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ANNUAL REPORT

2003-2004

भाकृ अनुप
ICAR

केन्द्रीय कृषि अनुसंधान संस्थान
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पोर्ट ब्लेयर – ७४४ १०१ अंडमान और निकोबार द्वीप

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प्रस्तावना

अण्डमान एवं निकोबार द्वीप समूह अपने अनोखे जैव विविधता के लिएविख्यात है। इन द्वीपों की बहुमूल्य वनस्पतियाँ तथा जीव-जन्तु यहाँ की गर्म व आर्द्र जलवायु के लिएअनुकूल है। इनकी विभिन्न प्रजातियाँ अपने आप में ही अमूल्य है और साथ ही इन द्वीपों के लिए यह प्राकृतिक संपदा एक वरदान के रूप में है।

केन्द्रीय कृषि अनुसंधान संस्थान ने 23 जून, 2003 को इन द्वीपों में अपने 25 वर्ष पूरे कर लिए है। इन द्वीपों के कृषि विकास तथा उचित फसल प्रणाली के अनुसंधान में निरंतर कार्य चल रहा है। इसके अलावा कृषि व इनसे जुड़े क्षेत्रों के समस्याओं के समाधान एवं विकास के लिए विभागीय कृषि व्यवधानों व तरीकों का प्रयोग कर कृषि विकास में कार्य चल रहा है।

किसी भी तकनीकी व अनुसंधान का कोई महत्व नही होता, जब तक कि वह किसानों तक आसानी से पहुँच न जाए और इसका उपयोग कृषि विकास में हो। इसी बात को ध्यान में रखते हुए हमारे संस्थान के वैज्ञानिक भी सीधे किसानों के खेतों में जाकर आज कार्य कर रहे हैं जिससे किसान भाईयों को सीधा लाभ प्राप्त हो रहा है और यह विधि प्रयोगशाला से किसानों तक या किसानों से प्रयोगशाला वाली बात को दर्शाता है और इसका सीधा लाभ किसानों को आसानी से प्राप्त हो रहा है क्योंकि वैज्ञानिक अपनी तकनीकियों के साथ सीधे किसानों से संपर्क रखते हैं। हाल ही में संस्थान द्वारा कई महत्वपूर्ण कार्य व अनुसंधान किये गए हैं जैसे-पशुओं में बांझपन की समस्या का निदान, *IFS (Integrated farming system)*, इसके अलावा अन्य महत्वपूर्ण उपलब्धियों में *Minor fruits*, फूलों व मसालों की खेती जल-संग्रह प्रणाली आदि में से किसी भी तकनीकी व विधि को बेरोजगार युवक स्वरोजगार के रूप में अपना सकते हैं। यह संस्थान इन द्वीपों के युवकों के भविष्य को ध्यान में रखते हुए स्वरोजगार के कई नए तरीके व साधन उपलब्ध कराने हेतु निरंतर कार्य कर रहा है।

किसानों के सहयोग के बिना किसी भी तकनीकी को सफल बनाना संभव नहीं है। इसी बात को ध्यान में रखते हुए संस्थान में किसानों को बहुत ही महत्व दिया जाता है। साथ ही समय-समय पर वैज्ञानिकों, अन्य विभागों व संस्थानों के साथ मिलकर किसानों की समस्याओं को सामने लाया जाता है। प्रस्तुत रिपोर्ट {2002-2003} में इस संस्थान की वार्षिक वैज्ञानिक उपलब्धियों का संक्षिप्त उल्लेख किया गया है। इन द्वीपों के ग्रामीण विकास को ध्यान में रखते हुए किसी भी सुझाव का हम हार्दिक स्वागत करते हैं।

डॉ. आर.बी.राय
कार्यपालक निदेशक

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ANNUAL REPORT
CARI

PREFACE

Andaman and Nicobar Islands have many disadvantages with regard to agricultural and allied sectors, but have many advantages not fully considered and exploited. The unique biodiversity, unexplored flora and fauna and prolonged rains with newly stable temperature are boon to the islands.

The CARI, which has completed 25 years of its existence on 23rd June, 2003, has been continuously engaged in developing appropriate land use technologies particularly in the area of plantation based and rice based cropping systems. It is focusing its efforts to exploit the areas where islands have advantages through technological interventions and developing integrated and pioneer approach using multi disciplinary resources in solving the problems as well as providing help in agricultural and allied sectors.

Any research work done or technology developed is not complete till it is transferred to the farmers in a simplified way. CARI is laying major stress in this area also and scientists are encouraged to conduct experiments at the farmers field itself. Thus the concept of lab to land and land to lab is effectively intermingled. This also integrates R & D and reduced the gap between development of a technology and its transfer.

The recent pioneering works being done by CARI, are infertility control in bovines, integrated dairy development, Integrated Farming System (IPS) where one component serves as self employment in the family, minor fruits and floriculture in the humid areas, integrated spices development particularly using gliricidia fencing, integrated technology for ornamental fish breeding, runoff water harvesting system in this high rainfall areas etc. These are opening new vista for rural youth and farmers who are gradually being integrated in agricultural and allied activities. This is a positive trend and CARI is putting all its efforts to sustain this.

Without the full participation of farmers, nothing will happen. Therefore, in total perspective of CARI, farmers has been placed on top and a continuous interaction of scientists, farmers, development department, other NGOs is being arranged. The brief annual scientific achievements for the year 2003-2004 is highlighted in this report and we invite one and all for their suggestions to improve us further in helping the rural masses.

Dr. R.B. Rai
Acting Director

सारांश

बागवानी तथा वानिकी विभाग

- आलू-परिवार की सब्जियों के प्रजातीय मूल्यांकन के अध्ययन से यह तथ्य स्थापित हुआ कि मिर्च की के.ए.-2 किस्म तथा बैंगन की बी.बी.-93सी किस्म की पैदावार बैक्टीरिया का मुकाबला करने की ताकत बढ़ जाने के साथ अन्य किस्मों की अपेक्षा अधिक हुई। इन द्वीपों के परिवेश में तोरई तथा फ्रैंचबीन की क्रमश: आई.ए.एच.एस.-1 तथा एम.एफ.बी-5 किस्मों में अधिकतम उपज की संभावनाएँ देखी गई। अदरक की 15 किस्मों के परीक्षण में यह पाया गया कि "महिमा" प्रजाति की पैदावार अन्य प्रजातियों की अपेक्षा अधिक अर्थात प्रति हेक्टेयर उपज 208 क्विंटल हुई ।

- फ्रैंचबीन और फूलगोभी पर किए गए परीक्षण से यह सिद्ध हुआ कि फ्रैंचबीन में 60 कि.ग्रा. तथा फूलगोभी में 120 किलोग्राम फॉस्फोरस के साथ 90 कि.ग्रा. नाइट्रोजन के प्रयोग से कमश: 31:66 क्विंटल प्रति हेक्टेयर तथा 61:40 क्विंटल प्रति हेक्टेयर की आर्थिक पैदावार प्राप्त की जा सकती है।

- अंडमान के समस्त भागों में सर्वेक्षण करके आम के उच्च पैदावारीय वाली डालियों {क्लान्ज} से कलमें चुनी गई। खुले परागण से होने वाले विभिन्न प्रकार के कृंतकों का उपयोग करके नियमित फल देने वाले कृंतकों की बढ़ोतरी के लिए कलमें लगाई गई।

- कुछ सामान्य रूप से पाए जाने वाले फल है, जैसे-पंडानस, पश्चिम-भारतीय चेरी, लसोड़ा, बिलिम्बी, जंगली आम, जंगली आमड़ा, माकी आमड़ा आदि। ऐसे फलों का पोषणिक लाभ कम लोग उठाते हैं। उनका पोषणिक विश्लेषण किया गया जिससे यह जानकारी मिली कि इन फलों में फॉस्फोरस, कैल्शियम तथा जिंक आदि सूक्ष्म पोषक तत्व प्रचुर मात्रा में उपलब्ध होता है। इसका अर्थ यह निकलता है कि इस क्षेत्र की पोषणिक सुरक्षा प्राप्त करने के लिए इन फलों की महत्वपूर्ण भूमिका की संभावना है।

- तीन आर्किड् और संकर आर्किड तमिलनाडु और केरल से प्राप्त किए गए, जिनका अंडमान परिवेश में मूल्यांकन किया गया। इसके अलावा बल्बोफाइलम की पाँच तथा डेन्ड्रोबियम की चौदह स्थानीय प्रजातियाँ एकत्र की गई जिनका कुल संग्रह 57 हो गया एन्थूरियम की 14 उपलब्ध किस्मों के अतिरिक्त एक नई किस्म सैंक्चुअरी पिंक केरल से प्राप्त की गई।

- माइक्रोसोडियम पंक्टेटम और एस्पलोडियम नाइड्स, दो देशी फर्नों का पोषण विश्लेषण किया गया। एसप्लोडियम नाइड्स की तुलना में कैल्शियम {2.00-3.26 प्रतिशत} और फॉस्फोरस {1.32 प्रतिशत} अधिक पाए गए।

- उन्नीस किस्मों में, 'अपराजिता' ने फूल/पौधा/वर्ष {160} की अधिकतम संख्या दर्ज की। 'बीरबल साहनी' {120} को दूसरा स्थान मिला। छाया परिवेश में वर्सेसी ने अधिकतम उपज {472 फूल/वर्ष/मी^{2}} दर्ज की। दूसरा स्थान मिला पिंक स्टार को, जिसकी 400.23 फूल/वर्ष/ मी^{2} उपज थी।

- बॉयोरेग्युलेटर्स के प्रयोग पर किए गए अध्ययन से GA-3 100 पी.पी.एम. के प्रयोग से अबोली किस्म की उपज में 120 ग्रा./पौधा खुले फूल की वृद्धि हुई।
- नारियल के बगीचों में अदरक की फसल उगाने के जो नतीजे मिले, उनसे यह संकेत मिला कि 8 से 20 साल तक की उम्र के नारियल-बागान में 93.75:62.5:31:25 कि.ग्रा. प्रति हैक्टेयर उर्वरक खुराक के साथ अदरक की खेती कारगर ढंग से की जा सकती है। नारियल के बगीचों में उगाई गई जमीकंद की फसल के नतीजों से यह निष्कर्ष मिला कि 120:90:150 कि.ग्रा. NPK प्रति हैक्टेयर की दर से करने पर प्रयोग से अधिकतम वजन का कंद और अधिकतम उत्पादन किया जा सकता है।
- द्वीपों के संकरी फसल (Alley cropping) पद्धति में मक्के की वृद्धि और उपज के लिए ग्लीरीसिडिया के पत्तियों का प्रयोग करने का जो परिणाम आया, उससे यह प्रदर्शित हुआ कि मक्के की फसल में नाइट्रोजन की प्रति 18 से 45 प्रतिशत् के बीच थी। मक्के का दाना-पैदावार अधिकतम 2 WAS उपचार था। अंडमान की नमीदार जलवायु में ग्लीरीसिडिया के पत्तों से शोधित मिट्टी से अधिक नाइट्रेट नाइट्रोजन और अमोनिया नाइट्रोजन प्रदर्शित हुए।

क्षेत्रीय फसल विभाग

- चावल की उच्च पैदावार संभावित वाली किस्मों की पहचान कर ली गई है। दोहरी फसल व्यवस्था मे अगेती किस्म 'हीरा' उसके तत्काल पश्चात् मध्यम अवधि की किस्मों जैसे क्विंवग लिवान-1 57164 अथवा ताईचुंग-सेन-यू की खेती करने की सलाह दी जाती है। इस व्यवस्था की खेती में 7 टन हैक्टेयर की औसत पैदावार की संभावना है। चावल की सी-14-8 किस्म खाड़ी के द्वीपों में 70 प्रतिशत् क्षेत्र में पुराने समय से उगाई जा रही है और उसकी उपज बहुत ही कम दर पर हासिल होती है। इस व्यवस्था के स्थान पर नई पद्धति का सूत्रपात किया जा सकता है। सुपर राइस की किस्मों में {एम.पी.-27} आई.आर. 6764-46-1-3-2 किस्मों की खेती से औसतन 7.5 टन का उत्पादन हुआ। किंतु उसके लिए तेज गति वाले थ्रैशर {भूसी निकालने वाले यंत्र} की जरूरत होती है। मोटे अनाज तथा पारंपरिक रूप से प्रयोग में लाए जाने वाले थ्रैशर का मेल नहीं है। इस मामले में और अधिक शोध किया जाना बाकी है।
- खारेपन की स्थिति में पनप सकने वाली किस्म बी. टी. एस-24 की खेती शानदार साबित हुई जिसकी पैदावार औसतन उपज 3.5 टन प्रति हैक्टेयर प्राप्त की गई है।
- सोमाक्लोन परिवर्तनों के जरिए अल्यूमिनियम तथा लौह विषाक्तता को सहन करने वाली पंक्तियाँ विकसित की गई है और वे किसानों के खेत में पैदावार-परीक्षण के लिए तैयार है।

- बैंगन की प्रजातियों में बी.बी.-66 सी, बी.बी.-60 सी, और एस. एम. 141 तथा टमाटर की प्रजातियों में एल. ई.-79 और पंत-5 से सोमाक्लोन विकसित किए गए। उनमें से बैंगन और टमाटर के 16 संभावनापूर्ण सोमाक्लोन चुने गए।
- एग्रो बैक्टीरियम माध्यम से बैंगन में आनुवंशिक रूपान्तरण सर्वश्रेष्ठ स्तर तक लाया गया जिसमें चिटिनेस जीन की भूमिका रखी गई। बैंगन किस्म में ऐग्रो बैक्टीरियल स्ट्रेस एल.बी.ए. 4404 सर्वश्रेष्ठ पाया गया। 'स्वर्णश्री' का रूपांतरण का अधिकाधिक स्तर तक आ सका।
- टमाटर की किस्म पी.पी.आई. में एम ओ डी क्रिया अधिकतर हुई जिसका रूपांतरण ए.एम. एस.ओ.डी. जीन से किया गया ।

प्राकृतिक संसाधन प्रबंधन

- नया बिंबलीटान के किसानों के खेत में मृदाओं तथा तलछटों का अध्ययन किया गया। छह मास की अवधि में होने वाले रनॉफ का माप किया गया है। नतीजा यह आया कि जो रनॉफ वन छत्री के नीचे था, वह कम हुआ, जो 4.4 से 33.3 मी.मी. था, इस बात पर निर्भर था कि नवंबर-दिसंबर, 2003 को छोड़कर वर्षा कितनी हुई और उसके बाद सुपारी-छत्रियों का विस्तार कितना था। इसी प्रकार का अध्ययन विभिन्न छत्रियों के नीचे मृदा के मामले मे किया गया। अधिक मृदा ह्रास ऐसे नियंत्रण में हुआ, जिसमें जैव सामग्री के तत्व कम थे।
- भौतिक रासायनिक तथा एंजाइम के गुणधर्मों पर विश्लेषण करने के लिए ऐसे प्राकृतिक बरसाती उष्ण कटिबंधीय वनों के उन स्थलों जिनमें छेड़छाड़ नही की गई थी तथा उनके साथ लगते नारियल, सुपारी, टीक पेड़, पडॉक आदि के बागानों वाले उन स्थलों से मृदाएँ हासिल की गई, जिनमें छेड़छाड़ की गई थी। दीर्घकालीन आधार पर की गई जंगल-कटाई तथा खेती बाड़ी के कारण अणुजीवी क्रिया स्पष्ट तौर पर घट चुकी थी। इस क्रिया के घट जाने का उल्लेखनीय कारण था जैविक सामग्री का निचली पत्तों में घट जाना।
- बी.बी.एफ. पद्धति में भिंडी, रतून भिंडी, बैंगन, रतून-बैंगन, बेबीकार्न-लोबिया, मल्टीकट फॉडर सॉरगम {सी.ओ एफ.में 29} बैंगन फूलगोभी-तोरई। इन पांच श्रृंखलाओं के मेलजोल से खेती करने की सलाह दी जाती है। पंक्ति-प्रतिरोपण {लाइन में पौधे लगाना} की तुलना में सीधा बुवाई {बीज बोना} अधिक लाभकर है। सीधे बुवाई से कम ऊर्जा खर्च हुई। इसलिए आमदनी-लाभ और बी.बी.सी. अनुपात अधिक हुआ, बुवाई के लिए ऊर्जा-अनुपात भी अधिक हो गया।
- सीधे बुवाई के लिए कुछ किस्मों का मूल्यांकन किया गया। क्विंवग लिवान नं. 1 की अधिक पैदावार हुई, अधिक आमदनी हुई, कम उर्जा खर्च हुई । उसके बाद ***Zen-guiAt-1*** और सी. 14-8 का बीजन हुआ। एनारॉबिक बुवाई से हुई पैदावार पंक्ति प्रतिरोपण के समतुल्य हुई, जबकि बेतरतीब प्रतिरोपण {रैडम ट्रांस्पलांटिंग मौजूद पद्धति} से हुई पैदावार कम निकली।

