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**Chief Editor** S. Dam Roy

Editorial Committee A. Kundu

B. Gangaiah R.K. Gautam R. Kirubasankar S.K. Zamir Ahmed

Nagesh Ram

Layout, Graphics & Cover Design Dibakar Khan

Type Setting Rina Saha

Photography K. Ali Akbar

Overall Compilation & Editing S.K. Zamir Ahmed

Amit Srivastava Rina Saha PME Cell

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E-mail: vprintschennai1@gmail.com; vprintschennai@gmail.com



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#### प्रस्तावना



में भा.कृ.अनु.प.—केन्द्रीय द्वीपीय कृषि अनुसंधान संस्थान, पोर्ट ब्लेयर के 2016—17 के वार्षिक प्रतिवेदन को प्रस्तुत करने के विशेषाधिकार से गौरावान्वित हूं, जिसमें कृषि एवं सम्बद्ध क्षेत्रों के सराहनीय अनुसंधान परिणाम हैं, जैसे द्वीपीय स्थितियों में ड्रैगन फल के उत्पादन प्रौद्योगिकी का मानकीकरण, मल्टीपल फ्लोरल स्पाइकलेट्स वाले विशेष जीनप्ररूप एल्पीनीया परपुराटा (लाल अदरक सी. आईएआरआई1) की पहचान तथा रूट ट्रेनर एवं संशोधित अध:स्तर के उपयोग एवं पत्ती डंठल के माध्यम से आइक्सोंरा एसपी (नारंगी एवं गुलाबी किस्म) में व्युत्पित तकनीक आदि उपलब्धियां हैं। कार निकोबार से मीठे जल की रेडियोगोबियस ऑयन्सी के अलावा उत्तरी अंडमान से जेब्रा फिश ब्रैकीडीनियो रेरियो भारत और अंडमान एवं निकोबार द्वीपों के लिए नएं रिकॉर्ड के रूप में दर्ज हुए हैं। अंडमान द्वीप समूह से पहली बार समुद्री पखमीन एम्बलीगैस्टर सिरम में ब्रैंकियल पैरासाइटिक साइमोथॉइड, रयूकाइवा सरकुलारिस की मौजूदगी तथा कैरेंजिड फिश लेलार कूमेनोथलमस में पैरासाइटिक साइमोथॉइड नूरीलेका इंडिका की सूचना मिली है। लोहाबैरेक तथा बेटापुर मत्स्य अवतरण केन्द्रों से एकत्रित पीनियस मोनोडॉन में संक्रमित हाइकोडर्मल हेमोपोयटिक नेक्रोसिस वायरस की पहचान भी पहली बार हुई। कार निकोबार के जनजातियों के लिए सहभागिता दृष्टिकोण को अपनाते हुए होमस्टेड फार्मिंग सिस्टम का विकास किया गया और इसके लाभ जनजातीय उप—योजना के माध्यम से वर्श के दौरान निकोबार और हरमिन्दर बे के अन्यभ जनजातीय किसानों तक पहुंचे हैं। mkisan पोर्टल पर द्वीप के 8725 किसानों का पंजीकरण कराया गया और एसएमएस आधारित कृषि परामर्श प्रत्येक मंगलवार और शुक्रवार को हिंदी और अंग्रेजी भाषाओं में दिया जाता है तािक उपयुक्त फसल प्रबंधन सुनिश्चित हो सके। अंडमान और निकोबार द्वीपों के तीन जिलों के लिए जिलों में संभावित प्रमुख आकस्मिकताओं के साथ आकस्मिक योजनाएं तैयारी की गई और अपनाने की रणनीतियों सहित इन्हें निक्रा वेबसाइट पर अपलोड किया गया।

पणधारियों की मांग, विशेषकर किसानों की मांग की पूर्ति के लिए, उच्चर उपज क्षमता वाले आठ फसल किस्मों, नामत: मूंग और उड़द के दो—दो किस्में, बैंगन के एक किस्म तथा खुंब के तीन किस्मों। को आईवीआरसी द्वारा जारी करने हेतु सिफारिश की गई।

कृषि एवं भारत के कृषि और सम्बद्ध क्षेत्रों में द्वीपीय परितंत्र की अनुसंधान आवश्यकताओं की पूर्ति के लिए विस्तृत अधिदेश के अनुपालन हेतु सीआईएआरआई ने अपनी गतिविधियों को लक्षद्वीपों तक फैलाया जो इस वर्ष की एक प्रमुख कार्यसिद्धि है।

संस्थान को वैश्विक पटल पर रखने हेतु संस्थान के वैज्ञानिकों ने विशेष गितविधियों को सम्पन्न किया, नामत: निकोबार समूह के द्वीपों की टैरेसा बकरी तथा निकोबारी शूकर को राष्ट्रीय पशु आनुवांशिकी संसाधन ब्यूरो, भा.कृ.अनु.प., करनाल, हरियाणा द्वारा इन्हें भारत के नए नस्ल के रूप में पहचान की गई। इसके अतिरिक्त, द्वीप के किसान समुदायों, नामत: करेन समुदाय तथा निकोबारी जनजाति को परम्परागत एवं विशिष्ट चावल तथा निकोबारी आलू के संरक्षण एवं पिरिरक्षण में उनके योगदान के लिए पौध किस्मे संरक्षण एवं किसान अधिकार प्राधिकरण, भारत सरकार, नई दिल्ली द्वारा इस प्रकार के पहली बार दो प्लांट जेनोम सेवियर अवार्ड दिए गए हैं और प्रत्येक अवार्ड के अंतर्गत 10 लाख रुपयों की राशि दी गई।

यह गर्व का विषय है कि कृषि एवं सम्बद्ध क्षेत्रों में प्रौद्योगिकीय बैकस्टॉपिंग को सफलतापूर्वक अपनाने हेतु उत्तरी एवं मध्य अंडमान के प्रगतिशील किसान श्री अशोक कुमार सरकार को अटारी, जोन ॥, कोलकाता द्वारा पण्डित दीन दयाल उपाध्याय अंत्योदया कृषि पुरस्कार से सम्मानित किया गया। संस्थान स्तर पर आईएफएस टीम द्वारा दक्षिणी एवं निकोबार जिलों में किए गए सराहनीय कार्य के लिए एआईसीआरआईपी आईएफएस को वर्ष 2014—15 के लिए राष्ट्रीय स्तर पर उत्कृष्ट केन्द्र घोषित किया गया।

संस्थान को सरकारी कामकाज में राजभाषा कार्यों के निष्पाादन हेतु भारतीय कृषि अनुसंधान परिषद, नई दिल्ली द्वारा वर्ष 2014—15 का "राजश्री टंडन राजभाषा पुरस्कार" से सम्मानित किया गया। इसके अतिरिक्त, नगर राजभाषा कार्यान्वयन समिति की पत्रिका "द्वीप तरंग—॥" का विमोचन भा.कृ.अनु.प. स्थापना दिवस के अवसर पर विज्ञान भवन, नई दिल्ली में श्री राधा मोहन सिंह, माननीय केन्द्रीय कृषि एवं किसान कल्याण मंत्री द्वारा 16 जुलाई, 2016 को किया गया। आईसीएआर—सीआईएआरआई को 15—17 मार्च, 2017 के



दौरान नई दिल्ली में आयोजित कृषि उन्नित मेला—2017 में अनुसंधान एवं विकास गतिविधियों के प्रदर्शन के लिए प्रशंसा पुरस्कार से सम्मानित किया गया।

अनुसंधान एवं विकास तथा विस्तार गतिविधियों को सुदृढ़ करने हेतु महत्वपूर्ण घटनाएं, जैसे प्रधान मंत्री फसल बीमा योजना, संस्थान का 38वां स्थापना दिवस, स्वच्छ भारत अभियान पखवाड़ा, राष्ट्रीय मत्स्य पालन दिवस, सतर्कता जागरुकता सप्ताह, विश्व मत्स्य दिवस, हिंदी कार्यशाला, नराकास की अर्धवार्षिक बैठक, कृषि सम्मेलन, कृषि शिक्षा दिवस, राष्ट्रीय उत्पादकता सप्ताह, इंस्टिट्यूट वैरायटी रिलीज कमेटी की बैठकों का आयोजन किया गया। इनके अतिरिक्त, तीनों जिलों में मेरा गांव मेरा गौरव को सफलतापूर्वक कार्यान्वित किया गया।

अंडमान साइंस एसोसिएशन द्वारा 08 से 10 दिसम्बर, 2016 के दौरान "जलवायु परिवर्तन का अनुकूलन एवं जैव विविधता : पारिस्थितिकीय सततता एवं आजीविका सुरक्षा के लिए संसाधन प्रबंधन" विषय पर सीआईएआरआई में सफलतापूर्वक आयोजित अंतरराष्ट्रीय संगोष्ठी को सराहा गया। इस आयोजन में अंतरराष्ट्रीय कार्यक्षेत्र से, जैसे संयुक्त राष्ट्र अमेरिका, कनाडा, स्वीडन, श्रीलंका, मॉरिशस, फिलिपाइंस तथा जर्मनी के आठ विदेशी प्रतिनिधियों सिहत देश के विभिन्न भागों से 250 प्रतिभागियों ने प्रतिनिधित्व किया। सभी प्रतिभागियों के लिए जलवायु परिवर्तन के संदर्भ में यह एक वास्तविक अनुभव रहा। आयोजकों की पूरी टीम इस आयोजन में अपने अद्भुत आचरण के लिए पुरस्कार की पात्र है।

माननीय राज्य मंत्री, श्री गिरीराज सिंह, सूक्ष्म, लघु एवं मध्यम उद्यम मंत्रालय, भारत सरकार द्वारा 29 दिसम्बर, 2016 को संस्थान का दौरा महत्वपूर्ण रहा है। प्रधान मंत्री फसल बीमा योजना कार्यक्रम हेतु 04 अप्रैल, 2016 को माननीय श्री विष्णु पदा रे संस्थान में पधारे, जलवायु परिवर्तन विषय पर अंतरराष्ट्रीय संगोष्ठी, नीति निर्माताओं की बैठक तथा अतिथिगृह के उद्घाटन हेतु 07 से 10 दिसम्बर, 2016 के दौरान प्रोफेसर रमेश चन्द, माननीय सदस्य, नीति आयोग, भारत सरकार, नई दिल्ली, डॉ. ए.के. सिंह, उपमहानिदेशक (कृषि विस्तार एवं बागवानी विज्ञान) भा.कृ.अनु.प., नई दिल्ली, डॉ. आर. आर. हंचिनाल, अध्यक्ष, पादप किस्म संरक्षण एवं किसान अधिकार प्राधिकरण, डॉ. आर. सी. अग्रवाल, रिजस्ट्रार जनरल, पादप किस्म संरक्षण एवं किसान अधिकार प्राधिकरण एवं श्री एच. पी. सोनगड. कर, महाप्रबंधक, नाबार्ड ने संस्थान का दौरा किया। श्री अनिंदो मजूमदार, भा.प्र.से., मुख्य सचिव ने श्रीमती आर. मेनका, सचिव (कृषि, पशुपालन व पशुचिकित्सा एवं मात्स्यिकी), अंडमान एवं निकोबार प्रशासन के साथ 12 नवंबर, 2016 को संस्थान का दौरा किया। डॉ. हर्ष कुमार बनवाला, अध्यक्ष, नाबार्ड ने संस्थान के निदेशक एवं कार्मिकों से वैज्ञानिक परिचर्चा हेतु 03 जनवरी, 2017 को संस्थान का दौरा किया। सभी गणमान्य एवं उच्च पदाधिकारियों ने संस्थान के अनुसंधान एवं विकास गतिविधियों की सराहना की।

मैं इस अवसर पर डॉ. टी. महापात्रा, सचिव डेयर तथा महानिदेशक के प्रति उभरती चुनौतियों का सामना करने में उनके दूरदर्शितापूर्ण नेतृत्व, उदार समर्थन एवं मार्गदर्शन के लिए आभारी हूँ। मैं डॉ. एन. के. कृष्ण कुमार, पूर्व उपमहानिदेशक तथा डॉ. ए.के. सिंह, वर्तमान उपमहानिदेशक (बागवानी विज्ञान) के प्रति संस्थान के अनुसंधान कार्यक्रमों के संदर्भ में उभरती पहलुओं के समाधान हेतु भावी कार्रवाई के लिए प्रेरणा एवं सुझावों के लिए आभारी हूँ। मैं डॉ. वसाका सिंह ढिल्लों तथा डॉ. टी. जानकीराम, सहायक महानिदेशकों तथा विषयवस्तु प्रभाग (वागवानी विज्ञान) के समस्त अधिकारियों एवं कार्मिकों को संस्थान के विभिन्न पहलुओं पर उनकी सहायता हेतु उन्हें धन्यवाद देता हूँ।

मैं माननीय उप-राज्यपाल, प्रो. जगदीश मुखी, श्री बिष्णुं पदा रे, माननीय संसद सदस्य, अंडमान एवं निकोबार द्वीप समूह, श्री अनिंदो मजूमदार, मुख्य सचिव, अंडमान एवं निकोबार प्रशासन, श्रीमती आर. मेनका, सचिव (कृषि, पशुपालन एवं मात्स्यिकी), अं. डमान एवं निकोबार प्रशासन, उपायुक्त, दक्षिणी, उत्तरी एवं मध्य तथा निकोबार जिले, अंडमान एवं निकोबार प्रशासन के निदेशकगण, अधिकारियों, जनजातीय परिषद एवं नाबार्ड के अध्यक्ष तथा सदस्यों को उनके निरंतर सहयोग एवं सक्रिय समर्थन के लिए उन्हें धन्यवाद देता हूँ।

अंत में, द्वीप के किसानों को आजीविका सुरक्षा उपलब्ध कराने के अतिरिक्त खाद्य फसलों एवं पशु उत्पादों में सततता प्राप्त करने की सामान्य अभिरूचि के लिए एकजुट होकर अथक प्रयास एवं समर्थन हेतु मैं अपने सहयोगियों एवं कार्मिकों को बधाई देता हूँ।

मुख हीन नीप

(शिबनारायण दाम रॉय)

निदेशक

भा.कृ.अनु,प.—केन्द्रीय द्वीपीय कृषि अनुसंधान संस्थान

दिनांक 21 मई, 2017



# **PREFACE**



I am privileged to present the Annual Report of ICAR- Central Island Agricultural Research Institute, Port Blair for year 2016-2017 with appreciative research outcome in agriculture and allied fields like standardization of production technology of dragon fruit at Island conditions, identification of an unique genotype, Alpinia purpurata (Red ginger CIARI1) with multiple floral spikelets and propagation technique in *Ixora sp* (orange and pink cultivars) through leaf petiole using root trainers and modified substrate. Beside Rediogobius ovensi, a freshwater goby from Car Nicobar and Brachydanio rerio, Zebra fish from North Andaman were reported as new records for India and Andaman and Nicobar Islands. Occurrence of branchial parasitic cymothoid, Ryukyua circularis from the marine finfish, Amblygaster sirm and the occurrence of parasitic cymothoid, Norileca indica from carangid fish, Selar crumenophthalmus were reported from Andaman Islands for the first time. Also first detection of Infectious Hypodermal Haemopoetic Necrosis Virus(IHHNV) were reported in *Penaeus monodon* samples collected from Lohabarrack and Betapur landing centres. Homestead farming system model were developed in participatory approach for tribals at Car Nicobar and the benefits through TSP programmes were reached to the other tribal farmers of Nicobar and Harminder Bay during the year. Registered 8725 island farmers on mKISAN portal, and SMS based agro-advisories were sent on every Tuesday and Friday in Hindi and English for ensuring proper crop management. Contingency plans for three districts of Andaman & Nicobar Islands were prepared with major contingencies the districts are prone to alongwith the adaptation strategies and were uploaded in NICRA web site.

To meet the demand of the stakeholders especially the farmers, eight crop varieties namely two each in mung and urd, one in brinjal and three in mushroom with good yield potential were recommended for release by the IVRC.

To accomplish the extended mandate of serving the Island ecosystem research needs in agriculture and allied sectors of India, CIARI has spread its activities into Lakshadweep Islands, which has been one of the major accomplishment during the year.

To place the Institute in the global map, distinguished activities were facilitated by the scientists of the Institute namely, recognition of Teressa goat and Nicobari pig of the Nicobar group of Island as new breeds of India by the NBAGR, ICAR, Karnal, Haryana. Beside, two Plant Genome Saviour Community Award of Rs.10 lakh each to the island farmers community i.e. Karen community and Nicobari tribe, for their contribution to conservation and preservation of traditional and unique rice and nicobari aloo, which is first of its kind given by PPV &FRA, GoI, New Delhi.

It is also a proud moment to share that at field level, for successful adoption of the technological backstopping in agriculture and allied fields, Shri Ashok Kumar Sarkar a progressive farmer from North & Middle Andaman was conferred with, Pandit Deen Dayal Upadhyay Antyodaya Krishi Puruskar by ATARI, Zone II, Kolkatta. At institute level for the commendable work done by the IFS team at South & Nicobar District, the AICRIP IFS was adjudged the best centre for the year 2014-15 at National level.

The Institute received II<sup>nd</sup> prize, "Rajshri Tandon Rajbhasha Award" for performance in use of O.L. in official use by ICAR, New Delhi for the year 2014-2015. Beside Town Official Language Implementation Committee magazine



"Dweep Tarang-II" was released during ICAR Foundation Day at Vigyan Bhavan, New Delhi by Shri Radha Mohan Singh, Honourable Union Minister of Agriculture & Farmers Welfare on 16<sup>th</sup> July, 2016. Appreciation award to ICAR-CIARI was also given during Krishi Unnati Mela 2017 for showcasing the R & D activities during 15<sup>th</sup> to 17<sup>th</sup> March, 2017 at New Delhi.

To strengthen the R & D and extension activities important events such as Pradhan Mantri Fasal Bima Yojana, 38<sup>th</sup> Foundation Day of the Institute, Swachh Bharat Abhiyan Pakhwara, National Fish Farmers Day, Vigilance Awareness Week, World Fisheries Day, Hindi Workshop, Half Yearly Meeting of TOLIC, Krishi Sammelan, Agriculture Education Day, National Productivity Week, Institute Variety Release Committee Meeting etc. were organized. In addition to this Mera Gaon Mera Gaurav (MGMG) has been successfully implemented in all the three districts.

The meticulous conduct of International conference on "Climate change adaptation and biodiversity: Ecological sustainability and resource management for livelihood security" from 8<sup>th</sup> to 10<sup>th</sup> December, 2016 by Andaman Science Association at CIARI, is appreciated. The event brought together 250 delegates representing different parts of the country including eight foreign delegates from International arena i.e.USA, Canada, Sweden, Sri Lanka, Mauritius, Philippines and Germany. It was a real time experience of climate change, by all the participating delegates. The entire team of organizers deserves all the accolades for their stupendous conduct of the event.

The most important were the visit of Hon'ble Minister of State, Shri Giriraj Singh, Ministry of Micro, Small and Medium Enterprises, Govt. of India on 29<sup>th</sup> December, 2016, Honourable Member of Parliament Shri Bishnu Pada Ray, during Pradhan Mantri Fasal Bhima Yojana on 4<sup>th</sup> April, 2016, Professor Ramesh Chand, Honourable Member NITI Aayog, GoI, New Delhi, Dr. A K Singh, DDG (Agri. Extn. & Horticultural Sciences), ICAR, New Delhi, Dr. R. R. Hanchinal, Chairperson PPV & FRA, Dr. R. C. Agrawal, Registrar General, PPV & FRA & Shri H.B. Songadkar GM NABARD visited from 7<sup>th</sup> to 10<sup>th</sup> December, 2016 for attending the International seminar on climate change, policy makers meet & inauguration of guest house, Shri Anindo Majumdar, IAS, Chief Secretary, along with Smti R. Maneka, Secretary (Ag, AH & VS & Fisheries), A & N Administration on 12<sup>th</sup> November, 2016 and Dr Harsh kumar Bhanwala, Chairman NABARD on 3<sup>rd</sup> January, 2017 to have scientific interaction with Director and staff. The R & D activities of the Institute was appreciated by one and all.

I take this opportunity to express my deep sense of gratitude to Dr. T. Mohapatra, Secretary, DARE and Director General, ICAR for his visionary leadership, unstinted support and guidance to meet the emerging challenges. I am grateful to Dr.N.K. Krishna Kumar, former and Dr. A.K. Singh our present Deputy Director General (Horticultural Science) who has been our source of inspiration and advising us constantly on future course of action to address the emergent issues related to research and programmes of the institute. I am thankful to Dr. Wasaka Singh Dhillon and Dr. T.Janakiram, ADGs and all the officers & staff of SMD (Horticultural Science) for rendering support on various issues related to the Institute.

I am thankful to the Hon'ble Lt. Governor, Professor Jagdish Mukhi, Shri Bishnu Pada Ray, Hon'ble MP, Andaman and Nicobar Islands, Shri Anindo Mazumdar, Chief Secretary, Andaman & Nicobar Administration, Secretary (Agriculture, Animal husbandry & Fisheries), A& N Administration, Deputy Commissioner, South, North & Middle and Nicobar District, Directors, officers of A & N Administration, Chairman & members of Tribal Council and NABARD for their continued support and active collaboration.

At the end, I congratulate my colleagues and staff for their constant hard work and support for working together in the area of common interest to achieve sustainability in food crops and animal products in addition to providing livelihood security to the island farmers.

(Sibnarayan Dam Roy)

Director ICAR-CIARI



#### **EXECUTIVE SUMMARY**

#### **Horticulture & Forestry**

- Augmentation of improved varieties of fruit crops like mango (5), guava (4) and banana (6) for evaluation was done.
- In the trial on high density planting of banana, spacing of 1.5m x1.5m planted with one sucker/pit recorded maximum yield (20.8 Kg/bunch).
- The treatment combination of FYM, vermicompost, coir compost and bio fertilizers recorded maximum bunch weight (21.6 Kg/bunch), weight of second hand (2.79 Kg), number of hands per bunch (11), maximum finger weight (0.205 Kg) with high TSS (14.3°B) and acidity (0.1%).
- The production technology of dragon fruit was standardized at Island conditions. The phytochemical analysis of the *Hylocereus sp*, revealed that the species is rich in phytochemicals with antioxidant activity. The reproductive biology of the dragon fruit revealed the pollen viability of 80.6% on the day of anthesis.
- The evaluation of 4 clones of edible cacti showed maximum height (31.4 cm) in the clone 1287 and maximum width (14.7 cm) in the clone 1280. The number of cladodes were maximum in the clone 1271 (5.2) and the thickness were maximum in the clone 1287 (1.9 cm) on eight months after planting in the main field.
- The molecular characterization with RAPD and ISSR markers in four accessions of *Gloriosa superba* showed the distinctness of the Wandoor (WND) accession which was grouped into a separate cluster.
- About 9 polyembryonic genotypes and three wild banana were collected and conserved for evaluation.
- Black pepper (20000), clove (3000), nutmeg (700), cinnamon (3500), ginger (2500 kg) and turmeric (1250 Kg) were produced. Fifteen FLDs was done in different parts of the Island for organic cultivation of ginger and turmeric.
- The combination of cocopeat, FYM, vermicompost in the ratio of 1:1:1 along with *Trichoderma* and VAM (T5) treatment recorded early sprouting (9.3 days), maximum plant height and width in the plug tray production of ginger transplants.
- The treatment combination of FYM, coir compost vermicompost together with the microbial inoculants gave maximum yield in the variety Prabha (650.50 gram of rhizome yield per plant).
- Accession no 3 (Sippighat) recorded maximum flower spike length (19.06 cm), number of florets per spike (47.33), duration of flower spike (54.33 days) and vase life in tap water (18.33 days) in the evaluation trial of four red ginger (*Alpinia purpurata*) accessions.
- A unique genotype *Alpinia purpurata* (Red ginger CIARI1) with multiple floral spikelets was observed in red ginger.
- Standardized modified ridges and furrow method with reconstituted media which showed maximum growth and yield performance in flower crops like marigold, tuberose and golden rod.
- Maximum yield (40.6 flowers per plant) and maximum flower diameter (8.2 cm) was recorded in the variety Yellow max in marigold.
- ZnSo<sub>4</sub> @ 1% as foliar spray gave maximum flowers per plant (78.6). Maximum flower weight (7.8 g) and early flowering (42 days) was observed in GA<sub>3</sub>@ 300 ppm as foliar spray in marigold.
- The growth and yield performance of marigold was good, when rooted cuttings were planted instead of the direct planted cuttings.
- New technology was standardized for the first time in *Ixora sp* (orange and pink cultivars) for propagation through leaf petiole using root trainers and modified substrate.



- Maximum success percentage of 98.2 was observed in propagation through air layering in *Nerium oleander*.
- The variety Arka Ambara showed maximum number of spikes per plant (22.5), spike length (8.2 cm) and number of flowers per spike (26) in crossandra.
- Mass multiplication of anthurium and dendrobium orchids were standardized using the modified MS media supplemented with growth regulators.
- The variety Zembla showed maximum number of flowers per plant and flower size with round the year flowering in chrysanthemum.
- The intensive cultivation of flower crops like marigold, tuberose and jasmine were evaluated in polyhouse in farmers field at New Bimblitan and Ograbraj of South Andaman.
- Exploratory surveys in different parts of the Islands resulted in identification and documentation of 20 palm,18 indigenous ornamental trees, 12 ornamental shrubs, 37 orchid, 12 fern and 46 perennial ornamental species respectively.
- A unique coconut genotype with edible husk was identified from the farmer's field in Middle Andaman Island.
- Vegetative propagation technique was standardized in *Piper sarmentosum* through stem cuttings. Use of double node cuttings treated with 1000 mg/L IBA and retention of leaves on the cuttings were found to be beneficial for improving rooting, survival and plant growth.
- Air layering technique was standardized in cinnamon under island conditions in which first week of July was found to be most suitable period. Use of soil: FYM (1:1, v/v) as substrate and commercial rooting hormone was found to support optimum root growth.
- Mango ginger was found to be a potential crop for cultivation in the islands. Size of propagules and biofertilizers were standardized for organic production of mango ginger in the islands.
- Souring fruits of Andaman Islands *viz*. carambola, hog plum and malabar tamarind were evaluated for their physico-chemical composition.
- Two morphotypes were identified and studied in *Garcinia gummi-gutta*. Seedlings of *G. gummi-gutta* and *G. dhanikhariensis* were raised and were used for afforestation programmes. Dried rind powder was prepared from *G. gummi-gutta* which could be successfully stored in screw capped glass bottles for 5 months at room temperature.
- Shoot tip cultures of banana variety Korangi were initiated as a part of experiment on optimization of micropropagation protocol for the locally preferred variety.
- In Colocasia, the entry TTr 12-8 recorded higher yield (15.3 t/ha), followed by TTr-5 and TTr-7 respectively.
- The net income generated from the tuber crops based farming system ranged from Rs. 28680.00 to Rs 69890.00 at Harminder Bay, Little Andaman.

#### **Field Crops Improvement & Protection**

- Farmers' participatory variety trial of rice under saline and acid sulphate soils (EC~4 dS²/m, pH 5.5) indicated highest grain yield of genotype IR 87831-3-1-1-2-2-BAY B (3.93 t/ha) compared to the best check variety CST 7-1 (3.37 t/ha). The farmers preferred variety RP 4353-MSC-38-43-6-2-4-3 having preference score of 0.09.
- Among traditional rice land races, 3 pure line selection derived genotypes *viz.* BB13-31 (4.38 t/ha), BB13-1 (3.89 t/ha) and BB 13-6 (3.88 t/ha) from Black Burma and two pure lines *viz.* KU 13-41 (3.73 t/ha) and KU 13-92 (3.70 t/ha) from Khushbayya rice land race were found promising across years and locations.
- The marker assisted transfer of pyramid of four genes (*Xa4*, *xa5*,*xa13*,*Xa21*) conferring resistance to bacterial blight (*Xanthomonas oryzae* pv.*oryzae*) is in BC<sub>3</sub>F<sub>2</sub> and BC<sub>2</sub>F<sub>2</sub> stages, in CIARI Dhan 5 and CIARI Dhan 8 genetic backgrounds respectively.



- A total of 134.5 kg Nucleus seed, 4.66q Breeder seed and 57.79 q Truthfully labelled (TFL) seed of 11 rice varieties were produced during *kharif* 2016-17.
- Total of 2.45q Breeder seed and 6.15 q TFL (Truthfully labelled seed) of rice was supplied to the Department of Agriculture, Andaman & Nicobar Administration, Port Blair during *kharif* 2016. In addition, 15 quintal Truthfully labelled seed of rice varieties (CARI Dhan 4, 5, 6, 7, CSR 36 and Gayatri) were distributed in tribal dominated areas at Great Nicobar and Hut Bay.
- In mungbean, genotypes ANM-12-02 (IC No.0611650) recorded the highest seed yield, followed by ANM-11-15 (IC No.0611667), ANM-11-08 (IC No.0611664), ANM-12-01 (IC No.0611649), CIARI Mung 1 (ANM-11-12, IC 0611666), CIARI Mung 2 (ANM-11-05, IC 0611661) and CIARI Mung 3 (ANM-11-07-2, IC 0611663) over the best checks IPM-02-14 and VBN-3. The promising advanced breeding lines ANM-12-02 and CIARI Mung-1 derived from local landrace were nominated to AICRP on MULLaRP for Rice Fallow mungbean IVT trial 2016-17.
- The accessions namely, ANM-12-02 (IC No.0611650), ANM-11-08 (IC No.0611664), ANM-11-15 (IC No.0611667), ANM-12-01 (IC No.0611649) showed resistance against charcoal rot, *Cercospora* leaf spot, powdery mildew, leaf crinckle and MYMV diseases of mungbean prevailing in these islands.
- In urdbean, advanced breeding lines namely ANU-11-29 recorded highest yield (13.61 q ha<sup>-1</sup>), followed by ANU-12-01, ANU-11-19 (IC No.0611675), ANU-11-10 (IC No.0611672) and ANU-11-30 (IC No.0611678), ANU-11-24 over the best checks IPU-02-43, VBN-7 and LBG-752. A promising line ANU-11-29 derived from local landrace was nominated to AICRP on MULLaRP for rice fallow urdbean IVT trial 2016-17.
- In urdbean, the accessions namely, ANU-11-29, ANU-11-09 (IC No.0611671), ANU-11-19 (IC No.0611675), ANU-11-12 (IC No.0611674) and ANU-11-22 (IC No.0611677) also exhibited determinate plant type and showed field resistance against charcoal rot, *Cercospora* leaf spot, powdery mildew, leaf crinckle and MYMV diseases of urdbean prevailing in these islands.
- In pigeonpea, promising lines namely, ANP-13-03, followed by ANP-11-14, ANP-12-02, ANP-11-12-2 and two advanced breeding lines IPAC-68 and IPAC-452 showed better performance for seed yield, plant type, plant growth parameters, number of branches per plant, earliness over the best check CO-6, Bahar and NA-1.
- In Beachpea (*Vigna marina*), 16 local accessions were evaluated and characterized. ANBp-14-03, ANBp-14-05 and ANBp-15-02 exhibited maximum number of seeds (5-8 seeds per pod), bold seeds with highest seed weight (7.96 g/ 100 seeds). The accessions, ANBp-14-03 recorded highest number of pods per plant (392 pods per plant) with pod length 6.2 cm having 4-6 seeds, bold seeds with highest seed weight (8.26 g/ 100 seeds) per pod, followed by ANBp-14-05, ANBp-15-02, ANBp14-01, ANBp-14-02 and ANBP-14-05.
- Dry seeds of beach pea (*Vigna marina*) exhibited wide range of protein (18.91 30.26 %). The highest protein content was estimated in ANBp-15-10 (30.5 % per 100 gram seed) followed by ANBp-14-03 (28.6%).
- A total of 4.3 quintal breeder and truthfully labelled seeds of high yielding varieties of mungbean (CIARI Mung 1, 2, 3, IPM-02-14, IPM-02-3 etc) and urdbean (IPU-02-43, VBN-7, LBG 752 etc) were produced.
- Two bacterial wilt resistant brinjal lines (CIARI Brinjal 2 and 3) with purple fruit colour have been developed.
- A total of 4 Kg TFL seed of bacterial wilt resistant brinjal variety 'CARI Brinjal 1' was produced during *Rabi* season.
- The study of 166 samples of vegetables and fruits, collected from farm gate and vendors from different markets of pesticide residual analysis, revealed that 27 percent had possessed multiple residues, while only 3.6 percent of the vegetable samples showed residues above Maximum Residue Limit (MRL).
- 21 Bacillus isolates potentially rich in antagonistic and plant growth promoting traits showed presence of
  antimicrobial peptide biosynthesis genes and found to have minimum of two and the maximum of six AMP
  genes.



- The pathogen diversity of *Xanthomonas oryzae* pv. *oryzae* in Andaman Islands studied through Multi locus sequence typing revealed that the pathogen might have entered in the Islands from mainland states and then evolved in Islands by selection pressure imposed by different rice cultivars and environment.
- Evaluation of different oyster mushroom strains led to the identification of five mushroom strains (both local and mainland types) suitable for commercial cultivation in the islands.
- Three oyster mushroom strains *viz.*, cream oyster, white oyster and blue oyster mushroom belonging to genus *Pleurotus* and *Hypsizygus* were released as CIARI Mush 1; CIARI Mush 2 and CIARI Mush 3 for the benefit of island farmers.
- Local *Lentinus* strain isolated from Andaman Islands evaluated for proximate analysis revealed high antioxidant and nutritional values and thus could be potential source for being utilized as animal/fish feed additives.
- The study of pathogen causing chilli anthracnose disease using random primers revealed high pathogen diversity in the islands. The results also revealed that the primers could differentiate the *C. capsici* isolates from *C. gloeosporioides* complex. Also the multilocus analysis revealed the presence of new *Colletotrichum* spp in the islands which infects chilli plants.

#### **Natural Resource Management**

- Study of impact of *La Nina* (cooling of waters in pacific ocean region) on South-West monsoon in islands have indicated that Mayabunder (-34.5%) and Long Islands (-29.9%) have recorded deficit rainfall, while Car Nicobar (44%) and Port Blair (22.8%) have recorded excess rainfall, than the normal indicating differential impact of *La Nina* on monsoon of islands.
- In photosensitive rice cultivar (C-14-8), 3.2 t/ha dry fodder yield was obtained by taking a fodder harvest at 45 days after transplanting without reducing the grain yield production.
- Contingency plans for three districts of Andaman & Nicobar Islands were prepared with major contingencies
  the districts are prone to with the adaptation strategies. The contingency plans were uploaded in NICRA web
  site
- Weeds have incited a yield penalty of 32.7% in transplanted rice. Pendimethalin (pre-em) 750 g a.i/ha + bispyribac (post-emergence on 25 day after transplanting) 25 g a.i/ha herbicide application has provided an effective weed management as 3 hand weedings in transplanted rice.
- AVT-2 IHRT-MS trial indicated IET 24888, IET 24887 and IET 24159 rice hybrids as promising. Multi-Location Trial of Hybrids indicated, MLT-1 and MLT-3 hybrids as promising.
- Phylogeny of plant growth promoting bacteria (PGPR) was done. Through maize seed and soil inoculated with PGPR *B. megaterium* (NC3) substantial root and shoot growth enhancement were obtained.
- During the period, 81 agromet bulletins in English and Hindi were issued through print and electronic media for effect crop management.
- For the registered 8725 island farmers on mKISAN portal, SMS based agro-advisories were sent on every Tuesday and Friday in Hindi and English.
- Seasonal variations (pre and post monsoon) in ground water quality studied for 248 samples revealed that 80% were of good quality.
- Raised bed and furrow system was found to reduce salinity of the coastal waterlogged areas and enhance the crop productivity and income as compared to normal.
- The diversification of coconut plantation with tubers, spices, vegetables and livestock resulted in generation of Rs.1.56 lakh income and 270 man days ha<sup>-1</sup> year<sup>-1</sup> of employment generation. The IFS model of low lying areas has generated an employment of 365 man days year<sup>-1</sup>.



- Analysis of 18 vegetable samples of South Andaman, indicated presence of acephate in all samples and its
  concentration was also highest. In fish samples of Neil Island, heavy metals of nickel, chromium and arsenic
  were found.
- Ground water samples (90) analysis for nitrate and phosphate contents, indicated the presence of phosphate in concentration more than the critical limits prescribed for drinking purpose.
- *Rabi* field on sunnhemp and dhaincha cultivation under coconut plantation indicated a green manure production of 7.85 t ha<sup>-1</sup> (61.5 kg nitrogen) in 60 days. Seed production of 840 and 713 kg ha<sup>-1</sup> in sunnhemp and dhaincha was also obtained.
- In vitro studies on antioxidant and free radical scavenging activity of Alpinia calcarata and Curcuma longa indicated high phenol and flavonoid content in Curcuma and Alpina, respectively.
- Developed ready-to-serve (RTS) rose apple and dragon fruit with better organoleptic qualities.
- Post harvest losses in fruits and vegetables were assessed using Multiple Linear Regression Analysis (MCRA) bringing out the contribution of various factors to losses.

#### **Animal Science**

- The effect of selection for short shank length on body weight, onset of sexual maturity and production performance was observed to be negatively correlated in Nicobari fowl and the immunity was found to be higher in the F1 progenies. A total of 1550 pure Nicobari fowl were distributed to farmers for its propagation.
- A total of 4166 vanaraja chicks were produced and 1050 chicks distributed to the adopted farmers. Gramapriya, a backyard poultry birds introduced for feasibility and adaptability could gain body weight of 1379±25.97g at 12 weeks.
- One new goat cluster was established at Nimbudera, North & Middle Andaman district and a total of 423 goats consisting of 158 males and 265 female goats were added to the cluster. The average body weight (kg) at birth, 3, 6, 9 and 12 months of age are 1.42±0.54, 5.86±0.10, 9.63±0.04, 13.24±0.19 and 16.10±0.12 respectively. The net income per animal was found to be Rs. 2564/-.
- Out of 16,719 clinical cases, parasitic diseases (99%) were of major problem followed by bacterial disease *viz*. leptospirosis and salmonellosis (1%). The main parasitic infestation reported were ascariasis, fasioliasis and amphistomiasis.
- Sero-surveillance of foot and mouth disease indicated, the protection antibody titre with serotype O (59.18%), serotype A (67.34%) and serotype A-1 (68.02%) respectively. Only 1.2% of the tested sera samples showed the FMD-DIVA positive results. The trend of the DIVA during the last three years indicated that there is a sharp decline in the number of positive cases for DIVA test.
- The reproduction performance *viz*. live litter size at birth, live litter weight at birth (kg) and litter size at weaning of Nicobari pig under intensive system of rearing were recorded as  $7.0 \pm 0.77$ ,  $8.92 \pm 1.84$  kg and  $6.25 \pm 0.85$  respectively.
- Intercropping of sorghum / maize with cowpea enhanced the dry fodder production system as a whole, which is evident from the increase of land equivalent ratio (0.37 -0.40) when compared with sole crops.
- Women farmers of Neil islands adopted the package of improved practices including elevated housing, low
  cost balanced feed formulae and health management for Nicobari fowl. They are preparing poultry feed ration
  using locally available rice, wheat, dry fish, coconut, throwable bones and egg shells as per the specification
  given by scientist of the Institute.
- A novel bioactive compound from marine sponge *Hyrtios erectus* was isolated and its therapeutic potential *viz*. antioxidant and anti-inflammatory activities were investigated.



#### **Fisheries Science**

- Rediogobius oyensi, a freshwater goby from Car Nicobar and Brachydanio rerio, Zebra fish from North Andaman were reported as new records for India and Andaman and Nicobar Islands respectively.
- Sea surface height(altimetry based) potential fishing advisories (PFZ) were developed for the first time during
  the period for experimental fishing and the PFZ /Non PFZ areas were validated for fishing. Of eight advisories
  generated, six were validated which showed that fish catches in PFZ were18530kgs in comparison with non
  PFZ 7015kgs.
- Occurrence of branchial parasitic cymothoid, *Ryukyua circularis* from the marine finfish, *Amblygaster sirm* and the occurrence of parasitic cymothoid, *Norileca indica* from carangid fish, *Selar crumenophthalmus* were reported from Andaman Islands for the first time.
- First detection of Infectious Hypodermal Haemopoetic Necrosis Virus(IHHNV) were reported in *Penaeus monodon* samples collected from Lohabarrack and Betapur landing centres.
- Cage culture using Silver pompano seeds were attempted at Minnie Bay, Port Blair using 6m diameter cages. After 120 days of culture in cage, Silver pompano attained an average length of  $5.54 \pm 0.09$  to  $18.64 \pm 0.22$  cm and an average weight of  $3.12 \pm 0.17$  gms to  $93.15 \pm 1.08$ .
- Fish feed mill was established in premises of ICAR-CIARI, which could produce 20 kg feed/hour to augment the aquaculture sector of Islands. Feeds such as Carp grower feed (25% protein, 6% lipid), *Macrobrachium lar* feed (45% protein, 8% lipid) and Broodstock feed (55% protein, 10% lipid) were formulated.

#### **Social Science**

- Out Reach Centre of CIARI, has taken need based technological application and training following group & participatory approach. The percentage of participation in training was 71 men and 29 women. In FLD the percentage increase in yield of CIARI rice varieties over the local check ranged from 18.75 to 49.09 % in farmers field. Under seed village concept 9.1 tons of TLS of paddy was produced. In addition market behavior for pork, chevon, marine & fresh water fish were also studied.
- The productivity trend percentage was positive i.e., in case of fruits (2.64), followed by paddy (3.13), coconut (4.68), arecanut (10.22), whereas decreasing trend was reflected in oilseeds (-3.97), followed by pulses (-3.06) & vegetables (-1.06) respectively. In BBF the gross return of Rs. 57,000 to 1,25,000/- and the net return of Rs. 38,500 to Rs. 1, 73, 200/- was obtained. It could also generate an employment of 110- 260 mandays.

#### Krishi Vigyan Kendra, South Andaman

- Krishi Vigyan Kendra, Port Blair, conducted 30 training at South Andaman for the benefits of practicing farmer/ farmwomen, rural youth and extension functionaries in addition to two sponsored programmes by National Fish Development Board, Hyderabad.
- Six FLDs in enterprises *viz.* ginger, green fodder, bitter gourd, okra, broiler and IFS, beside six OFTs for assessment and refinement of the selected technologies were conducted.
- Under NICRA, water harvesting, recycling, desilting of farm ponds, bund raising in BBF, cost effective rain shelters, drought tolerant paddy, Sahbhagi dhan, Naveen dhan, CIARI Poi selection for saline soil, CIARI AMA-Green, CIARI IFS model in fish farming, improved shelter management practices with well ventilated system for poultry, goatry and dairy animal, backyard poultry production with improved Vanraja bird, animal health camp and breed upgradation of local goats were conducted at adopted villages.



• Mushroom spawn production laboratory was established and oyster mushroom spawn was prepared and distributed to the farmers and farmwomen undertaking mushroom as a livelihood enterprise.

#### Krishi Vigyan Kendra, Car Nicobar

- A total of 28 trainings were conducted in different disciplines of agriculture viz. agronomy, animal science, horticulture, agriculture engineering, fisheries, wherein a total of 856 farmers including 384 female got benefitted.
- For assessment and refinement of technology OFTs were successfully undertaken with participation of 20 tribal farmers. Beside 8 FLDs were done with the active participation of 14 tribal farmers. A total of 337 extension activities were carried-out benefitting more than 2508 tribal farmers, students and general public for agricultural development in Nicobar district.
- Under Sansad Adarsha Gram Yojana in the adopted Kinyuka village, Car Nicobar, a total of 29 visits were made by the experts, training involving 22 tribal youths were conducted and developed five IFS models under the AICRP on IFS (TSP) project.
- Facilitated in registration of two new breed of Nicobar viz. Nicobar pig and Teressa goat.

#### Krishi Vigyan Kendra, North and Middle Andaman

- Thirty six trainings were conducted, in different disciplines of agriculture, wherein a total of 1198 farmers including 332 female got benefitted.
- Seven area specific need based OFTs and nine FLDs were conducted in agriculture and allied aspects for the dissemination of latest skills and technology.
- A total of 5014 farmers got benefited through the know how and do how disseminated by conduct of extension activities.
- For the benefit of the farming community two mega melas were conducted, one each on Rabi Kisan Sammelan and Pradhan Mantri Fasal BimaYojana, wherein a total of 590 farmers participated.
- Shri Ashok Kmar Sarkar from Govindpur village was awarded with Shri Pandit Deen Dayal Upadhyaya Antyodhyay Krishi Puraskar award from Zone II, with a cash prize of Rs. 50,000/- for his excellence in practicing new and innovative technologies adopted under IFS organic cultivation for sustainable farming.



#### **INTRODUCTION** -

#### ICAR -Central Island Agricultural Research Institute (CIARI)

ICAR-Central Island Agricultural Research Institute established in 1978 at strategic location of 6°45' North & 13°41'North Latitude and 92°12' East & 93°57' East Longitude, at Port Blair, Andaman is a model for tropical Island agriculture research to the South East Asian Countries. It is multidisciplinary Institute that caters to the specific needs of agricultural research and development for enhancing the productivity and production of crops, livestock and fishery to bridge the gap between requirements and the local production. It is located at of A & N Islands. The research activities are facilitated by five divisions, one section and technology dissemination through three Krishi Vigyan Kendra's & one Out Reach Centre covering all the three districts of the Island. Recently one KVK at Kavarati has come into the fold of the Institute. The Institute has been awarded IS/ISO 9001:2008 by BIS, Chennai w.e.f. 19<sup>th</sup> July, 2016.

#### Mission

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

#### Vision

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

#### **Mandate**

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

#### **Thrust Areas**

### Broad research programmes are as under

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

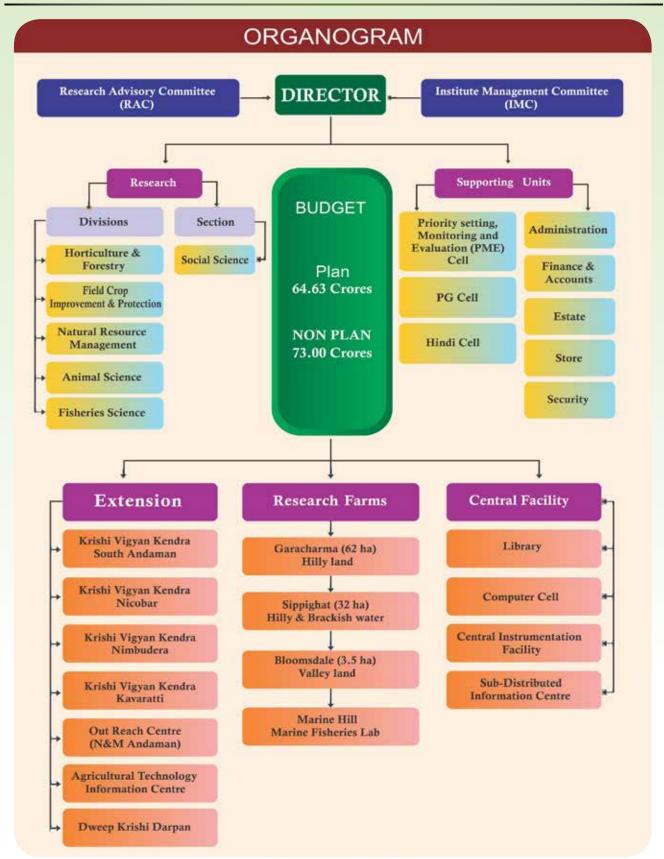
## Beside three other programmes are

- Flagship programme on Integrated agriculture system for eco-regions
- Establishment of composite bio-security & quarantine facility
- Tribal sub plan

#### ORGANISATIONAL SET UP

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







# **STAFF POSITION**

Sl. No.	Category	Sanctioned	Filled
1.	Scientific	50+1	39+1
2.	Technical	43	31
3.	Administrative	27	19
4.	Skilled Supporting Staff	78	63
Total		198+1	152+1

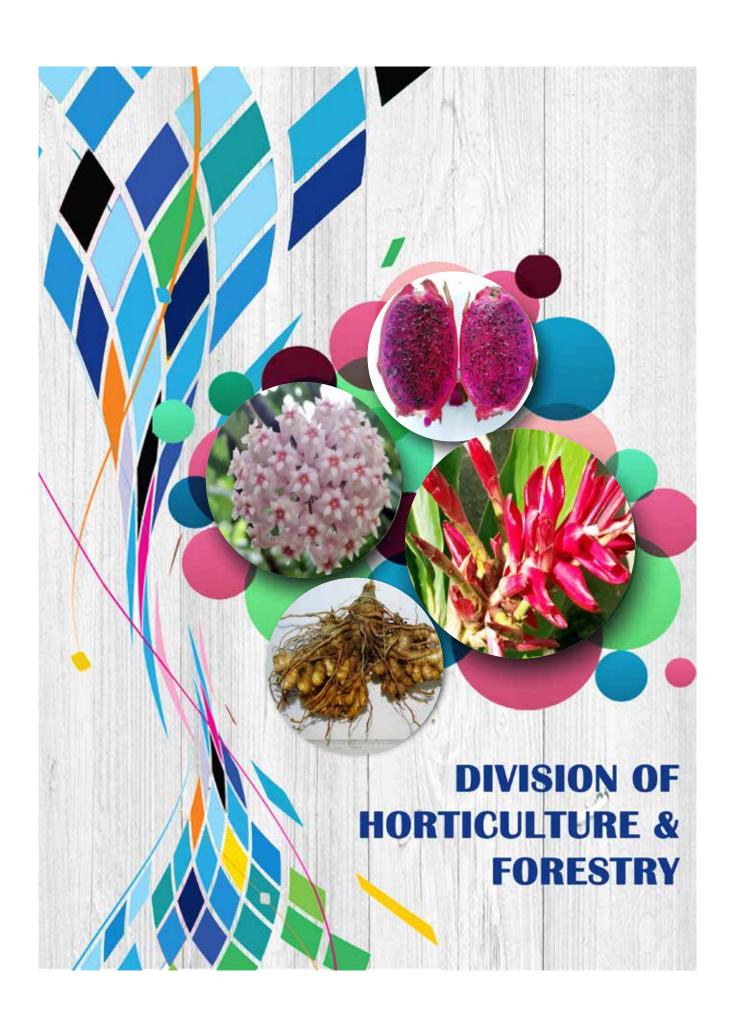
# **BUDGET UTILIZATION DURING 2016-2017**

Head of Account	Plan (in Lakhs)		Non-Plan (in Lakhs) including IRGS	
Particulars	Sanction	Expenditure	Sanction	Expenditure
Establishment charges			1458.69	1447.33
Travelling allowances	30.00	29.97	20.00	19.94
Recurring contingencies	135.00	133.21	223.30	223.01
Works (Main)	140.00	153.10	55.00	55.15
Equipment, furniture & livestock	115.00	102.16	10.00	9.95
Books (Library)	10.00	9.13	-	-
HRD/fellowships	20.0	19.15	-	-
TSP	60.0	59.89	-	-
Pension	-	-	110.0	99.71
Total	510.00	506.65	1892.77	1870.93
P. Loans & Advances	-	-	20.0	11.73

# RESEARCH PROGRAMMES









# **Development of Production Technology for Ornamental Crops in Bay Islands**

# V. Baskaran, K. Abirami and A. Velmurugan

#### Growth and yield evaluation of local red ginger accessions

Red ginger (*Alpinia purpurata* (vieill). K. Schum.) belonging to the family Zingiberaceae is an outstanding tropical cut flower. Four different local accessions of red ginger were studied for their growth and yield performance in randomized block design with five replications. Significant differences were recorded for different vegetative and floral characteristics. The results revealed that Accession no. 4 (Tusnabad) produced maximum plant height (140.50cm), plant spread (1.29m²), number of shoots (27.33), number of leaves (239) and number of flower spikes per plant (21.66). Accession no. 3 (Sippighat) recorded maximum flower spike length (19.06 cm),number of florets per spike (47.33),duration of flower spike (54.33 days) and vase life in tap water (18.33 days), when compared to other local accessions (Plate 1 & 2).



Plate 1: Local red ginger germplasm



Plate 2: Field view for local red ginger germplasm



#### Identification of a unique genotype 'Red ginger CIARI 1'

During the exploration and evaluation of the local accessions of red ginger in Andaman Islands, a local genotype, Red Ginger CIARI 1 was identified which is unique in its floral characteristics. Usually in red ginger, only vegetative aerial offshoots are produced in the inflorescence. In this identified genotype Red Ginger CIARI 1, multiple floral spikelets were observed in the inflorescence instead of vegetative aerial offshoots. The number of floral spikelets ranged from 3-6 in each inflorescence of Red Ginger CIARI 1. This unique type of multiple floral spikelets result in additional flowers per plant. This may be utilized for aesthetic purpose in flower arrangements, in floral bouquets making and is a potential genotype which may be utilized as effective parent in ornamental breeding programme to produce novel genotypes (Plate 3).





Plate 3: Multiple flowering trait in red ginger

#### Yield increase in marigold through modified ridges and furrow method and reconstituted media

In this method, the furrow was dug at a depth of 70-75 cm, width 70 cm and 8.5 m length. The width of ridges was 45 cm. The ridges and furrows were lined with weed mat and the reconstituted media with only top soil and farmyard manure were filled in the furrows (Plate 4). The seedlings of the marigold variety Siracole were planted in the media filled in furrows. The ridges were used as the walking space and for doing intercultural operations. Early flowering was noticed in this modified system (45.12 days), when compared to the normal system of planting (57.2 days). The flower yield of marigold was almost doubled (360.50 g per plant) in the modified system of planting in comparison with the normal system of planting (138.30 g/ plant). The flower yield per plant recorded in this system is 182 flowers/plant.







Plate 4: Modified ridges and furrows planting system with reconstituted media



#### Effect of foliar spray on growth and yield of marigold

The effect of 19 different foliar sprays was studied on the growth and yield of marigold. It was observed that  $ZnSO_4$  @ 1% gave maximum flowers per plant (78.6). Maximum flower weight (7.8 g) and early flowering (42 days) were observed in  $GA_3$ @ 300 ppm. The maximum longevity of flowers (26 days), when intact in the plant was observed in the treatment of Hi-foliar at all the concentrations tested (Plate 5 & 6).



Plate 5 & 6: Field view of marigold trial in the experimental plot ZnSO<sub>4</sub> @ 1%Floliar spray

# Varietal evaluation in marigold

Among the different varieties of marigold tested, the yield was maximum (40.6 flowers per plant) in the variety Yellow max and diameter of the flowers (8.2 cm) are also maximum in the variety Yellow max, when compared to the other varieties Arka Agni and Arka Bangara (Plate 7).



Plate 7: Yellow max, Arka agni & Arka bangara



# Comparative growth and yield performance of marigold through direct planting of cuttings and rooted cuttings

A comparative performance of the direct planted and transplanted rooted cuttings were evaluated in the field for their growth and yield performance (Plate 8). The transplanting of rooted cuttings recorded maximum growth and yield than the direct planted cuttings (Plate 9) The maximum plant height (75.6 cm), plant spread (71.3 cm), no. of secondary branches (58.7), average no. of flowers per plant (60.3) were observed in transplanted rooted cuttings, when compared to the direct planting of terminal cuttings in terms of maximum plant height (66.0 cm), plant spread (49.0 cm), no. of secondary branches (41.3), average no. of flowers per plant (50.7).



Plate 9: Field performance of transplanted rooted cuttings

#### Comparative growth performance of tuberose in modified planting system under polyhouse condition

The growth and yield performance of tuberose evaluated revealed that there was a significant increase in growth and flowering of tuberose in modified planting system, when compared to the conventional planting method (Plate 10). First flowering was observed in 32 days in the modified system, whereas it was 57 days in conventional planting system (Plate 11)





Plate 10: Evaluation of tuberose in modified planting system with reconstituted media







Plate 11: Evaluation of tuberose in conventional planting system

#### Evaluation of golden rod in modified planting system

Golden rod (*Solidago canadensis*) is a new introduction to the A & N Islands and is used as filler in bouquets and flower arrangements. A study was conducted to study the feasibility of growing this crop under the Island condition. The crop performs well in the Island condition with average number of spikes per plant (5.8), number of spikelets (17.2) and stalk length (37.9 cm). In the modified planting system the stalk length of golden rod was 79.5 cm and number of spikes (8.7 per plant) (Plate 12), whereas under conventional planting system the yield was comparatively less with average number of spikes per plant (5.8), number of spikelets (30.5) and stalk length (37.9 cm) (Plate 13).







Plate 12: Evaluation of golden rod in modified planting system with reconstituted media





Plate 13: Evaluation of golden rod in conventional planting system



#### A new propagation technique in Ixora

*Ixora* sp. is usually propagated by cuttings and air layering. Technology of propagation using leaf petiole as the propagule has been standardized. This is a new technology standardized for the first time in *Ixora* sp. (orange and pink cultivars) using root trainers and modified substrate (Plate 14).







Plate 14: A new plantlet in Ixora sp. through leaf petiole propagation

# Propagation of Nerium oleander through air layering

Among the different propagation methods tried like cuttings of different stages and air layering, maximum success percentage of 98.2 was observed in propagation through air layering (Plate 15).





Plate 15: Air layering in Nerium oleander

#### **Evaluation of crossandra varieties**

Among the four vareites of crossandra evaluated, Arka Ambara recorded maximum number of spikes per plant (22.5), spike length (8.2 cm) and number of flowers per spike (26) (Plate 16).





Plate 16: Arka Ambara –Best performing variety of crossandra



#### Mass multiplication of Anthurium and Dendrobium orchids

An experiment was done to study the optimization of micropropagation technique in anthurium with leaves and apical shoot buds as the explants. Maximum callus percentage (48.4%), number of shoots per explant (18.64) and percentage of rooted shoots (95) was observed in the treatment of MS media with growth regulator combination of BAP @ 2 mg/l and NAA @ 1 mg/l. The subculturing of regenerated shoots in the MS media showed a maximum number of shoots per explant in the treatments with apical buds as the explants (Plate 17).



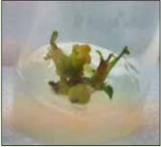






Plate 17: Micropropagation of anthurium in MS media using apical bud as explants

In mass multuplication of Dendrobium orchids, axillary buds as explants gave maximum success in MS media supplemented with growth regulator treatment combination of BAP @ 2 mg/l and NAA @ 1 mg/l. The callus formation percentage was 40.2% and number of shoots per explant was 12.4. Shoot multiplication was also observed when sub culturing was done in MS media supplemented with growth regulators (Plate 18).





Plate 18: Micropropagation of anthurium in MS media using apical bud as explants



# All India Co-ordinated Research Project (AICRP) on Flowers

#### V.Baskaran

#### **Evaluation of new entries of chrysanthemum**

Among the four entries of chrysanthemum varieties evaluated, the variety Zembla recorded maximum number of flowers per plant and flower size. Round the year flowering is observed in this variety even during high temperature (Plate 19).





Plate 19: Variety Zembla

#### **Evaluation of new entries of China aster**

The varieties of China aster like Arka Adhiya, Arka Archana, Arka Kamini, Local Pink and Local White were under evaluation. Maximum germination percentage was recorded in the variety Arka Adhiya (85.2%) (Plate 20).







Plate 20: Field evaluation of China aster varieties

#### Floriculture Based Sustainable Livelihood Model for Tropical Island Condition

V. Baskaran, K. Abirami, A. Velmurugan and N. Bommayasamy

This project aims at intensive cultivation of loose flowers for round the year flower production under polyhouse condition for the livelihood security of the farmers. Polyhouse was constructed in two farmers' field at Ograbraj and New Bimblitan, South Andaman (Plate 21). Intensive cultivation of flower crops like jasmine, tuberose and marigold were initiated in both the polyhouses at the farmers' field. Flowering is initiated in both marigold and tuberose in both the farmers' field. Early flowering was observed in tuberose in the polyhouse at farmers' field (Plate 22).







Plate 21: Flower cultivation in polyhouse at Ograbraj and New Bimblitan



Plate 22: Three flower crops under evaluation in the polyhouse

# Collection, Conservation and Utilization of Native Ornamental Plant Biodiversity of Andaman Nicobar and Lakshadweep Islands

V. Baskaran, K. Abirami, Divya Parisa and L. B. Singh

Exploration work was done for identification of native ornamentals in the South, Middle and North Andaman and the Nicobar group of Islands. Exploratory surveys resulted in identification and documentation of 20 palm sp,18 indigenous ornamental trees, 12 ornamental shrubs, 37 orchid spp., 12 fern spp. and 46 perennial ornamental species. Many of the species are conserved in the experimental farm (Plate 23-32).

#### Native ornamentals collected and conserved







Plate 23: Wild Jasmine & wild Ixora



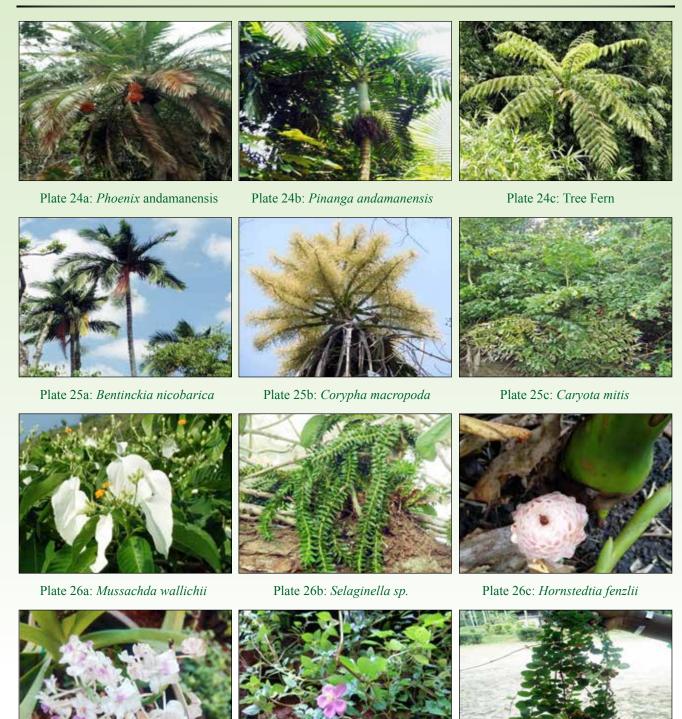


Plate 27a: Rhynchostylis gigantea

Plate 27b:

Plate 27c: Ficussp.





Plate 31a: Licuala spinosa

Plate 31b: Korthalsia rogersii

Plate 31c: Yeat (local name)









Plate 32a: Wild bulbiferous

Plate 32b: Wild Euphorbia Sp.

Plate 32c: Tabernamontana crispa

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

K. Abirami, V. Baskaran V. Damodaran and T. Subramani

#### Augmentation of germplasm of fruit crops

The varieties were collected from mainland and conserved for further evaluation in the fruit crops like:

Banana - Neypoovan, Manoranjitham, Udhayam, Virupakshi, Red banana and GG-9

Guava - Arka Kiran, Arka Mridula, Arka Reshmi and Lucknow 49

Mango - Arka Udhayan, Alphonso, Imam Pasand, Senthura and Malgoa

#### Effect of planting density on growth and yield of Banana variety Grand Naine

To study the growth and yield of the banana variety Grand Naine under high density planting, the planting was done in different planting systems with varied number of suckers per pit. Maximum yield (20.8 Kg/bunch) was recorded in the spacing of 1.5m x1.5m planted with 1 sucker/pit (Plate 33a & b).





Plate 33a: Field view of banana trial







Plate 33b: Field view of banana trial

#### Effect of organic nutrients on growth and yield of Banana variety Grand Naine

An experiment was conducted to study the effect of organic nutrients on growth and yield of Grand Naine variety of banana. Among all the treatments the treatment combination of FYM, vermicompost, coir compost and bio fertilizers recorded maximum bunch weight (21.6 Kg/bunch), weight of second hand (2.79 Kg), number of hands per bunch (11), maximum finger weight (0.205 Kg) with high TSS (14.3°B) and acidity (0.1%) (Plate 34).







Plate 34: Profuse fruit bearing in banana

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

Dragon fruit (*Hylocereus sp*) has great potential as a new crop for the farmers and entrepreneurs in the Island. There is an increasing demand for this new exotic fruit because of its health benefits and industrial applications. A germplasm collection of six different genotypes with four identified based on the DUS descriptors is maintained i.e. *Hylocereus undatus* (fruit red skin and white flesh) (Plate 35), *Hylocereus polyrhizus* (fruit red skin and magenta flesh) (Plate 36), *Hylocereus costaricensis* (fruit red skin with super red meat flesh colour) (Plate 37), *Selenicereus megalanthus* (dragon fruit yellow skin and white flesh) (Plate 38)





Plate 35: Hylocereus undatus







Plate 36: Hylocereus polyrhizus





Plate 37: Hylocereus costaricensis





Plate 38: Selenicereus megalanthus

Among the different trellis system, concrete support system is the best support system and highly suited for the Islands (Plate 39). About 4 rooted cuttings were planted around each pole and allowed to train over the concrete trellis system. Flowering was initiated in the month of March in the species *Hylocereus undatus*, *Hylocereus polyrhizus and Hylocereus costaricensis*. The fruit set percentage was highest in the species *H. undatus* (80.2%). The yield of the fruits recorded were 3 kg per pole in *H. Costaricensis* and 2.5 kg/ pole in *H. polyrhizus*. The fruit yield was highest in the species *H. undatus* (5 kg/pole).



