated along with non-purified C14-8 (control) in RBD with three replications in a plot size of 3.00 $m^2$. The highest average grain yield (t/ha) was recorded by group III (2.99) followed by group I (2.92) and group IV (2.80). The highest average grain yield was recorded by C14-8-11-113 (4.31 t/ha) and C14-8-11-108( 3.75 t/ha) in group III whereas by C14-8-11-117 (3.61 t/ha) in group IV. Some plants in C14-8 lines were observed to exhibit tendency for open spikelets and protruding stigma and anthers.

A total of 66 individual plant panicles of Black Burma and 76 of Khusbayya land races were also collected and evaluated. However, comparatively less intra-varietal variation was observed in these land races.

# Stress Tolerant Rice for Poor Farmers of Africa and South Asia

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

## Mother trials-2012

Two mother trials consisting of 15 elite salt tolerant rice genotypes were conducted at farmers fields. Each mother trial was conducted in thrice replicated RBD in Chouldari (South Andaman, ECe~4 dS/m, pH ~5.2) and Rajatgarh, Baratang (Middle Andaman, ECe~4 dS/m, pH ~5.6). In South Andaman, CSTVT-11-2227 (2.59 t/ha) recorded significantly higher grain yield than CARI Dhan 5 (1.37 t/ha). In Middle Andaman, CSR36 (2.85 t /ha) yielded highest followed by STBN21 (2.37 t/ha) and STBN22 (2.16 t/ha). However farmers' participatory variety selection in Rajatgarh revealed maximum preference for CARI Dhan 5 and CSR36.

Plate 23: Farmers' participatory variety selection in Middle Andaman

### Salinity tolerant breeding network (STBN) trial - 2012

A total of 30 genotypes under STBN trial-2012 were evaluated at Chouldhari village, Port Blair of South Andaman District in dual soil stress *i.e.* saline (ECe~4 dS/m) and acid sulphate soils (pH 5.0). The experiment was conducted in Randomized Block Design with two replications and plot size of 3.96 $m^2$ by including four check varieties. The perusal of data revealed that STBN 12-4 (3.00 t/ha) and STBN 12-11(2.69 t/ha) were found to be significantly better in respect of yield over local standard check CARI Dhan 5 (1.78 t/ha). However, compared to the best check CSR36, STBN 12-4 was significantly better. The evaluation revealed the better performance of above genotypes not only under salinity but also under combined stress of acid sulphate soils.

### Seed distribution in salt affected areas

Eight quintal seed of CARI Dhan 5 and CSR36 was distributed to farmers in salinity areas in Middle Andaman during kharif 2012. The demand for about 15 quintal of labelled seed of salt tolerant rice varieties CARI Dhan 5 and CSR36 has been received from the farmers in the project areas for kharif 2013.

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

***R.K.Gautam, Naresh Kumar, P. K. Singh, K. Devakumar* and *Krishna Kumar***

Bacterial blight (BB) is the most important disease of rice causing up to 30% yield loss in the islands. The popular rice varieties like C14-8 and CARI Dhan 5 are susceptible to BB. Resistance genes and linked markers for BB are known and marker assisted breeding is being utilized for development of BB resistant rice varieties.

With an objective to know the effectiveness of specific genes imparting resistance under island conditions, 19 IRBB lines possessing different *Xa* genes for resistance to bacterial blight (*Xanthomonas oryzae*) were collected and grown at Bloomsdale Farm during kharif 2012. A total of 4 isolates of *Xanthomonas oryzae* were collected from North, Middle and South Andaman and artificially inoculated on all IRBB lines to know the pathotypic variability. It was inferred that none of the single genes imparts absolute resistance to all the four isolates inoculated and requires a combination of effective genes. Crosses have been attempted between resistant donor IRBB 60 (possessing four gene pyramid Xa4 + *xa5+xa13+Xa21)* and local popular cultivars CARI Dhan 5 and C14-8 for initiating resistance transfer.

## Genetic Improvement of Long Duration Rice for Andaman and Nicobar Islands

***P. K. Singh, Krishna Kumar* and *Ajanta Birah***

A total of 19 long duration rice lines along with three check varieties were evaluated under rainfed transplanted condition at two locations *viz.* Port Blair (South Andaman District) and Diglipur (North Andaman District). The yield performance of varieties is depicted in Table 10. At Port Blair, the highest yield were recorded for ANR 34 (6.51 t/ha) followed by ANR 35 (5.97 t/ha) and ANR 36 (5.87 t/ha) during Kharif 2011. However, during Kharif 2012, highest yield was recorded for ANR 21 (5.53 and 6.96 t/ha) followed by ANR 26 (5.16and 6.83 t/ha) and ANR 14 (5.15and 6.19 t/ha) at Port Blair and Diglipur. While highest average yield (t/ha) over the years and locations was recorded for ANR 37 (5.91 t/ha) *i.e* 25.26% over the best check variety CARI Dhan

5) followed by ANR 21 (5.69 t/ha) and ANR 14 (5.17 t/ha) *i.e* 17.80% and 9.49% over the best check variety. ANR 21 and ANR 37 also showed stable performance over the years and locations. These lines were also preferred by the farmers during farmer's participatory variety selection at Port Blair and Diglipur.

Selected rice lines were also evaluated for major diseases (Sheath blight, leaf blast and bacterial leaf blight) and insect pests (Gundhi bug and leaf folder) resistance under field conditions during *Kharif 2012*. Moreover these lines were artificially inoculated by isolates of bacterial leaf blight. Out of these 19 lines, 5 lines *viz.* ANR 18, ANR 20, ANR 21, ANR 32, ANR 35 and Ranjeet showed multiple resistance against major pest and diseases (Table 11).

**Table 10: Yield performance of long duration rice over the locations and years**

| Entries | Yield (t/ha) | | | Average yield over the years and locations (t/ha) | Yield increase over the best check (%) | Stability | | Farmers preference | |
|---|---|---|---|---|---|---|---|---|---|
| | Port Blair (2011) | Port Blair (2012) | Diglipur (2012) | | | b | $S^2_{di}$ | Port Blair | Digli pur |
| ANR 14 | 4.17 | 5.15 | 6.19 | 5.17 | 9.49 | 3.46 | 0.97 | III | III |
| ANR 15 | 4.12 | 1.19 | 2.94 | 2.75 | -41.76 | 0.72 | 4.8 | | |
| ANR 16 | 1.85 | 0.96 | 3.43 | 2.08 | -55.89 | 1.18 | 2.72 | | |
| ANR 17 | 1.48 | 1.29 | 4.50 | 2.42 | -48.63 | 3.29 | -0.05 | | |
| ANR 18 | 0.46 | 1.85 | 4.38 | 2.23 | -52.71 | -0.42 | 1.42 | | III |
| ANR 20 | 2.50 | 3.96 | 6.10 | 4.19 | -11.30 | -1.6 | 6.44 | | |
| ANR 21 | 4.57 | 5.53 | 6.96 | 5.69 | 20.54 | 0.16 | 0.98 | II | I |
| ANR 22 | 0.56 | 1.11 | 3.46 | 1.71 | -63.78 | -1.29 | 0.15 | I | |
| ANR 23 | 2.22 | 2.89 | 5.08 | 3.40 | -28.03 | -2.31 | 0.49 | | II |
| ANR 24 | 5.37 | 2.37 | 4.04 | 3.93 | -16.77 | 2.15 | 6.31 | | |
| ANR 25 | 3.01 | 1.37 | 5.09 | 3.16 | -33.15 | 3.11 | 3.30 | | |
| ANR 26 | 4.12 | 3.05 | 5.36 | 4.18 | -11.48 | 1.74 | 2.12 | | |
| ANR 28 | 4.79 | 2.04 | 2.97 | 3.27 | -30.73 | 0.93 | 2.10 | | |
| ANR 31 | 1.45 | 2.44 | 2.82 | 2.24 | -52.57 | -2.59 | 0.59 | | |
| ANR 32 | 0.51 | 1.33 | 3.06 | 1.64 | -65.35 | 0.99 | 2.47 | | |
| ANR 34 | 6.51 | 1.65 | 4.60 | 4.25 | -9.91 | 0.39 | 1.05 | | |
| ANR 35 | 5.97 | 2.56 | 4.41 | 4.31 | -8.63 | 2.89 | -0.09 | | |
| ANR 36 | 5.87 | 0.96 | 1.35 | 2.73 | -42.22 | 1.80 | 3.18 | | |
| ANR 37 | 5.76 | 5.16 | 6.83 | 5.91 | 25.26 | 0.60 | 0.86 | I | II |
| CARI Dhan 5 | 3.83 | 4.39 | 5.94 | 4.72 | 0.00 | 0.39 | 8.10 | II | |
| Ranjeet | 3.58 | 3.01 | 4.66 | 3.75 | -20.55 | 2.62 | 4.49 | II | |
| Savitri | 2.75 | 4.05 | 6.60 | 4.47 | -5.35 | 3.76 | 2.14 | II | |

**Table 11: Evaluation of promising rice lines for reaction to major diseases and insect pests (1: Highly Resistant, 9: Highly Susceptible)**

| Entries | Disease | | | Pests | |
|---|---|---|---|---|---|
| | BLB | Leaf blast | Sheath blight | Leaf folder | Gundhi bug |
| ANR 18 | 1 | 1 | 1 | 1 | 1 |
| ANR 20 | 1 | 1 | 1 | 1 | 1 |
| ANR 21 | 1 | 1 | 1 | 1 | 1 |
| ANR 32 | 1 | 1 | 7 | 1 | 1 |
| ANR 35 | 1 | 1 | 3 | 1 | 1 |

## Grain quality analysis

Nineteen long duration rice lines and three check varieties (CARI Dhan 5, Ranjeet and Savitri) were analysed for 10 qualitative characters like hulling %, milling %, head rice recovery %, kernel length (mm), kernel breadth (mm), L:B ratio, 1000 grain weight (g) etc. The genotypes ANR 21 and ANR 37 were found promising which has medium slender grain, high milling percentage and head rice recovery yield (Table 12).

**Table 12: Grain quality analysis of long duration rice lines**

| Entry | Grain length (mm) | Grain breadth (mm) | Grain L:B ratio | 1000 Seed weight (g) | Kernel length (mm) | Kernel breadth (mm) | Kernel L:B ratio | Hulling (%) | Milling (%) | Head rice recovery (%) |
|---|---|---|---|---|---|---|---|---|---|---|
| ANR 21 | 8.47 | 2.37 | 3.60 | 26.00 | 6.40 | 2.27 | 2.83 | 73.60 | 65.40 | 56.71 |
| ANR 37 | 8.40 | 2.33 | 3.61 | 25.10 | 6.10 | 2.23 | 2.73 | 75.40 | 67.30 | 57.13 |
| CARI 5 | 8.73 | 2.77 | 3.16 | 25.83 | 5.38 | 2.47 | 2.18 | 73.60 | 65.73 | 56.03 |
| Ranjeet | 6.76 | 3.05 | 2.22 | 23.17 | 5.10 | 2.43 | 2.10 | 74.80 | 66.37 | 47.00 |
| Savitri | 9.56 | 2.25 | 4.26 | 24.47 | 5.22 | 2.69 | 1.94 | 73.60 | 64.45 | 51.33 |
| Mean | 8.57 | 2.53 | 3.42 | 24.28 | 6.17 | 2.39 | 2.60 | 73.33 | 63.77 | 50.04 |
| C.D. | 0.40 | 0.19 | 0.32 | 0.50 | 0.38 | 0.23 | 0.27 | 1.92 | 1.78 | 2.16 |
| C.V. | 2.798 | 4.43 | 5.73 | 1.24 | 3.68 | 5.86 | 6.19 | 1.59 | 1.68 | 2.61 |

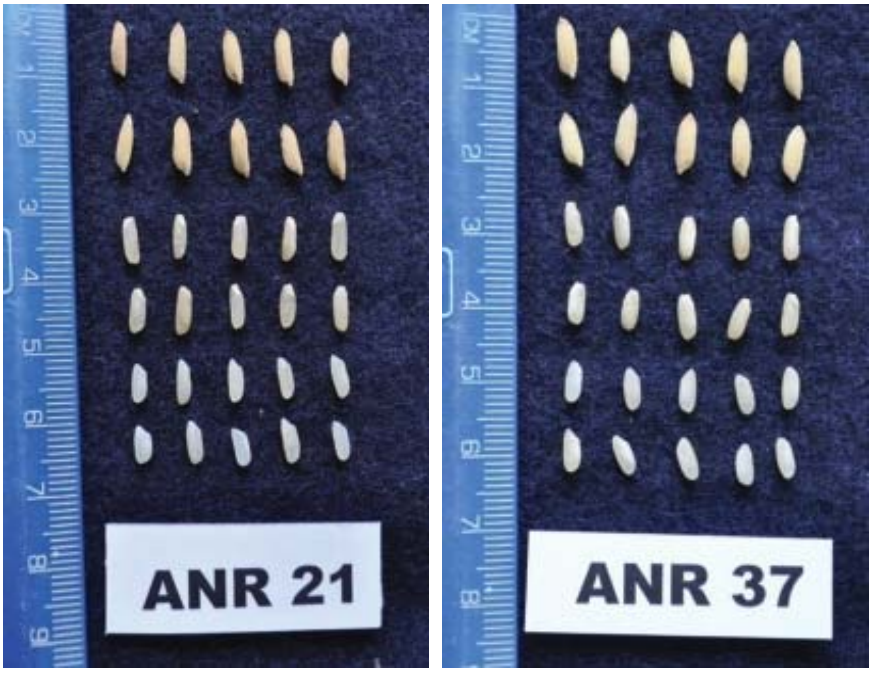



Plate 24: Grain type of ANR21 and ANR37

# ICAR Seed Project - Seed Production in Agricultural Crops

*P. K. Singh* and *A.K. Singh*

A total 8 kg of nucleus seed and 188.5 Kg of breeder seeds of 11 rice varieties was produced at CARI Farm, Port Blair. About 4033 Kg of Truthfully Labelled Seed (TLS) of 7 rice varieties has been produced under Farmers participatory mode in three villages in assocation with Out Reach Centre at Diglipur, during Kharif, 2012. About 2000 kg Truthfully Labelled Seed distributed to farmers/stakeholders. A three days farmers training on quality seed production and a field day was imparted at Diglipur, North and Middle Andaman.

Plate 25: Seed production at farmers' fields

# Genetic Improvement of Pulses for Andaman & Nicobar Islands Conditions

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

## Evaluation and characterization of local landraces and advanced lines of Mungbean, Urdbean and Pigeonpea

### Mungbean (PGET, PET and NVT)

Fifty four local germplasm along with six national checks of mungbean were evaluated in an augmented block design. Out of 54 local accessions, the accessions ANM-12-02 (32.93 g), ANM-11-12 (25.15 g) and ANM-11-15 (24.44 g) showed significant higher seed yield plant $^{-1}$ over the national check Pusa Vishal (19.22). However, genotypes ANM-11-05, ANM-12-01, ANM-11-08, ANM-11-44, ANM-11-14, ANM-11-06, ANM-11-04, ANM-11-11, ANM-11-22, ANM-11-19, ANM-11-16 and ANM-11-17-2 showed yield at par with the rest five checks Samrat, Meha, ML 1165, OBGG 66 and IPM-02-3. Twelve selected promising lines of mungbean from previous year germplasm were evaluated in a preliminary yield evaluation trial during Rabi 2012-13 along with 5 national checks. The genotypes ANM-12-02 (18.02 qha$^{-1}$), ANM-11-12 (17.69 qha$^{-1}$), ANM-11-12 (17.69 qha$^{-1}$), ANM-11-05 (15.69 qha$^{-1}$), ANM-11-08 (13.62 qha$^{-1}$), ANM-11-46 (13.14 qha$^{-1}$) and ANM-11-07-2 (12.16 qha$^{-1}$) showed significant higher estimated yield qha$^{-1}$ as against the standard checks Pusa Vishal (9.51 qha$^{-1}$). Further, varietal evaluation trial of 17 national entries along with two local checks of mungbean was conducted during the Rabi 2012-13 and found only one entry *i.e.* IPM 02-14 showing yield at par with the local check ANM-11-21 while all the entries showed significantly less yield as compared to ANM-12-02.

### Urdbean (PGET and PET)

A set of 46 exotic germplasm lines of mungbean were evaluated in an augmented block design for the evaluation and characterization of the superior germplasm line further breeding programme. Further,

the 12 selected promising lines of urdbean from previous year germplasm evaluation trial were carried out in preliminary yield evaluation trial during Rabi 2012-13 along with 04 national checks. The genotypes, ANU-11-19 (12.70 qha$^{-1}$), ANU-11-10 (12.06 qha$^{-1}$), ANU-11-29 (11.88 qha$^{-1}$), ANU-11-34 (10.43 qha$^{-1}$), ANU-11-11 (10.02 qha$^{-1}$) and ANU-11-22-1 (9.50 qha$^{-1}$) showed significant higher estimated yield qha$^{-1}$ as against the standard checks Uttara (7.74 qha$^{-1}$) and IPU 02-43 (6.21 qha$^{-1}$).

## Pigeonpea (Advanced germplasm evaluation trial)

An exploratory trial was conducted with a set of 9 locally collected pigeonpea germplasm lines collected from farmer's fields along with superior checks Bahar, Asha and Type-7. The entries ANP-12-02 followed by ANP-11-18 showed multiple resistance/ tolerance against insect-pest and diseases with significant better performance for plant growth parameters & pod formation. This trial was conducted to test the feasibility of the pigeon pea in these Islands.

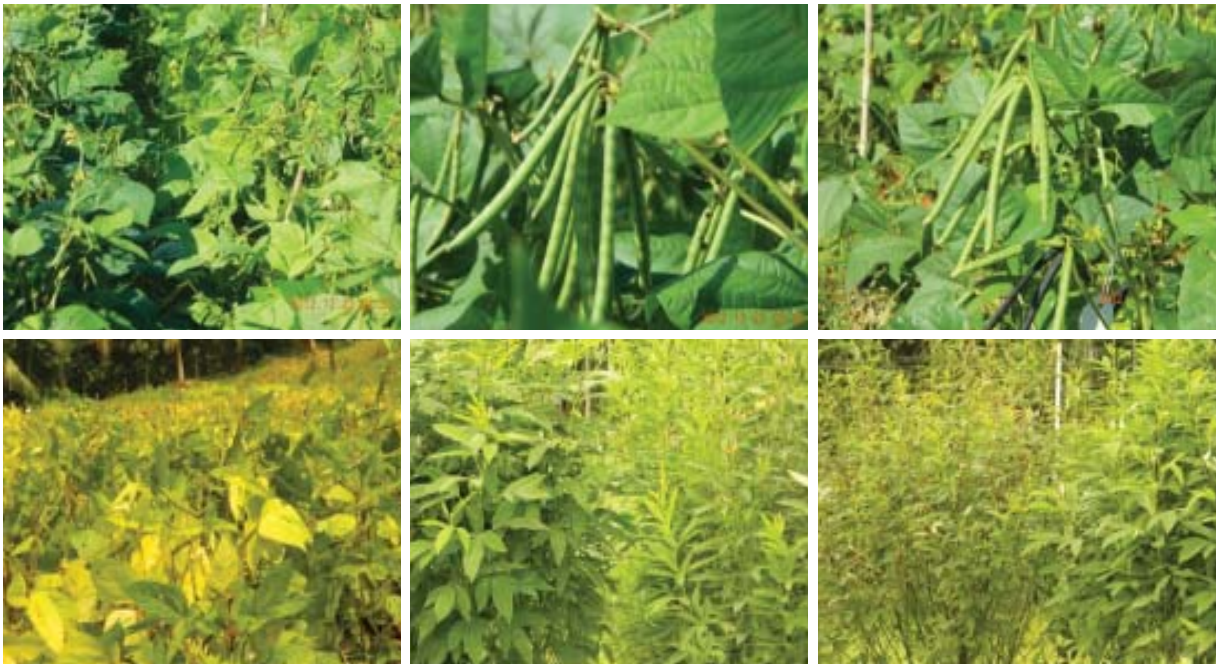


Plate 26:(a) Mungbean germplasm evaluation trial; (b) PYT mungbean during Rabi 2012-13 (ANM-12-02); (c) VET mungbean during Rabi 2012-13 (ANM-11-12); (d) PYT urdbean during Rabi 2012-13 (ANU-11-19); (e) Advanced germplasm evaluation trial of pigeonpea during 2012-13 ; (f) ANP-12-02 & Bahar (check) in advanced germplasm evaluation trial of pigeon pea

## All India Coordinated Research Project on MULLaRP (Rabi Mungbean & Urdbean trials)

An Initial Varietal Evaluation trial (IVT) under AICRP on MULLaRP trials for Rabi mungbean and urdbean was conducted during 2012-13. Nine entries of mungbean under initial varietal trial (IVT) were tested for Rabi mungbean. The entry RM-12-12 (9.24 qha$^{-1}$) was found most promising for yield and yield attributing traits. It is also resistant to Charcoal rot and Cercospora leaf spot diseases. An IVT & AVT trial of urdbean was also conducted during the period. A set of 12 entries under IVT and 5 entries under AVT were tested. The entry RU-12-6 followed by RU-12-10 and RU-12-21 showed the better performance in terms of yield and yield attributing traits. A trial of rice fallow summer trial of urdbean and mungbean with a set of 10 entries was also conducted.

# Molecular Tagging of Biotic Stress Resistance in Rice (*Oryza sativa*)

***Naresh Kumar, P.K. Singh, Krishna Kumar* and *Ajanta Birah***

## Germplasm evaluation and maintenance

A total of 113 genotypes of rice were evaluated for bacterial leaf blight resistance under field conditions during *Kharif* 2012. The genotypes were artificially inoculated by isolates of *Xanthomonas oryzae.* Out of 113 genotypes 3 genotypes *viz.* IET 8585, PR 116 and CSR 34 were found highly resistant (with score 1) while genotypes *viz.* IR 28, MLT 12, *Xa* 34, IRBB 4, IRBB 21, CSR 24, CSR 28, CSR 1, STBN 21 and BMZ 1were found to be moderately resistant (with score 3).


Plate 27: Scoring of symptom expression in artificial inoculation of BLB isolates

## Confirmatory screening of resistant lines

The confirmatory screening of selected lines of rice was done through artificial inoculation in order to identify genes conferring resistance against Bacterial Blight in rice under Islands conditions, donors lines for resistance transfer and tagged markers for foreground selection.The salient results are given in table 13.

From the confirmatory testing it is clear that no single gene can alone confer resistance against prevalent races of bacterial blight pathogen (*Xanthomonas oryzae* p.v. *oryzae*). However combination of *xa5* and *xa13* provides resistance. Therefore introgression of multiple resistance genes in to recurrent variety is the only solution for conferring long term resistance against bacterial blight. Fortunately the linked markers are available in public domain for the resistance genes which can be directly used for foreground selection while deploying marker assisted approach for transfer of genes in recurrent variety.

**Table 13. Confirmatory screening of differential lines of rice.**

| Sl. No. | Variety | Disease reaction | Xa gene | Tagged markers |
|---|---|---|---|---|
| 1 | IRBB13 | 7 | *xa13* | RG136, RM21, RM114, RM122, RM164, and RM190) |
| 2 | IRBB21 | 3 | *Xa21* | RAPD248,RG103,pTA248 |
| 3 | IRBB7 | 7 | *Xa7* | AFLP312-10, AFLP1415, and P3 |
| 4 | IRBB4 | 3 | *xa4* | RM 144 and RM 244 |
| 5 | IRBB5 | 7 | *xa5* | RG556, RZ390, RM13, RM122 and RM390 |
| 6 | IRBB8 | 5 | *xa8* | - |
| 7 | Xa 38 | 3 | *Xa 38* | - |
| 8 | IR28 | 3 | *Xa-a and Xa-h* | - |
| 9 | DV85 | 5 | *xa5, Xa7 and Xa 24* | Set of markers for *xa5, Xa7 and Xa 24* genes |
| 10 | PR116 | 1 | *xa5, xa13 and Xa21* | Set of markers for *xa5, Xa13 and Xa 21* genes |
| 11 | IET8585 | 1 | *xa5 and xa13* | Set of markers for *xa5, and Xa 13* genes |

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

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

## Disease reaction of selected plant progenies

Four plants *viz.* ANBF4-11-57, ANBF4-11-16, ANBF4-11-62 and ANBF4-11-04 were selected from previous seasons $F_3$ progeny plants having better resistance score. Their progenies at $F_4$ level were evaluated and disease reaction was noted up to seventh month of transplanting. The disease reaction as given in Plate 28, clearly indicated that these four lines carry effective resistance genes against bacterial wilt up to economic harvest period.

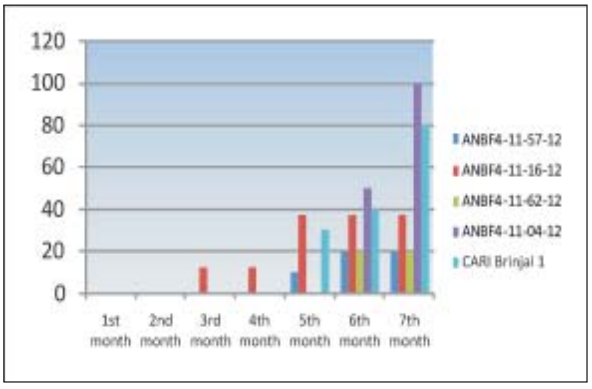



Plate 28. Disease reaction in select plant progenies (X-axis monthly time interval, Y axis % disease incidence, colour bars different progenies).

## Disease reaction in wild relatives of brinjal

The disease reaction was noted in selected wild relative's accessions to note the resistance against bacterial wilt and other diseases. It was noted that none of the wild relatives were susceptible to bacterial wilt. However, foliar blight affected *Solanum viarum* and *Solanum surratence* at 2nd fortnight and onwards (Plate 29.).

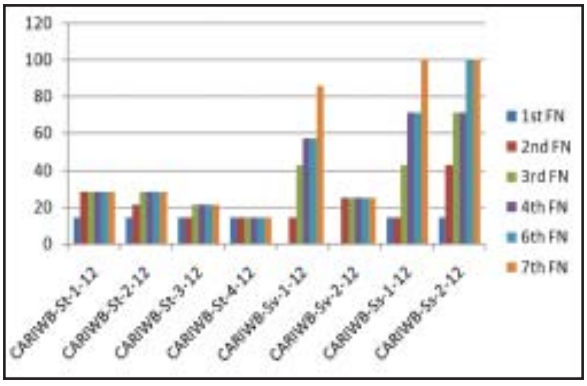



Plate 29. Disease reaction in wild relatives (on X-axis (*Solanum torvum* (CARIWB-St), *Solanum viarum* (CARIWB-Sv) and *Solanum surratzence* ( CARIWB-Ss)) accessions. and Y axis % disease incidence with different colour bars representing different fortnight intervals.

## Wide crosses (*Solanum melongena* X *S. torvum*):

Wide crosses were attempted between cultivated brinjal (*S. melongena*) and wild relatives *viz. S. vairum*, *S. surratence* and *S.torvum*. With repeated efforts, one success could be achieved in getting one putative wide cross hybrid fruit having very small size and few seed. The seeds were sown in pot out of which only single

Plate 30. Different stages of fruit development in a wide cross (S. *melongena* X S. *torvum*) F1 Plant

plant could be germinated. This plant is bearing fruits with some wild characters like spines in peduncle, smaller fruit size and lighter fruit colour which is an indicative of successful wide cross. The progenies from the fruit will be studied for reaction against diseases and pests in next season.