बेतरतीब प्रतिरोपण पद्धति पर उत्पादन-लागत अधिक हुई और उर्जा भी अधिक लगी। अर्थव्यवस्था और ऊर्जा-प्रयोग की दृष्टि से सीधी बुवाई, प्रतिरोपण पद्धति से अधिक उपयोगी सिद्ध हुआ।

- खेती बाड़ी मे यंत्र प्रयोग के सांख्यिकीय आँकड़ों से यह प्रदर्शित हुआ कि पशु ऊर्जा का भाग {55.6 प्रतिशत अचेतन ऊर्जा {44.4 प्रतिशत} से अधिक है। कृषि ऊर्जा की उपलब्धता सिर्फ 2001-02 तक की अवधि में ट्रैक्टर और बिजली चालित टिल्लर की बढ़ोत्तरी देखी गई। धान से भूसी निकालने का काम मोटर चालित थ्रैशर पैडल चालित थ्रैशर, तथा ट्रैक्टर पी.टी.ओ. चालित थ्रैशर से किया गया। सुपर इस की किस्म का भूसी-निवारण दोनों थ्रैशरों से कुशलतापूर्ण नहीं हो सकता। लेकिन ट्रैक्टर चालित थ्रैशर का काम बेहतर हुआ।

पशु विज्ञान विभाग

- आनुवांविशक रूप से विकसित तथा देसी पशुओं की वृद्धि, उत्पादन प्रजनन कार्यों के सम्पादन के अध्ययन तथा सापेक्ष तुलना करने पर ज्ञात हुआ कि अण्डमान की स्थानीय तथा एच.एफ. की संकर प्रजाति में RAPD PCR जाति के बीच वांशिक समानताएँ देखने को मिलती है।
- बैकयार्ड फार्म में कृत्रिम लेयर में *ILI*80 {नर} तथा ब्राउन निकोबारी मादा की संकर प्रजाति जीवित रहने तथा उत्पादन के लिए सर्वश्रेष्ठ है।
- बैकयार्ड कृत्रिम प्रजाति की फार्मिंग के अंतर्गत भोज्य सामग्री के रूप में विकसित लेयर के शरीर का वजन 14 हफ्तों 3में 775 ग्राम होना चाहिए। लैंगिक परिपक्वता क्रमश: 185 हपतों तथा 900 ग्राम में होती है। औसत वार्षिक अण्डों का उत्पादन 164-168 तथा उनका वजन 50 ग्राम होता है। इनके अण्डे देने के समय नैसर्गिक मृत्यु दर 8.56 प्रतिशत् है।
- अण्डमान में जापानीज बटेर के पालन और प्रबंधन में जलवायु संबंधी परिस्थितियाँ इन द्वीपों में ऊष्ण व आर्द्रता की दृष्टि से मानककृत रूप से सर्वोत्तम पाई गई है।
- Inter generic chicken {नर} तथा X Quail {मादा} की संकर प्रजाति क्विकन के नाम से विकसित की गई और इस संकर प्रजाति में व्यस्क बटेर अभिभावकों की विशेषताएँ अधिक लिए हुए पाए जाते है। इस संकर प्रजाति के परिवक्व का वजन बटेर के वजन से अधिक होता है जो व्यावसायिक दृष्टि से अत्यधिक महत्वपूर्ण है। यह संकर प्रजाति उत्पादन की दृष्टि से भी महत्वपूर्ण है। देखने मे ये बटेर से मिलती जुलती होती है।
- टर्की और गिनिया की मुर्गियों का पालन करने पर पाया गया कि इन दोनो के जर्मप्लाज्म ने यहाँ की जलवायु को पूरी तरह ग्रहण कर लिया है और इनके संबंध में और अधिक जानकारी प्राप्त की जा रही है।

- फर्न में माइकोसोरियम पंक्टम में पोषक संरचना इतनी अधिक होती हैं कि इनका उपयोग खाने के स्रोत के रूप खरगोश के पोषण के लिए किया जाता है।
- लैक्टोबैसीलस और यीस्ट के आंतरिक और बाह्य प्रभावों को अध्ययन करने पर पाया गया कि कवक विरोधी क्रियाएँ जीवित उत्पादों में ज्यादा पायी गई। जबकि संबंधित माध्यमों में यह कम थी।
- महत्वपूर्ण जीवित भंडार {पशुधन} के सेरोसरवेयलेंस तथा मुर्गियों संबंधी बीमारियों से ब्यूसिलोसिस का प्रचलन, IBR माइक्रो प्लाज्मोसिस, स्वाइन ज्वर तथा IBD की जानकारी प्राप्त हुई। IBD को नियमित करने वाली दवा IBD के लिए तथा AGPT द्वारा IBD की पहचान के हाइपर इम्यून रोधक सेरा प्रयोग किया गया।
- अण्डमान में Gram streptococcit के साथ staphylococcus बैक्टीरिया यीस्ट, कैन्डीडाको और ग्राम-बैक्टीरिया बोवाइन मास्टीटिस रोग का कारण है।
- मुर्गीपालन उत्पादों की वृद्धि के लिए उद्देश्य से उत्पादन के पश्चात् चिकन का अचार, गिज़ार्ड का अचार, बटेर के अंडों का अचार, चिकन के समोसे आदि का मानकीकरण और उनका दक्षिणी अण्डमान के किसानों और स्वरोजगार समुदायों में व्यापक प्रचार कर उनका व्यावसायीकरण किया गया।

मत्स्य विज्ञान विभाग

- उत्पादन क्षमता के अनुसार खाद्य सीपी की दो प्रजातियों क्रासोस्ट्रीया रिव्यूलेरिज और सेकोस्ट्रिया क्युक्युलेटा की उत्पादन क्षमता का अध्ययन किया गया। सी. रिव्यूलेरीज की विकास दर 7-8 महीनों में 60-69 तक पहुँचने की क्षमता है। खाने योग्य ऑयस्टर खाने योग्य मांस की उत्पादन क्षमता परिपक्व मादा में अधिक होती है।
- खारे पानी के तालाबों में भंडारित मिल्क फिश फिंगर लिंग्स सात महीने में 236 -310 मि. मी. और 97-228 ग्राम की औसत वृद्धि दर्शायी गई।
- इन द्वीपों द्वारा प्रकाशित समुद्री जीव-जन्तु व वनस्पति के 18 मैंग्रूव इस द्वीप समूह में पाए जाते हैं।
- क्लोन फिश एम्प्रीप्रिऑन परकुला की प्रजनन क्षमता से उत्पन्न उत्पादों का आकार 6 महीने में ब्रिकी योग्य हो गया था।
- प्रथम उभयलिंगी, जो लिंग परिवर्तन की क्षमता रखते हैं, नर तथा मादाओं का अवलोकन के बाद कियाशील मादाओं के अध्ययन से ज्ञात हुआ कि इनमें नर से मादा में लिंग परिवर्तन की क्षमता अधिक पाई जाती है।

- मुलेट लिजा टेड दो विलक्षण प्रजातियों की जनसंख्या जैव रासायनिक विशेषता के आधार पर पृथक पाई गई। यह पाया गया कि वालेन्स मीडियम में खारे पानी के सूक्ष्म शैवाल की वृद्धि दर ज्यादा है जो पशुओं के लिए और संवर्धन के लिए सर्वश्रेष्ठ है और जैव रसायन पर आधारित सात सूक्ष्म शैवाल की भी गणना की गई।

सामाजिक विज्ञान

- TAR-IVLP के अंर्तगत किसानों के बीच 10 तकनीकियों का प्रदर्शन किया गया और उनमें से 7 तकनीकियों को दक्षिण और मध्य अण्डमान के किसानों में सफलतापूर्वक स्थानांतरण किया गया। दशरथपुर गॉव की क्षारीय सल्फेट मिट्टी में धान की खेती नाला पर चेक डेम निर्माण के माध्यम से सब्जियों के लिए जल प्रबंध किसानों द्वारा कट फ्लावर की व्यावसायिक खेती अधिक आय के लिए घर के पिछवाड़े उन्नत निकोबारी मुर्गियों का पालन काफी महत्वपूर्ण रहा।
- अण्डमान निकोबार द्वीपों में कुक्कुट पालन व्यवसाय के आर्थिक विश्लेषण पर अध्ययन करने पर पाया गया कि ब्रायलर छोटा और मध्यम फार्म बनाने के लिए, जमीन, बिल्डिंग और सामानों पर में कुल लागत का एक बड़ा भाग खर्च हुआ । बड़े फार्मो पर जैसे पोल्ट्री शेड, भूमि और अन्य सामानों पर बड़ी लागत हुई। छोटा, मध्यम और बडे फार्मो के लिए प्रति ब्रायलर का उत्पादन मूल्य रू0 67.94, 64.88, 62.17 आंका गया। प्रति मुर्गी से रू0 9.26, 12.32 और 15.03 शुद्ध लाभ प्राप्त हुआ। रू0 100/- की लागत पर क्रमश रू0 2.20, 2.29 और 4.31 शुद्ध लाभ पाया गया। दाने का अनुपात दर 2.23, 2.12 और 1.98, मांस के दाने का अनुपात दर 2.96, 3.23 तथा 3.75 और लाभ अनुपात दर 1.13,1.19 और 1.24 पाया गया।
- लेयर में भूमि, बिल्डिंग सहित बिजली सामान व दिवार आदि पर कुल लागत क्रमश: रू0 36,000/- रू0 3,60,000/- और रू0 8000/- पाया गया। प्रति लेयर का उत्पादन मूल्य रू0 481/- आंका गया । प्रति मुर्गी में शुद्ध लाभ रू0 19.37 पायी गई।

EXECUTIVE SUMMARY

DIVISION OF HORTICULTURE AND FORESTRY

- Studies on varietal evaluation of solanaceous vegetables revealed that the variety KA-2 of chillies and BB-93C of brinjal recorded higher yield with increased resistance to bacterial wilt than others. With regard to ridgegourd and french beans, the variety IAHS-1 and MFB-5 were identified as the potential high yielder respectively under island ecosystem. Varietal trial with 15 varieties of ginger revealed that the variety Mahima outyielded others with a yield of 208 q/ha.
- Fertilizer trial on the french beans and cauliflower showed that the application of 60 kg of nitrogen in french bean and 90 kg of nitrogen with 120 kg of phosphorous gave the optimum economic yield of 31.66 q/ha and 61.40 q/ha respectively.
- Scions from high yielding clones of mango was selected by conducting survey in all parts of Andaman and grafted on local rootstocks for multiplication of regular bearing types utilizing interclonal variability resulted from open pollination.
- Nutritional analysis performed in underutilized fruits like Pandanus, West Indian Cherry, Lasoda, Bilimbi, Wild mangoes, Wild amra, Maki amra etc. revealed that the fruits in general are rich in phosphorous, calcium and other micronutrients like Zinc etc.This suggested the potential and important role of these fruits in meeting the nutritional security of the region.
- Three varieties and seven hybrids of orchids were collected from TamilNadu and Kerala for evaluation under Andaman conditions. Apart from this in local collection, five species of *Bulbophyllum* and 14 species of *Dendrobium* were collected which raised the total collection to 57. In addition to the existing 14 varieties of Anthurium, one new variety Sanctury Pink was collected from Kerala.
- Among different potting media tried for *E. andamanensis,* maximum number of flowers/spike (26.3) was recorded in the treatment consisting of Coconut husk+ charcoal+brick pieces+coir dust+leaf mould. For Anthurium, the media consisting of compost, charcoal, brick pieces, coconut husk and sand gave the best result producing 16 flowers/plant/year having maximum flower stalk length (18.9 cm).
- Nutritive analysis of two indigenous ferns, viz. *Microsorium puctatum* and *Aspledium nidus* were carried out. Calcium (2.00-3.26%) and phosphorus (1.32%) were more in *Microsorium punctatum* when compared to *Asplenium nidus.*
- Among the 19 varieties, Aparajitha recorded the maximum number of flowers/plant/year (160) followed by Birbal Sahini (120). In gerbera, under shade conditions Versace gave the maximum yield (472 flowers/year/m^2) followed by Pink Star (400 flowers/year/m^2).
- Studies on use of bioregulators revealed that application of GA_3 100 ppm increased the yield (120g/plant of loose flowers) in crossandra variety Aboli.
- The results of intercropping of ginger in coconut gardens suggested that cultivation can be taken up in 8-20 year old plantation effectively with a fertilizer dosage of 93.75:62.5:31.25 kg NPK ha^{-1} for ginger. The results of elephant foot yam intercropped in coconut gardens revealed that application of 120:90:150 Kg NPK ha^{-1} recorded maximum tuber weight and highest yield.

- Effect of *Gliricidia* leaves application on growth and yield of maize in alley cropping system of the Islands revealed that recovery of nitrogen from *Gliricidia* pruning by the current maize crop ranged from 18 to 45%. Shoot biomass and grain yield of the maize was maximum in 2 WAS treatment.
- Pool sizes of nitrate N, ammonium N and rate of their formation in the soil amended with *Gliricidia* leaves in humid tropical climate of Andaman exhibited greater Nitrate nitrogen and ammoniacal nitrogen rate in the soil treated with *Gliricidia* leaves at zero week after sowing (0WAS) and 2WAS treatments compared to that in control.
- The results of macropropagation of padauk wood, gurjan and marblewood reveal that two months after treatment padauk cuttings treated with IBA 500 ppm provided 55 per cent of rooting followed by IAA 500 ppm (50 per cent).

DIVISION OF FIELD CROPS

- Promising high yielding rice varieties from different maturity groups have been identified. In a double cropping system, cultivation of a very early variety-Heera followed by medium duration varieties like Quing Livan 1, Nanjing 57164 or Taichung Sen Yu is recommended and an average yield of 7 tons/ha could be achieved. Councurrently, this practice would replace the exceedingly low yielding age old tall traditional rice cultivar C14-8, which covers about 70% rice growing area in Bay Islands. Among the super rice varieties (NPT) IR67964-46-1-3-2 was found to produce about 7.5 tons. However, coarse grains and incompatability to conventional thresher (it requires high speed thresher) needs further research.
- Promising salt tolerant rice variety (BTS 24) developed *in situ* performed excellent in farmer field. An average of 3.5 tons/ha yield has been obtained across locatios.
- Al and Fe toxicity tolerant lines have been developed through exploitation of somoclonal variation and are now ready for yield trial in farmers' field. A set of new clones has been developed for subcellular targeting and mitochondia involving modern reporters like gfp, bfp and cfp with deployment of cox (leader sequence) TP and NLS swquences. crylA(b) and crylA(c) have been cloned in pCAMBIA 1035.2 to accomplish Agrobacterium -mediated genetic transformation. Putative transgenics involving crylA(b), CryA(c) and AmSod have been developed in Basmati 370 and Tarori Basmati.
- *In vitro* as says, insect feeding biassays etc. have showed a few promising lines. Further work involving Chitinars, xa21 and mtiD for inflate tolerance towards sheath blight, bacterial blight and salinity are in steady progress. Mapping population involving IR29 X Pokkali has been developed to tag salt tolerant gene/s. Phenotyping and molecular profiling involving RAPD, micro satelite and AFLP are progressing.
- Somaclones developed from brinjal varieties, viz. BB66C, BB60C and SMI41and tomato varieties, viz. LE 79 and Pant 5 were evaluated at SC3 and SC4 generations, respectivesly. Among them 16 promising somaclones were selected in brinjal as well as in tomato.

- Agrobacterium - mediated genetic transformation was obtimized in brinjal involving chitinase gene. The Agrobacterial strain LBA 4404 was found to be the best in brinjal var. Swarnashree showing maximum transformation. Chitinase activity in regenerated putative transgenic plants was high in comparison to parental control.
- Tomato varieties PPII, transformed with AmSOD gene showed greater Sod activity at in planta level.
- The shoot damage was more during the first five weeks after transplanting the brinjal, tomato and cauliflower crops, thereafter the pest shifted to the fruits with formation of flowers and fruit. For management of *Leucinodes orbonalis* many varieties were screened and DPL-B5, Arka Keshav, BB-93C and BB-45C of brinjal were found to be tolerant to fruit and shoot borer. Weekly removal of borer infested shoots and fruits and disposal by deep burial and deployment of Pheromone to attract male moth at crop canopy level @ 1 trap/100 m^2 were integrated. There was significant reduction in shoot, fruit damage and increase in marketable yield of brinjal. There was 58. 52 and 74. 52 % shoot, fruit damage reduction in IPM plots as compared to control plots and 2.3 fold increase in yield over control.
- Tomato with intercrop *of Hibiscus subdariffa* (4:1) rows + NPV application twice at 250 LE/ha. at 15 Days interval from 45 DAT was best treatment recording least fruit damage (3.41 %) followed by Tomato sole crop + NPV application twice at 250 LE/ha. at 15 days interval from 45 DAT (6.37 %). As compared to tomato sole crop, tomato with intercrop of *H. subdariffa* recorded less damage (16.22%).
- The application of NPV @ 250 LE/acre significantly reduced the leaf damage in sole cauliflower crop (4.20%) and mustard border with cauliflower (4.55 %), and they both were on par. It is inferred that NPV alone along with 2 % jaggery as phagostimulant was effective in managing *S. litura* in cauliflower.