#### Reproductive biology of Hylocereus polyrhizus



Plate 39: Field view of Dragon fruit

At the onset of flowering, 3-7 spherical buttons, medium elliptic in shape emerged from the stem margins. Only 4-6 develop into elongated cylindrical flower buds in about 14-16 days. The cylindrical flower buds are light green in colour with red colour in edges. The anthesis of the flower is initiated 17 to 20 days after flower initiation. The flowers are hermaphrodite, nocturnal and strongly scented. Each flower is large, up to 30 cm long, with a long flower tube that fans out into a funnel shaped corolla with thin, white petals. A nectary chamber is located at the bottom of the flower tube. Pollination is done by honey bees, bats and moths. The opening of the flower is initiated at 5.45 pm and the anthesis is completed at 10.30 pm. The stamen displayed profuse creamish-yellow pollens. The style is slender with 24 stigma lobes which are creamish white in colour. The stigma receptivity, pollen viability and fertility were maximum on the day of anthesis. The microscopic studies showed that the pollens are round in shape with size ranging from 280µm to 328µm. The viability of the pollen was maximum on the day of anthesis (80.6%) and decreased to 58.6% during the post anthesis. *The in-vitro* studies conducted on pollen germination revealed that maximum germination (45.8%) was recorded from pollen collected during anthesis when compared to the pollen of post anthesis period (22.8%) (Plate 40-42).

#### Physico-chemical and phytochemical analysis of dragon fruit species

The maximum average fruit weight was recorded in the species *H. polyrhizus* (524.3 g per fruit) followed by *H. undatus*(410.5 g)and minimum fruit weight was recorded in *Selenicereusmegalanthus*. The TSS was maximum in *H. polyrhizus*(10.8°B) followed by *H. costaricensis*(10.2°B). The titrable acidity was also maximum in *H. polyrhizus*(0.69%). The phytochemical analysis of the pink flesh species *H. Polyrhizus* revealed that phenolic (1534.7 mg GAE/100 mg) and flavonoid (784 mg rutin/100g) content was highest in the acetone extract. The antioxidant activity of the pulp of *H. polyrhizus* fruits were done using different methods like DPPH, ABTS and FRAP in the different extracts. The antioxidant activity showed highest values in the DPPH method in the methanolic extract (2137.5 mg BHT/100 g) (Table 1).





Plate 40: Floral developmental stages of *H. polyrhizus* 

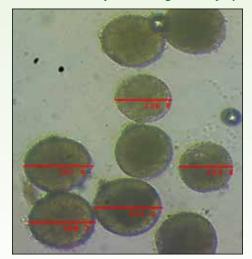


Plate 41: Pollen morphology (10X magnification)



Plate 42: Pollen fertility (10X magnification)



**Table 1: Phytochemical composition of** *Hylocereuspolyrhizus* 

Extract	Phenol (mg GAE/100g)	Flavonoids (mg rutin/100g)	DPPH (mg BHT/100g	ABTS (mMtrolox/g	FRAP (mM Fe <sup>+2</sup> /g)
Aqueous	75	280	236.25	17.72	9.56
Acetone	1534.722	784	1862.5	19.28	11.06
Methanolic	504.1667	184	2137.5	20.26	8.52
Ethanol	348.6111	40	2037.5	19.35	12.12

#### Disease incidence in dragon fruit

The fungal leaf spot or blight symptoms that occurred in dragon fruit were studied. The morphological identification recorded the presence of three fungal pathogens associated with the disease symptoms *viz.*, *Colletotichum*, *Bortyosphaeria* and *Pestalotia* (Plate 43).

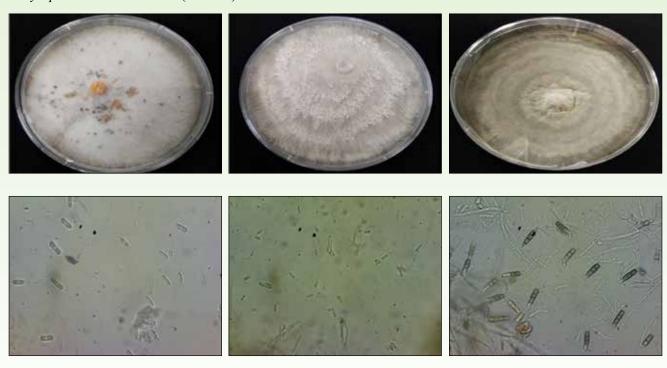


Plate 43: Colletotichum sp.

Bortyosphaera sp.

Pestalotia.sp.

#### Collection and evaluation of edible cacti

Four best performing clones of edible cacti (*Opuntia ficusindia*) namely 1270, 1271, 1280 and 1287 were procured from CSSRI, Karnal for conservation and evaluation at CIARI. The field planting of single cladode of the edible cacti accessions were done in August 2016 in raised beds and the growth observations recorded eight months after planting revealed maximum height (31.4 cm) in the clone 1287 and maximum width (14.7 cm) was recorded in the clone 1280 (Plate 44). The number of cladodes were maximum in the clone 1271 (5.2) and the cladode thickness were maximum in the clone 1287 (1.9 cm) (Plate 45).









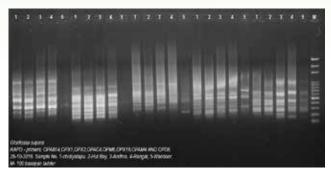
Plate 45: Field evaluation of edible cacti clones

### Collection and Evaluation of Medicinal Plants of Bay Islands

K. Abirami, V. Baskaran and Damodaran, V.

#### Genetic diversity analysis of different accessions of Gloriosa superba in the Island

Sixteen markers from each RAPD and ISSR were tested for assessing the genetic diversity among the five different accessions of *Gloriosa superba* collected from the different parts of the Andaman group of Islands. Among the 16 RAPD primers, 15 showed amplification and these 15 RAPD markers generated 426 bands in the five different accessions of *Gloriosa sp* with 0.320 PIC value. The maximum discriminating bands were obtained from the primer OPAG8 and minimum discriminating bands from the primer OPD1. The cluster analysis using the RAPD characterization generated three distinct groups with about 66% homology between the different accessions. Among the 16 ISSR markers used for molecular characterization, 13 generated 335 bands in the different accessions of the species *Gloriosa superba* with 0.264 PIC value (Figure 1). The maximum discriminating bands were obtained from the primer UBC 808 and minimum discriminating bands from the primer UBC 864. The cluster analysis using the ISSR characterization generated three distinct groups with about 63% homology between the different accessions. The molecular characterization with RAPD and ISSR markers revealed that the Wandoor(WND) accession is clustered into a separate cluster and quiet distinct from the other accessions like Chidiyatapu (CHT), Little Andaman (LA), Rangat (RGT) and Tamil Nadu Local (TNL) (Figure 2).



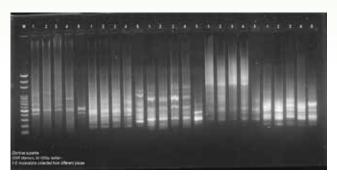
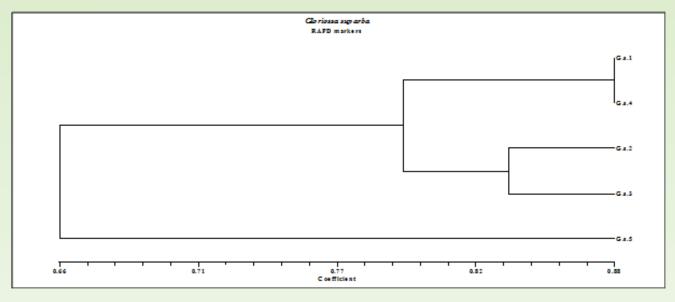
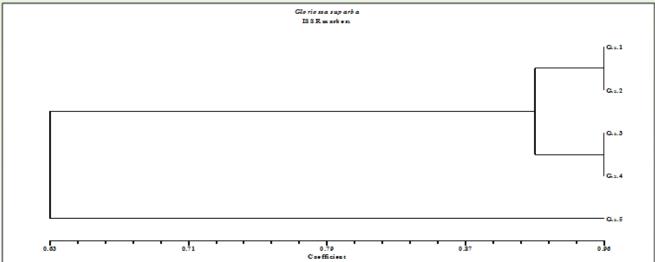


Figure 1: PCR profile Gloriosa superba accessions with ISSR and RAPD primers







Key: Gs1 - Chidiyatapu(CHT), Gs2- Little Andaman (LA); Gs3- Rangat (RGT); Gs4- Tamil Nadu local (TNL)

Figure 2: Genetic diversity in accessions of Gloriosa superba using RAPD and ISSR markers

## All India Coordinated Research Project (AICRP) on Fruits

### K. Abirami

#### Augmentation and evaluation of germplasm in mango

About 9 polyembryonic accessions were identified during the exploratory survey conducted in Middle and North Andaman. The physico-chemical characteristics of the fruits of the mango accessions identified were recorded. The highest TSS (26.9°B) was recorded from the accession identified at Kalipur, North Andaman. The individual fruit weight ranged from 106.1 g to 522.1 g in the different polyembryonic accessions. Wide variations were also observed in the pulp weight (36 g to 272 g) in the different polyembryonic accessions collected. The number of polyembryonic seedlings per stone varied from 1 to 3 in the different accessions of mango.



#### Augmentation and evaluation of germplasm in banana

Three native banana genotypes were collected from the different parts of the Island and conserved at the experimental farm for further evaluation. An ornamental species of banana namely *M. laterita* was collected from Sipighat farm, a banana with green colours pathe was identified and collected from Hut Bay. A dwarf banana genotype with small finger size was collected from Jirkatang, South Andaman (Plate 46).



Plate 46: Native banana genotypes of the Island

## **CSS-(MIDH) National Horticulture Mission Scheme on Spices**

K. Abirami and V. Damodaran

#### Production of quality planting material of spices

Multiplied and produced the quality planting materials of black pepper (20000 nos), clove (3000 nos), nutmeg (700 nos), cinnamon (3500 nos), ginger (600 kg) and turmeric (400 Kg). The planting materials of different spices were distributed to the farmers in different parts of the Andaman group of Islands.

#### **Technology demonstration programmes**

Sixteen FLDs are taken up on organic cultivation of ginger and turmeric in different parts of the Island. A FLD programme on black pepper cultivation is taken up in a farmer field at Rangachang (Plate 47). On an average the farmers recorded a yield of about 8- 10 t/ha of ginger in organic cultivation (Plate 48) and 12-16 t/ha in turmeric cultivation (Plate 49).





Plate 47: Distribution of planting material of spices and field monitoring of spices cultivation





Plate 48: Organic ginger cultivation in Chouldhari



Plate 49: Organic ginger & turmeric cultivation in Middle Andaman

#### Effect of organic treatments in plug tray production of turmeric transplants

The planting of transplants instead of seed rhizomes is of recent practice and the technology has been standardized using plug trays. This technology in organic method will be of high utility in the Island to save the planting material and for production of healthy planting material. The sprouted rhizome bits of ginger embedded in coir pith bed were planted in protrays containing organic media. The combination of cocopeat, FYM, vermicompost in the ratio of 1:1:1 along with trichoderma and VAM (T5) treatment recorded early sprouting (9.3 days) and maximum plant height and width (Plate 50).



Rhizome bits of ginger with single node sown in coir pith bed bed for sprouting



Ginger transplants- good shoot and root growth in T5

Ginger transplants ready for planting in main field

Sprouted rhizome bits planted in root trainers

Plate 50: Effect of organic treatments in plug tray production of turmeric transplants



#### Effect of organic nutrients on growth and yield of turmeric varieties

The turmeric transplants of the two varieties CO2 and Alleppey Supreme raised from rhizome bits were planted in raised beds under five different organic treatments with four replications. The maximum yield was recorded in the variety Allepey Supreme (650.50 g rhizome yield per plant) in the treatment combination of FYM, coir compost vermicompost together with the microbial inoculants. The same treatment combination recorded maximum yield in the variety CO2 (480.72 g rhizome yield per plant), however the yield was less than the yield of the variety Allepey Supreme (Plate 51 & 52).





Plate 51: Growth and yield performance of turmeric variety Alleppey supreme





Plate 52: Harvesting of turmeric

# Development and Evaluation of Silvipasture System under Coconut Plantation in Tropical Island Condition

#### I. Jaisankar, T.P. Swarnam and V. Damodaran

The initial growth observation of the system involving fodder trees and fodder legume crops showed a significant difference among the combinations with regard to the green fodder yield. The combination of *Leucaena leucocephala+Sesbania grandiflora+ Stylosanthes scabra+* Desmanthus recorded maximum green fodder (mean of two cuttings) yield of 7.00 t ha<sup>-1</sup> at the initial stage of the system established under coconut plantation, while the lowest green fodder yield was recorded under Desmanthus alone (0.5 t ha<sup>-1</sup>) (Plate 53). At the initial stages the fodder tree *Sesbania grandiflora* could not be established well due to high mortality under the coconut plantation. Hence, the species was replaced with *Bauhinia variegata* L. The soil samples were collected one year after the experiment and the results revealed that there was no significant difference among the system in case of organic carbon, nitrogen, phosphorous and potassium content.





Plate 53: Field view of Silvipasture system under coconut plantation

# Development and Standardization of DUS Characteristics Procedures for Noni (Morinda citrifolia L.)

#### I. Jaisankar and Awnindra K Singh

During the reporting period the draft DUS guidelines for Noni (*Morinda citrifolia* L.) was published by PPV & FRA, New Delhi. The CIARI center was approved as a Noni DUS center and as per the approval component of the project the CIARI released varieties *viz.*, CARI Sampada, CARI Rakshak, CARI Samridhi and CARI Sanjivini plantations were maintained with the timely implementation of the silvicultural practices. The impact of shade and parasite on growth and yield of noni was also studied for better management of noni plantation under Island condition.

#### Effect of Mistletoe (Dendrophthoecurvata Blume Miq.) on growth and yield of Noni

The results indicated a significant impact of mistletoe on the growth and yield parameters of noni viz., tree height (m), number of branches and DBH (cm) growth (Table 2). Among the 6500 individual plants of *Morinda citrifoila* observed on five blocks [ICAR-CIARI Garacharma farm (Block-1, Block-2), ICAR-CIARI Sippighat Horticulture



Plate 54: Effect of Mistletoe (Dendrophthoecurvata Blume Miq.)



farm (Block-3, Block-4) and APDC plantation, Mithakhari (Block-5)] of different localities, 11.3% of trees (735 trees) were infested by Dendrophthoecurvata. The infection intensity of infected plant was significant as compared to the healthy plants (Plate 54). Among the blocks the highest level of growth reduction due to the parasite infection was observed in block 3 (tree height and number of branches) and maximum DBH reduction was observed in Block1, when compared to healthy plants. The average mean fruit yield of the infected plants was 14.4 kg plant-1 and the healthy plant mean yield was 20.12 kg plant-1. It clearly showed that the infected tree fruit yield was reduced up to 38 % compared to the healthy plants. Effective control of the mistletoe and constantly monitoring its infestation is, very essential in order to save noni plantations.

Table 2: Comparative quantitative analysis of effected and healthy Noni plants

Bloc	k of Noni plantatio	n	Tree height (m)	No. of Branches	DBH (cm)	Total yield (Kg/plant)
Block-1	Healthy plant	Mean	4.48	23.6	10.45	17.6
		SE	0.19	1.69	0.42	0.92
	Infected plant	Mean	3.72	16.8	8.88	10.8
		SE	0.19	0.86	0.26	0.58
	Probability	-	0.005	0.001	0.003	0.002
Block-2	Healthy plant	Mean	5.68	18.6	10.6	15.2
		SE	0.47	1.96	0.61	1.15
	Infected plant	Mean	3.92	13.6	7.1	10.6
		SE	0.13	0.92	0.20	0.67
	Probability	-	0.015	0.03	0.003	0.000
Block-3	Healthy plant	Mean	7.76	39.6	12.23	22.6
		SE	0.29	2.48	0.50	1.07
	Infected plant	Mean	6	29.4	8.56	17.2
		SE	0.20	1.63	0.31	0.96
	Probability		0.002	0.009	0.001	0.011
Block-4	Healthy plant	Mean	6.48	31.4	9.85	21.2
		SE	0.23	0.97	0.40	1.35
	Infected plant	Mean	5.00	23.6	8.17	15.0
		SE	0.08	0.92	0.37	1.0
	Probability	-	0.001	0.001	0.03	0.019
Block-5	Healthy plant	Mean	6.94	34.8	10.37	24.0
		SE	0.33	2.13	0.63	1.41
	Infected plant	Mean	5.8	27.0	8.64	18.4
		SE	0.34	0.70	0.26	1.28
	Probability	-	0.02	0.008	0.01	0.035

(SE: standard error; p: probability of Student's t test comparing the two paired sampled Noni trees).

#### Effect of shade on growth and yield of noni

The effect of shade on growth and yield of noni plantations were studied under different shade condition *viz.*, open field, are canut intercropped, coconut intercropped, near forest trees for consequent two years (2015-16 and 2016-17). The results revealed that the shade affected the growth and yield of noni significantly compared to pure plantation (Table 3). Both the year the maximum mean height (3.89 m), number of branches (21.70), DBH (14.81 cm), crown diameter (3.70 m) and yield (17.75 kg/tree) was recorded in pure noni plantation, followed by noni intercropped with are canut and coconut while least [mean height (2.21 m), number of branches (9.15), DBH (10.83 cm), crown diameter (1.80 m) and yield (10.90 kg/tree)] were recorded in the plantation situated nearby the wild trees. The observation clearly state that the shade is having the influence on growth and yield of noni plantations under Island condition.



Table 3. Effect of shade on noni growth and fruit yield (Kg/tree) (2015-16 and 2016-17)

Shade		Height (m)			Branch (Nos)			рвн (сш)		Crov	Crown diameter (m)	ıter		Yield Kg/Plant	
	2015- 16	2016-	Mean	2015- 16	2016-	Mean	2015- 16	2016-	Mean	2015- 16	2016-	Mean	2015- 16	2016-	Mean
Open field	$3.60^{a}$	4.17ª	3.89	20.70ª	22.70ª	21.70	14.38ª	15.24ª	14.81	$3.50^{a}$	3.89ª	3.70	17.50ª	18.00ª	17.75
Arecanut plantation	3.12 <sup>b</sup>	3.68 <sup>ab</sup>	3.40	18.00 <sup>b</sup>	20.30a	19.15	19.15 12.29b	13.78 <sup>b</sup>	13.04	2.85 <sup>b</sup>	3.07 <sup>b</sup>	2.96	16.30 <sup>ab</sup>	15.70 <sup>b</sup>	16.00
Coconut plantation	2.94 <sup>b</sup>	3.20 <sup>b</sup>	3.07	17.30b	19.30ª	18.30		11.99b 12.82b	12.41	2.64b	3.03 <sup>b</sup>	2.84	14.60 <sup>b</sup>	15.10 <sup>b</sup>	14.85
Associated with forest trees	2.11°	2.31℃	2.21	8.30°	10.00 <sup>b</sup>	9.15	10.69°	10.97⁵	10.83	1.73°	1.86°	1.80	11.00°	10.80°	10.90
P value	0.87	0.32	09.0	0.05	0.03	0.04	0.37	0.51	0.44	0.79	0.97	0.88	0.21	66.0	09.0
CD (0.05)	0.37	0.49	0.43	2.32	3.49	2.91	1.24	1.20	1.22	0.43	0.41	0.42	1.91	2.18	2.05
CV	13.90	16.04	14.97	15.78	22.70	19.24 11.02	11.02	9.90	10.46 17.51	17.51	15.23	16.37	14.07	16.00	15.04



## All India Coordinated Research Project (AICRP) on Vegetable crops

#### I. Jaisankar and Divya Parisa

#### **Brinjal**

In brinjal bacterial wilt - IET trial, a total of seven entries were evaluated. Among the entries 2016/BRBW-5 recorded the maximum fruit yield of 28.58 (q/ha) followed by 2016/BRBW-8 (27.08 q/ha). There were eight entries evaluated under brinjal round - IET trial, the maximum fruit yield of 15.46 q/ha was recorded in 2016/BRRVAR-8, followed by 2016/BRRVAR-7 (12.40 q/ha). In brinjal long – IET trial a total of eight entries were evaluated and the maximum fruit yield (17.22 q/ha) was recorded in 2016/BRLVAR-1, followed by 2016/BRLVAR-6 (16.40 q/ha) and the least fruit yield of 10.34 q/ha was recorded in 2016/BRLVAR-2 entry.

#### Okra

There were six entries and two check varieties evaluated under okra hybrid AVT-II trial. The result revealed that the maximum fruit yield of 8.34 q/ha was recorded in 2014/OKHYB-8, followed by 2014/OKHYB-2 (7.95 q/ha). Both the entries out performed, when compared to the check varieties [Arka Anamika (96.92 q/ha) and NBH- 180 (6.75 q/ha)] (Plate 55).

#### **Tomato**

In Cherry tomato IET trial the entries 2016/TOCVAR-1 recorded the maximum fruit weight of 18.14 q/ha followed by 2016/TOCVAR-4 (15.5 q/ha). Among twelve entries evaluated 2016/TODVAR-3 recorded maximum fruit yield of 172.75 q/ha followed by 2016/TODVAR-10 (170.38 q/ha) and least yield was recorded in 2016/TODVAR-12 (110.98 q/ha) in tomato determinate IET. In Tomato (ToLCV) AVT II trial, maximum fruit yield of 139.96 q/ha was recorded in check variety H- 24, it was on par with 2014/TOLCVRES-2 (138.96 q/ha). Among the five entries and two check varieties evaluated in Tomato (ToLCV) AVT I, the maximum fruit yield was recorded in 2015/TOLCVRES-2 (170.13 q/ha), followed by 2015/TOLCVRES-1 (168.28 q/ha), which has out performed with the national check and susceptible checks (H-24) and Pb. Chhuhara. In tomato determinate AVT II trial six entries and one check variety were evaluated and the maximum fruit yield of 168.65 q/ha was recorded in check variety H-86 and the next best fruit yield was recorded in 2014/TODVAR-6 (110.41 q/ha). Among the five entries evaluated under tomato hybrid determinate IET trial the maximum fruit yield of 187.56 was recorded in 2016/TODHYB-1, followed by 2016/TODHYB-2 (171.27 q/ha) (Plate 55 a&b).

#### Pea

Among the eight green pea entries in the pea (mid) IET trial, the highest green pea yield was in 2016/PMVAR-3 (29.56 q/ha) followed by 2016/PMVAR-1 (27.08 q/ha). The entries 2016/PMVAR-4, 2016/PMVAR-6, 2016/PMVAR-9 had vegetative growth but no flowering observed in the growing season. Among the eight green pea entries in the pea (mid) IET trial, the highest green pea yield was recorded in 2016/PEVAR-6 (36.58 q/ha) followed by 2016/PEVAR-5 (26.88 q/ha)

#### Poi leafy vegetable

The leafy vegetable both red poi (*Basella rubra* L.) and green poi (*Basella alba* L.) cultivated under open field and poly house was observed that the poi cultivated under poly house gave maximum green leaf of 25.90 t/ha (Red Poi) and 24.19 t/ha (Green Poi) compared to open condition and also in poly house cultivated leafy vegetables both the species recorded less insect infestation.







Plate 55a: Field view of brinjal bacterial wilt – IET trial

Plate 55b: Field view of Okra hybrid AVT-II trial

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

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

Soil and climatic conditions of the Bay islands are favourable for cultivation of both indigenous and introduced fruit crops, especially those originated in South East Asian countries. Some of these species could be cultivated on commercial scale, while others need to be promoted for backyard cultivation. Experiments have been initiated to study the performance of five superior rambutan types and two mangosteen types under island conditions. Further, performance of *Annona* hybrid Arka Sahan and sweet carambola are being studied at closer spacing. Flowering was noticed in a few plants of both the species during first year of planting.

#### Collection and conservation of potential fruit species

During the year, regenerated plants of *khoonphal*(*Haematocarpus validus* (Miers.)Bakh.f. ex Forman) were planted in different areas of Garacharma farm as a part of habitat enrichment activities. Further, 45 regenerated seedlings of *Garcinia* species and bael (*Aegle marmelos* (L.) Correa) were planted in the Bachhara Pahad village, South Andaman as a part of Swachha Bharat Abhiyan (Plate 56). Pulasan (*Nepheliummutabile* Blume) was added to the underutilized fruit germplasm block of the institute. Further, seedlings of *G.dhanikhariensis* and *G. gummi-gutta*(L.) Roxb. have been raised (Plate 56) for carrying out further studies.





Plate 56: A view of afforestation activities in South Andaman (left) and regenerated seedlings of *G. gummigutta*(L.) Roxb.(right)



#### Physico-chemical analysis of souring fruits

Physico-chemical parameters of mature green fruits of hog plum (*Spondias dulcis*L.) were assessed, which revealed that fruit pulp had 8.32 °B total soluble solids, titratable acidity of 0.38 % (citric acid equivalent), ascorbic acid of 35.49 mg/100g and 108 mg/100 g GAE of total phenolic content. The species is consumed by both settler communities as well as native tribe and hence, could be popularized as a component of homestead gardens for utilization in the form of value added products. Fruits of sour carambola (*Averrhoa carambola* L.) were evaluated for their physico-chemical composition at different stages of maturity, while fruits of Malabar tamarind (*G. gummi-gutta*) were studied at two maturity stages for their morphological, biochemical and micronutrient composition. Significant differences were noticed for the studied parameters in both the species.

#### Morphological and biochemical characterization of *G. gummi-gutta*morphotypes

G. gummi-gutta, popularly known as Malabar tamarind, is a tropical fruit bearing species native to Southeast Asia. The economic part of the fruit is dried rind, which serves as an acidulant in various vegetarian and non-vegetarian cuisines and has been valued for its anti-obesity properties. Two distinct morphotypes of the species (GG-02 and GG-05) were observed in Garcinia conservation block at the Institute (Plate 57). Systematic morphological and biochemical characterization revealed significant differences in leaf morphological parameters, fruit dimensions, fruit weight, rind recovery (%), dry matter content in the rind (%), biochemical parameters viz. photosynthetic pigments, total soluble solids, pH, titratable acidity, ascorbic acid etc.





Plate 57: A view of Garcinia conservation block at the Institute (left) and two morphotypes observed (right)

## Exploring the possibility to prepare dried rind powder from G. gummi-gutta fruits

Mature green and ripe fruits of *G. gummi-gutta* were used for preparation of dried rind powder. The product prepared from mature green fruits had higher titratable acidity content and both the products were found to have acceptable sensory qualities. The product was packed in polypropylene vials and studied for five months at room temperature.

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

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

Micropropagation is an important technique for conservation and utilization of species of both economic and ecological importance. Keeping in view the growing demand for planting material of local banana types, experiments have been initiated to optimize efficient multiplication protocol for micropropagation of banana varieties Korangi and Cheena Kela. Cultures initiated during rainy season did not support aseptic establishment as microbial contaminant load was high and drier parts of the year could favour higher *in vitro* establishment in (Plate 58). In order to educate the farmers and officials of line department about the advantages and limitations of the tissue culture technology, awareness and sensitization programmes were conducted at different places in Andaman Islands. Technical support is



being rendered to the UT Department of Agriculture for establishing a commercial scale tissue culture laboratory for production of planting material in the islands, thereby reducing dependence on mainland supplies. This could also help in reducing introduction and spread of pathogens from other parts of country through faulty planting material.





Plate 58: Successfully established cultures of banana variety Korangi

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

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

Spice crops are amongst the most profitable crops, which could be cultivated on commercial scale in the islands especially in the existing coconut and arecanut plantations as intercrops. However, lack of island suited varieties, non-availability of planting material and lack of scientific cultivation are the major impediments in the development of this sector. Further, a number of native species of related taxa of pepper and nutmeg have been reported from the islands. Considering these points, systematic studies were initiated to utilize the natural diversity present in the islands and promotion of scientific cultivation of important species. Improved varieties of black pepper, cinnamon and nutmeg were established in the experimental fields and their performance is being evaluated under island condition. Improved varieties of pepper are also being multiplied for distribution to the island growers.

#### Regeneration studies in spices and their wild relatives

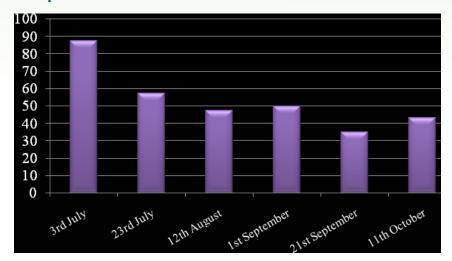


Fig.3: Effect of time of air layering on rooting percentage in cinnamon (pooled data for two consecutive years).



Cinnamon is one of the promising spice crops for cultivation under island conditions; however, the crop is extensively propagated through seeds. Being cross pollinated, considerable variability is noticed in this crop for growth, yield and quality parameters. In order to propagate superior genotypes in large quantity, experiments were conducted during 2015 and 2016 to optimize time of layering under island condition. Result revealed that first week of July was found to be the most suitable time for air layering in cinnamon under island condition (Fig.3) and hence could be recommended for the island farmers.

*Piper sarmentosum* Roxb. is one of the important members of the botanical family Piperaceae distributed in various parts of Andaman islands. This species has potential as antimicrobial, antioxidant, anti-tuberculosis and antispasmodial agent. However, very little information is available about its production aspects. In order to multiply elite types in large number, rapid vegetative propagation is desirable. Effect of type of stem cutting, growth regulators and retention of leaves was studied (Plate 59). Results revealed that double node cuttings performed better than single or triple node cuttings. Use of 1000 mg/L IBA as pre-treatment helped in improving sprouting percentage and plant growth. Further, retention of leaves on the cuttings was beneficial for improving the plant growth.





Plate 59: General view of vegetative propagation experiment in *P. sarmentosum* Roxb. showing variable response in studied treatments

Experiments were conducted to standardize micropropagation protocol in *P. sarmentosum* (Plate 60). The most suitable methodologies for establishment of aseptic cultures in five explants of *P. sarmentosum viz*. leaf, node, internode, petiole and shoot tip were standardized. Effect of kind and concentration of auxins on initiation and subculture was studied in leaf explants. Root induction was observed in the leaf explants initiated onto MS media supplemented with IAA (0.5 mg/L). Varied responses were observed in different explants, when subcultured onto cytokinin (BAP and TDZ) supplemented media. Callusing was noticed in leaf, internodal and petiolar explants. In another set of experiment, higher bud break in nodal explants was observed in basal media (87.5%) than media supplemented with BAP alone or in combination with NAA (0.5 mg/L).





Plate 60: Successfully established nodal cultures and indirect regeneration from callus of *P. sarmentosum* 



#### Collection, maintenance and utilization of wild relatives of spice crops

Two ecotypes of pepper wood were collected from Little Andaman and Middle Andaman islands and analysed for physico-chemical parameters. Results revealed considerable variations for morphological parameters, total phenol content and antioxidant activity.

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

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

Mango ginger (Plate 61) is a multipurpose species, which has been used as a spice in culinary preparations and processed into value added products such as pickles. It also possesses medicinal values and is used in a preparation of medicinal formulations. Considering the natural distribution of the species, scope for exploitation and low management requirement, this crop could be promoted for commercial scale cultivation in the Andaman Islands.

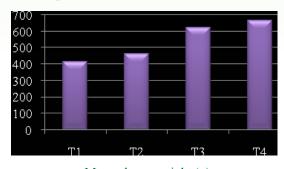




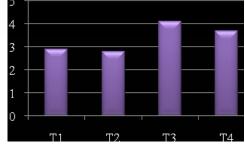
Plate 61: General view of experimental field and a harvested clump of mango ginger

#### Effect of size of rhizome on yield and quality parameters

In the experiment to standardize the size of rhizome used for planting, considerable variations (Fig. 4) were recorded amongst the treatments studied during first cropping year. Differences were reported for growth and yield parameters such as mean clump weight (415.0 to 665.8 g), number of primary rhizome (2.78 to 4.11), weight of primary rhizome (35.1 to 49.1 g), dry recovery (23.6 to 29.2 %), oil content (0.30 to 0.45% in primary and 0.30 to 0.40% in secondary rhizomes) and other parameters.



Mean clump weight (g)



No. of Primary Rhizomes



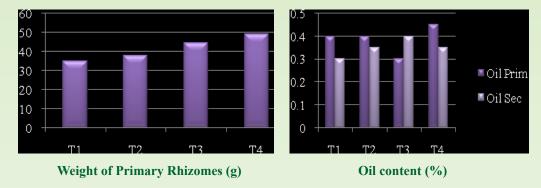


Fig.4: Effect of size of rhizome on yield parameters and oil content during first cropping year

#### Effect of bio fertilizers on yield and quality parameters

An experiment was conducted to study the effect of biofertilizers on growth, yield and quality of mango ginger, which revealed considerable variations during first cropping season amongst the treatments (Fig.5). Growth and yield parameters such as mean clump weight (412.8 to 490.7 g), number of primary rhizome (4.00 to 5.11), weight of primary rhizome (30.0 to 34.5 g), oil content (0.25 to 0.55% in primary and 0.35 to 0.40% in secondary rhizomes) and other parameters were influenced by the treatments.

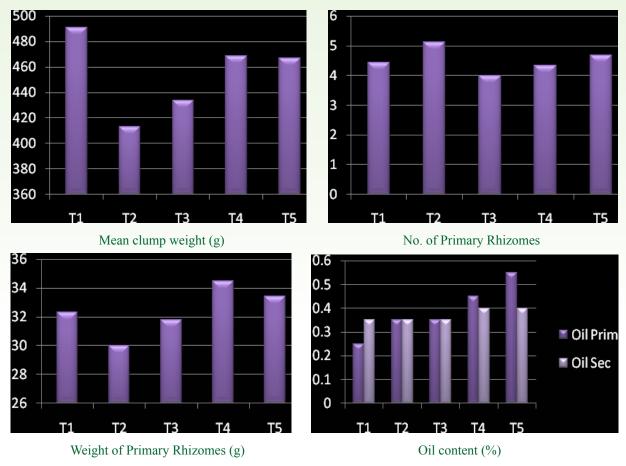


Fig.5: Effect of bio fertilizers on yield parameters and oil content during first year of cropping



### All India Coordinated Research Project on Palms

### Ajit Arun Waman

#### Arecanut based cropping system models

Studies on arecanut based cropping system models comprising of banana, ginger, black pepper and elephant foot yam have been initiated since July 2015. Initial soil analysis revealed acidic pH (4.64) with 0.7 dS/m of electrical conductivity, 292.2 kg/ha of available nitrogen, 225.5 kg/ha of available potassium and 2.1% of soil organic carbon. Pre-experimental growth and yield observations in various models viz. arecanut alone  $(T_1)$ ; arecanut + black pepper + banana  $(T_2)$ ; arecanut + black pepper + ginger  $(T_3)$ ; arecanut + black pepper + elephant foot yam  $(T_4)$  are presented in Table 4. Black pepper and banana have been successfully established in the experimental block (Plate 62), whereas ginger and elephant foot yam have been harvested.

Table 4: Pre-experimental observations in arecanut intercropping experimental block

Treatment	Plant height (m)	Plant girth (cm)	No. of leaves	No. of bunches/ palm	No. of nuts per palm
$T_1$	$7.9 \pm 0.32$	$51.3 \pm 1.18$	$9.1 \pm 0.44$	$1.73\pm0.27$	83.20
T <sub>2</sub>	$8.0 \pm 0.58$	$51.2 \pm 1.79$	$9.2 \pm 0.47$	$1.75 \pm 0.38$	
T <sub>3</sub>	$7.6 \pm 0.62$	$50.3 \pm 1.43$	$9.4 \pm 0.77$	$2.02 \pm 0.24$	
T <sub>4</sub>	$7.6 \pm 0.36$	$51.9 \pm 0.93$	$9.4 \pm 0.18$	$1.92 \pm 0.21$	





Plate 62: Arecanut based cropping system: well established vines of black pepper (left) and emergence of banana bunch (right)

#### Coconut based cropping system models

Coconut based cropping system models for island conditions were established in the Sipighat farm. Initial soil analysis revealed the following parameters: pH (4.65), electrical conductivity (0.66 dS/m), available nitrogen (332.5 kg/ha), available potassium (362.5 kg/ha) and organic carbon (1.75%). Pre-experimental growth observations were recorded for various parameters as presented in Table 5 and the mean yield was observed to be 50.14 nuts per palm.



Table 5: Pre-experimental growth observations of coconut in intercropping experimental block

Treatment	Plant height (m)	Plant girth (cm)	No. of leaves
$T_1$	$15.8 \pm 0.20$	$157.2 \pm 6.30$	$35.0 \pm 2.0$
T <sub>2</sub>	$15.8 \pm 0.30$	$151.8 \pm 2.70$	$33.9 \pm 1.5$
T <sub>3</sub>	$15.7 \pm 0.20$	$162.1 \pm 6.80$	$34.8 \pm 2.2$
$T_4$	$15.7 \pm 0.27$	$158.7 \pm 5.47$	$37.4 \pm 0.7$

#### Organic nutrient management in juvenile coconut plantation

Experiment was initiated during 2015 in juvenile palms of three dwarf varieties *viz*. Andaman Green Dwarf (AGD), Andaman Yellow Dwarf (AYD) and Andaman Orange Dwarf (AOD) to study the effect of organic nutrient management practices on soil health and yield of coconut. Pre-experimental growth observations were recorded for various parameters as presented in Table 6. Microbial count was recorded in the experimental block before commencing the experiment. Various organic management treatments have been imposed and the palms are being maintained following recommended package of practices.

Table 6: Pre-experimental growth observations in organic nutrient management experimental blocks of coconut

Parameters		Varieties	
rarameters	AGD	AYD	AOD
Plant height (cm)	$93.80 \pm 8.67$	$86.09 \pm 10.43$	$73.73 \pm 11.68$
Plant girth (cm)	$26.09 \pm 2.68$	$38.39 \pm 3.89$	$54.89 \pm 7.82$
No. of leaves	$6.87 \pm 0.31$	$8.20 \pm 0.62$	$10.07 \pm 0.56$
Total leaf length (m)	$2.32 \pm 0.13$	$2.75 \pm 0.24$	$4.04 \pm 0.27$
Petiole length (m)	$0.84 \pm 0.06$	$0.81 \pm 0.06$	$1.19 \pm 0.08$
No. of leaflets on one side	$42.53 \pm 1.92$	$59.07 \pm 5.40$	$75.47 \pm 3.82$
Breadth of leaflet at broadest point	$29.95 \pm 1.10$	$30.57 \pm 1.21$	$37.88 \pm 2.15$

#### Establishment of nucleus seed gardens

Land shaping work was taken up during the year for establishment of nucleus seed garden of coconut and arecanut at Garacharma farm. Seedlings are ready for transplanting and will be transferred in the field at the onset of monsoon season.

#### Identification of Edible Husk type coconut

A unique coconut type with edible husk that could be cut into pieces and eaten in raw form was identified from a farmer's field in Middle Andaman Island. Husk of mature nuts remains softer unlike the normal coconut fruits. Mean husk content was 723.8 g in young stage, which increased to 1990.8 g during tender nut stage, however with decreasing palatability. The mean tender water content was about 375 ml, while kernel content was about 256 g per nut at maturity. Further, the total soluble solids content was higher in the husk of tender fruits than in water in young as well as tender nut stage (Plate 63).





Plate 63: Mr. Haldar (in the middle) with nuts of edible husk coconut in his hands

## Development of Dwarf and High yielding Varieties in Coconut for Andaman & Nicobar Islands

#### V. Damodaran and K. Abirami

During the year, a total of 1570 female flowers were pollinated in 11 dwarf cross combinations in which the cross AYD x AOD recorded the highest setting percentage (26.8) followed by AGD x AYD. Among the CARI varieties the cross between CARI-Omkar xCARI-Surya recorded the highest setting percentage of 75.0. In DxT cross involving CARI Annapurna, CARI Surya, and AOD a total of 489 female flowers were pollinated with Sanraman Tall and CCNT and recorded overall setting percentage of 16.4% (Fig.6).

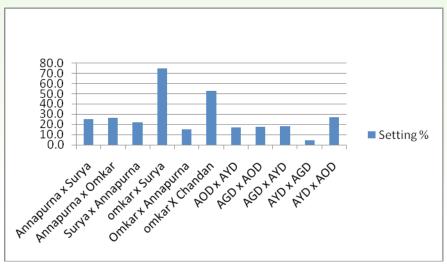


Fig.6: Setting percentage in D x D cross of Coconut

Inter-se- mating was carried out in 18 selected Pacific Ocean accessions and a total of 8547 female flowers were inter-se- mated and recorded overall setting percentage of 10.5%. The highest setting percent (77.8%) was recorded in ACC No.8 of American Samoa, followed by Acc 2 of Solomon Island (73.0%). Twenty seven  $F_1$  seedlings have been transplanted and maintained in the field for further evaluation of growth and yield parameters and 24  $F_1$  seedlings are maintained in the nursery. Initial evaluations of hybrids revealed that, AYD x AGD (Plate 64) recorded maximum plant height (4.43 m), girth of stem (72 cm), longest leaf (273 cm) and more number of leaflets on one side (76) followed by AGD x AYD (Plate 65).



About 580 pollinated seed nuts were sent to ICAR- CPCRI for characterization and conservation. Pollen grains (18 packets) from Niu lekha, Hari papua and Rennel Tall were sent to CPCRI, Kasaragod for diallel crossing.







Plate 65: AGD x AYD

### **AICRP on Tuber Crops**

V. Damodaran and L.B. Singh

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

Exploration were made in Hut bay, Car Nicobar, Nancowry and Campbell bay and collected 3 accessions of colocasia, 4 accessions of greater yam and one accession each in sweet potato and aerial yam. A total of 99 accessions are being maintained in the gene bank which includes the previous and current year collections.

#### URT on Colocasia (2<sup>nd</sup> year)

Six entries of colocasia along with one national check variety Muktakeshi and one local check were evaluated for growth and yield parameters under Island conditions. Among the entries, the highest plant height (96.8 cm) was recorded in Local, followed by TTr 12-8 while the maximum number of cormel per plant was recorded in TTr 12-7 (16). However TTr 12-8 recorded maximum weight of cormel (383.8g) followed by TTr-12-5. With regards to yield, TTr 12-8 recorded higher yield (15.3 t/ha) followed by TTr-5 and TTr-7 which are on par.

#### Farming system studies in tribal areas

The Nicobari tribal communities mainly rely on coconut, tuber crops, pigs and marine fisheries for their livelihood. They grow only Nicobar Aloo (Greater yam) mainly for food and use to work for one hour daily in their garden and to take care of their animal. The employment generation in their traditional system was only 41 man days/year. Considering the successful intervention of tuber crop based farming system, fifteen farmers have adopted the tuber crop based farming system at Harminder Bay (Plate 66). The model comprises of 300 m² of fenced area in the vicinity of the tribal settlement integrated with piggery unit. Farmers were distributed with planting materials of tuber crops (Elephant foot yam, Colocasia, Sweet potato), ginger and piglets. From the tuber crop based farming system the income generated from crop component ranged from Rs. 10700.00 to Rs. 30520.00 and from pigs they generated approximately Rs. 24000.00 to Rs. 62000.00. The net income generated from the system ranged from Rs. 28680.00 to Rs. 69890.00. In tuber crops based farming system, they use to work 2-3 hours per day and employment generation has increased to 101 days/year while net income has increased to Rs. 43,128 per annum (average of 15 farm families) as compared to their traditional system. Out of 51 piglets distributed at Harminder Bay during the past three years, the population of pigs has increased to 151 of which 11 animals were sold by the farmers. With the success of this system, more tribal youths has come forward to adopt the tuber crops based farming system as their livelihood options.





Plate 66: Glimpses of tuber crop based farming system at Harminder Bay





## Augmenting Rice Productivity through Varietal Purification of Popular Land Races

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

#### Yield evaluation of selected progenies of Black Burma rice

A total of 10 lines of Black Burma traditional rice variety selected from evaluation across 2 years were further evaluated across 3 locations (Port Blair in South Andaman, Diglipur in North Andaman and Nimbudera in Middle Andaman) during *Kharif* 2016 with two check varieties *viz*. CARI Dhan 5 and Ranjeet. The perusal of yield data across 3 locations revealed highest grain yield in BB13-31 (4.03 t/ha) followed by BB13-1 (3.89 t/ha) and BB 13-6 (3.88 t/ha) as shown in Table 7.

Table 7: Yield performance of Black Burma lines across locations during kharif 2016

	(	Grain yield (t/ha)			
Lines	Port Blair (South Andaman)	Nimbudera (Middle Andaman)	Diglipur (North Andaman)	Mean	Range
BB 13-1	3.60	3.68	4.38	3.89	3.60 - 4.38
BB 13-6	2.93	4.17	4.53	3.88	2.93 - 4.53
BB 13-20	2.93	2.60	3.75	3.10	2.60 - 3.75
BB 13-30	2.57	2.67	4.17	3.14	2.57 - 4.17
BB 13-31	2.93	4.79	4.38	4.03	2.93 - 4.79
BB 13-40	2.93	4.17	4.43	3.84	2.93 - 4.43
BB 13-50	2.62	3.58	3.91	3.37	2.62 - 3.91
BB 13-62	2.83	3.44	4.32	3.53	2.83 - 4.32
BB 13-78	2.83	3.61	4.27	3.57	2.83 - 4.27
BB 13-79	2.88	3.03	4.22	3.38	2.88 - 4.22
Ranjeet (Check)	4.78	4.72	4.53	4.68	4.53 -4.78
CARI Dhan 5 (Check)	5.09	4.51	4.22	4.61	4.22 - 5.09
Mean	3.25	3.75	4.26	3.75	3.25 - 4.26
CV	5.89	5.27	3.86	-	-
CD	0.32	0.33	0.28	-	-

#### Evaluation of selected progenies of Khusbuyya rice

A total of 10 selected lines of Khusbuyya rice with two check varieties *viz*. Ranjeet and CARI Dhan 5 were evaluated across three locations (Port Blair in South Andaman, Diglipur in North Andaman and Nimbudera in Middle Andaman) during *Kharif* 2016 (Plate 67). The perusal of yield data across the 3 locations revealed the best performance of selection KU 13-76 (4.27 t/ha), followed by KU 13-94 (4.23 t/ha) revealing yield equal to check variety Ranjeet (4.06 t/ha) which is shown in Table 8.



Table 8: Yield performance of Khusbuyya lines under location trials during Kharif 2016

	Gı	rain yield (t/ha)			
Lines	Port Blair (South Andaman)	Nimbudera (Middle Andaman)	Diglipur (North Andaman)	Mean	Range
KU 13-10	3.45	5.68	3.30	4.14	3.30 - 5.68
KU 13-41	2.78	4.95	4.47	4.07	2.78 - 4.95
KU 13-43	3.03	5.47	3.34	3.95	3.03 - 5.47
KU 13-48	2.88	4.27	4.25	3.80	2.88 - 4.27
KU 13-51	3.29	3.23	4.69	3.74	3.23 - 4.69
KU 13-63	3.60	5.47	3.08	4.05	3.08 - 5.47
KU 13-65	3.50	4.69	3.78	3.99	3.50 - 4.69
KU 13-76	3.86	5.47	3.47	4.27	3.47 - 5.47
KU 13-92	3.14	4.01	3.73	3.63	3.14 - 4.01
KU 13-94	2.93	5.68	4.08	4.23	2.93 - 5.68
Ranjeet (Check)	4.12	4.84	3.91	4.29	3.91 - 4.84
CARI Dhan 5 (Check)	4.96	4.74	3.99	4.57	3.99 - 4.96
Mean	3.46	4.87	3.84	4.06	3.27 - 4.87
CV	7.62	5.37	5.38	-	-
CD	0.45	0.44	0.35	-	-





Plate 67: A field view of rice land races evaluation of Khusbuyya and Black Burma

## Seed production of new varieties CIARI Dhan 8 and CIARI Dhan 9

About 47.0 kg seed of CIARI Dhan 8 (Nucleus seed: 7.5 kg, Breeder seed: 40 kg) and about 317 kg of CIARI Dhan 9 (Nucleus seed: 7.5 kg, Breeder seed: 60 kg, Truthfully labelled seed: 250 kg) has been produced during kharif 2016-17. Both these varieties are derived from the local land race C14-8 popularly called as *Aath Number Dhan*.



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

R. K. Gautam, P. K. Singh and K. Sakthivel

#### A. Introgression of Xa/xa genes(Xa4,xa5,xa13 and xa21) in CARI Dhan 5

A total 79 plants derived from BC<sub>2</sub>F<sub>1</sub> cross (CARIDhan5/IRBB60\*²) were transplanted at Bloomsdale Farm of CIARI, Port Blair during kharif 2016-17. These well grown plants at maximum tillering stage were artificially inoculated by clip inoculation with most virulent bacterial *Xoo* isolates. Scoring was performed after 21 days of transplanting. Eighteen plants ( plant no.17-2,7-3,46-5,17-21,46-2,7-1,7-5,134-4,17-24,134-5,17-1,46-3,131-1,131-2,17-12,7-11,46-8 and 46-9 showed highly resistant reaction to bacterial leaf blight with score of 1. Fresh leaves were collected from highly resistant 18 plants for DNA extraction. Genomic DNA was extracted by using liquid nitrogen, followed by CTAB and Chloroform Iso amyl alcohol method. These 32 DNA samples were screened in 0.8% agarose gel by using Gel documentation unit under UV light and the entire DNA sample were subjected to PCR amplification for foreground selection for the presence of *Xa4*, *xa5*, *xa13* and *Xa21* genes by using corresponding linked markers. The PCR products were screened in 2% agarose gel for the *xa5*, *xa13* and *Xa21* gene linked markers and 3% agarose gel for *Xa4* gene linked marker. Subsequently, 17-1 and 46-3 were found to have heterozygous condition for all the four genes *Xa4*, *xa5*, *xa13* and *Xa21* based upon linked markers. Based on the molecular presence of 4 resistance genes (*Xa4*, *xa5*, *xa13* and *xa21*) and phenotypic analysis, plant no. 17-1, 46-3 and 17-41 were selected for further back crossing with CARI Dhan 5 to generate sufficient number of BC<sub>3</sub>F<sub>1</sub> seeds (Table 9 and Fig. 7).

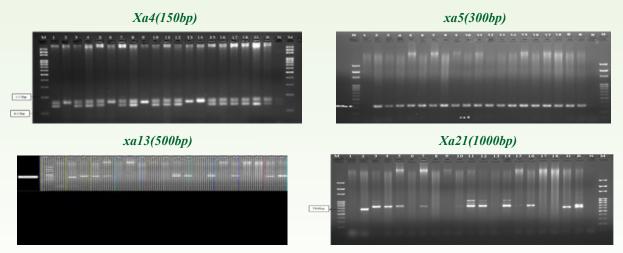


Fig 7:Rice lines showing the presence of *Xa4*, *xa5*, *xa13* and *Xa21* genes in the BC<sub>2</sub>F<sub>2</sub> plants of CARIDhan5/IRBB60\*2 cross through corresponding linked markers

Table 9: Presence of four genes (Xa4,xa5,xa13 and Xa21) in highly resistant BC,F, plants

Well no	Genotype/Cross	BB Score	Plant no	Xa4	xa 5	xa 13	Xa21	Crossed Seeds obtained
3	CARI5XIRBB60	1	46-5	+	+	+	+	275
11	CARI5XIRBB60	1	17-1	+	+	+	+	360
12	CARI5XIRBB60	1	46-3	+	+	+	+	65
14	CARI5XIRBB60	1	131-2	+	+	+	+	249



#### B. Introgression of Xa/xa genes(Xa4,xa5,xa13 and xa21) in CARI Dhan 8

It is mentioned that CIARI Dhan 8 is a yellow grained colour pure line selection variety derived from popular C14-8 landrace. Accordingly CIARI Dhan 8 has been chosen for introgression of four resistance genes from IRBB60. A total of 133 BC<sub>1</sub>F<sub>1</sub> plants obtained from cross CARIDhan8/IRBB60\*1 were transplanted at Bloomsdale Farm CARI Port Blair during Kharif 2016-2017. These well grown plants at maximum tillering stage were artificially inoculated by clip inoculation with most virulent bacterial *Xoo* isolates. Scoring was performed after 21 days of transplanting. Eight plants (plant no. 23,24,34,42,101,114,115 and 125 showed highly resistant reaction with score of 1. Fresh leave were collected from all the resistant 19 plants for DNA extraction. Genomic DNA was extracted by using liquid nitrogen followed by CTAB and Chloroform Iso amyl alcohol method. These 19 DNA samples were screened in 0.8% agarose gel by using Gel documentation unit under UV light and PCR amplification was performed for the 19 DNA samples which were subjected to foreground selection for the knowing the presence of *Xa4*, *xa5*, *xa13* and *Xa21* genes by using corresponding linked markers. The PCR products were screened in 2% agarose gel for the *xa5*, *xa13* and *Xa21* gene linked markers and 3% agarose gel for *Xa4* gene linked marker. The, plant no 68, 120 and 125 were found to have heterozygous condition for all the four genes *Xa4*, *xa5*, *xa13* and *Xa21* based upon linked markers. Based on the presence of 4 resistance genes (*Xa4*, *xa5*, *xa13* and *xa21*) and phenotypic analysis, plant No. 68, 120, 125 and 20 were selected for further back crossing with CARI Dhan 8 to generate sufficient number of BC<sub>2</sub>F, seeds (Table 10 & Fig. 8).

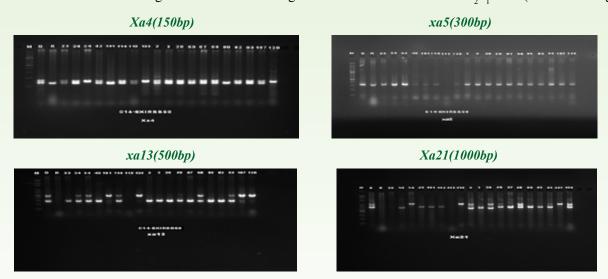


Fig 8: Rice lines showing the presence of (*Xa4*, *xa5*, *xa13* and *Xa21*) genes in the BC<sub>1</sub>F1 plants of CARIDhan8/IRBB60\*1 cross through corresponding linked markers

Table 10: Presence of four genes (Xa4,xa5,xa13 and Xa21) among resistant BC<sub>1</sub>F<sub>1</sub> plants

Genotype/Cross	BB Score	Plant no.	Xa4	xa 5	xa 13	Xa21	Number of BC <sub>2</sub> F <sub>1</sub> seeds obtained
CARI-8XIRBB60	1	34	+	+	+	+	3
CARI-8XIRBB60	1	125	+	+	+	+	35
CARI-8XIRBB60	3	20	+	+	-	+	614
CARI-8XIRBB60	3	93	+	+	+	+	32
CARI-8XIRBB60	3	120	+	+	+	+	135



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

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

#### (i) Salinity Tolerant Breeding Network (STBN) Trial-2016-17

Salinity Tolerance Breeding Network (STBN) trial 2016-17 was conducted at Creekabad village, Chouldari, Port Blair, South Andaman district under dual soil stress *i.e.* salinity (ECiw~ 5.5 dS/m²) and acid sulphate soils (pH 5.5).

A total of 58 rice genotypes were evaluated in sandy loam soil near the sea shore area having frequent high tides. The experiment was conducted with one standard local check namely, CARI Dhan 5 and national checks like CSR 10, CST7-1, CSR27 and CSR36 and one sensitive check Pusa 44 in Augmenting Block Design. The data were recorded for plant height (cm), days to 50% flowering, tillers/plant, productive tillers/plant, panicle length, spikelet fertility, filled grains, 1000 grain weight (g) grain yield (t/ha) and phenotypic acceptability scores.

Significant variability was revealed in the genotypes for all traits recorded except number of tillers. The grain yield data showed that genotypes *viz*. NDRK 11-20 and PAU7114-3480-1-1-1-0 were found to be numerically better (4.92 and 4.44 t/ha) than best check CSR-36 (2.85 t/ha). The yield performance of different check varieties across blocks is given in Table 11.

	• • • •				
Varieties	B 1	B2	В3	B4	Mean
CARI Dhan 5	4	2.38	0.73	1.78	2.22
CSR 36	2.48	3.05	1.9	3.97	2.85
CST 7-1	3.02	2.6	2.22	2.86	2.68
CSR 10	1.9	1.59	0.57	0.32	1.10
CSR 27	3.17	0.95	2.22	3.65	2.50
Pusa 44	3.02	2.76	2.7	2.35	2.71

Table 11: Grain yield (q/ha) of different check varieties across blocks in STBN trial

#### (ii) Farmers Participatory Variety Selection for Salinity Tolerant Rice varieties 2015-16

A total of 13 promising and previous years' selected lines of rice were evaluated under this trial at Creekabad village, Port Blair, South Andaman district in dual soil stress *i.e.* salinity (EC~5.5 dS/m) and acid sulphate soils (pH 5.95) near the sea shore with the sandy loam soil during Kharif -2016. The experiment was conducted with three standard local checks namely; CARI Dhan, 5 CST 7-1 and national check CSR36 in Randomized Block Design (RBD) with 3 replications. The crop was planted in gross plot size of 4.20 m² with a row spacing of 20 cm and plant spacing of 15 cm Yield data revealed that highest grain yield was recorded by genotype IR 87831-3-1-1-2-2-BAY B (3.93 t/ha) compared to the best check variety CST 7-1 (3.37 t/ha). However, > 3.0 t/ha grain yield was also recorded for IR 87952-1-1-1-2-3-B (3.37 t/ha) under stress of salinity and acid sulphate soils.

Field day was also organized on Farmers' participatory variety selection on the above farmers' field site on 20<sup>th</sup> October 2016. A total of 64 farmers (22 male and 35 female) and 11 researchers participated in the programme. All the farmers and researchers cast their votes for the selection of superior salt tolerant varieties of rice. The variety RP 4353-MSC-38-43-6-2-4-3 was preferred the most by the farmers (preference score of 0.27), followed by check variety CARI Dhan 5 (preference score of 0.09). RP 4353-MSC-38-43-6-2-4-3 was highly preferred by the female farmers and researchers with 20 and 9 positive votes respectively. While CARI Dhan 5 got highest 8 positive votes from the male farmers. However least preferred variety was IRRSTN –IR11T171 with 32 negative votes (Table 12 & Plate 68).



**Table 12: Farmers Participatory Variety Selection for Salinity Tolerant Rice varieties** 

Entry	Male	(n= 22)	Female	e (n=35)	Research	ers (n=11)	Total (	(n=64)	Preference	Grain
Name	Positive	Negative	Positive	Negative	Positive	Negative	Positive	Negative	score	yield (t/ha)
IR 87830- B-SDO2-1- 3-B	0	0	3	0	1	0	4	0	0.03	1.84
IR 87831- 3-1-1-2-2- BAY B	3	0	0	8	0	0	3	8	-0.04	2.68
IR 87952- 1-1-1-2- 3-B	0	3	0	0	0	0	0	3	-0.02	3.37
IR 87831- 3-1-1-2-2- BAY B	0	0	1	0	0	0	1	0	0.01	3.93
IR 87937- 6-1-3-2- 2-B	0	0	0	0	0	0	0	0	0.00	1.40
RP 4353- MSC-38- 43-6-2-4-3	5	0	20	0	9	0	34	0	0.27	2.90
GSR 3	0	0	3	1	0	0	3	1	0.02	0.84
GSR 4	0	0	0	2	0	0	0	2	-0.02	0.79
IR11T205	0	5	0	1	0	0	0	6	-0.05	1.15
IR11T208	0	0	1	0	0	0	1	0	0.01	1.52
IR12T193	2	0	3	1	0	0	5	1	0.03	2.25
IR11T213	0	0	0	4	0	5	0	9	-0.07	1.52
IR11T171	0	9	0	18	0	5	0	32	-0.25	1.19
CSR 36	0	1	0	0	0	1	0	2	-0.02	1.18
CARI Dhan 5	8	0	3	0	1	0	12	0	0.09	1.33
CST 7-1	0	0	1	0	0	0	1	0	0.01	3.45
Mean	-	-	-	-	-	-	-	-	-	1.95
CV	-	-	-	-	-	-	-	-	-	9.93
CD	-	-	-	-	-	-	-	-	-	0.34





Plate 68: Farmers participatory variety selection trials and activities

#### **Seed Distribution of Salt Tolerant Rice Varieties**

During 2016-17, a total of 36.33 quintal seed of salt tolerant varieties CARI Dhan 4, CARI Dhan 5 and CSR36 was distributed to farmers in North and Middle Andaman district and Hut Bay in South Andaman for increasing rice productivity in salinity areas in the islands especially under Tribal sub plan programme.

#### **International Network for Genetic Evaluation of Rice (INGER)**

#### (i) Green Super Rice - Rainfed Lowland Yield Trial (GSR-RFLL)

GSR-RFLL trial was conducted during *Kharif* 2016. Twenty improved rice lines received from IRRI, Philippines having high yield potential and multiple stress resistance/tolerance to major biotic and abiotic stresses were evaluated at Bloomsdale Research Farm under rainfed lowland conditions. Five lines *viz.* HHZ3-SAL 13-42DI1 (7.67 t/ha), HHZ 4-SAL S-LI 1-LI 1 (7.87 t/ha), HHZ 10-DT8-DT 1-DT 1 (6.42t/ha), HHZ 18-Y3-Y1-Y1 (6.35t/ha) and HHZ



16-SAL13-LI-LI1 (6.22t/ha) were found superior for grain yield more than 6.0 t/ha. These lines were also found resistant against bacterial leaf blight disease under artificial inoculation conditions (Plate 69).



Plate 69: Green Super Rice

## **ICAR Seed Project-Seed Production in Agricultural Crops**

P. K. Singh, A. K. Singh and R. K. Gautam

A total of 134.5 kg of Nucleus seed of 9 rice varieties (CARI Dhan 1, 2, 3, 4, 5, 6, 7, 8 and 9) and 466 kg of Breeder seed of 11 varieties were produced during kharif 2016. In addition, 57.79 quintal Truthfully labelled (TFL) seeds of 7 rice varieties (CARI Dhan 4, 5, 6 7, 9, CSR36 and Gayatri) was produced under farmers participatory mode in 3 villages through Out Reach Centre at Diglipur. A total of 4 Kg TFL seed of bacterial wilt resistant brinjal variety 'CARI Brinjal 1' and 223.5 kg pulses seed were also produced during *Rabi* season (Plate 70).











Plate 70: Seed production fields of paddy and brinjal varieties



#### **Trainings imparted**

Four training's were conducted on different aspects *viz*. quality seed production, storage, conservation and importance of land races etc. during 2016-17 in South, North and Middle Andaman in which a total of 350 farmers benefited (Plate 71).





Plate 71: Seed distribution of HYVs of rice in Tribal Sub Plan areas in Hut Bay, Little Andaman

#### HYV of seed sold and distributed

A total of 15.0 q truthfully labelled seed of 6 rice HYVs (CARI Dhan 4, 5, 67, CSR36 and Gayatri) were distributed in tribal dominated areas of Nicobar and Little Andaman during 2016-17. Moreover 2.5 kg seed of bacterial wilt resistant brinjal variety CARI Brinjal 1 were also given to the farmers in all three districts of Andaman and Nicobar Islands.

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

P.K. Singh and K. Sakthivel

#### Yield evaluation of bacterial wilt resistant brinjal lines during *Rabi 2016*

Three bacterial wilt resistant brinjal lines were evaluated for yield and disease resistance under field conditions with 2 checks *viz*. CARI Brinjal 1 (resistant check), hybrid check (susceptible check) during dry season (*Rabi* 2016). The experiment was conducted in CRBD with 3 replications at two locations *viz*. Bloomsdale and Garacharam Farm. The planting was done at the inter-row and inter-plant spacing respectively of 65 and 45 cm. Observations were recorded for 9 yield and yield attributing characters. The observation data revealed that all 3 developed lines were found superior for fruit yield/plant over the hybrid check. CARI Brinjal 3 gave highest fruit yield/plant (362.96 g), compared to the best hybrid check variety (163.70 g/plant). However bacterial wilt disease incidence was recorded at fortnightly interval from 15 days of planting to 120 days. CARI Brinjal 2 and CARI Brinjal 3 were found resistant, while CARI Brinjal 4 was found to be medium susceptible (Table 13 & Plate 72).



Table 13: Performance of bacterial wilt resistant brinjal li	Table 13:	Performance of	bacterial w	vilt resistant	brinial line
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Variety	Days to Flowering	Plant height	No of fruits/	Fruit weight	Fruit yield/plant (g)		Disease index (%)		Category
	(50%)	(cm)	plant	(g)	L1	L 2	L 1	L 2	
CARI brinjal 1 (Resistant check)	77	96.98	2.59	206.62	314.81	596.91	7.14	4.94	R
CARI brinjal 2	76	90.37	6.85	76.25	227.78	758.33	9.52	6.17	R
CARI brinjal 3	76	94.54	7.89	80.93	362.96	760.80	14.28	6.17	R
CARI brinjal 4	78	86.68	5.68	85.80	164.81	756.17	40.47	18.52	MS
Hybrid (Susceptible check)	72	85.02	5.16	96.50	163.70	713.58	88.08	39.51	S

L1 = Location 1 (Garacharma Farm), L2 = Location 2 (Bloomsdale farm), R = Resistant, Medium resistant, Medium susceptible and HS = Highly susceptible









Plate 72: Fruit bearing in CARI Brinjal 2 and CARI Brinjal 3

## Genetic Improvement of Pulses for Andaman & Nicobar Islands Conditions

Awnindra K Singh, P.K. Singh, R.K. Gautam, T. Subramani and S. K. Zamir Ahmed

A set of mungbean (23), urdbean (24) and pigeonpea (12) advanced breeding lines derived from local landraces along with national checks were evaluated during 2016-2017 for evaluation and characterization on the basis of agromorphological parameters and yield traits under advanced varietal trials. The promising landraces of mungbean (6), urdbean (6) and pigeonpea (5) were promoted for advanced varietal trials.