## Survey, Propagation and Molecular Characterization of Soft Endosperm (Macapuno) type Coconuts in Bay Islands

*K. Deva Kumar* and *R. K. Gautam*

### Collection of dahi nariyal nuts and embryo rescue for propagate into plantlets

Three dahi nariyal palms were identified out of which two were from Panighat and one from Chouldhari. All of these three palms belong to type I in which the viscous galactomnnan is present instead of the normal coconut water. A total of 140 dahi nariyal nuts (Plate 31) were collected from different copra units situated around Port Blair during 2012-13. The collected nuts were brought to the laboratory and embryos were excised according to standard procedures and inoculated in the Y3 media meant for coconut embryo culture. The embryos were inoculated in solid Y3 media without addition of any plant growth hormones. The embryos were sub cultured once in a month initially and when the sprout emerged, these were sub cultured once in 15 days. The fastest sprout emergence was observed in three months time. The germination percentage was 10- 20%. A three leaf stage plantlet ready for transfer to pot obtained (Plate 32).

Plate 31. A single largest collection of eight dahi nariyal coconuts from a copra unit at Burmanalla

Plate 32. Embryo rescue of dahi nariyal coconuts - A three leaf stage advanced dahi narial seedlings ready for transfer to pot

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

***Krishna Kumar* and *K. Sakthivel***

A survey was done for prevalence of bacterial wilt in solanaceous vegetable crops in South, Middle and North Andaman Islands. The survey results revealed that the maximum incidence of bacterial wilt was observed in chillies followed by tomato and brinjal. Twelve isolates of *Ralstonia solanacearum* were collected from four different solanaceous vegetable crops (Brinjal, chillies, tomato and capsicum) and pathogenicity was proved on susceptible tomato cv. Pusa Ruby. The results revealed that 10 isolates were grouped in highly virulent category whereas two isolates grouped in medium virulent category. The isolate collected from chillies of Chidiatapu village showed highest virulence (wilting within 3 days after challenge inoculation of pathogen). The studies on biovar identification through sugar utilization tests revealed prevalence of biovar 3 and 4 among solanaceous vegetable crops. The *in vitro* antagonistic ability of 80 PGPRs tested against highly virulent isolate (C3) found that only six PGPRs showed better antagonistic ability by both perpendicular streak method and paper disc method.

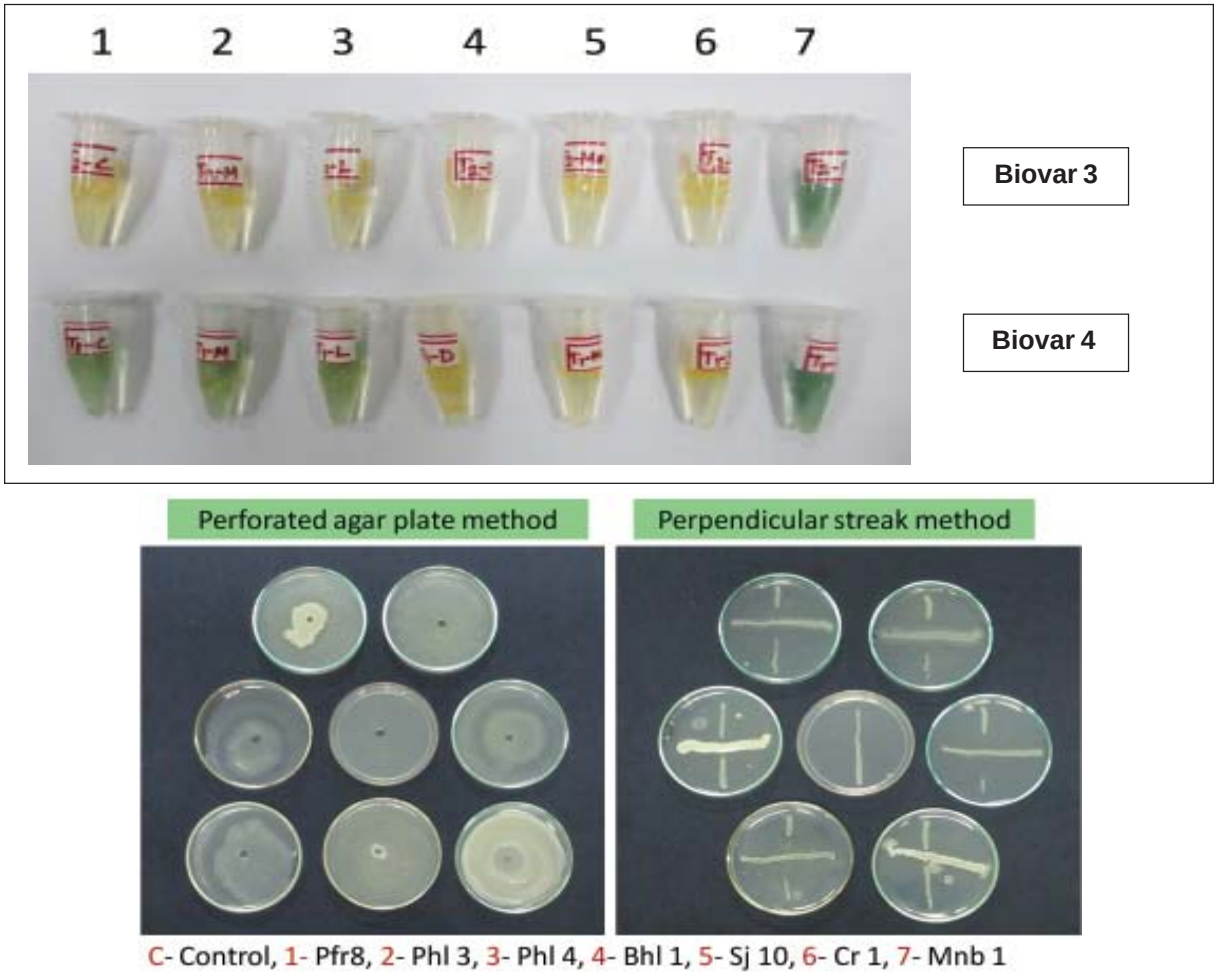



Plate 33: a) Biovar identification of *Ralstonia solanacearum*, b) Antagonistic activity of potential PGPR isolates against *Ralstonia solanacearum* using perforated agar plate method and perpendicular streak method

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

*Krishna Kumar*

## Screening of *Trichoderma* strains in different Nacl concentration

A total of 70 *Trichoderma* spp were screened in *vitro* in different saline condition from 1, 5 and 10g/ml. The results showed that 92.8% of the isolates were able to tolerate 5% NaCl conc. whereas 45.7% (32) isolates were able to tolerate 10% of NaCl concentration. The selected 32 halotolerant isolates were studied for plant growth promoting activity and antagonistic activity against *Macrophomina* sp., out of which 10 isolates were highly positive for P-solubilization, 12 produced siderophore and 9 isolates showed high IAA production. The TRC3 produced highest IAA 36.4 µg/ml followed by TRV1 (25 µg/ml), TGP1(21.3 µg/ml), THB4 (10.5 µg/ml) and THB3 (9.6 µg/ml) produced IAA in the presence of L-tryptophan. Dual culture test showed that 40.6 % of the isolates inhibited the mycelial growth of *Macrophomina* sp more than 60-69% over the control. THR3 showed statistically significant difference in the over growth rate between the different isolates on the *Macrophomina* spp. Based on PGP and antagonistic activity of the halotolerant *Trichoderma*, 9 isolates were selected randomly for their *in vitro* seed germination assay. In overall THB4 showed significant increase in both root and shoot growth of okra seedling i.e., stem length (88.8%), root length (37.5%) among all the treated isolates in 200mM NaCl concentrations.

Plate 34. *In vitro* seed germination assay in different saline (0mM, 50mM, 100mM, 150mM and 200mM) condition

## Growth promotion study of Rhizobacteria isolated from Rhizosphere soil of Little Andaman

Twelve promising rhizobacteria were selected based on antagonistic and PGP properties. Effects of seed bacterization were studied on growth enhancement of paddy seedlings grown under increasing salt stress (0g-6g/L) in water agar method in test tube for ten days.The strains BCP2, BHKn1, BRC3, PHL3 and PRR1 showed maximum stimulation of root, shoot and lateral root growth at 10$^{th}$day of observation. In pot study, BPC2 (*Bacillus cereus*), PHL3 and PRR1 (*Pseudomonas aeruginosa*) showed enhanced shoot, root growth and total fresh wet weight in salt susceptible paddy Cv. CARI Dhan-3 in saline soil (1.83dSm$^{-1}$) over control (Plate 35).


Plate 35. Growth enhancement of susceptible paddy seedling CARI DHAN 3 in saline soil

# Production of Disease free Elite Planting Materials for Improving the Productivity of Coconut in Bay Islands

*Krishna Kumar* and *Ajanta Birah*

Based on the criteria for the selection of elite planting material, 1601 nuts of 3 different Dwarf varieties i.e. Orange, Yellow and Green have been collected and sown at Garacharma Farm, CARI. Nursery has been successfully developed at Garacharma Farm for the distribution of seedling to the farmers. A total of 1601 nuts consisting of Orange Dwarf (473 nos.), Green Dwarf (212 nos.) and Yellow Dwarf (916 nos.) have been sold/distributed among the farmers of Andaman and Nicobar Islands.

# Monitoring of Pesticide Residue at National Level
## (Monitoring of Pesticide Residue in Vegetables in A&N Islands)

*Krishna Kumar*

The important vegetable samples (bottle gourd, bitter gourd, okra, brinjal, cowpea, cucumber, french bean, snake gourd, bean and green chili) were randomly collected from vendors at Bathubasti and Mohanpura vegetable markets of South Andaman district. A total of 229 different vegetable samples were collected and sent for analysis. Out of these, only 184 samples were analyzed for pesticide residue. Among the samples, 72 samples were detected with pesticide residue below MRL value and 23 samples were above MRL value. Out of which highest pesticide residue was recorded in cowpea (8) followed by green chilli (7), Okra (3), Cauliflower (3), bitter gourd (1) and ridge gourd (1). Triazophos was detected in green chilli in a very high level (10.39 mg/kg) as shown in Table 14.

**Table 14. Pesticide residue detected in vegetables *vis-a-vis* MRL**

| Crop/ Number of detected samples | Pesticide Detected above MRL (ppm) | Above Codex MRL mg/kg | Above PFA MRL mg/kg | Pesticide detected above MRL (mg/kg or ppm) |
|---|---|---|---|---|
| Green Chilly (07) | Triazophos | - | 0.2 | 10.39 |
| | Prophenophos | 1.0 | 0.05 | 0.74, 0.59, 0.032 |
| | Cypermethrin alpha | 0.2 | 0.1 | 0.20 |
| | Carbryl | 0.2 | - | 0.54 |
| | Methamidiphos | 0.1 | 0.1 (Cotton Seed) | 0.38 |
| Okra (03) | Acephate | 0.2 | - | 2.96 |
| | Monocrotophos | - | 0.2 | 0.35 |
| | Triazophos | | 0.2 | 0.37 |
| Cucumber (01) | Chlorpyriphos-ethyl | - | 0.2 | 0.27 |
| Bitter Gourd (01) | Acetampride | - | 0.1 (Cotton Seed) | 0.1 |
| Cauliflower (03) | Chlorpyriphos-ethyl | 0.05 | 0.01 | 1.87, 0.83 |
| | Cypermethrin | 0.2 | 0.1 (Chilly) | 0.17 |
| Cowpea (08) | Chlorpyriphos-ethyl | 0.2 | - | 0.242 |
| | Quinolphos | - | 0.2 | 0.22 |
| | Dimethoate | 0.5 | 2.0 | 2.72, 0.71 |
| | Methomyl | - | 0.1 (Cotton seed) | 0.29 |
| | Cypermethrin alpha | 0.2 | 0.2 (Brinjal) | 0.23 |
| | Monocrotophos | | 0.2 | 0.88, 0.84 |

# Development of Eco-friendly IPM Modules for Okra and Cucurbits in Andaman

***Ajanta Birah, Shrawan Singh, Subhash Chand, Krishna Kumar* and *Jai Sunder***

An IPM module was developed for the successful management of okra pest complex. The IPM module comprising of seed treatment with imidacloprid @ 3-5 g/kg of seed a day before sowing, sowing of maize at the borders as barrier crop for conservation of natural enemies, weekly clipping of infested shoot & fruit, erection of pheromone trap @ 30 traps/ha for mass trapping of fruit & shoot borer, foliar spray of neem seed kernel extract @ 30 ml/lt, spinosad 45SC or imidacloprid 17.8SL @0.3ml/lt and aqueous leaf extracts of *Morinda citrifolia* @ 100g/l at 15 days interval was found most effective in reducing fruit damage. In IPM module, less incidence of shoot and fruit borer (5.64%) and more fruit yield (10.55t/ha) was recorded as compared to untreated control (16.85% incidence and fruit yield 5.90t/ha).

An IPM module was developed for the successful management of cucurbit fruit fly. The IPM module comprising of installation of cue-lure baited traps @ 50 traps/ha for mass trapping, weekly clipping of infested fruits, foliar spray of aqueous leaf extracts of *Morinda citrifolia* @ 100g/l and foliar spray of spinosad 45SC or imidacloprid 17.8SL @ 0.3ml/l alternately at 15 days interval was found effective with respect to less fruit damage due to fruit fly (9%) and maximum fruit yield (10.75 t/ha) in bitter gourd as compared to untreated control (39.3% fruit damage and fruit yield 5.53 t/ha). The same trend was also noticed in ridge gourd also. The adoption of IPM technology for okra fruit & shoot borer resulted in higher cost benefit ratio of 1:2.73 in IPM and 1:2.26 in non-IPM fields (Chemical control or Farmer's practice). IPM module for cucurbit fruit fly gave higher cost benefit ratio of 1:3.35 in IPM and 1:2.30 in non-IPM fields of bitter gourd and 1:1.99 in IPM and 1:1.23 in non-IPM fields of ridge gourd, respectively. Data of On Farm Trial revealed that the adoption of IPM technology in okra resulted in reduction of number of pesticide sprays to only 2 from 5-6 in farmer's fields. Economic analysis revealed a much higher yield of 8.1- 9.6t/ha in IPM than 5.5 to 6.5t/ha in non-IPM fields. Though the cost of production was slightly higher in IPM fields, but on account of higher yields in IPM fields' higher income was obtained. Less pesticide sprays also resulted into a build- up of large numbers of natural enemies especially predatory spiders in IPM fields.

Plate 36. Field view of evaluation of pest management modules against fruit fly in bitter gourd and ridge gourd.

# All India Network Project on Rodent Control

*Ajanta Birah* and *K. Sakthivel*

The rodents damage rice crop at flowering and maturity stages. The rodent infestation surveys in paddy fields were conducted in 15 villages of South Andaman and 3 villages of North Andaman. The rodent infestations ranged from 3.66 to 22.50% percent indicating the intensity of their problem. The maximum rodent infestation was observed in Chouldhari and minimum in Colinpur village. Few specimens were also collected from the rice fields of South and North Andaman. The specimens were identified as *Bandicota bengalensis* by ZSI, Kolkata.

Field experiments were carried out in farmers' fields of South Andaman and North & Middle Andaman to control the rodent damage in rice crops. The data revealed that baiting with zinc phosphide was effective in controlling of rodents in paddy field. The rodent damage was drastically decreased after the poison baiting in all the villages. In North Andaman, the work was carried out in association with Out Reach Centre Diglipur, wherein the rodent population was brought down from 16 to 3 live burrows in Keralapuram village, whereas in Subash Gram I and II village, live burrows were brought down from 35 to 4 and 27 to 5 respectively (Table 15). In Chouldhari live burrows were brought down from 31 to 2. Rodent control success was obtained about 81% in Keralapuram, 93.54 % in Chouldhari, 88.57% in Subash Gram I and 81.48 % in Subash Gram II. In Chouldhari village, about 16 dead rats were seen after zinc phosphide treatment in the paddy fields whereas in Kerala Puram, Subash Gram I & II, dead rats were 8, 11, and 9 respectively. Most of the collected specimens were *Bandicota bengalensis* (Table 15).

**Table 15. Rodent control success in paddy**

| Particulars | Name of the Villages | | | |
|---|---|---|---|---|
| | Subash Gram I | Subash Gram II | Keralapuram | Chouldhari |
| Treated area (ha) with Zinc phosphide (2%) | 2 | 1.5 | 0.8 | 1.5 |
| No of live burrows/ha before treatment | 35 | 27 | 16 | 31 |
| No of live burrows/ha after treatment | 4 | 5 | 3 | 2 |
| Percent Rodent Control Success | 88.57 | 81.48 | 81.25 | 93.54 |

Plate 37. Farmer showing rodent damage in paddy field and management activity.

# पशु विज्ञान प्रभाग

# Division of Animal Science

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

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

The project was initiated under the rationale of rescuing the extinct status of indigenous Nicobari fowl, collecting data on population status of Nicobari fowl / other evolved native poultry germplasm after Tsunami, rejuvenation and purification of native poultry germplasm under in-situ conservation and establishment of renewed core unit for indigenous Nicobari fowl.

## Field survey

Two hundred fifty two respondents from various villages of Car Nicobar and Little Andaman were surveyed for realization of population status of Nicobari fowl. It revealed that 2.98% households in Car Nicobar were having Nicobari fowl with an average holding of 1.33. Population status in Little Andaman was found to be nil. At present, the

Plate 38 : Nicobari fowl found at Car Nicobar

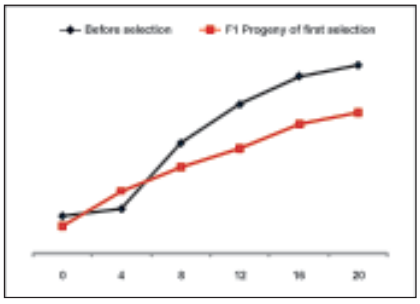
estimated population of Nicobari fowl in Car Nicobar was found to be 158 numbers.

## Work at farm

Selection of Nicobari fowl (white and black strains) for short shank length was carried out based on segregation at sexual maturity from base population of 200 each strain. F1 progeny from the selected population was propagated to 1000 numbers. Production performance of F1 progeny was evaluated (Table 16).

**Table 16: Response of selection on shank length**

| Age (wk) | Shank length (mm) | | | |
|---|---|---|---|---|
| | Black strain | | White strain | |
| | Before selection | F1 Progeny | Before selection | F1 Progeny |
| 0 | 7.39±0.24 | 5.22±0.14 | 7.82±0.25 | 4.14±0.08 |
| 4 | 8.8±0.98 | 12.26±0.57 | 11.46±0.38 | 8.23±0.58 |
| 8 | 21.81±1.43 | 17.11±14.5 | 18.01±1.13 | 12.11±11.1 |
| 12 | 29.47±1.76 | 20.71±10.7 | 25.39±1.27 | 18.91±17.0 |
| 16 | 35.07±2.58 | 25.56±25.8 | 33.69±2.08 | 25.11±20.8 |
| 20 | 37.25±3.75 | 27.93±1.48 | 34.77±3.43 | 26.01±18.4 |




Response of selection on shank length

## Response of selection on growing performance

The response of selection on growing performance was minimal in both strains where as white strain was on better half in response to selection for shank length and its subsequent influence on body weight gain (Table 17).

## Response of selection on laying performance

Shank length (mm) in the F1 progeny of Nicobari fowl was found to be low due to selection for short shank length based on segregation at age of sexual maturity. Selection for shank length had no influence on body weight during growing phase and laying performance of F1 progeny (Table 18).

**Table 17 : Response of selection on growing performance**

| Age (wk) | Black strain | | White strain | |
|---|---|---|---|---|
| | Before selection | F1 Progeny | Before selection | F1 Progeny |
| 0 | 30.13±0.67 | 31.65±0.72 | 31.4±0.81 | 30.77±0.81 |
| 4 | 188.6±8.09 | 175.9±14.4 | 164.5±10.9 | 170.9±15.7 |
| 8 | 492.7±41.0 | 510.6±31.0 | 313.2±13.1 | 353.1±33.1 |
| 12 | 792.6±36.2 | 822.6±46.2 | 623.7±35.3 | 653.8±45.3 |
| 16 | 980.3±45.0 | 996.3±65.0 | 854.3±66.6 | 894.5±76.6 |
| 20 | 1101±50.5 | 1198±56.98 | 997.6±70.5 | 1097±79.5 |

**Growing phase (Body weight (g) )**

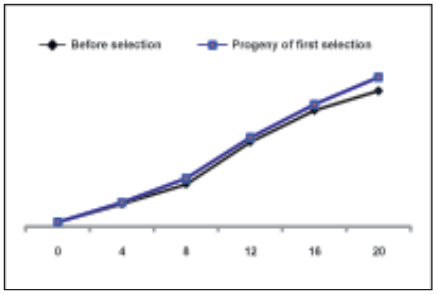



**Table 18: Response of selection on laying performance**

| Parameters | Black strain | | White strain | |
|---|---|---|---|---|
| | Before selection | F1 Progeny | Before selection | F1 Progeny |
| Age at sexual maturity (days) | 170 | 169 | 169 | 168 |
| Weight at sexual maturity | 1197 ± 36.2 | 1215 ± 46.6 | 1117 ± 36.2 | 1195 ± 60.5 |
| HDEP % (in 98 days ) | 38 | 42 | 39 | 43 |
| Hatchability % | 40 | 40 | 41 | 42 |
| Egg weight | 42.2 ± 6.78 | 42.8 ± 9.24 | 40.7 ± 7.11 | 41.2 ± 2.43 |
| Egg mass (g/bird/day) | 16.036 | 17.976 | 15.873 | 17.716 |
| Feed consumption | 100.5 | 105.5 | 100.8 | 101.9 |
| Feed efficiency per g egg mass | 6.27 | 5.87 | 6.35 | 5.75 |

## Dietary Supplementation of Micronutrient to Improve the Productivity of Livestock

*M.S. Kundu, S. Jeyakumar, Jai Sunder, A. Kundu* and *A.K. De*

The experiment was conducted on 18 Teressa Goat divided into three groups of 6 does (Female goat) each. Group 1 was kept as a control and was fed the basal diet consisting of roughage and concentrate mixture. Group 2 (ZnO 50 ppm) was fed the basal diet supplemented with 50 ppm zinc oxide. Group 3 (ZnO 100 ppm) received the same basal diet supplemented with 100 ppm zinc oxide. Fertility traits of does and weight of kids were recorded. Data indicated that the supplementation of different levels of inorganic zinc oxide significantly increased the incidence of oestrus, pregnancy, kidding rates and resulted in shorter onset of oestrus as compared to the control group. A similar trend was observed in the mean body weight and daily gain of kids born to supplemented does. In conclusion, the supplementation of 50 to 100 ppm zinc oxide to the basal diet of Teressa goat significantly improved the reproductive performance by decreasing the numbers of days to oestrus, increasing the incidence of oestrus, pregnancy, lambing rates and enhancing the body weight gain of their Kids.

In the second experiment 12 sows were divided to two groups of 6 sows each. Group 1 was kept as control and was fed the basal diet consisting of concentrate mixture. Group 2 was fed the basal diet supplemented with 5 g of CARIMIN. Fertility traits of sows and weight of piglets were recorded. It was found that the supplemented group receiving CARIMIN significantly increased the incidence of oestrous (9.66%) pregnancy rate (16.67%), farrowing rate (16.67%), and number of piglets per litter as compared to the control group. A similar trend was observed in the mean daily body weight gain of piglets born to supplemented sows. In conclusion, the supplementation of CARIMIN to the basal diet of sows significantly improved the reproductive performance by increasing the incidence of oestrus, pregnancy, farrowing rates and enhancing the body weight gain of their piglets.

## Development of Enriched Chicken Egg and Meat

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

The concept of enrichment is a technology to exploit products beyond their traditional food value i.e., enrichment of either egg or meat retaining their nutritional, functional and sensory qualities. Recent trend in the area of enriching poultry products is the enrichment with immune enhancing active principles, natural antioxidants and trace minerals through feed additives. This project was taken up to enrich/fortify the poultry produce using kalmegh, marigold and iron mineral as feed additive for further enhancement of demand for backyard poultry egg and meat and to improve the nutritional security and economic status of island rural poultry farmers.

Two experiments were conducted in an attempt to enrich carotenoid pigment and iron in egg yolk using marigold petals and iron in the form of iron soy proteinate as resources.

### Trial I: Enrichment of carotenoid pigments

Marigold petals were collected, shadow dried and subjected to proximate analysis in which dry matter: 15%, crude protein: 11.5%, crude fat: 8.25% and ash: 6.45% was found. The analysis also revealed that it can be a high resource feed additive for protein and energy apart from being an excellent source of carotenoid pigments.

Plate 39 : Shadow drying of marigold

A trial was conducted with supplementation of marigold dry powder at various inclusion levels viz., 0%, 1%, 2%, and 3% in commercial layer feed of Black Nicobari fowl at the age of 38 weeks for a period of 180 days. Each group was replicated into three with 12 birds (10 female + 2 male) in each replicate. Results indicated that marigold supplementation at any level did not affect the palatability of feed, egg production performance, egg weight, egg mass, egg qualities and feed efficiency for egg mass. Further, 3% marigold inclusion level recorded 8% higher HEDP, 15% egg weight, egg mass and 8% yolk percentage, though this improvement was not statistically significant (Table 19).

**Table 19: Effect of marigold feeding on production performance**

| Parameters | Control | 1% Marigold | 2% Marigold | 3% Marigold |
|---|---|---|---|---|
| HDEP% | 48.00± 23.18 | 48.53±34.16 | 49.53±26.13 | 51.84±31.18 |
| Total no of eggs per bird ( 180 d) | 86 | 87 | 89 | 93 |
| Egg weight (g) | 43.94±0.66 | 46.80±0.52 | 48.25± 0.44 | 50.34± 0.62 |
| Egg mass (g/hen/day) | 21.09±1.66 | 22.73±2.13 | 23.89±1.91 | 26.09±2.13 |
| Yolk percentage | 32.14 | 32.66 | 33.60 | 34.97 |
| Feed intake (g/bird/day) | 91.84±3.12 | 89.56±9.18 | 89.46±2.43 | 88.93±5.34 |
| Feed efficiency per doz eggs | 2.30±6.30 | 2.22±5.10 | 2.17±7.27 | 2.06±7.43 |
| Feed efficiency /egg mass | 4.34±4.87 | 3.94±2.39 | 3.74±6.69 | 3.40±9.11 |
| Livability % | 100 | 100 | 100 | 100 |

## Roche yolk colour score - enrichment of carotenoid pigments

The yolk colour scoring was done using Roche yolk colour fan. Supplementation of Marigold improved the yolk color score from 4 to 8. Intensity of yolk color is the best indicator of enrichment of carotenoid pigment in yolk. Improved egg yolk colour is positively correlated with enrichment of caroteinoid pigments.