DIVISION OF NATURAL RESOURCE MANAGEMENT

- Properties of plot soils and sediments in the farmer's field at New Bimblitan were studied. The runoff measurement has been done over a period of six months and results showed that runoff which was less under forest canopy, varied between 4.4 to 33.3 mm depending on the rainfall and followed by arecanut and canopies except November and December 2003. Similar observation was recorded in case of soil loss under different canopies. Greater soil loss occurred in control, which had less organic matter content.
- Soils under undisturbed native wet tropical forests (undisturbed sites) and adjacent disturbed sites under plantations of coconut, arecanut, teak, rubber, paduak etc. were collected for analysis on physio-chemical, chemical and enzyme properties. On long-term basis, deforestation and cultivation significantly reduced microbial activity due to decline in a available organic matter/substrate levels. The use of the combination of parameters to give an index of soil biochemical quality of tropical soils is new.

- In the BBF system, consortium of five sequences, viz. Amaranthus- Bhendi- Ratoon bhendi, Cowpea- Brinjal- Ratoon brinjal, Babycorn- Cowpea- Snake gourd, Multicut fodder sorghum (COFS 29) and Brinjal-Cauliflower-Ridge gourd are recommended for cultivation. This sort of diversified cropping in the beds would reduce the risk of price fluctuations and in turn resulted in higher net income and B:C ratio. Transplanting of Taichung-Sen-Yu followed by its ratoon registered higher yield than S_1P_1 681032.
- Direct seeding registered on par yield with that of line transplanting. Since lesser energy was consumed by direct seeding, the net returns and B:C ratio were higher with direct seeding vis-à-vis line transplanting . Energy ratio was also more for direct seeding.
- Among the varieties evaluated for direct seeding, Quing Livan No. 1 registered better yield, economics and energetics followed by Zen-gui-At-1 and C14-8. Anaerobic wet seeding registered yield on par with line transplanting while random transplanting (present practice) recorded lower yield. The random transplanting method has incurred higher cost of production and also consumed more energy. In terms of economics and energetics, direct seeding was found to be better than that of transplanting.
- Statistical data of farm mechanization revealed that the share of animal power is more (55.6%), followed by inanimate power (44.4%). The availability of farm power per hectare is only 0.41 KW. A very substantial increase in tractor and power tillers has been noticed during 1995-96 to 2001-02. Paddy threshing with motorized hold-on thresher, pedal operated hold-on thresher and tractor PTO operated thresher was done. Super rice variety has not been well threshed with both hold-on threshers. But, tractor operated thresher was found efficient in threshing have lowest and highest output capacities.

DIVISION OF ANIMAL SCIENCE

- Production of F3 generation with 50 % exotic inheritance of Holstein Friesian and 62.5 % exotic inheritance of Jersey (with local cattle) is in progress. Growth, production and reproductive performances were studied and compared between genetically upgraded and local (Desi) cattle. Molecular characterization study revealed that the genetic similarity between the breeds based on RAPD PCR indicated the maximum similarity of crossbred of local cattle of Andaman with HF and crossbreds of Sahiwal with HF.
- Synthetic layer for backyard farming was developed and the performance of the progeny of the crosses of ILI 80 (M) with Brown Nicobari (F) was found to be suitable for backyard farming based on their survivability and production.
- Under backyard farming, the body weight of the progeny of this layer was 775 g at 14 weeks of age. The age and weight at sexual maturity were 185 and 900 g, respectively. The average annual egg production was 164-168 eggs with egg weight of 50 g. The laying period mortality was 8.56%.

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- Housing and managemental conditions for Japanese Quails in A&N islands have been standardized for rearing quails under this hot and humid climatic condition.
- Inter generic Chicken (M) X Quail (F) cross-named 'Quicken' was developed and the crosses were found to be fertile and morphologically were more towards quail parents. Adult body weights of crosses were higher than quails, which have some commercial importance.
- Turkey and Guinea fowl have been introduced and overall performance of these two germplasm showed that they are well adapted to this climate and further study is in progress.
- A fern, *Mycrosorium punctum* was screened for its nutrient composition and the same was used as a edible source of herbage/roughage in rabbit feeding.
- Effect of addition of *Lactobacillus* and yeast to feed ingredients on Aflatoxin levels and *in vitro* antifungal activity of *L. acidophilus*-014 live culture, culture filtrate and sonicated suspension were studied. Results showed that the spectrum of antifungal activity varied and maximum antifungal activity was observed with live culture, followed by filtrate than sonicated suspension.
- Serosurveilance of important livestock and poultry diseases revealed the prevalence of Brucellosis, IBR, Mycoplasmosis, Swine Fever and IBD. Formalized IBD vaccine was found to be effective against IBD and hyper immune sera raised against IBD were used for diagnosis of IBD by AGPT. *Streptococci* followed by *Staphylococcus,* Gram positive, Yeast, *Candida sp.* and Gram negative organisms were found to be the major causative agents for bovine mastitis in Andaman.
- With an aim to promote value addition to the poultry products, various post harvest technologies, viz. chicken pickle, gizzard pickle, quail egg pickle, chicken samosas were standardized and the same were popularized as a commercial venture to the farmers and self help groups of Andaman islands.

DIVISION OF FISHERIES SCIENCE

- Two species of edible oysters, viz. *Crassostrea rivularis* and *Saccostrea cucullata* were studied for culture potential. The peak spat settlement in *C. rivularis* was observed between June and October 2003 and *S. cucullata* during February - April 2003 and September - November 2003. The growth rate of *C. rivularis* was faster to reach 60 - 69 mm in 7-8 months. The edibility of oyster meat was maximum in females with matured gonads.
- The screening of shrimps, *Penaeus monodon, P. merguinsis* and *P. semisulcatus* and crab, *Scylla serrata* for diseases indicated 15% of the shrimps to be the carrier for White Spot Syndrome Virus (WSSV).
- The milkfish fingerlings stocked in brackish water ponds showed average growth of 236-310 mm and 97-228 g in 7 months.
- A compendium on the biodiversity of mangrove ecosystem of Andamans was published after documentation of flora and fauna in 18 mangrove stands.

- The clown fish, *Amphiprion percula* was bred in captivity and the larvae were reared to marketable size in 6 months. The species was found to be protandrous hermaphrodite with sex conversion from male to female during the observance of active female.
- In the mullet, *Liza tade,* two distinct populations were identified based on biochemical characterization. Walnes' medium was found to give maximum multiplication of marine micro algae for stock and mass cultures and biochemical composition of 7 micro algal species has been evaluated.

SOCIAL SCIENCE SECTION

- Under TAR-IVLP, 10 technologies were assessed among the farmers and seven were successfully transferred to the farmers of South and Middle Andaman Islands. Some of the achievements like successful rice cultivation in saline sulphate soils of Dasrathpur village through intervention of suitable variety, participatory water stress management in vegetables through construction of check dam on the nallah, commercial cultivation of cut flowers by the farmers and backyard farmers of improved Nicobari birds for higher income were remarkable during this year.
- In the study on economic analysis of poultry farming enterprises in Andaman and Nicobar Islands, it was found that in case of broilers, the major part of total investment was found to have been made on land in case of small and medium farms, followed by those on buildings and equipment, whereas in case of large farms the major investment was on poultry sheds, followed by on land and equipment. The cost of production per broiler was worked out to be Rs. 67.94, 64.88, 62.17 for small, medium and large farms, respectively. The net return per bird was found to be Rs. 9.26, 12.32 and 15.03. The net return per Rs 100 invested was found to be Rs. 2.20, 2.29 and 4.31 respectively. Feed conversion ratio was found to be 2.23, 2.12 and 1.98; meat-feed price ratio 2.96, 3.23 and 3.75 and benefit cost ratio 1.13, 1.19 and 1.24 respectively. The optimum size of broiler unit in case of small, medium and large farms was estimated to be 166, 505 and 2436 respectively.
- In case of layers, the total investment was found to be Rs. 36, 000, Rs. 3, 60, 000 and Rs. 8, 000 on land, buildings including all electrical and equipment settings and fencing respectively. The cost of production per layer was worked out to be Rs. 481. The net return per bird was found to be Rs. 19.37. The performance efficiency measures such as feed conversion ratio, egg-feed price ratio and benefit cost ratio were worked out to be 3.97, 1.39 and 1.04 in Andaman district.

INTRODUCTION

HISTORICAL PERSPECTIVE

Agriculture in the Bay islands is about 135 years old and obviously started at the expense of forest land with the help of contract labourers and later on the activity was carried on by the settlers from different parts of mainland, India. In 1927, the Department of agriculture was established; till 1901, 10198 ha were cleared of which 4198 ha were put under cultivation. In 1981, the area under cultivation went up to 40594 ha and in the year 2000, the total area reached 50410 ha. Soon after independence, these islands faced the influx of refugees from Bangladesh (erstwhile East Pakistan) and with abrupt influx of these new settlers, the socio-economic status of the existing population underwent a tremendous metamorphosis. To ensure food and economic security, the government allotted 2 ha of cultivable paddy land and 2 ha hilly land to the settlers.

In Nicobar, coconut and arecanut cultivation has a historical past. But unsystematic cultivation and over-crowding population have affected the yields of these plantations very badly. Inspite of government grant and input assistance, agricultural production has fallen short of demand necessitating shipment of food grains, vegetables and fruits from mainland. With the opening of better communication infrastructure, the Islands attract tourist population from mainland and abroad. The increasing influx of population is taxing the assimilative capacity of the Andaman and Nicobar Islands. The Government of India has therefore decided to develop these islands in a more comprehensive and integrated manner with minimum disturbance to the environmental quality.

As the available land for cultivation is minimal, harnessing of the resources in a sustainable manner has assumed paramount importance. A step towards this goal was the establishment of Central Agricultural Research Institute by amalgamation of the Regional Research Stations of different ICAR institutes, namely, the Indian Agricultural Research Institute, New Delhi, the Central Marine Fisheries Research Institute, Cochin, the Central Plantation Crops Research Institute, Kasaragod and the Indian Veterinary Research Institute, Izatnagar with the ICAR Regional Centre for NEH region. The Institute has been entrusted with the onerous task of catering to the needs of the population of these islands and conservation of ecosystem, as well, by forging a research base to enhance crop, livestock and aquatic productivity through the judicious use of the rich and diversified, though, fragile natural resource base of these islands.

Central Agricultural Research Institute (CARI) is playing a significant role in agricultural research in these islands. The Institute is catering to the need of the Islands' farming community. CARI is evaluating and developing appropriate technologies in agriculture and allied fields and is transferring them to farmers through its Krishi Vigyan Kendra (KVK) and Agricultural Technology Information Centre (ATIC).

MANDATE

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

ORGANISATIONAL SET UP

The Central Agricultural Research Institute is located in the remote, backward and tribal territory of Andaman and Nicobar Islands. The main research and residential complex is located at Garacharma, 9 km away from Port Blair, the capital of the Union Territory. The Garacharma Complex houses the Director's Office within administrative block.

Division of Field Crops, Biotechnology Section, Division of Horticulture and Forestry, Entomology and Plant Pathology Section, Division of Animal Science, Division of Fisheries Science and Division of Natural Resource Management have their laboratories in Central Laboratory Block. A Central Instrumentation facility was set up in the Central Laboratory block for common access to all the Scientists for utilization of state of art equipments. The field research unit of horticulture, plantation crops, fisheries and the main Krishi Vigyan Kendra building are situated at the Sipighat farm which is 8 km away from the main campus. The Bloomsdale farm is situated 13 km away from the main campus, which is meant for the field experiment work of Natural Resource Management and Field Crops Division. The Institute has also established a fisheries laboratory at Marine Hill. World Germplasm Centre under CPCRI, Kasaragod has been merged with Central Agricultural Research Institute, Port Blair.

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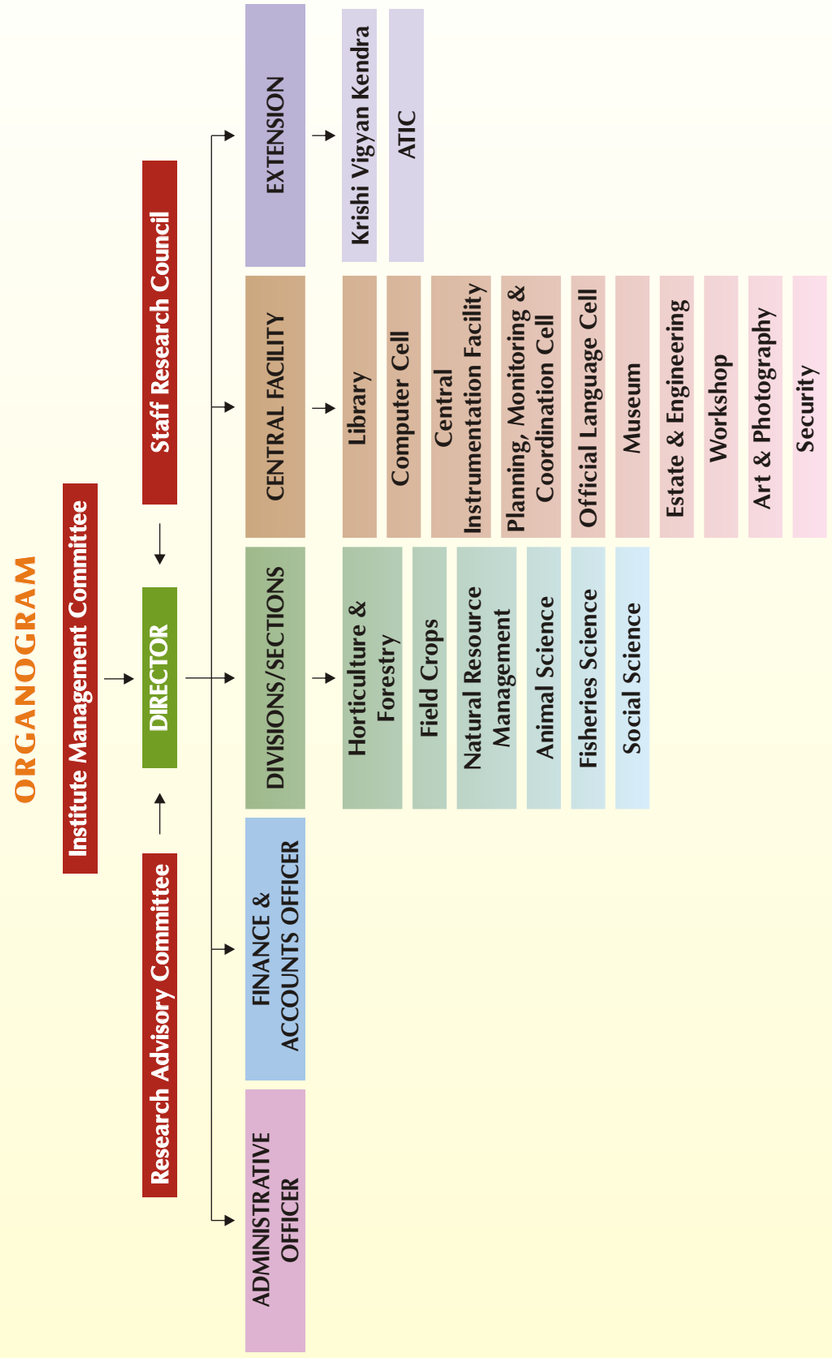

STAFF POSITION

Sl.No.	Category	Sanctioned	Filled
1.	Scientific	60	35
2.	Technical	47	45
3.	Administrative	32	28
4.	Supporting	76	84**

** 8 post to be surrendered under 10% cut.

FINANCIAL STATEMENT

The Annual Budget of the Institute for the year 2003-04 was Rs. 720 lakhs out of which Rs. 270.00 lakhs was under plan and Rs. 455.00 lakhs was under non-plan heads. Fund allocation and budget utilization under various heads are given below:

Budget Utilization During 2003-2004

Head of Account	Plan		Non-Plan	
	Sanctioned	Expenditure	Sanctioned	Expenditure
Pay & Allowances	0.30	--	320.55	315.81
T.A.	8.00	7.65	8.00	7.98
H.R.D.	2.00	0.99		-
Other contingencies				
Including equip.	159.70	170.74	98.00	96.84
Works	100.00	88.41	28.45	28.43
Total	270.00	267.79	455.00	449.06

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RESEARCH PROGRAMMES AND ACHIEVEMENTS

DIVISION OF HORTICULTURE AND FORESTRY

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IMPROVEMENT AND AGROTECHNIQUES OF VEGETABLE CROPS

R.P. Medhi and D.R. Singh

Varietal trial

Chillies

Totally 12 varieties were evaluated for yield and resistance to bacterial wilt. Significant variations were observed between all the varieties. Among them, the var. KA-2 registered the highest survival percentage (96.26 percent) against the bacterial wilt. With regard to yield, the var. Ajit-6 was found to be promising with a yield of 79.16q/ha followed by the var. KA-2. (Table 1).

The genotypic correlation values for the nine characters revealed that the characters, number of branches per plant, number of fruits per plant and the yield per plant had highly significant positive correlation with the yield. This notifies that increase in these characters will result in corresponding increase in the yield. Therefore, selections of varieties with these characters are preferable.