#### Mungbean

In mungbean, 11 advanced breeding lines, 8 new promising entries from previous season i.e. ANM-11-63, ANM-13-12, ANM-14-01, ANM-14-02, ANM-14-03, ANM-14-04, ANM-14-05 and ANM-14-14 (Sona mung) with 4 standard checks were evaluated during Rabi 2016-17. The genotypes namely, ANM-12-02 (IC No.0611650) showed highest seed yield (16.60 qha<sup>-1</sup>) with long pods, bold seed and earliness. The other accessions namely, ANM-11-15 (IC No.0611667, 14.56 qha<sup>-1</sup>), ANM-11-08, (IC No.0611664, 14.54 qha<sup>-1</sup>), ANM-12-01 (IC No. 0611649), CIARI Mung 1 (ANM-11-12, IC 0611666), CIARI Mung 2 (ANM-11-05, IC 0611661) and CIARI Mung 3 (ANM-11-12, IC 0611663) also revealed significant variation for seed yield and yield attributing traits over the checks IPM-02-14, VBN-2, HUM-16 and Pusa Vishal.

The genotypes, ANM-12-02, ANM-11-15, ANM-11-08, CIARI Mung 1, CIARI Mung 2 and CIARI Mung 3, showed resistance against charcoal rot, MYMV, powdery mildew and leaf crinckle diseases, while moderate resistant reaction against *Cercospora* leaf spot. Under the multi-locational trials, ANM-12-02, CIARI Mung 1, ANM-11-15, CIARI Mung 2 and ANM-11-08 showed significantly higher yield over the traditional varieties and standard checks. On the basis of seed yield parameters, promising lines derived from local landraces i.e. ANM-12-02 (IC 0611650) and CIARI Mung-1(ANM-11-12, IC 0611666) were identified by AICRP on MULLaRP for rice-fallow cultivation of mungbean trial 2016-17. Further, a set of 30 mungbean landraces was evaluated for salinity tolerance under laboratory condition, wherein the genotypes ANM-11-63 and ANM-11-11 showed salt tolerance at the 5<sup>th</sup> day and 7<sup>th</sup> day of planting (*in-vitro*) in 12.0 dS/m, while the accessions namely, ANM-14-02 at 14.0 dS/m, ANM-13-12 and ANM-14-10 exhibited salt tolerance capacity upto 10.0 dS/m, while ANM-12-02 showed tolerance at 4.0 dS/m (Plate 73 & Fig.9).

Nucleus seed of CIARI Mung 1 (ANM-11-12), CIARI Mung 2 (ANM-11-05), CIARI Mung-3 (ANM-11-07-2), CIARI Mung 4 (ANM-12-02), CIARI Mung 5 (ANM-11-15) and CIARI Mung 6 (ANM-11-08) was produced through progeny testing.

#### Urdbean

A total of 19 advanced breeding lines of urdbean along with 5 standard checks were evaluated during Rabi 2016-17. The accessions ANU-11-29, ANU-11-10 and ANU-12-01 were identified for determinate plant growth habit after five years evaluation in field under islands conditions. These accessions showed normal flower and pod setting as well as pollen viability. The genotype ANU-11-29 recorded the highest yield (13.61 qha<sup>-1</sup>), followed by ANU-12-01, ANU-11-19 (IC No.0611675), ANU-11-10 (IC No.0611672) and ANU-11-30 (IC No.0611678), ANU-11-24 over the best checks IPU-02-43, VBN-7 and LBG 752. While other genotypes namely ANU-11-08, ANU-11-09 (IC No.0611671), ANU-11-22-1, ANU-11-21 (IC No.0611676) showed yield at par with standard check LBG 752, besides resistant reaction against leaf curl virus, powdery mildew and MYMV diseases. These genotypes also exhibited determinate plant type having resistance to powdery mildew, leaf crinckle, MYMV and charcoal rot diseases of urdbean prevailing in these islands. The susceptible reaction in VBN 7, Pant-U-02-11 and TU-24-10 for powdery mildew disease was recorded. The other genotypes namely ANU-11-11, ANU-12-02 and ANU-12-03, showed indeterminate plant growth habit with moderate susceptible reaction to powdery mildew and leaf crinckle disease (Plate 74).

#### **Pigeonpea**

To validate the islands diversity of pigeonpea through agro-morphological characterization, a set of 10 promising lines derived from indigenous landraces and advanced germplasm lines were evaluated during 2015-16 and 2016-17. A set of 12 promising lines derived from a group of 32 germplasm represented a group of long duration genotypes which was characterized for 9 agronomic characters. ANP-13-03 followed by ANP-11-14, ANP-12-02, ANP-11-12-2 and two advanced breeding lines IPAC-68 and IPAC-452 showed significant higher yield (harvested in April 2016) along with better yield attributing agro-morphological characters like plant type, plant growth parameters, number of branches per plant, earliness over the best check Co 6, Bahar and NA-1. The entries ANP-13-03 followed by ANP-12-02 and ANP-11-12, showed significant better agro-morphological attributes like plant type, number of branches



per plant, earliness, pod bearing characteristics and branching pattern along with tolerances against insect-pest and diseases during crop season 2016-17 (Plate 75).





Plate 73: Field view of mungbean promising breeding lines ANM-11-15, ANM-11-08 and ANM-12-02





Plate 74: Field view of urdbean promising breeding lines ANU-11-29 and ANU-11-09





Plate 75: Field view of pigeonpea advanced breeding lines ANP-13-02 and ANP-12-02



(Germination % at 5<sup>th</sup> day of planting)



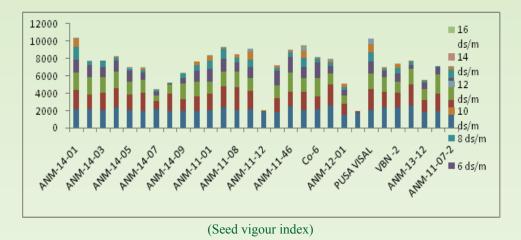


Fig.9: Performance of mungbean promising lines for salinity tolerance (*in-vitro*) for germination (%) and seed vigour index

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

### Awnindra K Singh

AICRP trial on MULLaRP Rabi mungbean and urdbean IVT and AVT was conducted during Rabi 2016-17. As per the technical programme, in IVT sets of 15 entries of mungbean and 16 entries of urdbean along with 2 local checks in each crop were sown during February 2017 for yield evaluation trial under IVT, while 5 entries in mungbean and 6 entries in urdbean were sown for yield evaluation trial during January 2017. The entries also exhibited resistance against yellow mosaic virus and cercospora leaf spot diseases at initial plant growth stage. The observations on initial plant growth and germination were recorded.

## Collection, Characterization and Utilization of Farmer's Variety, Landraces and Wild Relatives of Indigenous Pulses of Andaman & Nicobar Islands Agro-Ecosystem

#### Awnindra K Singh, Divya Parisa, S. Swain, T.P. Swarnam and R.K. Gautam

The performance of farmers' varieties comprising of 53 accessions of mungbean (*Vigna radiata*), 56 accessions of urdbean (*Vigna mungo*), 23 accessions of cowpea (*Vigna unguiculata*) and 25 accessions of pigeonpea were sown during 2016-17.

#### Ex-situ conservation of germplasm/ landraces farmers' varieties of pulse crops

A total of 51 mungbean, 56 urdbean, 27 cowpea and 26 pigeonpea accessions and 6 wild relatives of pulse crops were collected from different parts of the islands during the year 2016-17 and are maintained in *ex-situ*.

#### Evaluation and characterization of farmers' varieties of pulse crops

In the present study, the performance evaluation of farmers' varieties constituted by a set of 51 accessions of mungbean (*Vigna radiata*), 56 accessions of urdbean (*Vigna mungo*), 32 accessions of cowpea (*Vigna unguiculata*) and 26 accessions of pigeonpea were evaluated for agro-morphological parameters, visual screening, seed and yield parameters. Preliminary germplasm evaluation trials (PGT) were conducted to generate basic information and assess the genetic diversity among farmers' varieties of mungbean on the basis of important DUS descriptors & agro-morphological traits. The accessions were broadly classified on the basis of agro-morphological characters into extra early, early, medium and late in mungbean, urdbean, cowpea and pigeonpea following the DUS test guidelines of mungbean, urdbean, cowpea and pigeonpea (Plate 76 & 77).



In a bid to reveal the variability of farmers' varieties the genotypes namely, ANFVM-14-02, ANFVM-14-03, ANFVM-14-12, ANFVM-15-20, ANFVM-14-05, ANFVM-14-06, ANFVM-14-09, ANFVM-14-24 in mungbean, ANFVU-14-30, ANFVU-14-35, ANFVU-14-14, ANFVU-15-20, ANFVU-14-03, ANFVU-15-30, ANFVU-15-31, ANFVU-14-07, ANFVU-15-29, ANFVU-14-11, ANFVU-15-23 in urdbean, ANFVCp-15-17, ANFVCp-15-18, ANFVCp-15-19, ANFVCp-15-20 in cowpea, exhibited maximum diversity during preliminary on-station evaluation trial (2016-17). Similarly, AN-FVP-15-04, AN-FVP-15-11, AN-FVP-15-15 and ANFVP-16-16 in pigeon pea exhibited maximum diversity during preliminary on-station evaluation trial (2016-17).



Plate 76: Diversity among pigeonpea farmers' variety for flower colour and pod traits



Plate 77: Diversity among cowpea farmers' variety for plant type and pod traits



# All India Coordinated Research Network Project on Potential Crops [Beachpea (Vigna marina)]

### Awnindra K Singh, S. Dam Roy, A. Velmurugan and T. Sujatha

Beach pea (*Vigna marina*), is a wild and underutilized potential crops under cultivated *Vigna* species, which shows a great similarity in chromosome numbers (2n=22), floral structure and cowpea for a number of distinctive vegetative characters and of mungbean and urdbean. In particular, beachpea is a salt tolerant legume, possesses succulent stems and leaflets, the later being ovate, its legume grain are bold, seeds are oval in shape, brown-reddish brown in colour. To enhance the minicore collection of important underutilized legume 16 numbers of accessions were collected from the different islands of South Andaman (Havelock, Manjery and Chidiyatapu) & Car Nicobar. A total of diverse 16 accessions were maintained. The study of morphological characters carried out during growing seasons (2016-17) had the objective of characterization of traits useful in breeding programs. A set of 16 beachpea (*Vigna marina*) accessions collected and carried forward from previous season were replanted during kharif season 2016-17 for their evaluation and characterization. All the accessions are of indeterminate plant growth, flowering habit and creeper type. The ancillary characters exhibited plant height of 3-7 meters spreading type, number of pods per plant 26 - 392, pod length ranges 4.3-7.0 cm and number of seeds per pod 4-6. The accessions, ANBp-14-03 recorded highest pod per plant (392 pods per plant) with pod length 6.2 cm average pod length having 4-6 seeds, bold seeds with highest seed weight (8.26 g/ 100 seeds) per pod followed by ANBp-14-05, ANBp-15-02, ANBp-14-01, ANBp-14-02 and ANBP-14-05 exhibited maximum number of seeds (range 3-6 seeds per pod).

In order to investigate the genetic diversity present in the beachpea (*Vigna marina*), a study on the genetic diversity of among 16 diverse accessions was also conducted to assess the genetic similarity at molecular level using RAPD and ISSR markers. Cluster analysis revealed that the genotypes are grouped into three groups with 44% similarity and it has shown that the genotypes of collected from various islands showing 89 % similarity among the accessions collected from different places of Car Nicobar (ANBp-15-10 and ANBp-15-03), while maximum distance was exhibited between the accessions collected from Car Nicobar and Havelock Island (ANBp-15-09 and ANBp-16-01) (Fig.10).

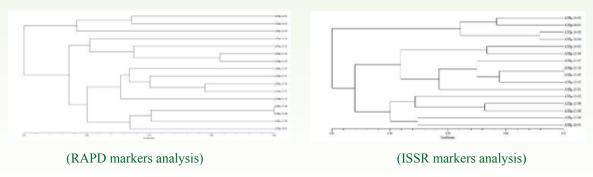


Fig.10: Dendrogram showing genetic diversity between 16 beachpea (*Vigna marina*) accessions at molecular level (using RAPD and ISSR markers)

To test the nutritional quality of beachpea (*Vigna marina*) dry seeds 10 best accessions, were analyzed for protein estimation, lipids and other micronutrients. The result revealed significant variation among the accessions and exhibited wide range of variation for protein (20.2 – 30.5 percent). The highest protein content was estimated in ANBp-15-10 (30.5 % per 100 gram seed) followed by ANBp-14-03 (28.6%). While lipid contents ranged from 1.8 to 3.5 per cent along with iron (1.8-2.53 mg), calcium (5.38-14.54 mg), magnesium (8.10-9.22 mg), zinc (0.60-1.46 mg) and cobalt (0.01-0.06 mg). The highest lipid content (% 100 gm seed) was recorded in ANBp-15-04 (3.5%) followed by ANBp-15-02 (3.02%) and ANBp-14-03 (2.66%) (Plate 78).













Plate 78: Beachpea (Vigna marina)

## **Monitoring of Pesticide Residue Analysis at National Level**

#### Awnindra K. Singh

The pulse, rice, vegetable samples (cowpea, brinjal, okra, bittergourd, cucumber, cauliflower, cabbage, ridgegourd, bottlegourd, coriander leaf and green chilli were randomly collected from farm gate, vendors of South, Middle and North Andaman vegetable markets and water sample from cultivation area of farmer's ponds of South, Middle and North Andaman. In the samples of food commodities different organochlorines, organophosphorus, synthetic pyrethroids, carbamates and other pesticides namely, imidacloprid, thiacloprid, thiamethoxam, acetamiprid, emamectin benzoate spinosad, pendimethalin, alachlor, Butachlor, indoxacarb, atrazine, simazine, flubendiamide & chlorantraniliprole residues were monitored using CODEX guidelines of pesticides residue analysis for the period of April 2016-17. As per the technical guidelines of the project, a total of 16 samples of pulse (mungbean and urdbean), 160 of vegetables and fruits, 3 water samples were collected from farm gate of South Andaman and vendors from different markets (Chouldhari, Guptapara, Jangalighat, Mohanpura, Bathubasti) and water from Fisheries Division Pond (Garacharma), Bloomsdale Farm, Chouldhari Pond were analyzed for Maximum Residue Limit using Gas Chromatography/ Mass Spectroscopy at Regional Plant Quarantine Station (RPQS), Chennai. Results revealed that 13.6 percent were detected with multiple residue while, 3.6 percent of the vegetable samples were detected with above Maximum Residue Limit (MRL) (Plate 79).



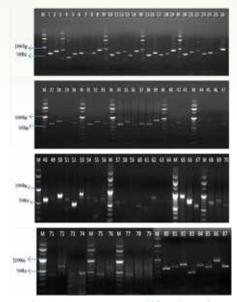


Plate 79: Collection of vegetable and fruit samples from farm gate

# **Exploring Antimicrobial Peptide Genes in Developing Bio-Formulation for the Management of Plant Disease of Andaman & Nicobar Islands**

K. Sakthivel and R.K. Gautam

Studies on diversity of antimicrobial peptide (AMP gene) in identified potential *Bacillus spp.* of Andaman Islands



M- Marker, Lane No. 1 to 9- C19, 10 to 14- BR7, 15 to 19- B1.6, 20 to 26- BS1, 27 to 30- NS2, 31 to 33- TB2, 34 to 39-  $1.5_{10}$ , 40 to 43- 2, 44 to 47- ML2b, 48 to 56- BM13, 57 to 64- HR4b, 65 to 67-  $W_{\rm nc}$ , 68 to 70- RNS, 71 to 74- NS 5, 75 to 76- NS 9, 77 to 79- BAN9 and 80 to 87- SM4.

Fig.11: AMP gene amplification of potential Bacillus species



The 21 bacterial isolates possessing *in vitro* antimicrobial properties and plant growth promoting abilities were screened for their antimicrobial peptide biosynthesis gene (AMP gene) amplification using 13 gene specific primers. Out of the 21 isolates, BM13 and C19 were able to amplify nine AMP biosynthetic genes and HR4b could amplify eight AMP gene primers (Fig.11). The isolate SM4 and BS1 could show the presence of five AMP biosynthesis genes. Other remaining *Bacillus* isolates except GNS<sub>10-3</sub> and LS<sub>1-4</sub>, were able to amplify between 2 to 6 number of AMP gene primers. The *Bacillus* isolates BM13, SM4, BR7, C19, BL6, BS1, HR4b and Cr1 could amplify more than five antimicrobial peptide gene primers and it might be the valid reason of those *Bacillus* isolates for their better antagonistic activity against plant pathogens.

#### **AICRP on Mushrooms**

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

The trials were conducted with 10 different local and mainland oyster mushroom strains for yield efficacy and farmers preference. The results showed that three CIARI-IVRC released mushroom varieties (CIARI- Mush 1 – cream oyster, CIARI- Mush 2 - white oyster and CIARI- Mush 3 - blue oyster) showed better performance in yield efficacy when compared to others. The CIARI- Mush 1 and CIARI- Mush 2 were superior in yield whereas the CIARI- Mush 3 showed earlier flowering when compared to others. All these new varieties were given to farmers to evaluate the yield efficacy in different locations (Plate 80).



Plate 80: Oyster mushroom strains for commercial cultivation

The cultivation techniques were standardized for local *Lentinus* strain and the proximate content evaluated. The results revealed that the strain is having high antioxidant and nutritional properties and thus could be potential additive in animal feed (Plate 81).







Plate 81: Growth of Lentinus spp in natural and artificial conditions

## **ORP on Fungal Foliar Diseases**

#### K.Sakthivel, R.K. Gautam and V.K. Pandey

Twenty fungal isolates associated with chilli (Capsicum spp.) anthracnose disease from diverse locations of tropical Andaman Islands, India were characterized using polyphasic approaches. Morphologically, the isolates were identified as *Colletotrichum gloeosporioides* and *C. capsici*, whereas the molecular confirmation revealed the presence of *C. siamense* in addition to other two species. The pathogenicity test on three chili varieties which comprised of two different capsicum species revealed that there is the difference in pathogenic potential in the collected isolates. The genetic variability analysis using 22 random primers revealed the presence of high genetic variability among the *Colletotrichum* isolates collected from the Andaman Islands. The cluster analysis using UPGMA revealed that these RAPD primers could clearly differentiate *C. capsici* from other *Colletotrichum* species. However, these primers could not differentiate *C. siamense* from *C. gloeosporoides* isolates in different clusters (Fig.12).

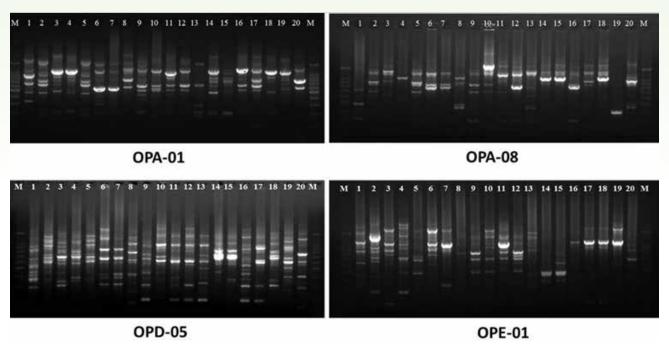


Fig. 12: RAPD profiling of Chilli Colletotrichum isolates from Andaman Islands



## All India Network Project on Vertebrate Pest Management

#### K. Sakthivel

#### Surveillance and population ecology of rodent pests in predominant cropping systems

The survey of rodent infestation in paddy fields was conducted in different villages of North Andaman. The results revealed that the rodent infestations were severe in North Andaman Islands which ranged from 10 to 20% indicating the severity of their problem. The maximum rodent infestation was observed in Madhupur and minimum in R. K.Gram village. In few fields of Madhupur and Khudirampur, the incidence of rodent damage was as high as 80%.

#### Sensitization of the farmers on rodent management in paddy fields

Sensitization programmes on rodent management in paddy fieds were organized under All India Network Project on Rodent Control along with KVK, Nimbudera and Out Reach Centre. A total of five trainings were conducted in Subashgram, Keralapuram, Kalighat, Kishorinagar and Radhannagar covering the farmers from the villages of Subashgram, R.K. Gram, Sitanagar, Gandhinagar, Madhupur, Shivpur, Kerelapuram, Kalighat, Nabagram, Paschimsagar, Kishorinagar, Laxmipur and Radhannagar. Altogether 220 farmers participated and benefited (Plate 82).



Plate 82: Rodent management awareness program at North Andaman

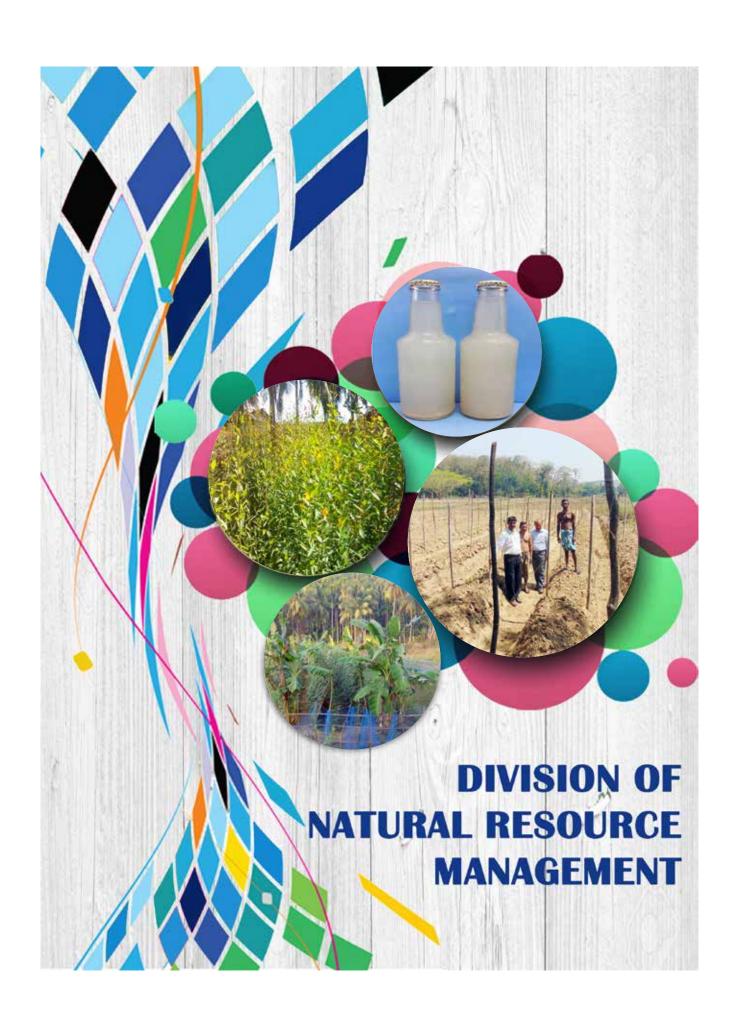
#### Consortium Research Platform on Insect Borers - Network Mode

#### T. Bharathimeena and I. Jaisankar

During the period it was noticed through survey that Jamun showed severe incidence of fruit and nut borer (Pyralidae: Lepidoptera to be identified). One more species of a pyralid fruit borer pest was also collected from wild jamun.Cashew was attacked by a fruit borer pest , the specimens has been sent to IARI. New Delhi / NBAIR, Bangalore for identification.

Incidence and damage assessment studies on brinjal shoot and fruit borer, okra shoot and fruit borer, lab lab pod borer, carried out in 10 different locations of South Andamans. Percent infestation by *Maruca* in field beans and french beans was recorded at Manglutan and Chouldhari of South Andaman. Incidence and damage levels of fruit and shoot borer in tomato was severe in Neil Island followed by Havelock with more than 60 per cent infested fruits. Occurrence of defoliator and borer specimens were sent to KAU, Trivandrum for identification.







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

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

#### Impact of La Nino on performance of South-West monsoon of Andaman & Nicobar Islands during 2016

IMD weather forecast of rainfall for 2016 is 106% of long period average due to La Nina effect. However, the observed data for the country is 97.1%. In light of this, the rainfall data of 6 weather stations of Andaman & Nicobar Islands was analysed for the variations in performance due to La Nina. Rainfall was regarded as excess or deficit when the variation is  $\pm$  20 - 59% from the mean values as per Indian Meteorological Department (IMD). Rainy days were also regarded as excess or deficit when the variation is  $\pm$  10% from the mean values.

The data (Table 14) reveals that La Nina effect on South–West monsoon varied with the location within the island. Among the six islands, Mayabunder and Long Island showed deficit rainfall as well as deficit rainy days. The deficit of rainfall, from South-West monsoon was highest for Mayabunder. Port Blair showed excess rainfall while there is deficit in rainy days. Car Nicobar station showed excess rainfall, while rainy days are normal. Hut Bay and Nancowrie showed not much variation in rainfall and rainy days though they have diametrically opposite trend in data.

Table 14: Impact of La Nina on South-West monsoon performance in the Islands

Location	Mean rainfall : mm (mean rainy days*): 2000-16	2016 rainfall (rainy days)	% Variation of rainfall (rainy days)
Car Nicobar	1149.0 (64.7)	1654.2 (70.0)	44.0 (8.2)
Mayabunder	2387.0 (83.2)	1563.0 (66.0)	-34.5(-20.7)
Port Blair	1821.3 (83.2)	2236.0 (70.0)	22.8 (-15.9)
Long Island	1602.7 (79.6)	1123.4 (69.0)	-29.9 (-13.3)
Hut Bay	1357.4 (80.1)	1559.8 (76.0)	14.9 (-5.1)
Nancowrie	972.0 (59.2)	929.3 (61.0)	-4.4 (3.0)
Mean	1548.2 (75.0)	1511.0 (68.7)	2.4 (-8.4)

<sup>\*</sup> Mean rainy days: 2008-16; + indicates excess and – indicates deficit of rainfall/ rainy days

Table 14a: Impact of La Nina on monthly South-West monsoon rainfall and its variations in the Islands

Month	Car Ni	cobar	Mayab	under	Port 1	Blair	Long	Island	Hut 1	Bay	Nanc	owrie
Month	2016	Mean	2016	Mean	2016	Mean	2016	Mean	2016	Mean	2016	Mean
Monthly rain	(mm)											
June	564.3	327.5	369.6	626.9	491.0	458.3	285.5	422.3	254.4	437.6	339.2	310.5
July	166.5	219.5	384.2	560.3	421.1	425.4	239.4	371.7	360.2	385.1	56.7	235.2
August	226.5	258.2	257.6	616.5	332.7	412.7	165	356.7	252.2	186.6	254.5	201.1
September	696.9	343.9	551.6	583.3	991.2	524.9	433.5	452.0	713.6	550.5	278.9	225.3
No. of rainy	days											
June	21.0	18.4	18	19.1	21	20	17	19.3	20	18.3	20	16.6
July	15.0	15.6	16	15.5	12	21.2	15	20.3	19	22.1	9	14.3
August	14.0	13.0	15	14.0	14	20.4	12	19.8	13	18.2	16	14.0
September	20.0	17.7	17	18.2	23	21.6	25	20.1	24	21.4	16	14.3



Month	Car Nicobar	Mayabunder	Port Blair	Long Island	Hut Bay	Nancowrie
Rainfall (mm) vari	ation (%)					
June	72.31	-41.05	7.14	-32.39	-41.86	9.25
July	-24.15	-31.43	-1.01	-35.59	-6.47	-75.89
August	-12.26	-58.21	-19.39	-53.74	35.16	26.58
September	102.67	-5.43	88.85	-4.09	29.63	23.80
Rainy days variation	on (%)					
June	13.86	-6.00	5.00	-12.07	9.09	20.81
July	-3.57	3.10	-43.46	-26.23	-14.07	-37.21
August	7.69	7.14	-31.52	-39.33	-28.66	14.29
September	13.21	-6.71	6.70	24.31	11.92	11.63

The analysis of monthly rainfall and rainy days variations (Table 14a) revealed that Car Nicobar had deficit rainfall only in July however, Nancowrie had both deficit rainfall as well as rainy days in July. Mayabunder had deficit rainfall from June-August while Long island had both deficit rainfall and deficit rainy days (June-August). Hut bay had deficit rainfall during June and deficit rainy days in July and August. Port Blair had deficit rainfall and rainy days during August. Further, rainy days were deficit in August also for Port Blair. Thus, the variations were different in different islands along the months. The variations in rainfall and rainy days in these islands are ascribed to physio-bio-graphic variations.

#### Dual purpose rice cultivation for crop intensification in lieu of changing climate

The rainfall pattern is ever changing in lieu of changing climate in the islands. There has been prolonged rain free season from December month onwards escalating moisture stress induced crop production limitations including curtailing the chances of crop rotations. The high and continuous rains from South-West monsoon have made the farmers to cultivate photosensitive long duration rice crop (C-14-8) in lowlands. As crop rotations are not possible with C-14-8 rice, an attempt was made to bring intensification in this system by assessing the possibility of taking dual harvest (fodder harvest to support the livestock and grain harvest from the ratoon). In this direction, a field study with three treatments (Table 15) was made in RBD with seven replications.

The data (Table 2) revealed that fodder harvest from C-14-8 at 45 DAS resulted in significantly higher green (dry) fodder yield than that harvested at 30 DAS. Further, it was found that fodder harvest did not markedly alter the grain yield production of C-14-8 rice crop, when compared with control (no fodder harvest).

Table 15: Impact of fodder harvests from C-14-8 on grain yield of rice

Treatment	Green (dry) fodder yield (t/ha)	Grain yield (t/ha)
Fodder harvest at 30 DAS	7.05 (1.80)	2.51
Fodder harvest at 45 DAS	11.83 (3.19)	2.35
No fodder harvest	-	2.68
SEm±	0.51 (0.13)	0.10
CD (P=0.05)	1.77 (0.45)	NS



#### Preparation of Contingency plans for Andaman & Nicobar Islands

As done in other 580 districts of the country, under NICRA project, Contingency plans for 3 districts of Andaman & Nicobar Islands were prepared by gathering the historical information pertaining to agriculture and allied sectors. From the data, major contingencies of each district were identified (Table 16). For each contingency, suitable solutions were suggested. The contingency plans so prepared were submitted to NICRA (CRIDA), Hyderabad on 10<sup>th</sup> June, 2016 and are available on NICRA web site.

Table 16: District wise major contingency proneness of the Andaman & Nicobar Islands

What is the major contingency the district is prone to?	Nicobar	North & Middle Andaman	South Andaman
Drought (post rainy season: December-April)	√	√	V
Flood (low lying and coastal areas)	$\sqrt{}$	$\sqrt{}$	V
Cyclone	$\sqrt{}$	$\sqrt{}$	V
Sea water intrusion	√	$\sqrt{}$	√
Pests and disease outbreak (specify)	Coconut/ arecanut: bud re blight/spot and rhinoceros Banana: Bunchy top viru	beetle	se, leaf
	-	<ul> <li>Rice: BLB, she stem borers, leaf Gundhi bug and</li> <li>Pulse: Dry root</li> </ul>	f folder, rats
		• Ginger and turm Rhizome rot/ lea Pepper: leaf blig	of blight
Others (specify)	High and asymmetric plant stand (due to self sown plants) of coconut	Soil erosion on slo runoff water loss a availability	
Livestock	<ul><li>Shortage of feed &amp; fo</li><li>Health issues</li></ul>	dder and water	
Fisheries (fresh water)		<ul> <li>Shallow water insufficient rain</li> <li>Inundation due</li> <li>Impact of salt l in ponds / charquality</li> </ul>	to floods oad build up

#### Soil Health Card

As part of understanding of the soil induced limitation of farm productivity, soil fertility analysis is being carried out under soil health card scheme. During the period 500 soil samples were collected from the two allotted villages (Wandoor and Manglutan villages of South Andaman) by Directorate of Agriculture, Andaman & Nicobar Islands. In addition 241 soil samples collected by, KVK, Nimbudrea, North & Middle Andaman and 15 soil samples collected from Kavaratti, Lakshadweep were analysed. Till date, these soil samples (756) were analysed for 7 parameters (pH, EC, organic carbon, available N, P, K and S). As a part of creating awareness, International Soils Day was celebrated along with KVK, Sippighat on 5<sup>th</sup> December, 2016 at Collinpur village.



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

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

The project work started in August 2016. Reconnaissance survey of the tsunami affected lands in South Andaman (Ograbraj, Mithakari, Namunaghar, Hathitapu, Bambooflat, Dollygunj, Sippighat and Wandoor) and North & Middle Andaman (Diglipur, Keralapuram, Durgapur, Shibpur, Lamia Bay, Dasarathpur, Yerata and Sabari) was conducted. Ninety soil samples were collected from Wandoor and Ograbraj villages of South Andaman and 16 soil samples from North & Middle Andaman districts for characterization following passage of 12 years of time after tsunami occurence. An interaction meeting with farmers owning tsunami affected lands was organized at Ograbraj (South Andaman district) and discussed various issues of their development. Training was organized on soil health issues of tsunami lands at Keralapuram and Dasarathpur (North & Middle Andaman district) during February, 2016.

To know the soil property changes following sea water intrusion, a lab study was conducted. Normal soil was inundated with sea water (with 8.74 pH and 37.2 mS EC) for 24, 48 and 96 hours. The changes in pH, EC, Ca, Mg, CO<sub>3</sub>, HCO<sub>3</sub>, Cl, Na and K of soil and other were recorded (Table 17). There is a drastic increase in electrical conductivity, chlorine and sodium contents of the soils, while the increase in other parameters was of lower magnitude.

To assess the impact of water (rain) in washing out the salts following sea water inundation, the above soils were flooded with tap and distilled water and the excess water was removed after 24 hours and their characteristics were measured. The water samples removed from sea water inundated soils had more pH and EC values than the original water samples, indicating the dilution effects of water (rain).

SamplepHECSoil (control)7.72572 μSSoil inundation with sea water for 24 hours7.803.54 mSSoil inundation with sea water for 48 hours7.856.94 mSSoil inundation with sea water for 96 hours7.906.90 mS

Table 17: Soil pH and EC changes following sea water inundation

# Herbicides Combinations for Control of Complex Weed Flora in Transplanted Rice (All India Coordinated Research Project (AICRP)-Weed Management)

#### B. Gangaiah

A field study was made at Bloomsdale farm during *kharif* -2016 season for the second consecutive year to evolve suitable weed management practices for transplanted rice (CARI Dhan 6). In this study, 9 weed management treatments (Table 18) were tested in randomized block design with three replications. Pendimethalin and pretilachlor was applied immediately after transplanting, cyhalofop and penoxsulam was applied 15 days after transplanting (DAT) and bispyribac and almix were applied at 25 DAT. Weed control efficiency (weed dry weight in weedy check- weed dry weight in treatment / weed dry weight in weedy check) x 100 and weed index (grain yield in pendimethalin + bispyribac treatment- grain yield in other treatment/ grain yield in pendimethalin + bispyribac treatment) x 100 were worked out.

The study indicates that there is a yield penalty of 32.7% due to presence of weeds (weedy check) over nearly weed free situation that is obtained with pendimethalin + bispyribac application (Table 5). Among the weed management treatments, pendimethalin + bispyribac application proved the best from yield as well as weed control efficiency indices



point of view. However, it performance as evident from yield was at par with penoxsulam + cyhalofop, bispyribac + almix and hand weeding (thrice). From the study it is concluded that herbicides pendimethalin + bispyribac provide as effective weed management in transplanted rice as that of 3 hand weedings thus providing scope for replacing the drudgerous manual weeding of rice with herbicides.

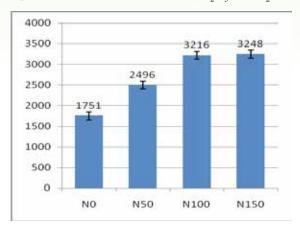
Table 18: Performance rice crop as impacted by different weed management treatments

Treatment	Grain yield (kg/ ha)	Weed dry weight (g/m²)	Weed control efficiency (%)	Weed Index
Bispyribac	5679.0	25.8	77.64	13.04
Penoxsulam	5556.0	27.8	75.90	13.45
Bispyribac + Almix	5802.3	38.3	66.81	9.62
Pretilachlor + Almix	5679.0	43.5	62.31	11.54
Penoxsulam + Cyhalofop	6173.0	28.9	74.96	3.84
Pendimethalin + Bispyribac	6419.7	15.1	86.91	-
Hand weeding (twice)	5533.3	24.7	78.59	13.81
Hand weeding (thrice)	5892.7	13.3	88.47	8.21
Weedy check	4321.0	115.4	-	32.69
SEm±	156.5	-	-	-
CD (P=0.05)	646.6	-	-	-

## All India Coordinated Rice Improvement Project (AICRIP) - Hybrid Rice Evaluation Trial (AVT2-IHRT-MS)

### B. Gangaiah

A field study was made at Bloomsdale farm during *kharif* -2016 season to assess the performance of eight varieties (six IET hybrids along with a hybrid check DRRH3 and varietal check: WGL 14) of rice (in main plot) at four levels (%) recommended dose of nitrogen (RDN) fertilization (in sub plot) in split plot design with three replication. The RDN used in the study i.e. 100 kg/ha was applied in three equal splits on 5, 27 and  $47^{\text{th}}$  day after transplanting. The crop also received uniformly  $60 \text{ kg P}_2\text{O}_5$  and  $\text{K}_2\text{O}$  at the time of transplanting.



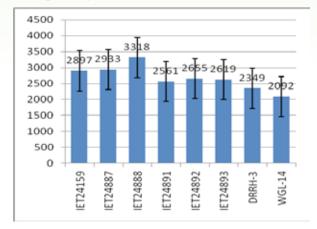


Fig 13a Fig 13b

Fig 13: Grain yield of rice (kg/ha) as influenced by nitrogen (kg/ha) fertilization (Fig 13a) and hybrid / variety (Fig 13b)



The data (Fig.13) reveals that there is significant response of rice to nitrogen fertilization up to RDN i.e. 100 kg N/ha (Fig 13a). Among the hybrid/varieties tested, IET 24888 being at a par with IET 24887 and IET 24159 recorded significantly higher grain yields than other 3 entries and two checks (Fig 13b). The interaction effect of variety and nitrogen dose on rice performance was found to be non-significant indicating their non-dependence.

## All India Coordinated Rice Improvement Project (AICRIP) – Multi-Location Trail of Hybrids (MLT)

#### B. Gangaiah

A field study was made at Bloomsdale farm during *kharif* -2016 season to assess the comparative performance of 13 hybrids along with a local check (CARI Dhan 6) of rice in Randomised Block Design with three replications. The RDN used in the study i.e. 100 kg/ha was applied in equal splits on 5, 27 and 47<sup>th</sup> day after transplanting. The crop also received uniformly 60 kg P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O each/ha at the time of planting.

The data (Fig. 14) reveals that among the MLT entries tested, MLT-1 being at a par with MLT-3 recorded significantly higher grain yield than all other entries and check (CARI-6). MLT-11 has the lowest grain yields closely followed by MLT 5. These two entries have poorer performance than the local check CARI-6.

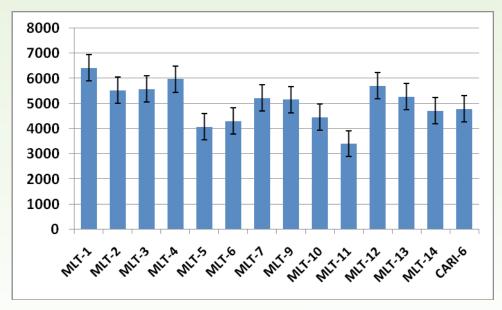


Fig 14: Grain yield (kg/ha) of MLT rice hybrids

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

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

Plant growth promoting bacteria (PGPR) are important for plant nutrition (N,P,K) particularly under low input island conditions as they reduce the need for use of chemical fertilizers. During the year, studies were made to understand the genetic diversity of soil bacterial isolates (six potential bacterial isolates having PGP and hydrolytic properties) studied for their genetic relationship with closest genBank isolates using maximum likelihood method (Fig. 15). The isolates were grouped into two major clusters in which the isolates NNB 2 and 4 were grouped in *Pseudomonas* sub-cluster, whereas MNB1, NPB6, MKP3 and NFB3 were grouped into *bacillus* sub-clusters. Among the different group of rhizosphere bacterial isolates, spore-forming *bacilli* have an advantage over the non-spore formers such



as *Pseudomonas*, because spores are more robust and resistant to the elevated temperature and high concentration of chemicals. In the present study the phylogeny analysis indicated that the potential *B. cereus* and *B. subtilis* have formed separate group from other isolates.

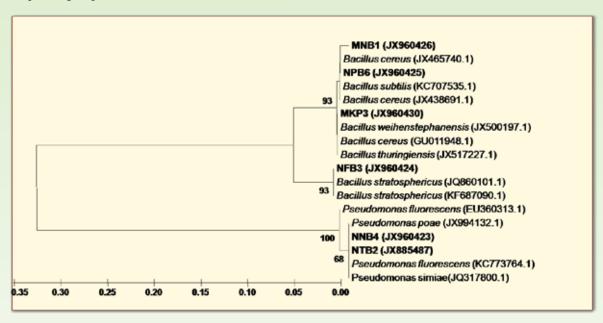


Fig. 15: Phylogeny diagram of some of the native bacterial isolates

## Effect of PGPR on maize

As the PGPR candidates had shown promising performances under controlled conditions, they were used as inoculants for plants cultivated under natural conditions in pots. The aim was to assess the effect of PGPR on the growth of maize on slightly acid soils. Six selected bacterial isolated were used for seed inoculation and soil application. The treatments were as follows; control, seeds coated with *B. megaterium* (NC3), *L. sphaericus* (NS2), *B. cereus* (NFB3), *B. subtilis* (SM4), *B. pumilus* (NB4) and *B. thuringiensis* (SM2). Two seeds of maize were sown in each plastic pot containing 2 kg of sterile soil. The results were analysed using CRBD and depicted in Fig.16.

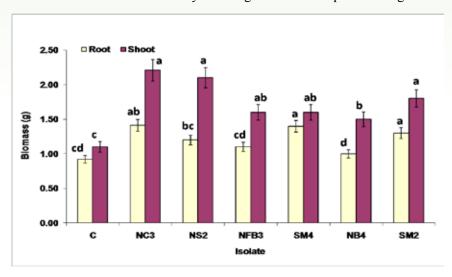


Fig.16: Biomass of roots and shoots of maize



Seed inoculation and soil application with PGPR isolates enhanced the maize root and shoot growth by 20 and 25% *B. megaterium* that enhanced the root and shoot biomass by 53 and 100% than control was identified as a potential PGPR for maize.

#### Effect of organics on plant growth and yield parameters of brinjal

A field experiment was conducted during January to May 2016 in RBD with 4 treatments (control, chemical fertilizer as per RDF, 100% RDF N through vermicompost and bioconsortia + biogranules @ 100 g per plant) with 3 replications at Bloomsdale farm on brinjal (Var.VNR 218). Fourty five day old brinjal seedlings were transplanted at a spacing of 60 x 60 cm in January and standard PoP were followed. The results (Table 19) showed that all the treatments have significantly increased plant growth and yield parameters over control. Among the treatments bioconsortia being at par with chemical fertilizers recorded significantly higher yield attributes and yield than other treatments.

Table 19: Effect of different treatments on growth and yield parameters of brinjal

		Mean /plant						
Treatment	Plant height (cm)	No. of branches	No. of leaves	No. of fruits	Fruit weight (g)	Yield (t ha <sup>-1</sup> )		
Control	64.1	5	72	22	362.0	10.6		
Chemical fertilizer (100% RDF)	75.2	11	91	30	856.8	23.8		
Vermicompost	73.4	8	95	24	637.2	17.7		
Bioconsortia + Biogranules	77.9	13	92	35	933.2	25.9*		
CD (0.05)	2.85	2.11	4.60	3.86	41.57	2.36		

## **Integrated Agromet Advisory Services (Gramin Krishi Mousam Seva)**

A. Velmurugan, T. Subramani and S. Dam Roy

Advisory team: T.P. Swarnam, A. Kundu, P.K. Singh, R. Kiruba Sankar, Nagesh Ram and S.K. Zamir Ahmed

Andaman and Nicobar Islands experiences hot and humid climate and receives rainfall from both South-West and North-East monsoons. However, agricultural production is largely dependent on the performance and distribution of monsoon as these Islands are rainfed and having very limited water storage capacity. Further untimely plant protection measures drastically reduce the productivity of crops. Therefore, the on-going Gramin Krishi Mousam Seva (Integrated Agromet Advisory Services) in collaboration with IMD, Pune and Ministry of agriculture, GOI regularly issues district wise weather based agro-advisories in Hindi, English and other local languages twice a week covering all the aspects of agricultural activities for the benefit of island farmers and other stakeholders.

#### Agro-advisory service

During the period (2016-17\*) the Agro-Meteorological Field Unit (AMFU) at ICAR-CIARI, Port Blair has issued 81 agromet bulletins based on the inputs received from IMD, Pune through print and electronic media. It was aimed at minimizing the production losses and aid in timely decision making in farm operations. The agromet unit effectively utilized the services of Doordarshan and All India Radio (AIR) to reach out to the farmers even in remote islands. A multidisciplinary team of scientist has delivered more than 15 talks in All India Radio on island weather and agricultural production in regional languages.



#### mKISAN and SMS service

AMFU Port Blair has activated mKISAN portal of Department of Agriculture, GOI, on 24<sup>th</sup> June 2014 and registered more than 8725 farmers covering all the blocks of Andaman and Nicobar Islands. They have been receiving agroadvisories which are specific to their block and crop through SMS on every Tuesday and Friday in Hindi and English. In terms of per cent of coverage of farmers, AMFU, Port Blair has provided one of the best service in the country (Fig. 17).

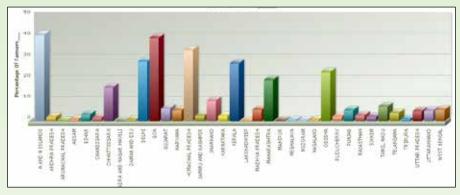


Fig 17: Performance of AMFU, Port Blair in terms of coverage of farmers

#### Verification of forecast

Verification of forecasted and observed values of rainfall in the islands was carried out for pre-monsoon, monsoon and post-monsoon period (Table 20). The results revealed that on an average forecasted and observed values of rainfall were matching to the tune of 80.6% for pre monsoon, 67.9% for monsoon and 73.3% for post-monsoon period. Concurrently monsoon and post-monsoon seasonal forecast and advisories were also issued for long-term planning of agricultural and land improvement activities through mass media.

**Table 20: Verification of forecast** 

Particulars	District	Pre monsoon (April to May 2016)	Monsoon (June to Nov 2016)	Post monsoon (Dec 2016 to Jan 2017)
No. of days when rain was forecasted and also observed (YY)	Andaman	12	92	21
and also observed (11)	Nicobar	8	97	31
No. of days when rain was observed	Andaman	2	1	2
but not forecasted (YN)	Nicobar	1	5	1
No. of days when rain was not observed but forecasted (NY)	Andaman	4	83	25
observed but forecasted (141)	Nicobar	19	77	27
No. of days when rain was not observed and also not forecasted (NN)	Andaman	43	7	14
observed and also not forecasted (NN)	Nicobar	33	4	3
No. of matching cases (YY+NN)	Andaman	55	99	35
	Nicobar	41	101	34
Skill score or ratio score of rainfall	Andaman	90.2	54.1	56.0
	Nicobar	67.2	55.2	56.5

Farmers awareness programme



AMFU, Port Blair, Andaman & Nicobar Island has organized awareness programme on "Weather based agricultural practices" during 2-3<sup>rd</sup> November, 2016 at Diglipur in collaboration with ORC, Diglipur to make the farmers aware of the impact of weather on Island agriculture and the utility of weather based agricultural practices (Plate 83). During which the farmers were apprised of moisture stress management in plantation crops, need for rain water harvesting and its efficient use for various crops during dry season.







b. Analysis of monsoon performance

Plate 83: Creation of awareness on the changing pattern of weather and crop production

### AICRP on Management of Salt Affected Soils and Use of Saline Water in Agriculture

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

In Andaman and Nicobar Islands the coastal areas are affected by salinity primarily due to sea water intrusion and capillary rise of saline water. The condition was further aggravated due to the subduction of landmass during 2004 tsunami. Therefore, a study was initiated in 2014-15 under AICRP-MSAS&USW to assess and characterize the salt affected coastal soils, spatio-temporal variations in water quality and development of alternate land management strategies for island ecosystem. During 2016-17 the ongoing study was continued and the results are given below.

#### Assessment of ground water quality

Ground water survey of all the three district of Andaman and Nicobar islands was carried out and grouped by blocks. The survey was carried out during post-monsoon (Oct-Nov) and pre-monsoon period (Mar-April). A total of 248 water samples during pre-monsoon and same number during post-monsoon period were collected by revisiting the same site in order to study the seasonal variations in ground water quality. The samples (496) were collected from the shallow wells located in the coastal areas which are mostly under multiple uses. The samples were analyzed for different hydrochemical properties by following standard procedures.

The mean and range of EC, pH, SAR and RSC are presented in Table 21. The mean value of EC showed that only at Ferrargunj and Mayabunder block it exceeded 2.0 dS m<sup>-1</sup>, however the values varied from 0.1 to 13.7 dS m<sup>-1</sup>. Among the district the salinity level was low in Car Nicobar followed by N&M Andaman and highest was observed in South Andaman district. The mean pH indicated that in all the districts it varied from slightly acidic to mildly alkaline however the values varied from strongly acidic to moderately alkaline in different blocks. In general the RSC and SAR were well within the permissible limits for irrigation. The results also showed wide variation between pre-monsoon and post-monsoon values of pH and EC at some sites which are probably subjected to sea water intrusion.



Table 21: Mean and range of ground water quality parameters in A&N islands

	Year of	EC(dS	5 m <sup>-1</sup> )	pН	[	RSC (m	neq l <sup>-1</sup> )	SAR (m	mol/l) <sup>1/2</sup>
Block	sampling	Range	Mean	Range	Mean	Range	Mean	Range	Mean
South Andaman Distric	t								
Ferrargunj	2016	0.1-13.68	2.10	6.10-8.09	7.10	0.0-0.1	0.0	0.04-3.52	0.56
Prothrapur	2016	0.02-2.69	1.36	5.29-8.05	7.35	0.0-0.0	0.0	0.01-5.66	0.46
Little Andaman	2015	0.20-4.62	1.80	5.52-7.86	6.82	0.0-0.2	0.0	0.02-4.62	0.42
North & Middle Andan	nan Distric	t							
Diglipur	2016	0.63-3.1	1.13	6.05-7.65	7.08	0.0-0.1	0.0	0.12-0.47	0.27
Mayabunder	2016	0.76-4.23	2.04	6.88-7.38	7.33	0.0-0.0	0.0	0.18-0.46	0.31
Rangat	2015	0.73-3.40	1.38	6.4-7.70	7.14	0.0-0.2	0.0	0.28-0.67	0.47
Car Nicobar district									
Car Nicobar	2015	0.23-3.65	0.93	7.23-8.31	7.78	0.0-9.2	0.0	0.03-3.78	0.72
Nancowry	2016	0.65-2.31	1.02	7.08-8.24	7.66	0.0-0.0	0.0	0.1256	0.29
Campbell Bay	2015	0.4-2.15	1.10	6.9-7.70	7.80	0.0-0.0	0.0	0.20-0.46	0.35

Based on EC, SAR and RSC the samples were grouped into different salinity categories. Only the samples from Ferrargunj and Prothrapur block of South Andaman district exceeded EC value of more than 5.0 dS m<sup>-1</sup> while none of the sample found to contain RSC. The distribution of samples in different water quality categories indicated that over 80% samples were good in quality in all the district and only 5% samples from South Andaman district found to be high SAR saline (Table 22). Among different blocks Nancowry was found to have largest per cent of sample (92%) under good category, while Prothrapur had 8.1% of samples under high SAR saline category.

Table 22: Distribution of water samples in different water quality categories (%)

		Total		Qual	lity	
District	Block	number of samples	Good	Marginally saline	Saline	High SAR saline
South Andaman	Ferrargunj	63	81.25	3.13	9.38	6.25
	Prothrapur	47	86.49	2.70	2.70	8.11
	Little Andaman	16	75.00	12.50	12.50	0.00
	Average		80.91	6.11	8.19	4.79
North & Middle	Rangat	18	87.50	12.50	0.00	0.00
Andaman	Mayabunder	14	75.00	25.00	0.00	0.00
	Diglipur	24	87.50	6.25	6.25	0.00
	Average		83.33	14.58	2.08	0.00
Nicobar	Car Nicobar	26	86.36	9.09	4.55	0.00
	Nancowry	22	91.67	8.33	0.00	0.00
	Campbell Bay	18	72.22	27.78	0.00	0.00
	Average		83.42	15.07	1.52	0.00

EC,SAR, RSC: Good: < 2,<10,<2.5; Moderately 2.4, < 10, <2.5; Saline: -4, <10,<2.5; High SAR saline >4,>10>2.5;



#### **Evaluation of alternate land management**

Raised bed and furrow system (RBF) also known as broad bed and furrow system is one of the options to manage coastal degraded and saline soils in the humid tropical island conditions. Four RBS with beds of 4 m width and furrows of 6 m width and 1.2-1.5 m depth with convenient length made at farmers field in the coastal areas was selected for monitoring the soil salinity level.

Two years after making of RBS the salts were leached out from the beds. This enabled growing of different vegetable crops in the beds (Plate 84). At the same time, the surrounding lowland was left fallow due to high salinity and water logging. It was observed that the dry season cropping reduced the salt built up in the beds due to crop cover and root system by way of reduced evaporation, leaching effect of irrigation and impeded salt movement by ploughing. Two different cropping system was evaluated in the beds of RBF system which showed very high net return and B:C ratio (Table 23). However, the surrounding low land was left fallow at best used for rice cultivation which resulted in a net return of around 15,000 – 25,000 /ha.

Table 23: Performance of different cropping system in the beds of RBF (Rs.'000)

Duration	Crop	Yield (t/ha)	Gross return	Total cost	Net return	B:C ratio		
	Cropping system 1							
Mar-Jun	Cowpea	3.83	0.77	0.38	0.39	2.0		
Jun-Oct	Bhendi	4.75	0.95	0.50	0.45	1.9		
Oct-Mar	Brinjal	6.43	1.29	0.50	0.79	2.6		
Total Income			3.00	1.38	1.63	2.2		
		(	Cropping system	2				
Apr-Jun	French beans	5.18	1.55	0.64	0.91	2.4		
Jul-Oct	Bitter gourd	3.13	0.94	0.62	0.32	1.5		
Nov-Feb	Bottle gourd	4.55	0.91	0.42	0.49	2.2		
Total Income			3.40	1.67	1.73	2.0		



Cucurbits in the beds of RBF system made in the coastal lowland (Chouldhari village, S.Andaman)



Smaller raised bed and furrow made in the saline coastal lowlands (Mithakari village, S.Andaman)





Intensive vegetable cultivation in the beds two years after making raised bed system (Lal pahad, S. Andaman)



Banana+beans intercropping with water harvesing in the RBF system, while the surrounding lowland are left fallow

Plate 84: Performance of alternate land management system

## All India Coordinated Research Project on Integrated Farming Systems

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

Integrated farming system offers wide scope for diversification of agricultural production and livelihood security to the marginal and small farmers of these islands. During the reporting year the ongoing project on IFS evaluated the suitable IFS models for lowland and upland areas.

#### **Evaluation of coconut based farming system (CBFS)**

Coconut is a perennial crop which occupies the land continuously for several decades but utilizes the natural resources only to a limited extent. The active root zone of the coconut is confined to only 25% of available land area and the crown allows a part of sun light to transmit to the ground surface. These conditions allowed for agricultural diversification by integrating tubers, spices, vegetables and livestock with coconut plantation. The system recorded total income of Rs.1.56 lakhs ha<sup>-1</sup> with employment generation of 270 man days year<sup>-1</sup> (Plate 85). The income is expected to increase with the maturity of various components.



\* Spices & coconut have not attained their full production potential

Plate 85: CBFS model for upland areas of Andaman Islands



Pig contributed 53% of income followed by crop and poultry+fish component. Crop component generated highest number of man days (150 man days year<sup>1</sup>). However, crop component is vital for sustaining pig and poultry by producing the required feed materials. Similarly harvesting of rainwater and recycling of farm organic wastes not only met the nutrient requirement of crops but also reduced the production cost.

#### Resource flow within the system

The IFS model developed for low lying areas resulted in vertical expansion of farming through various farm enterprises requiring less space and time but gave high productivity and ensured periodic income especially for the small and marginal farmers (Fig. 18). The crop + dairy based IFS models showed increased net returns over the rice or rice based cropping systems. Within the farm Rs. 91,000 worth of organic waste was recycled which amounted to 35% of total inputs required in the system. Broad bed and furrow system contributed Rs.97,000 from crop production and also supplied 15% of green fodder requirements. The results showed that BBF for water harvesting and livestock supported by inclusion of fodder is indispensable and economically viable components of lowland areas. The system also generated 365 man days year<sup>-1</sup> from 0.75 ha land.

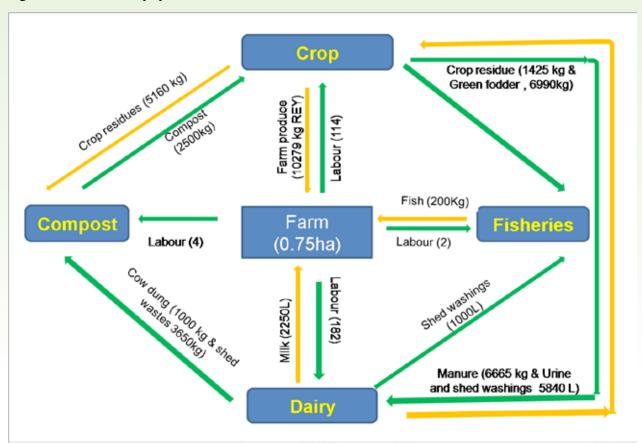


Fig.18: Resource flow within the system



## 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

In recent times some of the Island farmers are resorted to intensive vegetable cultivation involving use of different pesticides and fertilizers. At the same time low or no input agriculture is still practised by majority of the farmers. The presence and movement of chemical residues will be a matter of serious concern to the fragile Island ecosystem. In view of this during the reporting year the ongoing project determined the pesticide residues in vegetable samples, fertilizer use pattern and ground water pollution in different islands.

#### **Pesticide residues**

The analysis of 18 vegetable samples collected from South Andaman reported for this year showed the presence of 5 compounds with mean concentration ranging from 1.25 to 8.62 µg kg<sup>-1</sup>. OP compounds *viz.*, acephate (8.62 µg kg<sup>-1</sup>) and chlorpyrifos methyl (5.83 µg kg<sup>-1</sup>) recorded higher concentration of residues followed by neo-nicotinoids such as imidacloprid and acetamiprid. Acephate was also found in all the vegetable samples followed by imdacloprid (52%) and acetamiprid (48%). From the residue pattern found, it can be inferred that acephate and acetamirpid are more frequently used by the farmers in vegetable production.

#### Fertilizer use pattern

A study was conducted to assess the fertilizer use pattern in Andaman and Nicobar islands using basic data on fertilizer use, crop production and household survey (n=425) by stratified random sampling. The farm household survey revealed that only 70% of the farmers were using chemical fertilizers and among them 70% were using N and P fertilizers whereas only 12.5% used K fertilizer. The N P K fertilizer use intensity was 115 94 12 kg ha<sup>-1</sup> with highest application rate in Neil Island. The average N P K ratio was 4.2:2.7:1.0 but large variation in total and N, P and K fertilizer use were observed across different islands. Among the organic sources of nutrients neem cake was used in all the districts whereas poultry manure and FYM were mainly used in South Andaman. Of the total fertilizer consumption vegetable accounted for 65% followed by rice (18%) and plantation (8%). Further the marginal and small farmers accounted for the maximum amount of fertilizer used besides more balanced N, P and K use than medium farmers.

### Status of ground water pollution

Ground water samples (n = 90) were collected from different land uses viz., agriculture, forest and settlement areas across the Islands to assess the status of ammonia (NH<sub>4</sub>), nitrate (NO<sub>3</sub>) and phosphate (PO<sub>4</sub>) levels as nitrate and phosphate pollution has been reported as a major problem in agricultural ecosystems, especially under intensive use of nitrogen and phosphatic fertilizers (Table 24). The results indicated the presence of ammonia in the ground water samples ranging from 16.8 to 347.2 ppm with mean value of 97.1 ppm. Interestingly, it was significantly higher in samples collected from forests ecosystem (154 ± 130 ppm) compared to agricultural areas (97.1±51.4 ppm). However, the difference in nitrate level among different islands was insignificant. Moreover the nitrate concentration was less than the maximum contamination level prescribed by Indian Standards (BIS) and or World Health Organization (10ppm) for drinking purpose. The phosphate content of water bodies was found in the range of 1.6 to 7.2 ppm with mean of 3.81 ppm and found to exceed the critical limits prescribed for drinking purpose. There were not many variations among different land uses.



Table 24: Status of nitrate and phosphate levels in ground water sources of Andaman Islands

I and Use	Concentration (ppm)					
Land Use	Ammonia (NH <sub>4</sub> )	Nitrate (NO <sub>3</sub> )	Phosphate (PO <sub>4</sub> )			
Forest	$154.0 \pm 130.0$	4.5±3.2	4.11±1.21			
Agriculture	94.7±51.4	4.9±3.3	3.89±1.38			
Settlement	126.0±24.7	4.4±3.0	3.05±0.63			
Overall	97.1±60.6	4.9±3.2	3.81±1.36			
Critical limit		45*	0.1**			

<sup>\*</sup> Maximum contaminant level for drinking water (BIS); \*\*US public health standards; ± S.D

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

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

Due to the increased use of pesticide in crop production at Neil Island there is a possibility for residues entering the aquatic system and get biomagnified. Therefore, during the reporting year the ongoing project aimed to assess the presence of heavy metals in aquatic life. Contamination of heavy metals *viz.*, arsenic (As), chromium (Cr), nickel (Ni) and selenium (Se) was evaluated in muscle and gut of different fish species collected from Neil Island (Table 25). The results indicated that nickel (Ni) and chromium (Cr) were found in all the samples, while arsenic (As) was found in gut and muscles of different fish species.

Table 25: Concentration of heavy metals in fish samples collected from Neil Island

	Concentration (μg kg <sup>-1</sup> )							
Fish species		S	Cr		Ni		Se	
	Muscle	Gut	Muscle	Gut	Muscle	Gut	Muscle	Gut
Epinephelus acrolatus	8.98	ND*	64.42	35.15	20.9	23.27	ND	ND
Epinephalus I	ND	ND	15.89	25.27	11.19	17.29	ND	ND
Plectropomus sps.	ND	6.02	32.12	30.37	16.82	16.53	ND	ND
Cephalopholis bochak	ND	8.26	41.26	24.93	28.82	16.94	ND	ND
Variola albimargmata	ND	3.84	39.52	38.77	21.37	24.07	ND	ND
Lethinus sp.	8.64	ND	35.96	34.49	14.26	17.48	ND	ND
Lujaneus sp.	5.58	ND	31.42	29.24	18.09	21.2	ND	ND

<sup>\*</sup> ND – Not detected

The arsenic was found in muscle samples of only three species to the extent of 5.58 to 8.98 µg kg<sup>-1</sup>. Chromium and nickel were found in both muscle and gut samples of all the fish species analysed. Maximum accumulation of chromium was found in muscle tissues of *E. acrolatus* (64.42 µg kg<sup>-1</sup>). However in none of the samples the concentration exceeded the permissible limits prescribed by WHO (200 µg kg<sup>-1</sup>). Similarly maximum nickel accumulation was found in muscle tissues of *C. bochak* (28.82 µg kg<sup>-1</sup>) which is again less than the maximum permissible level of WHO (380 µg kg<sup>-1</sup>) indicating that the marine environment around the Neil Island is not yet contaminated to alarming level.



## Feasibility Evaluation of Pulse Cultivation and Resource Optimization under Coconut Plantation

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

Field study was made during *rabi* season (Oct –Dec, 2016) to assess the biomass and seed production potential of two green manure crops i.e. sunnhemp and dhaincha under coconut plantation in RBD with six replications (Plate 86 a&b). The data (Table 26) indicated that the biomass production of green manure crops on an average 7.85 t ha<sup>-1</sup> (dry weight: 2.56 t ha<sup>-1</sup>) in 60 days. Further, the biomass production by sunnhemp was significantly higher than that of dhaincha. The biomass produced by green manure crops at the time of incorporation accumulated 61.5 kg nitrogen. The N accumulation was comparatively more in sunnhemp (68.60 kg ha<sup>-1</sup>) than dhaincha (55.68 kg ha<sup>-1</sup>). The available N content in the soil has increased by 14 kg ha<sup>-1</sup> at 30 days after incorporation of green manure crops from its initial value (206 kg ha<sup>-1</sup>). On the contrary, there is a slight decline in N content of soil in control treatment.