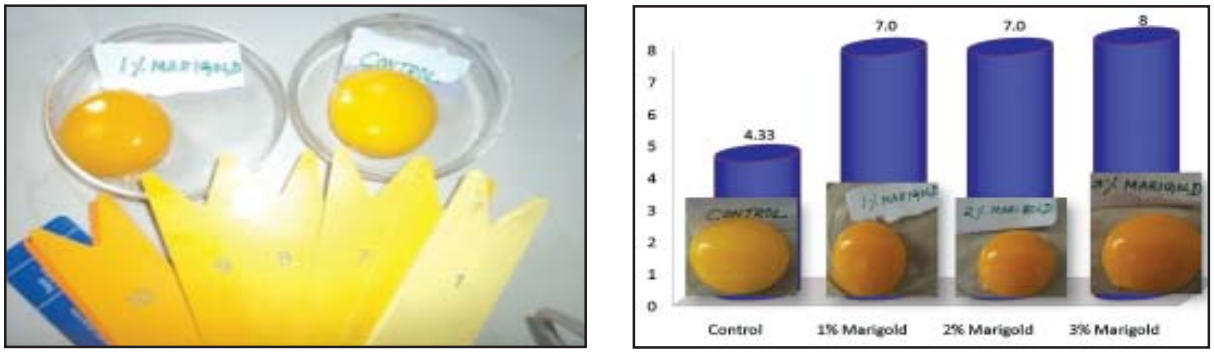
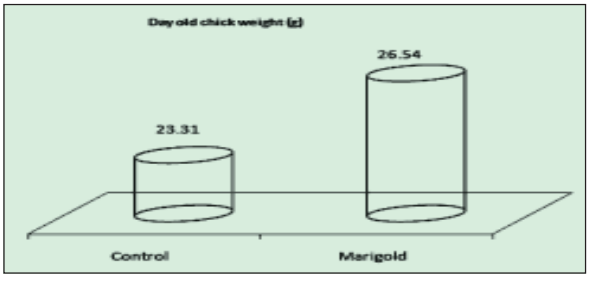



Plate 40: Enrichment of carotenoids - yolk colour

## Improved reproductive performance by carotenoid enrichment

At backyard level, lower hatchability is the major constraint among many problems that rural poultry production faces. Rapid oxidation of egg yolk contents before incubation may be one of many reasons for this hatchability problem at backyard level. Hence, the effect of potential antioxidant property of carotenoid pigments enriched in the egg yolk on hatchability was studied. 40 eggs per treatment were collected and hatched out. Hatchability was found to be 10% higher with marigold supplementation groups. Higher chick weight obtained was highly correlated with higher yolk percentage recorded with marigold supplementation.




## Economics of marigold feeding

Egg production cost increases max. by Rs.2.70 per egg with marigold supplement; spontaneously farm rate of enriched country egg itself will be higher; still from quality point of view, the rate is affordable and the consumers are always ready to pay for premium quality. Nutritional security of rural farming community will be enriched through rural poultry enriched egg (Table 20).

**Table 20: Economics of marigold feeding**

| Trial period: 6 months | 1% Marigold | 2% Marigold | 3% Marigold |
|---|---|---|---|
| Dry marigold consumed (g) | 180 | 360 | 540 |
| Fresh marigold needed (kg) | 1.2 | 2.4 | 3.6 |
| Marigold cost (Rs.) | 132 | 264 | 396 |
| Extra eggs obtained per bird (no.) | 1 | 3 | 7 |
| Extra cost from eggs (Rs.) | 10 | 30 | 70 |
| Extra chicks obtained (nos.) | 2.5 | 4 | 5 |
| Extra cost from chicks (Rs.) | 37.5 | 60 | 75 |
| Total extra cost spent on bird due to marigold feeding (Rs.) | 84.5 | 174 | 251 |
| Over head cost per egg (Rs.) | 0.97 | 1.96 | 2.7 |
| Farm rate of enriched desi eggs (Rs.) | 10.97 | 12 | 12.7 |

## Trial II: Iron enrichment

This trial was conducted with an aim of addressing ever increasing anemic problem through fortifying iron content in chicken egg and meat. Iron supplemented in the form of Fe-soya proteinate at various levels viz., 0, 200, 400 and 600 ppm in the commercial feed of Nicobari fowl at the age of 35 weeks. Trial was lasting for a period of 180 days to study the long term effect of iron supplementation on production performance. Results revealed that 200 ppm levels improved hen day egg production (10%), egg weight (5%) and egg mass (10%), feed efficiency; though significant influence was not found by iron supplementation on the mentioned production parameters (Table 21).

**Table 21: Production performance influenced by iron feed supplement**

| Parameters | Control | 200 ppm | 400 ppm | 600 ppm |
|---|---|---|---|---|
| HDEP% | 36.08 ± 1.96 | 40.00 ± 2.3 | 37.50 ± 3.2 | 36.90 ± 1.8 |
| Egg weight(g) | 49.50 ± 1.03 | 53.67 ± 1.35 | 51.93 ± 1.45 | 51.80 ± 1.02 |
| Egg mass (g/layer/day) | 18.58 ± 1.20 | 21.46 ± 1.3 | 19.51 ± 1.5 | 19.11 ± 1.2 |
| FI (g/bird/day) | 95.25 ± 1.71 | 94.97 ± 2.86 | 95.50 ± 2.34 | 99.54 ± 0.28 |
| FE/g E.mass | 8.21 ± 0.78 | 5.34 ± 0.57 | 6.02 ± 0.86 | 6.88 ± 0.71 |

## Iron Enrichment in egg yolk

Iron supplementation improved the iron content of egg yolk by 16 percent as compared to control group. Fortification of iron reached the plateau 15 days of supplementation. Inclusion of iron beyond 200 ppm is not effective for enrichment.

| *Treatments* | *Iron (µg/g yolk)* |
|---|---|
| ***Control*** | $39.55^{b} \pm 1.96$ |
| ***200 ppm*** | $64.11^{a} \pm 1.11$ |
| ***400 ppm*** | $63.31^{a} \pm 0.83$ |
| ***600 ppm*** | $62.35^{a} \pm 0.71$ |

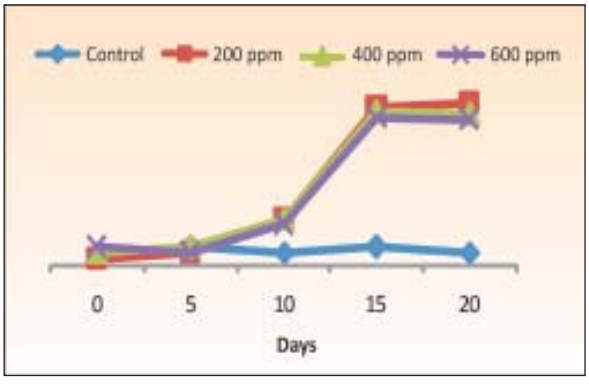



Plate 41: Iron deposition rate

### Iron enrichment influences hatchability

I200 ppm of iron supplementation significantly improved hatchability by 24% as compared to control. Nutrient density in a pack of yolk determines the development of embryo and chick quality. Improved blood circulation during incubation due to iron fortification might have enhanced the hatchability.

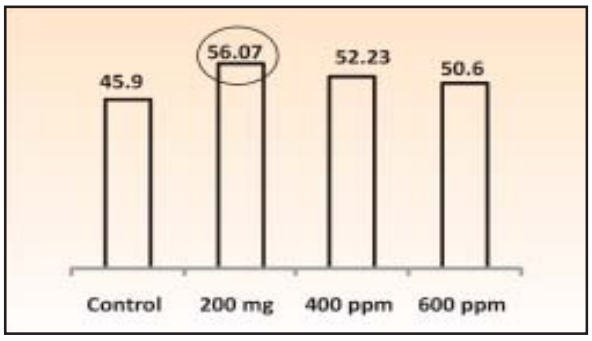



Plate 42: Hatchability% - iron enrichment

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

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

### Feeding of *Lactobacillus* and *Morinda citrifolia* fruit juice (noni) in broiler

Effect of feeding of *Lactobacillus acidophilus* (LAB) in combination with *Morinda citrifolia* fruit juice was evaluated in broilers. A total of 100 day old commercial broiler chicks were randomly divided into four groups with two replicates of 12 birds each. The birds were kept under deep litter system of rearing and provided with standard chick, grower and finisher ration and water *ad-lib*. No medication, deworming was given throughout the experiment. The dose of Morinda juice and Lactobacillus was given to each group of birds as mentioned below. The observations viz. body weight, weight gain, mortality, FCR, immune response, gut microbial load, carcass quality were recorded and economics was calculated.

Plate 43: Experimental birds

Plate 44: Morinda fruit juice

| Group A Morinda ( Noni) | Group B (LAB) | Group C (Noni+LAB) | Group D (Control) |
|---|---|---|---|
| 5ml juice/bird/ day in water | 5ml LAB/bird/ day in water | 2.5 ml Noni + 2.5 ml LAB/bird/ day in water | water only |

## Growth performance

Weekly and cumulative feed intake of Noni, LAB and Noni + LAB group was lower than the control group. Control group (2790.9 g) consumed more feed compared to other groups. LAB group consumed less feed (2237.2 g) followed by Noni and Noni + LAB group. The cumulative body weight and weekly body weight gain was found better in Noni as compared to control group. Higher body weight of 1434.5 g with best feed efficiency of 1.7 for body weight gain was recorded in Noni fed group than control group with body weight of 1412.5 g with lower feed efficiency of 2.1 though the difference was not significant. The result indicated that supplementation of Noni juice showed better feed efficiency (Fig. 12).

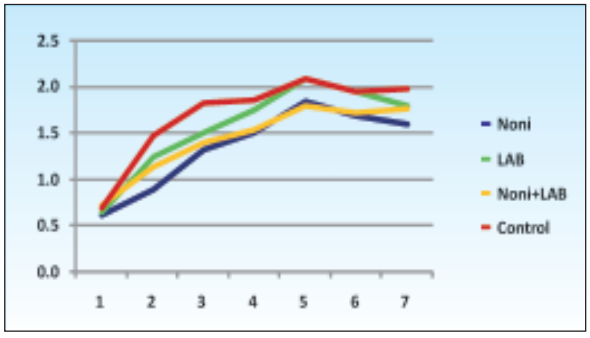



Fig 12: Feed efficiency at weekly interval

## Influence on immune status

The results of the humoral immune response revealed that the HA titer values in Noni + LAB group (0.73) was found to be significantly higher than control group (0.36) at 1 week post inoculation (PI) where as the HA titer in the Noni and LAB group was 0.53. The antibody titer reached its peak at 2nd week PI in Noni + LAB and Noni group (Fig. 13).

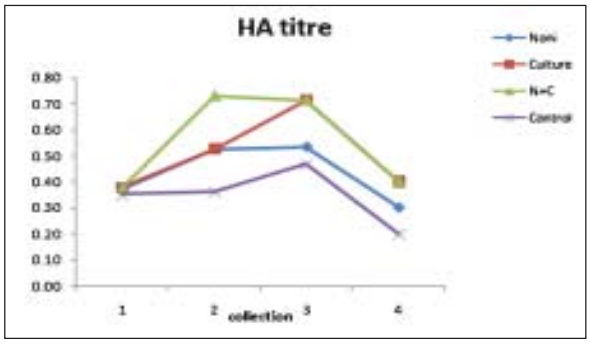



Fig 13: Haemagglutination antibody titre response in birds

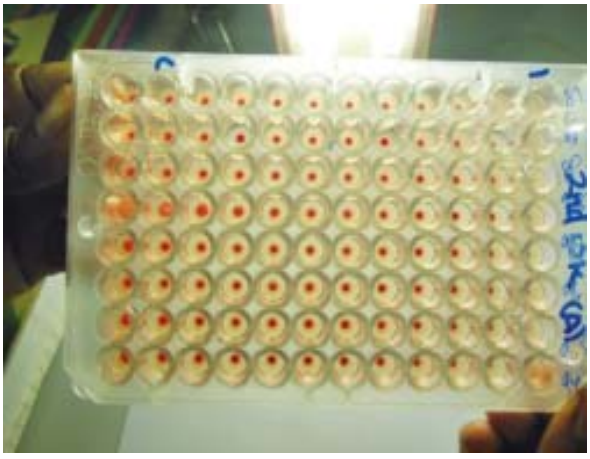


Plate 45: U bottom plate showing button formation and mat formation (HA Test)

## Effect on gut microbial load

Gut microbial load was low in Noni + LAB group compared to other groups. Control group showed higher microbial load than other group (Table 22).

**Table 22: Gut microbial load (cfu/ml)**

| | Noni | LAB | Noni + LAB | Control |
|---|---|---|---|---|
| *Enterobacter sp.* | $12.5 \times 10^6$ | $7.75 \times 10^6$ | $5.25 \times 10^6$ | $15.43 \times 10^6$ |
| *E.coli* | $14.5 \times 10^6$ | $13 \times 10^6$ | $5 \times 10^6$ | $16 \times 10^6$ |
| *Salmonella sp.* | $5 \times 10^6$ | $2.5 \times 10^6$ | $4.5 \times 10^6$ | $16.67 \times 10^6$ |

## Gut pH

No significant changes observed in pH of crop, intestine and proventriculus in any of the groups but the pH of Noni+LAB was found lower at 5th week followed by Noni, LAB and control group respectively.

## Carcass traits

A total of six birds each from different groups were slaughtered at 8th week of age. The birds were bled, plucked and weighed to determine blood and feather losses, carcasses were then eviscerated and weight of

dressed carcass were precisely recorded. No significant difference was observed in the dressing percentage in different groups of birds; however, all the treatment groups showed higher dressing percentage (62.5 %) compared to control group. The breast meat yield was higher in Noni group than all other groups.

## Economics

The lowest production cost per bird and feed cost efficiency for 1 kg body weight gain and the highest benefit feed cost efficiency for kg body weight gain was obtained in Noni fed group. The study revealed that supplementation of Noni juice supported the bird to convert feed efficiently so that 20 percent of feed cost incurred to produce 1 kg of meat could be saved (Table 23).

**Table 23: Cost efficiency for growth**

| Economic details | Noni | LAB | Noni+LAB | Control |
|---|---|---|---|---|
| Chick cost (Rs) | 25 | 25 | 25 | 25 |
| Total feed consumed till market age (kg) | 2.23 | 2.24 | 2.26 | 2.80 |
| Feed cost (Rs.) @ Rs. 25/kg | 55.75 | 56.00 | 56.50 | 70.00 |
| Production cost per broiler (Rs.) | 80.75 | 81.00 | 81.50 | 95.00 |
| Body weight (g) | 1434 | 1250 | 1283 | 1412 |
| Cost efficiency (Rs.) for 1 kg body weight gain | 56.31 | 64.80 | 63.52 | 67.28 |
| Feed cost efficiency (Rs.) for 1 kg body weight gain | 38.88 | 44.80 | 44.04 | 49.58 |
| Benefit feed cost efficiency (Rs.) for 1 kg body weight gain over control | 10.70 | 4.78 | 5.54 | |

## Development of herbal ointment for wound healing

Herbal ointments were prepared by using *Vitex trifolia* and *E. odoraturm* plants and were evaluated for its efficacy in wound in cow. The developed ointment was evaluated for acute and chronic wound healing. It was applied on a chronic hump sore of a cow and continuous observations were made on measurements of length and width of wound. Wound was completely healed in 14 days. The ointment was evaluated for healing of fresh cut wound with bleeding on a cow. It was applied after cleaning the blood with water. Wound started healing in a week unlike chronic wound, which took two weeks for healing.

Plate 46: Wound healing ointment

0 day | 3rd day | 7th day

Plate 47: Different stages of wound healing

## Sero-Surveillance and Monitoring of FMD in Andaman and Nicobar Islands

*Jai Sunder* and *Arun Kumar De*

Under the programme of sero-surveillance of Foot and Mouth Disease (FMD) and monitoring of sero-titre of the vaccinated animals in the A & N Islands, a total of 283 paired sera samples of cattle were collected from different places of South Andaman. The sero monitoring of post vaccinal antibody titer with LPB-ELISA revealed the protective titre of 27.5% (Type O), 18.3 % (Type A) and 15.5 % (Type A-1) respectively. Random Sero surveillance (LPB ELISA) against FMD Virus Types "O", "A "and "Asia-1" was done for 224 cattle and buffalo sera samples from different places of Andaman. The result revealed that the protective antibody titre with type O was found to be very less ( 10.5%) in the South Andaman. 896 random sera samples from cattle and buffalo of different places of A & N Islands were collected for screening for the prevalence of FMD by DIVA-ELISA test. The result revealed that 7.47% animal showed the presence of 3 rAB3 in the serum. Sensitization and awareness programmes on FMD were conducted for farmers and field veterinarians and leaflets, booklets and posters were also prepared and distributed to farmers to create awareness about the FMD in the islands.

Plate 48: FMD sensitization programme

## Isolation Identification and Characterization of Marine Actinomycetes

*Sumitha Gopalakrishnan* and *Jai Sunder*

Sediment from seabeds and water samples were collected from the different station in Andaman coasts at 0m, 5m and 10m depths. A total of 643 isolates belongs to genera *Streptomyces* sp., *Nocardia* sp., *Micromonospora* sp. were isolated. Marine actinobacterial load from the sediment samples were recorded and prepared a data base for further reference. The isolates were observed for their aerial mycelium, spore chain morphology (Rectiflexibles, Spirals, Verticillate), Spore mass colour (Red, Grey, Mycelium pigment red orange, Diffusible pigment produced, Diffusible pigment yellow brown), Melanin production; Enzyme activity (Nitrate reduction, Urease, $H_2S$ production, oxidase, catalase, sugar utilization, Voges Proskeur, Citrate, Indole, ONPG; Staining and growth with NaCl and temperature tolerance at 80°C. Thin Layer Chromatography (TLC) was also studied to determine the type of amino acid present in the cell wall.

The present study could record a number of Actinomycete genera along the coast of Andaman. The genera include *Streptomyces* spp., *Nocardia* spp., *Actinomadura* spp., *Streptosporangium* spp., *Actinoplanes*

spp., *Bifidobacterium* spp. and *Micromonospora* spp. It could be seen from the analysis of the species composition that *Streptomyces* sp. dominated in the study area and other genera were insignificant (Fig. 14, 15, 16 & 17).

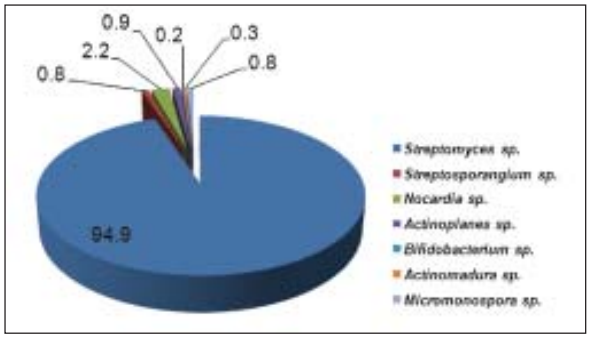



Fig 14. Distribution of actinomycetes

Based on the biochemical studies the isolates were characterized and grouped showing similarity index.

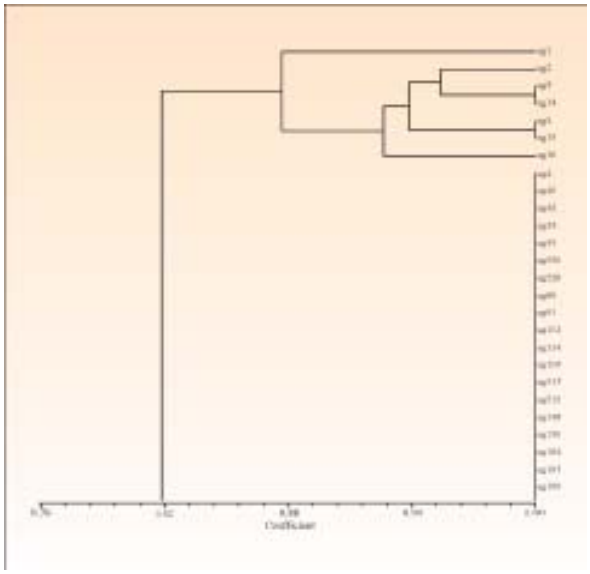


Fig 15: Dendrogram showing similarity between *Streptomyces* Sp.

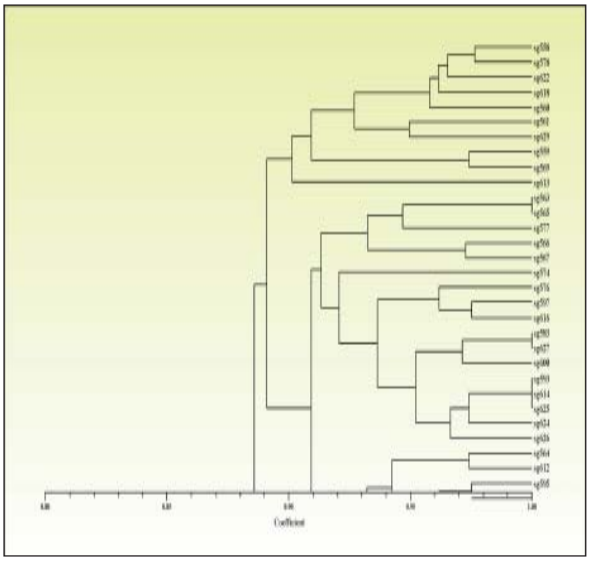


Fig 16: Dendrogram showing similarity between *Streptoverticillia* Sp.

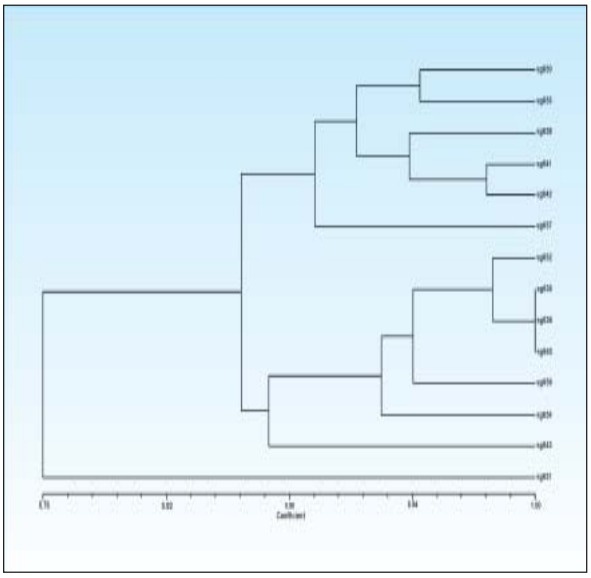


Fig 17: Dendrogram showing similarity between *Nocardia* Sp.

# मत्स्य विज्ञान प्रभाग

# Division of Fisheries Science

# Cataloguing and Conservation of Marine Sponges of Andaman through DNA Barcoding

*S. Dam Roy, P. Krishnan, C. Raghunathan* and *N.V. Vinith Kumar*

Sponges (Porifera) are primitive, multicellular animals. They are sessile, filter-feeding organisms that feed unselectively on organic particles within a size range of 0.1 to 50 ?m (i.e., phytoplankton, heterotrophic bacteria, heterotrophic eukaryotes, and detritus). They are difficult to identify, often even by taxonomic experts, attributable to scarcity of comparative highly variable morphological data and lack of taxonomical expertise, owing to which even globally about 8500 species have been described out of the estimated 15000 sponges. The project envisaged in cataloguing sponge resources of Andaman and Nicobar Islands through conventional taxonomy and establishes DNA sequence-aided taxonomic system. Cytochrome oxidase subunit 1 (COI 1) and ribosomal ITS region were used for sponge barcoding (Fig. 18). A total of 58 species (166 specimens) identified so far of which, 43 are being reported for the first time from Andaman and Nicobar Islands, including 25 new distributional records for India (Table 24). 54 Voucher specimens of identified sponges were registered and maintained at the A&N Regional Centre of ZSI.

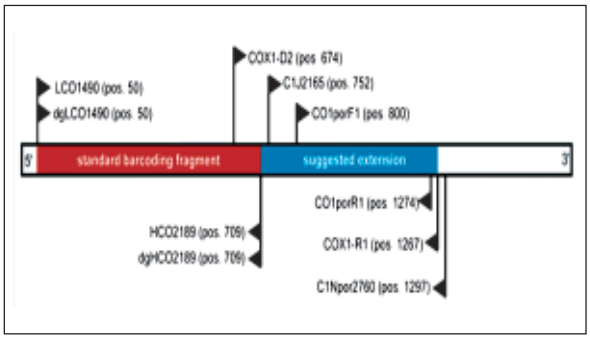



Fig. 18. Barcoding region and primers

**Table 24 : New locational records of sponges**

| India | | Andaman and Nicobar Islands | |
|---|---|---|---|
| 1. | *Acanthella cavernosa Dendy, 1922* | 1. | *Coelocarteria singaporensis* (Carter, 1883) |
| 2. | *Ircinia strobilina* (Lamarck, 1816) | 2. | *Chalinula nematifera* (de Laubenfels, 1954) |
| 3. | *Damiria toxifera* van Soest, Zea & Kielman, 1994 | 3. | *Mycale (Aegogropila) crassissima* (Dendy, 1905) |
| 4. | *Plakortis simplex* Schulze, 1880 | 4. | *Monanchora unguiculata* (Dendy, 1922) |
| 5. | *Petrosia (Strongylophora) strongylata* Thiele, 1903 | 5. | *Liosina paradoxa* Thiele, 1899 |
| 6. | *Axinella cannabina* (Esper, 1794) | 6. | *Lamellodysidea herbacea* (Keller, 1889) |
| 7. | *Stylissa massa* (Carter, 1887) | 7. | *Stylissa carteri* (Dendy, 1889) |
| 8. | *Aplysilla rosea* (Barrois, 1876) | 8. | *Oceanapia sagittaria* (Sollas, 1902) |
| 9. | *Callyspongia* (*Euplacella) australis* (Lendenfeld, 1887) | 9. | *Pseudoceratina purpurea* (Carter, 1880) |
| 10 | *Callyspongia (Toxochalina) multiformis* (Pulitzer-Finali, 1986) | 10 | *Hyrtios erectus* (Keller, 1889) |
| 11 | *Diacarnus megaspinorhabdosa* Kelly-Bourges & Vacelet, 1994 | 11 | *Crella (Grayella) cyathophora* Carter, 1869 |
| 12 | *Haliclona (Reniera) fascigera* (Hentschel, 1912) | 12 | *Clathria (Thalysias) cervicornis* (Thiele, 1903) |
| 13 | *Haliclona (Gellius) cymaeformis* (Esper, 1794) | 13 | *Spheciospongia vagabunda* (Ridley, 1884) |
| 14 | *Neopetrosia exigua* (Kirkpatrick, 1900) | 14 | *Chondrilla australiensis* Carter, 1873 |
| 15 | *Cliona varians* (Duchassaing & Michelotti, 1864) | 15 | *Chondrilla grandistellata* Thiele, 1900 |
| 16 | *Spirastrella cunctatrix* Schmidt, 1868 | 16 | *Myrmekioderma granulatum* (Esper, 1794) |

17 *Amphimedon chloros* Ilan, Gugel & van Soest, 2004

18 *Terpios gelatinosa* (Bowerbank, 1866)

19 *Callyspongia (Cladochalina) subarmigera* (Ridley, 1884)

20 *Dysidea avara* (Schmidt, 1862)

21 *Axinella minor* Thomas, 1981

22 *Hemiastrella boulini* (Thomas, 1973)

23 *Siphonodictyon paratypicum* (Fromont, 1993)

24 *Petrosia (Petrosia) nigricans* Lindgren, 1987

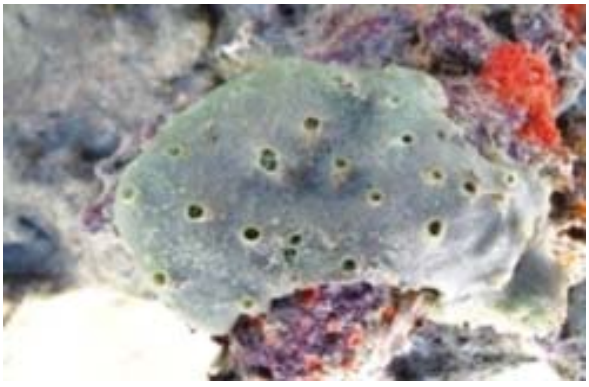
25 *Xestospongia viridenigra* (Vacelet, Vasseur & Levi, 1976)

17 *Neopetrosia carbonaria* (Lamarck, 1814)

18 *Agelas axifera* Hentschel, 1911

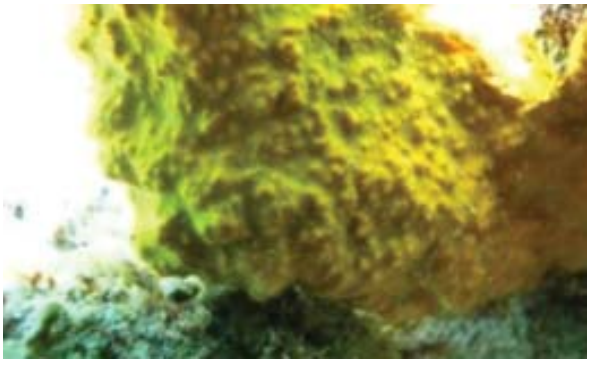
*All new records to India are new records to ANI also

Barcoding of sponges is a global challenge. Sponges produce potent bioactive compounds that can inhibit enzymatic reactions. Methodology for isolating sponge DNA and barcoding have been standardized. 14 new sponge barcodes have been generated so far of which 4 are identified (Fig. 19).