Brinjal

Significant variations were found between all the varieties for all characters observed. Evaluation of 14 varieties of Brinjal for yield and resistance to bacterial wilt the var. BB-93-C recorded 100% survival against BW while the varieties JBSR 98-2 and Round AVT-1 were found to be highly susceptible. With regard to fruit yield and number of fruits, the var. BB-93-C recorded the highest followed by var. HABL-1.

Association of different characters suggested that the number of fruits /plant, plot yield and yield/plant had positive and highly significant correlation with the yield/ha.

French Bean

Evaluation of eight varieties of French beans revealed that the varieties MFB 5 (24.26 q/ha), IVFB 2 (22.27 q/ha) and Sel.9 (22.08 q/ha) performed better than others under the island conditions. Correlation studies of the four characters showed that the character, number of pods/plant had significant positive correlation with yield.

Ridge gourd

Evaluation of nine varieties for three years resulted in identification of the variety IAHS 1 as potential high yielding one with an average yield of 225.97 q/ha, followed by the variety CHRG-2 with 196.79 q/ha and variety IAHS-2 (180.15 q/ha).

Tomato

Sixteen varieties were evaluated at Sipighat farm for yield and bacterial wilt resistance. Among them, variety HUR Sel-1 recorded maximum survival (92%) against bacterial wilt followed by the varieties HADT-3 and VLT-9531. However, the variety VLT-33 exhibited higher susceptibility to bacterial wilt.

Ginger

Out of 15 varieties evaluated at Garacharma farm, variety Mahima recorded the highest yield of 208 q/ha followed by Acc No.294 (200 q/ha). Variety China exhibited poor yield (64

q/ha) in comparison with the other varieties

Fertilizer trial

French bean

In an experiment to standardize the level of nitrogen for French beans, highly significant variations was observed between the treatments (Table 2). The highest yield was obtained with the treatment T5 (80 kg Nitrogen). However the yields of T4 (60 kg Nitrogen) and T8 (140 kg Nitrogen) was found to be on par with T5. Therefore, a dosage of 60 kg Nitrogen (T4) is sufficient to get the optimum yield of about 31.66 q/ha.

Cauliflower

Fertilizer trail with three levels of Nitrogen viz.45, 90 and 135 kg/ha and three levels of phosphorus (40,80 and 120 kg/ha) was conducted on the Best Early variety of cauliflower at Garacharma farm. The result indicated that application of 90 kg N/ha and 120 kg P/ha produces curds of bigger size and maximum yield of 61.40 q/ha.

Table 1. Varietal evaluation of chillies.

Sl.No	Varieties	No. of fruits/plant	Yield/plant (kg)	Yield (q/ha)
1	F-112-5-85	94.00	0.30	38.50
2	Pant Chilli-5	63.00	0.31	35.50
3	Pant chilli-4	92.66	0.28	42.18
4	KA-2	146.00	0.37	63.91
5	JLA-283	133.33	0.26	46.25
6	Ajit-6	147.00	0.50	79.16
7	ABT-11-ACS-2000-3	82.66	0.25	33.33
8	AVT-1	107.00	0.37	61.08
9	ACS-2002-6	66.66	0.18	12.75
10	ACS-2000-2	51.66	0.19	22.08
11	BC-40-2	80.33	0.17	21.91
12	BC-25	117.66	0.41	39.58
	CD (0.05%)	25.19	0.07	15.10
	SEd	12.04	0.03	7.28

Table 2. Fertilizer trial on French bean (var. Contender)

Treatment	Yield (q/ha)
T1	20.34
T2	25.34
T3	21.66
T4	31.66
T5	32.66
T6	25.34
T7	25.34
T8	31.00
CD(0.01%)	2.69
CD(0.05%)	1.94
SEd	0.90

T1 - 0 Kg Nitrogen; T5 - 80 Kg Nitrogen; T2 - 20 Kg Nitrogen; T6 - 100 Kg Nitrogen; T3 - 40 Kg Nitrogen; T7 - 120 Kg Nitrogen; T4 - 60 Kg Nitrogen; T8 -140 Kg Nitrogen

VARIETAL EVALUATION AND STANDARDIZATION OF AGROTECHNIQUES FOR TROPICAL FRUITS

R.P. Medhi and D.R. Singh

Mango

Scions from high yielding clones of mango was selected by conducting survey in all parts of Andaman and grafted on local rootstocks for multiplication of regular bearing types utilizing interclonal variability resulting from open pollination. Evaluation of mango varieties revealed that the variety Raspuri exhibited higher canopy spread (Table 3) than others.

Cashew nut

Evaluation of nine varieties of cashewnut (Table 4) collected from NRC (cashew) revealed that after three years of planting, the variety V6 exhibited the highest percentage of flowering with girth (34.00 cm) followed by V4.

Table 3. Performance of mango varieties.

Varieties	Height (cm)	Girth (cm)	Canopy spread Along the row (cm)	Canopy spread Across the row (cm)
Raspuri	319.66	75.0	371.10	406.66
Neelam	317.77	78.0	375.55	406.66
Malgoa	340.00	46.0	358.33	358.33
Hybrid				
Arka Arun	315	38.0	300	235
Arka Punit	388	52.0	395	370
Arka Anmol	265	34.5	249	260
Kesar Afus	180	25.0	200	180

Table 4. Performance of Cashew nut.

Variety	Height (m)	Girth (cm)
Sel.2	2.9	17.00
Priyanka	3.5	27.00
V6	3.3	34.00
V4	2.65	24.00
Jhargam	3.25	21.00
V1	2.43	29.00
UN-7	2.80	22.34
Local	3.40	21.00
VRI-3	2.00	16.34

INTRODUCTION AND EVALUATION OF EXOTIC AND LESS KNOWN INDIGENOUS FRUIT CROPS

D.R. Singh and R.P. Medhi

Laseda wild *(Cordia oblique)*

Laseda fruit was analysed for crude protein, crude fibre, ether extract, ash, insoluble ash, calcium, phosphorus and micro nutrients. The fruit contains 4.65 % crude protein, 0.99% calcium, 3.83% phosphorus. Potassium content was found to be very high in the fruit.

Oxalidaceae fruits

From this family, two species, viz. *Averrhoe bilimbi* and *Averrhoa carambola* were analyzed for copper, cobalt, zinc, manganese, potassium and iron. Both the fruits were rich in potassium (41.7213 ppm in carambola and 46.7220 ppm in bilimbi).

The micro nutrient content at different stages of development, viz. green stage,

fully mature, semi ripe and ripe stage of West Indian Cherry fruit was analyzed. In all the stages, potassium content was maximum (43.6695ppm, 41.7843ppm, 45.8449ppm and 47.949ppm in green fruit, fully mature, semiripe and ripe stage respectively).

Grafting of sita phal on saline resistant root stock (Alligator's apple)

Sita phal was grafted on Alligator's apple (saline resistant root stock) and about 50 successfully grafted plants are conserved in the nursery.

Table 5. Physico-chemical parameter of underutilized fruits.

	Fruit weight(g)	Juice %	TSS (Obrix) (%)	Total sugar	Reducing sugar (%)	Acidity (%)
Indigenous fruits						
Sapida	5.0	-	4.70	-	-	0.86
Laseda	-	-	-	-	-	-
Khattaphal	2.13	41	15.20	5.58	4.54	0.41
Makhi amra	2.47	-	-	-	-	-
Wild amra	2.09	-	17	4.35	3.23	1.76
Watery rose apple (white)	20.60	62.89	5.73	5.12	4.6	0.12
Watery rose apple (rose)	9.53	60.07	6.73	5.26	4.71	0.51
Exotic Fruits						
Rambutan	14.90	19	-	-	0.723	
Mangosteen	33.33	19.6	8.55	3.45	0.32	

Table 6. Nutrient contents in underutilized fruits.

	Macro nutrient (%)						
	Crude protein	Crude fibre	Ether extract	Ash	Insoluble ash	Ca	P
Indigenous fruits							
Sapida	6.30	-	0.40	6.11	0.02	0.29	0.006
Laseda	4.65	-	4.3	7.21	-	0.99	3.830
Khattaphal	6.82	18.53	0.89	7.04	0.09	0.99	0.168
Makhi amra	3.17	22.013	2.00	3.70	-	1.81	0.279
Wild amra	1.05	21.50	3.69	2.95	0.25	0.39	0.380
Chekurmanis Fruit	22.75	6.56	2.42	10.42	0.32	1.00	0.040
Chekurmanis leaf	23.18	16.25	5.5	9.65	0.35	2.25	0.770
Custard apple	4.72	8.95	0.66	2.6	0.09	1.22	0.165
Sour sop	1.83	14.57	1.43	3.05	0.07	0.79	0.095
Pandanus lerum	23.27	55.47	12.2	2.34	0.27	1.38	1.32
Pandanus andamanisium	11.55	14.44	2.01	3.54	1.33	6.65	0.853
Exotic fruits							
Mangosteen (Mature)	2.66	3.05	1.95	1.07	0.1	3.23	0.363
Mangosteen (Ripe)	2.7	2.63	0.30	1.08	0.31	1.55	0.37

	Micro nutrient (ppm)					
	Cu	Zn	Mn	Fe	Co	K
Indigenous fruits						
Sapida	0.174	0.119	0.489	0.210	0.021	39.571
Laseda	0.144	0.039	0.121	0.038	0.475	45.296
Makhi amra	0.184	0.107	0.449	0.186	0.320	32.555
Alligator's apple (ripe)	0.128	0.142	0.075	0.326	0.095	45.437
Alligator's apple (mature)	0.059	0.175	0.100	0.406	0.644	45.450
Custard apple	0.217	0.022	0.239	0.254	0.384	50.690
Sour sop	0.103	0.032	0.089	0.329	0.018	42.951
Carambola	0.0448	0.273	0.192	0.033	0.177	41.721
Bilimbi	0.0863	0.257	0.044	0.408	0.035	46.722
Chalta	0.0922	0.086	0.118	0.407	1.010	45.238
Pandanus lerum	0.347	0.289	0.020	0.133	0.123	18.55
Pandanus andamanisium	0.1426	0.066	1.646	0.190	0.857	15.024

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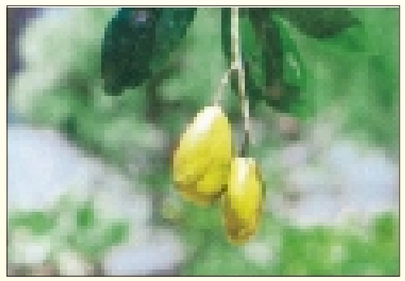
Wild amra *(Dracontomelum dao)*

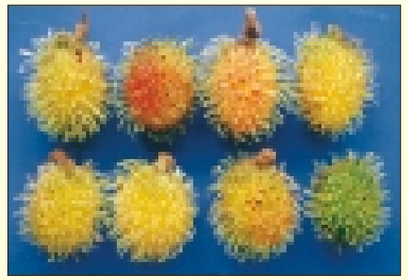
M. andamanica



M. camptosperma

M. griffithi

Laseda



Rambutan

West Indian Cherry

Mangosteen

COLLECTION, CATALOGUING, EVALUATION AND STANDARDIZATION OF AGROTECHNIQUES OF NATIVE AND EXOTIC ORCHIDS AND SHADE LOVING PLANTS

D.R. Singh and R.P. Medhi

Exotic orchids

2 varieties and 7 hybrids were collected from Kerala and 1 variety from Tamil Nadu.

Mokkara-1 (Variety- Oshyn Orange) from Kerala
Catlaya-1-1 (Variety- Asian Sunet)
Spider orchid - from Tamil Nadu

Orchid hybrid collection from Kerala

1. Phalaenopsis hakalu queen x datp. Orglads. Daff)y1 x Phalaenopsis Mou kaala "eledgalce"
2. Phalaenopsis white marie y3 x Hakallau Queen hawaii am- aos
3. Dt sweet melody sn-joga x Phalaenopsis pink festive x Abedrot y2
4. (Phalaenopsis Lanasu x City Girl) bm-joga x Phalaenopsis Feed's cherud tanchou bm joga

Dendrobium cretaceum

5. Taipei Gold Taida x White Marie y3
6. Taipei Gold Star x Bamboo Baby Coqu
7. Taipei Gold Star x Taipei Gold Taida sm-joga

Indigenous orchids

Extensive survey was carried out in Ograbranj, Wandoor, Chidiatapu, Jirkatang, Rut land, Mount Harriet, Shoal Bay, Bambooflat, Chouldari, Sippighat for collection of orchids, ferns and shade loving plants. Five species of Bulbophyllum and 14 species of Dendrobium were collected which raised the total collection to 57.

Ferns

A total of 40 ferns species were collected from South Andaman.

Anthurium

In addition to the existing 14 varieties of Anthurium, one new variety Sanctury Pink was collected from Kerala.

Foliage plants

Along with the existing foliage plants, 10 more spp. have been collected.

Standardization of potting media

Orchids

For the Orchid *Eulophia andamanensis,* potting media has been standardized Among different potting media tried for *E. andamanensis* maximum number of flowers/spike (26.3) was recorded in the treatment consisting of Coconut husk + charcoal+brick pieces+coir dust+leaf mould and red soil followed by the treatment consisting of Coconut husk + Brick pieces + Charcoal + Coir dust (25).

Anthurium

Out of eight different media tried for Anthurium, the media consisting of compost, charcoal, brick pieces, coconut husk and sand gave the best result producing 16 flowers/plant/year having maximum flower stalk length (18.9 cm).

Fern

Potting media for the Microsorium punctatum was standardized. The media consisting of coconut husk, compost, brick pieces, leaf mould was found to be best.

Standardization of weight of pseudobulbs for planting

Eulophia andamanensis

Different weight of pseudobulbs (60-140 gm, 150-220 g, 250-450 g) were taken for the study and it was revealed that maximum number of flowers per spike (24.89) as well as maximum length of the spike was obtained from the plants produced from the pseudobulbs having more weight.

Nutritional analysis of indigenous ferns

Nutritive analysis of two indigenous ferns viz *Microsorium puctatum* and *Aspledium nidus* were carried out. Calcium (2.00-3.26%) and phosphorus (1.32%) were more in *Microsorium punctatum* when compared to those in *Asplenium nidus.* The micro nutrient like Cu, Mn, Fe, Co, Zn and K were also

Microsorium punctatum

analysed. The potassium content was more in both the ferns (37.3198ppm and 29.936ppm in *Asplenium nidus* and *Microsorium punctatum* respectively.) The fern *Microsorium punctatum* was also tried as feed for rabbits and was found successful.

COLLECTION AND EVALUATION OF TUBEROSE, GLADIOLUS, CHRYSANTHEMUM, GERBERA, MARIGOLD, BALSAM, CROSSANDRA AND AMARYLLIS

D.R. Singh and R.P Medhi

Chrysanthemum

Ninteen varieties, viz Kasturi, Aparajitha, Lord Robbert, Appu, Mr. S. C Taaly, Autumn King, Nanako, Basanti, Pancho, Bhavana, Phillies, Birbal Sahani, Punjab Anuradha, Coy, Ravi Kiran, Flirt, Schizuca and Shyama were collected from Solan and were evaluated under open condition. Among the 19 varieties, Aparajitha recorded the maximum number of flowers/plant/year (160) followed by Birbal Sahini (120).

Gerbera

Seven varieties, viz Pride of Sikkim, Orange Gleam, Versace, Pink star, Red Monarch and Nebulusa were evaluated under shade net condition. The variety Versace gave the maximum yield (472 flowers/year/m^2) followed by Pink Star (400 flowers/year/m^2). The yield is almost 50% more under shade net condition than that in the open field condition.

Gladiolous

Seven varieties of Gladiolus, viz Hybrid-87-22-1-30, Darshan, Aarti, Tilak, Kumkum, Mohini and Manhar were evaluated and the variety Mohini gave the maximum yield (30 spikes/m2) followed by Darshan producing 25 marketable spikes/m^2.

Crossandra

Standardization of potting media

Different ratios of potting media like red soil, sand and compost were taken in different ratios T1: 2:1:1, T2: 1:2:1, T3: 1:1:2, T4-1:1:1, T5-2:2:1, T6-2:1:2, T7-2:2:2 respectively to make seven different treatments. Maximum yield of 190g/plant/year was recorded in plants raised from cutting planted in the potting mixture consisting of 1 part of red soil, 2 part of sand and 1 part of compost. The same treatment was done with seedlings which gave 91g/plant in the same potting media.

Effect of growth regulators

Effect of growth regulators like GA3 and MH was studied in combination with 1% urea. Application of bioregulators were done one month after planting and subsequently done at 2 months interval. It was revealed that GA3 @ 100ppm increased the yield (120g/plant of loose flowers) in crossandra variety Aboli which is 30% more when compared to seedlings grown without growth regulator treatment.