Plate 86 a: Sunnhemp

Plate 86 b: Dhaincha

The seed production potential of green manure crops under coconut plantation indicated that a seed yield of 840 and 713 kg ha<sup>-1</sup> can be obtained from sunnhemp and dhaincha, respectively.

Table 26: Performance o	f green manure crops und	der coconut plantation
-------------------------	--------------------------	------------------------

Treatments	Fresh (dry) biomass yield (t/ha)	N accumulation in biomass (kg/ha)	Soil available N status (kg/ha)
Control	-	-	203
Dhaincha	7.2 (2.31)	55.68	218
Sunnhemp	8.5 (2.80)	68.60	220
CD (0.05)	0.73	-	10.2

The light penetration pattern in coconut plantation in which the green manure crops were grown indicated higher light intensity in open space as compared to that under coconut plantation (Fig 19).

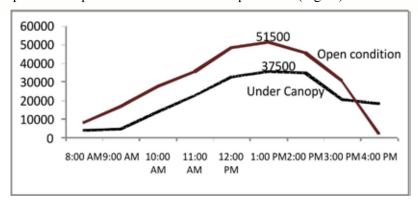


Fig 19: Light intensity (lux) on 08.12.2016 (hourly basis) at 38 years old coconut plantation



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

Sachidananda Swain, K Abirami, Pooja Bohra and Pooja Kapoor

#### In vitro Antioxidant and free radical scavenging activity of Alpinia calcarata and Curcuma Longa

The rhizome of two underutilized plant namely *Alpinia calcarata* and *Curcuma longa* L. was washed in tap water to remove mud, clay and sand particles adhered to it, followed by cabinet dryer drying at 50° C for 2-3 days to reduce the moisture content to 6-7%. Then rhizomes were cut into slices. These cut slices were oven dried at 45 °C for 48 hours. After drying, the slices were grinded into powder form by using high speed blander. One gram sample was mixed with each 50 ml of 80% three solvent (methanol, ethanol and distilled water) for *A.calcarata* and two solvent (methanol and distilled water) for *C.longa* and kept for 1-2 day followed by centrifugation at 8000 rpm for 10 minutes. This was repeated till the powder was devoid of colour and filtered through Whattman No. 1 filter paper.

#### Analysis of phenolics and flavonoids

Total phenolic and flavonoid content of extracts is shown in Table 27. Methanolic extract of Curcuma longa had highest phenolic (31.62 mg/g GAE) and lowest flavonoid content (18.02 mg/g GAE) by ethanolic (17.52) and aqueous extract (8.91 mg/g). This level of phenolic content was approx. 10 times more than the published literature. The reason may be due to different growth period, geographic location, storage type, genetic diversity etc. A similar behaviour was also observed for aqueous extract. Again, the flavonoid content varied between 47.3 mg rutin/g (methanolic extract) of *Alpinia calcarata* and 8.71 mg ruitn/g (aqueous extract) of *C.longa*. Ethanol, besides having higher extraction efficiency, is more efficient in cell wall degradation as compared with other two solvents. The higher values for methanolic extract may be due to the extraction power of solvent (80% methanol) to the flavonoid compounds of the dilution media. The phenolic compounds are the dominant antioxidants that exhibit scavenging efficiency on free radicals, and reactive oxygen species are numerous and widely distributed in the plant kingdom. Though the flavonoids are the classes of phenolic groups, but the high flavonoid content of the selected species compared to their phenolic content may be done tropical growing climate in the Islands, where high phenolic compounds might have synthesized in the plant to defend against oxidative stress *vis-à-vis* reactive oxygen species (free radicals).

Extract	Phenol (mg GAE /g)	Flavonoids (mg rutin /100g)	DPPH (mg BHT/g	ABTS (mg trolox/g	FRAP (mg Fe <sup>+2</sup> /g)	NO (mg Vit-C/g	MCA (mg EDTA/g)	H <sub>2</sub> O <sub>2</sub> (mg Vit-C/ g	RP (mg BHT/g
Ethanolic	17.52	60.7	5.82	6.96	2.17	11.65	11.90	14.05	11.02
Methanolic	21.08 31.62*	47.3 18.02*	5.25 16.33*	7.1 9.45*	1.90 4.38*	11.40 1.41*	12.35 5.46*	15.76 10.45*	15.01 33.87*
Aqueous	8.91 23.22*	14.3 8.71*	5.52 5.13	5.6 8.89	1.59 2.32	11.05 0.336	11.70 0.434	11.97 1.43*	6.1 10.91*

Table 27: Phytochemicals in Alpinia calcarata and Curcuma longa\* rhizome powder

#### Free radical scavenging activity (FRSA)

The radical scavenging activity (RSA) were measured by seven different methods (Fig.20). Highest DPPH activity in ethanolic extract (5.82 mg BHT/g) followed by methanolic extract (547.5 mg/g) and aqueous extract (532.5 mg/g) of *Alpinia calcarata*. The aqueous solution had least DPPH activity in both samples. DPPH radical scavenging activity of extracts were increased with increasing concentration (20-200 µg/ml, 10-75 µg/ml), being highest in ethanolic extract (83.9%) and lowest in aqueous extract (58.01%) in *A. calcarata* at 200 µg/ml and 49.79 and 17.24% in methanolic and aqueous extract of *C.longa* respectively. IC50 (concentration required for 50% reduction of scavenging activity)



is shown in table 27. Smaller IC50 value correlated with higher DPPH scavenging activity. Highest IC50 value was found in methanolic extract (142.5  $\mu$ g/ml, 168.73  $\mu$ g/ml) of both samples suggesting high efficiency in quenching DPPH radical.

ABTS activity was found to be highest in methanolic extract of both samples (7.1 mg trolox/g, 9.45 mg trolox/g) and lowest in aqueous extract (5.6 mg/g, 8.89 mg/g). The highest activity in methanolic extract corresponds to high phenolic content. The scavenging activity of powder to ABTS radical scavenging activity increased from 33.2 to 57.8 %, 23.82 to 89.52 in methanolic and 32.8 to 46.9%, 12.82 to 59.44 in aqueous extract Alpinia calcarata and Curcuma longa powder, As compared to DPPH activity, the scavenging effect is very high. The relative low scavenging potential for aqueous extract may be due to its low extract potential to remove the phytochemicals from its complex tissue to the solvent medium. The FRAP, NO and metal chelating activity (MCA) between two rhizome was found to be identical except MCA of aqueous extract of C.longa. With the increase in concentration, the absorbance value increased from 0.32 to 0.58 and 0.42 to 0.64 in Curcuma and Alpinia, respectively. In case of former, peroxide activity of aqueous extract is 10 times lower than corresponding methanolic extract. The reason may be due to non-polar nature of methanol in quenching free radicals. H<sub>2</sub>O<sub>2</sub> can cross membranes and may oxidize a number of compound, probably react with Fe<sup>2+</sup>, and possibly Cu<sup>2+</sup> to form hydroxyl radical and this may be the origin of many of its toxic effects. Data from Reducing power (RP) showed that the methanolic extract of Curcuma longa exhibited highest value (33.87 BHT/g) which is almost twice than Alpinia extract. The reducing capacity of extracts suggested that reductoneassociated and hydroxide groups of compounds can act as electron donors and can react with free radicals to convert them to more stable products, and thereby terminate radical chain reactions. However, the extracts are strong in ABTS and H<sub>2</sub>O<sub>2</sub> scavenging activity indicating as a viable source of antioxidant. Since reactive oxygen species are thought to be associated with food deterioration pathogenesis of chronic infections, and inflammatory diseases, the observed inhibitory potential may partially explain the helpful effects of selected rhizome powder in treating different disease conditions.

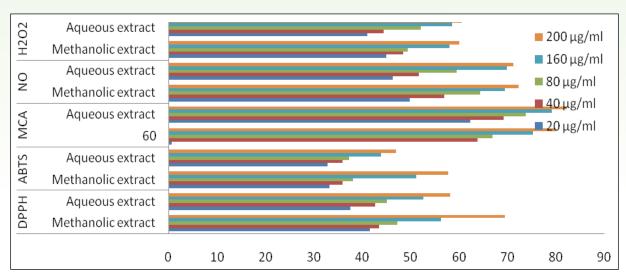


Fig 20: Free radical scavenging capacity (RSA) of different extract of A.calcarata and C. longa



## **Food Processing Training Centre (FPTC)**

#### Sachidananda Swain

#### Development of spiced rose apple and dragon fruit ready-to-serve (RTS) beverage

Rose apple (*Syzigium malacensis*) and dragon fruit were peeled, cut into small pieces and grinded followed by filtration though filter press to get crude pulps. The TSS, TA and pH was found to be  $4.4^{\circ}$  brix, 0.73%, 5.76 and 10.9, 0.62% and 6.57, respectively (Table 28). Sugar, citric acid and water required for RTS preparation were added. Then, the blended solution was pasteurized (75-80 °C for 4-53 minutes) to inactivate spore forming organisms and enzymatic browning followed by filling into glass containers (crown corking) and then stored at room temperature ( $27\pm3$ oC) and refrigerated temperature ( $4\pm1$ oC). For preparation of "Ready-To-Serve" (RTS) beverage, 15% TSS and 0.29% TA and preservative (mainly citric acid) was found satisfactory.

Table 28: Biochemical parameters used in preparation of RTS juice

Juice	Total Soluble solid (TSS)	Titrable acidity (TA) (%)	рН
Rose apple	4.4	0.73	5.76
Dragon fruit	10.9	0.62	6.57

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

As per norm of FPTC, two training-cum-demonstration on value addition of mango, pine apple, bael and coconut, were conducted where 98 participants including 88 females were benefitted. Trainees learnt about the scope and status of post harvest processing of food crops, their effective utilization, orchard management, application of organic input for quality fruit production, maturity index, insect and pest management during storage and economic analysis of setting up small scale food processing plant. Demonstration of RTS juice, squash, jam, jelly, candy from mango, bael, coconut milk and coco water processing and packaging were given (Plate 87).



Coconut milk





RTS Rose apple









Plate 87: Training and demonstration for coconut and fruit based value added products

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

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

#### Post-Harvest losses in marketing of fruits and vegetables

The study was conducted in three market namely Diglipur, Rangat and Junglighat market of two districts (South, North and Middle Andaman) to analyse the market chain of fruits and vegetables for estimation of post harvest losses. Multi stage sampling technique was used to select the sample for the study. Cluster sampling was used to select three communities, where fruit marketing is prevalent in nearby market/supply to whole saler. Simple random sampling technique was used to select fifty eight (58) fruits/vegetables/ (mango, banana, pine apple, tomato, brinjal, pumpkin and okra, cauliflower) marketers from the selected communities to make the sample for the study. Some farmers, because of their inability to pay the transport cost, harvest their produce and sell as much as they can at the farm gate. Data in this study were collected through a structured interview schedule based on predefined questionnaire. Information on age, marital status, and years of formal education, fruits marketing experience, annual income, transportation cost, distance from fruits source, storage system, and average price of fruit and monetary value of fruit loss during fruits marketing were collected (Table 29).

**Table 29: Socio-economic characteristics of the respondents (n=58)** 

Variable	Frequency	Per cent					
Age (Years)							
20-29	9	15					
30-39	14	24					
40-49	17	29					
50-59	8	14					
60-69	10	17					
Level of education							
Have never been to formal school	2	3					
Primary	7	12					
Middle	26	45					
Secondary	19	33					
Tertiary	4	7					
Marketing experience							
1-9 year	16	27					
10-19 year	21	36					
20-29 years	9	15					
30-39 Years	8	14					



Data in this study was analyzed with both descriptive and inferential statistics. The descriptive statistics that were employed in the study includes means, standard deviation, frequencies and percentages. The inferential statistics that were utilized are multiple regression analysis and analysis of variance (ANOVA) and presented in Table 30.

The empirical model that was used in the study is specified as follows:

$$Y = X_1 + X_2 + X_3 + X_4 + X_5 + X_6 + X_6 + X_8 + X_9$$

Where

Y= The monetary value of fruits loss during fruit marketing

X1= Age in years, X2=Marital status (dummy variable as 1 for single, 2 for married, 3 for widow, and 4 for others), X3=Years of formal education, X4=Fruits marketing experience in years, X5=Annual income, X6=Transportation cost, X7=Distance from fruits source in kilometres, X8=Storage system (dummy variable as 1 for basket, 2 for jute/cotton bags, 3 for refrigerator, 4 for saw dust, 5 for others) and X9=Average price of fruit/vegetable.

Table 30: Estimated parameter using Multiple Linear Regression Analysis (MLRA)

Variable	Parameter estimates	<b>Pr</b> > □ t □
Intercept	0.042	0.865
$X_1$	-0.002	0.548
$X_2$	0.028	0.338
$X_3$	-0.017	0.097*
$X_4$	- 0.0008	0.846
$X_5$	0.18	<0.001***
$X_6$	-0.45	<0.001***
$X_7$	0.002	0.041**
$X_8$	-0.05	0.35
$X_9$	-0.002	0.28
$\mathbb{R}^2$	0.67	
F static	5.79***	*, ** and *** are significant at 10, 5 and 1% level

#### **Result of Regression Analysis**

The result of regression analysis is presented in Table 30. The coefficient of  $R^2$  and F statistics shows that the model is well fitted. The coefficient of years of formal education ( $X_3$ ) is positive and statistically significant at 10% level. This result suggests that as the level of formal education of fruit marketers increases, post harvest losses in fruit marketing is drastically reduced. Similarly, the coefficient of transportation cost ( $X_6$ ) is negative and statistically significant at 1% level. This result implies that transportation cost of produces have a negative influence on the level of post harvest losses. The higher the transportation cost, the lower the level of post harvest losses. Equally, coefficient of years of fruit marketing experience ( $X_4$ ) is negative and statistically significant at 1% level. This means that this variable is inversely related to post harvest losses, that is, the higher the marketing experience of the sellers, the lower the level of post harvest losses (Plate 88 & 89).

The implication of this is that efficient transportation system will cost more money but, post harvest losses would be reduced. However, coefficient of annual income is positive and statistically significant at 1% level. This signifies that annual income of marketers is directly dependent on their level of post harvest losses.





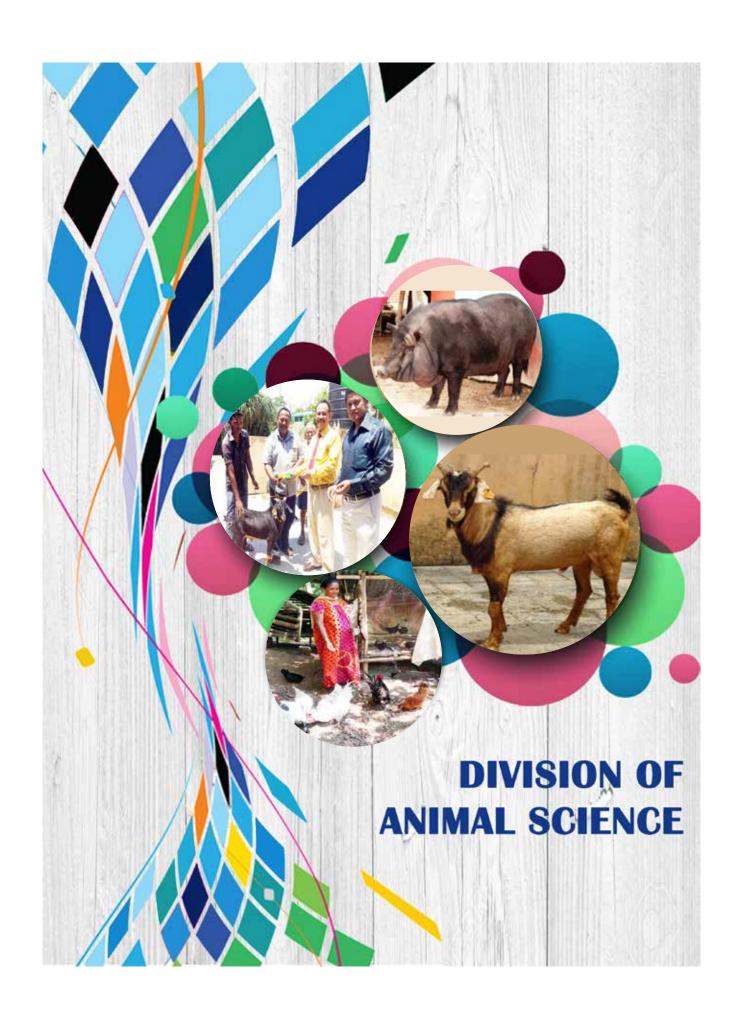


Plate 88: Taking information from retailer and packaging and transportation of vegetables (Neil Island)





Plate 89: Packaging and transportation of vegetables in Little Andaman





## 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 through mass selection and multiplication and establishment of renewed core unit for indigenous Nicobari fowl.

**First year:** 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. G1 progeny from the selected population was propagated to 1000 numbers. Production performance of G1 progeny was evaluated. 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.

**Second year:** Mass selection of Nicobari fowl was carried out based on segregation for short shank length at sexual maturity from base population of 200. A total of 1500  $G_2$  were evaluated for production performance. A total of 500  $G_3$  of Black and White Nicobari fowl and 150  $G_3$  brown Nicobari fowl were produced based on mass propagation, segregation and selection for short shank length at sexual maturity.

**Third year:** It was evident that response to selection for short shank length at ASM was highly significant in the first generation of black, brown and white Nicobari fowl at 0 day, 1, 2, 3 and 4 months of age; there was no significant difference between second and third generation in shank length at all stages in black and white Nicobari fowl. It was also observed that among the three varieties of Nicobari fowl, the black variety showed the lowest shank length as compared to White and Brown. There was gradual decrease of body weight in G1, G2 and G3 generation in all the ages of measurements in all the three varieties of Nicobari fowl.

**Fourth year:** The effect of selection for short shank length on body weight and production performance was observed to be negatively correlated. Selection for shank length reduced the body weight during the growing phase. The onset of sexual maturity was delayed by 15 days in G3 as compared to the groups before selection. Egg mass and feed intake was lower in G3 as compared to groups before selection. Improved antibody titer of 3.51 at 1<sup>st</sup> week post inoculation of Goat Red Blood Cell (GRBC) was found in the progeny of selected Nicobari fowl for short shank length.

#### **Outcome of the project**

Distribution of pure short shank length Nicobari fowls developed under the were done under TSP (100 Nos.), NABARD project (800 Nos.), N&M Andaman (50 Nos.) & other farmers (600 Nos.)

Shri Ajay Nair a farmer of Rangachang who received 15 numbers of Nicobari fowls from CIARI through proper management, multiplied the stock to 50 and has started distributing eggs and chicks to other farmers of the area.

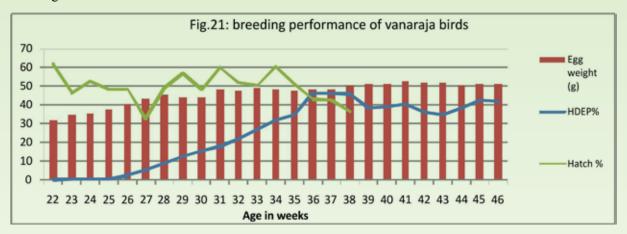
## **Poultry Seed Project**

#### A.Kundu and T.Sujatha

Breeding performance of second batch Vanaraja breeders: The second batch of 500 female and 70 male vanaraja breeder chicks were procured from Project Directorate on Poultry, Hyderabad on 27.01.2016. During the year 2016, a total of 298 female and 70 male vanaraja breeders (Parent stock) entered into breeding stage. A total of 13842 numbers of hatchable eggs were produced in a period from 22 to 46 weeks of age. The egg production trend line has been given in Fig.21. The age at sexual maturity (ASM) was 22 weeks with average egg weight of 35.06±14.2 g and the egg weight of 50 g was reached at 32 weeks of age. The age at 5% and 50% egg production were 24 and 38 weeks respectively. After 40 weeks, the peak egg production trend was maintained for a period of 9 weeks with the average



egg weight of 51±11.86 g. During breeding period, average feed allowance was 150g per bird per day. The body weight during the period of 24 to 45 weeks of age ranged from 2643±69.30g to 3648±56.3g for males and 1825±58.18 to 2751±63.51g for females.



**Production and distribution of vanaraja chicks:** A total of 4166 vanaraja chicks were produced in a period of 6 months. A total of 1050 chicks including 456 under MGMG programme and 145 chicks in North and Middle Andaman were distributed to the farmers and revenue of Rs.32745/- was earned (Plate 90).



Plate 90: Distribution of vanaraja chicks

**Growth performance of vanaraja chick at field level**: Hatched out vanaraja chicks were sold at 3 weeks of age and their average body weight at 8 weeks was 600 g.

Growing performance of Gramapriya breeders: A total of 402 numbers of Gramapriya chicks including 341 female and 61 male were brought on 11.11.2016 from Project Directorate on Poultry, Hyderabad. The standard managemental practices were followed for rearing the parent stock. The shed was cleaned, washed, flame gunned and fumigated with Pottasium permagnate and formaldehyde solution prior to the arrival of chicks and commencement of the experiment. The cemented floor brooding area was covered with paddy husk and standard brooding arrangement was made. All the chicks were provided with uniform brooding facilities using 60 W incandescent bulbs. The floor space of 675 cm<sup>2</sup> per chicks were provided (Table 31).

3.38



Male (FCR)

Age	0 day	4 weeks	8 weeks	12weeks	
Female body weight (g)	$38.45 \pm 0.98$	140.3± 4.36	411.55± 12.81	482.9± 23.49	
Male body weight (g)	46.4± 1.36	366.7± 4.17	785.9± 19.06	1379±25.97	
Cumulative feed consumption (g/bird) for Female		280	1085	2025	
Cumulative feed consumption (g/bird) for Male		400	1550	4660	
Female (FCR)		2.00	2.64	4.19	

Table 31: Performance of Gramapriya poultry breeder stocks

## **AICRP on Goat Improvement**

1.64

1.97

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

A total of three clusters at Port Blair, Baratang and Nimbudera comprising of 360 farmers have been established in Andaman Islands and 2959 number of goats have been registered under the project. The flock of Andaman Local Goat (ALG) was found to be in the range of 5 to 35 with an average flock size of 8.38 per family. The study showed that 47.43% of the goat farmers belong to the marginal land holding, followed by landless (3.60%) and small (1.44%) land holding farmers. The family size of the goat farmers were mainly small size (47.43%) followed by medium size (43.93%) and large family (9.61%). Education level was found to be mainly at the level of higher secondary (39.87%) followed by primary level (31.01%), senior secondary level (7.59%) and degree level (0.63%). However, 28.88% of the farmers were illiterate. The average income from the goat farming was calculated as Rs. 33,000/- per family.

Coat colour pattern varied from black, white and black mixed, black and brown. The predominant (90%) coat colour was black with admixture of black, brown and white (10%). The biometric dimensions (in cm) of Andaman local goats at different ages and sex have been recorded. The overall heart girth (HG) at birth, 3, 6, and 12 months were 26.17±0.22, 47.55±1.47and 61.91±0.18 respectively. Measurements for body length (BL) at birth, 3, 6, and 12 months were 24.93±0.15, 43.08±1.66 and 52.83±0.94 cm respectively. Measurements for body height (BH) at birth, 3, 6, 9 and 12 months were 25.93±0.22, 47.48±0.36 and 53.17±0.09 cm respectively. The body weight at different age is presented in table 32. The overall least square means of body weights (kg) at birth, 3, 6, 9 and 12 months of age were  $1.39\pm0.01$ ,  $5.52\pm0.11$ ,  $9.62\pm0.22$ ,  $13.35\pm0.21$  and  $16.06\pm0.04$  respectively. In general single born kids were heavier than the multiple born kids. Selective breeding and up gradation of Andaman local goat breeds for higher body weight is being done in the project area. Age at first mating, weight at first mating, age at first kidding, weight at first kidding, kidding interval, service period and gestation period was 249±7.04 days, 11.05±0.23 kg, 397.28±5.05 days,  $15.85\pm0.13$ kg,  $285\pm22.0$  days,  $95\pm15.43$  days and  $146.67\pm0.19$  days respectively. The kidding rate of 1.45 was recorded in the present stock of Andaman local goats. The percentage of singles, twins, triplets and quadruplets were 40.00, 53.55, 4.46 and 1.98 respectively in the present population under study during the period. Mortality rate is generally high in kids compared to the adult. Mortality of kids is high during the weaning period. Mortality % ranged from 2.28 % to 10.06 %. However, the highest mortality was observed in the age group of 0-3 months. Mortality was mainly reported during the monsoon season (July to November). Among the main diseases/symptoms, the morality is mainly due to the diarrhoea, blot and kid mortality due to low milk yield.

A total of 6 training, 3 awareness and 1 exposure visit were conducted this year, wherein 168 farmers participated. Mineral mixtures were provided to the pregnant does in the last stages of pregnancy and there is reduction in the kid



mortality to 2.17% from 10.06%. A total 18 elite bucks of ALG were distributed to the farmers for breeding purpose and it is exchanged among the farmers of 11 villages in South Andaman cluster (Plate 91). Deworming of 1584 goats in all the clusters has been done regularly (Plate 92). Mineral mixtures and other health tonics have been provided to 2542 goats in the field in all the clusters of our unit (Plate 93). Leaflet on "Scientific goat farming" in English and "Dweepon me bakri palan" in Hindi language was been developed and distributed to all the registered farmers in both the clusters. The overall economic growth of the farmers is 42% after the intervention of the project. Most of the selected farmers has increased share of goats income to the total family income.

Table 32: Biometric dimensions (Least square mean of body weight growth (Kg) in Andaman local goats)

Factors	Weight (kg)					
ractors	Birth	3 month	6 month	9 month	12 month	
Overall mean	1.40±0.01	5.58±0.08	9.61±0.23	13.21±0.17	16.07±0.04	
	(n=106)	(n=307)	(n=280)	(n=303)	(n=217)	
Sex of Kid						
Male	1.43±0.03	5.79±0.25	10.12±0.19	13.60±0.26	16.17±0.13	
	(n=62)	(n=134)	(n=127)	(n=184)	(n=115)	
Female	1.34±0.29	5.26±0.10	8.72±0.15	12.54±0.26	15.91±0.16	
	(n=44)	(n=173)	(n=153)	(n=119)	(n=102)	
Type of Birth			1			
Single	1.44±0.17	5.54±0.23	9.4±0.16	13.92±0.19	16.23±0.20	
	(n=52)	(n=123)	(n=115)	(n=163)	(n=76)	
Twin	$1.42\pm0.04$	5.71±0.47	9.921+0.40	13.62+0.323	16.16+0.29	
	(n=46)	(n=174)	(n=159)	(n=135)	(n=136)	
Triplet	1.3±0.13	4.81±0.49	8.5±0.68	12.51±0.283	14.7±0.632	
	(n=8)	(n=10)	(n=6)	(n=5)	(n=5)	



Plate 91: Awareness programme on goat farming at Burmanalla village, South Andaman







Plate 93: Distribution of elite bucks of Andaman Local goat to the farmers



# **AICRP on Animal Disease Monitoring and Surveillance**

## Jai Sunder and T. Sujatha

There were no major diseases outbreaks in livestock during the year 2016-17 except clinical cases of contagious ecthyma (orf) disease in goat. During the year a total of 16,719 clinical cases of various bacterial, parasitic and viral disease were reported. Parasitic diseases (99%) were of major problem, followed by bacterial disease *viz.* leptospirosis and salmonellosis (1%). The main parasitic infestation reported were ascariasis, fasioliasis and amphistomiasis (Table 33).

Parasitic diseases	Total no.	%			
Fasioliasis	4149	24.82			
Ascariasis	4113	24.60			
Amphisotmiasis	4335	25.93			
Strongyloides	1885	11.27			
Staphanophilariasis	692	4.14			
Paraamphistomiasis	501	3.00			
Monizia	484	2.89			
Strongylosis	185	1.11			
Coccidiosis	375	2.24			
Total	16719				

Table 33: List of the parasitic diseases reported in 2016

# **Temporal distribution**

**Fasioliasis:** The number of cases of fascioliasis on a monthly average was 218 (cattle), 62 (buffaloes) and 66 (caprines). The overall percent prevalence was found to be high in buffaloes (1%), followed by cattle (0.6%). The trend of facioliasis occurrence was observed erratic during the period among all species. The peak occurrence of fascioliasis was reported in September and October 2016 (Fig.22)

**Amphistomiasis:** The average number of recorded cases per month were 115 in cattle, 19 in buffaloe and 227 in caprine; but the percent prevalence was found to be high in caprine (0.4%) followed by cattle (0.3%). The frequency trend of amphistomiasis was highly fluctuating among all hosts throughout the period. The peak occurrence of amphistomiasis was reported in caprine in February 2016.

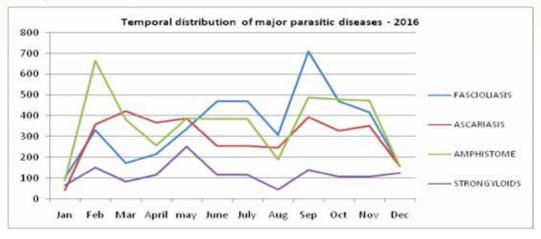


Fig. 22: Temporal disease pattern of major parasitic diseases during 2016



**Ascariasis:** The average numbers of recorded cases per month were 79 in cattle, 55 in buffaloe and 209 in caprine. The peak occurrence of ascariasis was reported in buffaloe in March 2016.

### Spatial distribution of major parasitic diseases

Occurrence of parasitic diseases is comparatively more in South Andaman (52%) followed by North & Middle Andaman (41%) and Nicobar (7 %) according to the proportion of livestock population density and distribution (Fig.23).

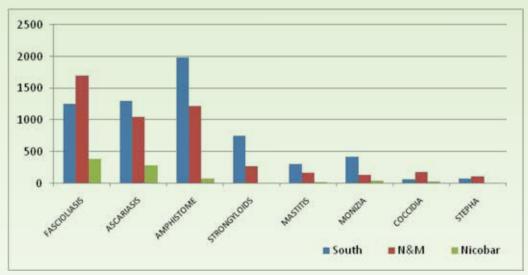


Fig.23: Spatial distribution of major parasitic diseases

#### Sero-surveillance of important disease

During the year, a total of 945 sera samples were collected from cattle and goat from South, N & M and Nicobar Islands. The samples were screened for presence of antibodies against different serovars of leptospira by microscopic agglutination test (MAT). The results revealed that out of 427 sera sample 180 (42.15%) showed antibodies against different serovars of leptrospira. The serovars which showed positive results are *L. australis*, *L. autumnalis*, *L. canicola*, *L. hardzo*, *L. hebdomadis*, *L. icterrohaemorrhagiae*, *L. pomona*, *L.pyrogenes*, *L.grippotyphosa*, *L. lai like*. The percent prevalence rate of leptospira ranged from 0.65 % (*L. autumnalis*) to as high as 19.61% (*L. hebdomadis*). Sero screening by ELISA for brucellosis was negative in all the 945 cattle sera samples. Out of 178 cattle sera screened for infectious bovine rhinotracheatis 113 were found positive. Seroscreening of goat sera sample for peste-des-petitis (PPR) virus antibodies showed that out of 319 samples, only 7 showed positive. Very high percentage of goat sera samples were found positive to blue tongue virus antibodies (102 out of 108 samples). Similarly, high antibody prevalence was found for trypanosomiasis among the cattle sera samples (141 out of 191 samples).

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

#### Jai Sunder and Arun Kumar De

Sero-surveillance and monitoring of foot and mouth disease (FMD) in cattle, buffalo and goats were conducted during the year. Under the National FMD sero-surveillance, a total of 147 cattle sera samples were collected randomly from vaccinated as well as non-vaccinated areas of A & N Islands. The results revealed the prevalence of protection antibody titre with seroptype O (59.18%), serotype A (67.34%) and serotype A-1 (68.02%) respectively. The last outbreak of FMD was reported in the year 2005 with serotype O, since then no clinical case of FMD has been reported



from any farm animals of A & N Islands. For conducting routine monitoring of the animals for presence of any traces of the FMD virus, DIVA (differentiating vaccinated from infected animals) ELISA tests were conducted. During the year, a total of 1701 random sera samples collected from different areas of A & N Islands were screened by DIVA test. The result indicated that only 22 (1.2%) of the tested sera samples showed the DIVA positive results. However, the clinical examinations of the DIVA positive animals did not exhibit any signs and symptoms of FMD infection. The trend of the DIVA during the last three years indicated that there is sharp decline in the number of positive cases for DIVA test. The trend of the DIVA test indicated that there is sharp decline in the number of samples showing positive to DIVA test which means that there is less chance of circulation of FMD virus in the population (Fig.24)

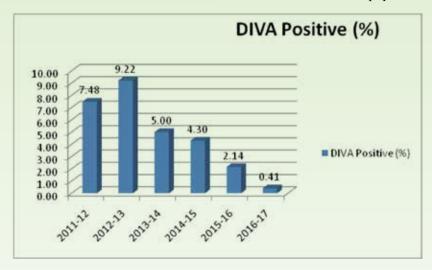


Fig.24: Trend of DIVA positive

# All India Coordination Project on Pig

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

During this reporting year total 5 farrowings have been recorded. Salient parameters like litter size at birth (no.), litter weight at birth (kg) and litter size at weaning (no.), were recorded as  $7.0 \pm 0.77$ ,  $8.92 \pm 1.84$ ,  $6.25 \pm 0.85$  respectively. The details of herd dynamics and performances of Andaman local pig have been given in table 34 & 35 respectively.

Deteile	Andaman Local Pigs				
Details	Male	Female	Total		
Opening balance as on 1/4/2016	11	9	20		
Birth 1/4/2016 to 28/2/2017	21	14	35		
Total	32	23	55		
Mortality	4	2	6		
Sold	22	13	35		
Total	26	15	41		
Closing balance as on 28/2/2017	6	8	14		

**Table 34: Herd Dynamics** 



Table 35: Performance of Andaman local pigs

GL N	T 1/4 (C)		Mea	n ± SE
Sl. No	Traits/ Characters	Male	Female	Total
1	Litter size at birth (no.)	$4.2 \pm 0.86$	$2.8 \pm 0.58$	$7.0 \pm 0.77$
2	Litter Weight At birth (Kg)	$5.42 \pm 1.55$	$3.5 \pm 0.82$	$8.92 \pm 1.84$
3	Litter size at weaning (no.)	$3.5 \pm 0.86$	$2.75 \pm 0.75$	$6.25 \pm 0.85$
4	Litter weight at weaning (kg)	$46.32 \pm 13.39$	$36.12 \pm 9.42$	$82.45 \pm 13.76$
5	Avg. Individual weight at birth (Kg)	$1.23 \pm 0.10$	$1.21 \pm 0.09$	$1.22 \pm 0.10$
6	Avg. Individual weight at weaning(Kg)	$12.90 \pm 0.53$	$13.25 \pm 0.33$	$13.01 \pm 0.45$
7	No. of days for weaning (d)	60	60	60
8	Pre weaning mortality rate (%)	14.28	7.14	11.42
9	Post weaning mortality rate (%)	0	0	0
10	Pre weaning growth rate (gm/d)	$0.19 \pm 0.005$	$1.77 \pm 1.56$	$0.19 \pm 0.003$
11	Post weaning growth rate (gm/d)	$0.14 \pm 0.009$	$0.16 \pm 0.008$	$0.15 \pm 0.006$
12	Overall growth rate (gm/d)	$0.34 \pm 0.01$	$0.39 \pm 0.031$	$0.36 \pm 2.50$
13	Body weight at different ages (Kg)			
	Birth weight	$1.3 \pm 0.06$	$1.25 \pm 0.05$	$1.27 \pm 0.93$
	1 Month	$5.47 \pm 0.15$	$5.86 \pm 0.2$	$5.62 \pm 0.11$
	2 Month	$13.23 \pm 0.37$	$13.13 \pm 0.33$	$13.15 \pm 0.23$
	3 Month	$18.41 \pm 0.95$	$18.42 \pm 0.51$	$18.05 \pm 0.48$
	4 Month	$25.25 \pm 0.25$	$24.25 \pm 0.25$	$24.62 \pm 0.23$

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

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

### Fodder production potential of annual and perennial fodders under rain fed conditions

A field experiment was conducted during *kharif* 2016 under rainfed conditions at Garacharma farm to assess the fodder production of five fodder crops and thus their ability to support livestock sector. Seven treatments (Table 36) were tested in Randomized Block Design with three replications. The data revealed that sweet sorghum (SSV 74) and maize have statistically similar fodder (green and dry) production in sole stands as well as in their intercropping with cowpea in additive series (1:1). Intercropping of maize/ sorghum with cowpea has reduced the cowpea dry fodder yield by 60.6%. Perennial sorghum (CoFS-29) from 3 harvests gave 26.26 t/ha of dry fodder yield that was 72 and 77.4 % higher than that maize and sorghum. Similarly Pillipesara gave 15.27 t/ha of dry fodder yield from 3 cuts in the island condition. Intercropping of sorghum / maize with cowpea has enhanced the dry fodder production system as a whole that is evident from the land equivalent ratio (LER) which has increased by 0.37 -0.40, when compared with their sole crops.



Table 36: Performance of sole and intercropped fodder crops, perennial sorghum and pillipesara

Tuestment	Fodder yi	LER (based dry	
Treatment	Green	Dry	matter yields)
Maize sole	46.04	14.80	1.00
Sweet sorghum sole	48.49	15.27	1.00
Perennial sorghum sole	82.78*	26.26*	1.00
Cowpea sole	22.04	6.33	1.00
Maize + cowpea	45.78 (9.65)	14.72 (2.55)	1.40
Sorghum + cowpea	47.97 (9.26)	14.98 (2.44)	1.37
Pillipesara	60.00*	15.27*	1.00
SEM±	1.91	0.39	-
CD (p=0.05)	5.79	1.18	-

Figures in parenthesis are intercrop cowpea yield; \* Yield from three cuts

## Performance of annual fodder crops during post-rainy season

Field experiment was conducted during post-South-West monsoon period ( $1^{st}$  December –  $28^{th}$  January) to assess the performance of three fodder crops (maize, sweet sorghum and pillipesara) in sole stands at Garacharma farm in Randomized Block Design with four replications. The data (Table 37) revealed that sweet sorghum and maize crops differed significantly for dry fodder production, though their green fodder production is statistically similar. Both green as well as dry fodder production of pillipesara was markedly lesser than maize and sorghum.

Table 37: Performance fodder crops in post rainy season

Treatment	Fodder yield (t/ha)		
Treatment	Green	Dry	
Maize sole	36.54	10.91	
Sweet sorghum sole	39.90	12.73	
Pillipesara	13.50	3.78	
SEM±	2.17	0.49	
CD (p=0.05)	7.52	1.70	

#### Performance evaluation of popular varieties of different fodders under Andaman and Nicobar Island

A study was conducted to assess performance of three Napier bajra hybrids (NBH), *viz* CO 4, CO 5, DHN 6 and a multi cut fodder sorghum (CO FS 29) under rainfed conditions for the second year. The treatments comprised of 3 different cultivars of hybrid Napier and one variety of sorghum planted at the onset of monsoon. The root slips were planted at a spacing of 60 x 60 cm for hybrid Napier and seed were sown for sorghum with same spacing in the month of May 2015 and three replications. The first harvest was taken at 65 days after onset of monsoon and subsequently harvests were taken at 50 days of interval. Total four harvests were made (Table 38). The average protein content was recorded to be significantly higher (P<0.05) in NBH CO 5 variety (Table 39 & 40). The average green fodder yield was significantly higher in NBH (DHN6) cultivars (177.4 ton/ ha), followed by perennial sorghum (174.4 tons/ ha) and was lowest in CO 5 (101.6 tons /ha. Among these four cultivars NBH (DHN6) was found superior with respect to total bio-mass yield, however NBH CO5 was found to be superior in terms of quality of the fodder.



Table 38: Green fodder yield of different cultivars at each harvest (ton/ha)

Cultivars	Harvest -1 (Green)	Harvest -2 (Green)	Harvest -3 (Green)	Harvest -4 (Green)	Total yield (ton/ha) (Green)
NBH (DHN-6)	35.6	46.02	44.54	51.22	177.4 <sup>b</sup>
NBH (CO-4)	34.0	44.10	50.93	41.50	170.5 <sup>b</sup>
NBH (CO-5)	21.5	28.13	30.34	21.66	101.6ª
Perennial Sorghum (CO-FS- 29)	40.2	52.19	48.96	33.04	174.4 <sup>b</sup>
SEM ±	1.58	1.59	1.74	2.63	7.5
CD ( P=0.05)	5.52	5.56	6.09	9.18	26.3

Means followed by different superscripts within a column are significantly different from each other at P<0.05.

Table 39: Moisture contain (%) of different cultivars of fodder

Cultivars	Harvest -1	Harvest -2	Harvest -3	Harvest -4	Average moisture content
NBH (DHN-6)	69.67	66.35	67.57	67.78	67.84
NBH (CO-4)	68.85	67.14	66.14	67.54	67.42
NBH (CO-5)	67.58	68.71	66.04	65.74	67.02
Perennial Sorghum (CO-FS- 29)	68.37	67.62	66.25	67.01	67.31
SEM ±	1.19	0.65	1.71	1.70	1.31
CD ( P=0.05)	NS	NS	NS	NS	NS

Table 40: Protein contain of different cultivars of fodder (%DM basis)

Cultivars	Harvest -1	Harvest -2	Harvest -3	Harvest -4	Average protein content
NBH (DHN-6)	8.6	8.00	6.83	8.17a	7.7ª
NBH (CO-4)	8.0	9.12	9.03	7.83a	8.7ª
NBH (CO-5)	9.5	10.03	9.15	9.47 <sup>b</sup>	9.6 <sup>b</sup>
Perennial Sorghum (CO-FS- 29)	8.0	8.00	8.62	9.39ª	8.7ª
SEM ±	0.56	0.43	0.60	0.45	0.5
CD ( P=0.05)	1.96	1.51	2.11	1.57	1.7

Means followed by different superscripts within a column are significantly different from each other at P<0.05.



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

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

**Impact study at Neil Island:** Impact study on adoption of package of improved practices including elevated housing, low cost balanced feed formulae and health management for Nicobari fowl was carried out. In subsequent to dissemination of those practices, farmers raised the flock in an elevated house made up of low cost locally available materials i.e. bamboo and wood. The farmers have started preparing their own poultry feed ration using locally available rice, wheat, dry fish, coconut, throwable bones and egg shells as per the specification given by scientist of ICAR-CIARI.

Birds were given with vegetable wastes, azolla and left for grazing for limited time period. After attaining maturity (28 weeks of age) they started getting eggs. Those eggs were used for home consumptions, hatching purpose and extra eggs were sold @ Rs. 10/ egg within the village itself.

By adopting the scientific management of rural poultry 153 numbers mean egg production per farmer in 9 months duration from a unit of 5 laying hens was recorded. About 80 per cent of eggs produced were used for home consumption and natural hatching was carried with rest of those eggs. 10-12 eggs were kept for hatching at a time by using local broody hens with 73 hatching per cent. Chicks were used as replacement stocks and sold to other fellow farmers thus making a horizontal dissemination of the technology (Plate 94).





Elevated housing

Feeding in bamboo feeder

Plate 94: Enhanced rural poultry farming techniques

**Third phase of project:** The third phase of the project was implemented at Rangachang. The preliminary survey in coordination with Department of Animal Husbandry and Veterinary Services was conducted and 10 farm women were selected.

**Capacity building:** Ten farm women were given capacity building on "*Women Empowerment on enhanced Rural Poultry Farming Techniques*" on various aspects of scientific packages of technologies *viz.* elevated housing, low cost balanced feed for rural poultry, feeding and watering management, vaccination and artificial incubation using mini incubator. Demonstrations were made on brooding, feeding and watering of poultry using locally made feeder and waterer and incubator operation.

Establishment of input units: A total of 10 input units with Nicobari fowls were established

**Success story at Rangachang:** Smti. Durga Devi, a farmer has started practising the improved rural poultry practices. She prepared low cost feed using rice, wheat, fish and coconut as per the low cost feed formulae and fed to birds. At the age of 28 weeks, five birds started laying. In a period of 6 months, she obtained a total of 1050 eggs, out of which 600 eggs were sold @ Rs.12 per egg and the rest were used for home consumption. From the sale of eggs, she earned Rs.7200/- that was used to purchase ration and vegetables. Keeping the rate of desi eggs @ Rs.15 per egg at retail



shop, the value of eggs used for home consumption was Rs.6750/-. The total income in 6 months period from a unit of 5 laying Nicobari fowls was Rs.13950/-. Expenditure on feed was Rs. 1000/- and thus the total net income designed was Rs.12950/- (Plate 95).







Farmer's selection

Preliminary survey at Rangachang

Capacity building







Establishing input unit

Distribution of Nicobari fowl

Successful farm women

Plate 95: Different activities under sustainable Rural Livelihood for Rural women

# Need based study

# A Novel Bioactive Compound from Marine Sponge Hyrtios erectus and its Therapeutic Potential

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





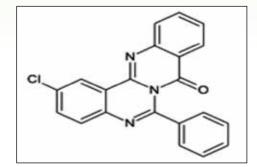


Fig. 25: Novel compound from Hyortios erectus

In the present study, marine sponge *Hyrtios erectus* (Plate 96) was collected from eastern coast of Andaman sea around South Andaman group of islands. Flash column chromatography (silica gel) followed by HPLC was used to



purify the biologically potent compounds from the methanol extract of *Hyrtios erectus* sponge. The purified compounds were analyzed by several spectroscopic techniques in order to establish their identity. It turns out, from the extensive HPLC purification and biophysical analysis of the methanol extract that the major bioactive constituents of the marine sponge *Hyrtios* erectus belong to the class of alkaloid natural products. Four of the identified compounds, 5-hydroxy-3-(2-hydroxyethyl) indole (1), 1,6-dihydroxy-1,2,3,4-tetrahydro-β-carboline (2), hyrtiosine-B (3) and hyrtiosulawesine (4) were previously discovered in marine sponges. Besides these four, another compound was identified as 2-chloro-6-phenyl-8H-quinazolino [4,3-b] quinazolin-8-one (5) (Fig. 25). was isolated for the first time from the sponge *Hyrtios erectus*. The structural assignments of compounds (1-5) were based on accurate study of the FT-IR, GC-MS and NMR spectral data based on the detailed spectroscopic analysis.

The antioxidant and anti-inflammatory activities of the novel sponge compound were investigated. The antioxidant activities of the compound were determined by measuring the free radical scavenging activities. The compound exhibited antioxidant activity against 2,2-diphenyl-1-picrylhydrazyl (DPPH) free radicals, superoxide anions and hydroxyl radicals. The anti-inflammatory activities of the compound were determined by measuring the inhibitory effect of the extract on inducible nitric oxide production. Extract of the sponge, at a concentration of 25  $\mu$ g/mL inhibited nitric oxide production by a macrophage cell line *in vitro* by 91.22  $\pm$  5.78% (Table 41).

Table 41: Inhibitory activity of sponge extracts on LPS-activated NO production in RAW 264.7 macrophages

Concentration (µg/mL)	% NO inhibition	% Cell viability
5	$67.94 \pm 08.64$	$88.34 \pm 05.33$
15	$86.45 \pm 05.39$	$86.08 \pm 03.84$
25	$91.22 \pm 05.78$	$91.65 \pm 05.11$
50	$91.09 \pm 04.67$	$89.30 \pm 03.18$
100	$87.57 \pm 06.34$	$86.52 \pm 04.31$

<sup>\*</sup>Values are presented as mean  $\pm$  SD (n = 3).

Quantitative real time polymerase chain reaction (qPCR) was used to investigate the effect of the sponge extract on the expression of eight pro-inflammatory cytokine genes in a breast carcinoma cell line. The sponge extract induced down regulation of eight pro-inflammatory cytokine genes in breast cancer Michigan Cancer Foundation-7 (MCF-7) cell line. In conclusion, compound from sponge *Hyrtios erectus* showed potential antioxidant and anti-inflammatory activities.

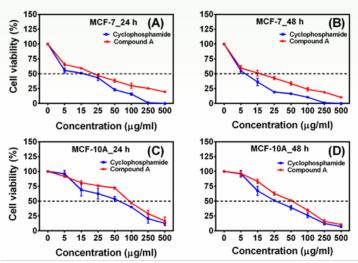


Fig. 26: MTT assay result of the comound



The anticancer potential of the novel compound against breast cancer was also investigated. The cytotoxic effect of the compound on human breast carcinoma cell line (MCF-7) and normal breast cancer cells (MCF-10A) were investigated. MCF-7 and MCF-10A cells were treated with the compound at various concentrations and the inhibitory effect of the compound on the proliferation of MCF-7 and MCF-10A cells were examined using the 4,5-dimethylthiazol-2-yl-2,5-diphenyltetrazolium bromide (MTT) assay. MTT assay results showed significant inhibition of MCF-7 cell viability with  $IC_{50}$  value of 13.04±1.03µg/mL after a 48 h treatment period whereas it was comparatively less cytotoxic towards MCF-10A cells (Fig. 26). The compound induced apoptosis of MCF-7 cells. Treatment of the compound induced down regulation of anti-apoptotic Bcl-2 protein and caused an increase in the pro-apoptotic Bcl-2/Bax ratio in MCF-7 cells (Fig. 26).

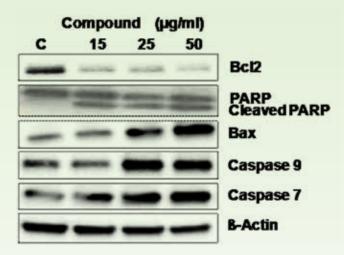


Fig. 26: Effect of the compound on expression of pro and anti-apoptotic proteins

The mechanism involved in apoptosis was assessed to evaluate the possible pathways induced by the compound. The treatment of the compound activated the expression of caspase-9 and stimulated downstream executioner caspase-7 (Fig. 26). Moreover, compound A stimulated the up-regulation of pro-apoptotic genes and down-regulation of anti- apoptotic genes in MCF-7 cell line. The results indicated that the compound could induce apoptosis of breast carcinoma cells via a mechanism that involves either extrinsic or intrinsic apoptosis pathways.

# Ad-hoc project

# Assessment of Biotic and Abiotic Stressors on Goat Health under Island Ecosystem

## Sophia Inbaraj, Jai Sunder, A.Kundu and T.Sujatha

In order to attain sustainable goat production, under climate change scenario in the island ecosystem, both the biotic (bacteria, virus and parasites) and abiotic (temperature, relative humidity, solar radiation and photoperiod) factors impeding animals' health need to thoroughly investigated.

#### Seasonal influence on serum biochemical and hormonal parameters of indigenous goats

The objective of the current study was to observe the impact of two seasons *viz.* summer (February-May) and monsoon (June-August) on the blood biochemical and hormonal parameters in indigenous goats of Andaman and Nicobar Islands, India maintained under extensive management system (Table 42). Sixty serum samples (n=10/season/breed)from three indigenous goat breeds namely Andaman local goat (AL), Teressa goat and Andaman local X Malabari (AL X M) cross goat were analyzed. Serum biochemical parameters were analyzed using spectrophotometer and hormonal estimation was done employing commercial ELISA kits. Study revealed that there was a significant



increase (p $\le$ 0.05) of serum total protein in Teressa goats during summer than monsoon. Serum albumin showed significant variation (p  $\le$  0.05) between AL and AL X M during summer, whereas significant variation of albumin (p  $\le$  0.05) was observed between AL and Teressa, AL X M and Teressa during monsoon season. Significant differences in serum albumin (p  $\le$  0.05) were also observed in AL and AL X M during summer and monsoon seasons respectively. Phosphorus levels varied significantly (p  $\le$  0.05) between each goat breed. Serum phosphorus levels varied significantly (p  $\le$  0.05) between summer and monsoon in AL goats. The serum cortisol levels were significantly higher (p  $\le$  0.05) in AL goats during summer than in monsoon season. Thus the study could able to establish the seasonal variation in biochemical and hormonal values of indigenous goat breeds of Andaman and Nicobar Islands maintained under extensive system (Fig. 27& 28).

Table 42: Weather parameters during the study period (February to August, 2016)

Month	Temperatu Max	re (□ C) Min	Humidity (%)	Total rainfall (mm)
February	$30.9 \pm 0.68$	$24.2 \pm 1.52$	$71.05 \pm 6.8$	0.0
March	$32.5 \pm 0.88$	$24.7 \pm 1.14$	$71.68 \pm 4.61$	$29.4 \pm 5.28$
April	$33.4 \pm 0.84$	$25.6 \pm 0.7$	$68.93 \pm 3.23$	$7.0 \pm 1.28$
May	$33.3 \pm 1.75$	$26.5 \pm 1.53$	$75.81 \pm 10.06$	$271 \pm 16.28$
June	$30.0 \pm 1.59$	$25.0 \pm 1.17$	$87.13 \pm 6.39$	$495.9 \pm 23.78$
July	$30.6 \pm 1.29$	$25.2 \pm 1.54$	$85.95 \pm 5.82$	$425.3 \pm 27.07$
August	$31.0 \pm 0.79$	$25.2 \pm 1.51$	$84.35 \pm 4.95$	$325.3 \pm 32.59$

(All the values are presented as Mean  $\pm$  standard deviation)

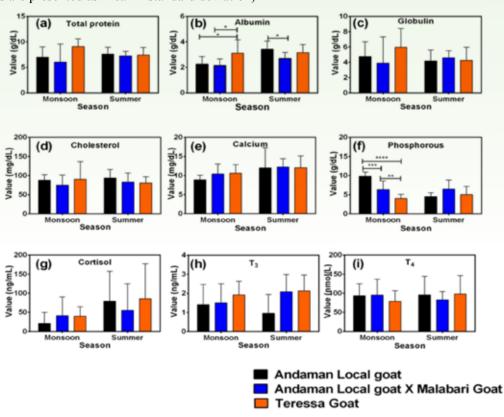


Fig.27: Effect of breed on blood biochemical and hormonal parameters



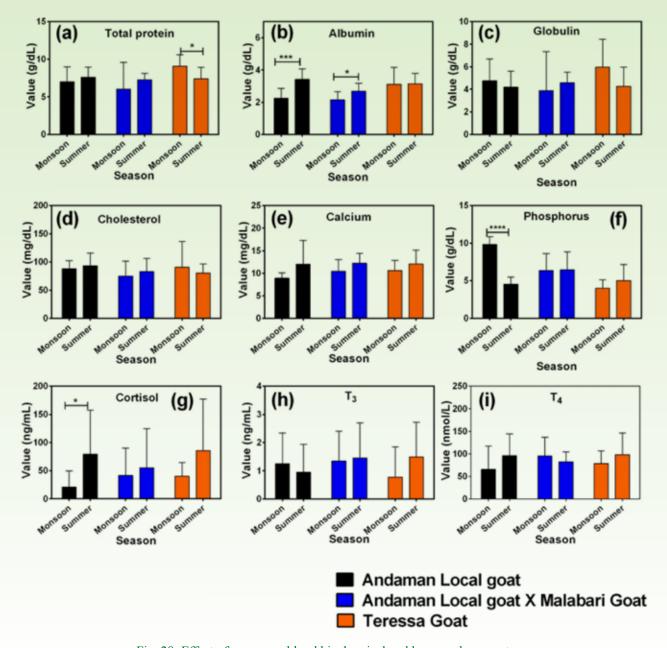
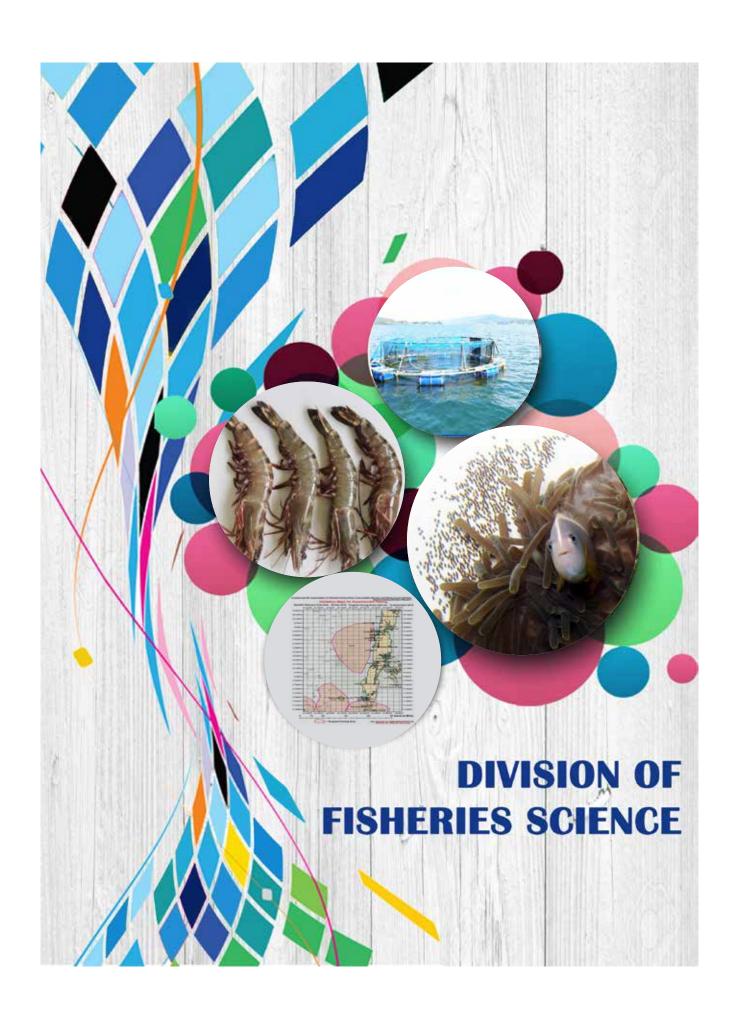


Fig. 28: Effect of season on blood biochemical and hormonal parameters

#### Serosurveillance for respiratory diseases of goats

Sera samples of goats were collected from different villages of Andaman and Nicobar Islands for screening of mycoplasmosis by Serum Agglutination Test (SAT) and for antibodies against blue tongue virus employing indirect ELISA (Test performed at IVRI campus, Mukteswar). A total of 86 serum samples from goats were tested for Mycoplasmas capri antigen procured from IVRI, Bareilly was used in the test. None of the serum samples showed positive results. Out of 186 serum samples tested for blue tongue antibodies, 145 serum samples (78%) were found to be positive by indirect ELISA. A total of 86 whole blood samples were tested for presence of blue tongue virus antigen using sandwich ELISA in which 64 samples (74%) showed positive results. However clinical manifestation of the disease was not observed in goats of the islands due to absence of sheep husbandry which act as main host of the virus.





# Bio-Physical Characterization and Site Suitability Analysis for Indian Mangroves

S. Dam Roy, J. Raymond Jani Angel, K. Lohith Kumar and R. Kiruba Sankar

#### Analysis of physico-chemical parameter of soil and water

Soil and water samples were collected from identified sites of Prolobjig creek. The available N and available P in Yerrata and Shyamkund were observed to be similar and there was no significant difference (p>0.05) in these two parameters of soil collected from both the sites, but, the available K and total organic carbon (OC) content of soil differ significantly (p<0.05) between both the sites (Fig. 29).

Water quality parameters like DO (3.06±0.016 ppm), pH (7.427±0.02), electrical conductivity (11.147±0.09 mS/cm) and salinity (27.18±0.34 ppt) were also analyzed using multi-parameter water analysis kit and found to be significantly high at Yerrata than in the Shyamkund region. There is no significant difference in the water temperature between both the sites (Fig. 30). The variation in soil and water quality parameters at two sites of Prolobjig creek namely Yerrata and Shyamkund is attributed to the fact that Yerrata region is close to the bar mouth, which are influenced by tidal brackish water from estuary and Shyamkund region is more nearer to terrestrial ecosystem influenced by freshwater run off.

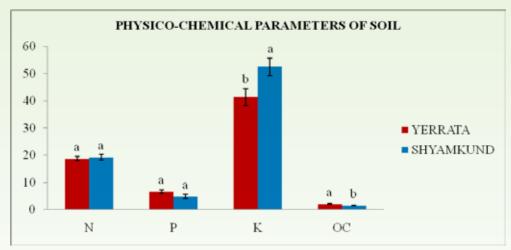


Fig. 29: Physico-chemical parameters of soil collected from Yerrata and Shyamkund regions of Prolobjig Creek. The bars within a parameter showing different superscripts are significantly different (p<0.05) (mean ± S.E) (n=3)

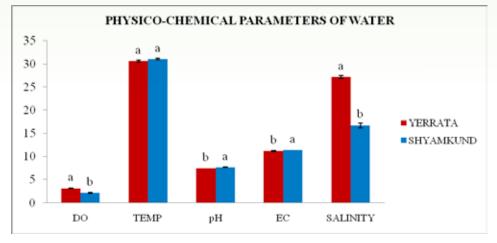


Fig. 30: Physico-chemical parameters of water collected from Yerrata and Shyamkund regions of Prolobjig Creek. The bars within a parameter showing different superscripts are significantly different (p<0.05) (mean  $\pm$  S.E) (n=3)



## Leaf Area Index and light interception

The Photosynthetically Active Radiation (PAR) and LAI value, which was taken below the canopy of selected mangroves at all the quadrats of Shyamkund area, were calculated using a Plant Canopy Imager. The PAR, PAR-LAI and LAI values obtained for various mangroves at different quadrats of Shyamkund area are presented in Fig. 31. Species which are seen near to the stream or road shows the highest PAR value. The PAR value of *Avicennia marina* and *Excocaria agallocha* present in quadrant 1 showed the highest PAR value. The lowest PAR value and the highest PAR-LAI value among all the species surveyed were observed in *Xylocarpus granatum* at quadrant 4. *Phoenix paludosa* seen at quadrant 4 also showed higher PAR LAI value. The PAR and PAR-LAI values showed an inverse relationship all over the areas surveyed (Plate 97). LAI was observed to be more in quadrant no. 6, which is attributed to denser mangrove canopy compared to other quadrats. Current scientific research and application studies will demonstrate the usefulness of physically derived biophysical data in assessing the GPP of mangrove forest in Andaman and Nicobar Islands.

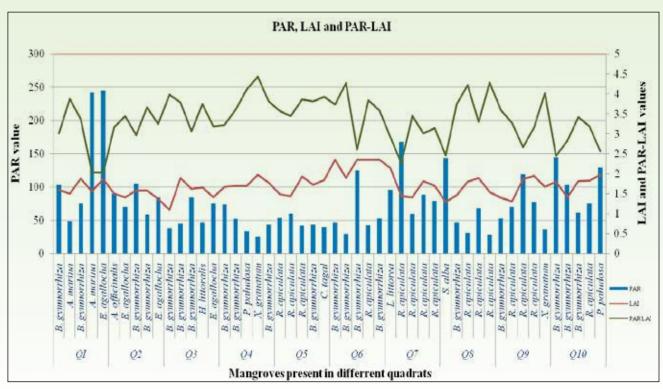


Fig. 31: Bio-physical variables, including PAR, LAI and PAR-LAI of mangroves present in various quadrats of Yerrata and Shyamkund region of Prolobjig Creek.).





Plate 97:Mangrove tree marked for sample and data collection (a); Data collection using plant canopy imager (b); Taking mangrove tree canopy diameter (c), water sample (d) and soil sample (e) from an identified quadrant.

# **Location Specific Augmentation of Potential Fishing Zones Advisories Using Satellite Altimetry and Fishing Ground Database**

# S. Dam Roy, R. Kiruba Sankar, P. Krishnan, A. Anand and K. Lohith Kumar

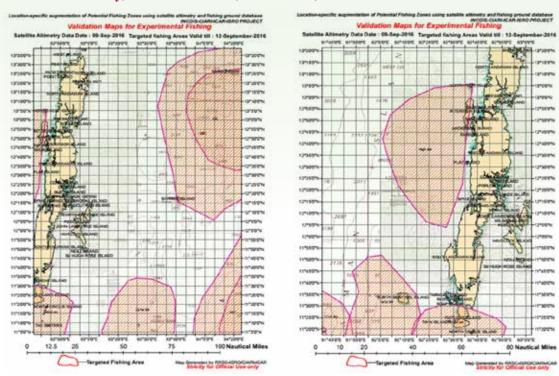


Fig.32: Eddy based advisories generated during the month September 2016



Potential fishing zone advisories based on eddies instead of conventional sea surface temperature and chlorophyll were generated and distributed to the fishermen of the Islands for validation and controlled experiments. Maps generated based on upwelling and downwelling regions are given in Fig. 32 and 33.

These advisories developed were used for experimental fishing and the catches in PFZ and non PFZ areas were compared. A total of eight advisories were generated of which six could be validated as advisories during December 2016, and could not be validated due to cyclonic conditions. The total fish catch in PFZ and non PFZ were found to be 18530kg and 7015kg respectively as the PFZ locations demarcated based on eddies gave promising results. The details of validation based on gears are given in Table 43.