*Amphimedon chloros*

*Hyrtios erectus*



*Stylissa massa*

*Neopetrosia exigua*

Fig. 19. Identified sponge species for which barcodes are generated

The geographical position of all sponges specimens collected and identified have been documented and the information has already been fed into a database. Geo-referencing of the sponges from the Andaman Islands is under process.

# Impacts of Climate Change on Corals in Andaman Sea

*R. Kiruba Sankar, P. Krishnan* and *Grinson George*

A total of 41 surveys have been conducted during 2012-13 for assessing the coral reef status in Andaman waters at Chidiyatapu and North Bay, Avis, Craggy, Ross and Smith Islands. During 2012, mean temperature (°C) stood higher in March & April (32.3 & 33.5 respectively). (Fig.20). Despite higher SST than the preceding years, coral bleaching was not observed during 2012 probably due to higher rainfall in subsequent months which might had decreased the effect of higher sea surface temperature on corals.

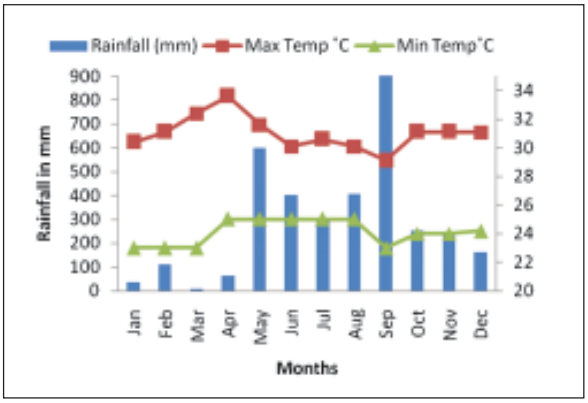



Fig.20 Climatic parameters during 2012

**Table 25. Benthic components (%) of the reefs surveyed (2012-13)**

| Benthic Components | *North Bay* | *Chidiyatapu* | *Pongibalu* | *Smith* | *Ross* | *Craagy* | *Avis* |
|---|---|---|---|---|---|---|---|
| *Sand* | 7.75 | 13.97 | 8.3 | 7.5 | 4 | 8.4 | 1.5 |
| *Sand + dead coral* | 3.98 | 6.92 | 2.1 | 3.2 | 0 | 2.3 | 1.1 |
| *Dead coral* | 36.2 | 30.14 | 40.7 | 42.3 | 39 | 53.4 | 56.9 |
| *Dead coral + algae* | 2.54 | 5.92 | 0.1 | 2.6 | 1.5 | 7.4 | 3.9 |
| *Live corals* | 44.4 | 38.9 | 44.5 | 34.5 | 46.2 | 25.5 | 35 |
| *Soft corals* | 2.77 | 1.47 | 1.9 | 1.1 | 0 | 0 | 1.3 |
| *Others* | 2.36 | 2.98 | 2.5 | 8.8 | 9.3 | 3 | 0.3 |

Percentage composition of benthic components from the survey sites is tabulated in Table 25. Live coral cover (%) was maximal at Ross Island (North Andaman) (46.2) followed by Pongibalu (44.5) and North Bay (44.4). Shanon-Weiner index ranged from 1.28 to 2.99 for Chidiyatapu, indicative of high species diversity. *Porites solida* was dominant invariably in all the study sites (Fig. 21). Hydrographical parameters were found to be significantly fluctuating on a spatial scale over the year. Gross Primary Productivity (GPP) was ranging from 8.25-387.4 mgCm$^3$/h, Total Dissolved Solids (TDS) was from 28.1-56 mg/l and Total Suspended Matter (TSM) was from 0.8-4.95 mg/l (Table 26).

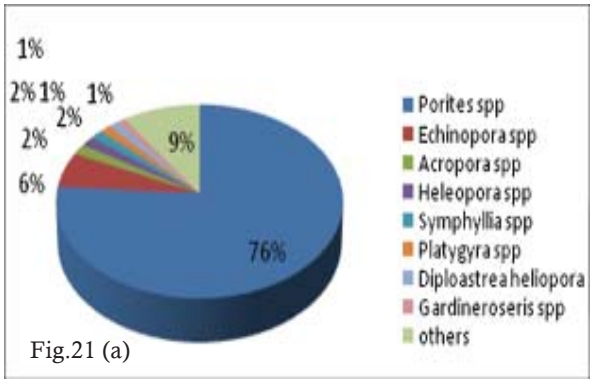



Fig.21 (a)

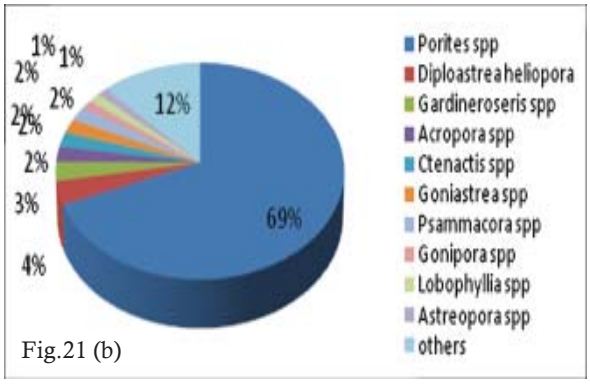



Fig.21 (b)

Fig.21. Percent composition of live corals: (a) North Bay and (b) Chidiyatapu

**Table 26. Hydrographical parameters at survey sites**

| Sites | | *Chidiyatapu* | *North Bay* | *Craggy* | *Ross* | *Smith* | *Avis* |
|---|---|---|---|---|---|---|---|
| **GPP (mg C/m3/h)** | Reef | 80-212 | 42-60.34 | 42 | 17.25 | 24.75 | 63.75 |
| | Non Reef | 68.7-387.4 | 50.25-43.3 | 25.5 | 17.25 | 8.25 | 82.75 |
| **NPP (mg C/m3/h)** | Reef | 33.52-148 | 24.75-36 | 42 | 8.25 | 33.75 | 31.5 |
| | Non Reef | 38.175-276 | 26.75-32 | 58.5 | 24.75 | 33.75 | 34.5 |
| **RR (mg C/m3/h)** | Reef | 32.5-156 | 17.25-22 | 50.25 | 25.5 | 24.5 | 32.35 |
| | Non Reef | 24.2-149.5 | 15.87-16.59 | 49.5 | 15.75 | 33.75 | 48 |
| **TSM (mg/l)** | Reef | 2.1-4.89 | 0.8-4.2 | 0.9 | 1.4 | 1.1 | 2.9 |
| | Non Reef | 2.21-4.95 | 1.925-4.87 | 1.2 | 1.8 | 1.6 | 4.1 |
| **TDS (mg/l)** | Reef | 28.1- 39.2 | 33.1-30.2 | 37 | 40 | 39 | 39.11 |
| | Non Reef | 29.8-40.24 | 36-39.3 | 40 | 56 | 47 | 42.07 |

The present study confirms that there is a clear increase in coral cover in regularly monitored sites Chidiyatapu and North Bay and also lots of new recruitment of corals in other surveyed sites indicating recovery of coral reefs. Presently procurement of Arc-GIS software is underway for mapping the coral reef resources at surveyed sites.

## Potential Fishing Zone Validation in Andaman Sea

***Grinson George* and *P. Krishnan***

A total of 20 landing centers were covered (10 from South Andaman; 5 North Andaman; 2 from Little Andaman; 1 each from Middle Andaman, Nancowrie and Great Nicobar) with 1076 visits over entire project period. PFZ forecasts received during 2010-12 varied significantly on a temporal scale (Fig. 22). During 2010-11 and as well as 2011-12, number of PFZ forecasts during the later-half of the year were scant due to non-availability of cloud-free data. However, during the extended period (April-December 2012), average receipt of PFZ forecasts was 21 per month valid for 1-2 days.

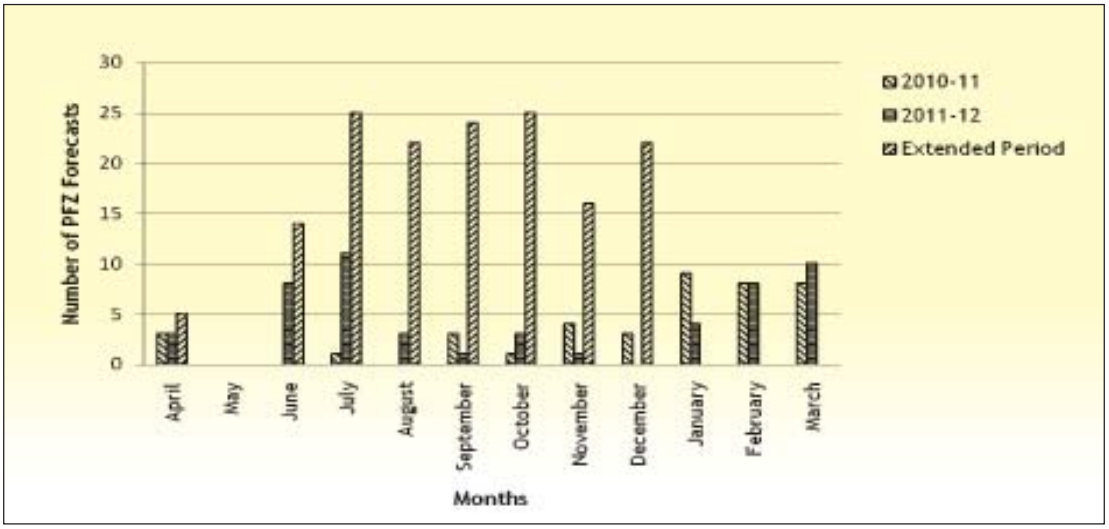



Fig.22. Temporal variation in receipt of PFZ forecasts during 2010-12

A total of 6 dissemination modes *viz.*, Digital Display Board (DDBs), e-mail, telephoning/text messaging, radio, community networking and distribution of print-outs of forecasts in person were evaluated. In view of near-real time dissemination, mobile text messaging was the most efficient mode with an average of 72 users per PFZ forecast followed by distribution of PFZ maps in person (35 users). Digital Display Board was viewed by 30 fishermen per forecast. The experience shows that more DDBs need to be installed in different islands considering the geographical distribution of islands, notwithstanding the number of fishers in each island.

A total of 46 awareness campaigns have been conducted wherein more than 600 fishers have been sensitized during the entire project period. PFZ advisories were found to have been adopted in various intensities across the islands ranging from 22% at Guptapara to 83.3% at Campbell Bay.

Economics of PFZ for the validation experiments conducted during the extended period revealed success of PFZ forecasts was 94% with 34.35% increase in CPUE. Horse mackerel (*Megalapsis cordyla*) was the predominant fish species in the PFZs, constituting more than 38%. Revenue earned from total fish catch was Rs. 81,000 at PFZ whereas it was 31,500 at non-PFZ. Net profit was found to be Rs. 45,000 for fishing in PFZs while it was 16,000 for fishing in non-PFZ which amounts to 2.8 times higher net profit for those adopting the PFZ advisories.

Experience inferred that PFZ forecasts of 1-2 days validity are not ideal for optimal fishing operations in the Islands. A networking has been developed involving various personnel where information related the availability of fish stock could be disseminated to fisherman within short time.

## Marine Faunal Biodiversity of the Nicobar Group of Islands

***R. Kiruba Sankar* and *S. Dam Roy***

Remotely located islands of Nicobar remain still virtually untouched in terms of biodiversity cataloguing. The present study proposes to bridge gap from the spatial angle (hitherto not studied region) as well as taxonomic angle (cover all organisms including those with no immediate commercial value) with the following specific objectives: (i) to identify and catalogue the biodiversity of benthic community from Nicobar group of Islands and Little Andaman and (ii) to assess the abundance, distribution and species richness of selected benthic organisms three islands in the Nicobar district, viz., Car Nicobar, Nancowrie and Great Nicobar as the study area for conducting in-situ surveys (Fig.23A).

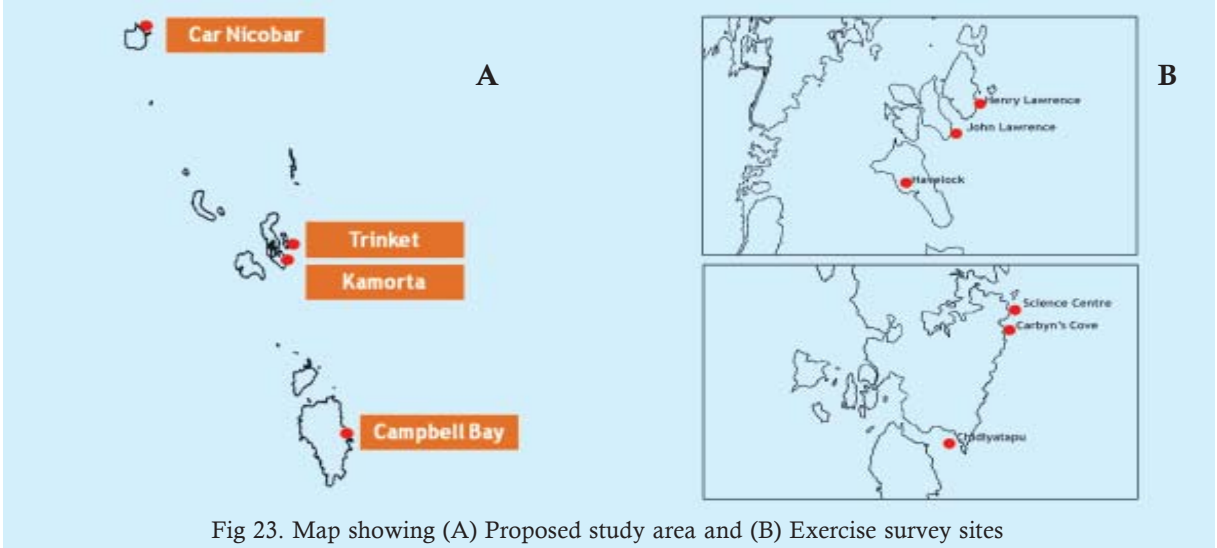



Fig 23. Map showing (A) Proposed study area and (B) Exercise survey sites

Exercise surveys to be executed in Nicobar group of Islands were conducted at three sites in Port Blair (Science Centre, Carbyn's Cove and Chidiyatapu) and at two sites Havelock (John and Henry Lawrence Is.,) of South Andaman (Fig23 B). A total of 79 species belonging to various faunal groups belong to 43 fishes, 11 echinodermata, 6 each from crustacea and mollusca, 4 corals, 3 nemertena and 1 each from sponges, echiura, ploychaeta and reptile have been recorded from the collections (Fig. 24). Survey and identification methodologies for different faunal groups were standardized from the exercise surveys. The project is very recently initiated and extensive surveys and documentation of marine faunal diversity will be carried out in future.

*Nemertenea* *Echinodermata*

*Polychaeta* *Eciura* *Mollusca* (Nudibranchia)

Fig.24. Identified faunal groups from exercise surveys

## Self Recruiting Species (SRS) Diversity in Aquatic Systems of South Andaman

***R. Kiruba Sankar* and *Nagesh Ram***

Self recruiting species (SRS) are those aquatic species which do not require repeated stocking in ponds but can be harvested at particular intervals without any special management practices. Rice fields, farmer fish ponds, open waters and trap ponds were surveyed for Self recruiting fishes and their ecological importance with importance to plankton diversity in Port Blair, Havelock, Neil Island and Hut bay. A total of 11 freshwater fishes, with seven introduced exotics were recorded (Fig.25). The Shannon weiner diversity index, richness and evenness were found as 2.14, 1.91 and 0.86 respectively (Table 27). 24 species of phytoplankton under 6 phyla and 4 groups of zooplankton have been documented (Fig.26). Cyprinids were the dominant family followed by cichlids and anabantids (Fig.28). Notopertus notopterus, Pangassius sp are imported from mainland to inland fish markets in south Andaman which subsequently led to their introduction in Andaman waters.


Fig.25. Self recruiting fishes (a) *Ananbas testidineus* (b) *Channa striatus* (c) *Heteropneustes fossilis* (d) *Oreochromis mossmabica*

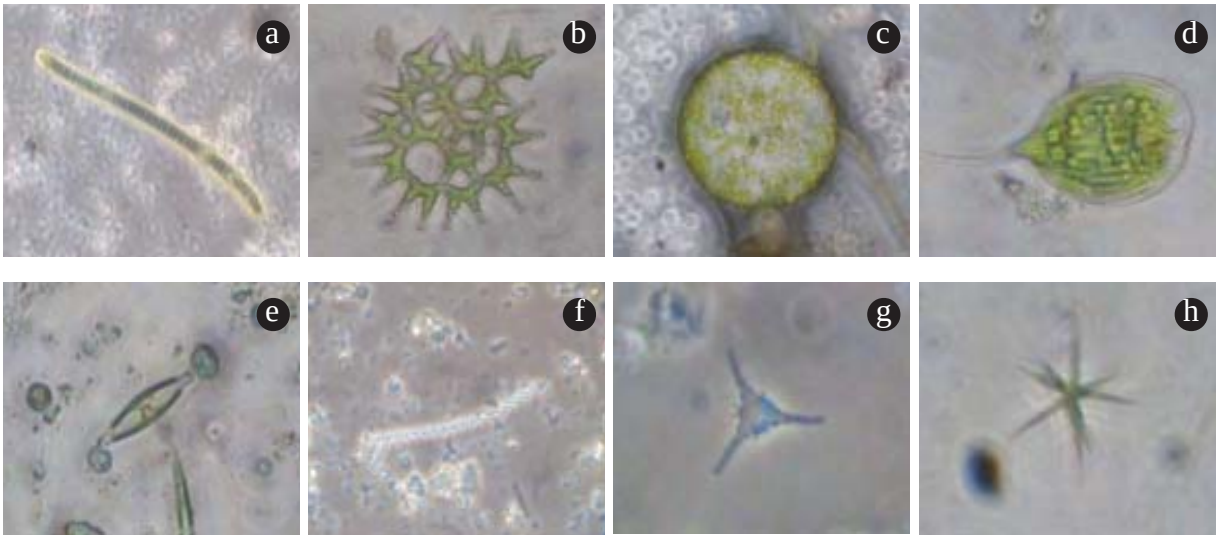



Fig.26. Phytoplankton from the aquatic systems in South Andaman (a) *Oscillatoria* sp (b) *Pediastrum sp* (c) *Coscinodiscus sp* (d) *Phacus sp* (e) *Navicula sp* (f) *Spirulina sp* (g) *Stauastrum sp* (h) *Ankistrodesmus*

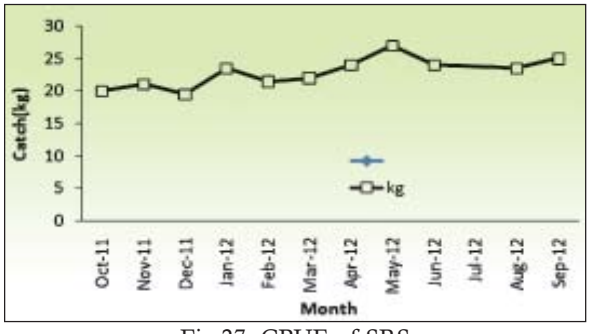



Fig.27. CPUE of SRS

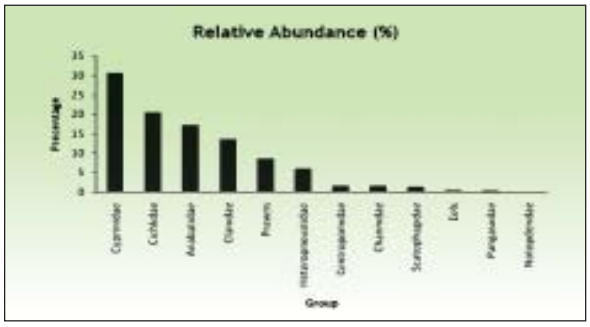



Fig 28. Relative Abundance of SRS

The catch per unit effort varied from 21 kg to 27kg/ fishermen/week and the major gears involved were gill nets, cast nets, lines and traps (Fig. 27). A model SRS farmer pond was taken in South Andaman wherein the attraction of SRS in farming system followed by their management options like releasing brooders back to pond, fencing the pond to prevent migration of SRS which were attracted earlier during rain and flood.

**Table 27. Diversity indices**

| Index | Values |
|---|---|
| Shannon Weiner (H) | 2.14 |
| Margalef species richness | 1.91 |
| Pielou evenness | 0.86 |

# सामाजिक विज्ञान अनुभाग

# Social Science Section

# Demand and Supply Analysis of Livestock Products in Andamans

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

The primary data for the project were collected from rural as well as urban areas on the parameters like family particulars, income profile, production, consumption and disposal of livestock products, consumption pattern of households and related aspects. Analysis was done to study socio-economic profile of the farmers, factors affecting demand as well as supply and marketed surplus of livestock products. The levels of demand and supply of these products were estimated and projected towards 2021 and 2031. There after gaps between supply and demand were analysed. Price and income elasticities were worked out and then complete demand and supply systems (equations) were estimated for rural as well urban areas. The key findings of the projects can be summarised as follows:

The prices of mutton and chicken rises during dry season whereas that of pork falls. The milk consumption has been found to be less than the minimum requirement where as meat was consumed almost double than the requirement among the farm families of Andaman. The expenditure pattern indicated that out of total monthly budget of Rs. 10464/-, nearly 47% goes to consumption of livestock and hi-value products. Consumption of livestock products are found to be highly income elastic as shown by the coefficient of income. The demand of milk, mutton and pork have found to be highly elastic to their prices. The coefficients of proportionate change in quantity demanded of a product as a result of unit change in its price, termed as own price elasticities, have been found negative in all the products that correspond to the law of economic goods. Whereas most of the cross price elasticities (proportionate change in quantity demanded of a product as a result of unit change in price of other product) are positive. It implies that most of the livestock products behave as good substitutes. Most significant of them are in case of milk- mutton, milk-chicken, mutton-chicken, mutton-fish and pork-chicken. In case of egg-fish, the cross-price elasticity have been found negative indicating a complimentary relationship between these products but which is not the case. This may be due to the fact that both eggs and fish form the same product group for low income consumers.

Prices of feed used for the production of these products are impacting the supply of these products negatively, which is more prominent in case of eggs. Current prices affect supply positively whereas lagged prices affect the supply negatively. The demand of milk, mutton and chicken are income elastic where as the supply of these products has been found to be responsive to own prices and feed prices. The demand of chicken would be almost double in 2021 and will be four times in 2031. The supply will increase faster and will surpass the demand in 2021. It implies that in Andaman, planning emphasis should shift from poultry to dairy and goatery.

The product wise growth rates of demand and supply for the next 20 years are given below:

**Milk:** The demand will increase @ 1.96% whereas supply will increase @ 1.74 per annum.

**Mutton:** The demand will increase @ 1.92% whereas supply will increase @ 1.22 per annum.

**Chicken:** The demand will increase @ 7.59% whereas supply will increase @ 9.38 per annum.

**Eggs:** The demand will decrease @ 1.09% whereas supply will increase @ 5.93 per annum.

## Determination of Carrying Capacity of Islands and its Potential for Organic Farming

*Ajmer Singh* and *Shrawan Singh*

Analysis was done both district and island wise. The salient findings of the project are as follows:

The estimates of production and requirements of various food commodities indicated that these islands are deficient with respect to almost all the major commodities ranging from 23% (milk) to 100% (sugar)

Wide gaps will persist between local supply and requirements of major food commodities which will expand towards 2021 and 2031 as estimated. In 2021, tourists flow will be almost equal to local population but in 2031, this will be almost double than the local population of the islands, as shown by the growth rates and projection modelling.

District level analysis shows quite different scenario. North & Middle Andaman District is comfortable in cereals and pulses, whereas it is having surplus production of fruits, vegetables and milk. It is deficit in roots, tubers and oils. South Andaman District is deficit in all the food commodities except fruits where it is producing just equal to its requirements. District Nicobar meets almost all its requirements of cereals and pulses by imports. It is deficient in milk and vegetables where as Nicobar is comfortable in roots , tubers and fruits. The local supply of fruits and vegetables is highly seasonal and localized, therefore availability is hampered and not uniform.

If tourists flow is added to the local population, then the scenario is quite changed. In case of commodities where the islands are having seasonal surplus like in case of vegetables, fruits etc, there also, the deficit appears and widens in future.

The potential recovery of nutrients from organic sources i.e. crop residues and animal waste was estimated exploring various options like composting, Vermicomposting, azolla application etc and then projected over the years district and island wise. Organic sources other than forest litter have the potential of supplying about 50% of N and less than 20% of P and K.

## Potential and Prospects of Campbell Bay being Production Hub to Meet the requirements of Perishable Foods (PDS Rice) of Nicobar District

*Ajmer Singh, S.K.Zamir Ahmed* and *S.K. Pandey*

At Campbell Bay wide yield gaps exist and the existing yield can be increased by seven times in rice, four times in pulses and three times in vegetables through extension approach only. Almost similar levels of yield gain can be achieved if technological interventions are made to achieve potential yields in rice. Cost of cultivation was estimated for major crops and possibility of production was worked out. As is evident by the frequency of utilizing different sources of information for gaining agriculture information per week, the most effective source was found to be radio (freq. = 0.49) followed by TV, NGOs and Government department. Under post-*T*sunami, only 61.3% of land is now available for cultivation and 30.6% is under submergence which needs reclamation.

# Impact Assessment of Technological Intervention in Andaman

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

During the year, five technological interventions namely Broad bed and furrow system, composite fish culture with C:R:M (Catla, Rohu, Mrigal), HYVs of rice, Improved Nicobari fowl and Peking cross duck were assessed for their economic feasibility in terms of additional income, additional man days generated, adoption rate, acceptance etc. A total 150 respondents representing South, Middle and North Andaman were surveyed through a well constructed interview schedule and observation technique.

The economic feasibility analysis 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/- against farmers practice of stocking multiple species of fish (Rs.3,500/-) which fetched an additional return of Rs. 19,450/0.08 ha of pond. In Broad bed and furrow system (0.20 ha) in fallow land a net return of Rs. 28,500/- was achieved against the farmers practice of growing paddy only, thereby fetching an additional income of Rs. 24,500/-. The HYV's of rice of the Institute viz., CARI - 5, Savitri, CARI - 3, CARI - 4, Gayatri, Ranjeet, Varsha and CSR-36 could give an average additional increase in yield of 30% over the farmers variety Jaya, thereby fetching an additional return of Rs. 9,400/-. Improved Nicobari fowl with a unit size of 20 under backyard gave a net return of Rs.13,600/- against the country fowl (Rs. 6,500/-) thus an additional income of Rs.7,100 was achieved. Peking cross duck under backyard with a unit size of 03 birds could give a net return of Rs.4, 350 against the desi birds (Rs.1,140/-) thus giving a additional income of Rs.3,210/-. The adoption rate was cent percent and acceptance was high for the technology Composite fish culture with CRM followed by others. The expenditure pattern on returns indicated that 45% of the income was spent on functions and special occasions, followed by 18% each on education and savings, 16% for food, 2% on local travel and 1% on personal expenses. The major constraints were non availability of inputs, technical know-how, labour, marketing and proper governance (Table 28).