Standardization of fertilizer dose

Among different fertilizer doses used for the study, maximum number of spikes per plant and maximum yield (110g/plant) was recorded from the treatment having maximum doses of nitrogen and phosphorous (N-60 kg/ha and P-40 kg/ha)

IMPROVEMENT OF COCONUT AND ARECANUT

R.P. Medhi

A total of 151 packets of pollen grains from the selected cultivars, viz. Rennel tall, Rangiroa tall (Avatoru), Rangiroa tall (Tiputa), Hari papaua and Natava tall from the Pacific Ocean collection were sent to CPCRI, Kasaragod for diallel crossing work. Assisted pollination (Inter-se-mating/selfing) was carried out in 19 accessions of Pacific Ocean Collection. A total of 14,814 female flowers were pollinated.

About 300 Andaman Ordinary tall and 104 Andaman giant seed coconuts were sent to DSP Farm, Coconut Development Board, Orissa for establishment of seed garden.

STUDIES ON PLANTATION BASED SPICES CROP FOR TROPICAL REGION

R.P. Medhi

Inter cropping in coconut garden

Ginger

Ginger was intercropped in three different situation, viz. 0-8 year old coconut, 8-20 year old and more than 20 year old coconut garden with four levels of fertilizer. The results suggested that cultivation of ginger as intercrop in coconut garden can be taken up in 8-20 year old plantation effectively. Moreover a fertilizer dose of 25 per cent higher than the recommended one (93.75: 62.5:31.25 kg NPK/ha) was found optimum under all age group conditions of coconut.

Elephant Foot Yam

Elephant foot yam var. local was inter cropped in 20 year old coconut plantation with four levels of fertilizers. The result revealed that application of 120:90:150 Kg NPK/ha recorded maximum tuber weight (3.17 kg) and highest yield (18.31 t/ha), followed by the application of recommended dose of fertilizer (80:60:100 Kg NPK/ha), which produced the yield of 15.27 t/ha.

TREE SOIL CROP INTERACTIONS IN AGROFORESTRY PRACTICES IN ANDAMAN AND NICOBAR ISLANDS

C.B. Pandey, A. Venkatesh and R. Dinesh

Effect of time and mode of application of *Gliricidia* leaves on growth and yield of maize in an alley cropping system

Gliricidia leaves were sun dried during dry period and its efficiency as a substitute for urea was analysed. The results indicated (Table 7) that within 15 days 52% nitrogen was released in incorporated and 50% in surface. Therefore, uptake of nitrogen was also maximum in 2WAS treatment and at par to urea (Table 8). Nitrogen uptake in 2WAS treatment equal to that of urea may be attributed to slopy land and high rainfall in the islands, which causes heavy run off loss or urea. High leaching of nutrients are also expected as sub- surface flow of water is observed during rainy season. However, recovery of nitrogen of *Gliricidia* pruning by the current maize crop ranged from 18 to 45%. It was maximum in 2WAS treatment (Table 8). Shoot biomass and grain yield of the maize was maximum in 2 WAS treatment.

Organic measuring with *Gliricidia*

However, application of *Gliricidia* pruning in 4WAS treatment was ineffective. Yield of maize was greater in 2WAS which was at par to urea (Table 9)

Pool sizes of nitrate N and ammonium N and rate of their formation in the soil amended with *Gliricidia* leaves

Nitrate N differed significantly due to time of application but did not differ due to mode of application. Nitrate N was greater in the soil treated with *Gliricidia* leaves at zero week after sowing (0WAS) and 2WAS treatments compared to that in control in all the sampling dates. Amount of NO3-N was greater in the plot applied with urea but with the passage of time it declined comparatively which was most likely due to greater leaching losses. Like NO3-N, ammonia N was also greater in *Gliricidia* treated plots compared to that in control. Moreover, amount of ammonium N was greater in 0WAS and 2WAS treatments compared to urea. It also differed due to time of application but did not differ due to mode of application. Rate of ammonium N formation was greater in *Gliricidia* treated (0WAS and 2WAS) plots than that in control plots in all the sampling dates. Rate of ammonium N formation in urea treated plots was lower compared to *Gliricidia* treated plots. Nitrate N was also higher in *Gliricidia* treated plots compared to that in control plot. Variation in nitrate N formation due to treatments was similar to that of ammonium N formation (Fig. 1). Similar pattern was also observed with net soil N mineralization (Fig. 2).

Table 7. N release from Gliricidia leaves under incorporated and surface condition

Days	Incorporated	Surface
15	x61.67a	y58.99a
30	x27.55b	y21.80b
45	x22.88c	y28.30c
60	x6.62d	y8.23d
Total	118.72	117.32

Table 8. N uptake, N recovery and Shoot biomass (kg/ha) by maize under different treatments.

Treatment	15 days		30 days		45 days		60 days	
	I	S	I	S	I	S	I	S
N uptake								
0WAS	x1.56a	x1.06a	x2.57a	x2.30a	x5.13a	x4.74a	x14.29a	x13.21a
2WAS	x0. 80b	x0.88a	x2.46 a	x2.19a	x7.11b	x6.33b	x18.26b	x19.20b
4WAS	x0.42c	x0.44b	x1.34b	x1.13a	x5.23c	x4.42ac	x11.95c	x10.91c
Control	x0.34c	x0.34b	x0.45c	x0.45b	x2.21d	x2.21d	x5.44d	x6.44d
Urea	x1.84d	x1.84c	x3.33d	x3.33c	x7.00b	x7.00b	x19.20b	x18.00b
N recovery								
0WAS	x1.00a	x0.59a	x1.75a	x1.53a	x2.41a	x2.09a	x7.29a	x6.39a
2WAS	x. 38b	x .44a	x1.66 a	x1.44a	x4.04b	x3.40b	x10.56b	x10.59 b
4WAS	x .06c	x.08b	x0.74b	x0.57b	x2.49c	x1.82c	x5.36c	x4.50c
Urea	x1.23d	x1.23e	x2.37c	x2.37c	x3.95bd	x3.95bd	x11.33b	x11.33b
Shoot biomass								
0WAS	x147a	x104a	x242a	x225a	x484a	x465a	x1348a	x1295a
2WAS	x76b	x87b	x235a	x217a	x678b	x626b	x1588b	x1579b
4WAS	x42c	x44c	x133b	x113b	x518c	x438c	x1183c	x1088c
Control	x43c	x43c	x56c	x56c	x276d	x276d	x680d	x680d
Urea	x150a	x150a	x271d	x271d	x 669e	x669b	x1561b	x1561e

Table 9. Yield (t/ha) of maize under different treatment

Days	Incorporated	Surface
0WAS	x5.41a	x5.18a
2WAS	x6.25b	x6.38b
4WAS	x2.04c	x2.12c
Control	x1.94d	x1.94d
Urea	x6.28b	x6.28b

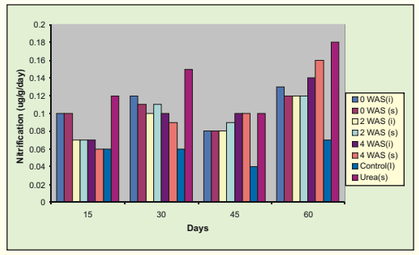


Fig.1 Rate of Nitrate formation in soil ammended with *Gliricidia* leaves under different treatments

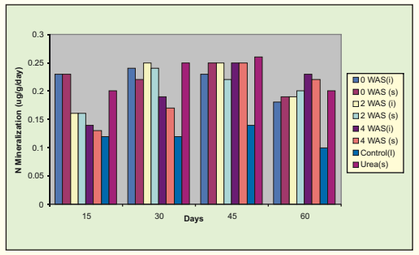
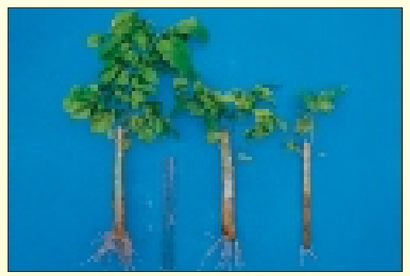


Fig.2 Net N mineralization in soil amended with *Gliricidia* leaves under different treatments.

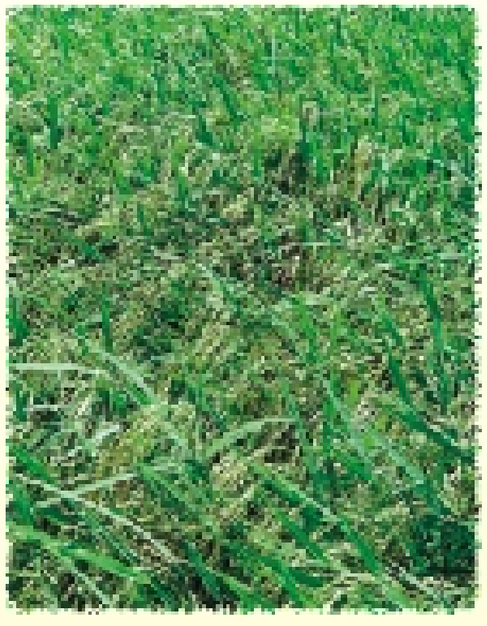
MACRO PROPAGATION STUDIES ON SOME IMPORTANT TIMBER SPECIES OF BAY ISLANDS

A.Venkatesh and C.B.Pandey

Stem cuttings of Padauk, Gurjan and Marblewood were collected from 5-6 years old mother trees and treated for 20 hours in IAA, IBA and NAA with the concentration of 500, 1000 and 1500 ppm besides treated with rooting mixture and water soaked control. The results revealed that two months after treatment Padauk cuttings treated with IBA 500 ppm provided 55 per cent of rooting followed by IAA 500 ppm (50 per cent). Water soaked control recorded 35 per cent of rooting. Compared to Padauk, minimum rooting per cent of Marblewood (40 % in IBA 500 ppm) and Gurjan (12 % in IAA 500 ppm) were observed.



Micropopagation of Padauk



DIVISION OF FIELD CROPS

2003-2004
ANNUAL REPORT
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GENETIC MANIPULATION FOR IMPROVED PRODUCTIVITY IN RICE WITH SPECIAL REFERENCE TO BIOTIC AND ABIOTIC STRESS TOLERANCES IN BAY ISLANDS

Asit B. Mandal and R. Elanchezhian

Identification of very early varieties

Among many lines tested Heera emerged as most promising producing about 2.5 tons. Seed to seed duration of these varieties was found to be 68 days. The insect and disease pest attack was found to be appreciably low and the crop was harvested without any health cover both under direct seeded and transplanted conditions. The transplanted rice produced about 3 tons /ha, which was more than direct seeded one.

Performance of breeding lines

The breeding lines, which were developed earlier in situ, are in advance generation yield trials. BM 2, BM 4 and BM 5 were found to be most promising yielding about 2.2 tons/ha.

Performance of somaclones in advanced generation

A few promising somaclones were originally selected from Kasturi, a scented fine grained indica rice. Among all, Soma-3, Soma-11and Soma-7 were found to be most promising producing 8.8, 8.2 and 7.8 g/ plant yield, respectively.

AICRIP trials

Fourteen trials were conducted under both normal and saline soil conditions. Promising varieties from each trial and their yield (tons/ha) are highlighted (in parenthesis) below:

The best three lines, under AVT (very early) which were found to be high yielding were AVT 103, AVT 106 and AVT 107, 5.9, 5.2 and 4.5 tons/ha, respectively. Most of the lines were lodging resistant. Those advanced lines may be recommended for cultivation in the upland of Andamans to harvest two crops in both monsoons. Under Initial variety trial (very early) IVT 212, IVT 201 and IVT 208 (5.2, 4.5 and 4.2 tons/ha, respectively) were found to be high yielder among the 15 advanced breeding lines received from DRR, Hyderabad. Under AVT-2 (irrigated medium), AVT 1304 (7.0), AVT 1305 (6.0) and AVT 1307 (5.5) were the most promising for the grain yield. They showed considerable field tolerance to prevailing insect pests in experimental research farm in south Andaman.

Advanced variety trial

Irrigated medium early

The medium early advanced lines namely AVT 1007, AVT 1004 and AVT 1005 produced 4.8, 4.4 and 4.2 tons/ha, respectively.

Varietal trial

Basmati

The advanced breeding lines of Basmati group received from DRR, Hyderabad were evaluated under rainfed condition. The entries AVT 2007, AVT 2006 and AVT 2005 performed well producing 4.0, 1.9 and 1.8 tons/ha, respectively. Under

initial variety trial (Basmati) the lines IVT 2225 (1.9), IVT 2214 (1.7) and IVT 2215 (1.7) were found to be high yield among the 26 entries received from DRR, Hyderabad.

Initial variety trial

Long duration

Very high yield were observed in many entries in this trial. The best performing lines were IVT 1644, IVT 1647 and IVT 1643 producing 7.2, 7.2 and 6.4 tons/ha, respectively.

Medium duration

Under IVT irrigated medium the lines IVT 1204 IVT 1218 and IVT 1201 could not perform well under the irrigated condition. They produced 1.30,1.34 and 1.25 tons/ha only.

Early duration

Under IVT (early) moderate performance were observed among the entries in this trial. The best performing entries were IVT 519, IVT 506 and IVT 522 producing 2.34, 2.2 and 2.1 tons/ha, respectively.

Performance of Pokkali somaclones

Among the somaclones developed from Pokkali, BTS 24 and 28 performed best during last 8 years. This year too BTS 24

BTS 24

BTS 28

excelled producing 3.7 tons/ha under research field condition. The variety also displayed appreciable field tolerance to prevailing disease and insect pests during the cropping season.

All India Agronomy Coordinated Trial (AVT 2-SAVT)

Among the entries evaluated under saline soil, IET 11355 performed best. It attained a plant height of 117 cm with 281 panicles / m2 and produced 2.0 tons/ha yield.

National Saline-Alkaline Screening Nursery (NSASN)

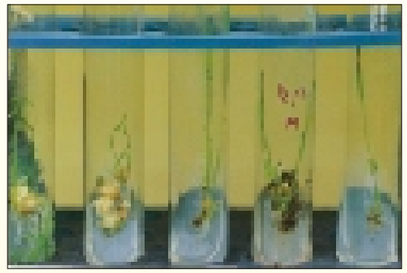
Among 31 entries, only three varieties performed appreciably well. They were characterized for plant height, panicle length, number of panicles/plant and grain yield /ha. The promising varieties are Entry No. 3304, 3310 and 3319.

Twenty third International Rice Saline Soil Stress Tolerance Observational Nursery (IRSSTN 2002)

The varieties were evaluated in saline plot having EC 6-9.5dS m-1 during the cropping season. The best performers in respect of grain yield were: Entry No. 030 and 031.

Development of lines tolerant to Al toxicity

Somaclones tolerant to Al toxicity were developed from embryogenic calli from



In vitro screening of rice for Al toxicity tolerence

mature seeds and were evaluated on medium with toxic levels of Al in the form of Al2 (SO4)3, 18 H2O. The RO plants were grown in experimental net house and R1 and R2 plants were evaluated in fiberglass tanks filled with Al toxic soil. R3 was evaluated in the field condition. A few lines derived from IR72 showed high yield, good plant type and normal root development (as observed in sand culture). Selectants were forwarded for advance generation trial.

Development of lines tolerant to Fe toxicity

In C14 -8 backgrounds, an early somaclone tolerant to Fe toxicity was developed earlier, which has been tested recurrently. This year under Fe toxic condition it could produce 1.9 tons/ha yield with 131 cm plant height and took 121 days for first flowering.

In vitro screening of rice for Fe toxicity tolerence

Genetic engineering research

Cloning of DsRed

To clone DsRed, a vector pDSRed2-C1from Clonetech Research was used. Primers used were :5'ttgagctcATG GCC TCC TCC GAG AAC GTC3' (Forward) and 5'tt ctagatta CAG GAA CAG GTG GTG GTG GCG G 3' (Reverse).The amplicon was ligated at SacI/XbaI site of pGEM Teasy vector and checked by DNA sequencing with T7 and SP6 promoters. Xho /XbaI and Sst I A/XbaI mapping confirmed correct orientation. Sst1/XbaI DsRed was finally ligated in pKLYX 80 to produce NLS-DsRed for microprojectile bombardment.

Development of Clones for subcellular targeting

A set of new clones were developed (below) to target mitochondnia, chloroplast and nucleus with three different sequences viz. Cox, TP (transit peptide) and NLS (nuclear localized signals) with a variety of recently discovered reporters like gfp, bfp, yfp and cfp. The major target is aimed at use of fluorescent reporters in conjunction of leader sequence (LS), TP and NLS to specifically target the subcellular parts and to asses the possibility of exploitation of multigene expression in different parts of a cell as well as to use the reporters fused with economically important genes and instant assessment of transgene expression.

Table 10. Development of New Clones

Accession Number	Clone	Description	Target
A	NKY 1	Xba/Sst NLS KLYX 80 + Xba/Sst yfp	Nucleus
B	NKB 1	Xba/ Sst KLYX 80 + Xba/Sst bfp	Nucleus
C	NKB 2	Xba/ Sst KLYX 80 + Xba/ Sst bfp	Nucleus
D	KLG 1	Xho/ Sst KLYX80 gfp + Cox (Xho/Sst)	Mitochondria
E	KDR 2	Xho / Sst KLYX80 DS Red + Xho / Sst Cox	Mitochondria

Cloning of Fesod

ClaI/Pst I fragment from pEXSOD10 (Originally received from University of Gent,Belgium) was inserted into pBluescript (intermediate vector). Insertion was checked by DNA sequencing involving T3 and T7 primers. FeSOD with TP was cleaved out (KpnI/XbaI) and ligated into pSFD1(A gift from MSSRF, Chennai). The newly constructed vector in pCAMBIA back ground with hygR as plant selection marker is compatible for monocot especially rice transformation. The FeSOD gene was sequenced which is highlighted below.