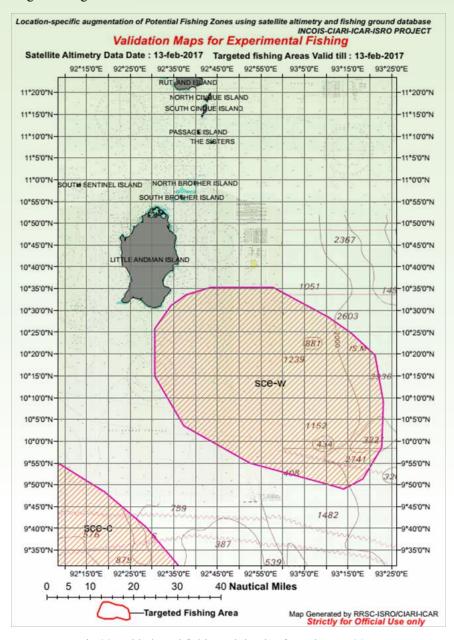


Fig.33: Eddy based fishing advisories for February 2017



F:-L:		PFZ	Non PFZ		
Fishing gear	Nos	Fish catch(kgs)	Nos	Fish catch(kgs)	
Ring net	7	13800	9	5050	
Gill net	2	600	2	275	
Long line	13	2330	10	990	
Hand line	9	1800	10	700	
Total	31	18530	31	7015	

Table 43: Validation results of eddy based PFZ advisories

Conventional PFZ using sea surface temperature (SST) and chlorophyll has limitations in ANI due to continuous cloud cover and prolonged rainfall with two monsoons. Hence alternative advisory using sea surface height (altimeter data) was intended and accordingly upwelling and down welling areas was demarcated and advisories were prepared. The study has provided encouraging results as it could be used as an alternative during absence of conventional (SST and Chlorophyll) advisories. Several more validations throughout the Islands are to be carried out to establish the potential of sea surface height based advisories as promising alternative technology to augment the marine fish catch in ANI.

### **Assessment of Stock of Neretic Sharks from Andaman Waters**

#### R. Kiruba Sankar, S. Dam Roy, , K. Lohith Kumar, S. Monalisha Devi, K. K. Bineesh and A.K.O Ratheesh

Around 39 species of sharks are reported from Andaman and Nicobar Islands (ANI) with probably several unreported species, since the elasmobranch diversity of Indian EEZ are scarce. Sharks, rays, skates and chiameras comprise the group Chondricthyans among which sharks are probably in demand owing to the export value of shark fins for food and medicinal purposes. The present study was mainly aimed to conserve the sharks by reporting the landings of juveniles, endangered and threatened species and their catch/effort from landings of ANI. The work also envisaged to demarcate important shark fishing grounds using gill nets and long lines and generate a data on traditional fishing grounds of them for conservation.

Around 17 sharks species were recorded during the study under order/family Hemiscyllidae, Scyliorhinidae, Hemigaleidae, Charcharhinidae, Sphyrnidae etc. The landings revealed that several sharks listed in threatened and endangered categories by IUCN are being landed regularly in ANI. *Hemigaleus microstoma* (Bleeker 1852), was classified by IUCN in vulnerable list, *Carcharhinus sealei* (Pietschmann, 1913) and *C. falciformes* (Muller and Henle, 1839) are under near threatened. *Loxodon macrorhinus* (Muller and Henle, 1839) being Least concerned, whereas *Triaenodon obesus* (Rupell 1837) is near threatened. A haul of sharks landed in Junghlighat fish landing center is given in Plate 98 a. Scalloped hammer head sharks *Sphyraena lewnii* are being landed regularly probably as by catch and are found frequently in markets for sale (Plate 98 b). *S. Lewnii* is categorized by IUCN as endangered in global level. *Carcharhinus limbatus* (Muller and Henle, 1839), *C. albimarginatus* (Ruppel, 1837) and *C. melanopterus* (Quoy and Gaimard 1834) are observed from the landings which are classified as near threatened by IUCN. The present study also reports the Sicklefin weasel shark *Hemigaleus microstoma* from Andaman Islands (Plate 99).



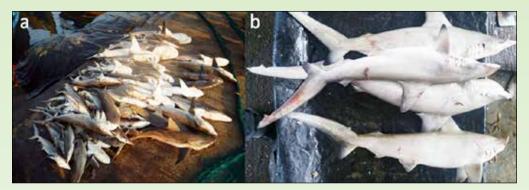


Plate 98 a&b: Shark haul (*Carcharinus sp*, *Carcharinus falciformis*); *Sphyraena lewnii*, Hammer head shark landed at Junglighat



Plate 99: Hemigaleus microstoma, Sicklefin weasel shark

In recent years many exploration in the nearby waters unravels the rich diversity of sharks and rays and that points the need of taxonomic exploration of elasmobranchs from Andaman Islands. On 08 October 2015 from Junglighat landing centre two specimens of *Hemigaleus microstoma* were collected. This species caught at 40-70 m depths off the Ross Islands in longline operation by artisanal fishermen. The sharks are mostly caught using gill nets and long lines and the plot of catches using gillnets and long lines from the catch and effort data in Andaman and Nicobar islands are shown in Fig.34. The traditional fishing grounds of long liners (Table 44), gill nets (Table 45) and hand lines are collected from the ANI which might be the major fishing locations/grounds of elasmobranchs particularly sharks including other pelagic and demersals.



Fig 34: Catch location of gill nets and long lines which lands Elasmobranchs particularly sharks, skates and rays



Marking traditional fishing grounds will be an important conservation measure as the areas of abundance if known could be used to delineate their fishing grounds and can be applicable to mark closed fishing areas and seasons. Catch and effort of elasmobranchs were recorded from landing centres from 2015-17. Catch data were recorded during nine landing centre visits in a calendar month. Important landings of elasmobranchs are concentrated in Little Andaman, Nancowry Islands and South Andaman where catches of more than 2 tonnes/day were reported in few locations. The mean catches of gears operating in South Andaman in given in Table 46 including gill nets, long lines and hand lines.

Table 44: Traditional Fishing grounds of Long liners

<b>Reference Points</b>	No. of visits	Total catch (kgs)	Reference point	No. of visits	Total catch (kgs)
Baratang	22	21198	Long Island	3	6410
Betapur	14	16340	Mayabunder	30	12695
Brother Sister	3	1593	Flat Island	6	1620
Cinque Island	24	25873.5	North Reef Island	4	1130
Diglipur	1	1090	Neil Island	2	9070
Havelock	8	4233	Nimbudera	1	265
Hut Bay	4	4330	North Sentinel	22	15125
Interview Islands	23	30093	Rut land	1	240
Kadamtala	9	9420	Tirur	2	950
Landfall	1	780	Wandoor	6	1260

Table 45: Traditional fishing grounds of gill nets

Reference Point	No. of visits	Total catch	Reference Point	No. of visits	Total catch
Amkunj	1	10	Madhuban	2	327
Bamboo flat	11	105	Mayabunder	14	5410
Baratang	8	5515	Minnie Bay	3	23
Betapur	9	3280	Mundapahar,	1	300
Brijgunj	22	3200	Muva tickry	1	1000
Burmanallah	2	600	Neil Island	9	1745
Carbyn's cove	32	5960	Nimbudera	1	230
Chidiyatappu	15	3580	North Point	9	684
Cinque Island	5	2350	Panighat	3	34
Diglipur	20	6425	Rangat Bay	27	518
Havelock	28	7700	Ross Island	51	9148
Hut Bay	8	2410	Rut land	25	7110
Interview Islands	31	10990	Shoal Bay	6	1620
Landfall	3	1665	Tirur	7	2635
Long Island	2	660	Viper Island	1	16
Mazharpahad	2	330	Wandoor	3	680



Table 46: Mean catch/ trip across gears operated and their target fish group

Gears	Mean catch (mean ± SE) (kg) /trip	Target fish group
Ring-net	$1105.21 \pm 73.21$	Small pelagics
Gillnet	$323.66 \pm 16.27$	Small and large pelagics and sharks
Hand-line	$200.13 \pm 51.32$	Large pelagic and column demersals including sharks
Long-line	541.30 ± 51.52	column demersals including sharks
Trawl	$1052.13 \pm 42.15$	Indiscriminate catch

Observations on length ranges of shark landings are currently in progress to determine the juvenile shark landings as many juvenile sharks are being discarded as bycatches in landing centers (Plate 100). Sharks placed in Schedule I of wild life act 1972 were not observed in landings.



Plate 100: Juvenile sharks landed and discarded in landing centre

# Mariculture of Selected Marine Finfishes and Shellfishes from Andaman Waters

#### R.Kiruba Sankar, J.Raymond Jani Angel, Venkatesh R Thakur, A. Anuraj and Benny Varghese

Water temperature, salinity, dissolved oxygen (DO) concentration, and photoperiod were the parameters that influence the feed consumption, metabolic rate and energy expenditure, and thus, on growth of poikilothermic vertebrates, including fish. Temperature plays an important role in reproduction of fishes hence, it is necessary to keep the temperature of the aquarium waters within the tolerance limit of the species. In case of clown fishes studies on temperature are scanty. Hence, attempts were made to check the effect of temperature on the reproductive performance of skunk anemone fish, *Amphiprion akallopisos*. Reproductive parameters like ova diameter, duration of 1st spawning, frequency of spawning, time interval between successive spawning and fecundity per spawning were observed and data collected. For the said experiments six matured pairs of *Amphiprion akallopisos* were collected from North Bay region of South Andaman. The experiment was carried out in 100L FRP aquarium tanks under controlled condition maintained with four constant temperature regimes *i.e.* 25°C, 27°C, 29°C and 31°C, for a period of three months. Study revealed that *Amphiprion akallopisos* showed best reproductive performance at 29°C than other temperature regimes. The reproductive performance of *Amphiprion akallopisos* at 29°C was as follows. The first spawning was observed one month of rearing and spawned five times with 12-15 days of time interval. The number of eggs progressively increased in successive spawning (Plate 101). Hence the results from the present study can be used for captive spawning which leads to a sustainable production of this species for the marine ornamental fish trade.



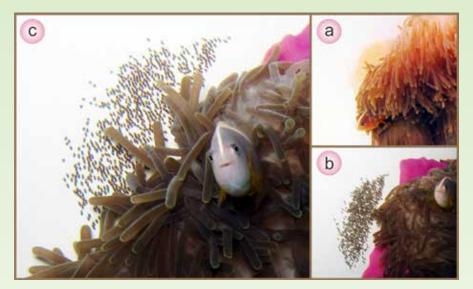


Plate 101a: Amphiprion akallopisos with 2 days old (101a); 4 days old (102b); and 6 days old (103c) eggs attached at the bottom of tank

# Marine Faunal Biodiversity of Nicobar Group of Islands

# R.Kiruba Sankar and S. Dam Roy

Nicobar group of Islands are some of the least explored regions for biodiversity exploration in comparison with other parts of country owing to its isolation and access. The project intended to catalogue and document the marine fauna of Nicobar group of Islands. With the objective surveys were conducted in Car Nicobar, Nancowry and Great Nicobar to document the marine fauna. Surveys were conducted in Great Nicobar (9 sites) and Nancowry Islands (22 sites) and reported 324 species belonging to 3 phyla/groups *viz.*, Cnidaria (78), Mollusca (5), and fishes(241). A snap shot of compilation of marine fauna is given in Fig.35.

ICTHYOFAUNA	NANCOWRIE	GREAT NICOBAR
DASYATIDAE Jordan & Gilbert, 1879		
1. Himantura uarnak (Gmetin, 1789)	•	
<ol> <li>Neotrygon kuhlii (Müller &amp; Henle, 1841)</li> </ol>	•	•
MYLIOBATIDAE Bonaparte, 1835		
3. Aetobatus ocellatus (Kuhl, 1823)	•	
4. Manta birostris (Walbaum, 1792)	•	
CARCHARHINIDAE Jordan & Evermann, 1896		
<ol> <li>Carcharhinus melanopterus (Quoy &amp; Galmard, 1824)</li> </ol>	•	
MURAENIDAE Rafinesque, 1815		
Gymnothorax flavimorginotus (Rüppell, 1830)	•	•
7. Gymnothorax javanicus (Bleeker, 1859)	•	•
8. Gymnothorax meleogris (Shaw, 1795)	•	
SYNODONTIDAE GIII, 1861		
9. Synodus variegatus (Lacepède, 1803)	•	•
HOLOCENTRIDAE Bonaparte, 1833		
10. Myripristis murdjan (Forsskål, 1775)	•	
11. Neoniphon samara (Forsskål, 1775)	•	•
12. Sargocentron caudimaculatum (Rüppell, 1838)	•	•
13. Sargocentron spiniferum (Forsskål, 1775)		•
14. Sargocentron prastin (Lacepède, 1802)	•	•
15. Myripristis violacea Bleeker, 1851		•
FISTULARIDAE Stark, 1828		
16. Fistularia commersonii Rüppell, 1838	•	•
CENTRISCIDAE Bonaparte, 1831		
17. Aeoliscus strigatus (Günther, 1861)	•	•

Fig.35: A snap shot of marine fauna documented during the study



318 species were recorded from Car Nicobar belonging to 10 phyla/groups including fishes, mollusc, Cnidaria, Porifera, Echinodermata, Crustacea, Annelida, Polycladida, Nemertia and Urochordata. Secondary data including checklists of 6 phyla/group *viz.*, Mollusca of India, Echinodermata of India, Opisthobranchs of Nicobar group of Islands, Scleractinia, Porifera and Icthyofauna of Andaman and Nicobar Islands were compiled (Table 47).

	v 1 1				
Phyla/Group	No of Families	No of Genera	No of Species	References	
Icthyofauna	176	602	1463	Rao et al. 2000 Ramakrishna et al. (2010)	
Mollusca	168	473	1489	Subba Rao (2003) Ramakrishna and Dey (2010)	
Opisthobranchia	15	29	52	Sreeraj et al. (2012)	
Porifera	50	79	123	Parranayak 2006, Pattanayak 2009 Immanuel and Raghunathan (2011) Titus Immanuel <i>et al.</i> (2012)	
Scleractinia	19	86	424	Venkataraman <i>et al.</i> (2003) Raghuraman <i>et al.</i> (2012) Venkataraman <i>et al.</i> (2012)	
Echinodermata	92	328	700	Sastry (2007)	

Table 47: Checklist of secondary data prepared

Under exercise surveys conducted in South Andaman, *Halgerda dalanghita*, an nudibranch recorded from Havelock Islands, was reported for the first time from India. Four opisthobranchs *Phaneropthalmus smaragdinus*, *Dendrodoris nigra*, *Phyllidiopsis krempfi* and *Herviella mietta* were reported as new distributional records to Nicobar group of Islands. New fish records for the Islands such as *Neopomacentrus cyanomus* and *Echidna xanthospilos* were reported from the present study. The Nicobar group of Islands still holds more promise in field of documenting marine biodiversity as many remote islands are unexplored with limited access.

# Study on Stock Assessment and Biology of *Pristipomoides filamentosus* (Valenniennes, 1830) from Andaman Waters

#### S. Monalisha Devi, S. Dam Roy, K. Lohith Kumar and R. Kiruba Sankar

Landing of *Pristipomoides filamentosus* was continuous throughout the year except for the month when cyclone Vardhastriked Andaman. Among *Pristipomoides spp* (Plate 103). the minimum recorded landing is from *Pristipomoides zonatus* which shows minimal catch. The species has easy identification character with rest of the species due to presence of 4 oblique bars on the side Plate 1. Work on DNA based differentiation of different species of *Prisitpomoides* has been initiated. Landing in a day to maximum of 300kg has been recorded from Junglighat. *Pristipomoides* occurs in rocky bottom beyond 90 m depth and its landing depends on the calmness of sea. *Pristipomoides spp.* shows hermaphrodite in nature therefore sex identification becomes difficult due to reversal of sex. From the collected samples some of gonads show presence of both male and female characters. Absolute fecundity ranged between 27,129 to 1,39, 310 for 910g and 1023g and relative fecundity ranged between 30 to 136.



Plate 103: Pristipomoides zonatus



# Study on Biology and Stock Assessment of Selected Tuna Species from Andaman Waters

## K. Lohith Kumar, R. Kiruba Sankar, S. Monalisha Devi, A.K.O. Ratheesh and S. Dam Roy

During the first year of the project, it was documented that tunas mainly landed in Junglighat landing centre followed by Burmanallah and Dignabad whereas, incidental landings were recorded from Wandoor and Guptapara landing centers'. Tuna catch comprised of *Thunnus albacares* (yellow fin tuna), *T. obsesus* (big eye tuna), *Katsuwonus pelamis* (skipjack tuna), *Gymnosarda unicolor* (dogtooth tuna), *Euthynnus affinis* (little tuna) (Plate 104), *Thunnus tonggol* (longtail tuna), *Sarda orientalis* (oriental bonito), *Auxis thazard* (frigate tuna) and *Auxis rochie* (bullet tuna). The catch of tuna was dominated by yellow fin tuna followed by skipjack tuna, little tuna and frigate tuna. *Euthynnus affinis* (little tuna/kawakawa) was selected to study due to its small size and frequent occurring in the landings. Also, this tuna being an epipelagic, neritic species is widely exploited and few studies have been carried out with regard to fishery and biology.



Plate 104: Euthynnus affinis, tuna species under investigation

Fork length and wet weight data were collected from the fish landing centre on fortnight basis. This forms the basis for studying the length-weight relation (Le Cren, 1951) of any fish species. The length measurements also form the basis for studying the growth parameters. Fish samples were collected randomly and brought to laboratory for studying reproductive biology and food and feeding habits.

A total of 46 visits were made to the landing centers to collect the required data and to record the fish catch. *Euthynnus affinis* was mainly exploited using the motorized boats using gill net followed by hand line. Catch by other gears such as shore seine, ring seine was insignificant. The total catch of little tuna during the observation days was estimated to be about 10.5 tons. It was observed that the catch of tuna was high during the no moon days and low during the full moon days. The catch was recorded round the year with the peak in August-September months. The fork length of little tuna landed ranged from 18 cm to 70 cm. Fishes in the length range of 30 cm to 55 cm dominated the catch with the average length being 42 cm.





Fig.36a: Stomach condition of Euthynnus affinis



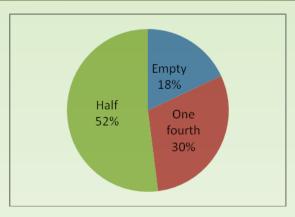


Fig. 36b: Stomach condition of Euthynnus affinis

Food and feeding intensity was observed to be medium with most of the sampled fish having half full stomach. This group comprised more than 50% of the sampled fish followed by fish with one-fourth stomach fullness forming about 30% and fish with empty stomach forming 18%.

Gut content analysis indicated that *Euthynnus affinis* is a non selective feeder mainly foraging upon finfish and crustaceans (Plate 105 & 106). Fin fishes, the smaller carangids and smaller anchovies formed about 80% of the preyed items. Other 20% was contributed by appendages of crustaceans, semi-digested food (Fig.36). The analysis of length weight relation (Le Cren, 1951) indicated that the fish is following slightly negative allometric growth being the 'b value  $\leq 3$ '.

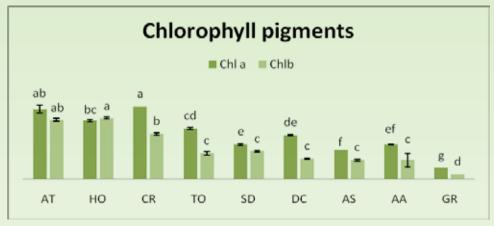
# Seaweed Diversity and its Culture Prospects in insitu Conditions of Andaman

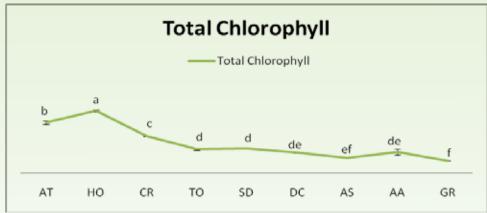
A.Anuraj, Venkatesh R. Thakur, J. Raymond Jani Angel, K. Lohith Kumar and R. Kiruba Sankar

Seaweeds were evaluated for photosynthetic pigments using 80% acetone as solvent for pigment extraction. Seaweeds were collected from the intertidal area during low tide from Burmanallah region (11°33'30''N & 92°43'47'') of Andaman Islands. Samples cleaned in seawater were thoroughly washed with distilled water before using them to estimate photosynthetic pigments. Seaweeds belonging to green seaweeds (*Acetabularia* sp. = AT, *Halimeda opuntia* = HO, *Caulerpa racemosa* = CR), red seaweeds (*Acanthophora spicifera* = AS, *Amphiroa anceps* = AA, *Gracilaria verucossa*= GV) and brown seaweeds (*Turbanaria ornata* = TO, *Sargassum duplicatum* = SD, *Dictyota* sp. = DC) were evaluated in the present study for photosynthetic pigments like chlorophyll a, chlorophyll b, total chlorophyll and carotenoid contents (Fig.37).

The chlorophyll a content of seaweeds AT  $(0.63\pm0.035 \text{ mg/gm})$  and CR  $(0.65\pm0.001 \text{ mg/gm})$  showed highest values and the highest content of chlorophyll b was observed in seaweeds AT  $(0.53\pm0.014 \text{ mg/gm})$  and HO  $(0.54\pm0.008 \text{ mg/gm})$ . The chlorophyll a content of all the seaweeds varied significantly with respect to each other (p<0.05). There was no significant difference (p>0.05) in the chlorophyll b content of seaweeds TO, SD, DC, AS and AA and the chlorophyll b content of all other seaweeds was significantly different (p<0.05) from each other. There was no significantly different from each other in their total chlorophyll content. The carotenoid content of seaweeds SD  $(0.051\pm0.001 \text{ mg/gm})$  was high compared to other seaweed species and that of seaweed GV showed minimum value  $(0.004\pm0.0010 \text{ mg/gm})$ . There was no significantly difference in the carotenoid content of seaweeds CR, DC, AS and AA. All other seaweeds are significantly different from each other in their carotenoid content.







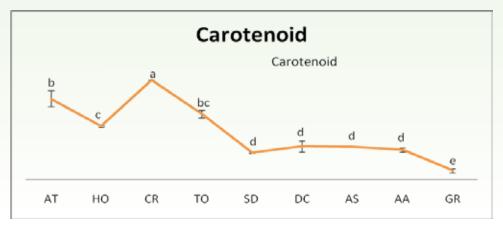


Fig.37: chlorophyll a, chlorophyll b, total chlorophyll and carotenoid contents in seaweed

Feasibility studies were carried out in the tsunami affected inundated areas of south Andaman for studying the possibilities of seaweed farming. Physical, biological & edaphic characteristics and water & sediment quality of inundated areas of Teylerabad, Garacharma, Bimblitan, Wimberlygunj, Kadakachang, Ograbranj and Sippighat were estimated. Water samples collected for estimating temperature, salinity, pH, depth, water transparency ranged 27°C-30°C, 0-21 ppt, 7.7-7.9, 1m-2.5m, 4-7.9, 1m-2.5m, 4cm to 70cm respectively and sediment samples recorded pH, salinity and organic carbon content of 5.81-7, 2.04ppt-12.8ppt and 0.49% to 2.88% respectively. Based on the results of the survey, inundated areas of Bimblitan and Kadakachang were found feasible for seaweed farming.



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

# Venkatesh R. Thakur, J. Praveenraj, J. Raymond Jani Angel, A.Anuraj and R. Kiruba Sankar

Andaman and Nicobar Islands (ANI) are poorly explored in terms of freshwater fish fauna and needs a thorough and intensive survey. Icthyological surveys were conducted during the year 2016 at different sites in the Andaman Islands (Table 48). DNA barcoding for two species of cyprinid has been done to resolve its ambiguous status. 16srDNA sequences for the new record of *Danio rerio* collected from from Kalpong river, North Andaman and *Esomus danrica* South Andaman has been generated and submitted under the accession number KY242364 and KY242366. As per the mandate broodstocks of some selected native ornamental fishes had been collected from the below mentioned sites. Sexual dimporphism of the selected ornamental fishes has been studied.

Table 48: Locations of all sites surveyed in each region

Region	Survey Site	
South Andomon(2)	Mannarghat 1	
South Andaman(2)	Mannarghat 2	
Middle Anderson (2)	Nimbudera	
Middle Andaman (2)	Rangat	
	Madhupur Nagar	
Diglipur (3)	Kalipur Nagar	
	Govind nagar	

The seleted species with ornamental potential like *Giurus margartiacea*, *Aplocheilus panchax*, *Redigobius tambujon*, *Oryzias javanicus*, *Microphis insularis* showed remarkable sexual dimorphism and have been shown in Plate 107.

# A. Giurus margartiacea

*Males:* The males are colourful with numerous coloured melanophores. The dorsal and anal fin ends are blunt yellow fin membrane and the ventral part of the body with numerous red and blue spots. Males possess a protruding genial papillae which is clearly visible.

*Female:* The females are dull with the dorsum greyish color. The dorsal and anal fin ends are blunt. Genital papillae pinkish and swollen.

## B. Aplocheilus panchax

*Males*: Males are slender and elongated with greenish dorsum and yellow fin membranes with numerous red pigments scattered.

Females: Body is stout with dull greyish white dorsum. The dorsal and anal fins are hyaline with yellow fin margins

# C. Redigobius tambujon

Male: Mature males possess a large maxillae and pointed dorsal and anal fin. The stripes in the cheek are prominent.

Female: Pale coloured with inconspicuous stripes in the cheek. Maxillae of the matured females are small.

#### D. Oryzias javanicus

*Male:* They have renarkable gonopodium or tube originating near anal fin. Body is slender with three long prolonged anal fin rays.

Female: Stout with blunt anal fins. Females carries a peculiar ovipositing organ for carrying eggs.



#### E. Microphis insularis

*Male:* Species carries a broad pouch in which the eggs are laid into it. They do brooding and parental care. Males with green and red spots in the lateral body.

Female: Dull and devoid of any spots in the lateral body.

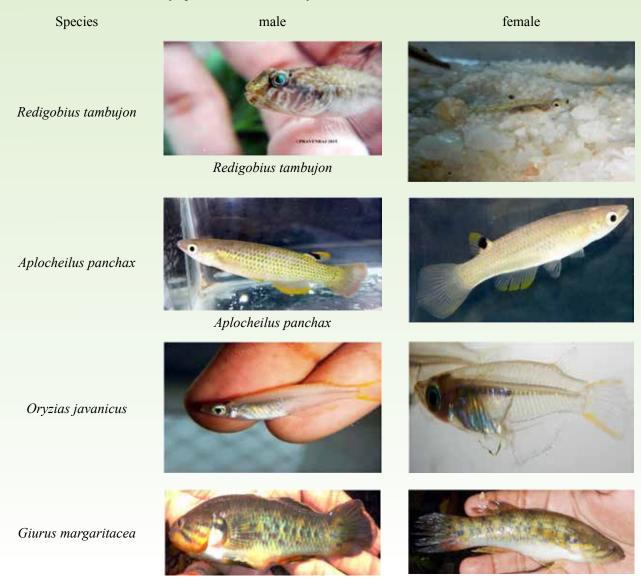


Plate 107. Males and females sexual dimorphism in selected native ornamental fishes

### **Breeding nature**

It is known that breeding of some gobies like *Giurus margaritacea* and *Redigobius tambujon* requires brackishwater water for their larval development. The adults mature in the freshwater bodies and breeds during the monsoon. The eggs washes into the brackishwater and the larval undergoes free sea drifting phase and the juveniles migrates to the freshwater and estuaries for feeding and growth. The males of the *Microphis insularis* develops brood pouch like their congener sea horses. Larva requires brackishwater for their growth. broodstocks requires infusoria, Daphnia and artemia nauplii. *Oryzias javanicus* can breed in eustaries and freshwater system and are euryhaline in nature.



Aplocheilus panchax breeds in freshwater but their sub adults were encountered in brackishwater also. Breeding of this native ornamental fishes generates an aveneue for export market and also plays a major role in conservation. Breeding programme of endemic species also plays a major role in preventing the species from being extinct.

# Capture Based Aquaculture of Economically Important Marine Finfishes of Andaman

J. Raymond Jani Angel, A.Anuraj, T. Sivaramakrishnan, Venkatesh R. Thakur, K. Saravanan and R. Kiruba Sankar

## Demonstration of open sea cage farming of marine fin fishes

In order to popularise cage culture technology of marine fin fishes among the fishers and fish farmers, demonstration of grow-out farming of silver pompano, *Trachinotus blochii* in marine sea cage is being conducted in participation with a Self Help Group for the first time in the Andaman and Nicobar Islands.

#### Construction of open sea cage

A low cost 6 m diameter, galvanised iron cage with floats (8 numbers of 200 L plastic barrels), mooring devices (24 mm polyester ropes, 18 mm GI chain and 20 L plastic barrels) and anchors (100 kg concrete block with grapnel anchors) were constructed locally and nets (Outer net: 2.5mm / 50mm mesh size, Inner net: 1.5mm / 28mm mesh size and bird net) were procured from Matsyafed Net Factory, Kerala. The cage was successfully launched at Minnie Bay, South Andaman (11° 39' 05.2" N latitude and 92° 42' 22.4" E longitude) on September 15th 2016. This type of low cost GI open sea cage is being tried for the first time in Andaman waters and so far proved to be sturdy, which also endured the catastrophic "Vardah" cyclone that hit the Islands during first quarter of December, 2016.

# Procurement of silver pompano seeds

Availability of fin fish seeds and formulated feed are the major impediments which hinder the establishment of cage farming of marine fin fishes in the Islands and are also considered as the major challenge in initiating this project. Cage culture of silver pompano was started with seeds procured and airlifted from Rajiv Gandhi Centre for Aquaculture, Vizhinjam, Kerala. Successful transportation of all the silver pompano seeds were achieved with 100 percent survival and the same were stocked in cages on October 15th 2016. A stocking density of 30 numbers/m³ was maintained in the cage.

#### **Grow-out culture**

Hatchery produced pompano fingerlings of one inch size are initially stocked in a small cage (8 mm mesh size) of 5 meter length, 3 meter width and 3 meter depth, which was placed inside the circular GI cage. The fishes were reared in this cage for 60 days, until they attain 30-40 grams size and thereafter released into the circular cage for further growout rearing. Due to continuous flow of water in the bay area, the water quality parameters were observed to be in the optimum range of; pH: 7.5 - 8.5, DO: 5.5 - 6.5 ppm, temperature:  $27^{\circ}\text{C} - 29^{\circ}\text{C}$  and salinity: 20 - 27 ppt. Attachment of algae to netting material is considered to be the major problem in the cultured site and regular cleaning of cage was done in two months interval. No incidence of disease was so far observed in the fishes cultured. Fishes belonging to family *Caesionidae* and *Pomacentridae* were also seen inside the cage. The growth pattern of silver pompano for the initial four months was monitored through random sampling of fishes at monthly intervals. The length weight measurements observed are presented in Fig. 38. After 120 days of culture in cage, pompano attained an average length of  $18.64 \pm 0.22$  cm and an average weight of  $93.15 \pm 1.08$  gms from an average length and weight of  $5.54 \pm 0.09$  cm and  $3.12 \pm 0.17$  gms respectively at  $1^{\text{st}}$  day of culture.



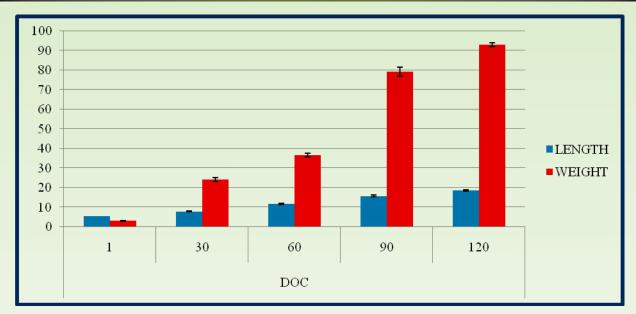


Fig.38: Length weight measurements observed during four months culture period (mean ± SE) (n=10)

### Feeding

Initial feeding was done with formulated feed procured from CIBA, Chennai, with 45% protein content for early one month rearing. With a view to solve the problem of feed in Islands, attempts were also made to formulate an indigenous marine fin fish grow-out feed with locally available feed ingredients such as fish meal, shrimp head meal, coconut oil cake (COC), paddy meal, broken rice, tapioca flour in combination with other mainland based ingredients such as groundnut oil cake (GNOC), corn flour and wheat flour. The feed was formulated with 45% protein and 8% lipid content. Feeding was done twice daily at the rate of 3-5 % body weight. Feed was prepared in the Marine Research Laboratory of Fisheries Science Division, the formulation of which is as follows (Table 49).

Sl. No.	Ingredients	Dose Used (%)	Required (Per Kg)
1	Fishmeal	35	350g
2	Shrimp head meal	5	50 g
3	GNOC	15	150g
4	COC	15	150g
5	Paddy meal	10	100g
6	Broken wheat	5.5	55g
7	Broken rice	8	80g
8	Tapioca flour	2.5	25g
9	Corn flour	2	20g
10	Vit. & Min. mix	2	20g
11	Total	100	1000g

**Table 49: Feed Formulation** 



#### Impact of the "Vardah" cyclone

In consequence to the "Vardah" cyclone that struck the Islands during first quarter of December, 2016, despite a small shift of 50 meters from the actual position, there were no damages for the GI cage frame and nets. Little mortality of fishes occurred during the natural catastrophe due to abrupt deterioration of water quality and heavy sedimentation, the exact assessment of which could only be made during the final harvest. The silver pompano is found to be a hardy species, which suits best for the open sea cage culture operated in bay area of South Andaman (Plate 108).



Plate 108: Directors visit during construction of cage (a); cage construction (b); verifying the construction of cage by committee (c); transporting the cage frame to site (d); attaching the cage net and mooring the cage (e); stocking pompano seeds (f); pompano at 1st day of culture in cage (g); pompano at 120 days of culture in cage (h); cage deployed at Minnie Bay

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

K. Saravanan, Arunjyoti Baruah, J. Praveenraj, Jackson Debbarma, T. Sivaramakrishnan, A. Anuraj, Venkatesh R Thakur and J. Raymond Jani Angel

A total of five awareness and two training programmes were conducted at various places of Andaman and Nicobar Islands (Table 50) to create awareness on fish diseases and fish health management measures among the fish farmers, in which a total of 163 farmers and Fisheries Department officials participated (Plate 109). Baseline data has been



collected from 93 freshwater fish farms of Andaman and Nicobar Islands and necessary advices were provided to the fish farmers (Plate 110).

**Table 50: Awareness and Training Programmes** 

S. No.	Date	Place	Title	Number of participants		
Aware	Awareness Program					
1	16-06-16	Madhupur, Diglipur	NSPAAD	42		
2	23-11-16	Sippighat, South Andaman	NSPAAD	17		
3	28-11-16	Manpur, South Andaman	NSPAAD	21		
4	22-12-16	Billy Ground, Middle Andaman	NSPAAD	22		
5	17-02-17	Netaji Nagar, Hut Bay NSPAAD		35		
Traini						
1	27-09-16 to 29-09-16	ICAR-CIARI, Port Blair	Quarantine and Biosecurity of Aquatic Animals	19		
2	17-01-17 to 19-01-17	ICAR-CIARI, Port Blair	Fish Disease Diagnosis	7		







Plate 109: Awareness and training programmes conducted at various places







Plate 110: Baseline data collection

Fish and shellfish samples were collected from three districts namely, North and Middle Andaman (N&M), South Andaman (SA) and Nicobar (Nic) for screening against the target pathogens by following OIE protocol. Freshwater fish and prawn samples (N&M-139; SA-102; Nic-41), wild marine shrimp samples (N&M-97; SA-88) and grouper samples (N&M-72; SA-101; Nic-13) were collected (Plate 111). All the analysed freshwater fish and shellfish samples



gave negative result for the screened pathogens like Koi Herpes Virus (KHV), Spring Viremia of Carp (SVC), Macrobrachium Noda Virus (MrNV) and Extra Small Virus (XSV) and marine grouper samples gave negative result for Red Sea Bream Irido Viral Disease (RSIVD) and Viral Nervous Necrosis (VNN). On the other hand, wild marine shrimp, *Penaeus monodon* samples collected from Lohabarrack and Junglighat landing centres gave positive result for White Spot Syndrome Virus (WSSV). Likewise, *Penaeus monodon* samples collected from Lohabarrack and Betapur landing centres gave positive result for Infectious Hypodermal and Haematopoietic Necrosis Virus (IHHNV). The positive samples were confirmed by PCR, sequencing and histopathology. Also the shrimp samples gave negative result for Monodon Baculo Virus (MBV), Yellow Head Virus (YHV), Taura Syndrome Virus (TSV), Infectious Myonecrosis Virus (IMNV) and *Enterocytozoan hepatopenaei* (EHP) infection. A total of 20 gold fishes were collected from an aquarium shop which gave negative result for Cyprinus Herpes Virus-2 (CyHV-2).







Plate 111: Fish and sheelfish sample collection

Occurrence of branchial parasitic cymothoid, *Ryukyua circularis* from the marine finfish, *Amblygaster sirm* (Plate 112) and the occurrence of parasitic cymothoid, *Norileca indica* from carangid fish, *Selar crumenophthalmus* were reported from Andaman Islands (Plate 113). Likewise, marine super giant isopod, *Bathynomus lowryi* (Isopoda: Cirolanidae) was also reported (Plate 114). Disease outbreak in rohu due to *Argulus sp.* was reported from a fish farm at South Andaman during the month of August, 2016 (Plate 115).

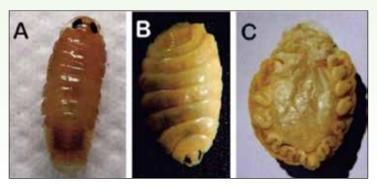


Plate 112: Ryukyua circularis : A.Male; B.Female dorsal view; C.Female ventral view



Plate 113: Norileca indica: A.Dorsal view of male; B-I.Dorsal view of females







Plate 114: Dorsal view of Bathynomus lowryi Plate 115: Infestation of Argulus sp. in rohu

Publications like training manual entitled "Fish disease diagnosis", folders entitled "Parasites of public health significance" and "Low cost fish feed preparation for island aquaculture" were published in both English and Hindi version for the benefit of stakeholders (Plate 116).

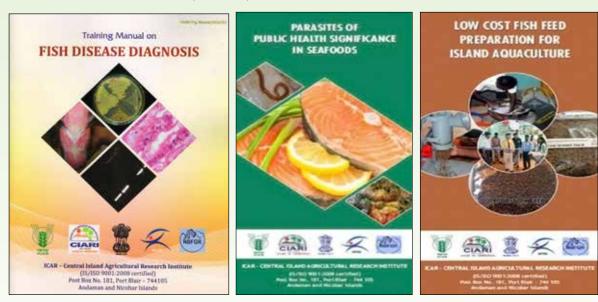


Plate 116: Publications for the benefit of stakeholders

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

K. Saravanan, Arunjyoti Baruah, J. Praveenraj, J. Raymond Jani Angel, T. Sivaramakrishnan and R.Kiruba Sankar

### Antagonistic activity of bacillus against pathogenic bacteria

Antagonistic activity of selected bacillus isolates against seven pathogenic bacteria namely, *Aeromonas hydrophila* (ATCC 35654), *Staphylococcus aureus* (ATCC 25923), *Escherichia coli* (ATCC 4157), *Streptococcus pneumoniae* (ATCC 49619), *Vibrio alginolyticus* (ATCC 17749), *Edwardsiella tarda* (ATCC 15947) and *Pseudomonas fluorescens* (ATCC 13525) was determined using agar well diffusion method (Holder and Boyce, 1994) (Fig. 39). Among all the isolates, B. *amyloliquefaciens* showed significantly (P<0.05) higher antagonistic activity against *P. fluorescens*, *V. alginolyticus* and *A. hydrophila* with the zone of inhibition (mm) as  $40.33 \pm 0.33$ ,  $30.33 \pm 0.41$  and  $30.0 \pm 5.0$  respectively (Fig. 1), whereas *B. subtilis* exhibited higher antagonistic activity against *A. hydrophila*, *E. tarda and E.* 



coli. On the other hand, B. megaterium showed better zone of inhibition against A. hydrophilla, S. pneumonia and E. tarda. Of all the isolates, B. flexus exhibited moderate antagonistic activity against all the pathogens except E. tarda. The present study indicated that the bacillus isolates have the potential to control the pathogenic infections (Plate 117).

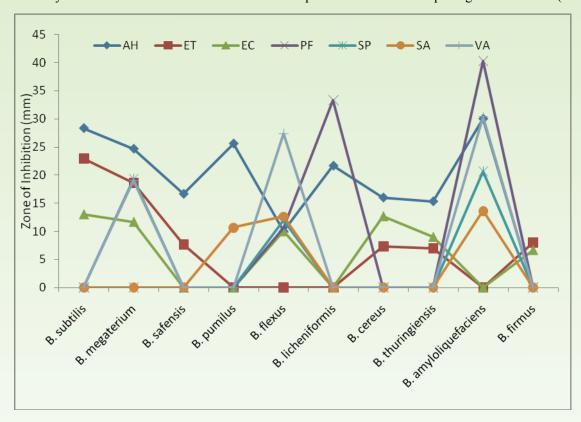


Fig. 39: Antagonistic activity of bacillus against pathogenic bacteria. AH: A. hydrophila ET: E. tarda; EC: E. coli; PF: P. fluorescens; SP: S. pneumonia; SA: S. aureus; VA: V. alginolyticus

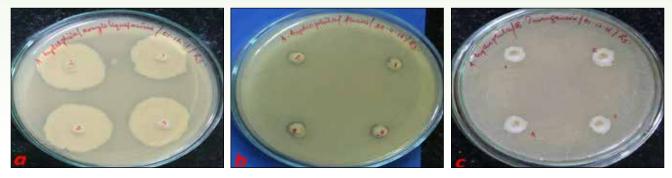


Plate 117: Antagonistic activity of B. amyloliquefaciens (a); B. flexus (b) and B. thuringiensis (c) against A. hydrophila

#### **Determination of proteolytic activity**

Proteolytic activity of the bacillus isolates was determined by following the method of Smibert and King, 1994 (Fig.40). The proteolytic activity of *B. amyloliquefaciens* is significantly (P<0.05) higher than all other isolates. *B. subtilis* and *B. safensis* also showed improved proteolytic activity which proved the capacity of bacillus to produce enzymes of biotechnological importance.



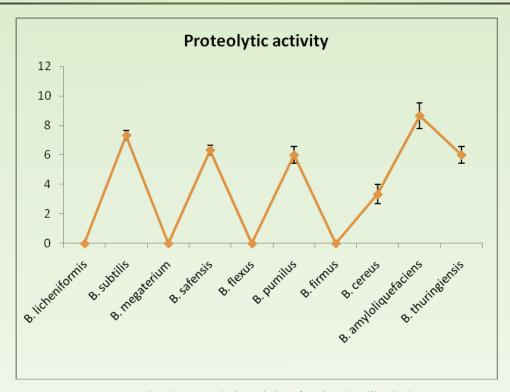
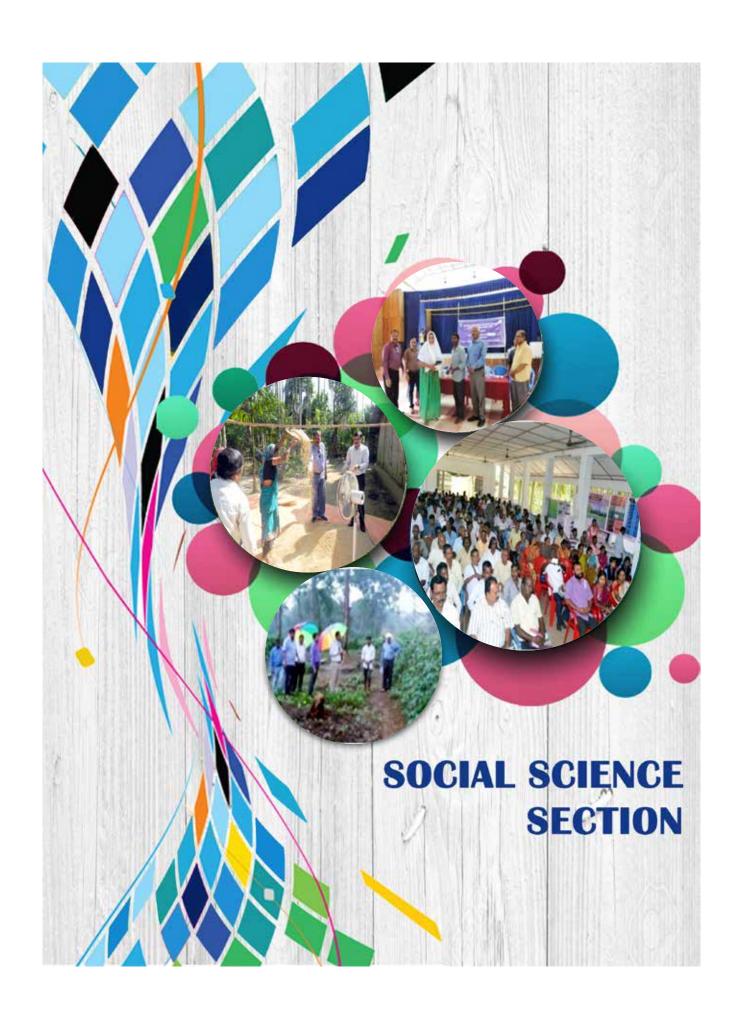


Fig. 40: Proteolytic activity of various bacillus isolates





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

S. K. Zamir Ahmed (Coordinator & Principal Investigator)

## **Training**

Thirteen trainings were conducted in agriculture and allied fields for the farmers, youths and other stakeholders with the Institutional support. A total of 624 men and 256 women totaling to 880 got benefitted. The percentage of participation was 71 men and 29 women respectively (Table 51).



Plate 118: Director as resource personal

Table 51: Details of training conducted

Sl.	Title of Tunining	Date	Village	Pa	rticipa	nts	Trainee	Collaboration
No	Title of Training			M	F	Т	Day	Conaboration
1	Post harvesting processing & value addition in fruit and vegetable	13 <sup>th</sup> April, 2016	Kerelapuram	22	6	28	28	NRM
2	Post harvest processing & value addition in fruits and vegetables	13 <sup>th</sup> April, 2016	Kerelapuram	22	06	28	28	NRM
3	HYV of rice and nursery management	29 <sup>th</sup> June, 2016	Kerelapuram	22	02	24	24	NRM
4	Scientist farmers interaction for livelihood options in agriculture	4 <sup>th</sup> Oct, 2016	Kerelapuram	40	48	88	88	ORC
5	Rodent and pest management in paddy fields & weather based agricultural practices	2 <sup>nd</sup> Nov, 2016	Subashgram	157	59	216	216	KVK & NRM
6	Poultry & goat farming management practice	30 <sup>th</sup> Nov, 2016	Madhupur	20	20	40	40	ASD
7	Livestock farming for livelihood support	30 <sup>th</sup> Nov, 2016	Madhupur	20	11	31	31	ASD
8	Integrated crop management in field crops	28 <sup>th</sup> Dec, 2016	Subashgram	66	12	78	78	KVK



9	Recent advance in cole crop vegetables cultivation	28 <sup>th</sup> Dec, 2016	Subashgram	66	12	78	78	KVK
10	Spices cultivation	31st Jan, 2017	Kerelapuram	65	19	84	84	ORC
11	HYV of rice, pulses and their crop management for seed production	02 <sup>nd</sup> Feb, 2016	Ramnagar	45	11	56	56	FCI&P
12	Soil health management	13 <sup>th</sup> Feb, 2017	Kerelapuram	22	10	32	32	NRM
13	Technological demonstration and exposition on livelihood options in agriculture and allied fields	25 <sup>th</sup> March, 2015	Kalipur	123	52	175	175	KVK
	Total	-	-	624	256	880	880	
	% of participations	-	-	71	29	-	-	

#### Kharif technological application on high yielding varieties of rice

A total of 25 demonstrations in 7 clusters of villages, covering 5.28 ha with six HYVs of rice in the farmer's field representing R.K. Gram, Krishnapuri, Subhash gram, Rabindra pally, Swarajgram, Nabagram, and Talbhagan was conducted at Diglipur, North Andaman. The result revealed that variety Gayatri gave a mean yield of 5.50 t/ha. followed by CIARI Dhan 5 (5.10 t/ha.), CSR 36 (5.00 t/ha.) CIARI Dhan 7 (4.50 t/ha.) and CIARI Dhan 6 (3.20 t/ha) against the local check Jaganath (3.15 t/ha) & Jaya (2.96 t/ha.) respectively. The percentage increase in yield of CIARI rice varieties over the local check ranged from 18.75 to 49.09 % in farmers field.



Plate 119: CIARI Dhan 6 in farmers field

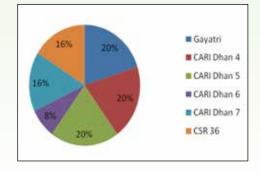


Fig. 41: FLD percentage of paddy varieties

#### Seed village concept for seed production in participatory mode

For the 6<sup>th</sup> successive year, seed production of truthfully labelled seeds of recomended CIARI varieties namely CIARI Dhan 4, 5, 6, 7, Gayatri & CSR 36 was taken in seed village concept mode with eleven farmers in 5 clusters *viz Madhupur-1, Madhupur-2, Kerelapuram, V.S.Pally, and R.K.Gram* covering 1.43 ha. A total of 9.1 tonnes of seeds were produced under the technical guidance of breeders of Division of FCI&P of the Institute. Horizontal spread of the technology is reflected in the neighbouring areas.











Plate 120: Chain of processing and packaging of paddy varieties monitored by scientists

### Result of rabi technological demonstration (RTD) of HYV of pulses

A total of twenty five demonstrations were conducted with two each of mung IPM-02-14, VBN 3 and urd IPU-02-43, LBG 645 varieties in the cluster of villages namely R.K.Gram, Ramnagar, Kerelapuram, Rabindrapally, Madhupur, & Kalipur covering 4.31ha during 2015-16. The result showed that in mung IPM-02-14 gave 45.46%, VBN 3 (91.56%) and urd IPU-02-43, (73.90%) LBG 645 (68.24%) increase in yield than farmer's variety respectively. (Table 52)



Plate 121: Threshing of urd



Plate 122: Harvested variety of LBG-645(Urd)



Table 52: Result of RTD with pulses (2015-2016)

Demonstration			Local check			
(Nos)	Variety	Yield t/ha	Variety	Yield t/ha	% Yield increase over the check	
8	IPM-02-14 (mung)	0.448	Mung (small)	0.308	45.46%	
2	VBN-3(mung)	0.726	Mung (big)	0.379	91.56%	
9	IPU-02-43(urd)	0.633	Urd ( Tel kalai)	0.364	73.90%	
6	LBG-645(urd)	0.922	Urd ( Jaat kalai)	0.548	68.24%	

**During 2016-17,** total of 78 demonstration of pulses (urd & mung) were conducted in a total of 8.84 ha, covering 15 villages with varieties namely, ANU-11-29, LBG 645, IPM-02-45 in urd and in mung CARI mung 1, 2, & 3, VBN3 & ANM-11-02. Beside, 100 demonstrations of CARI Brinjal 1, covering 4.0 ha, has also been implemented. The details are given in the table

Table 53: Rabi technological demonstration of pulses in 2016-17

Sl.No.	Varieties	No. of demo.	Area (ha.)	Village	Qty.(kg)		
	Mung						
1	CARI mung 1	8	1.54	5	30		
2	CARI mung 2	10	1.74	4	34		
3	CARI mung 3	1	0.13	1	4		
4	ANU 12 02	7	1.24	4	24		
5	IPM 02 14	2	0.45	2	9		
6	VBN 3	1	0.13	1	5		
	(A)	29	5.23	17	106		
		Urd					
1	ANU 11 29	9	1.54	5	30		
2	LBG 64	4	0.83	2	16		
3	IPU 02 45	5	1.24	3	24		
	(B)	18	3.61	10	70		
	Total (A+B)	47	8.84	27	176		





Plate 123: Demonstration on IPU-02-43(urd)



### **CARI Brinjal 1**

S.No.	Varieties	No. of demo.	Area (ha.)	Qty.(kg)
1	CARI Brinjal 1 @ 10 gm in 0.05ha	100	4.00	1Kg







Plate 124: Field visit

#### Farmer's club formed for effective ToT

Keeping the importance to deliver effective ToT and other market led enterprise , two farmers clubs during the period 2016-17 , wherein 20 famers have been linked. The account of the clubs was opened with the A & N Cooperative bank, Diglipur and Chief coordinator and Associate co-coordinator were appointed.

Table 54: Details of farmers club promoted during 2016-17

Sl. No.	Name of Farmers Club	Village	Date of formation	Bank Account No.	Total Members
1.	Vidhya Farmers club	V.S.Pally	11/02/2016	000734040100018	10
2.	Star Farmers club	R.K.Gram	28/03/2016	000734040100019	10





Plate 125: Star farmers club members of R.K gram Plate 126: Vidhya farmers club members of V.S.Pally

## Price behaviour of fresh, marine fish, pork and chevan at Diglipur Market, N/Andaman

For the period of 20 weeks from October 2016 to February 2017, the prices of the both fresh and marine water fishes were collected for the unregulated market and thereafter pooled. The selling prices of the major fresh water fishes ranged from Rs.160-200/kg for *Heteropneustes fossilis*(singhi), *Labio rohita*(rohu) Rs. 160-180/kg and *Plectorhynchus sp.*( katla) was Rs.160-200/kg, whereas in marine water fish, it ranged from Rs. 250-300/kg for *Penaeus monodon*(jinga big), Rs.200-300/kg for *Penaeus monodon*/*Metapaeneus* sp. (Jinga small) & *Liza tade*(farsha),



Rs. 100-200 kg for *Leiognathus* sp. (chanda),& Rs.60-120/kg for *kanagurta* (bangdi), *Trachurus* sp.(topi), *Sardinella* sp.(tarni) and *Stolephorus* sp.(maya) respectively. It is seen that the price of the fresh water fishes remain almost same, whereas there was steady increase in the marine water fishes on every month during the period. This shows good demand and market efficiency to the tune of 88 percent in the unregulated market.







Plate 127: Diglipur Market, N/Andaman

Pork meat sale ranged from 85 to 92 Nos (approximately 4370 to 4550 kgs of meat @ Rs 300/-, whereas chevon mostly the black bengal breed (16 to 25 nos). Approximately 135 to 196Kgs were sold with the price range of Rs 480 to 600/ kg. This reflects for good demand and market for pork meat followed by chevon.

### An overview of price trend & market efficiency of chevon and pork meat at Diglipur from 2013-2016

The main marketing hub for the animal husbandry sector is the Port Blair market which is the capital and is catering to the need of the domestic as well as burgeoning tourist population. The flow of the market channel is from North Andaman to Port Blair, however, due to increase in the tourist inflow and tourism activities in the North Andaman, particularly the Diglipur, there has been a considerable increase in the demand and consumption which is reflected in the market for the chevon and pork sale.

The analysis of the market trend of the pork and chevon during the last three years (2013-2016) showed that a total of 3148 goats were slaughtered in the market with an average of 1049.33 numbers in a year. The highest numbers of goats were slaughtered in the month of June-July and November –December. The trend of slaughter of pig at Diglipur market was found to be constant throughout the year (average 312.33 pigs per year). The market behavior during the last three years showed that there is a decline in the average number of goat slaughtered, which may be due to the decrease in the population of the goat herd due to high demand and consumption. However, the average price was found to increase from Rs. 450 to 480 and increase in the profit per goat i.e from Rs. 153.33 /kg to Rs. 175.20 kg. The average profit per kg of pork sale was found to be increased from Rs. 51.20 /kg to Rs. 84.54 /kg, similarly, the average profit from per pig was increased from Rs. 3244/- to Rs. 4474/-. The overall market efficiency of pork and chevon was found to be in declining trend i.e from 64 % to 43% and 64% to 57% respectively, which might be due to the unregulated market in the region.

#### **Extension Activities**

**Field visit i.e., monitoring of field demonstration & guidance:** 384 visits were made to monitor the FLDs on rice, pulses, spices, selection of farmers for formation of farmers club, for getting the feedback on the technological application, seed production of TLS of rice, survey for Mera gaon mera gauray.









Plate 129: Monitoring of harvested crop

#### Farmers linked with agromet cell

A total of 1205 farmers have been linked with the Institute agromet cell. The information on agro advisory is sent to them regularly through SMS, which enables them for effective management of crop and its related activities.

#### Spices technological demonstration

Three technological demonstration in an area of 0.10 ha each has been done at farmers' field situated at Keralapuram & R.K.Gram with black pepper variety P 2 under arecanut plantation, with an objective to provide more returns from the existing area in the long run.

#### **Other Extension activities**

- Field days on varietal selection of "Recent advance in cole crop vegetable cultivation" were conducted, wherein a total of 20 beneficiaries participated and got benefitted.
- Three video shows on technological intervention in agriculture & allied fields & Farmers right were screened, wherein 125 beneficiaries got benefitted.
- Twenty two telephonic advisories were imparted by the scientists of the host Institute to address to the
  problems faced by the farmers in pest and disease management in turmeric, ginger, arecanut, banana and paddy
  respectively.
- 23 visits were made by Scientists, PMC members, Pradhan & officials of Development Department to have face to face interaction and jointly addressing the problems of the farmers to logical ends.
- 158 target clientele visited Out Reach Centre for discussion on crop, training and reading technical books for updating information.



Plate 130: Distribution of Nicobari hen



Plate 131: Hands on mushroom cultivation







Plate 132: Scientist interaction with famers

# **Economic Impacts Studies on Crops Diversifcation and Technology Adoption in Horticulture**

#### S.K. Zamir Ahmed (CCPI) and Nagesh Ram

To assess the impact of the technological intervention over decade, the cumulative annual growth rate in percent (CAGR %) of the major crops based on the area, production and productivity in the Islands for the period from 2005-06 to 2014-15 ( 10 years ) was worked out.

The result signifies that the percentage increase in area was 0.46 for coconut followed by arecanut (1.44), fruits (2.50), vegetables (4.36) & pulses (13.14) in positive trend, whereas that of oilseeds (-3.89) and paddy (-1.76) is in decreasing trend. In case of production it was 1.32 for paddy thereafter in vegetables (3.26), fruits (5.24), coconut (5.16), pulses (9.97) & arecanut (11.82) in positive trend, whereas that of oilseeds it was in decreasing trend (-7.91). The productivity trend percentage was positive i.e., in case of fruits (2.64), followed by paddy (3.13), coconut (4.68), arecanut (10.22), whereas decreasing trend was reflected in oilseeds (-3.97) followed by pulses (-3.06) & vegetables (-1.06) respectively.

Thus, increasing productivity has long been recognised as the most important source of output growth and income improvement in the Islands of agriculture sector. Agricultural productivity growth in Andaman & Nicobar also plays important role in increasing efficiency in production of the agriculture products and maintaining national competitiveness in the face of declining terms of trade, increasing climate variability and tightening constraints on natural resource use. Beside, changing community attitudes and values are also emerging as important factors governing farm production systems. The contribution of agriculture towards the Island GDP is 17.40 % in which horticulture contribution is dominant, whereas the industries and service sector contributes 6.4 % and 76.2 %, respectively. (Table 55 & figure 42).

Table 55: CAGR % of Area, production & productivity of major crops of ANI (2005-2015)

Particulars	Area of ANI	Production of ANI	Productivity of ANI
Coconut	0.46	5.16	4.68
Arecanut	1.44	11.82	10.22
Pulses	13.41	9.97	-3.06
Paddy	-1.76	1.32	3.13
Oilseeds	-3.89	-7.91	-3.97
Vegetables	4.36	3.26	-1.06
Fruits	2.50	5.24	2.66



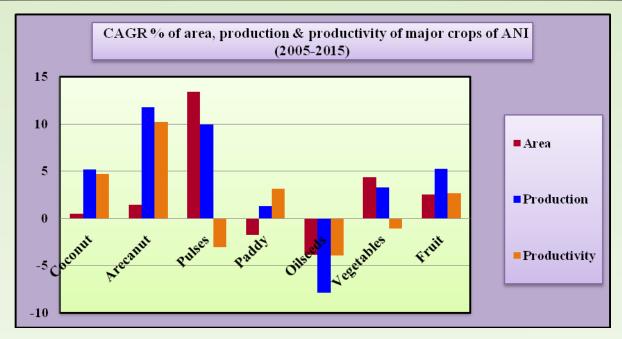


Fig. 42: CAGR % of area, production & productivity of major crops of ANI (2005-2015)

Broad bed furrow system is a technology identified to grow vegetables and fodders right in the midst of rice field. It involves making of broad beds (width 4 m, height 1m) and furrows (width 6 m, depth 1m) alternatively to provide drainage and standing water to the required crop *viz.*, vegetables and rice respectively. In addition to the vegetables, it helps the farmer to include various IFS components like fish rearing in the furrows, fodder crops on the beds which in turn helps to include animal component in the system.

Thirty respondents representing South and North Andaman were contacted. BBFs introduced by CIARI, was found to be adopted by the farmers in the village clusters of South & North Andaman . They opined that it was a good technology which assured round the year return from the field, mitigated the risk factor and also gave an additional income. It was also found that the respondents, got the information on the technological backstopping from CIARI and practiced the BBFS in the fallow land in an area ranging from of 0.20 to 0.80 ha. Crops like amaranthus, bhendi, bottle gourd, snake gourd, cowpea,momordica,beans,bitter gourd, banana, brinjal , and sugarcane were cultivated on the bed. The average operational cost incurred by the farmer was Rs. 26000 to 62,000/- depending on the area. The gross return of Rs. 57,000 to 1,25,000/- and the net return of Rs. 38,500 to Rs. 1, 73, 200/- was obtained .It could also generate an employment of 110- 260 mandays. A yield of 55 kg of fish was obtained in improved practice, which were sold at the gate price Rs. 150.00/kg, thus fetching additional return. Extension of the area due to joint mutation of the land was the major bottleneck with majority of the farmers



## Consortia Research Platform on Agro-biodiversity: Characterization and Conservation of Agricultural Biodiversity of A & N Islands

S. Dam Roy, Jai Sunder, R.K. Gautam, V. Baskaran, R.Kirubasankar M.S.Kundu, P.K.Singh, A.K. Singh, K. Abirami, A.K. De, V. Thakur, J.Raymond Jani Angel, Ajit Arun Waman and Pooja Bohra

#### Screening of rice germplasm for bacterial blight resistance (BLB)

For pathogenicity test, inoculation suspension was prepared in 250 ml of sterile distal water @100CFU/ml. 65 days old plants (before panicle initiation) with fully fresh and expanded leaves were inoculated by leaf cutting method. The disinfected, autoclave scissors was dipped in the inoculum and clipped the 5 leaves per plant of five plants about 3-4 cm from tip of each leaf. Disease observations were recorded after 21 days of leaf clipping on all 5 plants. Total of 27 genotypes of rice were artificially inoculated by Xoo pathotype ANBB 9 in the field conditions during Kharif 2015 and 2016. The analysis data revelled that none of the tested rice genotype was found resistant for BLB. But only three genotypes viz. CARI Dhan 2, CARI Dhan 6 and CARI Dhan 7 were found moderately resistant. Moreover out of 27 genotypes 10 and 9 genotypes showed moderate susceptibility and susceptibility against Xoo pathotype respectively. However 5 genotypes were recorded highly susceptible reaction against Xoo pathotype in the find conditions (Table 56& Plate 133).

Table 56: Evaluation of rice genotypes for bacterial blight resistance

S.No	Constance	Disease s	scoring	Catagomy
5.110	Genotypes	2015	2016	Category
1	CARI Dhan 1	5	5	MS
2	CARI Dhan 2	3	3	MR
3	CARI Dhan 3	5	5	MS
4	CARI Dhan 4	5	5	MS
5	CARI Dhan 5	7	5	S
6	CARI Dhan 6	3	3	MR
7	CARI Dhan 7	3	1	MR
8	CARI Dhan 8	7	9	HS
9	CARI Dhan 9	9	9	HS
10	Nyaw-in	7	7	S
11	Govid Bhog	9	9	HS
12	Black Burma	7	9	HS
13	Silver Jaya	5	5	MS
14	Maslay	7	7	S
15	White Burma	7	7	S
16	Jaya	5	5	MS
17	Kusbuyya	7	7	S
18	Jeera Dhan (Farmer field)	9	9	HS
19	Jagnnath	5	5	MS
20	Lal Sanno	5	5	MS
21	Pagla Jaya	5	5	MS
22	Gol Dhan	7	7	S
23	Jeera Dhan (Cross)	5	7	S
24	Jeera Dhan (Diglipur)	7	7	S
25	Nata Khusbu	7	7	S
26	Ranchi Dhan	5	5	MS
27	Red Burma	7	7	MS





Plate 133: Artificial inoculation of rice genotypes by Xoo pathotype "ANBB 9"

#### Quality analysis of selected rice genotypes

Out of 27 rice genotypes 9 has been analysed for grain quality. The samples were analysed for 13 numbers of qualitative characters *viz*. Grain length (mm), Grain width (mm) Grain length width ratio, 1000 grain weight (g), brown rice length (mm), brown rice width (mm) brown rice length width ratio, 1000 grain weight of brown rice (g), hulling (%), Milling (%), Head rice recovery (%), Alkali spreading value (ASV) Gel consistency (mm) and Amylase Content (%) at 14% moisture content. The study revealed that tow varieties CARI Dhan 3 and & CARI Dhan 6 having long slender grain while CARI Dhan 1, 4, 5, 8 and 9 having Medium bold grain. However only CARI Dhan 2 and CARI Dhan 7 having long bold and medium slender grain type respectively.