**Table 28. Economic feasibility of technologies**

| Technology | Net Income (in Rs.) | | Additional income (Rs.) | Additional Mandays generated | Acceptance level (scale 1 - 5) |
|---|---|---|---|---|---|
| | Farmers practice | Tech. Intervention | | | |
| Composite fish culture /0.08 ha of pond | 3,500.00 | 22,950.00 | 19,450.00 | 87.50 | High |
| Broad Bed & Furrow /0.20 ha | 4,000.00 | 21,250.00 | 17,250.00 | 87.00 | Medium |
| HYV of Rice/ha | 12,200.00 | 21,600.00 | 9,400.00 | 40.00 | Medium |
| Improved Nicobari fowl (20 birds/unit) | 6,500.00 | 13,600.00 | 7,100.00 | 42.50 | Medium |
| Peking cross duck (03 birds/ unit) | 1,140.00 | 4,350.00 | 3,210.00 | 40.00 | Medium |

# Establishment of Out Reach Centre (ORC) at Diglipur, North & Middle Andaman District

*S. Dam Roy* and *S.K Zamir Ahmed*

Need based technological intervention in the mode of training and demonstrations like HYV of rice, pulses, tuber crops, oil seeds, seed village production of rice, satellite nursery for fresh water fish, Peking cross ducks under backyard, Mini dal mill and rodent & pest management in paddy was taken up during the period of report.

Eleven field level training programmes were conducted in agricultural and allied fields, wherein 397 farmers got trained and 746 trainee days were utilized accounting to 76.5% males and 23.5 % females.

Fifty three kharif technological demonstrations with seven HYVs of rice viz., Ranjeet, CARI - 5, CSR - 36, Gayatri , CARI -3, CARI -4 and Savitri were taken in 14 cluster of villages covering 14.68 ha in participatory mode. The results indicated that var. CSR -36 gave mean yield of 5.10 t/ha against local check var. Jaya (3.40 t/ha) followed by CARI- 05 (4.87 t/ha), Ranjeet (4.80 t/ha), Gayatri (4.70 t/ha), CARI -4 (4.20 t/ha), CARI-03 (4.10 t/ha) and Savitri (3.50 t/ha) respectively. Here, CSR- 36 gave 50% increase in yield followed by CARI-05 (49.85%), Gayatri (42.42 %), Savitri (40.00%), CARI-04 (35.48%), Ranjeet (33.33 %) and CARI 03 (13.00%) respectively.

Twenty four rabi technological demonstrations were conducted covering 2.0 ha. Tapioca variety Sri prakash gave an yield of 37.20 to 42.00 t/ha, whereas var. H226 gave 31.00 to 34.30 t/ha, Sweet potato var. SP -2 gave 11.25 t/ha and Elephant foot yam var. Gajendra yielded 1.5 kg to 6.00 kg/ plant. Peking cross duck under backyard would grow to average weight of 2.637 Kg with low level of mortality, when compared to desi i.e. 1.975 kg of weight with high mortality rate.

Seed village production of HYV of paddy was carried out under the technical guidance of Division of Field Crops for for the second successive year in an area of 4.13 ha in participatory mode. Around 10 tons of truthfully labelled seed was produced and four tons were taken in buyback system.

Satellite fish nursery for fresh water fish seed production was introduced for the first time in Diglipur under the technical guidance of Division of Fisheries in association with Dept. of Fisheries & KVK with an objective to raise nursery of fresh water fishes. In a span of six months a farmer from V.S. Pally could earn Rs.2,70,000.00 by adopting the technology. In addition to this Mini Dal Mill was operationalized during the period for extending livelihood support to the Self Help Group, wherein they could process the dal and get good remuneration price from the product against the sale of pulse whole in a marginal rate.

For effective transfer and dissemination of technology various programs like Scientists-farmers interaction (02 Nos.), Exposure visit during Kisan Mela and Farm Innovators meet (01 Nos.), Field day (02 Nos.), Radio talk (01), 642 field visits by experts and staff, 378 clientele visits to ORC for advisory, information sharing and feedback, 16 telephonic advisory, and participation in Block Mela (02 Nos.) were done to showcase the technologies in agriculture and allied field.

**Recognition to the farmers**

Three farmers for adopting Satellite fish nursery, Seed production of rice var. Gayatri and Composite demonstration of various technologies as livelihood were awarded with Best farmer award and six farmers were felicitated for their innovative process\produce during the Island Kisan Mela.

## Identification of Technological Options to Increase Production of Tribal Farming System in Car Nicobar Island

*Subhash Chand, Ajmer Singh, S.K.Pandey, Viveka Nand Singh* and *Chandrika Ram*

The District is having a population of 42,068 of which 70% belong to tribal category. Nicobari are Mongloid and constitutes about 19000 (Census 2011) and reside in all the inhabitant islands of the district. They are horticulturist and pig-herders inhabiting large permanent villages mostly close to seashore. In area, it is 127 km² with 15 villages (Fig.29.), which are inhabitants, the largest being Malacca.


**Fig. 29**

The data from 45 respondents of five villages scattered in Car Nicobar were collected on family size, education, family income, literacy, crops grown and livestock reared and the finding is put forth:

**Family System:** They are patriarchal and as a rule live jointly which is called Tuhet. There is no individual ownership, but the Tuhet owns land, coconut and pigs. Love marriage is very common and the age of marriage is sufficiently high. The main food articles are coconut, pandanus pulp, fish and rice etc.

**Distribution of population based on the number of Tuhets**: The 15 villages categorized based on the tuhet population Fig. 30 & 31. It was observed that villages possessed 9 to maximum 40 numbers of tuhets and members in the tuhet varies from 20 to 500 peoples. Thus, there is no linear correlation between number of tuhets and population in the village.

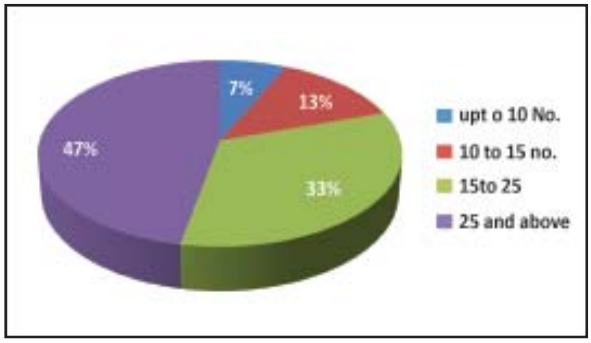



Fig. 30: Population wise distribution of village

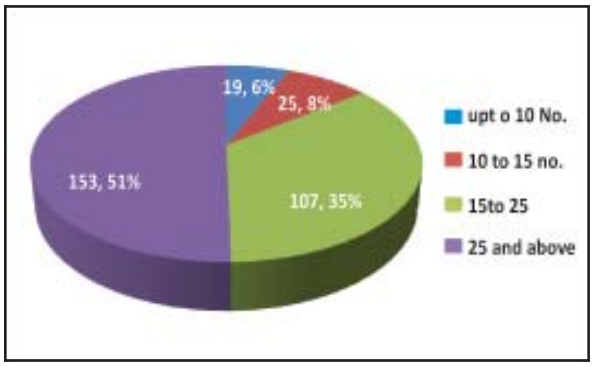



Fig. 31: Tuhet wise distribution

**Socio economic status of the respondents:** Average number of family members were 8 to 10 person. The average income per annum/capita varies from Rs. 0.75 lakh to 0.95 lakh, which is from coconut, livestock and small amount from other sources.

**Role in decisions making process:** The male and female do not equally participate in decision making process. However, female views were considered in household, agriculture, and social decisions. Most of the time tuhet captain or headman influence the decisions related to all activities like agriculture, household, education, social and political to the extent of 85 to 100 percent.

**Constraints in taking modern agriculture:** The constraints were identified and analysed based on RBQ method. It was observed that heavy rains and long spell of dry periods were ranked I$^{st}$ and II$^{nd}$ as the major constraints. However, lack of technological knowledge, non availability of inputs in time, diseases and marketing problem were also hurdles in adoption of agriculture and allied sector technologies.

**Status of farm and non- farm assets**: It was observed that on an average Nicbaries had more than one lakh rupees worth farm assets (spade, coconut dehsuker, crowbar, pickaxe, coconut dryer etc. However, non-farm assets were worth more than one lakh rupees. Further, it was found that most of the non-farm assets were modern and purchased after tsunami.

**Sports:** The great pastime of the Nicobarese is feasting. Football is the most popular game here and they have won Subroto Mukerjee Cup (Junior National) four times. Canoe racing, Volley ball, Wrestling are other popular games and sports. Some of Nicobari sports personnel have excelled in National and International events in Cycling, Kayaking, Rowing.

**Entertainments:** Music & dance are components of Nicobari culture. Overall the Nicobari enjoy peaceful and harmonious religion with each other. There is a leader in a monotonous concerted sound and then the dances step right and left under his direction, and jump in unison, coming down on both heels. The most popular musical instrument in Guitar.

**Religion & Languages**: Ninty eight percent of the Nicobarese are Christians following the Protestant faith. Christianity spread after the advent of a South Indian Missionary. The remaining two percent population consists of Muslim. Six distinct dialects and languages are spoken in the archipleago- one in Car Nicobar, another dialect is spoken in Chowra, Teressa and Bompoka, and the central Islands of Kamorta, Nancowry, Trinket and Katchal that speak a fourth. Little Nicobar and Great Nicobar with their adjacent Islands have a fifth. Lastly, the Shompens who are also one of the aboriginal tribe staying in interior part of Great Nicobar employ a speech that is different from the others.

**Culture/Festivals:** The "TUHET" or large joint family is mostly prevalent in Car Nicobar. The nuclear family is more prominent in Central and Southern Nicobar. The art & culture of Nicobari are in tune with their environment & needs. Their large seafaring canoes are so skilfully built that they are light and easily can be carried out. Each one of them are curved out from a single piece of wood.

# Emeritus Scientist Scheme of ICAR Project

## Promotion and Exploitation of Neglected and Underutilize Agriculturally Important Genetic Resources of Bay Islands

*T.V.R.S. Sharma*

During the year field visits were made to Diglipur, Jirkatang, Shoalbay, Rutland, Guptapara, Manjery, Chidiyatapu and in an around Port Blair to identify the species, location and its uses. From Shoalbay three *Eleaocarpus* sp. two wild mango (*Mangifera andamanica* and *M. griffithii*), one climber (Creeper), one wild Carrillo, and British introduced Tea plant parts like fruits, leaves and flowers were collected and GPS readings recorded. From Rutland, fifteen plants were collected and their locations were pointed with GPS. The wild rice plant (*Oriza mayerina*) and its location was found by GPS (N 11° 29' 03.7" E 092° 37' 17.1") near Badakhadi dam and *Terminalia* sp. was found from the Village of Rutland (N 11° 26' 02.5" E 092° 37' 28.1"). Plants species such as *Piper* sp. *Syzygium sp*, *Kanema andamanica*, *Articarpus* sp., *Mangifera* sp., *Mangifera andamanica*, *Garcinia* sp. *Citrus* sp., *Artocarpus* sp., and *Myristica* sp were also found from the Rutland. During the field visit to Guptapara, Manjery, Jirkatang, North Andaman and Chidiyatapu the information on species such as *Musa* s., *Diospyrus* sp., *Momoridica chochenchinensi* (wild carrilla), *Mangifera Andamanica, Piper betel, Nypha fruticans* and *Haematocarpus validus* (khoon phal, rakta phal, or alata phal) were collected.

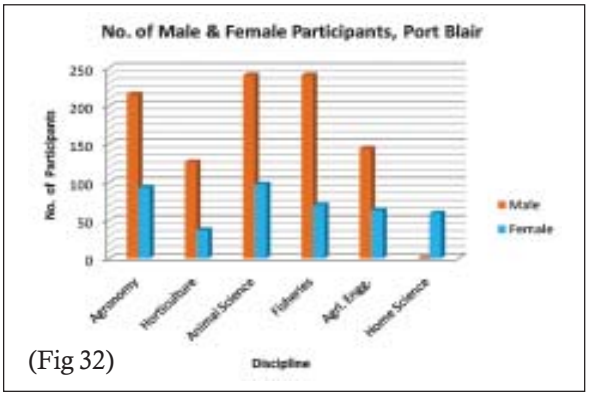
A total of 622 medicinal plants belonging to 135 family were scrutinized from the original research article and their location, parts used by tribals were recorded from the literature. 89 plant species were used for the treatment of fever, 41 for skin related disease, 29 species for asthma, 26 for ulcer, 24 for urinary related problem, 17 for snake bite and 6 for the cancer/tumor. Among these a total of 72 endemic medicinal plant belonging to 40 families were recognized from the Andaman and Nicobar Islands and are being processed for preparing descriptor and to find out their location.

**Tranquilizing rock bee and biological control plants**

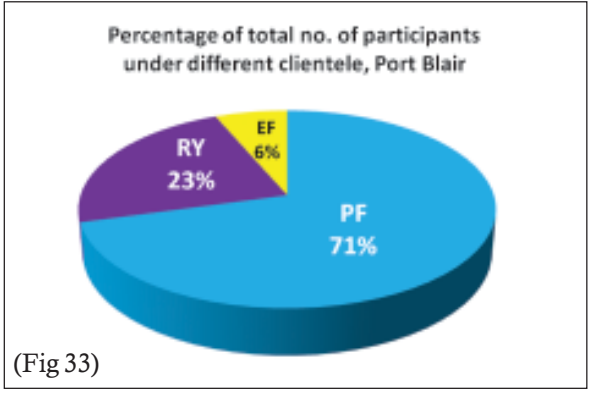
Plants species that are used to tranquilize rock bee by tribals of Andaman and Nicobar for collecting honey and plants that can be used in biological control have been isolated from literature namely *Alpinia manil* King ex Baker, *Orophea katschallica* Kurz, *Amomum aculeatum* Roxb., *Amomum fenzlii* Kurz, *Pseudouvaria praimii* King, *Zingiber squarrosum* rock, *Calotrophis gigantean*, *Calophyllum inophyllgum*, *Anacardium occidentale*, *Lantana camara* and *Amoma squamosa*. are found to be most promising.

# KRISHI VIGYAN KENDRA - SOUTH ANDAMAN

Fourty one trainings covering South Andaman, Neil, Havelock and Hut Bay were conducted for practising farmers, rural youths and extension functionaries, wherein 1,384 beneficiaries got benefited in agriculture and allied sector. In North and Middle Andaman district eight trainings were conducted, wherein 390 trainees were benefited. Beside, four trainings sponsored by NGOs have also been conducted, wherein 75 farmers got benefited. Under TSP 4 trainings were imparted exclusively for the tribal population of Car Nicobar district and a total of 79 tribal people were trained in livelihood options through agriculture and allied sectors. Ten numbers of On Farm Trial (OFT) at farmers field were conducted to assess and refined the selected technologies in agriculture and allied fields (Fig 32 & 33).



(Fig 32)



(Fig 33)

RY: Rural Youth; EF: Extension Functionaries; PF: Practicing Farmer

## Front Line Demonstrations (FLD)

Fifteen FLD in agriculture and allied fields *viz.* paddy, ginger, elephant foot yam, backyard poultry, pig, Japanese quail, khaki Campbell duck, composite fish culture and mechanical weeder were conducted. The result is manifested below:

- On salt tolerant paddy (*var.* CARI Dhan 5) in three farmers field (0.4 ha/farmer) indicated an average grain and straw yield of 41.2 q/ha and 65.3 q/ha which was 42.5 % higher grain yield as compared to local check (var. C14-8) was recorded.
- On paddy (*var.* ANR 16) an average yield of 47.0 q/ha was recorded, which was 22.1 % higher yield than local check (*var.* Jaya).
- In ginger (*var.* Jorhat), yield of 75 q/ha was obtained as compared to the local check (32 q/ha).
- On elephant foot yam *var.* Gajendra the yield of 250 q/ha was obtained as compared to 150 q/ha from local variety.
- On pig farming (Large White Yorkshire breed) revealed that an average body weight of 110 kg per animal was attained over the local check (non descriptive) 70 kg per animal in a period of one year.
- On backyard poultry farming with Nicobari and its crosses with Vanraja conducted, recorded egg production of 140 eggs / annum compared to its counterparts of local desi bird (75 eggs/annum).
- Japanese Quail birds attained an average body weight of 175 g in 6$^{th}$ weeks of age.
- On composite fish culture conducted, an average yield of 1.2 t/ ha was recorded which was 200 % higher than local check (0.4 t/ha).
- Weeder for mechanical weeding of paddy fields showed that drudgery was reduced and an amount

of Rs 8,250 was saved in weeding operation of 1.0 ha of paddy field against the manual weeding.

## On Farm Trials (OFT)

Nine OFT at farmers field were conducted to assess and refine the selected technologies in agriculture and allied fields. The result is given below:

- Effect of integrated weed management in paddy revealed that application of Butachlor @1.25 kg a.i.ha$^{-1}$ at 3 DAP followed by hand weeding at 30 DAP resulted in significantly higher grain yield of 52.3 q/ha which was at par with Dhaincha intercropping *fb* 2-4 DEE @ 0.5 kg a.i. ha$^{-1}$ at 30DAP.
- Effect of potassium on rice under low-lying acid soils indicated that application of recommended dose (RD) of 100 % K had significantly more yield attributes and yield over other treatments. Among K management practices, application of 100 % RD of K recorded higher grain yield of 45.23 q/ ha and straw yield of 61.7 q/ ha which was 10.7 % and 17.8 % higher grain yield over control. 100% recommended dose of K recorded higher agronomic use efficiency and physiological use efficiency of 10.21 and 15.04 respectively with highest net return of Rs. 25,710/- and B:C ratio of 2.32.
- Integrated pest management for bitter gourd (Fruit fly) showed that the bio intensive module recorded higher fruit yield of 10.75 t/ha. as compared to IPM module and farmers practices.
- Evaluation and growth performance of Carps in bay island indicated that Technical option two (Fish seed+ Feed+ Lime), performed well. The cost of rearing was (Rs.97000/ ha) and the increased in yield was from 0.70 t/ha to 1.6 t/ha over the farmers practices. Net return (Rs. 1, 35, 000/ha) with BC ratio of 2.31 was obtained.
- Evaluation and growth performance of Fresh water cat fish (*Singhi/Magur)* indicated that Technical option 3 (Fish fry + RB + GOC + Fish meal + Poultry offal + lime & light), performed well. The cost incurred towards management was Rs.60,000/ ha and increased in yield was from 0.06 t/ha to 1.2 t/ha over the farmers practices. The net return from the intervention was Rs.3,00,000/ha @ Rs 250/-Kg with BC ratio of 5.5.
- Performance evaluation of poultry under different litter condition indicated that the bird reared under the chopped dry coconut leaf + lime as deep litter material recorded the weight at sexual maturity (WASM), age at sexual maturity (ASM) and mortality percentage in the tune of 2200g, 181days and 10 respectively and found better than the other two groups. The highest net return of Rs. 920/ - was recorded in chopped dry coconut leaf + lime as deep litter material with B:C ratio of 1.87. The result further indicated that the moisture absorption in chopped dry coconut leaf is less compared to the other treatments and can replace the traditional and not readily available saw dust as litter material.
- Performance and evaluation of gravity fed drip irrigation for arecanut plants indicated that the uniformity coefficient of irrigation in gravity fed drip irrigation is less as compared to other methods. But the water saving in irrigation and energy cost parameters are better in gravity fed drip irrigation system.

**Table 29: Summary of the extension activities**

| Extension Activities | No. | Farmers | | Extension Officials | | Total | | |
|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | T |
| Field Day | 7 | 212 | 65 | 1 | | 213 | 65 | 188 |
| Kisan Mela | 2 | 489 | 236 | - | - | 489 | 236 | 725 |
| Kisan Ghosthi | 1 | 19 | 18 | - | - | 19 | 18 | 37 |
| Exhibition | 2 | 489 | 236 | - | - | 489 | 236 | 725 |
| Film Show | 20 | 239 | 144 | - | - | 239 | 144 | 383 |
| Method Demonstrations | 6 | 77 | 36 | 2 | | 79 | 36 | 115 |
| Workshop | 1 | - | - | - | - | - | - | - |
| Group meetings | 6 | 63 | 30 | - | - | 63 | 30 | 93 |
| Lectures delivered as resource personnel | 24 | 189 | 140 | 8 | 4 | 197 | 144 | 341 |
| Newspaper coverage | 23 | Published in dailies of Port Blair | | | | | | |
| Radio talks | 2 | Broadcasted through All India Radio, Port Blair | | | | | | |
| TV talks | 2 | Broadcasted through DDK, Port Blair | | | | | | |
| Extension Literature | 1 | - | - | - | - | - | - | - |
| Advisory Services | 65 | 73 | 12 | 9 | 11 | 82 | 21 | 103 |
| Scientific visit to farmers field | 130 | 269 | 131 | | | | | |
| Farmers visit to KVK | 107 | 90 | 28 | 12 | 10 | 102 | 38 | 140 |
| Diagnostic visits | 62 | 105 | 53 | - | - | 105 | 53 | 158 |
| Exposure visits | 8 | 132 | 61 | - | - | 132 | 61 | 193 |
| Animal Health Camp | 20 | 59 | 38 | - | - | 59 | 38 | 97 |
| Awards | 2 | Best poster awards | | | | | | |

M: Male; F: Female; T: Total

# National Initiative on Climate Resilient Agriculture (NICRA)

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

## Technologies transferred in NICRA villages

Ridge and furrow cultivation, aerial vegetable cultivation for moisture conservation and to check soil erosion in hilly slope, fodder cultivation, composite fish culture, backyard poultry, nutritious kitchen garden and mulching in plantation and field crops for moisture conservation.

## Village Climate Risk Management Committee (VCRMC)

VCRMC was formed on 27.07.12, two meetings were conducted on 27.07.12 and 11.12.12 and a Bank Account has been opened on 17.08.12.

## Custom Hiring Center

One room has been hired on monthly rental basis at Port Mout village for keeping the farm implements, purchased under NICRA project and to monitor NICRA activities at the adopted villages.

## Significant achievement

### Under 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. Six ponds were cleaned and one new pond was constructed for storage of water and ground water recharge. Trenches and bunds were made along the contour lines. Two BBFs were constructed in fresh water submerged and one in brackish water inundated area.

### Under Crop Production

To overcome the damage of vegetables in summer months due to rain, ridge and furrow method of cultivation was adopted in the fallow land for vegetable cultivation. In CARI Brinjal-1, 10-12% wilt was noticed with less water requirement. Creeper long (cowpea) was recommended, as it was resistant to fruit borer, had good keeping quality and gave high market price. In cowpea 5.2 t/ha was recorded in demonstration plot with variety Creeper long against 2.8 t/ ha of local variety (Lafa). Bhendi No.64 was found free from Yellow Vein Mosaic and suitable for both kharif and rabi season. It gave 7.5 t/ ha followed by var. Arka Anamika (3.8 t/ha). Salt tolerant paddy variety was demonstrated in sea water inundated land in adopted villages. CARI Dhan 5 recorded yield of 3.7 t/ha., which was 25.6 % higher as compared to local check (Jaya). Short duration rice variety MLT-10 was introduced in late onset of monsoon season, which gave grain yield of 3.6 t/ ha.

### Under Livestock and Fisheries

Azolla inclusion in diet of poultry & dairy animals showed better performance.Treatment of hump sore disease was carried out in cattle by topical application of ointment developed by Animal Science Division of the Institute.Improved poultry and dairy animal sheds were recommended in shady area to reduce heat stress and low mortality rate of calf and birds.Fish fingerling of Catla, Rohu and Mrigal were distributed to 10 farmers in the NICRA adopted villages for practicing composite fish culture in their ponds.

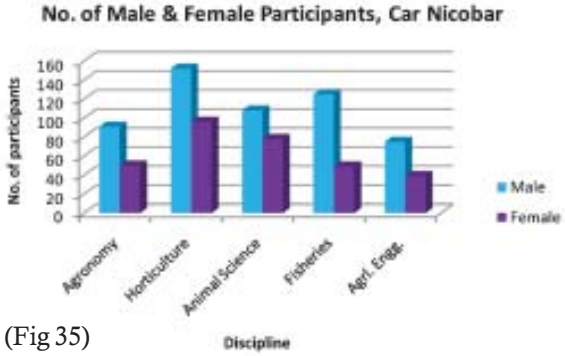
## Institutional interventions

Broad bed and furrow system, paddy-cum-fish farming, three tier system and three drip irrigation system have been facilitated through NAIP of CARI.

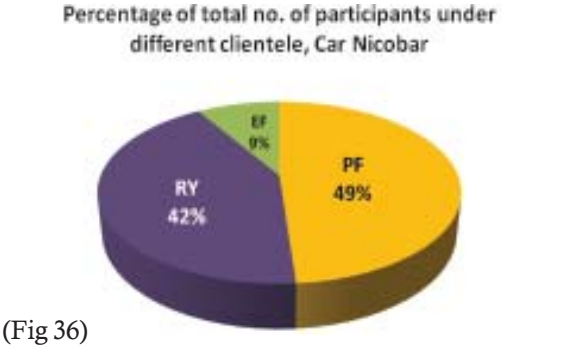
Fig.34: Glimpses of activities

# KRISHI VIGYAN KENDRA - NICOBAR

Thirty one trainings were conducted wherein, a total of 870 beneficiaries participated. Under TSP 10 trainings were imparted at Nicobar, wherein a total of 240 tribal people got trained in livelihood options in agriculture and allied sectors. To assess and refine the selected technologies in agriculture and allied fields nine OFT at farmers field were conducted (Fig 35 & 36).




(Fig 35)




(Fig 36)

RY: Rural Youth; EF: Extension Functionaries; PF: Practicing Farmer

**Front Line Demonstrations (FLD) Result**

- Sweet potato *var.* CARI SP-I gave average yield of 117 q/ha and CARI-SP-2 (110 q/ha) respectively.
- Radish cv. Pusa Chetki gave an average yield of 110 q/ha and net return of Rs. 1,95,000/ ha.
- Method for preparation of mango pickle was conducted in three villages of Car Nicobar, which was accepted over traditional method due to its good taste and long shelf life. The net return of mango pickle was Rs.100/kg.
- Demonstration on fish processing and value addition revealed that fish processing increased the quality and self storage life of the fish with net return of Rs. 1271/- per quintal.
- Maize (*var.* HQPM-1, Vivek-9 and 17) gave an average yield of 15.68 q/ha.
- Five units of duck and 20 units of Vanraja under backyard have also been put under FLD.

**On Farm Trials (OFT)**

Six numbers of On Farm Trial (OFT) at farmer's field were conducted to assess and refine the selected technologies in agriculture and allied fields.

- Effect of organic manure on yield of Okra (Bhendi) revealed that the application of organic manures increased the plant height as well as yield as compared to farmers practice. Among the organics, goat manure at 75% of RDF significantly increased the yield to 12.8 kg/plot as compared to farmers practice (6.5kg/ plot).
- Introduction of Azolla and its productivity in farmer field as feed supplement for livestock experiment is in progress.
- Performance and evaluation of paddle and hand operated coconut dehusker revealed that the operators experienced higher bending stress in case of 'sabbal' followed by daw and hand operated dehusker. They felt more comfort in hand operated dehusker as compared to 'sabbal' as risk and drudgery involved was less. Most of the farmers liked pedal operated coconut dehusker, whereas farm women showed more interest to operate the hand operated dehusker.
- Assessment of chilli varieties with improved production technology indicated that the chilli cultivar LCA-334 showed maximum growth, yield attributes and produced maximum green chilli yield (81.96 q/ha) as compared to Kashi Anmol (35.00 q/ha) and Local cultivar (15.77 q/ha) respectively.