AAAANNNNNNNNGNGCCNGCNGCA
GCATTGAAACTCTTCATAGAACTTCT
CATAAGAAGTGAAATCTCTTAGCAAG
CAAAGCAAGAAGCTCTCCTGATGGT
TTTCCTCCACCACCTGGTTTCATTGA
CTCCCAGAAGAACTCGTGGTTCCAC
GCCTGNAGCAGCGTTGTTGAAAGC
AGGGAGGAGATCACCATTGTTGTAA
GTGCTGTGGATAATGTGCTCTAAGG
GCTTGCCTTCAAGCTCGGTTCCAAG
AACCTGTTTCTTGAGGTTGTCCACGT
AAGCTCTGTGATGTTTTCCCCAGTG
GAAACTCCAGAGTTTGCTCATATGCG
GCTCCAAAGCATCCAGTGCGAAATG
GGAGGTGGCTTGGAGGACGTAGTTT
AGATCCATGCACTTTACTCTTCCACCC
ATTGCTTGTAATGGGAAAGTAAATGT
CCAGTGTTGACCTTCTTCCACTGGG
GNAATCCAGTCATGGATTTGNAGGC
CCGCCCGAAATGGGA.

Cloning of cry 1A(b) and cry 1A(c)

To exploit the advantages of pCAMBIA vectors especially the monocot compatible hygromycin selection marker, Cry IA(b) and Cry IA(c) were cloned from pUBB and puBC (pGEM 4Z based vector) with ubi-cry1A(b)-nos and ubi-cry1A(c)-nos (devoid of selectable marker gene) into an intermediate vector pBluescript. They were sequenced before ligation at the Hind III site of pCAMBIA 1301 to generate pCAMBB and pCAMBC vectors, respectively.

Cloning of Amsod

A 3 kb ubi+Amsod fragment was excised with Hind III from pSFOD1, further spliced with SmaI to recover HindIII/Sma I ubi. It was ligated in HindIII/SmaI of pCAMBIA1305.2. In the second step EcoRI/SmaI fragment of Amsod was picked upfrom pSFOD1 and ligated in pCAMBIA305.2 with ubi at Eco/Sma site. Final product was ubi-Amsod-nos in pCAMBIA 1305.2

Development of transgenic plants via particle bombardment

Twenty nine transgenic plants of Basmati 370 harboring cryIA(b), cryIA(c) and hpt genes were developed following bombardment in co-transformation mode in 4:1 ratio with hpt in a separate binary vector. Out of these 29 plants, 11 showed PCR positive result.

Insect bioassay of putative transgenic plants harbouring cryIA(b) and cryIA(c) genes

Insect feeding bioassay was carried out in petriplates. Larval mortality was determined 4 days after infestation. The score was based on 18 larvae per plant (6 larvae per stem per plant). Alive, dead and missing larvae were determined for each petridish. On the basis of insect feeding biossay, seven Basmati 370 lines were identified as promising viz. TC 5 and TC 7(61.11%). TC 6 (66.7%), TC 13 (61.1%), TC 17 (66.7%), TC 18 (94.5%) and Basmati 370-1 (66.7%).

Methyl Viologen (MV) test

To assess oxidative stress tolerance of the putative transgenics of Tarori Basmati harbouring AmSod gene MV test was performed. 17 presumptive transgenic plants were incubated for 16 h involving 50, 75 and 100M of MV. Wide variation in terms of leaf rolling, leaf colour change and survival was discernible and a few lines showed more tolerance in comparison to non transgenic control plant.

Development of putative transgenic plants involving chitinase

Agrobacterium-mediated genetic transformation was resorted to introgress chitinase into IR72 involving miniature microtillers. After selection survivors were transferred onto MS basal with G418 (50mg/l) for root induction. Selected microtillers from IR 72 were transferred to rooting medium where they putforth roots successfully.Green transformants with chitinase have also been selected on antibiotic supplemented medium in Basmati 370. Those plants are currently progressing under molecular analyses.

PHYSIOLOGICAL APPROACHES FOR IMPROVED BIOTIC AND ABIOTIC STRESS TOLERANCES IN SOLANACEOUS VEGETABLE CROPS

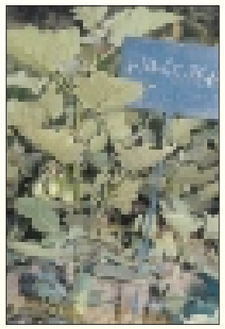
R. Elanchezhian, Asit B. Mandal and T.E. Sheeja

Evaluation of brinjal somaclones at SC4 generation

Somaclones of brinjal varieties viz. BB 66C, SM 141 and BB 60C were evaluated at SC4 generations for agro-morphological characters including disease and insect pest tolerances. At SC3, nine families of somaclones were evaluated and 149 promising somaclones of three varieties were selected and were evaluated at SC4 generations. Eight promising somaclones were selected from var. BB66C, viz. FCB 1-10-45-47-13, FCB 1-10-45-47-72, FCB 1-10-45-76-9, FCB 1-10-45-102-1, FCB 1-10-45-103-1, FCB 1-11-12-107-3, FCB 1-14-6-3-1 and FCB 1-14-6-28-1. Similarly in var. BB 60C four somaclones were selected namely FCB 4-1-65-6-7, FCB 4-1-65-12-1, FCB 4-1-65-51-7 and FCB 4-1-65-97-5. In var. SM141 also four somaclones were selected namely FCB 3-4-12-58-1, FCB 3-4-12-75-1, FCB 3-4-12-78-1 and FCB 3-4-12-82-1.

Brinjal somaclones

Evaluation of tomato somaclones


Tomato somaclone

Seventy four somaclones of tomato varieties viz. Le 79, Pant 5 and Pant 11 were generated initially. Ten promising somaclonal families were forwarded to SC2 generation. At SC2, 150 somaclones were evaluated and 16 somaclones from 10 families were forwarded to SC3 generation. The selected 16 somaclones were FCT 1-3-1, 1-9-1, 1-9-2, 1-10-1, 1-15-1 of Le 79; FCT 2-3-1, 2-4-3, 2-4-7, 2-5-1, 2-5-2, 2-5-4, 2-5-7, 2-16-2, 2-16-3 of Pant 5 and FCT 3-1-1, 3-1-2 of Pant 11. At SC3, 16 promising somaclones were selected and forwarded to SC4. Among 16 somaclones, 11 were from Le 79 (1-9-1-13, 1-10-1-4, 1-15-1-13, 1-15-1-22, 1-15-1-23, 1-15-1-27, 1-15-1-28, 1-15-1-32, 1-15-1-33, 1-15-1-40, 1-15-1-42) and 5 were from Pant 5 (2-4-7-9, 2-5-1-14, 2-16-2-33, 2-16-3-2, 2-16-3-3).

Assessment of the effect of different strains of *Agrobacterium* in governing genetic transformation in tomato

To effect maximum transgene expression, optimization experiments were undertaken by using gus as reporter gene harboured in pCAMBIA 1305.2. The tomato stem and leaf and explants were cut in similar size and three strains of Agrobacterium (EHA105, AGL 1, and LBA4404 in which the plasmid pCAMBIA 1305.2 was mobilized) were used for transformation of the explants. The explants were subjected to GUS staining. Agrobacterium mediated genetic transformation was found to be maximum in strain EHA105 when compared to other strains. The average percentage of GUS stained portion of the explants with EHA105 was 41.39%, AGL1 32.38% and LBA4404 26.01%.

Assessment of genotype specificity for transformation in tomato

Three varieties of tomato (PPII, Pant 5 and L15) were used in optimization experiment to pinpoint the most appropriate variety amenable to genetic transformation. The strain EHA105 was employed (as found most promising earlier) involving three varieties. Co cultivation for 48 hours and 10 minutes soaking time was adopted. After 48 hours of co-cultivation, the Variety PPII displayed maximum GUS expression in terms of stained explants. The percentage of the transformation in PPII was found to be 87.04%, Pant 5 showed 70.97% and L 15 showed 32.7% stained explants.

Optimisation of soaking time and cocultivation period for efficient transformation in tomato

To efficiently transfer alien genes using Agrobacterium tumifaciens, soaking time with Agrobacterium cells and the co-cultivation period was optimised. Soaking time of 5, 10, 15 minutes and cocultivation period of 48, 72, and 96 hours were taken as a base line for optimization. Cocultivation period of 48 hrs with 10 mins soaking time was selected based on maximum gus staining with minimal cell damage for undertaking genetic transformation.

In vitro assay for superoxide dismutase activity in the transformed plantlets

Tomato explants were transformed with Agrobacterium strains EHA105 containing AmSOD gene harboured in pCAMBIA 1305.2. In the regenerated plantlets, in vitro assay of SOD was done to assess SOD activities in planta level. It was observed that the SOD activities of the transformed plants were much greater than that of the controls. Variety PP II showed a maximum of 7.1 fold increase in SOD acitivity over wild type plants, followed by variety Pant 5 (5.25 fold increase). L 15 variety showed minimum SOD activity with 2.17 fold increase over wild type plants.

Assessment of the effect of different strains of *Agrobacterium* in governing genetic transformation in brinjal

The average % of gus stained portion in leaf, stem and callus explants, when infected with LBA 4404 was 27.619%, 79.310%, and 76.667%, respectively. However, gus stained area when infected with EHA 105 was found to be 7.246%, 30.00% and 15.556%, respectively in leaf, stem and callus explants. It was found to be 18.667%, 27.273%, 37.778%, respectively in the case of strain AGl-1. The percentage of transformation ability of bacterial strains (EHA 105, AGL-1 and LBA 4404) was found to be more in stem explants of brinjal when compared to transformation efficiency in leaf and callus explants. Among the Agrobacterial strains LBA 4404 was found to be the best strain in terms of gus expression pattern (79.31%).

Assessment of genotype specificity for transformation in brinjal for

Three brinjal varieties namely Swarnasree, IVBR, and BB95C had been used for this experiment with the selected Agrobacterium strain LBA 4404 with a soaking time of 10 min and co-cultivation period of 48 h. The average percentages of gus staining in leaf explants was found to be 8.943%, 25.151% and 27.619% for IVBR, BB95C and Swarnasree, respectively, while that of stem and callus explants of IVBR, BB95C and Swarnasree were found to be 37.5%, 27.273%, 79.310% and 44%, 34.375%, 76.667% respectively. Since regeneration from transformed plants, stem explants with minimum damage and maximum transformation persentage had to be selected, the % of transformation by measuring the area of gus reporter gene expression had been found that 37.50%, 27.273% and 79.310%, respectively for IVBR, BB95.C and Swarnasree. From the above data it is discernable that the genetic transformation is found to be high in Swarnasree when compared to IVBR and BB 95C. Among the explants stem was found to be suitable for better transformation efficiency.

Optimization of soaking time and cocultivation period for efficient transformation in brinjal

To efficiently transfer alien genes using Agrobacterium tumifaciens, soaking time with Agrobacterium cells and the co-cultivation period was optimized. Soaking time of 5, 10, 15 minutes and cocultivation period of 48, 72, and 96 hours were taken as a base line for optimization. The average

percentage of gus stained portion in leaf explants was found to be high in 10 and 15 min of soaking duration with 72 h of cocultivation i.e. 36.08 and 28.0%, respectively. However for stem and callus explants 10 min of soaking time with 48 h of co-cultivation was found to be the best and resulted in 79.31 and 76.667% of gus stained area, respectively.

Estimation of chitinase enzyme activity in the transformed brinjal plantlets

Brinjal explants were transformed with Agrobacterium strains LBA4404 containing chitinase 11 gene harboured in pCAMBIA 1301. In the regenerated plantlets, chitinase activity was estimated colorimetrically by estimating the reducing ends of sugars. It was observed that the chitinase activities of the transformed plants were much greater than that of the controls. Variety Swarnasree showed a maximum of 77.3% increase in enzyme activity over wild type plants, followed by variety IVBR (62.79% increase). BB 95C variety showed minimum enzyme activity with 5.93% increase over wild type plants. Among all the three varieties of transformed brinjal plants, Swarnasree variety had more transgene expression than the other two varieties.

Evaluation of antifungal activity of chitinase enzyme on fungal species like *Colletotrithum sp* and *Aspergillus sp.*

Antifungal activity of crude chitinases extracted from putative transformants were assayed against fungal species viz. *Aspergillus sp* and *Colletotrichum sp.* The colony diameter and mycelial growth pattern of fungi were studied with the incorporation of chitinase extract in the PDA media. All the transformants showed chitinolytic activity when compared to their wild type counter parts. The reduction in colony diameter/ mycelial growth was very high in plates treated with Chitinase extracts from swarnasree when compared to other two varieties.

INVITRO PROPAGATION AND MOLECULAR CHARACTERIZATION OF A FEW SELECTED MEDICINAL PLANTS OF BAY ISLANDS

T.E.Sheeja and A. B. Mandal

Survey and identification of medicinal plants suitable for homestead cultivation

A homestead survey was conducted in Wandoor village to identify the common plants of medicinal value. A total of 39 plants with multipurpose functions without side effects were identified. A few important of them are *Acorus calamus* (Bocho), *Aegle marmelos* (Bael), *Aloe vera* (Geekowr), *Andrographis paniculata* (Bhuineem), *Asparagus racemosus* (Mahadevjad), *Azadirachta indica* (Neem), *Baccopa monnieri* (Brahmi), *Centella asiatica* (Mendak bhaji), *Cissus quadrangularis* (Hadjod), *Coleus amboisensis* (Patharchur), *Datura metel* (Datura), *Kalonchoe pinnata* (Patherkuchi), *Lawsonia inermis* (Henna), *Mentha arvensis* (Pudina), *Morinda oleifera* (Sajna), *Nyctanthes arbo-tritis* (Rajanigandha), *Punica granatum* (Anar), *Phyllanthus niruri* (Chotabuty), *Rauvolfia serpentina* (Sarpagandhi), *Vitex sp.* (Sambalu).

Collection and conservation of weeds of medicinal value

In Andaman and Nicobar Islands a total of 78 weeds were found to be used for cure of more than 47 diseases. Some of the important ones are *Acalypha indica, Andrographis laxiflora, Anisomeles indica, Blumea lacera, Cassia occidentalis, Chromolaena ordorata, Commelina bengalensis, Cyanodon dactylon, Desmodium trifolium, Dioscorea alata, Heliotrapium indicum, Peperomia pellucida, Phyllanthus amarus, Sida rhombifolia* and *Solanum nigrum.*

Formulation of *in vitro* culture protocols in *Bacopa monnieri*

In vitro propagation, protocols were formulated in Brahmi. A low cost technology for *in vitro* liquid culture of *Bacopa monnieri* has been devised involving liquid MS medium in gro-tek culture vessels. Within 15 days direct regeneration occurred from the cut ends. These shoots were excised and transferred to liquid MS basal in gro-tek culture vessels. The approximate recovery of plantlets was 35.685 g fresh weight within a period of two months of culture against 0.385 g in solid culture and the corresponding dry weights were 4.54 and 0.046 g respectively. No hormones were found to be required. Plantlet regeneration and rooting occurred simultaneously. Keeping 2-3 cm of shootlets in a horizontal position also yielded similar results. The *in vitro* grown plantlets were well developed and transferred to plastic cups filled with soil under ambient condition. After a week, they were field transferred. The plantlets are found to perform appreciably well *ex vitro.*

Field evaluation of *Bacopa monnieri*

The *in vitro* grown plantlets of brahmi were hardened and transferred to the field and trials undertaken. Ideal planting time was found to be from September to October 50% shade was required for optimum growth. It is an annual herb and the harvesting should be started from the 4th month onwards, and completed within 2 months time. The requirement of compost was 5 kg/m2. Flowering could be observed within 30-40 days.

Formulation of in vitro propagation protocols in *Stevia rheubaudiana*

In case of Stevia, maximum multiplication of 49 shootlets per explant was observed on MS media supplemented with 10 mg/l GA3, 5 mg/lBAP and 0.05 mg/lIAA in the initial phase for a period of 3 weeks and

Stevia rheubaudiana

subsequent transfer onto 2 mg/l BAP. *In vitro* generated plantlets were directly field transferred without any hardening process and survival rate was found to be 80-100%.

Molecular characterization involving isozyme markers in selected endemic species

Selected endemic medicinal species viz. *Mallotus* and *Semicarpus* were chosen. Out of the isozyme systems analysed,

esterase and peroxidase gave discernible enzyme patterns for distinguishing the different members. Esterase enzyme profiles gave a prominent band of rf 0.877, that distinguished *Mallotus phillippinsis* from *Semicarpus kurzii.* Analysis of peroxidase profiles revealed that accessions from Bidnabad, Bridgegunj, Birdline and Guptapara can be distinguished by marker bands of rf, 0.555. Manjeri accessions could be distinguished by a marker of rf, 0.714, which is a unique feature to this accession.