#### Genetic diversity studies of pulse crops

The genetic diversity among landraces of pulse crops of these islands offer an immense significance for their utilization in breeding programmes due to its wide variability and resistance to several biotic and abiotic stresses. Therefore, collection, conservation and characterization of the important landraces of pulse crops of these islands are essential. Keeping in view of the vital importance of pulse crops genetic resources present in the form of landraces and indigenous wild relatives of targeted pulse crops in relation to their significant importance due to its resistance to several biotic and abiotic stresses (Plate 134).

#### Farmers' variety & indigenous landraces

- Mungbean (Vigna radiata L. Wilczek),
- Urdbean (Vigna mungo L. Hepper),
- Cowpea (Vigna unguiculata L.) (Pulse type),
- Wild relatives of pulse crops



List of Landraces of different pulse crops collected during April 2016 to March 2016 from different parts of Andaman & Nicobar Islands.

Mungbean	Urdbean	Cowpea	Beachpea
18	27	10	08







Plate 134: *In-situ* conservation of Farmers varieties of Cowpea showing farm saved traditional variety during collection at different parts of Andaman & Nicobar Islands

#### Collection, conservation and characterization of mango biodiversity

Exploratory surveys were carried out at Andaman and Nicobar islands to locate the genetic diversity and distribution of wild and indigenous mango species within the Islands. The indigenous mango species like *Mangifera andamanica*, *Mangifera griffithi* (Plate 135) and *Mangifera camptosperma* (Plate 136) were found distributed in specific locations. In addition to the earlier report on the geographical distribution of the species, we have identified the species in new locations. *Mangifera andamanica* was identified in the Chouldhari. *Mangifera camptosperma* was identified in Brichgunj. Earlier *Mangifera griffithi* distribution was reported only in two places of the Island namely Mt. Harriet and Shoal Bay where each tree was located. For the first time we have identified the distribution of *Mangifera griffithi* in Chouldhari (Single tree) and four trees in Nancowry Island based on the taxonomical keys. The wild mango species were characterized based on the NBPGR minimal descriptors. Modified in-situ approach grafting proved to be the successful propagation method in the Island by using *Mangifera indica* as rootstock. The successful grafted saplings are conserved in the CIARI experimental farm.





Plate 135: Mangifera griffithi







Plate 136: Mangifera camptosperma

#### Ex situ conservation of mango at the experimental farm

Three wild species of mango and the blue mango (Mangifera indica) are conserved in the experimental farm (Plate 137).



Plate 137: Ex situ conservation of mango

#### Exploration, collection, conservation and Documentation of ornamentals

Exploration done in different parts of the Island for ornamental biodiversity and native ornamentals like palms (20), ferns (12), orchids (37), bulbous ornamentals (08), zingiberaceous ornamentals (06) and ornamental trees(20) were collected and conserved. Three indigenous palms of the Island namely *Areca triandra, Korthalsialacenosa, Licualapeltata* and *Bentinkia nicobarica* are identified, collected and conserved at CIARI. *Bentinkia nicobarica* is an endangered species and is endemic to the Nicobar group of Islands. The important palm species identified are *Caryotamitis, Pinanga andamanensis, Daemonorops kurzianus* and *Calamus andamanicus*. Major ferns collected and conserved include *Microsorium punctatum, Aslplenium nidus, Lycodium circinatum* and *Tectaria melanocaulon* are collected in the exploratory survey and conserved in the experimental field. Characterization was done in the red ginger and molecular characterization was done in the bird nest fern (*Asplenium nidus*).

#### Genetic diversity in bael and regeneration

Bael is one of the 32 medicinal plants prioritized by National Medicinal Plants Board. During explorations conducted in different parts of Andaman Islands, 21 elite bael types have been identified and are being characterized following DUS guidelines. Considerable variations were noticed in fruit (Plate 138), leaf, growth pattern and biochemical constituents in the types studied. Multiplication of these types through vegetative techniques would essentially require rootstocks in sufficient numbers. Hence, experiments were taken up to standardize seed germination pretreatments for raising seedling rootstocks. Among the pretreatments tried, germination percentage varied between 56% in control (soaking



in water for 24 h) to 77.5% and 80.5% in treatments involving 1000 mg/L GA<sub>3</sub> and 500 mg/L GA<sub>3</sub>, respectively. Seedling length was affected by the pretreatments, while other growth parameters remained unaffected. Considering various parameters, pretreatment of seeds with 500 mg/L GA<sub>3</sub> solution for 24 h could be recommended for large scale rootstock production in bael.



Plate 138: Variability in fruit characters observed in bael collections of Andaman Islands

#### Diversity analysis in *Piper* germplasm

The genus *Piper* holds a prime position in plant based systems of medicine. Ten *Piper* germplasm collected from various parts of Andaman Islands were studied for morphological, biochemical parameters and for testing their antibacterial properties. Plants of genotype *P. colubrinum*-2 had leaves with maximum length, weight and petiole thickness, while that of *P. sarmentosum*-3 had broadest leaves and widest petioles (Plate 139). Dry matter content of the genotypes varied between 18 and 40%. Amount of total chlorophyll content varied from 0.60 mg/g to 6.72 mg/g. Wide variations were also observed in antibacterial activity of ethanolic extracts of the studied genotypes at two doses (80 and 100µl) against seven bacterial pathogens. Two genotypes of *P. colubrinum*-1 and 2 were effective in inhibiting the growth of *Staphylococcus aureus* and the results were comparable with positive control. In case of *Pseudomonas fluorescens*, extracts of all the genotypes were effective as their zone of inhibition was found to be statistically *on par* with the control chloramphenicol. Though moderate level of inhibition was observed for rest of the pathogens, it remained much lower than the inhibition observed for positive control.







Plate 139: Wild nutmeg species of Andaman Islands: a. *Knema andamanica*, b. *Myristica andamanica* and c. *Horsfieldia glabra* 

#### Collection and characterization of fish diversity

A total of 15 mangroves, 100 marine fish, 100 corals, 30 sponges have been documented, 3 new records and 3 new species of freshwater species have been documented for the first time.

A freshwater goby, *Redigobius oyensi* is reported for the first time from Car Nicobar Island (Plate 140), belonging to the archipelago of Andaman and Nicobar Islands, India. This report is the first record of *R. oyensi* to Andaman and Nicobar islands and in turn to India and also the first freshwater fish record from Car Nicobar Island. Zebra fish, *Danio rerio*, was reported for the first time in the Islands during the surveys in Middle and North Andaman (Plate 141) and



the presence was confirmed through conventional and molecular taxonomy. *Esomus metallicus* (Sumatran flying barb) was recorded for the first time from south Andaman (Plate 142). DNA barcoding targeting the cytochrome oxidase unit I (COI) and 16SrDNA, reveals that the freshwater fishes of Andaman group of islands possess a strong Burmese affinity which is a first proof for species origin from Burma (Myanmar). Previous icthyological reports only 2 endemic freshwater fish namely *Eleotris andamensis* and *Microphis insularis* are known from Andaman Islands, but with the aid of integrated taxonomic study it is known that 80% of the native fish fauna must be endemic to Andaman Islands. Phylogenetic postion for the new species of *Channa (Channa royi* sp. nov) has been established (Plate 143).



Plate 140: Redigobious oyensii (female) recorded from Car Nicobar



Plate 141: Danio rerio from middle and north Andaman



Plate 142: Esomus metallicus from south Andaman



Plate 143: Channa royi sp. nov from north Andaman

#### **Characterization of Teressa goat**

Teressa goat (Plate 144a&b) has been recognized as new goat breed by ICAR-NBAGR and breed registration certificate was awarded on 23.08.2016 (Plate 145). Breed descriptor has been prepared as per the format of NBAGR. The Teressa goat is an indigenous goat breed of Andaman and Nicobar Islands and is primarily found in Nicobar group



of islands. Studies on population, characterization and conservation were coaried out. Information on flock statistics, husbandry practices and constraints faced by the farmers in Teressa goat production was collected. Productive and reproductive performances of the goat breed were also recorded. Teressa goats appeared tall with brownish or dark tan in colour. The goat flock size per household ranged from 2 to 10 in Teressa Island and from 1 to 9 in Car Nicobar with an average of 5.89 and 5.51 in Teressa Island and Car Nicobar respectively. This indigenous goat breed has a high growth rate and adult body weight (6 teeth stage) reaches up to was 39.85± 1.03 kg (mean ± SE). The goats were reared either in a free range or in semi-intensive management system. Main feed for the goats was coconut and some locally available tree fodders such as Kathal (Wild jack fruit tree), *Morinda citrifolia (Noni)*, *Erithrina indica*, *Ficus spp.*, *Gliricidia sepium* and *Tinospora cordifoli*. The main constraints faced by the farmers were lack of feed, premature kidding, high incidence of infertility, abortion, dystokia and lack of proper veterinary services.



Plate 144a:Teressa goat Female





Plate 144b:Teressa goat Male



Plate 145: Certification of breed registration

#### Characterization of Nicobari pig

Nicobari pig (Plate 146 a&b) has been recognized as new goat breed by ICAR-NBAGR and breed registration certificate was awarded on 23.08.2016 (Plate 147). Breed descriptor has been prepared as per the format of NBAGR.



Plate 146 a :Nicobari pig male



Plate 146 b:Nicobari pig female



Plate 147: Certification of breed registration



## ICAR-Krishi Vigyan Kendra – South Andaman

KVK is one of the innovative institutions with the mandate of imparting vocational training to the practicing farmers, farmwomen, rural youths and extension functionaries in improved technologies in agriculture, horticulture, animal husbandry, fisheries and other allied enterprises. It has additional responsibilities of testing and refining the developed technologies and conducting front line demonstrations of new technologies in the farmers' fields.

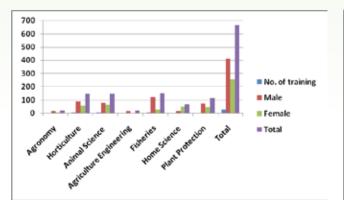
## **Training Programme**

Total

Krishi Vigyan Kendra, Port Blair has conducted 30 training during the year 2016-17 covering South Andaman and Little Andaman for the benefit of practicing farmers/ farmwomen, rural youths and extension functionaries. The details of the training are given in table 57 and figure 43.

**Discipline** Male Training (Nos) **Female Total** Agronomy Horticulture **Animal Science** Agriculture Engineering **Fisheries** Home Science Plant Protection 

**Table 57: Details of training conducted** 



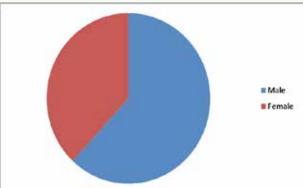


Fig.43: Participation of male and female during training



Plate 148: Glimpses of Training Programmes



















#### Front Line Demonstration [FLD]

Six Front Line Demonstrations in proven technologies of ginger, bitter gourd, okra, poultry, green fodder, and IFS were conducted. The result is given below:

- Ginger (var. Jorhat): Net income recieved were Rs.2,55,258.00 as compared to local cultivar 1,31,677.00
- **Bittergourd:** In IPM demonstration low disease incidence occured (downy mildew 25.5 %, powdery mildew 21.9%, fruit borer 20.3% and leaf minor 35.4%) as compared to non IPM practices (downy mildew 70.2%, powdery mildew 90.8%, fruit borer 42.1% and leaf minor 91.6%) respectively.
- **Okra:**In IPM demonstration low disease incidence occured (downy mildew 10.5 %, powdery mildew 30.3%, phoma 5.5%, white fly 15.6% and flea beetle 31.2%) as compared to non IPM practices (downy mildew 40.6 %, powdery mildew 85.4%, phoma 20.5% white fly 55.6% and flea beetle 70.4%).
- **Poultry (Broiler):** Growth rate of scientific broiler farming was 1.82 kg as compared to farmer practices 1.56 kg
- Fodder: An average yield of 120 t/ha green matter was recorded as compared to the local check of 40t/ha.
- **Development of IFS model:** Development of IFS model with the component (Fish+ duck+ seasonal vegetables + banana) was conducted at three farmer's field. Fish (catla and rohu) attained the average weight of 450gm and 280 gm in three months and ducks to 1.2kg (Av). Farmers harvested 974 Kg fish (RCM)/ha + 145 nos.of eggs + 1.9 t/ha vegetable + 19.7 t/ha banana crops as compared to farmer practices 122 Kg fish/ha + 0.8t/ha vegetables + 8.3 t/ha fruit crops respectively.

#### On Farm Trials [OFT]

Six On Farm Trials at farmer's field were conducted for assessment and refinement of the selected technology on agriculture and allied fields.

Title of On farm Trial	Results
Growth characters and yield of elephant foot yam in coconut gardens as influenced by integrated nutrient management practices	Intercropping in coconut gardens with the application of 50 % recommended dose of NPK fertilizers along with vermicompost + neem cake (each @1kg plant <sup>-1</sup> ) were found effective in farmer field among all technical option.
Evaluation of growth performance of IMC seed with different feed	The result revealed that the growth registered in the fish seed feed with CIARI developed feed was 119.4 mm with an average weight of 12.4 gm compared to feed with Treatment T-3 as 98.4 mm/9.24 gm followed by farmers' practice 76.65 mm /6.45 gm. During the trial water pH was maintain at 5.8 to 6.5, water temperature -28.5°c – 31.2°c and DO at 3.5 - 4.5 ml/lit. Survival percentage recorded was 90%, 80% and 60% in CIARI feed, followed by T-3 and farmers practice respectively.
Integrated pest management practices for leaf curl complex of chilli (Capsicum annuum L.)	Thrips and mites populations were significantly low in all the IPM-modules, as compared to non farmer practices. Over all lowest population of thrips (4 No/twig/plant) and mites 10 No/Leaf/plant) were recorded in Technical Option 4 (neem cake (basal) + 2 weeding (15 and 30 DAT) + yellow sticky trap + abamectin (1 ml/l)) as compared with other technical options.
Evaluation of different substrate for Oyster Mushroom ( <i>Pleurotus</i> sp.) production	It revealed that highest mushroom production was recorded in paddy straw (700g/kg), followed by saw dust (690g/kg) and banana leaves (680g/kg). Lowest production was recorded in farmer practices (agricultural waste, 400g/kg). Highest benefit-cost ratio (4.2) was recorded as compared to framer practices (2.4)



Effect of LCC based Nitrogen management on growth, yield, of rice

Among treatments, LCC based N management (25kg N/ha@<4) recorded significantly higher number of panicles m<sup>-2</sup> and number of grains panicle<sup>-1</sup>, nutrient efficiency and economic followed by (20kg N/ha@<4) than other treatments. The highest nitrogen use efficiencies, such as agronomic efficiency, physiological efficiency, recovery efficiency and partial factor productivity was observed under LCC based N management @ 20kg N/ha <4 and gross & net returns of Rs. 49200 /- and Rs. 25,100/- was recorded in LCC based N management @ 20 kg/ha < 4 with B C ratio of 2.04.

Performance evaluation of milk through mineral production supplementation and probiotics in desi cattle

The result revealed that the average milk yield (lit.) was recorded in the group fed with normal feeding + probiotics + mineral supplementation. It is suggested that, exogenous source of feed additives in the form of mineral / probiotics supplementation is very essential in lactating cows during the peak lactation phase for improving the milk yield as per the genetic potential of desi cattle.

Plate 149: Glimpses of OFT & FLD















## **National Initiative on Climate Resilient Agriculture (NICRA)**

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

#### Significant achievement

#### Natural resource management

• Water harvesting and recycling, desilting of farm ponds, bund raising of BBF and intervention of cost effective rain shelters was done.

#### **Crop production**

- **Drought tolerant paddy (Sahbhagi dhan):** Higher grain (5.42t/ha) was recorded by Sahbhagi dhan (30.8 % higher yield) followed by farmers variety, mainly due to more number of productive tillers/hill and no of grains/ panicle. Higher gross return (Rs. 54,280/- ha<sup>-1</sup>) and net return (Rs. 27,430/- ha<sup>-1</sup>) with B: C ratio of 2.02 was recorded in Sahbhagi dhan which is mainly due to higher grain and straw yield.
- **Drought tolerant paddy (Naveen dhan):** Naveen recorded grain yield of 3.28 t/ha which was 27.6 % higher with moisture stress (48.6% deficit rainfall) during early stage of crop growth. It gave highest net return and B: C ratio (Rs. 11,300/- and 1.55), while Swarna was least profitable with net return of Rs.4200/- and B:C ratio of 1.20.
- **CIARI poi selection for saline soil:** CIARI poi selection recorded yield of 5.4t/ha which was 32% higher as compared to local check (green pole type).
- CIARI AMA-green and CIARI-AMA-red drought tolerant leafy vegetables: CIARI AMA-green recorded yield of 7.2t/ha followed by CIARI-AMA-red 7.0t/ha, which was 21% higher as compared to local check.

#### Livestock and fisheries

- Fodder cultivation for sustainable livestock production: To meet the requirement during acute shortage of green fodder; fodder cowpea, maize and hybrid napier were promoted in the area. Fodder tree (Agathi) was demonstrated in the Port Mout village for availability of green fodder during summer season for the goat.
- Improved shelter management practices with well ventilated system as a means to resist extreme climatic variables for poultry, goatry and dairy animal: Improved poultry shed with well ventilated system resumed in low mortality rate. Developing improved sheds in shady area reduced heat stress. Adequate space in improved shed resulted better performance in poultry and dairy animals.
- Backyard poultry production with improved Nicobari and Vanraja birds: The Nicobari bird which possess resistant to common diseases of the birds were found suitable under backyard condition. The production characteristics revealed that the bird can thrive well and perform better in terms of egg production, compared to other indigenous bird. The rearing of Vanraja was also initiated to provide more profitability to the farmers which could attain higher bodyweight, when provided with the supplemental feed, apart from the feed they intake by scavenging during daytime.
- Awareness on status & control of FMD and animal health camp in Badmaspahad village: Two numbers of animal health camp were organized in collaboration of AH&VS of A&N Administration, wherein 65 animals including cow, goat and 168 poultry birds were diagnosed and treated.



• Integrated fish farming: Six ponds were taken for demonstration of integrated fish farming wherein fish+ seasonal vegetables + duck (khaki campbell) were reared with total area of 0.48 ha. In each pond 265 fish fingerlings (40-50gm.), 25 nos. khaki campbell and on the bunds seasonal vegetables were raised. For the demonstration Rs. 23,700/- was incurred towards the inter cultural operation and net return obtained was Rs. 48,670/- with B:C of 3.05, as against the control with net return of Rs.9450 and B:C of 1.90 respectively.

# Production Technology of Mushroom for Nutritional and Livelihood Security of Islands Farmers

N.C. Choudhuri, Nagesh Ram, L.B. Singh, K. Saktivel, V.K. Pandey and Pooja Kapoor

Field survey of 200 farmwomen including SHG members were completed. Paddy straw and dry banana leaves were selected for substrate. Establishment of laboratory for spawn production with BOD incubator, auto clave, laminar air flow, AC, glassware and utensils were done. Oyster mushroom spawn is prepared in the laboratory and distributed to the farmers for mushroom cultivation.

New edible mushroom (*Pleurotus* sp.) was identified and released as a new variety for the farmers (Plate 150).







Plate 150: New edible mushrooms

## **Farmers Producer Organization**

KVK, Port Blair has made a Farmers Producer Organization (FPO) in the name of Andaman Kisan Agro Producer Company Ltd., with the following objectives *viz.*, to identify potential group of farmers, farmwomen and nurture FPO, to develop sustainable organization structure, formulate business plan, facilitate registration of FPO and to provide skill training and capacity building support to different functionaries.



## ICAR-Krishi Vigyan Kendra – Nicobar

The ICAR-KVK - Nicobar, Car Nicobar was established on 20<sup>th</sup> May, 2010 under the administrative control of ICAR - Central Island Agricultural Research Institute (CIARI), Port Blair. Presently, the KVK Office is functioning from the Headquarter, Car Nicobar covering entire Nicobar district. The KVK has a 5 ha farm at Auckchung, Car Nicobar.

In Nicobar Islands, where the available cultivable area and the local resources are limited, there is need for disseminating innovative and highly productive technologies with due care for sustainability and eco-friendliness. The KVK – Nicobar functions as change agent to bring about desirable improvement in the production from agriculture, animal husbandry and fisheries and enhance the income of farmers apart from creating additional employment opportunities. To achieve its mandates, the KVK – Nicobar started as one of the methodologies i.e. adoption of a village for its allround development. 'Transfer of Technology Programmes (TOT) in an integrated manner was implemented so that holistic development could be ushered in with an overall upliftment in socio-economic status of farming community through production of more food and profitability as well.

#### **Trainings**

During this year a total of 28 trainings were conducted in different disciplines of agriculture *viz*. Agronomy, animal science, horticulture, agriculture engineering, fisheries. A total of 856 farmers including 384 female got benefited from the trainings which involved 69 days and 2172 trainee days.

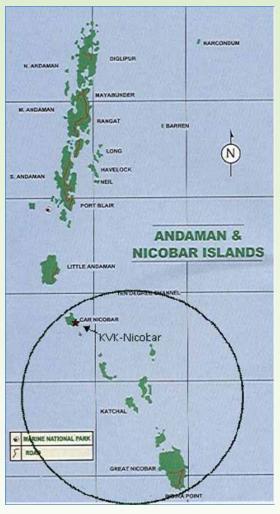
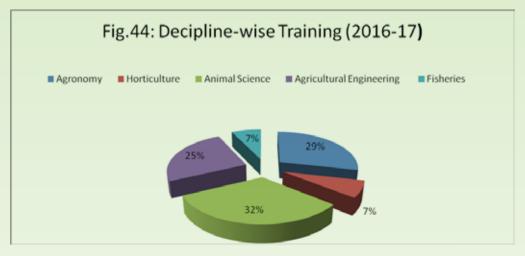


Table 58: Discipline wise training conducted

Discipline	Training (Nos)	Male	Female	Total
Agronomy	8	133	116	249
Horticulture	2	55	30	85
Animal Science	9	136	123	259
Agriculture Engineering	7	101	83	184
Fisheries	2	47	32	79
Total	28	472	384	856







## On Farm Trials (OFTs)

Sl. No.	Title of OFT	Treatments	Results
1	Effect of different organic manure on growth and yield of maize.	TO <sub>1:</sub> Farmer practice (Traditional farming)  TO <sub>2:</sub> Farm yard manure @ 12 t/ha  TO <sub>3:</sub> Goat manure @ 5 t/ha  TO <sub>4:</sub> Poultry manure @ 6 t/ha.	The result revealed that, the treatment T <sub>3</sub> Goat manure @ 5 t/ha yielded significantly higher grain yield 31.9 q/ha followed by T <sub>2</sub> Farm yard manure (28.6 q/ha) and T <sub>4</sub> poultry manure (25.90 q/ha). The goat manure @ 5t/ha may be used for getting higher maize yield in Car Nicobar.
2.	Evaluation of iron supplementation for reduction of pre- weaning piglet mortality in Nicobar	TO <sub>1:</sub> Sow milk (SM)  TO <sub>2:</sub> SM + 100mg Fe I/M  TO <sub>3:</sub> SM + 100mg Fe Oral	The result revealed that, the mortality percentage was to the tune of 50% in T <sub>0</sub> whereas T <sub>2</sub> and T <sub>1</sub> had 40% and 30% mortality at 3 months of age respectively. The body weight at 3 months of age revealed that T <sub>1</sub> had better body weight gain (16.44kg) followed by T <sub>2</sub> (16.32kg) and T <sub>0</sub> (16.23kg) with respective B:C ratio of 4.08, 3.77 and 3.44.



## OFT on Effect of different organic manure on growth and yield of Maize







OFT on Evaluation of the effect of low cost drip irrigation on water and crop productivity to conventional surface irrigation.



OFT on Effect of Iron supplementation on reduction of pre-weaning piglet mortality





Plate 152: OFTs

#### A. Front Line Demonstrations

Title of the FLD	Results
Promotion and popularization of pulse crop	The result has showed that the black gram cv. CARI-U-13-02 gave an average yield of 3.0 q/ha with B: C ratio of 1.5. During the period of crop there was two time cyclone yield was poor (due to heavy rainfall) but farmer was happy to see the black gram crop at his field.
Promotion of scientific cultivation of maize crop	FLD conducted at one farmer field of Kinmai Village, Car Nicobar was damaged due to heavy rainfall in the month of December, 2016.
Vermi composting	Result was good and farmers had harvested 600 kg vermi compost in 1st round and second round of in progress.



Rainwater harvesting structure	The rain water harvested tank was constructed at farmer field size of the tank is (2.25 x 4.20 x 1.00 m) with water storage capacity 9000L. The water was collected from roof water collecting structure, which was constructed near the tank. This water is successfully utilised for vegetable cultivation through low cost gravity forces drip irrigation system during the period of dry season for life saving irrigation for round the year crop production.
Protected cultivation (Green house, shed net)	The maximum average yield was recorded in green house/shed net for the leafy vegetable of Spinach (7.8 Kg/plot), tomato (11.5 kg/ plot) and raddish (25.7 kg/ plot) as compared to traditional practice and other rain shelter in production of the leafy vegetable.
Green fodder (hybrid napier)	Result showed that hybrid napier yielded 1956 q/ha in first year with B:C ratio of 3.26.
Intensive pig farming	Inputs have been provided for construction of pig shed (Cement) The pigs are kept in the pig shed and its design is being changed for scientific rearing. The availability of balanced feed is the main constraint.

Plate 153: Glimpse of Front Line Demonstrations





# **Extension Activities**

Nature of extension activity	No. of activities	Farmers			Total		
		M	F	Т	M	F	Т
Field day	06	118	96	214	118	96	214
Kisan gosthi	04	336	187	523	336	187	523
Exhibition	02	-	-	-	-	-	Many
Lectures delivered as resource persons	36	515	436	951	515	436	951
Extension literature	01	-	-	-	-	-	Many
Scientific visit to farmers field	180	301	279	580	301	279	580
Diagnostic visits	104	74	38	112	74	38	112
Soil health camp	1	18	29	47	18	29	47
Exposure visits	1	17	23	40	17	23	40
Animal health camp	2	18	23	43	18	23	43
Total	337	1397	1111	2508 +	1397	1111	2508 +



## ICAR-Krishi Vigyan Kendra North and Middle Andaman

ICAR-Krishi Vigyan Kendra North and Middle Andaman of A&N Group of Islands under ATARI Zone-II, Kolkata working under the host institute ICAR-Central Island Agricultural Research Institute was sanctioned in the year 2012 and started functioning from the year 2013-14. It is situated at Nimbudera, which is about 215 Kms away from Port Blair. Krishi Vigyan Kendra act as an innovative institution with the mandate of imparting vocational training to the practicing farmers, farm women, rural youths and extension functionaries on recent and improved technologies in the field of agriculture, horticulture, animal husbandry, fisheries, agricultural engineering and home science. In addition to this KVK proactively involved in testing and refining of new technologies in local condition in the form of On Farm Trials (OFT) and demonstration of proven technologies in the farmer's field as Front Line Demonstrations (FLD). In also caters to the need of the farmers for seeds, planting material and soil testing etc. The salient achievements made during the year is given below.

#### **Trainings**

A total of 36 trainings were conducted in different disciplines of agriculture *viz*. agronomy, horticulture, animal science, fisheries, agriculture engineering and home science. A total of 1198 farmers including 332 female got benefited from the trainings (Table 58 & figure 46& 47).

Discipline	No. of training	Male	Female	Total	
Agronomy	06	105	88	193	
Horticulture	06	172	77	249	
Animal Science	06	133	57	190	
Agricultural Engineering	05	120	25	145	
Fisheries	07	184	70	254	
Home Science	06	152	15	167	
Total	36	866	332	1198	

Table 58: Details of training programmes conducted

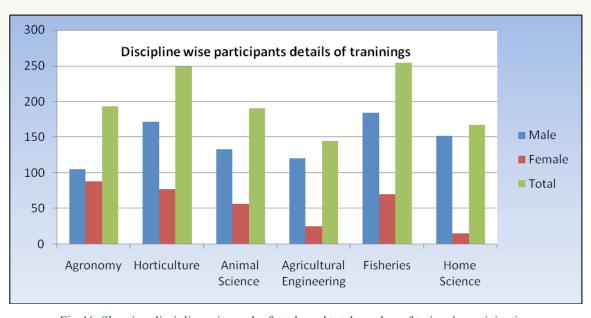


Fig.46: Showing discipline wise male, female and total number of trainee's participation.



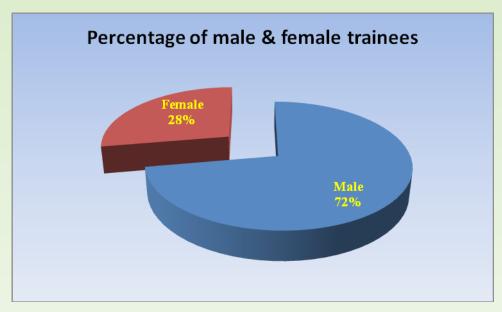


Fig.47: Showing the percentage of male and female trainees participation

Plate 153: Glimpses of training



Scientific practices for production of oil seed



Soil and water conservation methods for better crop productivity



Commercial floriculture



Recent advances in goat farming









Low cost nutrient rich recipes for pregnant & lactating women

#### Front Line Demonstration [FLD]

During the year nine Front Line demonstrations were conducted in agriculture and allied aspects and the salient results are given as follows:

- **FLD on paddy variety CIARI Dhan 9,** conducted at Jaipur and Dharmapur villages in an area of 0.25 ha each showed average paddy yield of 3.5 t/ha, which is 9.37 % higher grain yield than local check variety C-8-14.
- **Demonstration trials of paddy variety CSR 36,** was conducted at two farmer's field located at Ragatgarh and Adazig villages in an area of 0.25 ha each. This variety gave an average paddy yield of 4.8 t/ha and recorded 33.33 % higher yield than local Swarnjaya.
- FLD on elephant foot yam (variety Gajendra), was conducted at two different locations of Middle Andaman. The growth performance of variety Gajendra was superior than local variety with an average yield of 250q/ha. Acceptability for this variety was high among the farmers due to its fast growth, big yam size and higher productivity in comparison to local variety of elephant foot yam.
- Demonstration for azolla cultivation was conducted at Harinagar, Pareshnagar and Govindpur. Polythene sheets were provided for azolla production and proper method of azolla cultivation was demonstrated to the farmers. The farmers were also informed on the routine management operations in the azolla plot such as application of cow dung and superphosphate once in two week to ensure better growth of Azolla. In this demonstration, about 98 kg of fresh azolla was obtained from a pit of 2.5m X 1.5m in 6 months with BC ratio of 3.7, compared to only 23 kg of fresh azolla with BC ratio of 2.3 from the check.
- Low cost balanced feed for backyard poultry: The percent egg hatchability of hens fed with low cost balanced feed developed by CIARI was improved to 83.9 % as compared to that of 53.5 % in check.
- Rearing of carp stunted yearlings: The present demonstration on rearing of carps yearling in grow-out pond was carried out at farmer field at Govindpur, where one year old yearling of Catla and Rohu were stocked in pond for a period of 5 months. Average production of fish in demonstration pond was recorded to be 881 kg/ ha compared to 155 kg/ ha in check in 5 months with BCR of 3.79 and 1.61 in demonstration and check respectively.
- Rearing of carp fingerlings in grow-out pond: Demonstration on rearing of carp fingerlings was undertaken to impart awareness about advantages of stocking fish fingerlings in pond. Fingerlings of rohu and catla were stocked in demonstration pond and grown for a period of three months. Average yield of fish from pond was recorded to be 141 kg/ ha compared to 32.4 kg/ ha in checks with BCR of 1.3 in 3 months from demonstration pond.



- Arecanut climber/ harvester: Demonstration on use of arecanut climber/harvester was carried out at eight farmer's field with average plantation area of 0.5 ha. During the study it was found that Arecanut Climber is easy to operate and can be handled easily by farm women with equal efficiency. Major advantages of harvesting arecanut bunches with this implement is minimum damage to nuts as compared with manual method of harvesting and also the machine cleans the parasitic plants during the process of harvesting. Harvesting cost also gets reduced to an average of Rs. 9/ tree as compared to manual harvesting of Rs. 15/- tree, thereby saving of Rs. 24000/- ha is done.
- Manual coconut dehusker: It was carried out at 15 farmers field involving both men and women. It was found that manual dehusker involves minimum risk of injury to operator and found easiness in handling as compared to local method of dehusking using sabbal. Furthermore, it was observed that dehusking implement is very much useful for domestic purpose.

#### CIARI-conoweeder

Demonstration on use of CARI cono-weeder was employed to remove weeds in the selected paddy fields of 6 farmers in an area of 3 ha., The results showed that by employing CIARI cono-weeder a reduction of Rs. 1650/- per ha towards weeding cost was achieved in comparison with control plot. Further it was also observed that 9 percent incidence of pest and diseases in conoweeder used plots. Cono-weeder plots given a additional benefit to farmers with a BC ratio of 1.59 as compared to control where is BC ratio was 1.33

#### Post harvest management of excess fruits involving SHG

Three SHG'S were selected and value added products from seasonal local fruits were demonstrated like jams, marmalade, squashes, banana chips, tutti fruity from papaya, banana & pommelo. The products were later sold by SHG in the retail market at par with the market prices. The cost benefit ratio recorded after selling the products was 3.12.

Plate 154: Glimpses of Front Line Demonstration conducted







Paddy: Var. CIARI Dhan 9

Paddy: Var. CSR 36

Elephant foot yam (Var.Gajendra)







Azolla cultivation

Low cost balanced feed for backyard poultry

Rearing of stunted yearlings









**Demonstration on rearing of fingerlings** 

Arecanut and coconut dehusker demonstration



Display of value added products from excess farm produce

### **ON FARM TRIALS [OFT]**

• Evaluation of high yielding medium duration paddy varieties: Varietal trial with three technical options *viz* CIARI Dhan 6, CIARI Dhan 7 (Plate 155) and Swarnajaya were carried out at 07 farmer's fields. Technical option 2 (CIARI Dhan 7) recorded the highest yield followed by Technical option 1 (CIARI Dhan 6),than farmers variety Swarnajaya. Infestation of bacterial leaf blight was 23.2 % in control plot with highest gross and net return of Rs 47500.00 and Rs12500.00 and B.C. ratio of 1.36 in technical option 2.



Plate 155: High yielding medium duration Paddy CARI Dhan 7

• Assessment and evaluation of intercrops in arecanut plantations: Planting ginger (variety-Jorhat) and turmeric (variety CO 2) as intercrops in arecanut plantation showed that intercropping resulted in additional yield of 160 q/ha in turmeric and 90 q/ha in ginger. Average yield of main crop i.e arecanut was recorded 200



q/ha (Plate 156). Therefore farmers can achieve additional income of Rs. 68,000/ha by adopting intercropping system.





Plate 156: Ginger and turmeric as intercrops in arecanut plantation

• Effect of partial replacement of coconut cake with azolla in the ration of dairy cattle: In this study, sun dried azolla 100 gm (T2) and 200 gm (T3) was used to replace the 400 gm coconut cake (T1) in the ration of indigenous dairy cattle for a period of 30 days (Plate 157). During the trial it was observed that partial replacement of coconut cake with azolla improves the performance of dairy cattle. Further, improved lactometer reading (LCR) was noticed on supplementation of azolla indicating best performance in T3 with BC ratio of 2.10 compared to BC ratio of 1.86 in control.





Plate 157: Feeding animals with azolla

- Evaluation of different feed supplements in backyard poultry farming: Result indicated that chicks fed with extract of *Morinda citrifolia* fruit @ 2ml/bird + Groviplex @ 20ml/100 birds attained higher body weight with reduced mortality rate, thereby leading to BC ratio of 1.26 (T3). Overall, chickens fed with extract of *Morinda citrifolia* fruit @ 2ml/bird showed pronounced growth performance.
- Evaluation of CIARI fish grower diet: Growth performance was superior in Technical option 1 (CIARI fish feed 1), followed by Technical option 2 (CIARI fish feed 2) and control. Cost incurred towards the farming operation was recorded to be Rs.44,525 /ha, Rs.51,786 /ha and 47,396 /ha for T1, T2 and control respectively. Net return obtained from T1 was Rs 38818 / ha with a B: C ratio of 1.75.
- Impact of nutrition education (NE) and counseling in reducing iron deficiency anemia in adolescent schoolgirls: The OFT was carried out at two schools i.e Vivekananad Kendriya Vidyala & Government Secondary School ,Govindpur. A total of 6 groups 12 to 18 years with average hemoglobin levels 9 mg/dl and below were selected (Plate 158). The result of the post evaluation indicated a drastic increase in knowledge about anemia from 15% to 85%. Anthropometric measurements were taken and BMI was calculated which revealed that 82 % of the girls were underweight. Hb levels showed mean increase from 8.2 mg/dl to 8.9



mg/dl in technical option 1 (imparting NE role and importance of iron in daily diet) & from 8.75 mg/dl to 10.0 mg/dl in technical option 2 (Imparting NE alongwith demonstration of low cost locally available iron rich receipe). No increase was reflected in control group. Nutrition education resulted in improvement of nutritional knowledge as well as increase in consumption of iron rich foods.





Plate 158: Nutrition education & counseling to schoolgirls

Development of low cost supplementary diet for infants and children using locally available food ingredients: KVK, N and M Andaman developed supplementary foods for children keeping in mind easy availability of ingredients, locally acceptable and low in cost. The sensory evaluation of different recipes was carried out by using nine-point with Hedonic rating scale through 6 panel members. Appearance, taste, texture, odour and overall acceptability were different attributes considered during evaluation. The mean scores of different sensory parameters of various recipes developed by incorporating rice, wheat, soya, ragi pumpkin leaves were calculated. On the basis of overall acceptability scores of different recipe it was found that Technical option 0 (standard) scored highest for namakpara while Technical Option 1 scored highest for chila and pakoda whereas Technical option 3 scored highest for murukku. It was observed that pakoda was most acceptable recipe followed by namakpara, murukku and chili in terms of mean score of overall acceptability. On the basis of sensory evaluation none of the incorporated product was disliked by the panel members. Thus, it can be conclude of that the entire product can be given readily. After incorporating unprocessed and processed forms of rice, wheat, soya, ragi flours, pumpkin leaves and groundnut it was found that energy content was increased to maximum in pakoda i.e. 269.74 kcal/serving (Technical option 2) and minimum is Chila i.e. 120 kcal/serving. Protein and micronutrients also increased i.e. calcium and iron content was high in all the modified recipes, when compared to standards but was highest in Technical option 3. So it can be concluded that malted flour increased energy, protein and micronutrients content of different recipes in comparison to other options.

#### **Extension Activities**

Table 59: Details of extension activities

<b>Extension Activities</b>	Number	Farmers		Extension official			Total			
		M	F	Total	M	F	Total	M	F	Total
Field Day	09	138	46	184	-	-	-	138	46	184
Kisan Gosthi	03	213	56	269	3	2	05	216	58	274
Kisan Mela	02	448	82	530	43	16	59	491	98	589
World soil health day	01		Celebr	ated togethe	er with I	Rabi k	isan mela	on 05-1	2-16	
Women in agriculture	01	-	36	36				-	36	36
World fisheries day	01	81	11	92	8	3	11	89	14	103
National nutrition week	01	150	100	250	5	3	8	155	103	258



Eilm ab and	2.1	124	20	152		1		124	20	152
Film show	31	124	29	153	-	-	-	124	29	153
Method demonstration	16	170	67	237	7	5	12	177	72	249
Group meetings	34	709	332	1041	21	7	28	730	339	1069
Lecture delivered as	23	489	86	575				489	86	575
resource persons										
Advisory services	64	56	8	47	-	-	-	56	8	64
Scientific visit to farm-	539	612	136	748	-	-	-	612	136	748
ers field										
Farmers visits to KVK	196	196	-	196				196	-	196
Diagnostic visits	68	118	31	149	-	-	-	118	31	149
Exposure visits	02	48	7	55				48	7	55
SHGs conveners meet-	01	-	40	40	-	-	-	-	40	40
ing										
Swachh Bharat abhiyan	09	213	60	273				213	60	273
Total	1001	3765	1126	4874	87	36	123	3837	1160	5014

# Field Day

Nine field days were conducted on scientific demonstrations to practically demonstrate farmers on recent and innovative technologies suitable in involving farmers and farm women on superior variety of paddy ,CIARI Dhan 9, Elephant foot yam (Cv.Gajendra), azolla cultivation, low cost balanced feed for backyard poultry, feed management in aquaculture, fish seed production in cement tank, arecanut climber, coconut dehusker, nutritious kitchen gardening etc. A total of 184 farmers participated and got benefitted (Plate 159).

Plate 159: Glimpses of field day activities



Nutritious kitchen gardening in schools



Azolla cultivation



Low cost balanced feed for backyard poultry









Arecanut climber

### Kisan sammelan on Pradhan Mantri Fasal BimaYojana

On 4<sup>th</sup> April 2016, ICAR-Krishi Vigyan Kendra (CIARI), Nimbudera organized Kisan sammelan on Pradhan Mantri Fasal Bima Yojana (PMFBY) with farmers, PRI members, Officers of line departments and bankers of N&M Andaman district at Tugapur. The programme was organized to create awareness to the farmers about Pradhan Mantri Fasal Beema Yojna (PMFBY) and its benefit to farming community. Smt. Prabhabati Biswas, Adhyaksha, Zilla Parishad, N&M Andaman was the chief guest, Smt. K. Nachiamma, Pramukh, Panchayat Samiti, Mayabunder; Pradhan, Pahalgaon; Zilla Parishad members; Divisional Forest Officer, Mayabunder; Assistant Commissioner, Rangat; Project Director, ATMA, N&M Andaman; Officers from line department; Banking institutions; Senior Scientist and Head, KVK, Nimbudera and others participated. In the programme about 350 persons participated including 300 farmers representing from all the three tehsils of N&M Andaman district (Plate 160). During the technical session lectures and interactive session was held on different aspects of Pradhan Mantri Fasal Bima Yojana and recent technologies of CIARI and ICAR institutes.





Plate 160: Glimpse of Kisan sammelan on Pradhan Mantri Fasal BimaYojana

### Rabi kisan sammelan and World soil day

On 5<sup>th</sup> December 2016 ICAR-Krishi Vigyan Kendra (CIARI), Nimbudera organized Rabi kisan sammelan and World soil day at Shantipur under Swadeshnagar Panchayat. During the programme exhibitions from line departments and KVK were arranged to showcase the latest technologies and activities. Shri Subodh Mondal, Up-Adhyaksh, Zilla Parishad, N&M Andaman was the Chief Guest (Plate 161). Smt K. Nachiamma, Pramukh, Mayabunder, Shri Jayant Nag, Pradhan Swadeshnagar were the guest of honour. During the technical session different aspects of rabi grown crops like pulse, vegetable cultivation and water stress management in rabi crops were discussed. Apart from this on the eve of World soil day different topics on soil fertility, soil health and testing were also discussed, About 180 farmers and farmwomen participated from different parts of Rangat and Mayabunder tehsils.







Plate 161: Glimpses of Rabi kisan sammelan & World soil day

#### **National nutrition week**

National nutrition week was celebrated with students and teachers in Govt. Senior Secondary School, Swadesh Nagar on 1<sup>st</sup> and 2<sup>nd</sup> September 2016 with great zeal & enthusiasm. The objective of the programme was to create awareness among students about need and importance of nutrition for good health, impact of health on economic growth and national development. Shri. S. C Majumder, Principal, Govt. Senior Secondary School, Swadesh Nagar was the chief guest (Plate 162). The programme included interactive lectures, film shows & poster competition etc covering topics on role of vegetables in daily diet, nutritional significance of fruits, supreme contribution of fish in promoting healthy life, requirements of milk and eggs in the daily diets, nutritive value of cereals & its products, need of balanced diet & weight management for adolescent children. A total of 250 students participated.





Plate 162: Glimpse of celebration of National nutrition week

# World fisheries day

In accordance with the direction of Ministry of Agriculture and Farmers Welfare, Government of India World fisheries day was organized at Nimbutala, Rangat. Shri. Rajesh Kumar Choudhari, Assistant Commissioner, Rangat was the chief guest. Smti. Manjula Tirkey, Pramukh, Rangat, Smt. Sarvana Kumari, Pradhan, Nimbutala, Shri. Govind Das, Tehsildar, Rangat, Shri. V.Chandrya,Sarpanch,Nimbutala, PRI's members and fishermen/farmers participated (Plate 163). In the technical session speakers highlighted about the activities of KVK, importance of fish in integrated farming system for generating higher income, importance of sustainable fisheries production in Andaman, developmental schemes of fisheries department, preservation and value addition in fish and fisheries products etc. An interactive session and quiz competition was also conducted for the fishermen and others. A total of 92 fishermen/farmers participated in the programme.









Water stress management in arecanut dealt

Plate 163: Glimpses of World fisheries day

# Kisan gosthi

During the year three Kisan gosthi were organized, wherein a total of 274 farmers participated to find a solution to their problems. In these programmes scientific knowledge and practices on recent and innovative technologies were imparted to overcome the hurdles in different aspects of farming.





Plate 164: Glimpse of Kisan gosthi

# **Group meetings**

ICAR-Krishi vigyan Kendra, N&M Andaman organized 34 group meetings with farmers and rural youth to create awareness among them on recent innovative and scientific technologies. In these meetings a total of 1069 farmers participated in the deliberations including interactive sessions.





Plate 165: Glimpses of group meetings



### **Demonstrations**

Need based demonstrations were organized in farmers field and KVK farm on different aspects to give hands on experience to farmers on seed production technologies of fish, paddy, vegetables, seed treatment, mushroom cultivation, rat control and preparation of farm made fish feed etc. A total 16 demonstrations were conducted with the participation of 249 farmers.











Plate 165: Glimpses of demonstration activities

# Film show

A total of 31 film shows were screened on different topics to aware farmers about recent farming technologies being practices in and around the globe so as to create confidence in them on adoption of latest scientific technologies. Around 153 farmers were benefited.





Plate 166: Glimpses of film show for farmining community



#### **Field visits**

Need based field visits were under taken by experts to understand farming situation, farming practices and resolve to problems faced in agriculture by farmers by giving proper remedies, awareness them about recent innovative technologies and knowledge on them sustainable production practices etc.







Plate 167: Glimpses of field visits

### Diagnostic visit

Diagnostic field visits were made to address sudden crisis aroused in farmer fields. Suitable and effective remedies were employed to overcome the problem for hassle free production.





Plate 168: Glimpses of diagnostic visit

# **Advisory services**

Time to time farmers are being advised through SMS portal, broadcasts of messages through all India radio, daily news paper, personal contacts and field visits etc. Several farmers have obtained guidance of KVK to starts new projects in agriculture and allied fields.

### **Exposure visits**

In order to see and study the new technologies/innovations visits of farmers were organized to fields of line departments and innovative farmers. During the visit field interactions with successful farmers were done, so as to imbibe confidence in them through seeing, believing for better adoption.









Plate 169: Glimpses of exposure visits

### **Distribution of inputs**

Seed and planting materials were distributed to farmers based on their demand on improved varieties for achieving higher productivity.



Plate 170: Glimpses of distribution of inputs

### Director's visit to KVK, N&M Andaman

Director, CIARI, Port Blair along with team of Scientists, Dr. R.K.Gautam, Dr.S.K. Zamir Ahmed and Dr.P.K.Singh of CIARI visited KVK from 03.10.2016 to 6-10-16 to see and review the progress and achievement made as per the annual action plan targets of KVK. During the visit he visited the KVK farm and appreciated the KVK team for growing and maintaining good seed production plots of paddy, fish seed production and development of infrastructure facilities at KVK farms and inoffice. Suggestions were given by the Director and his team for upkeeping the work. He also visited farmers fields at Mayabandar and Diglipur tehsils and held interactive sessions with farmers at Nimbudera, Sitanagar and Radhanagar.





Plate 171: Glimpse of Director visit to KVK and farmers fields

# Visit of SAC team

Scientific advisory committee meeting 2016-17 was held at CIARI, Port Blair on 19<sup>th</sup> March 2016 under the chairmanship of Director, CIARI. Team visited farmer's field of KVK, N&M Andaman at Rajatgarh under Sundergarh Panchayat and held interactive sessions with farmers to assess intervention of KVK, Nimbudera.





Plate 172: Glimpses of activities of SAC



# Pandit Deen Dayal Upadhyaya Antyodhyay Krishi Puruskar

Shri Ashok Kmar Sarkar from Govindpur village, a KVK farmer,was awarded Shri Pandit Deen Dayal Upadhyaya Antyodhyay Krishi Puraskar award from Zone II, with a cash prize of Rs. 50,000/- for his excellence in practicing new and innovative technologies adopted under IFS organic cultivation for sustainable farming. The award was given to him at the function organized by ATARI at Kolkata on 25<sup>th</sup> September 2016, wherein 300 farmers participated. Shri Sarkar awardee shared his experience on the occasion.





Plate 173: Glimpses of award ceremony

# Development of KVK hilly land of KVK farm

The KVK allotted 2.0 ha of hilly land was developed for year round cultivation of horticulture and field crops by making terraces. The area was broadcasted with Green gram variety of the institute.











Plate 174: Development of KVK hilly land of KVK farm



# **Development of low land**

Construction of peripheral roads and fish nursery ponds in KVK farm is being constructed under MNREGA scheme with total out lay of Rs 12.00 lakhs.



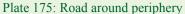




Plate 176: Approach road to pond

Different innovative technologies is being demonstrated on farm to farmers and KVK land is also being used for production of seeds of paddy, pulses, vegetables and fish seeds.













Plate 177: Farming activity at KVK, Nimbudera

**Table 60: Farm production and revenue generation** 

Sl.	Crop & variety	Area	Product	tion	Sold	Revenue
No.	Crop & variety	(Ha)	Commercial	Seed	Solu	generation
1.	Paddy (mixed)	1.5	1700 kg		1633 kg	17963
2.	Pulses (mixed)	0.45	50 kg		25 kg	750
3.	Lobia (A. mangala)	0.05		1.05 Kg	1.05 Kg	315



4.	Dolichos bean (A. swagath)	0.05	1.0 kg	1.0 kg	1.0 kg	400
5.	Pumpkin (A. suryamukhi)	0.2		800 gm	800 gm	320
6.	Chilli (A. suphal)	0.05	0.5 kg	50 gm	50 gm	200
7.	Tomato (A. abha)	0.05		50 gm	50 gm	200
8.	Brinjal (A. keshav)	0.03	7.5 kg	150 gm	150 gm	750
9.	Bhendi (A. anamika)	0.16		1.5 kg	1.5 kg	600
10.	Paddy seed (TFL)			57kg	57kg	1482
11.	Chicken (Live weight)		10 Nos.		10 kg	1200
12.	Arecanut with husk		2285 Nos.		2285 Nos.	1599
13	Fish seed		3893		3893 Nos.	5839
14	Arecanut seedling		2761		2761 Nos.	24610
15	Chicks				220 Nos*	
	Total	2.54		4.60 Kg	Total	56228

<sup>\*</sup>Chicks distributed to farmers with the assistance of Animal Science division of CIARI

# Media coverage





# TRIBAL SUB PLAN (TSP)

Under Tribal Sub Plan (TSP) empowerment of tribal population through training cum technology dissemination was carried out. It was aimed to improve the existing practices of agriculture and allied sectors, dissemination of need based improved production technologies through training, demonstration of technologies, supply of inputs, providing community assets and exposure visits.

A total of 24 training programmes representing field of agriculture, horticulture, animal husbandry, fisheries, field crops, land resource management, post harvest, crop protection and value addition technologies were conducted for the benefit of the tribals in Nicobar District and Little Andaman. The effort has benefited a total of 1674 (869 males and 805 females) farmers spread across different villages of Little Andaman and Nicobar Islands. Tribal farmers have been provided with seeds and planting materials of improved varieties, livestock, farm tools, bio-control agents, sprayer, fencing materials for effective utilization and improving the productivity of the agri-horti-animal and fisheries sector. Besides community assets *viz*. hatchery for poultry, OBM engine, solar drier, coconut dehusker and model pulse farm were also established for the benefit of the tribal farming community.

# **Details of Capacity building programmes**

S.	T!41.	<b>\$</b> 7	D-4-	Pa	ırticipar	ıts
No	Title	Venue	Date	M	F	Total
1	Resources management in integrated farming system for backyard conditions	Campbell Bay	21st April, 2016	16	14	30
2	Weed management in rice	Hut Bay	21st July 2016	55	28	83
3	Parthenium ecological management under island ecosystem	Harminder Bay, Little Andaman	20 <sup>th</sup> - 21 <sup>st</sup> August, 2016	28	23	51
4	Vegetable cultivation	Kavaratti, Lakshadweep	1st Sept., 2016	26	11	37
5	Cultivation of bacterial wilt resistant brinjal : CARI brinjal 1 in Nicobar islands	Car Nicobar	29th Sep., 2016	13	16	29
6	Utilization of solar energy for the production of quality copra using solar dryer	Harminder Bay, Hutbay	November 2016	25	27	52
7	Health management of rural poultry through ethno veterinary practices (EVP)	Small, Big lapathy & Tamalo, Car Nicobar	6 <sup>th</sup> to 8 <sup>th</sup> Feb.,2017	35	60	95
8	Lined pond for water harvesting and vegetable production during dry season	Kamorta	7th-8th Feb., 2017	25	22	47
9	Intercropping of pulses and vegetables under coconut plantation through rainwater harvesting	Car Nicobar	11 <sup>th</sup> -12 <sup>th</sup> Feb., 2017	32	30	62
10	Homestead based IFS	Car Nicobar	18 <sup>th</sup> Feb., 2017	15	20	35



S.	T'A	N/	Ditt	Pa	articipar	ıts
No	Title	Venue	Date	M	F	Total
12	Establishment of fruit orchard and their management	Harminder Bay, Little Andaman	28 <sup>th</sup> Feb., to 01 <sup>st</sup> March, 2017	48	53	101
13	Operation and maintenance of solar and biomass fired copra dryer	Kamorta	Feb., 2017	49	27	76
14	Value addition of plantation crops: a way for employment generation in tribal region	Car Nicobar	Feb., 2017	35	14	49
15	Cultivation of high yielding rice varieties	Hut Bay, Little Andaman	3 <sup>rd</sup> March, 2017	52	48	100
16	Cultivation of high yielding rice varieties	Hut Bay, Little Andaman	4 <sup>th</sup> March, 2017	19	25	44
17	Nutritious kitchen garden and value addition	Minicoy, Lakshadweep	5 <sup>th</sup> March, 2017	53	35	88
18	Augmentation of feed and fodder resources in Lakshadweep Islands	Minicoy, Lakshadweep	6 <sup>th</sup> March, 2017	23	34	57
19	Pulse crops production for sustainable nutritional security in tribal area of A & N Islands	Big & Small lapathy, Car Nicobar	19 <sup>th</sup> to 20 <sup>th</sup> March, 2017	53	38	91
20	Package of practices for Jasmine	Malacca & Chuchucha, Car Nicobar	21st to 22nd March, 2017	48	38	86
21	Package of practices and value addition for Jasmine	Harminder Bay, Hut Bay , Little Andaman	27 <sup>th</sup> to 28 <sup>th</sup> March, 2017	58	70	128
22	Knowledge and skill on pulse crops production for sustainable nutritional security in tribal area of A & N Islands	Harminder Bay, Little Andaman	29 <sup>th</sup> to 30 <sup>th</sup> March, 2017	84	71	155
23	Nutritious kitchen garden (NKG) for nutritional security	Harminder Bay, Little Andaman	20th March, 2017	35	24	59
24	Scientific goat rearing	Small Lapathy, Car Nicobar	23 <sup>rd</sup> March 2017	20	14	34
	Total					1674



# Details of input provided to the tribal farmers

Sl. No.	Inputs	Quantity	Place
1	Farm implements	445 Nos.	Kamorta, Car Nicobar & Minicoy
2	Agricultural inputs	500 Nos.	Kamorta & Car Nicobar
3	Seed		
	Mungbean	86 kg	Car Nicobar & Hutbay
	Urdbean	55 kg	Car Nicobar & Hutbay
	Pigeonpea	09 kg	Car Nicobar & Hutbay
	Rice	20 q	Hutbay
	Brinjal ( CARI 1)	0.5 kg	Car Nicobar & Hutbay
4	Planting material		
	Jasmine plants	6000 Nos.	Harminder Bay & Car Nicobar
	Mango saplings	1500 Nos.	Harminder Bay & Car Nicobar
	Sapota saplings	1000 Nos.	Harminder Bay & Car Nicobar
	Guava saplings	1200 Nos.	Harminder Bay & Car Nicobar
	Vegetable seed kit	78 Nos.	Hut bay, Car Nicobar & Kamorta
	Vegetable seed kit	275 Nos.	Minicoy, Kavaratti & Lakshadweep
5	Goat	50 Nos.	Car Nicobar
6	Coconut climber	20 Nos.	Hut Bay
7	Organic NPK	1000 kg	Harminder Bay & Car Nicobar
8	Bio consortia	177 lit	Harminder Bay & Car Nicobar
9	Coconut dehusker	20 Nos.	Kamorta & Hutbay
10	Solar dryer	04 Nos.	Kamorta & Hutbay
11	OBM engine	20 Nos.	Kamorta, Hutbay & Car Nicobar

# **Details of community asset created**

Sl. No.	Asset	Quantity (Nos.)	Place
1	Out board engine	20	Hut Bay, Car Nicobar
2	Hatchery Shed	01	Car Nicobar
3	Solar dryer	04	Kamorta, Hut Bay
4	Coconut dehusker	20	Campbell Bay, Hut Bay
5	Model pulse farm	01	Car Nicobar



# **Glimpses of Activities**

# Details of input provided to the tribal farmers









Training and input distribution





Distribution of planting materials and other inputs









# Training and distribution of inputs











Distribution of vegetable seeds and farm implements to tribal farmers













# Demonstration of Homestead based IFS model at Car Nicobar





Visit of Scientist to homestead garden grown with maize at Car Nicobar



Drip irrigation to vegetables using indigenous knowledge



Training on Lined pond for water harvesting at Kamorta





Training on Intercropping of pulses and vegetables under Coconut plantation at Car Nicobar







Parthenium awareness programme at Harminder Bay





Distribution of Solar and Copra dryer at Harminder bay





Distribution of Solar dryer and copra dryer at Kamorta



Distribution of coconut climber at Harminder bay



# **WOMEN PARTICIPATION (SC/ST)**

Empowering women specially the SC/ST beneficiaries through various capacity building and a need based technological demonstration in agriculture and allied fields were undertaken by the Institute. The women folks participated with lots of enthusiasm to harness the benefit of latest knowledge and skill in the field of scientific goat farming, maintenance of fishing inputs, nursery and weeds management of rice, scientific cultivation of ornamental plants in pots, IFS, conservation of Nicobari fowl, production and post harvest processing of coconut, application of bio-consortia for control of plant disease, agri-silvi pastoral system, pulses, maize production technology, banana fibre extraction, nutritious kitchen garden, tuber crops, poultry, pig farming, parthenium weed management, horticulture based cropping system, importance of quality seeds, community based home garden, vermicomposting, line pond for water harvesting, poultry shed and hatchery management. The participation of women were 805 in the category of ST comprising from Nicobar District and Little Andaman, beside 253 from South Andaman & 588 from North & Middle Andaman District belong to other than SC& ST category.





# **Technologies Tested, Demonstrated & Transferred**

- Low cost fish feed production technology developed and disseminated to the farmers to increases the productivity of the island aquaculture.
- Pure Nicobari fowls under backyard.
- Package of practices for Vanaraja chicks.
- Suitable local feed preparation for rural poultry.
- Demonstrated herbal acaricide for control of ticks in livestock and herbal eye drop in poultry.
- Demonstrated importance of soil health card in soil fertility management.
- Post harvest processing and value addition of mango, pineapple, coconut and bael demonstrated at Port Blair.
- Demonstrated utilization of solar energy for the production of quality copra at Harminder Bay.
- Standardized technology for spiced based ready-to-serve (RTS) products of dragon fruit and rose apple.
- Demonstrated bioconsortia for enhancing vegetable production at Harminder Bay and Campbell Bay.
- Developed and transferred homestead IFS model for household nutritional security at Car Nicobar.
- Integrated Farming System for hilly land of Andaman Islands demonstrated.
- Pekin duck for small farmers under backyard at Diglipur, North Andaman.
- High yielding varieties of rice namely Gayatri, CIARI 5, CSR 36, CIARI 6, CIARI 7 and Ranjit at Diglipur, North Andaman.
- Seed village concept for TLS seed production of rice.
- Spices (Black pepper) as intercrop under arecanut at Diglipur, North Andaman.
- Bacterial wilt resistant brinjal variety CARI Brinjal 1 seed demonstrated and disseminated of Hut Bay Car Nicobar and Diglipur.
- Application of CIARI Bioconsortia for management of solanaceous bacterial wilt disease.
- Rodent management in paddy fields and vegetable crops.
- Oyster mushroom cultivation techniques for the island farmers.
- Mungbean, urdbean and pigeonpea demonstration at Car Nicobar.



### Seed and Planting Material Produced (2012-2013 to 2016-2017)

Particulars	2012-13	2013-14	2014-15	2015-16	2016-2017
Spices	5000 Nos.	11500 Nos.	10500 Nos.	47800 Nos.	27,200 Nos.
Coconut	1100 Nos.	1000 Nos.	1456 Nos.	2513 Nos.	5755 Nos.
Arecanut	-	-	-	11778 Nos.	1264Nos.
Pineapple	6000 Nos.	-	-	-	-
Elephant foot yam/	-	680 Kgs.	1050 Kgs.	1750 Kgs.	2500 Kgs.
Ginger	260 Kgs.	500 Kgs.	600 Kgs.	630 Kgs.	600 Kgs.
Turmeric	-	-	-	800 Kgs.	400 Kgs.
Fresh water fish fry	19500 Nos.	25621 Nos.	29900 Nos.	28980 Nos.	28300 Nos.
Sweet potato rooted cutting (Var. CARI SP1 & SP2)	-	-	-	300 Nos.	-
Paddy (TFL)	4.0 Tons	4.0 Tons	4.6 Tons	5.88 Tons	6.7 Tons
CARI Brinjal 1, Bacterial wilt resistant (TFL)	-	-	-	-	2.5 Kgs.
Pulse (TFL) of CIARI	-	-	-	-	Green gram: 100 Kgs.
varieties	-	-	-	-	Black gram: 100 kgs
Breeder seeds	-	-	-	Paddy: 445 Kgs.,	Paddy: 465 Kgs.
				Green gram: 189 Kgs.	-
				Black gram: 90 Kgs.	-
				Brinjal (Var. CARI Brinjal 1, Bacterial wilt resistant): 3.5 Kgs.	-

#### **Patents Granted**

Invention: A method and an apparatus for developing gonadal maturity in carps. S. K Sarkar, Ashis Saha, Subrata Dasgupta, Samiran Nandi, Niranjan Sarangi, P Routray, D K Verma, J Mohanty, R Kiruba Sankar and S Ayyappan. Patent Number: 275820, Granted in: 22 Sep 2016, Patentee: Indian Council of Agricultural Research, New Delhi

### **Patents Filed**

One patent application entitled "Novel acaricide composition for veterinary topical applications and the method of preparation thereof" by Animal Science division, ICAR-Central Island Agricultural Research Institute with Patent application no. 201631043680 on 21st December, 2016.



# Varieties released through Institute Variety Release Committee (IVRC) for Farmers and Stakeholders

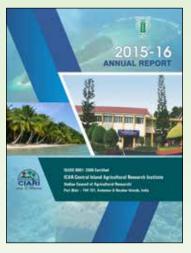
Name of crop	Variety	Maturity range (Days)	Average Yield	Contributors
Brinjal	CARI Brinjal 2	120-130	15-16 q/ha.	P. K. Singh, Naresh Kumar, R. K. Gautam, Krishna Kumar, Ajanta Birah, K. Sakthivel, S. K. Zamir Ahmed, and S. Dam Roy
Mung	CIARI Mung 4	61-70 15 - 18 q/ha.		A.K. Singh, Sudhir Tirki, P.K.Singh, R.K.Gautam, Naresh Kumar, T.P. Swarnam, T. Subramani, A.Velmurugan, S.K. Zamir Ahmed and S. Dam Roy
	CIARI Mung 5	58-69	12.7 – 19.4 q/ha	A.K.Singh, Niranjan Roy, P. K. Singh, R.K.Gautam, Naresh Kumar, T.P. warnam, T. Subramani, A. Velmurugan, S.K. Zamir Ahmed and S. Dam Roy.
Urd	CIARI Urd 1	62-70	9.0 – 13 q/ha	A.K. Singh, P. K. Singh, R.K. Gautam, Naresh Kumar, T.P. Swarnam, T. Subramani, A. Velmurugan, S.K. Zamir Ahmed and S. Dam Roy
	CIARI Urd 2	64-72	9.0-14 q/ha	A.K.Singh, P.K. Singh, R.K. Gautam, Naresh Kumar, T.P.Swarnam,T. Subramani,A. Velmurugan, S.K. Zamir Ahmed and S. Dam Roy.
Mushroom	CIARI Mushroom 1 (Cream Oyster)	10-12	700 g to 1 Kg / kg of substrate	K. Sakthivel, R.K. Gautam, V. K. Pandey, Archana Sharma, N. C. Choudhari, P.K. Singh, K. Abirami and S. Dam Roy
Mushroom	CIARI mushroom 2 (White Oyster)	18-21	800 g to 1 kg/kg of substrate	K. Sakthivel, R.K. Gautam, V. K. Pandey, N. C. Choudhari, P.K. Singh, A. S. Krishnamoorthy, S. Nakkeeran, S. K. Zamir Ahmed, T. Subramani, and S. Dam Roy
Mushroom	CIARI mushroom 3 (Blue Oyster)	15-20	800 g to 1 kg/ Kg of substrate	K. Sakthivel, R.K. Gautam, V. K. Pandey, N. C. Choudhari, A. S. Krishnamoorthy, S. Nakkeeran, Archana Sharma, and S. Dam Roy



### INFORMATION ON OTHER SECTION

### Priority setting, Monitoring and Evaluation (PME) Cell

The Project review meeting both for external and institute funded projects was held from 18<sup>th</sup> to 19<sup>th</sup> April, 2016 at the Conference Hall of Library building under the Chairmanship of Dr. S. Dam Roy, Director, CIARI. Dr. S. Dam Roy, Director and Chairman expressed his happiness on the good research work done by the scientific colleague of the Institute which has come out in the form of high impact NAAS rated research papers, technical article, varieties strains and technology development. A total of 48 projects were reviewed.