- Assessment of fish pickle preparation method revealed that new methodology was beneficial over the traditional method as the products could be stored for longer time and is found tastier. In traditional method they do not add vinegar and add less quantity of oil, garlic, ginger, moreover they add fresh fishes in the pickle without frying it. The cost of preparation, net return for fish pickle by traditional method and CIFT method was Rs.322.60 & Rs.52.40/-and 337.10 & 105.90/-respectively.
- Evaluation of solar tent dryer for fish showed that the fishes dried in the solar tent dryer are having high quality and faster rate of drying (3.6 kg) compared with the fish drying on rack (4.0 kg) and on ground (4.3 kg) at the end of 5$^{th}$ day. The situation presently makes the drying process economically not viable but with popularizing of this technology, the market rate of fishes can be reduced by increasing the fish landings and giving support to the fishers to meet out their protein requirement by utilizing the dried fishes during off season and any disaster.

## Extension activities

**Table 30: Summary of the extension activities**

| Extension Activities | No. | Farmers | | Extension Officials | | Total | | |
|---|---|---|---|---|---|---|---|---|
| | | M | F | M | F | M | F | Total |
| Field Day | 2 | 15 | 5 | 0 | 0 | 0 | 0 | 35 |
| Kisan Mela | 2 | 77 | 6 | 0 | 0 | 77 | 6 | 83 |
| Kisan Ghosthi | 1 | 20 | 30 | 0 | 0 | 0 | 0 | 50 |
| Group meetings | 5 | 127 | 35 | 0 | 0 | 127 | 35 | 162 |
| Lectures delivered as resource personnel | 105 | 1324 | 954 | 0 | 0 | 974 | 534 | 2978 |
| Newspaper coverage | 25 | – | – | – | – | – | – | 25 |
| Scientific visit to farmers field | 310 | 418 | 234 | 10 | 8 | 243 | 107 | 893 |
| Exposure visits | 2 | 45 | 3 | 0 | 0 | 45 | 3 | 48 |
| Animal health camp | 1 | 0 | 0 | 0 | 0 | 0 | 0 | 15 |
| **Total** | **453** | **2026** | **1267** | **10** | **8** | **1466** | **685** | **4289** |

M: Male; F: Female; T: Total

# TRIBAL SUB PLAN (TSP) ACTIVITIES

Under TSP empowerment of tribal 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.

To influence the benefit to tribal farmers through technological interventions and knowledge support, some of the location specific and need based livelihood options were identified as:

- To create awareness among the tribal community on various improved technologies and modern cultural practices in agriculture and allied sectors
- Special initiatives for integrated farming system
- Scientific cultivation of field and horticultural crops
- Scientific pig and poultry farming
- Modern fishing technologies
- Dissemination of technological interventions for improving production of pulse and maize crops through sensitization and awareness
- To create awareness on post-harvest processing and value addition of agricultural commodities

A total of 28 training programmes in the field of fisheries, horticulture, field crops, animal husbandry, post harvest, crop protection and value addition technologies for the benefit of the tribals in Nicobar District and Little Andaman were conducted by the Scientist of CARI and KVKs in collaboration with development departments, wherein a total of 1515 participated.

## Feedback from trainees

- Tribal farmers got awareness about improved cultivation, livestock farming technologies, modern fishing technologies, and scope of new technologies like protected cultivations options for livelihood & nutritional aspects of agricultural and horticultural crops.
- Showed interest on various know-how of cultivation of non-traditional and suitable crops like pulses and maize as a option for their food, nutritional security, soil health management and farming systems.
- Need inputs like planting materials/seeds etc.
- Need trainings on income generating agri business options like processing and value addition.
- Conduct of regular training programmes to update their agricultural knowledge was also told by them.

Beside, an exposure visit of 5 Tribal Captains from Nicobar to CPCRI, Kasargod & CTCRI, Thiruvananthapuram was executed to give them exposure on the coconut based farming system, suitable intercropping methods with crops like spices, pineapple and tuber crops along with value addition aspects, which can be adopted by the tribal farmers as better livelihood options.

**Glimpses of training in agriculture and allied fields under TSP**

# WOMEN'S PARTICIPATION: SC/ST

The 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 in all the three districts under the TSP, KVK, South and Nicobar and Out Reach Centre, Diglipur , North & Middle Andaman programmes.

The overall participation of the women has been 1929, of which 1063 (56%) constitute the clientele under ST and 866 (44%) belongs to other categories (Table 31).

**Table 31 : An overview of women participation in training on agriculture and allied fields in all three districts**

| Programme | Women's Participation | | |
|---|---|---|---|
| | ST | Other than SC/ST | Total |
| Under TSP | 439 | - | 439 |
| KVK, Nicobar | 624 | 336 | 960 |
| KVK,South Andaman | - | 441 | 441 |
| Out Reach Centre, Diglipur , North & Middle Andaman | - | 89 | 89 |
| **Total** | **1063 (56%)** | **866 (44%)** | **1929** |


# TECHNOLOGIES DEMONSTRATED & TRANSFERRED

- Broad Bed & Furrow system(BBF), Paddy-fish system, 3 tier farming, paired BBF, pond for fish culture, drip irrigation, integrated farming system and groundnut cultivation under coconut plantations technologies were transferred to farmers through demonstration under NAIP and FPARP.
- Demonstrated rain water harvesting structures for multiple use of water in tribal farmers' field.
- New high yielding varieties of poi (CARI Poi Selection) and Broad Dhaniya (CARI Broad Dhaniya) were demonstrated at farmer's field.
- Transferred four varieties of Noni (*Morinda citrifolia* L.) CARI Samridhi, CARI Sanjivini, CARI Sampada and CARI Rakshak) to Noni growers in South Andaman.
- Rain shelter cauliflower technology for rainy season was demonstrated at South Andaman.
- Raised bed technology for leafy vegetables (palak) for multi-cutting was transferred.
- Demonstrated organic ginger production under Coconut plantation in South Andaman.
- Demonstrated tuber crops production in South, North and Middle Andaman and Car Nicobar.
- Twenty quintal truthfully labelled seed of rice varieties were produced and distributed to farmers/ stakeholders.
- Fourty quintal truthfully labelled seed of 7 rice varieties were produced under Farmers participatory seed production at Diglipur.
- Fifty five kg Breeder seed of rice varieties were supplied to Directorate of Agriculture, A&N Administration for multiplication.
- Seed of the high yielding pulse varieties were provided for demonstration among the farmers of North & Middle Andaman, Little Andaman, South Andaman, Car Nicobar and Campbell Bay islands.
- 4500 seedlings and 425g seeds of CARI Brinjal1 were provided for demonstration to the farmers of South, North & Middle Andaman and Nicobar district.
- IPM modules have been developed for the successful management of okra fruit and shoot borer and cucurbit fruit fly.
- Technology on rodent management in paddy was demonstrated in farmer's field of South and North Andaman and transferred.
- Demonstrated quality protein maize hybrid (HQPM-1) at Car Nicobar, maize hybrid ( DHM117) and baby corn hybrid (HM4) at South Andaman.
- Transferred technology on improved Nicobari crosses for backyard farming.
- Transferred potential fishing zone advisories and validation for increased fish catch and reduced scouting time.
- Peking cross duck under backyard at Diglipur, North & Middle Andaman were transferred.
- Satellite Nursery for fresh water fishes at Diglipur, North & Middle Andaman were demonstrated.

# INFORMATION ON OTHER SECTIONS

## 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 28th to 30th June and 11th July, 2012 in the presence of four eminent Scientist Dr. S.D. Tripathi, Former Director, CIFA & CIFE, Mumbai (as an Expert in the Fisheries), Dr. C.L. Acharya, Former Director Extension Education (HPAU, Palampur) & Indian Institute of Soil Science(ICAR),Bhopal (as an Expert in Soil Science), Dr. R.K. Singh, Ex-Director (Research), NDUAT, Faizabad (as an Expert in the Field Crops) and Dr. W.S. Dhillon, Director,Punjab Horticultural Post Harvest Technology Centre, PAU Campus, Ludhiana (as an Expert in Post Harvest & IFS) with an objective to give first hand information and orientation to the fellow scientist on the field experiments conducted. Fifty two ongoing projects and nine new projects totalling to sixty one were presented by the Scientists.


Also coordinated submission of online HYPM & 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. It has coordinated the publishing of research articles, technical bulletins, folders, books, newsletter, farmer's data base, proceedings of the workshop, symposium and seminars in time frame. Showcasing of activities and achievement of the institute both at Island and National level has been done successfully. Database of the Institute and External funded projects from 2000 - 2012 has been made, along with coding of 149 institute projects for the first time. 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 serves to fulfill 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. Internet services via VSAT connection are also available for easy access to this information. The library has been enriched with 6573 books, 2520 miscellaneous publications in addition to journals by subscription, gratis, on exchange basis and technical books. During the report year 432 books were procured, 61 Indian journals subscribed and recent advances and methods

of different subjects comprising 27 volumes were added. Gratis publications such as Annual Report, Newsletter and Research Bulletin received from India and Foreign Institutes as exchange relationship is also maintained. Special collection of island related books, hindi 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.

### Hindi Cell

For the successful implementation of the official language policy and the target fixed in the annual programme, efforts were made for doing maximum work in official language.

- During Hindi Fortnight in September (11 September–09 October, 2012) various programme for scientist/technical and administrative staff and farm ladies were organized to bring awareness about the importance of increasing use of hindi.
- Article 3(3) is being followed in *toto* in institute. All administrative meeting are being conducted in hindi.
- For the extension of new technologies developed by the institute, All India Radio Doordarshan, Port Blair has broadcasted/telecast agricultural article/programme for the island farmers.
- Achieved the targets of using hindi fully in the field of transfer of technology.
- Half yearly meeting of Town official language implementation committee was conducted on 02.08.2012 and 28.12.2012 respectively.

Joint Hindi Workshop (TOLIC)

- Quarterly meeting of official language implementation committee was conducted.
- 15 days Hindi Workshop was conducted for non-hindi speaking Scientific/Technical staff from 11.09.2012 to increase the strength of the staff in implementation of official language and to bring awareness about the importance of increasing use of hindi in official dealings.
- One day Rajbhasha seminar was conducted on 25th September, 2012.

Rajbhasha seminar

- One day Joint Hindi Workshop of Town official language implementation committee, Port Blair, was conducted on 01st February, 2013. Altogether 40 participants from various offices attended.

TOLIC Half Yearly Meeting

## 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 Nicobar Islands, India. It provides computational support and training to the scientists and students & also offers traineeships and studentships to deserving bioinformatics students. The databases on butterfly, horticultural biodiversity, coral & sponges were developed using ASP.Net and MS SQL, which provides information on all bioresources available in the island. This database is user friendly and provides all the information about butterflies to the end user like researcher, academician and development departments.

## Post Graduate Students Cell (PG Cell)

PG Cell has been established to facilitate the post graduate research work undertaken at CARI in collaboration with the other research Institutes. A total of five students have registered for undertaking M.Sc dissertation for duration from 3-6 months. In addition six students were also registered to undergo implant training for a period of one month from SRM University and Kalsalingam University, Tamil Nadu.

| Name of Scientist | Name of Student | Title of the Thesis |
|---|---|---|
| Dr. M. Sankaran | Mr. Manikandan, Barthidashan University, Trichy, Tamil Nadu | Biochemical & molecular characterization of coconut with respect to leaf spot disease |
| | Ms.Divya, MSc (Plant Biotechnology), Bharathidasan University, Trichy, Tamil Nadu | Genetic diversity analysis in *Jatropha curcus* L. by using the RAPD markers |
| Dr. K. Abirami | Mr. Gopinath, Barthidashan University, Trichy, Tamil Nadu | Studies on micropropagation, phytochemical and antifungal – activity of *Costus cuspidatus* in A & N Islands |
| Dr. Shrawan Singh | Mr. R. Karthikeyan, Barthidashan University, Trichy, Tamil Nadu | Diversity analysis in drumstick (*Moringa oleifera*) germplasm in Andaman and Nicobar Islands using RAPD markers and phytochemicals |
| Dr. Krishna Kumar | Mr. K. Manigundan, M. Sc.( Biotechnology), Bharathiar University, Tamil Nadu | Characterization of salt tolerant multi functional *Trichoderma sp.* for plant growth promotion in Okra |
| Mr. K. Sakthivel | Mr. Murugesan K, M. Sc. (Biotechnology) Bharathiar University, Tamil Nadu | Characterization of solanaceous bacterial pathogen *(Ralstonia solanacearum*) and biocontrol agents isolated from Andaman & Nicobar Islands |

# AWARDS AND RECOGNITION

| Scientist | Award / Recognition | Awarding Agency/ Organization Society |
|---|---|---|
| D.R.Singh, Shrawan Singh, Jai Sunder and Subhash Chand | Fakhruddin Ali Ahmed Award | ICAR, Ministry of Agriculture, Govt. of India, New Delhi on 16th July, 2012 |
| D. R. Singh, K. Abirami & Shajeeda Banu | Best Poster Award | National Seminar on Innovative Technologies for Conservation and Sustainable Utilization of Island Biodiversity – 2012 held at Port Blair from 20th to 22nd Dec., 2012 |
| K. Abirami, Priya Alphonso, Da'Costa Brian | Best Poster Award | |
| Krishna Kumar | Best Poster Presentation Award | |
| K. Deva Kumar & R.K.Gautam | Best Poster Presentation Award | |
| B. K. Nanda, Nagesh Ram, L.B.Singh, N.C.Choudhuri, N.Bommayasamy,A.K . Singh, S. Dam Roy and A. K. Singh | Poster Award | |
| N. Bommayasamy, Nagesh Ram, L.B. Singh, N.C. Choudhuri, Subhash Chand and A.K. Singh | Poster Award | |
| T.Sujatha, A.Kundu and M.S.Kundu | Best Poster Presentation Award | |
| M.Sankaran | Chairman, Best Farmer Award Selection Committee during ITF – 2013 | A &N Administration, GOI |
| | Judge, Judging Committee for Coconut show | Directorate of Agriculture, A&N Administration, 2012 |
| | Peer Reviewer | Indian Journal of Horticulture & Indian Journal of Agricultural Sciences (ICAR) |
| P. Krishnan | Co-Chairman | Technical Session of Global Symposium on Aquatic Resources for Eradicating Hunger and Malnutrition – Opportunities and Challenges organized by Asian Fisheries Society-Indian Branch from 4th – 6th Dec., 2012 at Mangalore |
| | Expert | To review the e-course for Biotechnology and Bioinformatics under the ICAR-NAIP's – Development of e-courses for B.F.Sc. degree programme |
| Naresh Kumar | Excellence in Academics for standing third in PhD program in all disciplines | College of Agriculture, CCSHAU, Hisar on the occasion of Golden Jubilee celebrations on 29th Aug., 2012 |

| Scientist | Award / Recognition | Awarding Agency/ Organization Society |
|---|---|---|
| T.Sujatha | Gold Medal for Best PhD thesis in Poultry Science | M/s Venkys (India) Ltd- 2012 by TANUVAS |
| | Gold Medal for Best PhD student in Avian studies | SKM Animal Feeds and Foods (India) Ltd by TANUVAS |
| A.K.De | ICAR International 2011-12 Fellowship for PhD in foreign country | Illinois University, USA |
| | Best Research Paper Award | SADHNA 2012 |
| | Young Achiever Award for outstanding contribution to the society especially in the field of farming/agriculture | Society for Advancement of Human and Nature (SADHNA) and Dr. YS Parmar University of Horticulture and Forestry, Nauni, Solan, Himachal Pradesh |
| Grinson George | Dr. I. Karunasagar Award for Best PhD thesis | PFGF |

# ON GOING RESEARCH PROJECTS

## External Funded

| Title | Principal Investigator | Budget (lakhs) | Year of Start | Year of Completion |
|---|---|---|---|---|
| **NMPB** | | | | |
| Technological innovations for commercial exploitation of *Morinda citrifolia* as livelihood option for island farmers | D. R. Singh | 246.00 | 2008 | 2013 |
| **NOVOD** | | | | |
| Germplasm collection, evaluation and identification of high yielding genotypes of Jatropha and Karanja and their multiplication in bay Islands | M. Sankaran | 20.00 | 2008 | 2013 |
| **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 |
| **ICAR** | | | | |
| AICRP on vegetable crop | Shrawan Singh | - | 2008 | Continued |
| AICRP on tuber crops | M. Sankaran | - | 2008 | Continued |
| Sero-surveillance of FMD in Andaman and Nicobar Islands | Jai Sunder | 6.50 | 2011 | Continued |
| AICRP on integrated farming system | T.P.Swarnam | 85.0 | 2010 | 2017 |
| Post award project for tribal farming system | D. R. Singh | 1.0 | 2013 | 2014 |
| National initiative on climate resilient agriculture | Nagesh Ram | 30.35 | 2010 | 2013 |
| Promotion and exploitation of neglected and underutilized agriculturally important genetic resource of bay Islands | T.V.R.S. Sharma (Emeritus Scientist) | - | 2011 | Continued |
| ICAR seed project for agricultural crops | P.K. Singh | 39.72 | 2007 | Continued |
| Monitoring of pesticide residues at National level | Krishna Kumar | 21.5 | 2010 | 2013 |
| All India network project on rodent control | Ajanta Birah | 8.31 | 2009 | 2013 |
| Exploration of plant pathogenic and antagonistic microbial resources associated with vegetable and spice crops of Andaman and Nicobar Islands | Krishna Kumar | 35.15 | 2006 | 2013 |
| **NHM** | | | | |
| Centrally sponsored scheme for integrated development of spices | M. Sankaran | 5.79 | 2004 | Continued |
| **DST (Women Scientist Scheme)** | | | | |
| Isolation, identification and characterization of marine actinomycetes from Andaman coasts | Sumitha Gopalakrishnan/ Jai Sunder (Mentor) | 11.8 | 2009 | 2013 |

| Title | Principal Investigator | Budget (lakhs) | Year of Start | Year of Completion |
|---|---|---|---|---|
| **NABARD** | | | | |
| Establishment of Out Reach Centre at Diglipur, North & Middle Andaman District | S.Dam Roy (PL)/ S.K. Zamir Ahmed | 79.69 | 2009 | 2015 |
| Sustainable rural livelihood through improved rural poultry farming techniques in Andaman Islands | T.Sujatha | 8.99 | 2013 | 2016 |
| **INCOIS** | | | | |
| Potential fishing zone validation in Andaman sea | Grinson George | 34.0 | 2008 | 2012 |
| **NRSC** | | | | |
| Impact of climate change on coral reefs of Andaman sea | R. Kiruba Sankar | 11.55 | 2010 | 2013 |
| **DBT** | | | | |
| Cataloguing and conservation of marine sponges from Andaman through DNA barcoding | S. Dam Roy | 33.82 | 2010 | 2013 |
| Establishment of SUB-DIC | M.Sankaran | 75.00 | 2012 | 2017 |
| Marker assisted introgression of bacterial blight resistance in popular rice cultivars of Andaman & Nicobar Islands | R. K. Gautam | 68.00 | 2013 | 2017 |
| **CMLRE** | | | | |
| Marine faunal biodiversity of the Nicobar group of Islands | R. Kiruba Sankar | 75.6 | 2012 | 2017 |
| **NAIP** | | | | |
| Strategies for sustainable management of degraded land and water for enhancing livelihood in coastal area | A. Velmurugan | 278.26 | 2009 | 2014 |
| **Ministry of Water Resources (MoWR)** | | | | |
| Farmers participatory action research programme-II | T. Subramani | 50.0 | 2011 | 2012 |
| **IMD, Ministry of Earth Sciences (MoES)** | | | | |
| Integrated agromet advisory services (IAAS - AAB) | A. Velmurugan | 60.0 | 2008 | 2017 |
| **DAC , Ministry of Agriculture** | | | | |
| FASAL (Forecasting Agricultural output using Space, Agro-meteorology and Land based observations) | A. Velmurugan | 17.0 | 2011 | 2017 |
| **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 |
| **Coconut Development Board** | | | | |
| Production of disease free elite planting material for improving the productivity of coconut in Bay Islands | Krishna Kumar | 20.00 | 2010 | 2013 |
| **IRRI, Philippines** | | | | |
| Stress tolerant rice for Africa and South Asia | R..K. Gautam | 7.50 | 2011 | 2015 |

## Institute Funded

| Division/Section | Project Title | PI | CO-PIs |
|---|---|---|---|
| Natural Resource Management | Water and nutrient management in capsicum through drip system under protected cultivation | A. Velmurugan | T. Subramani |
| | Post harvest management of rice and pulses in the islands | S. Swain | P. K Singh |
| | Post harvest management and value addition of spices in the island | | Shrawan Singh and Jai Sunder |
| Horticulture & Forestry | Development of dwarf and high yielding varieties in coconut for A & N Islands | M. Sankaran | V. Damodaran, K. Abirami and P.K.Singh |
| | Characterization and standardization of agro techniques for fruit crops in A & N Islands | Dipak Nayak | Shrawan Singh, D.R. Singh and M. Sankaran |
| | Collection, bioprospecting and documentation of perennial vegetables of A & N islands | Shrawan Singh | D.R.Singh, Dipak Nayak and Viveka N and Singh |
| | Development of production technologies for ornamental crops in bay islands | V. Baskaran | A. Velumurgan, K. Abirami and D.R. Singh |
| | Collection and evaluation of medicinal plants of bay islands | K. Abirami | D.R. Singh, V. Baskaran and V. Damodaran |
| Field Crops | Molecular tagging of biotic stress resistance in rice (*Oryza sativa* L.) | Naresh Kumar | P.K. Singh, Krishna Kumar and Ajanta Birah |
| | Development of biotic stress resistant lines in brinjal (*Solanum melongona* L.) | | P.K. Singh, Sharwan Singh, Krishna Kumar and Ajanta Birah |
| | Genetic improvement of long duration rice for Andaman and Nicobar islands | P. K. Singh | Krishna Kumar and Ajanta Birah |
| | Genetic improvement of pulses for Andaman and Nicobar islands conditions | Awnindra Kumar Singh | Naresh Kumar, P. K. Singh and R. K. Gautam |
| | Survey, propagation and molecular characterization of soft endosperm (macapuno) contents in bay islands | K. Devakumar | R. K. Gautam |
| | Augmenting rice productivity through varietal purification of popular land races | R.K. Gautam | P.K. Singh, S.K. Zamir Ahmed and K. Devakumar |
| | Induction of systemic resistance by application of potential bio control agents on solanaceous vegetable crops against Bacterial wilt | Krishna Kumar | K. Sakthivel |

| Division/Section | Project Title | PI | CO-PIs |
|---|---|---|---|
| Animal Science | Dietary supplementation of micronutrient to improve the productivity of livestock | M.S. Kundu | S. Jeyakumar, Jai Sunder, A. Kundu and Arun Kumar De |
| | Development of therapeutics & supplements by using indigenous herbs and beneficial microorganisms for livestock health and production | Jai Sunder | S. Jeyakumar, M.S. Kundu and A. Kundu |
| | Development of designer egg and meat | T. Sujatha | A. Kundu and M.S. Kundu |
| | Conservation, improvement and propagation of Nicobari fowl through selection | A. Kundu | T. Sujatha, Arun De, Z.George, N.C. Choudhuri |
| Fisheries Science | Self recruiting species diversity in aquatic systems of Andaman | R. Kiruba Sankar | Nagesh Ram |
| Social Science Section | Determination of carrying capacity of islands and its potential for organic farming | Ajmer Singh | Shrawan Singh |
| | Demand and supply analysis of livestock products in Andaman's | | S. K. Zamir Ahmed and Nagesh Ram |
| | Development of database on biodiversity of horticultural crops in Andaman & Nicobar islands | M. Sankaran | ---- |
| | Natural resources degradation, socio economic impact and leased farming | Subhash Chand | T. Subramani and L.B. Singh |
| | Impact assessment of technological interventions in Andaman | S.K. Zamir Ahmed | Ajmer Singh and Nagesh Ram |

# Publication

## Research Article


Abirami, K., Sharma Anjali, Samanta Jatindra Nath, Rana,V.S. and Mandal Kunal (2012). Morphological, anatomical and molecular investigation into Witches' Broom disease of Mamejvo (*Enicostemma axillare*). *Phyto-parasitica,* 40(5):445-450.

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## Books / Book Chapters/ Bulletins/ Folders /Training Manual/ Database/Proceedings

### Books

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## Training Manual

Kundu, M.S., Kundu, A., Sunder Jai, Sujatha, T., De, A.K., Dam Roy, S. and George Z. (2012). Training manual on scientific pig farming. CARI, Port Blair. pp 1 - 53.

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## Database Developed

Ahmed Zamir, S.K., Srivastava Amit and Saha Rina (2013). Database of the Institute and External funded projects (2000 -2012). CARI, Port Blair.

## Proceedings/ Abstract Book

Dam Roy, S., Krishnan, P., Kiruba Sankar, R., Ravikumar, T. and Ram Nagesh (2012). Proceedings of consultation on revitalizing Andaman and Nicobar tribal fishers through fish harvest and post harvest technologies (CRAFT), 06$^{th}$ -16$^{th}$ Oct 2012. CARI, Port Blair. pp 1- 12.

Krishnan, P., George Grinson and Kiruba Sankar, R. (2012). Proceedings of FISH- First interface meeting for synergetic harvest - revitalizing island fisheries. 10$^{th}$ May 2012. CARI, Port Blair. pp 1-14.

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Sunder Jai, De, A.K., Kundu, A., Sharma, R., pattnaik, B., Dam Roy, S. (2012). Proceedings on one day sensitization programme on Status and control of Food and Mouth Disease in A & N Islands. pp 1-42.

**In addition to above 78 papers were presented in the Conference/Symposium/Workshop.**

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

## Dr. Sibnarayan Dam Roy new Director for CARI, Port Blair

Dr. S. Dam Roy has taken over the charge of Director of the Institute on 18th August, 2012. Earlier he has worked in various capacities and places beginning with 1984 to 1989 in Department of Fisheries, Arunachal Pradesh. After being selected in Agricultural Research Services (ARS) and undergoing training at NAARM, Hyderabad and attachment at Central Institute of Fisheries Education (CIFE), Mumbai, he joined Central Agricultural Research Institute, Port Blair in 1990 as Scientist, wherein he has put up two decades of meritorious service in various capacities like Senior Scientist, Principal Scientist and Head of Division etc. He has also worked as Director of Fisheries in A & N Administration for a period of one year (1999-2000) on deputation. From June, 2010, he was working as Head of the Division, Aquaculture at Central Institute of Fisheries Education, Mumbai. He has got to his credit many National awards and research papers published in National and International journals.

## Award

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

- **Rajshri Tandon Rajbhasha Award** for the year 2011-12 by ICAR, New Delhi on 19th March, 2013 in recognition of work done for implementation of Official language.
- The Institute has been awarded with a trophy in recognition of significant work done in Hindi and also awarded first prize for bringing out a Hindi magazine named Krishika by **Raj Bhasha Karyanavyan evam Prashikshan Mission (RAKAMI), New Delhi** on 16th February, 2013 at Port Blair.
- **Karayalay Dweep Smriti Chinah** for better implementation of Rajbhasha on official uses by Rajbhasha Sansthan, New Delhi on 24th April, 2012 at Solan.
- As Chairman of Town Official Language Implementation Committee **(TOLIC),** Port Blair has been awarded IIIrd prize (2011-2012) by Govt. of India, Home Ministry, Deptt. of Official Language, for best implementation of Official language policy in Andaman and Nicobar Islands.

## Special deliberations

- Role of CARI in agricultural development in A & N Islands in All India Radio, Port Blair on 26th November 2012.
- Central Agricultural Research Institute and its perspective for XII– Five Year Plan in Door Darshan, Port Blair on 28th November 2012.
- Climate change vis-à-vis impact on island during the winter school organized by CIFE, Mumbai on 30th November 2012.
- Fisheries Education, Research & Developments in the Global Alumni Meet organized by Asian Society, Indian Branch at Mangalore, on 1st December, 2012.
- Fisheries sector of Andaman & Nicobar Islands in the Global Television at Mangalore, on 4th December 2012.
- Aquatic environment & health management with special reference to island fisheries – A case from Andaman, during the Centenary celebration of Indian Science Congress at Kolkata on 5th January, 2013.
- Establishment of Quarantine and Bio-security in Andaman & Nicobar Islands at NASC, New Delhi on 12th March, 2013.