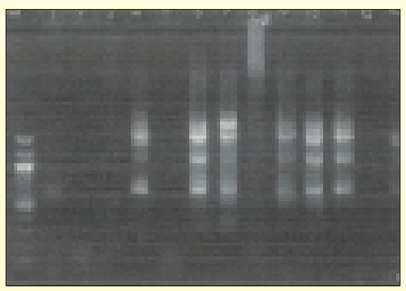
Unique bands could be observed in peroxidase profiles of *Mallotus recinosus* of rf, 0.64 and 0.46. A unique band of rf, 0.96 distinguished *Mallotus oblongifolius* and *Mallotus philippinsis* from the rest of the species. A related endemic species *Cleistanthes myrianthus* closely resembling *Mallotus* could be clearly distinguished from all the *Mallotus species* by the unique band of rf, 0.16.

Molecular characterization involving RAPD markers in selected species, viz. *Semicarpus kurzii*

The dendrogram separated accessions to two major groups. The upper cluster carrying accession from SK1, SK2 and SK5 detaching at a similarity index of 0.30 with SK1 separating alone while other two collections from the same location closely related to each other. The 2nd cluster carries accessions from Mundapahad, Lalpahad, Humphreygunh, Koriaghat, Rangachang, Lohabarek, Chouldhari separated from that of Bloomsdale at a coefficient of 0.49 and showing more closeness to the next sub cluster from Sippighat and Collinpur than from Bursabad and Chidiyatapu.

A total of 29 Operon primers were used for amplification and 14 (48%) showed clear bands. About 97 bands (15.32%) were polymorphic in nature. The number of monomorphic bands was 506. Maximum polymorphic bands were produced in OPAW 2 and 6 (9). Maximum amplification was produced by primers OPZ 13 that showed amplification in 12 samples, while OPAW 10 showed amplification only in sample collected from Sippighat (SK8), and the markers amplified by this primer can be designated as a unique primer for identifying this accession.

A total of 28 unique bands could be observed. Primer OPAW 10 had maximum number of unique bands (6) (Table 11), which amounts to 0.95 %. The total number of unique bands obtained from each primer ranged from 1 (OPAW 3,4,8,12,14,18, OPZ 3, 7 (1) to 6 (OPAW 10), with an average of 0.96 bands per primer.



PCR Amplified DNA of the different accessions of Semicarpus kurzii in the operon primers OPAW20

Table 11. List of unique bands in RAPD-PCR

Primer	Band No.	Sample No.
OPAW-2	2	6,12
OPAW-3	1	5
OPAW-4	1	1
OPAW-7	3	9,5,5
OPAW-8	1	5
OPAW-10	6	8
OPAW-11	5	1,7,11,13,13
OPAW-12	1	3
OPAW-14	1	9
OPAW-15	3	9,12,13
OPAW-18	1	12
OPAW-19	2	2,13
OPZ-3	1	3
OPZ-7	1	4

DEVELOPMENT OF IPM PRACTICES FOR KEY PESTS OF BRINJAL, TOMATO, COLE CROPS (CAULIFLOWER, CABBAGE)

G. Shyam Prasad and T.V. R.S. Sharma

In A & N Islands vegetables are cultivated over an area of about 4,000 ha. mainly in Paddy fallows and hilly lands. About 85 % of pesticide consumed in these Islands is used for managing pests and diseases in vegetables. Use of chemicals indiscriminately leads to environmental pollution besides posing health hazards. Hence, to phase out chemical pesticides overtime, IPM technologies are being developed with integration of environmentally safe pest management practices.

Standardization of the height *of Leucinodes orbonalis* trap for maximum efficacy

Experiments were conducted to standardize the height at which water trap has to be deployed to increase the efficacy of trap in attraction of *Leucinodes* moths. It was observed that deployment of *L. orbonalis* trap at crop canopy level or 1.5 m above the ground level (Table 13). It implies that the trap height has to be raised with the age of the crop maintaining at crop canopy level to derive maximum efficacy of pheromone. Thus, pheromone lure has to be used @ 1 trap /100 m^2 at crop canopy level. Each tap was found to last for 15 days thereafter the efficacy of trap decreased needing replacement of Pheromone septa.

Table 12. Monitoring of pests of Brinjal, Tomato, Cauliflower.

Crop	Pest	Time of appearance
Brinjal	Fruit and Shoot borer (BFSB), *Leucinodes orbonalis*	Available throughout the year
	Jassid, *Amrasca biguttula biguttula*	Appears in all stages of crop and intensity is high in crop sprayed with pyrethroids.
	Cotton aphid, *Aphis gossypii*	Its intensity was very low in all brinjal plots. Present throughout the year
Tomato	Fruit borer, *Helicoverpa armigera*	Apperas when crop starts flowering, i.e. 45 DAT
	Serpentine leaf miner : *Liriomyza trifoti*	Present throughout as it is polyphagous.
	Spiralling White fly : *Aleurodicus disperses*	Present throughout as it is polyphagous in nature
Cauliflower, Cabbage	Cut worm, *Spodoptera litura*	The pest appeared during 1st week of September and was available till March.
	Diamond back moth : *Plutella xylostella*	The pest appeared during 3rd week of September and remained till March.

Table 13. Effect of sex pheromone trap height on catch of male *L. orbonalis.*

Trap height w.r. soil (m) canopy (m)	Trap height w.r.t crop	Moths trapped / week
0.5	-1.0	8.65[b]
1.0	-0.5	6.45[b]
1.5	0	15.10[a]
2.0	0.5	6.25[b]

Means followed by the same letter are not significantly different (p = 0.05) by DMRT on square root transformed values

Integration shoot clipping and use of pheromone lure on incidence of L. *orbonalis* in brinjal

The IPM practices, viz.

a. Weekly removal of borer infested shoots and fruits and disposal by deep burial
b. Deployment of Pheromone to attract male moth at crop canopy level @ 1 trap/100 m^2

were integrated. It was observed that there was significant reduction in Shoot, fruit damnage and increase in Marketable yield of brinjal. There was remarkable difference in IPM and control plots. There was 58.52 and 74.52 % damage reduction in IPM plots as compared to control plots. There was 2.3 fold increase in yield which received IPM practices as compared to control (Table 14).

Effect of Kenaf, inter crop on incidence of fruit borer in Tomato

The tomato fruit borer, *Helicoverpa armigera* is the major tomato pest in these Islands damaging the tomato fruits. To manage this pest, experiment was laid by intercropping tomato with Kenaf, *Hibiscus subdarifa* . There was significant effect of intercropping on the reduction of *H. armigera* incidence. Tomato with intercrop *of H. subdariffa* (4:1) rows + NPV application twice at 250 LE/ha. at 15 Days interval from 45 DAT was best treatment recording least fruit damage (3.41 %) followed by Tomato sole crop + NPV application twice at 250 LE/ha. at 15 Days interval from 45 DAT (6.37 %). As compared to tomato sole crop, tomato with intercrop of *H. subdariffa* recorded less damage (16.22%) (Table 15).

Table 14. Effect of IPM practices on incidence of *L. orbonalis* in brinjal.

Brinjal Shoot damage by *L.orbonalis*	
IPM plot (Weekly infested shoot, fruit removal and disposal by deep burial + deployment of lure trap @ 1/ 100m ^{2}	14.1 ± 4.8
Control plot	34 ± 2.6
Student t value	4.52*
Fruit damage	
IPM plot (Weekly infested shoot, fruit removal and disposal by deep burial + deployment of lure trap @ 1/ 100m ^{2}	15.1 ± 5.5
Control plot	59.25 + 2.2
Student T value	11.32**
Marketable yield (T/ ha.)	
IPM plot (Weekly infested shoot, fruit removal and disposal by deep burial + deployment of lure trap @ 1/ 100m ^{2}	22.50 ± 2.8
Control plot	9.6 ± 0.75
Student 't value	3.07**

** Significant at 0.05 % level*
*** Significant at 0.01 % level*

Using trap card of Corcyra eggs it was found that that the population of native *Trichogramma* sp. were more in intercropped plots as compared to tomato sole crop, implying that the intercrop serves as an excellent reservoir of natural enemy providing pollen and nectar. The egg parasitoid Trichogramma sp. is responsible for damage reduction as they colonise in intercropped plots and parasitise eggs of *H. armigera*.

Table 15. Influence of intercropping *H. subdariffa* in Tomato for managing *H. armigera*.

Treatment	Damaged fruits (%)	Population of Trichogramma
Tomato sole crop	24.52 [d]	11.8[b]
Tomato wffli intercrop *of H. subdariffa* (4:1) rows	16.22[c]	30.40 [a]
Tomato sole crop + NPV application twice at 250 LE/ha. at 15 Days interval from 45 DAT	6.37 b	12.25[b]
Tomato with intercrop *of H. subdariffa* (4:1) rows + NPV application twice at 250 LE/ha. at 15 Days interval from 45 DAT	3.41 a	32.48 [a]

Means followed by the same letter are not significantly different (p=0. 05) by DMRT

Efficacy of trap crop and NPV for the management of *Spodoptera litura* in cauliflower

The polyphagous pest *Spodoptera litura* is major pest attacking cole crops like cauliflower, cabbage etc. It was observed that mustard planted as trap crop was on par to control. The application of NPV @ 250 LE/acre significantly reduced the leaf damage in sole cauliflower crop (4.20%) and mustard border with cauliflower (4.55 %), and they both were on par (Table 16). It is inferred that NPV alone along with 2 % jaggery as phagostimulant was effective in managing *S. litura* in Cauliflower.

Table 16. Effect of mustard trap crop and NPV application on incidence of *S. litura* on cauliflower.

Treatment	Mean Egg mass*	Mean larvae *	Mean leaf damage %*
Control	15.50[c]	34.25 [c]	31.50[b]
Cauliflower + mustard border	13.50[c]	34.75 [c]	32.1 5 [b]
NPV 250 LE/acre thrice at 15 days interval from 30 DAT	1.5 [a]	3.50 [a]	4.55 [a]
Mustard border + NPV 250 LE/acre thrice at 15 days interval from 30 DAT	1.75[a]	5.21 [a]	4.20 [a]
Monocrotophos 0.07% 4 times at 15 days interval from 30 DAT	5.20 [b]	14.75 [b]	8.42 [a]
Mustard border + monocrotophos 0.07% 4 times at 15 days interval from 30 DAT	4.80 [b]	15.25 [b]	9.25 [a]

Means followed by the same letter are not significantly different (p = 0.05) by DMRT

DIVISION OF NATURAL RESOURCE MANAGEMENT

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ASSESSMENT OF SOIL LOSS WITH BIOLOGICAL CONTROL MEASURES UNDER DIFFERENT CANOPIES IN HILL SLOPES OF ANDAMAN ISLANDS

S.Ghoshal Chaudhuri, S.C.Pramanik and R.Dinesh

The properties of plot soils and eroded sediments in the farmer's field at New Bimblitan were compared (Table 17). The runoff measurement has been done over a period of six months and results showed that runoff loss was less in undisturbed soils under forest canopy compared to other disturbed soils irrespective of canopy and rainfall. The runoff loss, which was less under forest canopy, varied between 4.4 to 33.3 mm depending on the rainfall and followed by arecanut and vegetable canopies except during of November and December 2003. Similar observation was recorded in case of soil loss under different canopies (Table 17). The erosion rates from July 2003 to December 2003 under different canopies (Table 18) revealed that greater soil loss occurred in control, which had less organic matter content and which contributed to the higher susceptibility to rill erosion and thus more soil loss occurred. Plot erosion rates were variable and possibly was also influenced by slope shape tending to be higher on convex slope.

The mean percentage of clay, silt, sand and coarse fractions of plot soil (PE) and sediment (E) of the experimental area was also determined (Table 19). Erosion selectively removed sand. Sediment contained more sand than the soil but silt, clay and coarse fractions were less in case of sediment compared to plot soil. The study also included slope and total loss associated with particle classes and the coefficient between slope and particle class loss in farmers field. Total weights and percentage of clay and silt loss in the sediment positively correlated with slope and the sand and coarse fraction was negatively correlated with slope. This suggests that more silt and especially clay were eroded with increasing slope. A possible explanation is increased runoff velocities and therefore erosivity on steeper slopes would be increasingly competent to detach clays from soil aggregates. Comparison of mean organic carbon content (%) and total N content (%) of plot soil (PE) and sediment (E) from each runoff plot revealed that the organic C & total N content of the sediment was always lower than that of the soil. This can be attributed to the lower clay and silt contents of sediments. The concentration of other nutrients, viz. Ca, Mg, P and K were also lower in the sediment than in the soil probably because the organic matter, silt and clay contents of sediments were less.

Table 17. Runoff loss (mm) and Soil loss (t/ha) at farmers field, New Bimblitan

Months	Rainfall (mm)	Control	Disturbed soil (Arecanut)	Disturbed soil (Vegetable)	Undisturbed soil (Forest)
Runoff loss					
July, 2003	808	64.1	42.3	47.9	33.3
August, 2003	631	57.6	38.5	40.8	26.2
September, 2003	333	43.0	27.1	32.3	15.6
October, 2003	352	44.2	26.4	28.3	12.4
November, 2003	242	23.7	18.4	17.2	9.7
December, 2003	194	19.6	15.8	13.4	4.4
Soil loss					
July, 2003	808	29.8	16.9	23.4	12.7
August, 2003	631	24.3	14.8	18.3	10.0
September, 2003	333	17.7	11.1	13.4	7.8
October, 2003	352	18.9	11.8	14.2	7.1
November, 2003	242	12.6	8.7	5.4	3.8
December, 2003	194	10.4	6.2	3.8	1.2

Table 18. Erosion rates from July 2003 to December 2003 of experimental plots

Plots	Slope (%)	Erosion (Kg)	Erosion equivalent (t/ ha)
Control	21.2	36.1	14.4
Disturbed soil (Arecanut)	20.1	48.9	19.5
Disturbed soil (Vegetable)	23.4	52.4	20.9
Undisturbed soil (Forest)	20.8	27.6	11.0

Table 19. Comparison of mean percentages of clay, silt, sand and coarse fractions of plot soil (PE) and sediment (E) for the experimental area

Plot	Clay (< 0.002 mm)		Silt (0.02-0.06 mm)		Sand (0.06-2.00 mm)		Coarse (> 2.00 mm)	
	PE	E	PE	E	PE	E	PE	E
Control	6.18	2.51	33.28	16.13	49.24	78.85	11.30	2.51
Disturbed soil (Arecanut)	5.22	2.60	38.48	19.09	51.90	77.85	4.40	0.46
Disturbed soil (Vegetable)	4.04	1.00	20.24	6.39	63.52	90.62	12.20	1.99
Undisturbed soil (Forest)	3.62	0.90	18.62	4.94	64.77	91.02	12.99	3.1

ASSESSMENT OF QUALITY OF SOILS IN PLOTS OF KNOWN AGRICULTURAL HISTORY IN A & N ISLANDS FOR THE DEVELOPMENT OF A SOIL QUALITY INDEX

R.Dinesh, S.Ghoshal Chaudhuri and T.E.Sheeja

Changes in soil physico-chemical, chemical and microbial indices and their relationships following deforestation and cultivation in wet tropical forests

For the study, four locations each representing undisturbed forests (moist deciduous and semi-evergreen) and adjacent plantations of padauk (*Pterocarpus dalbergioides*) and teak (*Tectona grandis*), established by clearing portions of these forests were selected and soil samples (0-30 cm) were taken from 15 randomly selected spots distributed over an area of 10 ha from each location. The four locations were treated as replications of each forests and plantation types. The soils were then analyzed for various physico-chemical, chemical, biochemical and microbial indices.

Physico-chemical and chemical parameters

Soil pH of the forest and plantation sites was acidic and varied in a narrow range of 4.98-5.32. The CEC also exhibited minimum variation between the sites and was on an average 372 $\mu mol_C\ g^{-1}$ under the forests and 367 $\mu mol_C\ g^{-1}$ under the plantations. Similarly the clay content also differed little between the sites (mean 27% under the forests and 26% under the plantations). On the contrary, the levels of organic C (20.5-28.0 mg g^{-1}; mean 24.4) were significantly higher those at the plantation sites where they ranged from 6.9- 8.1 mg g^{-1} (mean 7.4). The total N content, which ranged between 1.54 and 2.18 mg g^{-1} (mean 1.87) under the forests, was also significantly higher than those under the plantations (0.81 to 0.86 mg g^{-1}; mean 0.83).