Institute Annual Report 2015-16, Island Agriculture Newsletter both in English and Hindi (April, 2016 to March, 2017), DARE/ICAR Annual Report 2016-17, DARE Report from 2012-2013 to 2015-2016, Cabinet Report (Every month), Half Yearly Performance Review (April to September, 2016 & October 16 – March, 2017), Result Frame

Work Document (RFD) report - 2016-2017 (Monthly, Half yearly & Annually), Skill training programme of less than 32 Hrs, Achievements of the Institute w.e.f. 2012-2016, salient achievements of the Institute 2015-2016, brief information of the Institute for Standing Committee on Agriculture (2016-2017) — Selection of subjects for examination, relevant salient information on Farmer Centric Initiatives, Report for DARE- ICAR-CIARI, for 2012-2016 and XXIII ICAR Regional Committee Meeting, Data Sheet for Institute Information Management System (IIMS) for ICAR web portal, accomplishments of Plan period 2012-2017 and News items to local and mainland press.



Audit reply, documents / records screening for promotion of the scientists (5 Nos.) under the revised Career Advancement Scheme, fifteen project proposal for externally funded project, 143 research articles, 11 folders and 5 bulletins and a book of the scientists were processed.

Beside, the Parliamentary replies, the major events were coordinated like Institute foundation day on 23<sup>rd</sup> June, 2016, Agriculture Education Day on 17<sup>th</sup> December, 2016, Workshop on Digital Payment on 4<sup>th</sup> February, 2017, &

National Productivity Week Celebration under the theme "From waste to profits through Reduce, Recycle and Reuse" on 13th February, 2017.









38th Foundation day

Agril. Edn. Day

Digital Payment

Internal audit on every quarters and the NCR were conducted and Certification of IS/ISO 9001:2008 with BIS, Chennai w.e.f. 19th July, 2016 was obtained for the Institute.

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

The library of the institute has a comprehensive collection of resources on Horticulture, Field Crops, Natural Resource Management, Animal Sciences, Biotechnology, Fisheries Science, Social Science and many other related areas. It plays a pivotal role in catering the information needs of the scientist, technical, research workers, students and administrative staff of the institute. It also extends these facilities to the local researchers and educational institutes of these Island and mainland. The library has been enriched with 7024 books, 2541 miscellaneous publications in addition to journals by subscription, gratis, on exchange basis and technical books. During the report year 102 books were procured, beside 39 Indian and 4 foreign journals were subscribed. Gratis publications such as Annual Report, Newsletter and Research Bulletin received from India and Foreign Institutes as exchange relationship is also maintained. Special collection of Island related books, Hindi books along with reprographic facility is also available. Efforts have been made to acquire non-conventional literatures such as technical reports, reports on socio-economic study and annual reports from various sources to be kept as a ready reckoner for the users. It is also custodian of a well furnished conference rooms, wherein a total of 34 meeting were organised.

### Official Language Cell

For the successful implementation of the official language policy. Various steps were taken to popularize Official Language among the officers and staff and to promote the use of Hindi in the official work of the institute.

### **Activities conducted**

- Hindi Fortnight was conducted from 05<sup>th</sup> to 20<sup>th</sup> September, 2016 for extension and maximum use of Hindi in official works. Programmes like quiz, extempore, essay, letter-writing, noting-drafting, vocabulary, speech competition for staff and farm ladies were organized to bring awareness about the importance of increasing use of Hindi.
- Rajbhasha Seminar on राष्ट्रीय एकता का प्रतीकरू हिंदी, was held on 05th September, 2016, under the chairmanship of Dr. S. Dam Roy, Director, ICAR-CIARI. Dr. N. Lakshmi, Associate Professor, JNRM, Port Blair was the main speaker on the occasion.
- Fifteen days Hindi Workshop was organized for Non-Hindi speaking Scientist/Technical Officers from 22<sup>nd</sup> December, 2016 to 18<sup>th</sup> January, 2017.









- Twenty one bilingual scientific bulletins/ folder in Hindi were printed for the benefit of the local farmers of these islands.
- Technology backstopping were broadcasted through electronic media such as radio and TV.

In addition to above the cell has achieved the targets of using Hindi fully in the field of transfer of technology and extension. The Institute library has facilitated purchase of literature books in Hindi and has established a separate section for Hindi books.

### TOWN OFFICIAL LANGUAGE IMPLEMENTATION COMMITTEE, Port Blair

As per the Office Memorandum No. 12024/09/2010/OL, dated 15.10.2010 issued by the Rajbhasha Vibhag, Home Ministry, Govt. of India, the Town Official Language Implementation Committee (TOLIC), Port Blair was headed and coordinated by Central Island Agricultural Research Institute, Port Blair.

Half yearly meeting of Town Official Language Implementation Committee, Port Blair was conducted on 29<sup>th</sup> July, 2016 and 29<sup>th</sup> December, 2016 respectively. On the basis of quarterly report received, the *Chal Vaijayanti Shield* and *Cup* were awarded to offices on annual basis.









### **Annual Magazine of TOLIC**

Town Official Language Implementation Committee magazine "Dweep Tarang-II", was released during ICAR Foundation Day at Vigyan Bhavan, New Delhi by Shri Radha Mohan Singh, Union Minister of Agriculture & Farmers Welfare along with other dignitaries on 16<sup>th</sup> July, 2016.



### **Sub-Distributed Information Center (Sub-DIC)**

Bioinformatics center of ICAR-CIARI serves as an active centre 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 and also offers traineeships and studentship on bioinformatics to the deserving students.

### **Development of Databases**

One database on 'Tree borne oil Seeds' tree and another database on 'Fodder Trees' of Andaman and Nicobar Islands were developed using PHP, MySql and Xampp servers. A total of 49 species of oil yielding trees and 95 species of fodder trees are documented in the database.







Development of Tree Borne Oil Seeds

# Metagenomics analysis of South Andaman seawater for bacterial genetic diversity

Five Sea waters sample from different depths were analyzed for bacterial diversity in Amplicon-16s-rRNA sequencing using illumina MiSeq Platform. The data statistics of the five samples are given below.



# Data statistics of the five water samples

Sample Name	Number of Reads	<b>Total Bases</b>	Data in MB
Sample-1	574,055	291,276,204	~291
Sample-2	338,585	173,085,636	~173
Sample-3	536,747	276,356,184	~276
Sample-4	478,719	244,547,814	~244
Sample-5	586,326	301,703,216	~301

# **Training and Workshop**

One training cum workshop and one seminar were organized as below:

Title	Date	Male	Female	Total
Training cum Workshop on "Recent Trends in Bioinformatics"	24 <sup>th</sup> -25 <sup>th</sup> January, 2017	55	12	67
Seminar on "Schrodinger Software and Applications"	20 <sup>th</sup> January, 2017	50	12	62





# Seminar on Schrodinger software

Seminar on Schrodinger software and Applications for Molecular drug designing and development from Schrodinger Company, Bangalore was organized by Sub-DIC on  $20^{th}$  Jan, 2017.







### Launching of Bioinformatics Centre webpage

Webpage for bioinformatics centre was launched by Director on 16th Jan, 2017.





#### **Post Graduate Cell**

Post Graduate Cell has been established to facilitate the training/ dissertation/ implant training to graduate & post graduate students in collaboration with the other research institutes. During the year one student of M. Sc. Biotechnology from Vels University registered for M.Sc. dissertation work. Besides, 10 students have undergone implant training for a period of one month to three months. The PG cell also facilitates Ph.D. work related to the students registered with the PRIST University, Thanjavur.

#### **Estate Section**

The Estate Section consists of Estate, Workshop and Instrumentation centre. It takes up works related to infrastructure development and repair & maintenance of the institute to support its research activities. The power supply plays an important role for laboratory research works. Three Diesel Generator sets are kept as stand by for restoration of power supply during power cuts and exigencies. The electricity and water supply system to residential & non-residential buildings are also operated and maintained to support research activities and staff welfare.

### Infrastructure development and repair works undertaken:

The work at the tune of 34.04 lakhs have been executed for repair and maintenance of residential, non – residential buildings and development of new structures based on proposals. Under the infrastructure development two naturally ventilated poly house have been constructed one at Ograbraj and old Bimlitan village under NABARD funded project. Drip Irrigation system has been installed in ginger block for an area of 1200 Sqm at Sippighat Farm under CSS-NHM project. The damaged boundary wall at Haddo, adjoining to Botanical Survey of India have been reconstructed which was damaged during earthquake occurred in December 2004 and tilted thereafter. Six cubicals have been constructed for making seating arrangement for Scientist of Fisheries Science Division. A Store room was constructed with roof for the open stair case area at Farm Office at Bloomsdale Farm. To arrest leakage of rain water, walls roof projection has been done all around the Central Lab Building at Garacharma Farm. The copper plate earthing has been provided for Pesticide Residue Laboratory at Garacharma Farm. Repair and painting of Nicobari hut near guest house, beside painting of quarters, part of canteen, phase – I office building, portico of guest house etc. were done for face lifting and maintenance of buildings.

### Workshop

Workshop plays an important role for arranging transportation for Scientists, staff farmers to carry out that research activities and welfare activities of the Institute. It also plies regular school trips and coordinate vehicles during major events of the Institute. The routine and major repairs of staff car, jeep and staff/school bus were also carried out in stipulated time to facilitate research activity of the Institute.



#### **Instrumentation Cell**

The repairs and maintenance of scientific equipments, refrigerators and air conditioners installed in the Central Laboratory and other building were carried out to keep it in good condition to facilitate research activities of the Institute. Un-interrupted power supply was also provided through our Stand by Generators during important meetings and functions of the Institute to cater to the need of the Scientists and the Institute as a whole.

# **Zonal Technology Management Unit (ZTMU)**

Technology display unit of ITMU cell was inaugurated by the Director, ICAR-CIARI, Port Blair on 23<sup>rd</sup> May, 2016 displaying 20 brochures, 15 books, seeds of rice & mung and commercializable technology developed by the institute.





The cell facilitated for trade marking/ patent/ animal breed registration. Two animal breeds namely, Teresa Goat with accession no INDIA\_GOAT\_3300\_TERESSA\_06025 and Nicobari pig with accession no INDIA\_PIG\_3300\_NICOBARI\_09005 were registered on 21st June, 2016 at National Bureau for Animal Genetic Resources (NBAGR). ITMC meeting was conducted on 14th October, 2016 to discuss about the commercialization of four Noni varieties with private partners and to commercialize two noni varieties *viz*. CARI Sanjivini and CARI Samridhi with non-exclusive license fee of `5 lakhs for each variety. One patent application was filed entitled "Novel acaricide composition for veterinary topical applications and the method of preparation thereof" in the name of Animal Science division, ICAR-Central Island Agricultural Research Institute with Patent application no. 201631043680 on 21st December, 2016.

### **ARIS Cell**

Agricultural Research Information System (ARIS) envisages providing online interconnectivity between the different research institutes, national centres and state agricultural universities. This cell is responsible for the creation and updating of the Institute bilingual web site and for the conduct of ARS-NET online examination through ASRB, New Delhi. It is equipped with 2 servers, switches, router, modem, 20 desktop/terminals and one 10 KVA UPS. The ARS-NET examination 2016 was conducted from 1st to 6th August, 2016, wherein 32 candidates appeared for the exam at the CIARI, Centre.

### **Management Information System and Financial Management System**

ICAR-ERP developed under NAIP project "Implementation of Management Information System (MIS) including Financial Management System (FMS) in ICAR" was regularly updated.

# Activities during the period

- Maintenance of Hardware/ Software, Servers LAN and internet connectivity. *VSAT* equipment and its peripherals.
- Handling institute email accounts with ids at gmail.com and icar.gov.in



- Handling Personnel Management Information System Network (PERMISnet-II) and Project Information & Management System (PIMS) of ICAR PIMS
- Maintaining records with respect to inventory management of Computer Cell, antivirus licenses, cartridges etc.
- Online submission of tender in Central Public Procurement Portal (CPPP). e-Procurement and e-Publishing of tenders. Purchase and handling of DSC of all the designated users.
- Online submission of institute service tax on monthly basis and e-filing of return of service tax on half yearly basis.
- Online submission of institute income tax on monthly basis and e-filing of return of income tax for individuals.
- Maintenance and management of Aadhar based and Non Aadhar based biometric attendance system.
- Preparation of presentations and slide operating for various meetings/ seminars for Director.
- Handling Government E-market Place (GeM), DGSnD, social media account *viz*; Facebook and Twitter and Guest house communication
- Preparation of banners, posters, brochure, certificates, nameplates for various meetings/ seminars etc.
- R-governance, office automation, software for the preparation of salary of TSM staff.
- Downloading the circulars and other information from ICAR website.
- Installation of Statistical analysis software for data compilation for scientists.

### **Institute Website**

 http://icar-ciari.res.in - Institute bilingual website is updated regularly by uploading the latest Institute progress in terms of research, technologies developed, tender notifications, recruitment notifications and other information.



# **Award and Recognition**

Scientist	Award/ Recognition	Awarding Agency/ Organizing society	
T. Sivaramakrishnan	Best Poster	Andaman Science Association (ASA), during ICCB-2016 at ICAR-CIARI, Port Blair	
	Peer Reviewer	Turkish Journal of Fisheries and Aquatic Sciences	
K. Abirami & K. Saravanan,	Best scientific work in Hindi, 2015-16	38th Foundation Day of ICAR-CIARI, Port Blair	
	Best Oral Presentation	Andaman Science Association (ASA), during ICCB-2016 at ICAR-CIARI, Port Blair from 8 <sup>th</sup> -10 <sup>th</sup> Dec, 2016.	
	Peer Reviewer	International Research Journal of Agricultural and Food Sciences	
R. Kiruba Sankar	Best Scientist	38th Foundation Day of ICAR-CIARI, Port Blair.	
	Young Scientist	Andaman Science Association, Port Blair	
	Fellow of ASA	Andaman Science Association, Port Blair	
	Certificate of Appreciation	National Sample Survey Office, Ministry of Statistics on 29 <sup>th</sup> June, 2016	
Raymond Jani Angel, A Anuraj, K Lohith Kumar	Fellow of ASA	Andaman Science Association, Port Blair	
S.K. Zamir Ahmed	Dr. A.K. Bandyopadhyay Outstanding Scientist	Andaman Science Association during ICCB-2016 at Port Blair	
	Fellow of Mobilization	Society for Community Mobilization for Sustainable Development, IARI, New Delhi	
	Member, Task Force	DBT, Govt. of India, Task Force on SC/ST and Rural Development programme	
	Appreciation Certificate	1st Headman, Car Nicobar	
Sukham Monalisha Devi	Best Poster	Andaman Science Association, Port Blair during ICCB-2016	
S. Jeyakumar, S.P.Yadav, Jai Sunder, A.Kundu, M.S. Kundu, Z. George, S. Dam Roy & S. Shiv Kumar	Breed registration certificate for Teressa goat	ICAR, New Delhi	
S. Jeyakumar, Jai Sunder, M.S. Kundu, , A.Kundu, A.K. De, S.P.Yadav, Z. George, S. Dam Roy & S. Shiv Kumar	Breed registration certificate for Nicobari pig	ICAR, New Delhi	
A.Kundu	Dr N.T. Singh Eminent Scientist	Andaman Science Association, Port Blair during ICCB-2016	
Jai Sunder	Dr. A.K. Bandyopdhayay Outstanding Scientist	Andaman Science Association, Port Blair during ICCB-2016	
	Mid Career Scientist	International Academy of Biosciences (UK)	



Scientist	Award/ Recognition	Awarding Agency/ Organizing society		
Sunder, J. A.Kundu, M.S.Kundu, T.Sujatha & A.K.De	Best Research Paper	Andaman Science Association, ICAR-CIARI, Port Blair		
T. Sujatha	Fellow of ASA	Andaman Science Association, Port Blair		
T.Sujatha, Jai Sunder, Thangapandian & A.Kundu	Best Poster	IPSACON		
T.Sujatha, A.Kundu, Jai Sunder & S. Dam Roy	Best Oral Presentation	IPSACON		
A.Velmurugan	Fellow of Ecological Society of India	Ecological Society of India, Ludhiana		
	ASA Gold Medal	Andaman Science Association, Port Blair		
Swarnam, T.P.	Fellow of Andaman Science Association	ASA, CIARI, Port Blair		
	Fellow of Mobilization	Society for Community Mobilization for Sustainable Development, IARI, New Delhi		
T. Subramani	Member of Committee for selection of Technical Officer	Coconut Development Board, Port Blair		
S. Swain	Member of Technical scrutiny committee (TSC) under NMFP programme	Directorate of Industries, Port Blair.		
	Expert on utilization of biomass for electricity generation	NRSE, Port Blair		
	Fellow of ASA	Andaman Science Association, Port Blair		
	Young Professional	Society of Community Mobilization, New Delhi		
	Appreciation Certificate	Asst. Commissioner (Nancowrie), Nicobar		
R.K. Gautam	Achiever Award (2016) and Honorary Member	SADHNA, Dr. Y.S. Parmar University of Horticulture & Forestry, Solan, H.P.		
R.K.Gautam, P.K. Singh, S.K. Zamir Ahmed & S. Dam Roy	Facilitator for PPVFRA, Plant Genome Saviour Community Award of Rs.10 lakh (Rupees Ten lakh) to Karen community for conservation of traditional and unique land races of rice in A&N Islands.	PPVFRA, New Delhi		
Sakthivel, K., Kumar, A., Devendrakumar, C., Vibhuti, M., Neelam, S., Gautam, R. K., Kumar, K., Dam Roy, S., & Vinazter, B. A.	Best Research Publication	38 <sup>th</sup> Institute Foundation Day, ICAR-CIARI, Port Blair		



Scientist	Award/ Recognition	Awarding Agency/ Organizing society		
Gautam R.K. Singh, P K, Sakthivel, K, Singh, Awnindra Kumar, Rajeni Ekka, Shyam Sunder Rao and Reena Singh	Best Research Paper	ASA, during ICCB-2016, Port Blair.		
P. K. Singh	Fellow of ASA	ASA, during ICCB-2016, Port Blair.		
	Best Poster	ASA, during ICCB-2016, Port Blair.		
Awnindra K. Singh	ASA Gold Medal of the Andaman Science Association	ASA, during ICCB-2016, Port Blair.		
	Fellow of the Indian Ecological Society, Ludhiana	ASA, during ICCB-2016, Port Blair.		
	Fellow of Mobilization	Society for Community Mobilization for Sustainable Development, IARI, New Delhi		
	Fellow of ISGPB	Indian Society of Genetics and Plant Breeding, New Delhi during Platinum Jubilee of ISGPB at New Delhi		
K. Sakthivel	Best Research Paper	Department of Plant Pathology, Coimbatore for publication in Vegetos		
	Best research Paper	ICAR-CIARI, Port Blair		
V. Baskaran	Best Oral Presentation	3 <sup>rd</sup> International conference on Agriculture, Horticulture and Plant Sciences held at New Delhi		
	Best Oral Presentation	National conference on advances in Indian Floriculture with focus on North East and Hill region held at Central Institute of Horticulture, Medziphema, Nagaland		
	Fellow of ASA	Andaman Science Association, Port Blair		
	Appreciation letter for developing "New planting system in flower crops".	ADG (Hort.) HS, II, New Delhi		
	Member (Formation of block technology team)	Prothrapur and Ferrargunj block, UTATMA, South Andaman district.		
	Judge	ITF 2017, A&N Administration		
I. Jaisankar	Dr. S. Dam Roy Young Scientist	Andaman Science Association, Port Blair		
	Best Community Mobilizer	Society for Community Mobilization for Sustainable Development, IARI, New Delhi		
	Member of State CAMPA	Andaman and Nicobar Forest Department, MOEF&CC, Port Blair.		
	Appreciation Certificate	Captain, Tribal Council, Campbell Bay		
	Member, Editorial Board	Journal of Andaman Science Association, Port Blair		



Scientist	Award/ Recognition	Awarding Agency/ Organizing society		
Ajit Waman	Member, Editorial Board	Amity Journal of Agribusiness		
	Peer Reviewer	<ul> <li>Current Science, India</li> <li>Ciencia Rural, Brazil</li> <li>The Philippine Agriculture Journal</li> <li>Journal of Horticulture and Forestry, Academic Journals</li> <li>International Journal of Plant Physiology and Biochemistry, Academic Journals</li> </ul>		
	Judge	State level exhibition 'Gyanodaya' at Port Blair		
	Expert Member	Committee for establishment of commercial plant tissue culture laboratory at Jirkatang under UT Department of Agriculture.		
	Honorary Life Member	Asian PGPR Society for Sustainable Agriculture, Alabama, USA.		
Pooja Bohra	Member, Global Executive Council	Society for Underutilized Plants for Future Research		
	Member of the Editorial Board	<ul> <li>Selcuk Journal of Agriculture and Food Science, Turkey</li> <li>Journal of Horticulture and Forestry, Academic Journals</li> <li>African Journal of Plant Science, Academic Journals</li> </ul>		
	Peer Reviewer	<ul> <li>Scientia Horticulturae, Elsevier</li> <li>Plant Growth Regulation, Springer</li> <li>Journal of Food Science and Technology, Springer</li> <li>International Journal of Fruit Science, Taylor and Francis</li> <li>The Philippine Agriculture Journal</li> <li>African Journal of Biotechnology, Academic Journals</li> <li>International Journal of Plant Physiology and Biochemistry, Academic Journals</li> <li>The Open Plant Science Journal</li> </ul>		
	Honorary Life Member	• Asian PGPR Society for Sustainable Agriculture, Alabama, USA.		
KVK, Nicobar	Best KVK	38th Foundation Day, ICAR-CIARI, Port Blair		
	3 <sup>rd</sup> Prize for Best stall in Carnic / Tribal Festival	A&N Administration		
	Letter of Appreciation	Headman, Big Lapathi village Council, Car Nicobar, Nicobar, A&N Islands for the efforts of developing agriculture and allied sector in Nicobar		



# **ONGOING RESEARCH PROJECT**

# **External Funded Project**

Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
PPV & FRA, Govt. of India						
1.	Collection, Characterization and Utilization of Farmers Variety, Landraces and Wild Relatives of Indigenous Pulses of Andaman & Nicobar Islands Agro-Ecosystem	Awnindra K. Singh	B. Divya Parisa, S. Swain, T.P. Swarnam and R.K. Gautam	20.00	2014	2017
2.	Development and Standardization of DUS Characteristics Procedures for Noni (Morinda citrifolia L.)	I.Jaisankar	A.K. Singh	28.3	2013	2017
DASD,	Calicut					
3.	CSS- MIDH (NHM) Project on Spices	K. Abirami	V. Damodaran	5.16	2002	Contd.
		NABAI	RD			
4.	Establishment of Out Reach Centre for North & Middle Andaman	S.K.Zamir Ahmed	-	79.69	2009	2017
5.	Sustainable Rural Livelihood through Improved Rural Poultry Farming Techniques in Andaman Islands	T.Sujatha	A.Kundu, M.S. Kundu and N.C. Choudhuri	8.99	2013	2016
6.	Floriculture Based Sustainable Livelihood Model for Island Farmers	V.Baskaran	K. Abirami, A. Velmurugan and N. Bommayasamy	17.06	2015	2018
7.	Production Technology of Mushroom for Nutritional and Livelihood Security of Island Farmers	N. C. Choudhuri	Nagesh Ram, K. Sakthivel, L.B. Singh, V.K. Pandey and Pooja Kapoor	9.95	2015	2017
8.	Enhancing on Farm Production and Promoting Forward & Backward Linkages through Technological Interventions	S.K.Zamir Ahmed	A. Velmurgan, Amit Srivastava and B.L.Kashinath	9.99	2017	2019



Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
9.	Evaluation and Popularisation of Value added Compost and other Organic Inputs in Neil Island	A. Velmurgan	T.P. Swarnam, I. Jaisankar and S.K. Zamir Ahmed	9.99	2017	2019
10.	Technological Intervention for Enhancing Pulse Production in Andaman Islands	A.K.Singh	A. Velmurugan, B.L. Kashinath and T.P. Swarnam	9.99	2017	2019
11.	Establishment of Duckling Resource Unit for Sustainable Duck Production in North and Middle Andaman	T.Sujatha	A. Kundu, Jai Sunder and Shardul Vikram Lal		2017	2019
12.	Quality Fish Seed Production for Adoption of Scientific Fish Farming for Economic, Nutritional and Social Upliftment of Farmers in N&M Andaman	Shailesh Kumar	B.L. Kashinath, T. Sivaramakrishnan, Nagesh Ram, Pooja Kapoor, Manoj Kumar, Debabrata Basantia, Batti Lal Meena, Shardul Vikram Lal and S.Dam Roy	9.99	2017	2019
13.	Popularization of Growing Freshwater Fish with Improvised Pellet Fish Feeds in N&M Andaman to Improve the Economic and Social Status of Fish Farmers	Shailesh Kumar	B.L. Kashinath, S.K.Zamir Ahmed, Nagesh Ram, Pooja Kapoor, Manoj Kumar, Debabrata Basantia, Batti Lal Meena, Shardul Vikram Lal and S.Dam Roy	9.99	2017	2019
14.	Vegetable Seed Production and Supply of Quality Seeds to Island Farmers for Increasing Vegetable Productivity and Nutritional Security of Island	B.L. Kasinath	Shailesh Kumar, Pooja Kapoor, Manoj Kumar, Debabrata Basantia, Batti Lal Meena, Shardul Vikram Lal, Tanmoy Pal and S.Dam Roy	9.99	2017	2019
15.	Establishment of Nursery for Supply of Quality Planting Materials to Farmers for Higher Income Generation through Crop Diversification	Debabrata Basantia	B.L. Kashinath, Ajit A. Waman,Shailesh Kumar ,Pooja Kapoor, Manoj Kumar, Batti Lal Meena, Shardul Vikram Lal, Tanmoy Pal and S.Dam Roy	9.99	2017	2019



CL N	TOTAL STATE OF THE	Principal	CO PI	Budget	Year of	Year of
Sl. No.	Title	Investigator	CO-PIs	(lakhs)	Start	Completion
NICRA	1			,		
16.	Restoration of agriculture in <i>tsunami</i> affected lands of Andaman and Nicobar Islands	B. Gangaiah	A. Anuraj, M.S. Kundu, T. Subramani, S. Swain, A. Velmurugan, L.B. Singh, S.K. Pandey and B.L. Meena	76.5	2016	2019
ICAR,	New Delhi					
17.	Sero-Surveillance of FMD in Andaman and Nicobar Islands	Jai Sunder	Arun Kumar De	3.0	2011	Contd.
18.	AICRP on FMD	Jai Sunder	Arun Kumar De	3.0	2014	Contd.
19.	AICRP on Goat Improvement	Jai Sunder	A. Kundu and M.S.Kundu	57.0	2014	Contd.
20.	AICRP on ADMAS	Jai Sunder	T.Sujatha	-	2014	Contd.
21.	Poultry Seed Project	A.Kundu	T.Sujatha	190.68	2014	Contd.
22.	AICRP on Pig	M.S.Kundu	Jai Sunder and A. Kundu	142.06	2015	Contd.
	AICRP on Management of Salt Affected Soils and Use of Saline Water in Agriculture	A.Velmurugan	T.P. Swarnam and T. Subramani	11.5	2014	Contd.
24.	AICRP on Integrated Farming Systems	T.P. Swarnam	A. Velmurugan, T. Subramani, S. Swain, M.S. Kundu, R. Kiruba Sankar, I. Jaisankar, Ajit Arun Wamen, B.K. Nanda, S.K. Pandey and Zacharia George	85.0	2010	Contd.
	Economic Impact Studies on Crop Diversification and Technology Adoption in Horticulture (CCPI)	S. K. Zamir Ahmed (CCPI)	Nagesh Ram	21.70	2015	2017
26.	ICAR Seed Project: Seed Production In Agricultural Crops	P. K. Singh	A. K. Singh and R. K. Gautam	66.50	2006	2016
27.	All India Coordinated Research Project on MULLaRP	Awnindra K. Singh		-	2011	2019
28.	All India Coordinated Research Network Project on Potential Crops on Vigna marina		S. Dam Roy, A. Velmurugan and T. Sujatha	-	2015	2019



Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
29.	All India Network Project on Vertebrate Pest Management	K. Sakthivel		0.35	2009	2017
30.	Outreach Programme on Management of Sucking Pests in Horticultural Crops	T. Bharathimeena		25.5	2014	2017
31.	Exploring Antimicrobial Peptide Genes in <i>Bacillus</i> Strains to Develop Bioformulations for the Management of Plant Diseases of Andaman and Nicobar Islands (AMAAS)	K. Sakthivel	R.K. Gautam	19.60	2015	2017
32.	ORP on Fungal Foliar Diseases	K. Sakthivel	R.K. Gautam and V.K. Pandey	21.48	2015	2017
33.	AICRP on Mushrooms	K. Sakthivel	N.C. Choudhuri, V.K. Pandey, Pooja Kapoor, R.K. Gautam and S. Dam Roy	8.5	2015	2017
34.	AICRP on Flowers	V.Baskaran	-	1.50	2015	2017
35.	Collection , Cataloguing and Conservation of Native Ornamental Plant Biodiversity in Andaman ,Nicobar and Lakshsdweep Islands	V.Baskaran	K. Abirami, Divya Parisa and L.B.Singh	55.24	2016	2017
36.	AICRP on Fruit crops	K. Abirami		1.05	2015	2016
37.	AICRP on Vegetable Crops	I.Jaisankar	Divya Parisa	1.2	2008	Contd.
38.	Consortium Research Platform on Borers in Network mode	T. Bharathimeena	I. Jaisankar	25.0	2009	2017
39.	AICRP on Palms	Ajit Waman	-	34.3	2015	2017
CMLR	E(MoES), Cochin					
40.	Marine Faunal Biodiversity of the Nicobar Group of Islands	R .Kiruba Sankar	S Dam Roy	75.00	2013	2017
MOFP	I, A & N Administration					
41.	Food Processing Training Centre (FPTC)	S. Swain	-	20.0	2014	2013



Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
DBT, G	ovt. of India			()	~	- Company
42.	Marker Assisted Introgression of Bacterial Blight Resistance in Popular Rice cultivars of Andaman and Nicobar Islands	R. K. Gautam	-	69.00	2013	2017
43.	Development and Standardization of DUS Characteristics Procedures for Noni (Morinda citrifolia L.)	I. Jaisankar	A.K.Singh	22.8	2013	2016
44.	Establishment of Sub- Distributed Information Centre	T. Subramani (upto 31st Nov., 2016) A.K.De (1st Dec.,16 onwards)	-	60.0	2008	Contd.
IMD (N	ToES)					
45.	Integrated Agromet Advisory Services for A&N Islands		T. Subramani, S. Dam Roy, T.P. Swarnam, P.K.Singh, A.Kundu, R.Kiruba Sankar, Nagesh Ram and S.K. Zamir Ahmed	60.0	2008	2017
DAC (N	MoA)					
46.	Monitoring of Pesticides Residue Analysis at National Level	Awnindra K. Singh	-	10.50	2011	2018
IRRI, P	Philippines					
47.	Stress Tolerant Rice for Africa and South Asia (STRASA)		P.K. Singh, A.K. Singh, S.K. Zamir Ahmed and A. Velmurugan	7.00	2011	2019
INCOIS	S, Hyderabad					
48.	Location Specific Augmentation of PFZ Advisories using Satellite Altimetry and Fishing Ground Database	S. Dam Roy	R.Kiruba Sankar, P. Krishnan, A.Anand and K. Lohith Kumar	75.00	2013	2017



Sl. No.	Title	Principal Investigator	CO-PIs	Budget (lakhs)	Year of Start	Year of Completion
SAC, A	hmedabad					
49.	Integrated Coastal Zone Management	K. Lohith Kumar	R.Kiruba Sankar	20.0	2013	2017
50.	Biophysical Characterization and Site Suitability Analysis of Indian Mangroves	S. Dam Roy	J. Raymond Jani Angel, K. Lohith Kumar and R.Kiruba Sankar	16.08	2014	2017
NFDB,	Hyderabad		<del>,</del>			
51.	National Surveillance Programme for Aquatic Animal Diseases (NSPAAD) of Andaman and Nicobar Islands	K. Saravanan	Arunjyoti Baruah, J. Praveenraj, A. Anuraj, Venkatesh R Thakur and J. Raymond Jani Angel	51.35	2015	2018
Andam	an & Nicobar Administra	tion				
52.	Consultancy Project on Preparation of District Irrigation Plan Water Harvesting Structures for Andaman and Nicobar Islands	A. Velmurugan	T.P.Swarnam and S. Dam Roy	10.0	2016	2017
	ment of Agriculture, And			1		
53.	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	26.14	2012	2016

**Institute Funded Project: 2016-2017** 

Sl. No.	Project Title	PI	CO-PIs	Year of Start	Year of Completion
		Horticulture &	Forestry		
1	Development of Production Technology for Ornamental Crops in Bay Islands	V.Baskaran	K. Abirami and A. Velmurugan	2011	2017
2	Collection and Evaluation of Medicinal Plants of Bay Islands	K. Abirami	V. Baskaran and V.Damodaran	2011	2017
3	Collection, Characterization and Standardization of Agro techniques of Fruit Crops in A & N Islands	K. Abirami	V. Baskaran, V. Damodaran and T. Subramani	2010	2017
4	Development and Evaluation of Silvipasture System under Coconut Plantation in Tropical Island Condition	I.Jaisankar	T.P. Swarnam and V. Damodaran	2015	2018



Sl.	Project Title	PI	CO-PIs	Year of	Year of
No.				Start	Completion
5	Collection, Characterization and Utilization of Natural	Ajit Waman	Pooja Bohra, T. Sujatha, L.B. Singh	2015	2021
	Diversity of Important Spice		and V. Damodaran		
	Crops from Bay				
	Islands and Evaluation of				
	their Improved Varieties	A ::4 XX/	Dania Dalam	2015	2010
6	Exploration, Characterization, Micropropagation and Agro-	Ajit Waman	Pooja Bohra, I. Jaisankar,	2015	2019
	Technique Standardization		D. Basantia and		
	of an Important Rhizomatous		V. Damodaran		
	Species- Mango Ginger from				
7	Bay Islands	Dania Dalam	A :: 4 A XX7	2015	2021
/	Collection, Characterization, Evaluation and Mass	Pooja Bohra	Ajit Arun Waman, T. Bharathimeena	2015	2021
	Multiplication of		and		
	Unconventional Native and		S.K. Zamir Ahmed		
	Exotic Fruit Crops for Bay				
	Islands	D D. 1	A *** XX7 1	2015	2010
8	Development of Protocols for Micropropagation of Selected	Pooja Bohra	Ajit Waman and L.B. Singh	2015	2019
	Fruit Crops for Bay Islands		L.D. Siligii		
Field (	Crop Improvement & Protectio	n	'		
9	Augmenting Rice	R. K. Gautam	P. K. Singh,	2012	2016
	Productivity through Varietal		S. K. Zamir Ahmed,		
	Purification of Popular Land		A.K. Singh, K. Sakthivel and		
	Races		S. Swain		
10	Development of Biotic	P. K. Singh	K. Sakthivel	2010	2016
	Stress Resistant Lines in				
	Brinjal (S. Melongena L.)				
11	Genetic Improvement of	Awnindra K.	P.K. Singh,	2011	2017
	Pulse Crops for Andaman & Nicobar	Singh	R.K. Gautam, K. Sakthivel,		
	Islands Conditions		T. Subramani and		
			S. K. Zamir Ahmed		
12	Insect Pests of Legumes in	T. Bharathimeena	A.K. Singh	2014	2017
	the Andaman and Nicobar				
	Islands : Bioecology and Management				
13	Induction of Systemic	K. Sakthivel	-	2012	2016
	Resistance through				
	Application of Potential				
	Antagonistic				
	Microorganisms against Ralstonia Solanacearum				
	causing Bacterial Wilt of				
	Solanaceous Crops				



Sl. No.	Project Title	PI	CO-PIs	Year of Start	Year of Completion		
Natura	Natural Resource Management						
14.	Vulnerability Assessment and Adaptation Led Mitigation Strategies of Andaman and Nicobar Islands Farming to Climate Change	B. Gangaiah	T. Subramani, S. Swain, A. Velmurugan, B.K. Nanda, V. Damodaran, K. Lohit Kumar and M.S. Kundu	2015	2019		
15.	Assessment and Utilization of Soil Biodiversity for Improving Soil Health under Tropical Island Condition	A.Velmurugan	T.P.Swarnam and K. Sakthivel	2013	2016		
16.	Assessing the Status of Pesticide Residues in Sediments and Aquatic Biota in Neil Island	S. Dam Roy	T.P. Swarnam, A. Velmurugan and R. Kiruba Sankar	2014	2017		
17.	Assessment of Post Harvest Losses in Fruits and Vegetables and Strategies for their Reduction in the Islands	S. Swain	S. K. Zamir Ahmed, L. B Singh, Chandrika Ram and Manoj Kumar	2015	2017		
18.	Development of Nutraceutical Beverages from Potential Underutilized Fruits and Medicinal Herbs of Andaman and Nicobar Islands	S. Swain	K Abirami, Pooja Bohra and Pooja Kapoor	2015	2018		
19.	Feasibility Evaluation of Pulses Cultivation and Resource Optimization under Coconut Plantation	T. Subramani	A. Velmurugan, B. Gangaiah, A.K. Singh, V. Damodaran, B.K. Nanda and T. Bharathimeena	2013	2017		
Anima	l Science						
20.	Augmentation of Fodder Resources to Improve Livestock Productivity in Andaman & Nicobar Islands	M.S. Kundu	B. Gangaiah, T. Sujatha and A. Kundu	2015	2018		
Fisheri	ies Science						
21.	Mariculture of Selected Marine Fin Fishes and Shell Fishes of Andaman Waters		Raymond Jani Angel, Venkatesh R Thakur, Anuraj A and Benny Varghese	2013	2017		
22.	Studies on Stock Assessment and Biology of <i>Pristipomoides</i> <i>Filamentosus</i> (Valenciennes, 1830) from Andaman Water	S. Monalisha Devi	S. Dam Roy, K. Lohith Kumar and R. Kiruba Sankar	2013	2017		



Sl. No.	Project Title	PI	CO-PIs	Year of Start	Year of Completion
23.	Capture Based Aquaculture of Economically Important Marine Finfishes of Andaman	J. Raymond Jani Angel	Anuraj A, Venkatesh R. Thakur, K. Saravanan and R.Kiruba Sankar	2015	2019
24.	Cataloguing Inland Aquatic Diversity and Breeding of Indigenous Freshwater Fishes of Andaman and Nicobar Islands	Venkatesh R. Thakur	J. Praveenraj, J.Raymond Jani Angel, Anuraj A and R. Kiruba Sankar	2015	2018
25.	Characterization of <i>Bacillus spp</i> from Andaman Mangroves and Evaluation of its Antagonistic Effect on Fish Pathogens	. K. Saravanan	Arunjyoti Baruah, J. Praveenraj, J. Raymond Jani Angel, T. Sivaramakrishnan and R. Kiruba Sankar	2015	2018
26.	Seaweed Diversity and its Culture Prospects in <i>in-situ</i> Conditions of Andaman	Anuraj A	Venkatesh R Thakur, J Raymond Jani Angel, K. Lohith Kumar and R. Kiruba Sankar	2015	2019
27.	Assessment of Stock of Neritic Sharks from Andaman Waters	R. Kiruba Sankar	S. Monalisha Devi, K. Lohith Kumar and A K O Ratheesh	2015	2018
28.	Study on Biology and Stock Assessment of Selected Tuna Species from Andaman Waters	K. Lohith Kumar	R.Kiruba Sankar, S. Monalisha Devi, A K O Ratheesh and S. Dam Roy	2015	2018

## Flagship Programme: Integrated Agriculture System for Eco Regions

**Period**: 2014-17

Project Leader : S. Dam Roy
Co-ordinator : A. Velmurugan

Co-orun	Co-of diffactor . A. velindrugan				
SI.No.	Technical Programme	Team Leader	Associates		
1	Crop improvement	R.K. Gautam	V. Bhaskaran, K. Abirami, I. Jaisankar, Sachidananda Swain, K. Sakthivel, T. Bharathimeena, Pooja Bohra, Divya Parisa, T.Damodaran and Chandrika Ram		
2	Livestock component	A.Kundu	M.S. Kundu, Jai Sunder, T. Sujatha, Sophia Inbaraj,Zachariah George and N.C. Choudhuri		
3	Fisheries component	R. Kiruba Sankar	A. Anuraj, K. Saravanan, T. Sivaramakrishnan and Shailesh Kumar		
4	Natural resource management	B. Gangaiah	A. Velmurgan, T.P. Swarnam, T. Subramani, B.K. Nanda, V.N.Singh, S.K. Pandey, Manoj Kumar and B. L. Meena		
5	Socio-economic and impact assessment	S.K. Zamir Ahmed	Nagesh Ram, Amit Srivastava, Pooja Kapoor, Haripriya Nayak, Ani Dath and Dibakar Khan		



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#### Research Article

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- Anuraj, A., Kiruba Sankar, R., S Dam Roy and M Kaliamoorthy (2016). Genetic evidence and morphometry for shovel nosed lobster, *Thenus unimaculatus* from Andaman and Nicobar Islands, India. *Turkish Journal of Fisheries and Aquatic Sciences*, 17: 205-215. (NAAS Rating:6.55)
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- Baskaran, V., K. Abirami, L. Saravanan, P. Simachalam, R. K. Gautam and S. Dam Roy (2016). A first report of a chrysomelid beetle infesting on indigenous orchid *Eulophia andamanensis* Reichbf. in Bay Islands. *International Journal of Tropical Agriculture*, 34(4): 1171-1172. (NAAS Rating:3.49)
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- Gangaiah, B and Prasad Babu., M.B.B (2016). Brown manuring as a tool of weed management and contributor to nitrogen nutrition of direct wet seeded rice. *Oryza* 53 (4): 415-421. (NAAS Rating: 4.44)
- Gautam R.K., P.K. Singh., S.K. Zamir Ahmed., Naresh Kumar., Awnindra K. Singh., K. Sakthivel and S. Dam Roy (2016). ANR38 (IC 0613963, INGR15014), a rice (*Oryza sativa*) germplasm with open floret. *Indian Journal of Plant Genetic Resources*, 29 (2): 201.(NAAS Rating: 5.12)
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- Jaisankar, I., R. Revathi., R. Umarani., Awnindra K. Singh and A. Velmurugan (2016). Diameter-utilizable wood curve modelling for integrated nutrient management based *Dalbergiasissoo*Roxb. Clones. *Vegetos*, 29:102-113. (NAAS Rating: 5.0)
- Jaisankar, I., T. Subramani., Awnindra K. Singh., R.K. Gautam., A. Velmurugan., T. Rajeshkannan and Divya Parisa (2016). Genetic diversity among Jamun (*Syzygiumcumini* L. Skeels) accessions of Andaman and Nicobar Islands revealed through morpho-biochemical and DNA markers. *Journal of the Andaman Science Association*, 21(1): 35-44. (NAAS Rating: 3.68)
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N.B. Research Paper score is as per the NAAS score of Scientific Journals 2017 (Effective from January 1, 2017)

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#### **Manual**

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## PEER RECOGNITION TO DIRECTOR

### FNAAS HONOUR TO DR. S. DAM ROY, DIRECTOR, CIARI

Dr. Sibnarayan Dam Roy, Director, ICAR-Central Island Agricultural Research Institute, Port Blair has been bestowed upon the **Fellow of the Prestigious National Academy of Agricultural Sciences** (FNAAS), New Delhi with effect from 01<sup>st</sup> January, 2017. The Fellow is in the section of Fisheries Science; specialization in Fishery Resource Management and Aquaculture. He joins the select band of 30 Fellows in the section, since the inception of the NAAS (1990).



In December, 2016, Dr. S. Dam Roy has also been made an **Honorary Fellow of the Indian Ecological Society**, **Ludhiana**, and been inducted in **the Advisory Board of Indian Ecological Society** for his extensive knowledge and expertise on Island Ecosystem.

During the International Conference on Climate Adaptation and Biodiversity: Ecological Sustainability and Resource Management for Livelihood Security held at Port Blair, during 8<sup>th</sup> to 10<sup>th</sup> December, 2016; he has been awarded with the prestigious "Shanti Prasad Gupta Award" by the Society for Community Mobilization for Sustainable Development, New Delhi.

Andaman Science Association Ratna Award 2016, was conferred to him for his outstanding contribution for the cause of popularization of science and for providing platform to the Scientists of the Islands by serving the Andaman Science Association for past 25 years in various capacities culminating in serving as the President of the Association since 2012 and contributing to its remarkable revival and revitalization. The Journal of Andaman Science Association, the only scientific journal of the Island is now rated 3.68 in NAAS accredited Journal.

Dr. S. Dam Roy has also been elected as **the Vice President of the Indian Society of Coastal Agricultural Research** (ISCAR) functioning from Canning town of West Bengal.



# Honour's to the Institute and the Island for implementation of Official Language under the Chairmanship of Director, CIARI

• Institute was awarded II<sup>nd</sup> prize, "Rajshri Tandon Rajbhasha Award" for performance in use of O.L. in official use by ICAR, New Delhi for the year 2014-2015.



## Peer recognition to Director in committees and panels

- President, Andaman Science Association, Port Blair, A&N Islands
- Chairman, Town Official Language Implementation Committee, Port Blair
- Member, Andaman and Nicobar Price Stabilization Fund and Andaman and Nicobar Price Stabilization Fund Management Committee, Andaman and Nicobar Administration, Directorate of Civil Supplies & Consumer Affairs, Port Blair
- Member, Task Force on Agriculture Development for the UT of A&N Islands
- Expert Member, State Level Executive Committee for implementation of PKVY, A&N Islands, Port Blair.
- Member, State Level Steering Committee for promotion of City Compost, A&N Islands
- Chairman, Independent Third Party Monitoring and Evaluation Committee for evaluation of works carried out under State CAMPA, A & N Islands, Port Blair
- Member, UT Coordination Committee between A&N Administration & CIARI, Port Blair
- Member, Society for Science Centre, A&N Islands, Port Blair
- Member, State Level Environment Council, A&N Islands, Port Blair
- Member, State Level Water Quality Review Committee, A&N Islands, Port Blair
- Member, Andaman & Nicobar Science and Technology Council, A&N Islands.



- Member, State Level Sanction Committee for Rashtriya Krishi Vikas Yojana, 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.
- Member, High Value Agriculture Development Agency for the UT of A&N Islands.
- Member, Governing Council of Andaman & Nicobar Coconut Mission
- Member, Agriculture Technology Management Agency Governing Body 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, Interdepartmental Committee on encouraging investments in supply Chains including provisions for cold storage for more efficient distribution of Farm Produce.
- Member, State Level Steering Committee for promotion of City Compost constituted by Chief Secretary (Agri.), A&N Administration, Port Blair
- Member, in the committee to coordinate the activities of skill development training programme in the area of Food Processing Sector, constituted by the Hon'ble Lt. Governor, A&N Islands
- Member, Project Appraisal Committee of A&N Administration, Directorate of Industries, Port Blair
- Member, Panel for Fish and Fisheries Products, Food Safety & Standards Authority of India, Ministry of Health & Family Welfare, New Delhi
- Member, State Level Monitoring Committee (SLMC) for UT of A&N Islands to monitor periodically the Operationalization of National Policy for Farmers
- Member, State Board for Wildlife for the Union Territory of A&N Islands
- Member, Steering Committee to monitor the progress of development of Coconut based Food Processing Industries in A&N Islands



# Participation of Scientist in Conference/ Seminar/ Symposium/ Meetings & Training

Scientist	Program	Venue	Date / Duration
R. K. Gautam and P. K. Singh	51st Annual Rice Research Group Meeting	IGKV, Raipur	2 <sup>nd</sup> - 5 <sup>th</sup> April, 2016
T.P. Swarnam	Pesticide Residue Analysis and its Management in Agricultural system	NIPHM, Hyderabad	11 <sup>th</sup> – 22 <sup>nd</sup> April, 2016
K. Abirami & V. Damodaran	National Seminar on planting material production in spices	Kozhikode, Kerala	21st to 22nd April, 2016
R. K. Gautam	Review Meeting of IRRI-India STRASA project	Bhubaneshwar	25 <sup>th</sup> -27 <sup>th</sup> , April 2016
T. Sujatha	Reservation in Service and Roster Preparation	NAARM, HYDERABAD	27 <sup>th</sup> –29 <sup>th</sup> April, 2016
Awnindra K Singh	27th Group Meeting of All India Coordinated Research Network on Potential Crops	SDAU, SK Nagar, Gujarat	2 <sup>nd</sup> - 3 <sup>rd</sup> May, 2016
I.Jaisankar	XXXIV Group Meeting on Vegetable Crops	IARI, New Delhi	10 <sup>th</sup> to 13 <sup>th</sup> May, 2016
Jai Sunder	Annual Review Meeting of AICRP on Goat Improvement	Thrissur	11 <sup>th</sup> – 12 <sup>th</sup> May, 2016
AjitWaman	Annual General Meeting of AICRP on Palms	ICAR-CPCRI, Kasargod	19 <sup>th</sup> – 21 <sup>st</sup> May, 2016
Awnindra K Singh	Annual Group Meeting of AICRP on MULLaRP	UAS, Bengaluru, Karnataka	21st – 24th May, 2016
A.Kundu	Annual Review Meet on Poultry Seed Project	Sikkim	21st – 27th May, 2016
Awnindra K Singh	10 <sup>th</sup> Annual Workshop of CSS on Monitoring of Pesticides Residue at National Level	PAU, Ludhiana, Punjab	26 <sup>th</sup> -27 <sup>th</sup> May, 2016
Pooja Bohra	Summer School on Contemporary Methods of Conservation and Management of Horticultural Genetic Resources	ICAR-IIHR, Bengaluru	7 <sup>th</sup> – 27 <sup>th</sup> June, 2016
K Sakthivel	Training on Taxonomy of mushrooms	DMR, Solan	13th June, 2016
K. Abirami	National Workshop on Sustainable Mango Production: Challenges under Changing Climate in Tropics and Sub Tropics cum Mango Diversity	ICAR-CISH Regional Research Station, Malda	18th -19th June, 2016
Jai Sunder	Regional Committee Meeting	ICAR-NAARM, Hyderabad	24 <sup>th</sup> – 25 <sup>th</sup> June, 2016
K. Abirami	10 <sup>th</sup> Annual Review Meeting of CSS-NHM Project on Spices	MPKV, Rahuri	24 <sup>th</sup> - 25 <sup>th</sup> June, 2016



Scientist	Program	Venue	Date / Duration
V. Baskaran	3 <sup>rd</sup> International conference on Agriculture, Horticulture and Plant Sciences at New Delhi	New Delhi	25 <sup>th</sup> to 26 <sup>th</sup> June, 2016
A.Velmurugan	Geosstatistical Application in Agriculture and Farmers Welfare	NSSO, Port Blair	29th June, 2016
B. Gangaiah	Small Scale Micro-grid Solutions for Andaman & Nicobar islands	DBRAIT, Port Blair	21st July, 2016
B. L. Meena	Recent Innovations in Management of Organic Production Systems	ICAR- IARI, New Delhi	05th to 25th Aug., 2016
A .Anuraj	International Conference on Advances in Algal Biotechnology	VIT University, Vellore	10th -12th August, 2016
P. K. Singh	XI Annual Review Meeting of ICAR Seed Project- Seed Production in Agricultural Crops	G. B. Pant University of Agricultural Science and Technology, Pantnagar	17 <sup>th</sup> - 18 <sup>th</sup> Aug., 2016
K. Saravanan	International Conference on Aquaculture, Reflect and Restore Tempo of Vannamei Shrimp Farming in India (ACCRRI'16)	TNFU & World Aquaculture Society at Chennai	23 <sup>rd</sup> to 24 <sup>th</sup> Aug., 2016
Awnindra K Singh	9 <sup>th</sup> Global Agriculture Leadership Summit	Hotel Taj Palace, New Delhi	8 <sup>th</sup> – 9 <sup>th</sup> Sept., 2016
A Anuraj & J. Raymond Jani Angel	International Training Workshop on Taxonomy of Crustacean (ITWOTAC 2016)	University of Kerala, Thiruvananthapuram	20 <sup>th</sup> - 23 <sup>rd</sup> Sept., 2016
Jai Sunder	Annual Review Meeting of AICRP ADMAS	Ahmedabad	23 <sup>rd</sup> – 24 <sup>th</sup> Sep., 2016
Jai Sunder, M.S.Kundu, T.Sujatha & Sophia Inbaraj	Seminar on World Rabies by DAHVS, A&N Admn.	Veterinary Hospital, , Port Blair	28th Sept., 2016
Jai Sunder	Midterm Review Meeting of AICRP on Goat Improvement	ICAR-CIRG, Makdhom	5 <sup>th</sup> Oct., 2016.
Jai Sunder & T.Sujatha	1st International Satellite Symposium (ISS)–2016, International Academy of Biosciences (IAB) on Advances in Animal Sciences and Biomedicine in 21st Century	Satellite Symposium on line	12 <sup>th</sup> Oct., 2016
R. Kiruba Sankar	Online RTI Implantation	NAARM, Hyderabad	24th Oct., 2016
A.Kundu & T.Sujatha	IPSACON 2016	Assam Agricultural University, Guwahati, Assam	3 <sup>rd</sup> – 5 <sup>th</sup> Nov., 2016



Scientist	Program	Venue	Date / Duration
Jai Sunder, M.S.Kundu, V. Baskaran & K. Abirami	Ist International Agro-biodiversity Conference 2016	New Delhi	6 <sup>th</sup> – 9 <sup>th</sup> Nov., 2016
Ajit Waman	National Seminar on Ethnomedicinal Practices in Andaman and Nicobar Islands: Scope, limitation and Prospective	Regional Research Centre for Ayurveda, Port Blair	11 <sup>th</sup> -12 <sup>th</sup> Nov., 2016
A.Velmurugan	Scientific and Technical Terminologies	HRD, GOI, New Delhi,	15 <sup>th</sup> - 16 <sup>th</sup> Nov., 2016
Shardul Vikram Lal	Optimization of Production Efficiency of Livestock –Fish Integrated Farming	ICAR-Research Complex for Eastern Region, Patna	17 <sup>th</sup> Nov., - 7 <sup>th</sup> Dec., 2016
B. Gangaiah	IV <sup>th</sup> International Agronomy Congress	IARI, New Delhi	22 <sup>nd</sup> – 26 <sup>th</sup> Nov., 2016
T. Subramani	Workshop on Knowledge Management through Crowd Sourcing	JNRM College, Port Blair	25 <sup>th</sup> Nov., 2016
T. Sivaramakrishnan	National Seminar on Aquaculture Diversification: the Way Forward for Blue Revolution	ICAR-CIFA, Bhubaneswar	1 <sup>st</sup> – 3 <sup>rd</sup> Dec., 2016
T. Subramani	Training on Water Resource Management under Jal Kranti Abhiyan by MoWR, Govt. of India	CIARI, Port Blair	14 <sup>th</sup> -15 <sup>th</sup> Dec., 2016
B.L.Kasinath	5 <sup>th</sup> MDP training programme for newly recruited Programme Coordinators of KVK	Three phases I.NAARM-Hyderabad II. KVK, Calicut III. ATARI, Kolkata	16 <sup>th</sup> Dec., 2016 to 20 <sup>th</sup> Jan., 2017
I.Jaisankar	IV (XXXII of Project) Biennial Workshop of AICRP-IFS	SKUAST, Jammu	20th - 21st Dec., 2016
R. K. Gautam, P. K. Singh, S.K. Zamir Ahmed & Awnindra K .Singh	Plant Genome Savior Award -2016 organized by PPV & FRA at IARI, New Delhi.	IARI, New Delhi	21st Dec., 2016
I.Jaisankar	National Seminar on Tree and Tree Based Land Use Systems for Livelihood, Nutritional and Environmental Security	Navsari Agricultural University, Gujarat	22 <sup>nd</sup> and 23 <sup>rd</sup> Dec., 2016
A.Kundu, M.S.Kundu, T. Sivaramakrishnan, K. Saravanan & Sophia Inbaraj	Hindi Workshop	ICAR-CIARI, Port Blair	22 <sup>nd</sup> Dec., 2016 to 10 <sup>th</sup> Jan., 2017
K. Abirami	Fourth Annual Group Meeting of AICRP on Fruits	IIHR, Bengaluru	4 <sup>th</sup> - 7 <sup>th</sup> January, 2017



Scientist	Program	Venue	Date / Duration
V. Baskaran	National Conference on Recent Advances in Floriculture with Major Focus on Hilly Region	Dimapur, Nagaland	13 <sup>th</sup> to 15 <sup>th</sup> January, 2017
T. Sivaramakrishnan & K. Saravanan	Recent Trends in Bioinformatics	ICAR-CIARI, Port Blair	24 <sup>th</sup> -25 <sup>th</sup> Jan, 2017
A.Velmurugan	ICAR Research Data Repository for Knowledge Management	NAAS Complex, New Delhi	24th - 25th Jan., 2017
Ajit Waman	XIII Agriculture Science Congress	UAS, Bengaluru	21st -24th Feb., 2017
S.K. Zamir Ahmed, Jai Sunder & M.S. Kundu	Seminar on One Health Approach : Emerging Infectious Diseases and Challenges	RMRC, Port Blair	23 <sup>rd</sup> Feb., 2017
Soobedar Yadav	Recent Trends in Bioinformatics	ICAR-CIARI	24 <sup>th</sup> - 25 <sup>th</sup> Feb., 2017
I.Jaisankar	9 <sup>th</sup> Meeting of State Board for Wildlife of ANI	Raj Niwas, Port Blair	08th March, 2017
	Issues Related to Optimal Utilization of Infrastructure Created at the Institutes.	ASRB, KAB – I, New Delhi	10 <sup>th</sup> March, 2017
Awnindra K Singh	Coastal Ecosystem of India: Recent Developments and Future Strategies	NIRJAFT, Kolkata	19 <sup>th</sup> March, 2017
I.Jaisankar	National Workshop on Agro forestry Strategies for Climate Change Mitigation and Adaptation	Forest College and Research Institute, TNAU, Mettupalayam	21st - 22nd March, 2017
K. Abirami & Pooja Bohra	State level Seminar cum Exhibition on Processing and Product Diversification of Fruits	DBRAIT, Port Blair	24 <sup>th</sup> – 25 <sup>th</sup> March, 2017



# HUMAN RESOURCES DEVELOPMENT OF STAKEHOLDERS

# a) Training to stakeholders

Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
1	Sensitization- cum- awareness on reduction of post harvest losses through processing and value addition of food crops	3 <sup>rd</sup> April, 2016	38	Farmers	Neil Island	NRM
2	Improved rural poultry farming practices	5 <sup>th</sup> – 7 <sup>th</sup> April, 2016	12	Farm women	ICAR-CIARI	NABARD
3	Post harvesting processing & value addition in fruit and vegetable	13 <sup>th</sup> April, 2016	28	Farmers	Kerelapuram	NRM
4	Sensitization- cum- awareness on post	13 <sup>th</sup> April, 2016	37	Farmers	Diglipur	NRM
	harvest processing and value addition	15 <sup>th</sup> April, 2016	36	Farmers	Mayabunder	NRM
	in fruits and vegetables	16 <sup>th</sup> April, 2016	35	Farmers	Billy ground	NRM
5	Reduction of post harvest losses: a way to enhance food security	17 <sup>th</sup> April, 2016	29	Farmers	Rangat	NRM
6	Integrated farming system and kitchen gardening for nutritional security	20 <sup>th</sup> April, 2016	40	Farmers	Rajiv nagar, Campbell Bay	H&F and NRM Division
7	High yielding varieties of rice and nursery management	29 <sup>th</sup> June, 2016	35	Farmers	Keralapuram	FCI&P and ORC, Diglipur
8	Induced breeding and culture of carps	6 <sup>th</sup> – 8 <sup>th</sup> July, 2016	23	Farmers	ATIC, CIARI	FSD
9	Goat farming	15 <sup>th</sup> July, 2016	15	Farmers	ICAR-CIARI	ASD
10	Weed management on rice	21st July, 2016	83	Farmers	Hut Bay, Little Andaman	FCI&P
11	Changing weather and plant protection	28 <sup>th</sup> July, 2015	20	Farmers	Collinpur, S. Andaman	NRM



Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
12	Breeding and seed production of exotic carps	28 <sup>th</sup> -30 <sup>th</sup> July, 2016	07	Farmers	ATIC, CIARI	FSD
13	Post harvest processing and value addition of mango, pineapple and bael	9 <sup>th</sup> – 11 <sup>th</sup> Aug., 2016	49	Farmers	Port Blair	NRM
14	Carp seed production, nursery pond management	11 <sup>th</sup> – 12 <sup>th</sup> Aug., 2016	27	Fishermen	Bimblitan	DoF, ATMA and CIARI
15	Coconut climbing device	20 <sup>th</sup> Aug.,2016	30	Tribal farmers	Harminder Bay, Little Andaman	AICRP on Palms
16	Scientific cultivation of tissue culture raised banana plants	20 <sup>th</sup> Aug.,2016	23		Harminder Bay, Little Andaman	NRM
17	Parthenium awareness cum its ecological management under island ecosystem	20 <sup>th</sup> - 21 <sup>st</sup> Aug., 2016	51	Farmers	Harminder Bay, Little Andaman	NRM
18	Scientific poultry farming	22 <sup>nd</sup> – 24 <sup>th</sup> , Aug., 2016	30	Farmers	KVK, ICAR- CIARI	ASD
19	Vegetable cultivation	1st Sep., 2016	37	Farmers	Kavaratti, Lakshadweep	NRM
20	Feed based aquaculture in island ecosystem	21 <sup>st</sup> - 23 <sup>rd</sup> Sep., 2016	13	Farmer	MRL, Marine Hill	FSD
21	Fodder production on different topography	23 <sup>rd</sup> Oct., 2016	23	Farmers	South Andaman	NRM, KVK and ORC
22	Quarantine and biosecurity of aquatic animals	27 <sup>th</sup> – 29 <sup>th</sup> Sep., 2016	19	Farmers	ICAR-CIARI, Port Blair	FSD
23	Promotion of pulse crops cultivation for sustainable Island agriculture and nutritional security	28 <sup>th</sup> Sep., 2016	49	Farmers	Guptapara	FCI&P and KVK, S. Andaman



Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
24	Cultivation of bacterial wilt resistant Brinjal: CARI Brinjal 1	29 <sup>th</sup> Sept, 2016	29	Farmers	Car Nicobar	FCI&P
25	Conservation and utilization of native landraces of rice through farmers' participation	3 <sup>rd</sup> Oct., 2016	26	Farmers	Lucknow, Mayabubder, North and Middle Andaman	FCI&P and ORC, Diglipur
26	Flower bouquet making and flower arrangement	24 <sup>th</sup> – 25 <sup>th</sup> Oct., 2016	26	Farmers	S.Andaman	H&F
27	Scientific goat farming	26 <sup>th</sup> – 27 <sup>th</sup> Oct., 2016.	25	Farmers	CIARI	AICRP-Goat Improvement
28	Management of bacterial wilt disease in brinjal crop	30 <sup>th</sup> Oct., 2016	65	Farmers	S. Andaman	FCI&P
29	Rodent and pest management in paddy fields & weather based agricultural practices	2 <sup>nd</sup> Nov, 2016	216	Farmers	Subashgram	KVK & NRM
30	Utilization of solar energy for the production of quality copra	26 <sup>th</sup> – 28 <sup>th</sup> Nov., 2016	52	Farmers	Harminder bay	NRM
31	Post harvest management and value addition of produces	28 <sup>th</sup> Nov., 2016	46	Farmers	R.K.Pur	NRM
32	Poultry & goat farming management practice	30 <sup>th</sup> Nov., 2016	40	Farmers	Madhupur, Diglipur	ASD
33	Livestock farming for livelihood support	30 <sup>th</sup> Nov., 2016	31	Farmers	Madhupur, Diglipur	ASD
34	Rodent management in paddy fields	2 <sup>nd</sup> – 4 <sup>th</sup> , Dec., 2016	240	Farmers and youths	Nimbudera	FCI&P and KVK, Nimbudera