## Invited paper

- **S. Dam Roy,** and D.R. Singh, (2012). Climate changes resilient horticulture : Exploring adaptation and mitigation strategies for Andaman & Nicobar Islands during 25-27 May, 2012 at BAU, Bhagalpur, Bihar.
- D.R.Singh, M.Sankaran and **S.Dam Roy (**2012). Horticultural and fisheries biodiversity in Bay islands and strategies for their conservation, during National Seminar on Innovative Technologies for conservation and sustainable utilization of Island biodiversity, during 21-22nd December, at CARI, Port Blair.
- M.Sankaran, V.Damodaran, D.R.Singh and S. **Dam Roy** (2013). Biodiversity of Coconut for livelihood opportunity of Bay Island farmers, during the Science Communicator's meet, held on the occasion of 100th ISCA meeting at Kolkata.

## 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 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' of A&N Islands.
- 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 Andaman & Nicobar Coconut Mission
- Member, UT level Task Force Committee for A & N Islands.
- Member, Agriculture Technology Management Agency Governing Body of A & N Islands.
- Member, Purchase Committee of the revised package for Tsunami Rehabilitation for Livestock & Poultry under Animal Husbandry sector of A & N Islands.
- Member of 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.
- अध्यक्ष, नगर राजभाषा कार्यान्वयन समिति, पोर्ट ब्लेयर

## Participation in important meeting, symposium and workshop

- Knowledge Meet with the Vice Chancellors/ Directors of ICAR Institutes held at NASC Complex, New Delhi from 21 to 22nd August, 2012.

- 39th Foundation Day of Agricultural Scientists Recruitment Board at Delhi on 1st Nov. 2012.
- Special Consultation meeting at NAARM, Hyderabad on 15th Nov. 2012.
- National training on Research Strategies of Mitigation & Impact of Climate Change on Fisheries at CIFE, Mumbai on 1st Dec. 2012.
- Global Symposium, organized by Asian Fisheries Society, Indian Branch, Mangalore on 2nd to 4th Dec. 2012.
- Meeting on Quarantine requirement for plant and animals at A & N Islands at NBPGR, New Delhi on 4-5th Dec.2012.
- Indian Science Congress held at Salt Lake, Kolkata from 4th & 5th Jan. 2013.
- RFD meeting at ICAR, New Delhi on 16th Jan. 2013.
- Workshop on Prospectus of fish culture in Sunderbans and Inaugural function of Pillai Aquaculture Foundation at CIFRI, Barrackpore from 8th to 9th Feb, 2013.
- Head of Divisions meeting alongwith the Directors of other Institutes. A consultative meeting on establishment of quarantine facility at A & N Islands from 12th and 13th March 2013.
- Director's Conference held at ICAR, New Delhi from 19th and 20th March 2012.

## Management & Guidance of Research, Development and Extension (RDE)

### Research:

**Thrust areas for XII Plan has been budget under the following programmes:**

- Characterization of bio-prospecting of natural island bio-resources.
- Climate proofing island agriculture for productivity.
- Development of harvest-post harvest management practices and value addition.
- Policy support research for integrated island agriculture.

### Flagship programme

- For the first time a flagship programme entitled **"Integrated Agriculture System for Tropical Island"** has been launched for 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.

### Five sponsored research programmes have been initiated viz.

- Development of suitable pre- and post- harvest technologies to increase the shelf life of *Morinda citrifolia :* WNRF: Rs. 12.95 lakhs.
- Post award project for tribal farming system: ICAR: Rs. 1.0 lakhs.
- Sustainable Rural Livelihood through improved rural poultry farming techniques in Andaman Islands. NABARD, Port Blair : Rs. 8.99 lakhs.
- Marine Faunal Biodiversity of the Nicobar Group of Islands. CMLRE : 75.6 lakhs.
- Base line survey to ascertain the present status of chemical residues in soil, water and agricultural products and its regular monitoring. RKVY, A & N Administration: 26.0 lakhs.

### Significant achievement

- Two varieties of Rice CARI Dhan 6 and CARI Dhan 7 , four varieties of coconut viz., CARI C 1 (CARI Annapurna), CARI C 2 (CARI Surya), CARI C 3 (CARI Omkar) & CARI C 4 (CARI Chandan), two varieties of sweet potato viz., CARI SP 1 (CARI Swarna) & CARI SP 2 (CARI Aparna), four variety of *Morinda citrifolia* CARI Sampada, CARI Sanjivini, CARI Samridhi & CARI Rakshak and one variety of Poi (*Basella alba*) namely CARI Poi 1 were recommended for release by the State Seed Sub Committee on Agriculture & Horticulture Crops in A & N Islands.

- 238 germplasm of indigenous and exotic-horticultural crops namely in Fruits (53), Vegetables(77), Flowers(03), Tuber crops (33), Plantation crops (36) and Medicinal plants (36) is maintained.
- 80 Dahi nariyal nuts (Coconut) were collected and their embryo extracted and cultured.
- Six new records of marine sponges namely *Axinella minor* Thomas, 1981, *Xestospongia viridenigra* (Vacelet, Vasseur & Levi, 1976), *Clathria* (Isociella) *eccentrica* (Burton, 1934), *Hemiasterella bouilloni* (Thomas, 1973), *Petrosia nigricans* Lindgren, 1987 & *Spheciospongia andamanesis* (Pattanayak, 2006) of the island were reported.
- Four tons paddy seeds of promising varieties were produced at farmer's field beside 250 kg of Breeder seeds at Bloomsdale farm to address to the demand of the stakeholders.
- 70 trichoderma isolates screened for stress tolerance revealed that 92.8% of the trichoderma isolates were able to tolerate 5% NaCl, whereas only 45.7 % isolates tolerated 10% of NaCl concentration.
- Database on Research Projects of CARI from 2000 to 2012 has been developed.
- Teresa Goat, Nicobari fowl and Nicobari Pig were added under Germplasm conservation.

## Development activities initiated

**Establishment of Composite Bio-Security Laboratory**.

- Islands are known for floral & faunal biodiversity particularly so for its specific ecology namely mangrove, coral and marine. Situated 1200 km away from the mainland, it is free from many dreadful diseases. However due to advent of many invasive flora and fauna from mainland through the airport and seaport, there are chances of spread of disease in these Islands. Hence it is felt to have a Bio-security and quarantine facility in these islands for plant, animal and fishes. A provision of 40 crore has been kept for establishment of such facility in A & N Islands by this Institute.

**Infrastructure created**

| | |
|---|---|
| Vegetable experimental block | 0.75 ha |
| Dwarf coconut block | 1.5 ha |
| Floriculture block | 0.1 ha |
| Medicinal plants | 0.025 ha |
| Noni variety block | 1.0 ha |
| Temporary rain shelters | 4 Nos. |
| Temporary rain shelters | 0.03 ha |

- Besides, it is planned to develop Island biodiversity park, Techno park, Laboratory animal shed, Modern Hatchery cum Incubator building, laying of seawater inlet and distribution lines & brooders maintenance tank.

## Transfer of Technology for Stakeholders

- Twenty one hectare of coastal degraded land have been brought under crop cultivation and fish farming in South, Middle & North Andaman by Land improvement methods under NAIP.
- One Krishi Vigyan Kendra under the administrative control of CARI has started functioning at Nimbudera for transfer of technologies in agriculture and allied fields to farmers and the stakeholders of North and Middle Andaman District.
- Through PFZ forecasts 34.35% increase in CPUE (Catch per unit effort) and reduction in scouting time for fishing grounds by 50% was reported, beside a net profit of Rs. 45,000 while it was 16,000 in non PFZ, which is 2.8 times higher than non PFZ.
- Mini Dal Mill was operationalized and Satellite fish nursery for fresh water fish introduced at Diglipur as one of the technological intervention to support livelihood of the SHG's and other stakeholders.
- Seed village production of HYV of paddy was conducted in an area of 4.13 ha in participatory mode. Around 10 tons of truthfully labeled seed

was produced and four tons were taken in buyback system.

- The rodent infestation in paddy fields ranged from 3.66 to 22.50% in South and North Andaman. The trapped rodent specimens were identified as *Rattus rattus*.
- To meet the need of the quality fresh water fish seeds community based nurseries rearing system was introduced successfully under satellites system in South and N& M Andaman district in collaboration with Department of Fisheries, A& N Admn.
- 72 training programmes covering 1880 beneficiaries for upgrading knowledge and skill, beside technology demonstration in agriculture and allied fields in participatory mode for adoption were conducted by the extension arm of the institute i.e. KVK South, Car Nicobar and ORC, Diglipur.
- Peking cross ducks under backyard have been popularized by ORC and there is spread of technology to twenty farmers from one at Diglipur.
- Issued 70 numbers of Agromet advisories in agriculture and allied field for Andaman and Nicobar districts through Electronic, print media, KVK and RKC for the stakeholders.

### Tribal Sub-Plan

- Special focus has been given under Tribal Sub Plan by organizing 28 training programme in fisheries, horticulture, field crops, animal husbandry, post harvest, crop protection and value addition technologies for the benefit of the tribals in Nicobar District and Little Andaman, wherein 1515 participated.
- Exposure visit of 5 Tribal Captains from Nicobar to CPCRI, Kasargod & CTCRI, Thiruvananthapuram was executed.

### Resource generation:

- An amount of Rs. 124.54 lakh from externally funded projects were approved during the period which is funded by different funding agencies like World Noni Research Foundation, ICAR, NABARD, Port Blair, CLMRE, RKVY, A & N Administration etc.,
- A record revenue of Rs. 2,59,186/- was obtained from Garacharma farm, which is an increase of 70% from the previous year. Similarly from the Guest House 17 % increase revenue was obtained than previous year.
- Revenue or Rs. 66.12 lakh was generated against the target of 30 lakh.

### Budget utilization:

- Out of allotted 500 lakh, 499.52 lakh has been spent accounting to 99.90% of fund utilization.

### 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 and Scientists concerned. Conducting visit to experimental plots, visiting farmer's field and getting their feedback. Attending most of the functions conducted by all the three KVK's of CARI and ORC.
- Facilitating the conduct of QRT, RAC, IRC meetings and taking their feedback into cognizance & action taken report are carried.
- To sensitize our research priorities and strengthen the coordination with the other R & D institution a series of important events such as *viz.,* Agriculture Education Day, Consultation on Revitalizing Andaman & Nicobar Tribal Fisheries through Fish Harvest / Post-harvest Technologies, Sensitization on Foot and Mouth Disease, ICAR Industry day, Reconstitution of Andaman Science Association, Group discussion on Animal Science Research for XII Plan, National Seminar on Innovative Technologies for conservation and sustainable utilization of Island Biodiversity and Town Official Language Implementation Committee (TOLIC) meeting were conducted for the benefit of the stakeholders.

- Indian Science Congress Association (ISCA) on its centenary year have recognized CARI as Andaman Chapter.
- CARI participated in both National and Island level exhibition/mela by putting up a stall to showcase its technologies in Agri, Horti., Fish, Livestock and other priority programmes during Khudiram Bose Mela at Diglipur, XI Agricultural Science Congress at Bhubaneswar, BNPIC at Hut Bay & Nancowry, Vikas Mela at Diglipur and Subhash Mela at Neil island.
- In addition Island Kisan Mela with theme "Integrated farming system for livelihood security" on 12th Feb. 2013 and Farm Innovators Meet on 13th Feb. 2013 was conducted wherein more than 1500 representing South, Middle & North Andaman and Nicobar District participated.

# PARTICIPATION OF SCIENTISTS IN CONFERENCES / SEMINARS/ SYMPOSIA /WORKSHOP/TRAINING

| Scientist | Programme | Venue | Date/Duration |
|---|---|---|---|
| Subhash Chand | Technical and financial evaluation of research project by Commission for Agriculture Costs and Price (CACP) | Krishi Bhavan, New Delhi, | 15th Feb., 2012 |
| S.K. Zamir Ahmed | International Women's Day | A&N Cooperative Bank, Port Blair | 9th March, 2012 |
| R.K. Gautam, Krishna Kumar and P.K. Singh | 47th Annual Rice Group Meeting | DRR, Hyderabad | 5th - 10th April, 2012 |
| Nagesh Ram | Zonal Workshop for KVKs Zone-II | BCKV, West Bengal | 16th - 18th April, 2012 |
| Naresh Kumar | 55th Annual Maize Workshop | CCSHAU, Hisar | 20th - 22nd April, 2012 |
| Ajmer Singh | गहन हिंदी कार्यशाला | New Delhi | 22nd - 26th April, 2012 |
| S.K. Zamir Ahmed, Nagesh Ram S.Swain and L.B.Singh | Global Conference on Horticulture for Food, Nutrition and Livelihood Options | Bhubaneswar, Odisha | 28th - 31st May, 2012 |
| Subhash Chand | Training workshop on technology forecasting methods with application in agriculture under the aegis of sub programme on technology forecasting | IASRI, New Delhi | 6th - 15th June, 2012 |
| M. Sankaran | Annual Group meeting of AICRP on Tuber Crops | MPUAT, Udaipur | 18th - 20th June, 2012 |
| M. Sankaran | Annual Group meeting of AICRP on Palms | AC&RI, Madurai | 11th - 13th July, 2012 |
| M. Sankaran | Annual Group meeting of NHM on Spices | UAS, Bangalore | 18th - 20th July, 2012 |
| P.K.Singh | Annual Review Meeting of ICAR Seed Project | NAAS, New Delhi | 25th - 26th July, 2012 |
| S.K. Zamir Ahmed | Institutional Innovations in Agri-Extension for Inclusive growth | NAARM, Hyderabad | 1st - 7th Aug., 2012 |
| A.K.Singh | Science Administration and Research Management | ASCI, Hyderabad | 15th - 17th Aug., 2012 |
| A.K. De | Hands on training on mPCR for diagnosis for FMD | PD FMD, Mukteshwar | 19th - 25th Aug., 2012 |
| A.K.Singh | Annual Workshop on Rabi MULLaRP | IIPR, Kanpur | 6th - 8th Sep., 2012 |
| M.S.Kundu | Advances in Clinical Medicine and Surgery | Patna | 9th - 22nd , Sept., 2012 |
| K.Abirami | International Conference on Agriculture and Horticultural Sciences | International Convention Centre, Hyderabad | 14th - 15th Sept., 2012 |
| M. Sankaran | Training on E-learning, Germplasm Conservation, Climate Change & Mitigation Strategies | CTCRI, Sreekariyam | 24th - 27th Sept., 2012 |
| R.Sudha | Short course on Advances in Gene Identification and Marker Development | NRCB, Trichy | 1st - 10th Oct., 2012 |

| | | | |
|---|---|---|---|
| Ajmer Singh | Recent Advances in Sample Survey Techniques and Analysis of Survey Data | IASRI, New Delhi | 3rd - 23rd Oct., 2012 |
| S.Swain | Engineering Interventions and Innovations for Opportunities and Challenges in Indian Agriculture | PAU, Ludhiana | 4th - 6th Oct, 2012 |
| A.Kundu | MDP on Leadership Development | NAARM,Hyderabad | 8th - 19th Oct., 2012 |
| R.K. Gautam | Management Development Programme for Leadership Development | NAARM, Hyderabad | 8th - 19th Oct., 2012 |
| P. Krishnan | National Brainstorming on Barcoding | CIFE, Mumbai | 26th Oct., 2012 |
| Ajanta Birah | Science Administration and Research Management | ASCI, Hyderabad | 29th Oct. - 9th Nov., 2012 |
| M. Sankaran | A Meeting on Status of State Wildlife | Raj Niwas, Port Blair | 7th Nov., 2012 |
| M. Sankaran | A Meeting on National Mission for Food Processing | A & N Admn., Port Blair | 9th Nov., 2012 |
| Kiruba Sankar, R | CAFT training on Research strategies for mitigation of climate change in fisheries | CIFE, Mumbai | 15th Nov. - 5th Dec., 2012 |
| T. P. Swarnam | Biennial workshop of AICRP on Integrated Farming Systems | ICAR Research Complex, Goa | 16th -19th Nov., 2012 |
| Nagesh Ram | 7th National Conference of KVKs | PAU, Ludhiana | 20th - 22nd Nov., 2012 |
| Subhash Chand | Training on supply chain management system in agricultural food security | NAARM, Hyderabad | 16th - 26th Nov., 2012 |
| S.K. Zamir Ahmed | RFD Nodal Officer Meeting | NASC, New Delhi | 23rd Nov.,2012 |
| A. Velmurugan, T. P. Swarnam, T.Subramani and S.Swain | National training program on Village level water resources development and management plan | CARI, Port Blair | 24th - 25th Nov., 2012 |
| Jai Sunder | NADRS | NIT, New Delhi | 26th - 30th , Nov, 2012 |
| All Scientist | ICAR Industry Day | CARI, Port Blair | 26th Nov., 2013 |
| M.S.Kundu | 8th Biennial ANA conference | Bikaner | 28th - 30th Nov., 2012 |
| T.Subramani | Annual Review Meeting of Integrated Agro Advisory Services | BHU, Varanasi | Nov, 2012 |
| S.K. Zamir Ahmed, P. Krishnan, A Velmurugan, and M. Sankaran | Global Symposium on aquatic resources for eradicating hunger and malnutrition-opportunities and challenges | Mangalore, Karnataka | 3rd - 6th Dec., 2012 |
| K. Deva Kumar | Nanotechnology-Creating better tomorrow for India and for the world | Bangalore | 5th - 7th Dec., 2012 |
| A.Kundu and T.Sujatha | IPSACON 2012 | Hyderabad | 5th -7th Dec., 2012 |
| P. Krishnan and Kiruba Sankar, R | SATCORE project proposal meeting | INCOIS, Hyderabad | 14th Dec., 2012 |
| Krishna Kumar | QRT Meeting of AMMAS project | CIBA, Chennai | 15th Dec, 2012 |

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|---|---|---|---|
| Kiruba Sankar, R | INCOIS project proposal meeting | INCOIS, Hyderabad | 17th Dec.,2012 |
| Subhash Chand | Training Programme on Climate Change, Forest Ecosystems and Biodiversity: Vulnerabilities and Adaptation Strategies | ICFRI, Dehradun | 17th - 21st Dec., 2012 |
| P.K.Singh | Management of Genetic Resources of Horticultural Crops | NBPGR, New Delhi | 18th - 19th Dec., 2012 |
| All Scientist | National Seminar on Innovative Technologies for Conservation and Sustainable Utilization of Island Biodiversity | CARI, Port Blair | 20th - 22nd Dec., 2012 |
| M.Sankaran | State Innovation Council Meeting | A&N Admn., Port Blair | 2nd Jan.,2013 |
| D.R.Singh, M.Sankaran and A.K.Singh | 100th Meeting of ISCA & Science Communicators Meet | Kolkata University, Kolkata | 3rd - 7th Jan., 2013 |
| D.R.Singh | Farmers Meeting | ITF, Port Blair | 8th Jan., 2013 |
| K. Sakthivel | Bio-security and Incursion Management | NIPHM, Hyderabad | 17th Jan.- 7th Feb, 2013 |
| Krishna Kumar | 34th Annual Conference and Symposium on Crop Disease Management | Navsari Agricultural University, Navsari, Gujarat | 21st - 23rd Jan, 2013 |
| K. Abirami | National Conference on Integration of Medicinal and Aromatic Plants for Rural Development and Prosperity | Anand, Gujarat | 22nd - 23rd Jan., 2013 |
| S.Swain | International Symposium on Bio-Energy- Challenges and Opportunities in 47th Annual Convention of ISAE | DRR, Hyderabad | 28th - 30th Jan, 2013 |
| V. Baskaran | 12th Annual group Meeting of AICRP on Floriculture | Pune | 29th -31st Jan, 2013 |
| M.Sankaran | 24th BTISnet Coordinators Annual Group Meet | CIMAP, Lucknow | 3rd - 4th Feb, 2013 |
| S.Swain | 11th Agricultural Science Congress | OUAT, Bhubaneswar | 7th - 9th Feb, 2013 |
| M.S.Kundu | Bioinformatics for Conservation and Improvement of Animal Genetic Resources | NGAGR, Karnal | 18th - 28th , Feb, 2013 |
| Subhash Chand and Shrawan Singh | National Workshop on foresight and future pathways through youth in Indian agriculture | NASC, New Delhi | 1st - 2nd March, 2013 |
| R.K. Gautam | ARRW Golden Jubilee International Rice Symposium | Cuttack, Odisha | 2nd - 4th March, 2013 |
| V. Baskaran | National Dialogue on Orchid Conservation and Sustainable Development for Community Livelihood | Gangtok, Sikkim | 8th - 9th March, 2013 |

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|---|---|---|---|
| D.R.Singh, R.K. Gautam, A.Kundu, A .Velmurugan, S.K.Zamir Ahmed and Jai Sunder | HODs meeting of Division of Horticulture, ICAR and Consultancy Meeting on Establishment of Quarantine and Biosecurity Facilities at Port Blair | NASC, New Delhi | 12th - 13th March, 2013 |
| M.Sankaran | ITMU Meet cum Agribusiness Camp | BNCCI, Kolkata | 18th March, 2013 |
| D.R.Singh | Farmers –Scientist Interaction Meet | Directorate of Agriculture, Port Blair | 21st March, 2013 |
| K. Abirami | Research Advisory Board Meeting | WNRF, Chennai | 22nd March, 2013 |
| D.R.Singh | National Consultation Meet on HDP and Plant Architecture | TNAU, Coimbatore, Tamil Nadu | 25th March, 2013 |

## International Programme

| Scientist | Programme | Venue | Date/Duration |
|---|---|---|---|
| A.K.De | ICAR International Fellowship for Ph.D., | University of Illinois, USA | 4th Jan., 2013 - 3rd Jan., 2016 |
| Krishna Kumar | Training on Marker Assisted Selection | Michigan State University, USA | 3rd Aug., - 9th Nov., 2012 |

# HUMAN RESOURCE DEVELOPMENT OF STAKEHOLDERS

| Title | Period | Participants (No.) | Type of Participants | Venue | Conducted by |
|---|---|---|---|---|---|
| **Training to stakeholders** | | | | | |
| Fish breeding & pond management | 23rd -24th April 2012 | 15 | Farmers | ORC | KVK & ORC |
| Tuber crops cultivation | 1st - 2nd May 2012 | 52 | Farmers | ORC | H &F & ORC |
| Carp breeding & model for satellite nurseries in Andaman | 11th -15th June 2012 | 41 | Farmers | ORC | FSD, Dept. of Fisheries, KVK & ORC |
| Freshwater carp breeding and setting up of satellite nurseries | 14th -22nd June 2012 | 80 | Farmers | Diglipur, Nimbudera & Chouldhari | NRM, FSD, KVK & ORC |
| Operation and maintenance of power tiller | 19th -21st July 2012 | 25 | Farmers | Collinpur | NRM |
| Underutilized fruits and vegetables for nutritional security in islands | 21st - 23rd Aug., 2012 | 25 | Farmers | CARI | H&F |
| Post harvest processing and value addition techniques for plantation crop produces | 29th - 31st Aug., 2012 | 20 | Farmers | KVK | NRM |
| Rodent pest management in paddy | 11th - 12th Sept., 2012 | 35 | Farmers | Diglipur | AINPR & ORC |
| Improved farm practices for additional income | 12th Oct., 2012 | 22 | Farmers | Gandinagar, Diglipur | ORC |
| Quality seed production of agricultural crops | 09th -11th Nov., 2012 | 32 | Farmers | ORC | FCD & ORC |
| Water harvesting and its effective use for crops and livestock | 23rd -25th Dec., 2012 | 25 | Farmers | Calicut | NRM & KVK |
| Rodent pest management in paddy | 23rd Dec. 2012 | 40 | Farmers | R.K Gram | AINPR & ORC |
| Rodent pest management in paddy | 24th Dec. 2012 | 34 | Farmers | Milan gram | AINPR & ORC |
| Rodent pest management in paddy | 25th Dec. 2012 | 55 | Farmers | Madhupur | AINPR & ORC |
| Production technology for vegetable cultivation on coastal degraded land | 4th Jan 2013 | 30 | Farmers | ORC | NRM & ORC |
| Enterprise development | 19th - 21st Feb 2013 | 23 | Farmers | ORC | WBVHAI , ORC & Dept.of Agriculture |
| Training cum exposure /demonstration to the veterinary volunteers on livestock related diseases | 18th - 20th March, 2013 | | Veterinary volunteers | CARI | WBVHA & CARI |

## Seminar/ Workshop

| | |
|---|---|
| Zonal Workshop on NICRA | 23rd - 24th May, 2012 |
| National Seminar on Innovative Technologies for Conservation and Sustainable Utilization of Island Biodiversity | 21st - 22nd Dec., 2012 |
| Joint Hindi Workshop for TOLIC members | 1st Feb., 2013 |

## Meeting

| | |
|---|---|
| First interface meet by CARI for synergetic harvest in Fisheries | 10th May , 2012 |
| Interface meeting cum sensitization programme on prospects and scope of Maize | 11th -13th May 2012 |
| Scientific Advisory Committee (SAC) meeting of KVK | 22nd May, 2012 |
| Island livestock development - an interface meet | 12th June, 2012 |
| An Interface meeting of CMFRI-CARI Scientists | 09th July, 2012 |
| Town Official Language Implementation Committee meeting | 2nd Aug., 2012 and on 28th Dec.,2012 |
| Consultation on revitalizing Andaman & Nicobar tribal fisheries through fish harvest/post-harvest technologies (CRAFT) meeting | 7th - 16th Oct., 2012 |
| Sensitization on status & control of FMD in A & N islands | 17th Nov., 2012 |
| Interaction cum sensitization meeting from PPV & FRA, branch office, Ranchi | 29th Nov., 2012 |
| Group Discussion on Animal Science Research for XII Five year plan | 17th Dec., 2012 |
| Consultancy meeting at NASC Complex, New Delhi on establishment of quarantine and biosecurity facilities at Port Blair | 13th March, 2013 |
| Interaction meeting with board members of KVAFSU,BIDAR | 15th March, 2013 |

## Extension Activities

| Title | Period | Participants (No.) | Type of Participants | Venue | Conducted by |
|---|---|---|---|---|---|
| Sensitization and awareness programme for enhancing pulse production in the islands | 27th - 29th Sept., 2012 | 101 | Farmers | Middle Andaman | FCD |
| Sensitization programme on FMD | 17th Nov., 2012 | 30 | SVOs, AH & VS, A& N Admn. | CARI | CARI |
| Farmers' participatory variety selection of salt tolerant rice varieties | 21st Nov., 2012 | 25 | Farmers | Baratang, Middle Andaman | FCD |
| FMD awareness programme | 6th Feb., 2013 | 25 | Farmers | KVK | FMDCP & KVK |
| Livestock health camp | 9th Feb., 2013 | 97 nos. livestock | Farmers | Badmaspahad, S.Andaman | FMDCP & KVK |
| FMD awareness programme | 21st Feb., 2013 | 28 | Farmers | Beodanabad, S.Andaman | FMDCP & KVK |
| Island Kisan Mela on the theme "Integrated Farming System for Livelihood Security" and Farm Innovators meet | 12th - 13th Feb ., 2013 | 1500 | Farmers, Youth, PRIs, Students, Urban dwellers | CARI | CARI |

## Radio Talks

| Title | Date of Broadcast | Expert |
|---|---|---|
| Activities of Out Reach Centre of CARI | 28th January, 2013 | S.K. Zamir Ahmed |
| Selection of seed nuts of coconut | 3rd February, 2013 | L. B. Singh |
| Pasuon mein kuposhan se hone wali samasyaein | 23rd February, 2013 | M.S. Kundu |
| Dweepon ke liye battakho ki upyukt nasale aur unka palan | 1st March, 2013 | A.Kundu |

## Doordarshan Interview

| Title | Date of Broadcast | Expert |
|---|---|---|
| CARI Brinjal-1 field demonstration at Collinpur village | April, 2012 | R.K. Gautam & Team |
| Role of KVK in Island Agriculture | 19th June, 2012 | Nagesh Ram |
| जैविक कीट नाशको द्वारा कीट प्रबंधन | 11th December, 2012 | Ajanta Birah |
| दलहनी फसलों में रोग प्रबंधन | 15th December, 2012 | Krishna Kumar |
| Activities of KVK to promote agriculture and allied activities in A&N Islands | 12th February, 2013 | Nagesh Ram |
| उरद के फसल में रोग प्रबंधन | 16th February, 2013 | Krishna Kumar |
| दलहनी फसलो की देखभाल | 18th February, 2013 | Awnindra Kumar Singh |
| स्थानीय किस्मों के विकास में किसानों की भागेदारी | 18th February, 2013 | Pankaj Kumar Singh |
| द्वीपों के लिए लवण रोधी धान की किस्में | 19th February, 2013 | R.K. Gautam |
| Technologies for improving the productivity of coastal degraded areas | 12th February 2013 | A. Velmurugan |

# ROUND UP OF INSTITUTE ACTIVITIES

## CARIEWA

CARIEWA the welfare arm of the institute has taken the following activities:

- CARIEWA scholarship to the wards of the staff for excelling in the class XII.
- Best workers award for staff from T.S.M to technical category (T-5).
- Discourse of the GITA by Secretary Rama Krishnan Mission, Port Blair.
- Facilitated in running the CARI canteen.

Beside staff who retired/ transferred were accorded farewell and new comers were welcomed in august gathering of all staff.


Felicitating superannuation of the staff

Director handing over the best worker certificate

## Celebration of Independence and Republic day

Institute celebrated Independence and Republic Day with great joviality and fervour. Dr S. Dam Roy, Director unfurled the National flag on Republic Day at CARI campus in presence of the staff and family members of the Institute. He appreciated the contribution made by the scientist and staff of the CARI, which has been recognized at the national level. Various functions like quiz, drawing completion for children's and fun games for staff were arranged.

Director delivering his message

The Institute also celebrated the Communal harmony week by organising different events like painting competitions on national integration, debate and communal harmony speech by the religious heads in one platform from 19th to 25th Nov.,2012.


Director & CAO along with religious Heads during the communal harmony deliberation

## Events of the Institute

| Event | Duration |
|---|---|
| QRT visit to Diglipur and Car Nicobar | 8th May, 2012 & 21st January 2013 |
| First interface meet by CARI for Synergetic Harvest in Fisheries | 10th May , 2012 |
| Interface meet cum sensitization programme on Maize | 11th May , 2012 |
| SAC meeting of KVK | 22nd May, 2012 |
| Zonal Workshop on NICRA | 23rd to 24th May, 2012 |
| Visit of Dr. Charan Das Mahant, Hon'ble Minister of State for Agriculture & Food Processing Industries, Govt. of India | 25th May, 2012 |
| Island Livestock Development - An Interface Meet | 12th June, 2012 |
| Institute Foundation Day | 23rd June, 2012 |
| Institute Research Committee Meeting | 28th to 30th June and 10th July, 2012 |
| An Interface Meeting of CMFRI-CARI Scientists | 09th July, 2012 |
| TOLIC Meeting | 2nd Aug., 2012 and on 28th Dec., 2012 |
| Hindi Fortnight | 11th Sept. to 9th Oct., 2012 |
| Agriculture Education Day | 24th Sept., 2012 |
| Consultation on Revitalizing Andaman & Nicobar Tribal Fisheries through Fish Harvest/Post-Harvest Technologies (CRAFT) meeting | 7th to 16th October, 2012 |
| Vigilance Awareness Week | 29th Oct., to 3rd Nov., 2012 |
| Visit of Director to North and Middle Andaman | 9th to 11th Nov. 2012 |
| Sensitization on Status & Control of FMD in A & N Islands | 17th Nov., 2012 |
| ICAR Industry day | 26th November, 2012 |
| Interaction cum Sensitization meeting from PPV & FRA , Branch office, Ranchi. | 29th Nov., 2012 |
| Reconstitution of Andaman Science Association | 15th December, 2012 |
| Group Discussion on Animal Science Research for XII Five Year Plan | 17th December, 2012 |
| National Seminar on Innovative Technologies for Conservation and Sustainable Utilization of Island Biodiversity | 21st December, 2012 |
| Visit of Director to Car Nicobar | 21st January 2013 |
| Joint Hindi Workshop for TOLIC members | 1st Feb., 2013 |
| Island Kisan Mela and Farm Innovators Meet conducted | 12th & 13th Feb., 2013 |
| Visit of NAIP Advisory Committee | 23rd to 25th Feb., 2013 |
| Consultancy Meeting at NASC Complex, New Delhi for Establishment of Quarantine and Biosecurity Facilities at Port Blair | 13th March, 2013 |
| Interaction meeting with Board Members of KVAFSU, BIDAR | 15th March, 2013 |
| Third meeting of 6th RAC | 23rd March, 2013 |
| Institute Management Committee meeting | 25th March, 2013 |
| Visit of Director to NICRA village | 29th March 2013 |

# IMPRESSION OF DELEGATES

| Delegates | Impression |
|---|---|
| Shri T. Nanda Kumar, Ex -Secretary (Agri.), GoI & Member, NDMA on 8th May, 2012 | CARI is doing very good work. However it is important that this gets reflected in the next income of local farmers. An innovative extension methodology needs to be developed alongwith A & N Administration. I wish the scientists of CARI who work in difficult circumstances all the best! |
| Dr. T.R. Dutta, Founder Director, CARI on 23 rd June, 2012 | I am highly impressed by this museum of CARI activities in the islands. These displays will surely be augmented in future for the benefit of scholars, lay Public and potential beneficiaries of the CARI. May God bless CARI. |
| Dr. R.B. Singh, President, NAAS, New Delhi on 23rd June, 2012 | It was a delight to visit and learn from the outstanding work on coconut, noni and multitier cropping system involving a large number of spice and other species. The World Centre of Coconut Germplasm maintained at the centre is a global treasure. This good work should be make known to the whole world and to develop global partnership for prosperity of the farmers. I wish the CARI Centre all the best and congratulation to the scientists and other staff. |
| Dr. N. Neethiselvan, Professor and Head, Dept. of Fishing Technology and Fisheries Engineering, Fisheries College and Research Institute, TANUVAS, on 11 th October, 2012 | Excellent display unit. Activities related to Fishing gears and crafts of Andaman & Nicobar Islands may also be displayed. |
| Dr. B.A. Shamasundar, Professor & Head, Dept. of Fish Processing Technology, College of Fisheries, Mangalore on 11th October, 2012 | Display of achievements of CARI was excellent. The island resources are neatly presented. |
| Dr. M.C. Nandeesha, Special Officer, Tamil Nadu Fisheries University, Nagapattinam on 11th October, 2012 | Excellent presentation. |
| Shri S.B.S. Deol, DGP, A & N Islands on 20th October, 2012 | After spending a total of five years in the Islands, I had the occasion to visit the Institute. This museum is very well maintained and the display is commend. I wish it was open to the public and tourists. Congratulations! |
| Dr. Maheswarappa, H.P. , Project Coordinator, C.P.C .R.I., Kasaragod, Kerala on 24th January, 2013 | WCGC plots are maintained very well. Scientists and I.O. have made good effort in maintaining germplasm and other research project. They can strengthen their work in cropping system, organic recycling etc. Wishing them all the best. |
| Shri Derik Fred, Executive Member, Tribal Council, Car Nicobar on 13th February, 2013 | Participated in the Kisan Mela conducted by KVK-CARI. Interacted with Director, CARI & other official/ scientist of CARI and feel the experience of having good knowledge in the Integrated Farming System. |

# OUR DISTINGUISHED VISITORS

Dr. Charan Das Mahant, Hon'ble Minister of State for Agriculture & Food Processing Industries GoI on 25.05.2012

Lt Gen (Retd.) Bhopinder Singh, PVSM, AVSM along with Dr. A.K.Singh, Former DDG (NRM), Director CARI, Dr.S.Dam Roy and Shri Anand Prakash, Chief Secretary A&N Administration on 21.12.2012

Shri Bishnu Pada Ray, Hon'ble Member of Parliament (Lok Sabha), A & N Islands along with Director (on the right) during Island Kisan Mela celebration on 12.02.2013


Dr. T.R. Dutta, Founder Director, CARI on the occasion of 34th Foundation Day of Institute on 23.06.2012

## LINKAGES & COLLABORATION WITH OTHER DEPARTMENTS

- Central Marine Living Resources and Ecology, Cochin
- INCOIS, Hyderabad
- DBT, New Delhi
- NRSC, Hyderabad
- TNFU, Nagappatinam
- CIBA, Chennai
- SAC, Ahmadabad
- DST, New Delhi
- ICAR Institutes; IVRI, NDRI, PD_ADMAS, CIRG, CSWRI, IGFRI, PDP, CARI, Izatnagar
- TANUVAS, Tamil Nadu
- Project Directorate for Farming Systems Research (PDFSR), Modipuram
- Indian Institute of Remote Sensing, ISRO, Dehradun
- India Meteorological Department, Pune
- Space Application Centre, ISRO, Ahmedabad
- CSSRI Regional Station, Canning Town, Kolkata, WB
- Central Water Commission, New Delhi
- Directorate of Agriculture, A & N Administration, Port Blair
- Department of A.H & V.S, A & N Administration, Port Blair
- Dept. of Fisheries, A & N Administration, Port Blair
- Dept. of Rural Development, A & N Administration, Port Blair
- Directorate of Industries, A & N Administration, Port Blair
- RMRC, ICMR, Port Blair
- Tribal Council, Nicobar & Nancowry
- NABARD, Port Blair
- WBVHAI, Port Blair
- ACANI, Port Blair

# PERSONNEL

| | |
|---|---|
| **Director** | **Dr. S. Dam Roy** |
| **Head / In charge 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 |
| Head i/c, Division of Fisheries | Shri R. Kiruba Sankar |
| Incharge, Social Science Section | Dr. Ajmer Singh |
| Chief Administrative Officer | Shri Debasis Moitra |
| Finance & Accounts Officer | Shri G. 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, Garacharma Farm | Dr. K.K. Singh |
| Incharge, Sippigaht Farm | Dr. M.Sankaran |
| Incharge, Bloomsdale Farm | Dr. P.K. Singh |
| Incharge Estate Section | Er. S.L. Paik |
| Incharge overall, Security & Sanitation | Er. S.L. Paik |
| Incharge, Guest House | Dr. V.B. Pandey |
| Security Officer | Shri N.K. Pushp |
| Programme Coordinator, KVKs (South, N & M Andaman and Nicobar) | Dr. Nagesh Ram |
| Coordinator, Bio-Informatics Centre | Dr. M. Sankaran |
| Coordinator, Out Reach Centre | Dr. S.K. Zamir Ahmed |
| Incharge PG Cell | Dr. Jai Sunder |
| Assistant Director (OL) | Mrs. Sulochana |

| | |
|---|---|
| Vigilance Officer | Dr. D.R. Singh |
| Transparency Officer | Dr. R.K. Gautam |
| Chief Public Information Officer | Dr. Shwaran Singh |

## 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)
Dr. Pankaj Kumar Singh, Senior Scientist (Plant Breeding)
Dr. K. Deva Kumar, Senior Scientist (Biotechnology-Plant Science)
Dr. Awnindra Kumar Singh, Senior Scientist (Plant Breeding)
Shri Israr Ahmed, Scientist (Biotechnology) - on study leave
Dr. Naresh Kumar, Scientist (Plant Breeding)

**Division of Horticulture & Forestry**

Dr. D.R. Singh, Principal. Scientist & Head
Dr. M. Sankaran, Senior Scientist (Horticulture)
Dr. V. Bhaskaran, Senior Scientist (Horticulture)
Dr. R. Sudha, Scientist (Horticulture)
Shri I. Jaisankar, Scientist (Forestry) - on study leave
Dr. Shrawan Singh, Scientist (Vegetables)
Shri Dipak Nayak, Scientist (Fruit Science) upto 30.06.2012
Dr. K. Abirami, Scientist (Fruit Science)

**Division of Fisheries Science**

Dr. P. Krishnan, Scientist (Fish & Fishery Science), Head I/c upto 01.11.2012
Shri R. Kiruba Sankar, Scientist (Fish & Fishery Science), Head I/c from 02.11.2012

**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. Ajmer Singh, Senior Scientist (Agriculture Economics) & Head I/c
Dr. Subhash Chand, Senior Scientist, (Agriculture Economics)
Dr. S.K. Zamir Ahmed, Senior Scientist, (Agriculture Extension)

**Krishi Vigyan Kendra, Port Blair**

Dr. Nagesh Ram, Programme Coordinator
Shri L.B. Singh, Subject Matter Specialist (Horticulture)
Dr. Abhay Kumar Singh, Subject Matter Specialist (Animal Science) - on study leave
Shri Bijaya Kumar Nanda, Subject Matter Specialist (Agri. Engineering)
Ms. Haripriya Nayak, Subject Matter Specialist (Home Science)
Dr. N.C. Choudhuri, Programme Assistant T-6 (Animal Science)

**Krishi Vigyan Kendra, Nicobar**

Dr. Nagesh Ram, Programme Coordinator I/c
Shri Sanjay Kumar Pandey, Subject Matter Specialist (Agronomy)
Dr. Zachariah George, Subject Matter Specialist (Animal Science)
Dr. Viveka Nand Singh, Subject Matter Specialist (Horticulture)
Shri Chandrika Ram, Subject Matter Specialist (Agri. Engineering)

# COMMITTEES OF THE INSTITUTE

## Research Advisory Committee

| | | |
|---|---|---|
| Dr. K. Pradhan | - | Chairman |
| Dr. S. Edison | - | Member |
| Dr. R. P. Tewari | - | Member |
| Dr. Shyam Singh | - | Member |
| Dr. Umesh Srivastava | - | Member |
| Dr. Y.Basavaraju | - | Member |
| Dr. Karianna | - | Member |
| Dr. S. Dam Roy, Director | - | Member |
| Shri Aloke Biswas | - | Non Official Member |
| Shri Mehrzed Akhtaekhavai | - | Non Official Member |
| Dr. Jai Sunder | - | Member Secretary |

## IJSC Members

| | | | |
|---|---|---|---|
| Dr. S. Dam Roy, Director | - | Chairman | Official side |
| Dr. A. Kundu, Principal Scientist | - | Official Member | |
| Dr. Krishna Kumar, Sr. Scientist | - | Member | |
| Dr. Subhash Chand, Sr. Scientist | - | Member | |
| Shri G.Ghosh, FAO | - | Member | |
| Er. S.L.Paik, T-7-8 | - | Member | |
| Shri D.Moitra, CAO | - | Member Secretary | |
| Shri K. Naryanan | - | Secretary (IJSC) | Technical |
| Shri Harishankar Prasad | - | Member (CJSC) | |
| Shri Prasanta Kumar Das, Sr. Clerk | - | Member (Admn.) | |
| Shri B. Mahadevaiah, SSS | - | Member | Supporting |
| Shri K. Ali, SSS | - | Member | |

## Institute Management Committee

| | | |
|---|---|---|
| Dr. S. Dam Roy, Director | - | Chairman |
| Shri M.A.Salam, Director, Dept. of Agriculture, A&N Admn. | - | Member |
| Dr. D.P. Singh | - | Member |
| Dr. Akella Vani | - | Member |
| Dr. A. Gopalakrishnan | - | Member |
| ADG (Hort.-II) | - | Member |
| Dr. K. Saha, Director, Dept. of Animal Husbandry, W.B. | - | Member |
| Dr. M. Babu, Director of CAPS TANAVUS, Chennai | - | Member |

| | | |
|---|---|---|
| Finance & Accounts Officer, (CRIJAF, Barrackpore) | - | Member |
| Shri Aloke Biswas | - | Member |
| Shri Mehrzed Akhtaekhavai | - | Member |
| Chief Administrative Officer | - | Member Secretary |

### Foreign Deputation Committee

| | | |
|---|---|---|
| Director | - | Chairman |
| Dr. R.K. Gautam | - | Member |
| Dr. A. Kundu | - | Member |
| Dr. A. Velmurugan | - | Member |
| Chief Administrative Officer | - | Member Secretary |

### Award Screening Committee

| | | |
|---|---|---|
| Dr. D.R. Singh | - | Chairman |
| Dr. R.K. Gautam | - | Member |
| Dr. A. Kundu | - | Member |
| Incharge PME Cell | - | Member Secretary |

### Purchase Advisory Committee

| | | |
|---|---|---|
| Dr. R.K. Gautam | - | Chairman |
| Dr. P. Krishnan | - | Member |
| Dr. V.Baskaran | - | Member |
| Dr. Sachidananda Swain | - | Member |
| Dr. S. Jeyakumar | - | Member |
| FAO | - | Member |
| CAO | - | Member Secretary |

### Local Purchase Committee

| | | |
|---|---|---|
| Dr. M.Sankaran | - | Chairman |
| Dr. Dev Kumar | - | Member |
| Shri M. Algar | - | Member |
| FAO/Representative | - | Member |
| AAO (Stores) | - | Member Secretary |

### Works Committee

| | | |
|---|---|---|
| Dr. M.S. Kundu | - | Chairman |
| Er. S.L. Paik | - | Member |
| FAO | - | Member |
| CAO | - | Member |
| Er. Selvam | - | Member Secretary |

### Tender Specification & Opening Committee

| | | |
|---|---|---|
| Dr. Dev Kumar | - | Chairman |
| CAO | - | Member |
| AEO (Civil) | - | Member |
| FAO/ Representative | - | Member |
| AAO (Stores) | - | Member Secretary |

### Library Management Committee

| | | |
|---|---|---|
| Dr. A. Kundu | - | Chairman |
| Dr. (Mrs.) Ajanta Birah | - | Member |
| Dr. (Mrs.) T.P. Swarnam | - | Member |
| Dr. Shrawan Singh | - | Member |
| Librarian | - | Member Secretary |

### Condemnation Committee & Auction Committee

| | | |
|---|---|---|
| Dr. K.K. Singh | - | Chairman |
| Dr. A.K. Singh | - | Member |
| Dr. T. Subramani | - | Member |
| Er. S.L. Paik | - | Member |
| AEO (Electrical) | - | Member |
| FAO/ Representative | - | Member |
| AAO (Store) | - | Member Secretary |

### Price Fixation Committee

| | | |
|---|---|---|
| Dr. Ajmer Singh | - | Chairman |
| Dr. P.K. Singh | - | Member |
| FAO/ Representative | - | Member |
| Shri V. Damodaran | - | Member |
| Shri A.K. Tripathi | - | Member |
| Dr. V.B. Pandey | - | Member Secretary |

### House Allotment Committee

| | | |
|---|---|---|
| Dr. R.K. Gautam | - | Chairman |
| Dr. A.K. Singh | - | Member |
| Dr. M. Balakrishnan | - | Member |
| Secretary, IJSC | - | Member |
| FAO/Representative | - | Member |
| Shri M. Algar | - | Member Secretary |

### Official Language Implementation Committee

| | | |
|---|---|---|
| Director | - | Chairman |
| Dr. R.K.Gautam | - | Member |
| Dr. M.S. Kundu | - | Member |
| Dr. S.K. Zamir Ahmed | - | Member |
| Dr. M. Balakrishnan | - | Member |
| Dr. A. Velmurugan | - | Member |
| Dr. A.K. Singh | - | Member |
| Shri Amit Srivastava | - | Member |
| Shri Shyam Sunder Rao | - | Member |
| Shri Ashish Singh Yadav | - | Member |
| Mrs. Sulochana | - | Member Secretary |

### Landscape & Beautification Committee

| | | |
|---|---|---|
| Dr. V. Baskaran | - | Chairman |
| Shri V. Damodaran | - | Member |
| Shri N. David | - | Member |
| Shri Shyam Sunder Rao | - | Member |
| Farm Manager (Garacharma) | - | Member Secretary |

### Women Grievance Committee

| | | |
|---|---|---|
| Dr. Ajanta Birah | - | Chairperson |
| Dr. (Mrs.) T.P. Swarnam | - | Member |
| Dr. (Mrs.) K. Abirami | - | Member |
| Dr. T. Sujatha | - | Member |
| Mrs. Sibani Sengupta | - | Member |
| Smt. Sulochana | - | Member Secretary |

### Cultural Programme Committee

| | | |
|---|---|---|
| Dr. M.S. Kundu | - | Chairman |
| Dr. Ajanta Birah | - | Member |
| Dr. Dipak Nayak | - | Member |
| Shri Amit Srivastava | - | Member |
| Shri Ashish Singh Yadav | - | Member Secretary |

### Sports Committee

| | | |
|---|---|---|
| Dr. Subhash Chand | - | Chairman |
| Mr. R. Kiruba Sankar | - | Member |
| Shri M. Das | - | Member |
| Shri A. Babuswamy | - | Member |
| Shri Ashish Singh Yadav | - | Member |
| Dr. A. Velmurugan | - | Member Secretary |

### Technical Evaluation Committee

| | | |
|---|---|---|
| Dr. A. Velmurugan | - | Chairman |
| Dr. Shrawan Singh | - | Member |
| Dr. Grinson George | - | Member |
| Dr. Naresh Kumar | - | Member |
| AAO (Stores) | - | Member Secretary |

### Website Management Committee

| | | |
|---|---|---|
| Dr. M. Balakrishnan | - | Chairman |
| Mr. R. Kiruba Sankar | - | Member |
| Dr. Arun Kumar De | - | Member |
| Dr. Shrawan Singh | - | Member |
| Shri K. Gopal Nath | - | Member Secretary |

# NEW ENTRANTS / TRANSER / PROMOTION / RETIREMENT

## New Director to CARI

- Dr. S. Dam Roy, Director joined CARI on 18.08.2012 from CIFE, Mumbai

## New entrants

The following TSM staff joined as SSS on 18.02.2013

- Shri Ramullu
- Shri Tapan Kumar Shit
- Smti Sheela Pal
- Shri Simachalam
- Shri K. Ali Akbar
- Shri T.A. Kumar Tirkey
- Shri R. Burman
- Shri Satya Narayan
- Shri Bikash Mondal
- Shri Krishna Tigga
- Shri N. Gopinathan
- Shri Lucas Minj
- Shri Milred Tirkey
- Shri B.B.V. Trinath

## Transferred from CARI

- Dr. S. Jeyakumar, Scientist on 16.06.2012
- Dr. Dipak Nayak, Scientist on 30.06.2012
- Dr. Grinson George, Scientist on 02.08.2012
- Dr. P. Krishnan, Scientist on 01.11.2012
- Dr. (Mrs.) Ajanta Birah, Sr. Scientist on 11.01.2013

## Retirement

- Shri Venkata Rao, SSS on 30.06.2012
- Shri Sayyudin Khan, SSS on 31.10.2012
- Shri N.K.D. Pillai, T-5 on 31.12.12
- Shri N.K. Pusph, Security Officer, on 31.01.2013
- Shri M. Michael, AAO on 31.3.2013
- Shri T. Tata Rao, SSS on 31.03.2013

## Left to heavenly abode

- Late Y. Ranjan, SSS on 12.06.2012

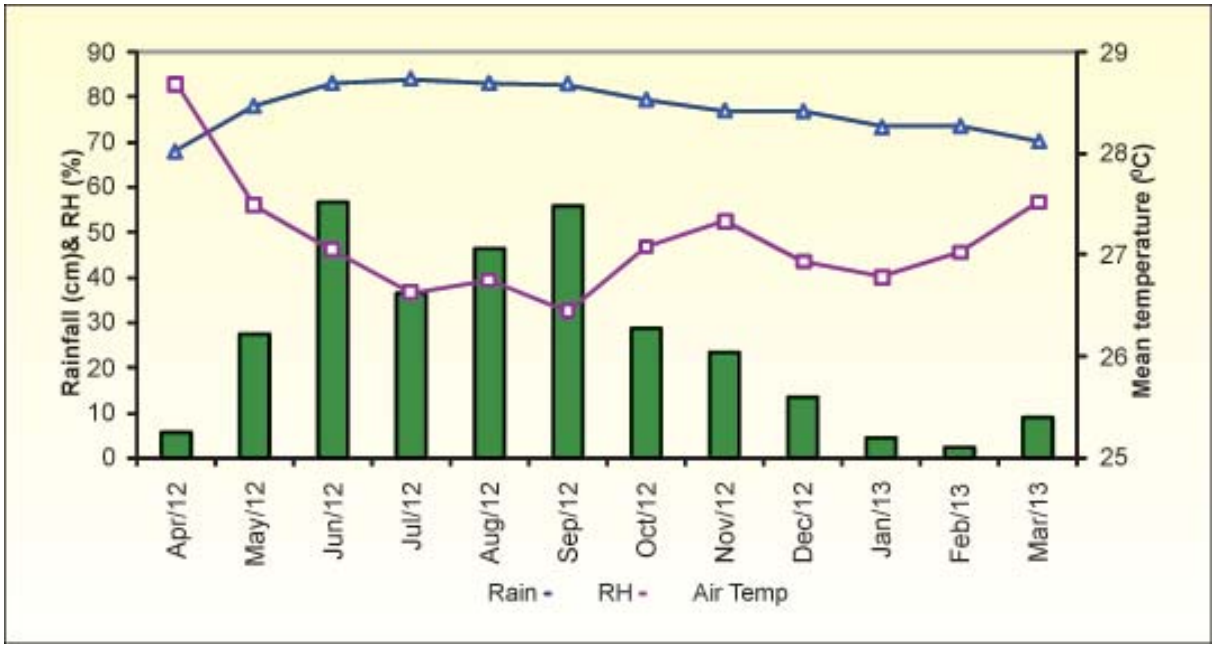
# CARI IN NEWS


KVK, AHVS conducts Animal Health Camp
Successful satellite fish nursery model created
Experts stress on use of modern tech
Island Kisan Mela, Farm Innovators Meet concludes at CARI
Collinpur: CARI experts stress on livestock farming
XII FYP research priorities at CARI
"CARI's Animal Science Dwn on awareness spree at Carnic
Research parley on isles fisheries at CARI
Two-day kisan mela begins at CARI complex
KVK trng on capacity building for tribal youth concludes
KVK training on 'Intensive broiler farming'

# Climatic Parameters of Andaman and Nicobar Islands (2012-13)

| Month | Rain fall (cm) | Air Temp(Avg. in °c) | RH |
|---|---|---|---|
| April, 12 | 5.70 | 28.69 | 68.00 |
| May, 12 | 27.70 | 27.486 | 78.00 |
| June, 12 | 56.83 | 27.05 | 83.00 |
| July, 12 | 36.78 | 26.63 | 84.00 |
| August, 12 | 46.48 | 26.75 | 83.00 |
| September, 12 | 55.78 | 26.44 | 82.94 |
| October, 12 | 28.84 | 27.08 | 79.40 |
| November, 12 | 23.52 | 27.33 | 77.00 |
| December, 12 | 13.47 | 26.93 | 76.87 |
| January, 13 | 4.32 | 26.78 | 73.30 |
| February, 13 | 2.34 | 27.02 | 73.60 |
| March, 13 | 8.89 | 27.52 | 70.25 |
| **Total** | **310.65** | **-** | **-** |
| **Average** | - | **27.14** | **77.45** |

Climatic Parameters of Andaman and Nicobar Islands (2012-13)



# NOTE


**केन्द्रीय कृषि अनुसंधान संस्थान**
पोर्ट ब्लेयर - 744 101, अंडमान एवं निकोबार द्वीप
**Central Agricultural Researach Institute**
Port Blair-744 101, Andaman & Nicobar Islands