CI.						
Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
35	Floriculture: as livelihood option for Island farmers	26 <sup>th</sup> Dec., 2016	70	Farmers	Mayabunder	H & F
36	Scientific cultivation of ginger, turmeric and black pepper for livelihood options	26 <sup>th</sup> - 27 <sup>th</sup> Dec., 2016	75	Farmers	Karmatang, Mayabunder	CSS-NHM & KVK, Nimbudera
37	Post harvest processing and value addition of coconut	27 <sup>th</sup> – 29 <sup>th</sup> Dec., 2016	51	Farmers	Port Blair	NRM
38	Integrated crop management in field crops	28 <sup>th</sup> Dec., 2016	78	Farmers	Subashgram	KVK
39	Recent advance in cole crop vegetables cultivation	28 <sup>th</sup> Dec., 2016	78	Farmers	Subashgram	KVK
40	Scientific goat farming	11 <sup>th</sup> Jan., 2017	5	Farmers	Rajatghar, Baratang	AICRP-Goat improvement
		12 <sup>th</sup> Jan., 2017	20	Farmers	Nimbudera	AICRP-Goat Improvement
		12 <sup>th</sup> Jan., 2017	19	Farmers	Dharampur, Rangat	AICRP-Goat Improvement
		17 <sup>th</sup> Jan., 2017	39	Farmers	Burmanalla, South Andaman	AICRP-Goat Improvement
41	Fish disease diagnosis	17 <sup>th</sup> – 19 <sup>th</sup> Jan, 2017	7	Farmers	ICAR-CIARI, Port Blair	ICAR-CIARI
42	Recent trends in bioinformatics	24 <sup>th</sup> - 25 <sup>th</sup> Jan., 2017	67	Students & Scholars	ICAR-CIARI	DBT
43	Spices cultivation	31st Jan., 2017	84	Farmers	Kerelapuram	ORC
44	HYV of rice, pulses and their management for seed production	02 <sup>nd</sup> Feb., 2016	56	Farmers	Ramnagar	FCI&P
45	Potential of exotic fruits cultivation in Andaman Islands	2 <sup>nd</sup> Feb., 2017	20	Farmers	Nimbudera	ICAR-CIARI
46	Health management of rural poultry through ethno veterinary practices (EVP)	6 <sup>th</sup> – 8 <sup>th</sup> Feb.,2017	95	Tribal farmers	Car Nicobar	Tribal Sub Plan



Sl. No.	Training	Period	Participants (No.)	Type of participants	Venue	Conducted by
47	Lined pond for water harvesting and vegetable production during dry season	7 <sup>th</sup> -8 <sup>th</sup> Feb., 2017	47	Farmers	Kamorta	NRM
48	Intercropping of pulses and vegetables under coconut plantation through rain water harvesting	11 <sup>th</sup> -12 <sup>th</sup> Feb., 2017	62	Farmers	Car Nicobar	NRM
49	Soil health management	13 <sup>th</sup> Feb., 2017	32	Farmers	Kerelapuram	NRM & ORC
50	Cultivation of tuber crops livelihood options of tribal farmers	7 <sup>th</sup> - 8 <sup>th</sup> Feb., 2017	50	Farmers	Vikas Nagar, Kamorta	AICRP on Tuber Crops
51	Production and processing of tree spices	1 <sup>st</sup> to 2 <sup>nd</sup> March, 2017	60	Farmers	Little Andaman	H & F
52	Augmentation of feed and fodder resources in Lakshadweep islands	6 <sup>th</sup> March, 2017	57	Farmers	Mincoy, Lakshadweep	NRM
53	Pulse crops production for sustainable nutritional security in tribal areas	19 <sup>th</sup> -20 <sup>th</sup> March, 2017	93	Tribal farmers	Car Nicobar	FCI&P & KVK, Car Nicobar
54	Technological demonstration and exposition on livelihood options in agriculture and allied fields	25 <sup>th</sup> March, 2015	175	Farmers	Kalipur	ORC & KVK
55	Pulse crops production for sustainable nutritional security in tribal areas	29 <sup>th</sup> -30 <sup>th</sup> March, 2017	64	Tribal farmers	Harmindar Bay	FCI&P



# b) Field Days Conducted

Sl. No	Field day	Period	Participants	Venue	Conducted by
1	Marigold cultivation in modified planting system	10 <sup>th</sup> May, 2016	40	ICAR-CIARI, Port Blair	Н& F
2	Dragon fruit cultivation in Bay Islands at ICAR- CIARI on	9 <sup>th</sup> Aug.,2016	52	ICAR-CIARI, Port Blair	Н&F
3	Farmers participatory variety selection under STRASA	20 <sup>th</sup> Oct., 2016	70	Creekabad, Chouldari, South Andaman	FCI&P
4	Feed management in aquaculture	23 <sup>rd</sup> Dec., 2016	13	Nimbudera	FSD & KVK
5	Demonstration of fish feed formulation	24 <sup>th</sup> Dec., 2016	13	Keralapuram	FSD & KVK
6	Demonstration of low cost fish feed preparation	25 <sup>th</sup> Dec., 2016	07	Ramnagar	FSD & KVK
7	Urdbean high yielding varieties	25 <sup>th</sup> March, 2017	96	Kalipur, North Andaman	ORC & FCI & P

## c) Awareness campaigns

S. No.	Title	Period	Number of Participants	Place
1.	Awareness on National Surveillance for aquatic animal diseases	16 <sup>th</sup> June, 2016	42	Madhupur, Diglipur
	(NSPAAD) of ANI	23 <sup>rd</sup> Nov., 2016	17	Sippighat, South Andaman
		28th Nov., 2016	21	Manpur, South Andaman
		22 <sup>nd</sup> Dec., 2016	22	Billy Ground, Middle Andaman
		17 <sup>th</sup> Feb., 2017	35	Netaji Nagar, Hut Bay



## d) Radio Talks

Title	Date of broadcast	Expert
Weather based farming activities	Weekly program (April 2016 to March 2017)	A.Velmurugan
Planting technique on arecanut	18 <sup>th</sup> April, 2016	L. Brojendra Singh
Disease management in vegetable crops	13 <sup>th</sup> May, 2016	Vivek Kumar Pandey
Planting technique on fruit crops	15 <sup>th</sup> May, 2016	L. Brojendra Singh
Machliyon mein projanan	22 <sup>nd</sup> June, 2016	Nagesh Ram
Dhan ke beejon ka ankuran evam beejopchaar	4 <sup>th</sup> July, 2016	P. K. Singh
Dweepon mein arhar ki kheti	5 <sup>th</sup> July, 2016	Awnindra K Singh
Deepon me adrak ki Jaivik Krishi	8th July, 2016	V.Damodaran
Role of KVK s in Andaman	14 <sup>th</sup> July, 2016	Nagesh Ram
Enhancing food production and organic waste recycling under rainfed condition	3 weeks (July 16 to Aug 16)	T.P.Swarnam and A.Velmurugan
Activities of KVK, North Andaman	04th Aug., 2016	B.L. Kasinath
Nursery making and seed treatment in rice	05th Aug., 2016	B. L. Meena
Fish culture in paddy field	08th Aug., 2016	Shailesh Kumar
Plantation and fruit crops cultivation in North Andaman	11 <sup>th</sup> Aug.,2016	D. Basantia
Balanced food for family health	17 <sup>th</sup> Aug., 2016	Pooja Kapoor
Soil conservation- why and when ?	18 <sup>th</sup> Aug., 2016	Manoj Kumar
Mushroom cultivation	30th August, 2016	N.C.Choudhuri
Dweepon ki apni teressa bakri	6th Sep., 2016	.Jai Sunder
Nitrogen prabhandan me neem coated urea	08th Nov., 2016	B. Gangaiah
Seed village concept	8th Nov., 2016	R. K. Gautam
Pulses for food security	11th Nov., 2016	Awnindra K Singh
Low cost fish feed preparation for aquaculture in Andaman and Nicobar Islands	18th March, 2017	T. Sivaramakrishnan
Employment opportunities in fisheries sector	18th March, 2017	K. Saravanan

## e) Doordarshan Interview

Title	Date of broadcast	Expert
Diseases of backyard poultry and its control measures	1st June, 2016	A.Kundu
Mushroom cultivation	03 <sup>rd</sup> June, 2016	N.C.Choudhuri & V.K. Pandey
Spice marketing in Andaman	03 <sup>rd</sup> June, 2016	N.C.Choudhuri
Dragon fruit cultivation in Bay Islands	09th July, .2016	K. Abirami
Broiler farming	16th July, 2016	N.C.Choudhuri
IPM	27th July, 2016	Vivek Kumar Pandey
Agricultural practices in crops in Andaman & Nicobar Islands	03 <sup>rd</sup> Aug., 2016	B. Gangaiah
Mangemnt and care of Teressa goat	03 <sup>rd</sup> Aug.,2016	Jai Sunder



Title	Date of broadcast	Expert
Agro techniques for elephant foot yam cultivation in A & N Islands	4th Aug.,2016.	V.Damodaran & Vivek Kumar Pandey
IFS	19th Aug., 2016	Nagesh Ram
Parthenium weed management in Andaman & Nicobar Islands	24th Aug.,2016	B. Gangaiah
Diseases of goats treatment and management	31st Aug.,2016	Jai Sunder
Dhudaru gaiyon ka dekh bhal aur rakh rakhao	31st Aug., 2016	A. Kundu
Animal as component in integrated farming system in A&N Islands	14 <sup>th</sup> Sept., 2016	A. Kundu
Pulse crops for Islands	28th Sept., 2016	Awnindra K Singh
Production of vegetable	07th Oct., 2016	L. Brojendra Singh
Scientific goat rearing in A & N Islands	24th Oct., 2016	Jai Sunder
Island Biodiversity	30 <sup>th</sup> Nov., 2016	S. Dam Roy & S.K. Zamir Ahmed
Dweep mein Pphal aur phoolon ka utpadhan	15th Nov., 2016	L. Brojendra Singh
Arecanut based cropping systems	29th Nov., 2016	AjitWaman
Importance of SHC	09th Jan., 2017	Nagesh Ram
Mushroom cultivation	10th Jan., 2017	Vivek Kumar Pandey
Importance of IFS in island condition	23rd March, 2017	Nagesh Ram
Mera gaon mera gaurav	31st March, 2017	S.K. Zamir Ahmed & Amit Srivastava
Management of drought and moisture stress in agriculture	14 <sup>th</sup> March 2016	A.Velmurugan



# **Training and Capacity Building**

# A. Physical targets and achievement

		Total	No. of training	No. of employees undergone training		
S.No	Category	No. of employees	planned for 2015-16 as per ATP	April- September 2016	Oct., 2016-March, 2017	April 2016- March,2017
1.	Scientists including KVK Heads	39	04	01	03	04
2.	Technical +KVK SMS	31	12	06	06	12
3.	Administrative & Finance	19	05	03	02	05
4.	SSS & TSM	95	Nil	Nil	Nil	Nil
Total 183						

## B. Category-wise training attended by employees

Category : Scientific Staff						
S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (days)	Organizing institution
1.	Pooja Bohra	Scientist	Horticulture & Forestry	Summer school on Contemporary methods of conservation and management of horticulture and genetic resources	21	ICAR-IIHR, Bangaluru
2.	B. L. Kasinath	Sr. Scientist & Head	KVK, Nimbudera	Training cum orientation programme for newly recruited programme coordinators KVK	15	NAARM, Hyderabad KVK, Calicut, ATARI, Kolkata
3.	R. Kiruba Sanker	Senior Scientist	Fisheries Science	RTI, Nodal Officer	01	NAARM Hyderabad
4.	Sophia Imbaraj	Scientist	Animal Science	Microbial identification, preservation &genome analysis	10	NCCS, Pune



Categ	Category : Technical Staff					
S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (days)	Organizing institution
1.	Archna Sharma	Technical Officer	Field Crop Improvement and Protection	Microbial culture handling and maintenance	10	NBAIM, MAU
2.	A. K Tripathi	STO	Bloomsdale Farm	Competence enhancement programme on Motivation and positive thinking for technical officer	10	NAARM, Hyderabad
3.	Tanamai Paul	Farm Manager	KVK, Nimbudera	Use and maintenance of advance instrument in soil and plant analysis	05	IISS-Bhopal
4	M N Das	Sr. Technician	Bloomsdale Farm	Principles of seed production, processing storage and quality assurance	10	IISS-Bhopal
5	Abhay K. Srivastava	STA	CIF	Advance instrumentation in plant and soil analysis	13	
6	Dibakar Khan	STA	Computer Section	Implementation of NIC- se-procurement solution through Cpp Portal	2	NAARM, Hyderbad
7	B.L.Meena	SMS KVK	KVK Nimbudera	Summer School on Recent innovation in management of organic production system	21	ICAR-IARI, New Delhi
8	Shardul Vikram Lal	SMS (Animal Science)	KVK, Nimbudera	Winter School on Optimization of production efficiency of livestock- fish integrated farming'	21	ICAR-RCER, Patna
9	Shailesh Kumar	SMS	KVK, Nimbudera	Advance in experimental data analysis	21	IASRI, Pusa New Delhi
10	Debabrata Basantia	SMS	KVK, Nimbudera	Recent advance in breeding of approaches and bacterial development of perennial horticultural crops	21	IARI New Delhi
11	Sunil Chakraborthy	Sr. Technician	CIARI, Port Blair	Automobile maintenance road safety and behavioural skills	19	HRM Unit, ICAR
12	Zachariah George	SMS	KVK, CAR Nicobar	Strategies for promoting farmers producers organizations	05	NCCS Pune



Category : Administrative Staff						
S.No	Name of employee	Designation	Discipline/ Section	Name of training programme attended	Duration (days)	Organizing institution
1.	Nehru Ram	UDC	Bill & Cash	H.R modules pay roll	02	IASRI, New Delhi
2.	P. Kakesh Rao	UDC	Store Section	Implementation of NIC s e- procurement solution through Cpp portal	02	NAARM Hyderabad
3.	Prakesh Mandal	UDC	Audit Section	H.R modules pay roll	02	IASRI, New Delhi
4.	Lucy Thomas	Personal Secretary	PS Section	Enhancing efficiency and behavioural skills	07	NAARM Hyderabad
5.	Florence Toppo	Jr. Stenographer	SAO Section	Enhancing efficiency and behavioural skills for Stenographer Grade- III, PAs, PSs, and PPSs.	07	NAARM Hyderabad



# **Round up of Institute Main Activities**

Sl. No.	Activities	Date	
1.	Pradhan Mantri Fasal Bima Yojana (PMFBY) by KVK, South Andaman	4th April, 2016	
2.	Director, ICAR-CIARI alongwith HoD NRM Division visited Lakshadweep Island for discussion on taking over the KVK, Kiltan from Lakshadweep Administration.	4 <sup>th</sup> to 12 <sup>th</sup> April, 2016	
3.	Farmers' Fair on Pradhan Mantri Fasal Bima Yojana by KVK, Nicobar	16 <sup>th</sup> April, 2016	
4.	Project review meeting of both external and institute funded projects under the Chairmanship of Director	18th to 19th April, 2016	
5.	2 <sup>nd</sup> audit for ISO-9001:2008 Certification by External Auditors of BIS, Chennai	12 <sup>th</sup> to 13 <sup>th</sup> June, 2016	
6.	Fortnight Celebration of Swachh Bharat Abhiyan Pakhwara	16th to 31st May, 2016	
7.	International Yoga day	21st June, 2016	
8.	Teressa goat and Nicobari pig recognized as new breeds of India by the NBAGR, ICAR, Karnal, Haryana	21st June,2016	
9.	38 <sup>th</sup> Institute foundation day of the Institute	23 <sup>rd</sup> June, 2016	
10.	National Fish Farmers Day	10 <sup>th</sup> July, 2016	
11.	Half yearly meeting of Town Official Language Implementation Committee, Port Blair	29th July, 2016	
12.	ICAR-ASRB-NET (1) online examination by ASRB, New Delhi	1st to 6th August, 2016.	
13.	Customer Meet by State Bank of India, Port Blair	27th August, 2016	
14.	Annual Sports Prize Distribution	29th August, 2016	
15.	Press Meet on Teressa goat and Nicobari pig recognized as new breeds of India by the NBAGR, ICAR, Karnal, Haryana	29th August, 2016,	
16.	Technician (T-1) examination conducted	4 <sup>th</sup> September, 2016	
17.	Hindi fortnight celebrated	5 <sup>th</sup> to 20 <sup>th</sup> September, 2016	
18.	Fish Feed Mill inaugurated	21st September, 2016	
19.	Pandit Deen Dayal Upadhyay Antyodaya Krishi Puruskar award to KVK/CIARI of Farmer of N&M Andaman	25 <sup>th</sup> September, 2016	
20.	Swachh Bharat Abhiyan Pakhwara	16 <sup>th</sup> to 31 <sup>st</sup> October, 2016	
21.	Hindi Workshop	20th October, 2016.	
22.	Vigilance Awareness Week-2016 with theme Public participation in promoting integrity and eradicating corruption	31st October to 5th November, 2016	
23.	World Fisheries Day at Guptapara, South Andaman	21st November, 2016	
24.	Institute Internal audit for the year 2015-2016 conducted by audit team of IPAI, New Delhi	5 <sup>th</sup> to 15 <sup>th</sup> December, 2016	
25.	Dr A.K. Singh, DDG (Agrl.Extn & Hort. Science), New Delhi visited the Institute to participate in the Policy Makers and Farmers Interaction Meet on Indigenous knowledge and technology for climate change adaptation & International conference on Climate Change Adaptation and Biodiversity: Ecological Sustainability and Resource Management for Livelihood Security	7th & 8th December, 2016	



26.	Prof. Ramesh Chand, Member NITI Aayog, GoI, New Delhi visited the Institute during International Seminar and interacted with the Director & the other delegates.	7 <sup>th</sup> & 8 <sup>th</sup> December, 2016
27.	Policy makers and farmers interaction meet	7 <sup>th</sup> December, 2016
28.	International Conference on "Climate Change Adaptation and Biodiversity: Ecological Sustainability and Resource Management for Livelihood Security" (ASA-ICCB-2016)	8 <sup>th</sup> to 10 <sup>th</sup> December
29.	Agriculture Education Day (AED)	17 <sup>th</sup> December, 2016
30.	Plant Genome Saviour Community Award to Karen community of Middle Andaman for Conserving Traditional Rice Varieties by Shri Radha Mohan Singh, Hon'ble Union Minister of Agriculture & Farmers Welfare, Govt. of India, at New Delhi.	21st December, 2016
31.	15 days Hindi Workshop for Non-Hindi speaking Scientist/technical officer	22 <sup>nd</sup> December, 16 to 9 <sup>th</sup> January, 2017
32.	Half yearly meeting of Town Official Language Implementation Committee	29th December, 2016
33.	Hon'ble Minister of State, Shri Giriraj Singh, Ministry of Micro, Small and Medium Enterprises, Govt. of India visited CIARI and interacted with Director & staff	29 <sup>th</sup> December, 2016.
34.	Krishi Sammelan by KVK, South Andaman	30 <sup>th</sup> December, 2016
35.	Run for Swacchta followed by shramdan and cleaning	28 <sup>th</sup> January, 2017
36.	Awareness on Digital Payments	4th February, 2017.
37.	Sensitization on National Productivity Week (NPW) under the theme From waste to profits through Reduce, Recycle and Reuse	8 <sup>th</sup> February, 2017
38.	Dr. Manas Choudhury, Dy. Advisor to Govt. of India, NITI Aayog visited the Institute	22 <sup>nd</sup> February, 2017
39.	Visit of Director with Nodal and Asstt. Nodal Officer at KVK, Kavaratti, Lakshadweep	28 <sup>th</sup> February to 11 <sup>th</sup> March, 2017
40.	Interaction with Mohan Joseph, Ex-chairman, ASRB, Ex-Director, CMFRI, Kochin	15 <sup>th</sup> March, 2017
41.	ICAR-CIARI participated in <i>Krishi Unnati Mela-2017</i> , by putting up a stall showcasing the R & D activities and display of inputs at New Delhi.	15th to 17th March,2017
42.	Dr. W.S. Dhillion, ADG (Hort.), New Delhi visited the Institute	25 <sup>th</sup> March, 2017
43.	IVRC meeting	28th March, 2017



## **Impression of Delegates**

Delegates	Impression
T. Rangasamy, Director, BIS, Chennai	Good No. of collections, new area of work and the exhibits are very informative and will be quite useful for further studies.
Dr. R.C. Srivastava, VC, Dr. R.P.C.A.U., Pusa Bihar & Ex-Director, CIARI, Port Blair	Nice to see it again. Keep it up.
Dr. A.R. Pathak, Vice-Chancellor, Junagadh Agril. University, Junagadh, Gujrat	Visited museum depicting the traditional agriculture in Island and sincere and hard efforts made by CIARI by developing technologies in all fields of plant, animal, fisheries for upgrading livelihood of farmers of the islands. Very good technologies alongwith its distribution, propagation through training & demonstration has given good results and will certainly improve livelihood of farming community. Congratulations to all those who developed technologies.
Prof M.J. Modayil, Ex-ASRB, New Delhi	Very impressive display of work and achievements. Can perhaps think of touch screen digital display of each component with multilingual audio. Best wishes, keep walking.
Prof. (Dr.) W.S. Dhillion, ADG (Hort.)	Very nice depiction of integrated agricultural models for the benefit of farmers. The Director has put lot of efforts to improve the quality of transfer of technologies. I wish the Institute further grow.
Dr. K.K. Katoch, Ex-Vice-Chancellor (CSKHPKV), Palampur	I am very much impressed with the research activities which are being undertaken by Central Island Agricultural Research Institute under very diverse condition specially, in different Island. Coral preservation and management research efforts are excellent. I wish a very prosperous and happy time to the scientists of this Institute and hope they will serve different people of different islands in a very effective manner. Keep up the sprite the developing new technologies as per need of the area.



### **Linkage and Collaboration with other Departments**

- ICAR Institutes; IVRI, PD ADMAS, CIRG, CSWRI, DPR.
- ICAR- Central Institute of Brackish water aquaculture, Chennai
- TNFU, Nagapattinam, Tamil Nadu
- NAARM, Hyderabad
- Indian Institute of Rice Research, Hyderabad
- TANUVAS, Chennai
- NABARD, Port Blair
- Department of Agriculture & Cooperation, Ministry of Agriculture & Farmers Welfare, Govt. of India, New Delhi
- Department of Nuclear Agriculture, BARC, Trombey, Mumbai
- Protection of Plant Varieties and Farmers Right Authority, New Delhi
- Indian Institute of Pulses Research, Kanpur
- ANGRAU (RARS, Lam Centre), Hyderabad (AP)
- TNAU (NPRC, Vamban), Coimbatore
- Banaras Hindu University, Varanasi
- Directorate of Maize Research, New Delhi
- National Seed Corporation (Regional Office Kolkata), New Delhi
- NBPGR, New Delhi
- DMR, Solan
- IIHR, Bengaluru
- IARI, New Delhi
- NBAIM, Mau, UP
- National Bureau of Agricultural Insect Resources, Bengaluru, India
- Space Applications Centre, Ahmedabad
- Indian National Centre for Ocean Information Services, Hyderabad
- Regional Remote Sensing Centre (ISRO), Nagpur
- CMLRE, Ministry of Earth Science, Cochin
- National Fisheries Development Board, Hyderabad
- National Bureau of Fish Genetic Resources, Lucknow
- RMRC, ICMR, Port Blair
- A & N Administration
- Tribal Council, Nicobar District, A & N Islands
- Department of Agriculture, Animal Husbandry & Veterinary Sciences and Fisheries of Andaman & Nicobar Administration.



### Personnel

Director Dr. S. Dam Roy

### **Head / Incharge Divisions / Section/ KVK**

Head, Division of Animal Science	Dr. A. Kundu
Head, Division of Natural Resource Management	Dr. B. Gangaiah
Head I/c, Division of Horticulture & Forestry	Dr. R.K. Gautam
Head I/c, Division of Field Crop Improvement & Protection	Dr. R.K. Gautam
Head i/c, Division of Fisheries	Dr. R. Kiruba Sankar
Incharge, Social Science Section	Dr. S.K. Zamir Ahmed
Senior Scientist & Head, KVK (South Andaman & Nicobar)	Dr. Nagesh Ram
Senior Scientist & Head, KVK, N & M Andaman	Dr. B.L. Kashinath
Head of Office	Dr. M.S. Kundu (upto 20th March, 2017)
Senior Administrative Officer	Mr. S.K. Singh (w.e.f. 21st March, 2017)
Sr. Finance & Accounts Officer	Dr. Jai Sunder (w.e.f. 22 <sup>nd</sup> Sept., 2017)
Incharge, Priority Setting, Monitoring & Evaluation Cell	Dr. S.K. Zamir Ahmed
Incharge, Computer Cell	Dr. T. Subramani Dr. I. Jaisankar w.e.f. 26 <sup>th</sup> November, 2016
Incharge, Library	Dr. M.S. Kundu
Incharge, Central Instrumentation Facility	Dr. Jai Sunder
Incharge, Legal Cell	Dr. S.K. Zamir Ahmed
Incharge, Estate Section	Er. S.L. Paik
Incharge, Workshop &Instrumentation Cell	Er. M. Arul Selvam
Incharge, Guest House	Dr. V.B. Pandey
Incharge, Security Officer	Mr. A.K. Betal
Incharge, Sippigaht Farm	Dr. V. Bhaskaran
Incharge, Bloomsdale Farm	Dr. P.K. Singh
Coordinator, Bio-Informatics Centre	Dr. T. Subramani Dr. A.K. De w.e.f. 1st December, 2016
Incharge, ITMU	Dr. T. Subramani Dr. I. Jaisankar w.e.f. 26 <sup>th</sup> November, 2016
Coordinator, Out Reach Centre	Dr. S.K. Zamir Ahmed
Incharge PG Cell	Dr. Jai Sunder
Assistant Director (OL)	Mrs. Sulochna
Nodal Officer, KVK, Kavarati & Regional Centre, Minicoy	Dr. B. Gangaiah
Asstt. Nodal Officer	Dr. S.K. Zamir Ahmed
Farm Managers	
Garacharma	Dr. V.B. Pandey
Sippighat	Dr. V. Damodaran
Bloomsdale Farm	Mr. A.K. Tripathi



Vigilance Officer Dr. R.K. Gautam
Transparency Officer Dr. R.K. Gautam
Nodal Officer, HRD Dr. R.K. Gautam

Central Public Information Officer Dr. R. Kirubasankar Nodal Officer online HYPM & RFD Dr.S.K.Zamir Ahmed

Nodal Officer, PIMS, PERMISnet & ASRB Online Dr. T. Subramani (up to 26/11/2016)
Nodal Officer, PIMS, PERMISnet & ASRB Online Dr. I. Jaisankar (since 27/11/2016)

Nodal Officer, Biometric Attendance System Mr. R.N. Mozumdar Nodal Officer, FMS/MTS (ERP) Dr. I. Jaisankar

Nodal Officer, Court Case Monitoring System Mr. Amit Srivastava

Nodal Officer, Swachh Bharat Abhiyan Dr. Jai Sunder

Nodal Officer, MGMG Dr. S.K. Zamir Ahmed

Nodal Officer, TSP Dr. A. Kundu

ISO 9001:2008 Management Representative Dr. S.K. Zamir Ahmed ISO 9001:2008 Asstt. Management Representative Mr. Amit Srivastava

RFD Co-Nodal Officer Mr. Amit Srivastava

### **Division of Natural Resource Management**

Dr. B. Gangaiah, Head (Agronomy)

Dr. A. Velmurgan, Senior Scientist (Soil Science :CF&M)

Dr. T.P. Swarnam, Senior Scientist (Agronomy)

Dr. T. Subramani, Scientist (Agronomy)

Dr. Sachidananda Swain, Scientist (Ag. Structure & Process Engineering)

### **Division of Field Crops Improvement & Protection**

Dr. R.K. Gautam, Principal Scientist & Head I/c

Dr. Pankaj Kumar Singh, Senior Scientist (Plant Breeding)

Dr. Awnindra Kumar Singh, Senior Scientist (Plant Breeding)

Mr. K. Sakthivel, Scientist (Plant Pathology)

Miss. T. Bharathimeena, Scientist (Entomology) (Study leave)

### **Division of Horticulture & Forestry**

Dr. B. Augustine Jerard (Hort.), HoD w.e..f 14th June, 2016 (Study leave)

Dr. R.K. Gautam, Principal Scientist & Head I/c

Dr. V. Bhaskaran, Senior Scientist (Horticulture)

Dr. I. Jaisankar, Scientist (Forestry)

Dr. K. Abirami, Scientist (Fruit Science)

Dr. (Ms) Pooja Bohra, Scientist (Fruit Science)

Dr. Ajit A. Waman, Scientist (Spice, Plantation, Medicinal & Aromatic Plants)

Mrs. Divya Parisa, Scientist (Vegetable Science)

Mr. Soobedar Yadav, Scientist (Spices, Plantation & Medicinal & Aromatic Plants)



### **Division of Animal Science**

- Dr. A. Kundu, Principal Scientist (LP&M) & Head
- Dr. Jai Sunder, Principal Scientist (Veterinary Microbiology)
- Dr. Madhu Sudan Kundu, Principal Scientist (Animal Nutrition)
- Dr. T. Sujatha, Scientist (Poultry Science)
- Dr. Arun Kumar De, Scientist (Animal Biotechnology)
- Ms. Sophia Inbaraj, Scientist (Veterinary Microbiology)
- Dr. K. Muniswamy, Scientist (Animal Biotechnology)

### **Division of Fisheries Science**

- Dr. R. Kiruba Sankar, Scientist (Fish & Fishery Science) & Head I/c
- Dr. (Mrs.) S. Monalisha Devi, Scientist (Fisheries Resource Management)
- Mr. K. Lohit Kumar, Scientist (Fisheries Resource Management)
- Dr. J. Raymond Jani Angel, Scientist (Aquaculture)
- Dr. A. Anuraj, Scientist (Aquaculture)
- Dr. K. Saravanan, Scientist (Fish Health)
- Dr. Venkatesh R. Thakur, Scientist (Aquaculture)
- Mr. Arunjyoti Baruah, Scientist (Fish Health)
- Mr. T. Sivaramakrishnan, Scientist (Fish Nutrition)
- Mr. J. Praveen Raj, Scientist (Fish Health)
- Mr. Arun Kumar Oppoottil Ratheesh, Scientist (Fisheries Resource Management)
- Shri Jackson Debbarma, Scientist (Fish Health)

### **Social Science Section**

Dr. S.K. Zamir Ahmed, Principal Scientist, (Agriculture Extension) & Section I/c

### Krishi Vigyan Kendra, Port Blair

- Dr. Nagesh Ram, Sr. Scientist & Head
- Dr. L.B. Singh, Subject Matter Specialist (Horticulture)
- Er. Bijaya Kumar Nanda, Subject Matter Specialist (Agri. Engineering)
- Mrs. Haripriya Navak, Subject Matter Specialist (Home Science) on study leave
- Mr. N. Bommayswamy, Subject Matter Specialist (Horticulture) on study leave
- Dr. Vivek Kr. Pandey, Subject Matter Specialist (Plant Protection)
- Dr. N.C. Choudhuri, Asstt. Chief Technical Officer (Animal Science)

### Krishi Vigyan Kendra, Nicobar

- Dr. Nagesh Ram, Sr. Scientist & Head I/c
- Mr. Sanjay Kumar Pandey, Subject Matter Specialist (Agronomy)
- Dr. Zachariah George, Subject Matter Specialist (Animal Science)
- Er. Chandrika Ram, Subject Matter Specialist (Agri. Engineering)



### Krishi Vigyan Kendra, North & Middle Andaman

Dr. B.L. Kashinath, Senior Scientist & Head

Dr.Pooja Kapoor, Subject Matter Specialist (Home Science)

Er. Manoj Kumar, Subject Matter Specialist, (Agricultural Engineering)

Mr. Debabrata Basantia, Subject Matter Specialist (Horticulture)

Mr. Batti Lal Meena, Subject Matter Specialist (Agronomy)

Dr. Shardul Vikram Lal, Subject Matter Specialist (Animal Science)

Dr. Shailesh Kumar, Subject Matter Specialist (Fisheries)



### **Committee of the Institute**

### **Research Advisory Committee**

1. Prof. S.K. Sharma : Chairman

2. Dr. W.S. Dhillon : Member (ADG-HS)

3. Dr. H.K. Pradhan : Member (Animal Science)

4. Dr. B.C. Viraktamath : Member (Field Crops)

5. Dr. S. Dixit : Member (Social Science)

6. Dr. V.R. Suresh : Member (Fisheries)
7. Dr. Manish Das : Member (Horticulture)
8. Dr. L.M. Garnayak : Member (Agronomy)

9. Dr. S. Dam Roy : Member (Director, CIARI)

10. Dr. T.V.R.S. Sharma : IMC Member (Farmer Representative)
 11. Shri N.C. Roy : IMC Member (Farmer Representative)

12. Dr. Jai Sunder : Member Secretary

	Institute Variety Release	Co	mmittee		IJSC New Comm	ittee	e member
1.	Dr .S .Dam Roy	:	Director	1.	Shri S.P. Narayan	:	Secretary
2.	Dr. R.K. Gautam, Head I/C, FCI&P and H&F	:	Chairman	2.	Shri Dibakar Khan	:	CISC
3.	Dr. A. Kundu, HOD (Animal Science)	:	Member	3.	Shri A. Babuswamy	:	Member
4.	Dr. B. Gangaiah, Head, (NRM)	:	Member	4.	Shri P. Kakesh Rao	:	Member
5.	Dr. R. Kirubasankar, I/C Head, Fisheries Science	:	Member	5.	Shri K. Ali Akbar	:	Member
6.	Dr. S.K. Zamir Ahmed, I/C Social Science	:	Member	6.	Smti S. Sheela Pal	:	Member
7.	Dr. Nagesh Ram, Sr. Scientist & Head, KVK, Port Blair:	÷	Member				
	Internal Complaints C	om	mittee		Foreign Deputation	on C	ommittee
1.	Dr. K. Abirami	:	Chairperson	1.	Director	:	Chairman
2.	Mrs. Ratna Kannan (Ex-Chairperson of A&N State Social Welfare Board)	:	Member	2.	Dr. R.K. Gautam	:	Member
3.	Smt. Sibani Sengupta	:	Member	3.	Dr. A. Kundu	:	Member
4.	Dr. M.S. Kundu	:	Member	4.	Dr. A. Velmurgan	:	Member
5.	Dr. A.K. Singh	:	Member	5.	A.O I/c	:	Member Secretary
6.	Dr.(Mrs.) T. Sujatha	:	Member Secretary				



	Award Screening Co	mm	nittee		Works Co	mmi	ttee
1.		:	Chairman	1.	Dr. M.S. Kundu	:	Chairman
2.	Dr. A. Kundu	:	Member	2.	Mr. R.N. Mozumder	:	Member
3.	Dr. A. Velmurugan	:	Member	3.	Er. S.L. Paik	:	Member
4.		:	Member	4.	SFAO	:	Member
5.	Dr. S.K. Zamir Ahmed, I/c	:	Member	5.	Dr. Jai Sunder	:	Member
	PME Cell		Secretary				
				6.	Mr. A. Selvam	:	Member Secretary
	Tender Opening Con	nm	ittee		Purchase Adviso	ry C	Committee
1	. Dr. P.K. Singh	:	Member	1.	Dr. A. Kundu	:	Chairman
2	Dr. T. Sujatha	:	Member	2.	Dr. M.S. Kundu	:	Member
3	. SFAO	:	Member	3.	Dr. T.P. Swarnam	:	Member
4	Shri R.N. Mozumder AO I/c	:	Member	4.	Dr. Kiruba Sankar	:	Member
			Secretary	5.	SFAO	:	Member
				6.	Shri R.N. Mozumder,	:	Member Secretary
					AAO		
	Library Management (	Con			Local Pu	rcha	<del>-</del>
1		:	Chairman	1.	Dr. Jaisunder	:	Chairman
2	3	:	Member	2.	Er. S.L. Paik	:	Member
3		:	Member	3.	Dr. Shaktivel	:	Member
4	. Dr. Kiruba Sankar	:	Member	4.	SFAO/ Representative	:	Member
5	. Librarian	:	Member	5.	Shri R.N. Mozumder,	:	Member Secretary
	H. All A. All C.		Secretary		AO I/c		- Committee
	House Allotment Co	mm	Γ	1	Condemnation & Au	uctio	r
1		:	Chairman	1.	Dr. Jai Sunder	+:	Chairman
2		:	Member	2.	Dr. A.K. Singh	-	Member
3	8	:	Member	3.	Dr. T. Subramani	<u> </u>	Member
4	37	:	Member	4.	Er. S.L. Paik	:	Member
5	•		Member	5.	SFAO	<u> </u> :	Member
6	Er. S.L. Paik	:	Member	6.	Shri R.N. Mozumder,	:	Member Secretary
			Secretary		AO I/c		
	Cultural Programme (	Com	ımittee		Price Fixation Committ	ee	
1		:	Chairman	1.	Dr. B. Gangaiah	1:	Chairman
2		:	Member	2.	Dr. P.K. Singh	:	Member
3		:	Member	3.	SFAO/ Representative	:	Member
4		:	Member	4.	Dr. V. Damodaran	:	Member
5		:	Member	5.	Mr. A.K. Tripathi	:	Member
					•		
6	. Secretary, IJSC	:	Member	6.	Secretary, IJSC	:	Member



8.	Shri Praveenraj	:	Member		Landscape & Beautifi	icat	ion Committee
9.	Shri Sivaramakrishnan	:	Member	1.	Dr. V. Bhaskaran		Chairman
10.	Shri Arun Kumar O.R.	:	Member	2.	Dr. V. Damodaran	:	Member
11.	Dr. Jai Sunder	:	Member Secretary	3.	Mr. Venkatesh Ramrao Thakur		Member
	Official Language C	omr	nittee	4.	Mr. A.K. Tripathi		Member
1.	Director	:	Chairman	5.	Mr. Shyam Sunder Rao		Member
2.	Dr. R.K. Gautam	:	Member	6.	Dr. V.B. Pandey		Member Secretary
3.	Dr. M.S. Kundu	:	Member		Sports Cor	nmi	ttee
4.	Dr. S.K. Zamir Ahmed	:	Member	1.	Dr. Jai Sunder	:	Chairman
5.	Dr. A.K. Singh	:	Member	2.	Dr. R. Kiruba Sankar	:	Member
6.	Dr. A. Velmurgan	:	Member	3.	Mr. K. Lohith Kumar	:	Member
7.	Dr. Abhay Srivastava	:	Member	5.	Dr. N.C. Choudhury		Member
8.	Shri Lohit Kumar	:	Member	6.	Dr. S. Monalisa Devi	:	Member
9.	Shri Amit Srivastava	:	Member	7.	Smt. Shibani Sengupta	:	Member
10.	Dr. Venkatesh Ramrao Thakur	:	Member	8.	Dr. K. Saravanan		Member
11.	Mr. Shyam Sunder Rao	:	Member	9.	Mr. A. Babuswamy	:	Member
12.	Smt. Sulochana	:	Member Secretary	10.	Dr. A. Anuraj		Member
	Technical Evaluation	Con	ımittee	11.	Shri Abhay Srivastava		Member
1.	Dr. B. Gangaiah	:	Chairman	12.	Shri Mohd Javed		Member
2.	Dr. A.K. Singh	:	Member	13.	Shri Arunjyoti Baruah		Member
3.	Dr. R. Kiruba Sankar	:	Member	14.	Shri Vijay Rao		Member
4.	Dr. Sakthivel	:	Member	15.	Dr. J. Raymond Jani Angel		Member Secretary
5.	Shri R.N. Mozumder,	:	Member		Website Managem	ent	Committee
	AAO		Secretary	1.	Dr. A. Velmurgan	:	Chairman
				2.	Dr. T. Subramaniam	:	Member
				3.	Dr. R. Kiruba Sankar	:	Member
				4.	Smt. Ani Dath	:	Member
				5.	Shri Dibakar Khan	:	Member Secretary



### New Entrants/ Transfer / Promotion/ Retirement/ Death

### **New Entrants**

- Shri Jackson Debbarma, Scientist CIARI on 11th April, 2016
- Dr. B. Augustine Jerard, HoD (Hort.) CIARI on 14th June, 2016
- Shri Sushil Kumar Singh, Senior Administrative Officer on 21st March, 2017

### **Transferred from CIARI**

- Dr. P. Krishnan, Scientist transferred to (NAARM) Hyderabad on 28th September, 2016
- Shri Jackson Debbarma, Scientist transferred to CIFA, Bhubaneswar on 20th March, 2017
- Shri. Arunjyoti Baruah, Scientist transferred to CIFA, Bhubaneswar on 20th March, 2017
- Shri Sivaramakrishnan Thirugnanamurth, Scientist transferred to CIBA, Chennai on 20th March, 2017
- Dr. Venkatesh R. Thakur, Scientist transferred to CIFRI, Regional Station, Allahabad on 20th March, 2017
- Dr. J. Raymond Jani Angel, Scientist to CIBA, Chennai on 20th March, 2017
- Dr. (Miss) Sophia Inbaraj, Scientist transferred to IVRI, Izatnagar on 28th March, 2017

### **Promotion**

### a) Scientist

- Dr. V. Baskaran, Sr. Scientist (G.P. Rs. 8,000/- to Rs. 9,000/-) (PB -3 to PB-4)
- Dr. A.K. Singh, Sr. Scientist (G.P. Rs. 8,000/- to Rs. 9,000/-) (PB -3 to PB-4)
- Dr. (Mrs.) T.P. Swarnam, Sr. Scientist (G.P. Rs. 8,000/- to Rs. 9,000/-) (PB -3 to PB-4)
- Dr. P. Krishnan, Sr. Scientist (G.P. Rs. 7,000/- to Rs. 8,000/-) (PB -3)
- Dr. (Mrs.) T. Sujatha, Sr. Scientist (G.P. Rs. 7,000/- to Rs. 8,000/-) (PB -3)
- Dr. Babulal Meena, Scientist (G.P. Rs. 6,000/- to Rs. 7,000/-) (PB -3)
- Dr. I. Jaisankar, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)
- Dr. Sachidananda Swain, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)
- Dr. Naresh Kumar, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)
- Dr. Israr Ahmed, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)
- Dr. Kiruba Sankar R, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)
- Dr. (Mrs.) K. Abirami, Scientist (G.P. Rs. 6,000/- to Rs.7,000/-) (PB -3)

### b) Administrative

- Smti. Saida Bibi, PA to PS
- Smti. Shibani Sengupta, Assistant MACP

### (c) Technical

- Dr. S. Murugesan, T-5 to T-6
- Er. M. Arul Selvam, T-6 to T-7-8
- Er. Bijaya Kumar Nanda, T-6 to T-7-8
- Shri N. Bommayaswamy, T-6 to T-7-8
- Shri A.K. Betal, T- 4 to T-5
- Shri Abhay Kumar Srivastava, T-3 to T-4
- Shri M.N. Das, T-1 to T-2



- Shri K. Shyam Sunder Rao, T-1 to T-2
- Dr.(Mrs.) T.P. Swapna, T-1 to T-2

### (d) Skilled Supporting Staff

- Shri Rajnarayan Tiwari, SSS to Technician (13.4.2016)
- Shri Nemai Chandra Paul, SSS to Technician (13.4.2016)
- Shri M. Subramanian- 3<sup>rd</sup> MACP
- Shri K. Thulasi Das- 3<sup>rd</sup> MACP

### **Retirement/VRS**

### **Administrative**

Shri. Joseph George, VRS on 21.9.2016

### **Technical**

• Shri S. Murugesan-T-6,on 30.06.2016

### SSS

- Shri Sebasteen Tirkey, on 30th April, 2016
- Shri Mariyanus Dung Dung, on 30<sup>th</sup> April, 2016
- Shri B. Mahadevaiah, on 30th June,2016
- Shri P. Malaikannu, on 30<sup>th</sup> June, 2016
- Shri M. Subramanian, on 30th September,2016
- Shri Khalil Khan, on 30<sup>th</sup> November, 2016
- Shri K. Thulasi Das, on 30<sup>th</sup> March, 2017

### Left to heavenly abode

- Late Madan Kumar Pandey, TSM on 8th September, 2016
- Late P. Janaki Rao, SSS on 21st February, 2017

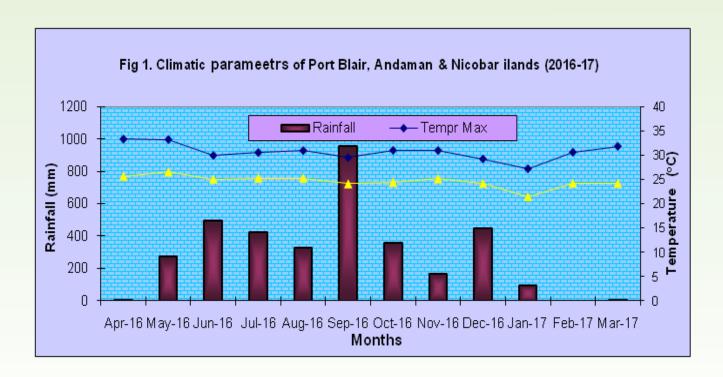






### Climate and Climatic Parameters of Andaman and Nicobar Islands: an Overview

Port Blair, Andaman & Nicobar islands received a rainfall of 3552.3 mm during the year (April, 2016 –March, 2017) in 126 rainy days. Of this rainfall, 2202.6, 970.5 and 380.1 mm were received from South-West (June-September), North-East (October-December) and post monsoon period (January-May). Rainfall received was highest (956.1 mm) in September and least in February (0.6 mm). The overall performance of during the year was rated as normal though it was 372.3 mm higher than the mean rainfall of 3180 mm. The year has recorded a mean annual temperature of 27.65°C with a mean maximum and minimum temperatures of 30.75 and 24.55°C. Mean monthly temperature was highest during April 2016 (33.4 °C) and lowest during January, 2017 (21.3°C). The climatic parameters are depicted in the figure below.







# Results- Framework Document (RFD)

for

# **Central Island Agricultural Research Institute**

(2015 - 2016)

Address: Garacharma, P.O. Box No. 181, Port Blair – 744 101, A& N Islands, India Website ID: http://cari.res.in



### Section 1: Vision, Mission, Objectives and Functions

### 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 in a fragile island ecosystem on sustainable basis.

### **Objectives**

- 1. Conservation of germplasm / genetic resources.
- 2. Natural resource management for island ecosystem and transfer of technology for dissemination and adoption.

### **Functions**

- Development of technologies to fulfill above mentioned objectives.
- Bio-prospecting.
- Transfer of technologies to stakeholders.
- Promote public private partnership.
- Capacity building for entrepreneurship of stakeholders.



Section -2: Inter se priorities among Key Objectives, Success Indicators and Targets

	Poor	%09	55	04	03	3600	490	330	150
/alue	Fair	70%	08	05	04	5300	710	470	250
Target/Criteria value	Good	80%	105	90	05	7000	930	610	350
Tars	Very Good	%06	130	07	90	8700	1150	750	450
	Excellent	100%	155	80	07	10400	1370	068	550
	Weight		28	17	90	02	02	02	02
	Unit		No.	No.	No.	No.	No.	Kg.	Kg.
	Success	I I I I I I I I I I I I I I I I I I I	Germplasm of plant and animal collected and characterized	Development of improved varieties for higher yields and other traits	Development of technology for increasing production	Production of quality planting materials of spices	Production of quality planting materials of coconut	Production of quality planting materials of elephant foot yam	Production of quality planting materials of ginger
	Actions		Collection, characterization and conservation of plant and animal genetic resource	Evolving high yielding lines of agriculture, horticulture and allied crop	Development of production/ management technology	on of anting and led	products		
	Weight		45		35				
	Objectives		Conservation of germplasm / genetic resources		Natural resource management for island ecosystem and transfer of	technology for dissemination and adoption			
	S. S.	• OV	-:		2.				



			1				Targ	Target/Criteria value	'alue	
Objectives	Weight	Actions	Success	Unit	Weight	Excellent	Very Good	Good	Fair	Poor
						100%	%06	%08	20%	%09
			Production of TLS of rice	Tons	02	5.6	4.6	3.6	2.6	1.6
			Production of quality fresh water fish fry	No.	02	31700	26500	21300	16100	10900
		Development of technologies for natural resource management	Number of technologies developed/ tested/ validated	No.	04	03	02	01	0	0
		Animal health management	Disease surveillance surveys and health management practices	No.	02	13	11	60	70	05
		Dissemination of Potential Fishing Zone (PFZ) advisories for enhancing marine fish catch	Number of awareness campaign	No.	02	80	70	90	05	04
		Dissemination of Agro advisory for minimizing production losses	Number of Agro advisories	No.	02	110	92	74	56	38
		Organizing training and	Number of trainings	No.	04	116	76	78	59	40
		demonstration	Number of demonstrations	No.	03	89	57	46	35	24



	Poor	%09	29	09.07.2015		21,	7	08	08
				0.60	06	May 21, 2015	May 7 2015		
value	Fair	20%	31	07.07.2015	92	May 20, 2015	May 6 2015	85	85
Target/Criteria value	Cood	%08	33	04.07.2015	94	May 19, 2015	May 5 2015	06	06
Tar	Very Good	%06	36	02.07.2015	26	May 16, 2015	May 2 2015	95	95
	Excellent	100%	37	30.06.2015	86	May 15, 2015	May 1 2015	100	100
	Weight	)	ю	2	2	2	П	4	-
	Unit		o Z	Date	%	Date	Date	%	%
	Success	Indicators	Research articles published	Annual Report published	Plan fund utilized	On-time submission	On-time submission	Degree of implementation of commitments in CCC	Degree of success in implementing GRM
	Actions		Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Timely publication of the Institute Annual Report (2015-2016)	Utilization of released plan fund	Timely submission of Draft RFD for 2015-2016 for Approval	Timely submission of Results for 2014-2015	Rating from Independent Audit of implementation of Citizens'/ Clients' Charter (CCC)	Independent Audit of implementation of Grievance Redress Management (GRM) system
	Weight	)	'n		2	3		8	
	Objectives		* Publication/ Documentation		* Fiscal resource management	* Efficient Functioning of the RFDSystem		* Enhanced Transparency / Improved Service delivery of Ministry/ Department	
	SI.	No.							



				Z				Tar	Target/Criteria value	value	
Objectives		Weight	Actions	Success	Unit	Weight	Excellent	Very Good	Good	Fair	Poor
							100%	90%	%08	20%	%09
* Administrative Reforms	ive	7	Update organizational strategy to align with revised priorities	Date	Date	7	Nov.1 2015	Nov.2 2015	Nov.2 2015 Nov.3 2015	Nov.4 2015	Nov.5 2015
			ntation s ed g f f f f f f f f f f f f f f f f f f	% of implementation	%	-	100	06	08	70	09
			Implementation of agreed milestones for ISO 9001	% of implementation	%	7	100	95	06	85	08
			Implementation of milestones of approved Innovation Action Plans (IAPs)	% of implementation	%	7	100	06	08	70	09

\* Mandatory Objectives (s)



Section – 3: Trend Values of the Success Indicators

Projected Value for FY 17/18	140	80	07	9200	1250	850	500	4.8	27500
Projected Value for FY 16/17	135	80	07	0006	1200	800	475	4.7	27000
Projected Value for FY 15/16	130	07	90	8700	1150	750	450	4.6	26500
Target Value for FY 14/15	125	07	90	0058	1100	700	400	4.5	26000
Actual Value for FY 13/14	132	07	90	8000	1000	089	475	04	25621
Actual Value for FY 12/13	127	05	05	2000	1100	*	*	04	19500
Unit	No.	No.	No.	No.	No.	Kg.	Kg.	Tons	No.
Success indicators	Gemplasm of plant and animal collected and characterized	Development of improved varieties for higher yields and other traits	Development of technology for increasing production	Production of quality planting materials of spices	Production of quality planting materials of coconut/arecanut	Production of quality planting materials of elephant foot yam	Production of quality planting materials of ginger	Production of TLS of rice	Production of quality fresh water fish fry
Actions	Collection, characterization and conservation of plant and animal genetic resource	Evolving high yielding lines of agriculture, horticulture and allied crops	Development of production/ management technology	Production of seeds, planting materials and value added	products				
Objectives	Conservation of germplasm / genetic resources		e e e	technology for dissemination and adoption					
SI. No.	-:		2.						



	ted Projected Projected for Value for Value for 16 FY 16/17 FY 17/18	figure can be	02 02	12 12	80 80	95 95	100 102	60 63	37 37	1
•	Target Value   Projected for FY 14/15   FY 15/16	ginger was introduced in 2013-14 onwards, hence no figure can be	02 02	11 11	07 07	90 92	26 26	55 57	35 36	02.07.2014 -
	Actual   T   Value for   ft   FY 13/14   Ft   T   T   T   T   T   T   T   T   T	oduced in 2013-1	01	10	05	80	104	58	34	1
	t Value for FY 12/13	inger was intro	00	90	22	100	62	55	34	1
	Unit	m & g	No.	No.	No.	No.	No.	No.	No.	Date
	Success indicators	ls of elephant foot yam &	Number of technologies developed/tested/ validated	Disease surveillance surveys and health management practices	Number of awareness campaign	Number of Agro advisories	Number of trainings	Number of demonstration s	Research articles published	Annual Report published
	Actions	ality planting material	Development of technologies for natural resource management	Animal health management	Dissemination of Potential Fishing Zone (PFZ) advisories for enhancing marine fish catch	Dissemination of Agro advisory for minimizing production losses	Organizing training and demonstration		Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Timely publication of the Institute Annual Report
	Objectives	* Production of qu given for 2012-13							* Publication/ Documentation	
	SI. No.									



for 18									
Projected Value for FY 17/18	66	1	1	1	1	1	•	1	1
Projected Value for FY 16/17	86		ı		•	ı	-	-	1
Projected Value for FY 15/16	<i>L</i> 6	-	-	-	-	-	-	-	-
Target Value for FY 14/15	96	May 16, 2014	May 2, 2014	95	95	Nov.2, 2014	06	95	06
Actual Value for FY 13/14	88.86	ı	ı			-	•	1	
Actual Value for FY 12/13	06.66	1	1	1	1	ı	ı	1	-
Unit	%	Date	Date	%	%	Date	%	%	%
Success indicators	Plan fund utilized	On-time submission	On-time submission	Degree of implementation of commitments in CCC	Degree of success in implementing GRM	Date	% of implementation	% of implementation	% of implementation
Actions	Utilization of released plan fund	Timely submission of Draft RFD for 2014-2015 for Approval	Timely submission of Results for 2013-	Rating from Independent Audit of implementation of Citizens' / Clients' Charter (CCC)	Independent Audit of implementation of Grievance Redress Management (GRM) system	Update organizational strategy to align with revised priorities	Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	Implementation of agreed milestones for ISO 9001	Implementation of milestones of approved Innovation Action Plans (IAPs)
Objectives	Fiscal resource management	Efficient Functioning of the RFD System		Enhanced Transparency / Improved Service delivery of Ministry/	Department	Administrative Reforms			
SI. No.									



# Section 4 (a): Acronyms

Description	KrishiVigyan Kendra	Non Government Organization	Information and Communication Technologies	Integrated Nutrient Management	Truthfully Labelled Seed	Ministry of Agriculture	Andaman & Nicobar	Coconut Development Board	National Bank on Agriculture and Rural Development	Potential Fishing Zone
Acronym	KVK	NGO	ICT	INM	TLS	MoA	A&N	CDB	NABARD	PFZ
SI.No.	1.	2.	3.	4.	5.	.9	7.	8.	9.	10.



Section 4 (b): Description and definition of success indicators and proposed measurement methodology

General Comments	Germplasm of Rice, Paddy, Pulses, Brinjal Indigenous Vegetables, Tuber Crops, Medicinal, Ornamental crops, Microbes, Livestock, Nicobari fowl, Nicobari pig, Marine fin & shell fishes collected to improve the diversity and germplasm repository	Evaluation is done for agronomics(yield attributes), quality or stress (biotic/abiotic) tolerance/ resistance to support development of improved varieties for different agro-ecological zones and for specific purpose	To ensure higher productivity/ profitability and sustainability of production system	Planting material includes seedlings of spices	Planting material includes seedlings of coconut/arecanut
Measurement	Number of germplasm accessions collected	Number of improved varieties developed (Rice/Noni)	Number of production technologies for crop & livestock farming system developed	Number of planting material produced	Number of planting material produced
Definition	Basic genetic resource for crop improvement	Germplasm / improved breeding lines/hybrids are evaluated in field trials for development of improved varieties	Cropping system/INM/ cultivation packages refers to the maintenance of soil/ plant, ecosystem at an optimum level for enhancing productivity/profitability/ sustaining productivity through optimization of the resources	Production of planting material in the form of spices	Production of planting material in the form of coconut/arecanut
Description	Germplasm is the basic requirement to develop improved variety	The experimental material developed through selection/hybridization using selected germplasm is evaluated	Cropping system/INM/ cultivation packages are evaluated for improving productivity & profitability	Production of quality planting materials for distribution to development agencies/ farmers and other stakeholders	Production of quality planting materials for distribution to development agencies/ farmers and other stakeholders
Success Indicator	Germplasm of plant and animal collected and characterized	Development of improved varieties for higher yields and other traits	Development of technology for increasing production	Production of quality planting materials of spices	Production of quality planting materials of coconut/arecanut
SI. No.	<del>-</del>	2.	3.	4	5.





SI. No.	Success Indicator	Description	Definition	Measurement	General Comments
13.	Number of agro- advisories	To issue weather based agro-advisories through print and electronic media	To provide information on forecasted weather to minimize losses	Number of agroadvisories issued	To enhance technology adoption through print and electronic media
14.	Number of trainings	Organize trainings involving ICT, KVK/NGOs and other stakeholders	To enable dissemination of technology for enhancing technology adoption	Number of training conducted	To enhance technology adoption through dissemination of technologies for wider audience of stakeholders
15.	Number of demonstrations	Organize demonstrations in participatory mode	To enable dissemination of technology for enhancing technology adoption and acceptance for profitability	Number of demonstrations conducted	To enhance technology adoption through demonstrations in participatory mode in agriculture and allied field in different cluster of villages



Section 5: Specific performance requirement for other departments that are critical of delivering agreed results

Location Type	State	Organisation Type	Organization Name	Relevant Success Indicator	What is your requirement for this organization	Justification for this requirement	Please quantify your requirement from this organization	What happens if your requirement is not met
State Andaman Government and Nicobar Islands		Departments	State Biodiversity Germplasm of Authority/ Forest plant and anima Department/ Tribal collected and Council characterized	Germplasm of plant and animal collected and characterized	Permission to survey/ collection	Without Number of permission it is permission illegal to enter letters issue the reserved forest for collection	Number of permission letters issued	Less number of germplasm accessions collected
State Government	All States	Departments	Directorate of Extension/MOA/ Development Departments/ NGOs	Number of trainings	Sponsoring farmers/ extension personnel for training	If trainees are not deputed, they cannot be imparted training	Number of candidates sponsored	Less number of training will be conducted

Section 6: Outcome / Impact of activities of Department/Ministry



# Annual (April, 2015 to March 31, 2016) Performance Evaluation Report in respect of RFD 2015-2016 of RSCs i.e. Institutes

Name of the Division: Horticulture

Name of the Institution: ICAR-Central Island Agricultural Research Institute, Port Blair

RFD Nodal Officer: Dr. S. K. Zamir Ahmed

Reasons for	shortfalls or excessive achievements, if	applicable	Due to joining of seven new scientists in the field of Horticulture and Fisheries, exploration and collection of germplasm was assigned. Hence the % achievement is more.		-	Seasonal demand by stakeholders.	Seasonal demand by stakeholders.	Seasonal demand by stakeholders.
Percent	achievements against Target values	of 90% Col.	123.07	128.57	183.33	126.43	218.52	193.33
ormance	Performance Raw Weighted Score		28	17	90	00	02	02
Perf			001	100	100	100	100	100
	Achieve		160	60	=	11000	2513	1450
	Target/Criteria value           Very Good         Fair         Poor           90%         80%         70%         60%		55	04	03	3600	490	330
value			08	0.5	40	5300	710	470
//Criteria			105	90	05	7000	930	610
Target			130	07	90	8700	1150	750
	Excellent 100%		155	80	07	10400	1370	068
	Weight F (%)		58	17	90	00	02	02
	Unit		No.	oN.	o N	O	o	X èë
	Success		Germplasm of plant and animal collected and characterized	Development of improved varieties for higher yields and other traits	Development of technology for increasing production	Production of quality planting materials of spices	Production of quality planting materials of coconut	Production of quality planting materials of elephant foot yam
	Actions		Collection, characterization and conservation of plant and animal genetic resource	Evolving high yielding lines of agriculture, horticulture and allied crop	Development of production/ management technology	Production of seeds, planting materials and value added products		
	Weight (%)		45		35			
	Objectives		Conservation of germplasm / genetic resources		Natural resource management for island ecosystem	and transfer of technology for dissemination and adoption		
	S. S.		-i		2.			



Reasons for	shortfalls or excessive achievements, if	applicable	Seasonal demand by stakeholders.	Seasonal demand by stakeholders.	Seasonal demand by stakeholders.	-	Increase due to FMD surveillance jointly conducted by A & N Admn.		Due to good weather and no cloud condition during the period advisories number got increased.	Due to demand of the tribal farmers under TSP during review meeting	Due to demand of the tribal farmers under TSP during review meeting		,
Percent	achievements against Target values	of 90% Col.	188.88	127.82	109.35	200.00	727.27	100	109.78	112.37	124.56	75.00	1
Performance	Weighted	Score	02	02	1.8	04	02	02	1.8	3.6	03	1.8	02
Perf	Raw	Score	100	100	06	100	100	100	06	06	100	09	100
	Achieve ments		850	5.88	28980	04	14	07	101	109	71	27	
	Poor	%09	150	1.6	10900	0	05	04	38	40	24	29	09.07.
value			250	2.6	16100	0	07	90	56	59	35	31	07.07.
Target/Criteria value			350	3.6	21300	01	60	90	74	78	46	33	04.07.
Target			450	4.6	26500	02	11	07	92	97	57	36	2015
	Excellent	100%	550	5.6	31700	03	13	80	110	116	89	37	30.06.
	Weight (%)		02	02	05	04	02	00	00	04	03	3	2
	Unit		Kg.	Tons	No.	No.	S.	No.	No.	No.	No.	No.	Date
	Success Indicators		Production of quality planting materials of ginger	Production of TLS of rice	Production of quality fresh water fish fry	Number of technologies developed/ tested/validated	Disease surveillance surveys and health management practices	Number of awareness campaign	Number of Agro advisories	Number of trainings	Number of demonstrations	Research articles published	Annual Report published
	Actions					Development of technologies for natural resource management	Animal health management	Dissemination of Potential Fishing Zone (PFZ) advisories for enhancing marine fish catch	Dissemination of Agro advisory for minimizing production losses	Organizing training and demonstration		Publication of the research articles in the journals having the NAAS rating of 6.0 and above	Timely publication of the Institute Annual Report (2014-2015)
	Weight (%)											S	
	Objectives											* Publication/ Documentation	
	Š. Š.												



Reasons for	shortfalls or excessive achievements, if	applicable									1	
Percent	achievements against Target values	of 90% Col.	1	-	-		1	-	ı	Nil		
Performance	Weighted	2006	1.4	02	01	02	01	02	01	-	02	95.4
Perfe	Raw	2006	70	100	100	100	100	100	100		100	
	Achieve		92	May 2, 2015	30.6. 2015	100	100	Sept., 24, 2015	100	1	100	_
	Poor	%09	06	May 21, 2015	09.07. 2015	80	08	Nov.5 2015	09	08	09	Rating : Very good
value	Fair	%02	92	May 20, 2015	07.07. 2015	85	85	Nov.4 2015	70	85	70	Rating
Target/Criteria value	Good	%08	94	May 19, 2015	04.07. 2015	90	06	Nov.3 2015	08	06	08	
Target	Very Good	%06	26	May 16, 2015	02.07. 2015	95	95	Nov.2 2015	06	96	8	Score
	Excellent	100%	86	May 15, 2015	30.06. 2015	100	100	Nov.1 2015	100	100	100	Total Composite Score
	Weight (%)		2	2	1	2	-	2	1	2	2	Total
	Unit		%	Date	Date	%	%	Date	%	%	%	
	Success Indicators		Plan fund utilized	On-time submission	On-time submission	Degree of implementation of commitments in CCC	Degree of success in implementing GRM	Date	% of implementation	% of implementation	% of implementation	
	Actions		Utilization of released plan fund	Timely submission of Draft RFD for 2015- 2016 for Approval	Timely submission of Results for 2015-2016	Rating from Independent Audit of implementation of Citizens'/Clients' Charter (CCC)	Independent Audit of implementation of Grievance Redress Management (GRM) system	Update organizational strategy to align with revised priorities	Implementation of agreed milestones of approved Mitigating Strategies for Reduction of potential risk of corruption (MSC)	Implementation of agreed milestones for ISO 9001	Implementation of milestones of approved Innovation Action Plans (IAPs)	
	Weight (%)		2	3		3		7				
	Objectives		* Fiscal resource management	* Efficient Functioning of the RFD System		* Enhanced Transparency / Improved Service delivery of	Ministry/ Department	* Administrative Reforms				
	S. S.											