Biochemical and microbial parameters

The two sites revealed marked differences in soil organic matter and microbial properties. The levels of microbial biomass C, biomass N, basal respiration, ergosterol and adenylates (ATP, AMP, ADP) at the forest sites significantly exceeded the corresponding values at the plantation sites, indicating greater microbial activity under the former (Table 20). Among the ratios of different microbial properties, the ergosterol–to-biomass C ratio and mean metabolic quotient (qCO_2) were significantly higher under the forests suggesting a marked decline due to deforestation and cultivation. The ergosterol–to-biomass C ratio further indicated that the fungi, especially at the plantation sites have very low ergosterol content. The ratios of biomass N-to-total N, biomass C-to-N, biomass C–to-organic C and ATP-to-biomass C, however, did not vary significantly between the forest and plantation sites. On the contrary, AEC (Adenylate Energy Charge) levels at the forest sites were consistently higher than 8.0 reflecting greater microbial proliferation at these sites. Overall, the study indicated that on long-term basis, deforestation and cultivation significantly reduced microbial

activity due to decline in available organic matter/ substrate levels.

Interrelationships between various soil parameters

In order to describe overall patterns of interrelationships among individual soil properties and to extract common factors responsible for total variation, a joint principal components analysis (PCA) was performed. PCA indicated that the ratios of soil organic C-to-total N, ATP-to-biomass C and ergosterol-to-biomass C formed the first factor indicating a decomposition pathway dominated by fungi (Table 21). The second factor was loaded by the ratios of biomass N-total N, biomass C-to-N and biomass C-to-soil organic C reflecting soil organic matter availability in relation to nutrient availability. The ratio qCO_2 and AEC formed the third factor, reflecting the specific metabolic activity of soil microbes. The biomass N-total N ratio could not be definitely assigned to factor II because it was also strongly affected by factor III and to some extent by factor I. Likewise, AEC could not be definitely assigned to factor III because this property was also strongly affected by factor I and II.

Development of an index for soil quality assessment in the tropics

A soil quality index was developed from the 5 yr data obtained from analyses of native undisturbed forest soils because it has been time and again reiterated that these native undisturbed soils should be used as standards for soil quality evaluation because they developed freely to attain an equilibrium between their environment and their physical, chemical and biological properties. Therefore, keeping in mind that the soils studied can be considered to be of high quality (native forest soils) and based on the high correlations obtained between the biochemical/ microbial indices and total C and N, a large number of polynomial expressions was used incorporating these additional soil properties that increase the proportion of variance. To facilitate selection of the most appropriate variables, the following criteria was used. The multiple correlation coefficient of the equation should be as close as possible to unity, the number of variables in the final equation should be small, the parameters selected should reflect not only important soil biological and biochemical processes but should also be measurable by simple, accurate and rapid methods.

Among the various polynomial equations, the one explaining 96% of the variation in total N was selected. The equation was:

Total N = (0.41×10^{-3}) microbial biomass C + (1.5×10^{-3}) mineralized N + (12.3×10^{-3}) phosphomonoesterase + (9.2×10^{-3}) glucosidase + (1.5×10^{-3}) urease

An approximation of this equation is given by:

4880 (total N) = (2 microbial biomass-C + 7 N mineralized) + 4 (15 phosphomonoesterase + 11 glucosidase + 2 urease)

Where, total N is expressed as percent, biomass C and N mineralized in mg kg^{-1}, and the enzyme activities in μ mol of liberated product $g^{-1} h^{-1}$

This equation provides a simple expression for the total N content of high quality wet tropical forest soils in terms of two fundamental biological properties- microbial biomass C and mineralized N-and the activities of three enzymes, involved in P, C and N cycles. This relationship may be useful as an index of soil quality of the tropics. The use of the above combination of parameters to give an index of soil biochemical quality of tropical soils is new. However, the usefulness of the biological parameters as indicators of soil quality has already been recognized in temperate soils.

Table 20. Microbial activity and biomass indices at the forest and plantation sites

Site[a]	Biomass C ($\mu g\ g^{-1}$)	Biomass N ($\mu g\ g^{-1}$)	Basal Respiration ($\mu g\ CO_2$-C g^{-1} per day)	Ergosterol ($\mu g\ g^{-1}$)	AMP (nmol g^{-1})	ADP (nmol g^{-1})	ATP (nmol g^{-1})
MD1	623 ± 11	50 ± 5	16.9 ± 3.4	3.91 ± 0.62	0.27 ± 0.04	0.57 ± 0.09	2.94 ± 0.45
MD2	674 ± 14	54 ± 5	26.6 ± 4.2	4.14 ± 0.51	0.21 ± 0.05	0.48 ± 0.10	2.72 ± 0.53
SE1	503 ± 13	41 ± 6	14.5 ± 3.5	3.28 ± 0.49	0.25 ± 0.05	0.61 ± 0.08	2.78 ± 0.61
SE2	583 ± 11	46 ± 6	16.6 ± 3.6	3.71 ± 0.50	0.28 ± 0.06	0.41 ± 0. 06	2.71 ± 0.54
T1	154 ± 8	11 ± 3	2.3 ± 0.4	0.54 ± 0.16	0.12 ± 0.03	0.21 ± 0.03	0.64 ± 0.18
T2	143 ± 6	10 ± 3	2.4 ± 0.4	0.46 ± 0.17	0.12 ± 0.03	0.21 ± 0.04	0.61 ± 0.19
P1	151 ± 6	11 ± 4	2.4 ± 0.3	0.47 ± 0.18	0.15 ± 0.04	0.23 ± 0.04	0.62 ± 0.16
P2	195 ± 8	14 ± 4	2.7 ± 0.3	0.58 ± 0.18	0.15 ± 0.03	0.25 ± 0.05	0.67 ± 0.14
HSD	82	9	2.3	0.81	0.08	0.11	0.31

[a] MD-Moist Deciduous; SE-Semi-evergreen; T- Teak; P- Padauk; HSD- Honest significant difference (Tukey/Kramer P< 0.05, n=20)

Table 21. Ratios of the different soil microbial properties

Site[a]	Microbial biomass C/ organic C (%)	Microbial biomass N/ total N (%)	Microbial biomass C/N	Ergosterol/ microbial biomass C (%)	ATP/microbial biomass C ($\mu mol\ g^{-1}$)	AEC	qCO_2 (mg CO_2-C g^{-1} biomass C per day)
MD1	2.3	2.3	12.4	0.63	4.7	0.85	27.6
MD2	2.4	2.5	12.4	0.61	4.1	0.87	40.1
SE1	2.4	2.7	12.2	0.66	5.6	0.85	29.7
SE2	2.7	2.8	12.6	0.64	4.7	0.86	28.9
T1	2.0	1.3	13.6	0.36	4.3	0.77	15.7
T2	2.0	1.2	14.0	0.33	4.4	0.76	17.5
P1	2.2	1.3	13.6	0.31	4.1	0.73	16.6
P2	2.3	1.7	13.6	0.30	3.5	0.74	14.3
HSD	-	-	-	0.12	0.7	0.02	4.6

HSD- Honest significant difference (Tukey/Kramer P< 0.05, n=20). HSD values not given when ANOVA F values were non significant

Table 22. Principal component analysis of soil parameters

	Factor I	Factor II	Factor III
Soil organic C/total N	0.70	0.30	0.13
Microbial biomass C/N	-0.15	0.71	-0.19
Microbial biomass N/ total N	0.45	0.73	0.51
ATP/ Microbial biomass C	0.87	0.28	0.39
Ergosterol/ Microbial biomass C	0.71	0.44	0.53
Microbial biomass C/ soil organic C	0.22	0.80	0.25
AEC	0.55	0.44	0.71
qCO_2	0.40	0.33	0.84
Eigen value	6.99	0.54	0.22
Expl. Variance	87.5	6.8	2.8

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EVALUATION OF BROAD BED AND FURROW SYSTEM OF LAND MANIPULATION FOR GROWING FODDER AND VEGETABLES IN RICE FIELDS

N. Ravisankar, R. Raja, R. Dinesh, and S. Ghoshal Chaudhuri

Experiment 1. Inclusion of new crops especially high value vegetables and annual crops on the beds

Cabbage in Beds of BBF system

The field experiments conducted during the previous year revealed that instead of adopting only one cropping sequence of Amaranthus- Bhendi- Ratoon bhendi in all the beds, the consortium of five crop sequences *viz.*, Amaranthus- Bhendi- Ratoon bhendi, Cowpea- Brinjal- Ratoon brinjal, Babycorn- Cowpea- Snake gourd, Multicut fodder sorghum (COFS 29) and Brinjal- Cauliflower- Ridge gourd can be recommended for cultivation. This sort of diversified cropping in the beds has reduced the risk of market price fluctuations and in turn resulted in higher net income and B: C ratio (Table 23).

Chilies on the bed of BBF system

Matured paddy in the furrows of BBF system

Experiment 2. Performance testing of rice – Ratoon rice - Maize (under zero tillage)

Sequence

In the furrows, transplanting of Taichung-Sen-Yu followed by its ratoon registered higher yield than S_1P_1 681032 and its ratoon crop. The maize crop (Mahidiwal) raised in the furrows under zero tillage was not germinated properly and in turn resulted in very poor crop stand.

Table 23. Yield and economics of the cropping sequence of beds in BBF system

S.No.	Cropping sequence	Yield (kg in 400 m^2 area)	Gross Income (Rs.)	Net Income (Rs.)	B:C ratio
1	Brinjal -	117.6	1176	696	2.45
	Babycorn - Bitter gourd	65.2	652	372	2.33
2	Baby corn-	76.3	763	483	2.73
	Cowpea – Snake gourd	139.6	698	457	2.90
3	Chillies –	20.8	520	264	2.03
	Cauliflower- Cowpea	340.0	3400	2050	2.52
4	Tomato-	37.8	378	38	1.11
	Cauliflower- Amaranthus	369.2	3692	2342	2.73
5	Cowpea-	158.4	792	551	3.29
	Brinjal- Ratoon	149.3	1493	1013	3.11
6	Amaranthus-Bhendi-	53.6	268	82	2174
	Ratoon Bhendi	251.5	2515	1.44	7.38
7	Pumpkin-	28.0	280	105	1.60
	Cauliflower- Radish	402.4	4024	2674	2.98
8	Brinjal-	122.0	1220	740	2.54
	Cauliflower- Ridge gourd	398.6	3986	2636	2.95
9	Tapioca- Cucumber	240.0	720	380	2.12
10	Multicut fodder sorghum (COFS 29)	1560 (6 cuttings)	1560	1210	4.46
11	Pineapple- Chillies	25	200	60	1.43
Total from 4400 m^2 area		-	28337	18327	4.82
Paddy from 5600 m^2 area		2352	11760	5040	1.75
Total (BBF of one ha area)		-	40097	23367	2.39
One ha paddy alone (Improved variety) (q/ha)		4200	21000	9000	1.75

Table 24. Yield attributes and Yield of Rice - Ratoon rice - Maize in the furrows

Cropping sequence	Characters	Taichung-sen-Yu	S_1P_1 681032
Rice	Plant height (cm)	114.0	111.4
	EBT/m^2 Filled	256	198
	Grains/panicle	119.4	108.6
	Grain Yield (q/ha)	30.4	28.4
Ratoon rice	Grain Yield (q/ha)	0.626	0.424
Maize (Mahidiwal)	-	Very low germination	Very low germination

AGRO TECHNIQUES FOR DIRECT SEEDED RICE IN BAY ISLANDS

N.Ravisankar, R. Raja, M. Din, S.C.Pramanik and R. Elanchezhian

Super rice 6 under direct seeding

Experiment 1: Response of varieties and super rice cultures to direct seeding

The results of the experiment revealed that super rice varieties 6 and 7 registered better growth, yield attributes, yield consequently better economics and energetics under transplanted condition, where as it did not establish properly under direct seeded condition. In case of 145, BTS 24 and BG1639, direct seeding

Direct seed rice in experimental plots

registered on par yield with that of line transplanting. Since lesser energy was consumed by direct seeding, the net returns and B:C ratio were higher with direct seeding *vis-a-vis* line transplanting. Energy ratio was also more for direct seeding. However, energy required to produce one kg of grain remained same for direct seeding and line transplanting.

Conoweeding in direct seeded rice plots

Table 25. Influence of growth and yield attributes of rice varieties and super rice cultures by direct seeding

Treatments	Plant height (cm)	No. of productive panicles/m^2	Filled grains/ panicle	1000 grain weight (g)	Grain Yield (kg/ha)	Straw Yield (kg/ha)	Harvest Index
AWS of 145	101.3	158	124.3	20.8	4117^b	4833	0.46
AWS of BTS24	115.4	187	105.6	20.1	3715^b	4925	0.43
AWS of BG1639	92.4	165	109.8	20.4	3617^b	4349	0.45
AWS of SR6	107.8	14	158.2	22.3	506^c	940	0.35
AWS of SR7	99.4	20	158.4	22.1	716^c	1219	0.37
LT of 145	106.4	169	129.4	20.9	4246^b	4788	0.47
LT of BTS24	120.6	192	106.7	20.4	4124^b	5695	0.42
LT of BG1639	99.6	177	118.4	20.6	3847^b	4896	0.44
LT of SR6	110.9	238	148.4	22.1	7486^a	13903	0.35
LT of SR7	103.4	227	142.6	22.5	6912^a	14688	0.32
CD (P=0.05)	NS	26	20.2	NS	681	1137	0.06
CV (%)	8.99	14.4	9.06	8.92	10.1	15.7	9.11

AWS-Anaerobic wet seeding, LT-Line Transplanting

Table 26. Economics and energetics of rice varieties and super rice cultures under direct seeding

Treatments	Cost of Cultivation (Rs.)	Gross returns (Rs.)	B:C ratio	Labour involved in S/T (No/ ha)	Energy input (MJ)	Specific energy (MJ/kg)	Energy output (MJ)	Energy ratio
AWS of 145	11805	23485	1.99	3	13563	3.29	120932.4	8.82
AWS of BTS24	11805	21530	1.82	3	13563	3.65	116173.0	8.47
AWS of BG1639	11805	20694	1.75	3	13563	3.97	104592.4	7.62
AWS of SR6	11805	3094	0.26	3	13563	26.80	19188.2	1.40
AWS of SR7	11805	4311	0.37	3	13563	19.16	25762.7	1.88
LT of 145	14705	24103	1.64	35	14316	3.37	122266.2	8.54
LT of BTS24	14705	24037	1.64	35	14316	3.47	131810.3	9.21
LT of BG1639	14705	22173	1.51	35	14316	3.72	117750.9	8.23
LT of SR6	14705	45772	3.11	35	14316	1.91	283831.7	19.83
LT of SR7	14705	43373	2.95	35	14316	2.07	285206.4	19.92
CD (P=0.05)	-	4070	0.30	-	-	1.66	24031.8	1.69
CV (%)	-	10.20	10.09	-	-	13.57	17.66	10.50

Rice grain: Rs. 5 kg^{-1}; Straw: Rs.0.60 kg^{-1}; Wage: Rs. 100 manday^{-1}
Energy output: 14.7 MJ /kg for main product; 12.5 MJ/kg for by product ; Energy input : 1.96 MJ for one man hour

Experiment 2: Establishment methods of different varieties of rice

Among the varieties evaluated, Quing Livan No.1 registered better yield, economics and energetics followed by Zen-gui-At-1 and C14-8. In case of establishment methods, anaerobic wet seeding registered yield on par with line transplanting while random transplanting (present practice) recorded lower yield. The random transplanting method has incurred higher cost of production and also

Quing livan No 1 under direct seeding

consumed more energy. In terms of economics and energetics, direct seeding was found to be better than that of transplanting.

Table 27. Growth and yield attributes of rice varieties influenced by establishment methods

Treatments	Plant height (cm)	No. of tillers/m2	No. of productive panicles/m2	Filled grains/ panicle	1000 grain weight (g)
Varieties					
C14-8	154.2^a	163^c	142^c	79.6^c	21.3^b
Quing Livan No.1	105.6^b	226^a	201^a	117.8^a	22.4^b
Zen-Gui-AT-1	98.7^b	204^b	192^b	99.5^b	23.5^a
CD (P=0.05)	7.1	10	9	5.2	1.3
CV (%)	8.2	6.8	12.3	9.8	6.7
Establishment methods					
SWS	120.4	187^b	164^b	94.6^b	22.4
AWS	117.2	206^a	187^a	103.5^a	22.1
LT	122.3	211^a	192^a	106.2^a	22.5
RT	118.1	186^b	169^b	91.7^b	22.5
CD (P=0.05)	NS	16	14	7.8	NS
CV (%)	14.6	7.9	17.4	14.6	9.7

Interaction: NS; SWS-Surface wet seeding, AWS-Anaerobic wet seeding, LT-Line transplanting, RT-Random transplanting

STATUS AND SCOPE OF FARM MECHANIZATION IN A & N ISLANDS

M. Din, P. S. Deshmukh and N. Ravisankar

Survey of the villages

Survey of villages namely Tuga pur, Karmatang-10, Rampur, Chainpur, Diglipur and Webi of North Andaman and Havelock in South Andaman was done. Male bullocks and buffaloes are the main source of draught animal power (DAP) in these islands. The population of cattle and buffaloes has increased significantly from 10455 in 1956 to 74384 in the year 1997 (Table 28) because these draught animals are available as progenies of milch animals.

Table 28. Livestock population of draught animals from 1956-1997 in A&N islands

Category	1956	1966	1977	1987	1997
Cattle	4350	10131	27401	47325	60180
Buffalo	6105	8078	9719	14400	14204
Total	10455	18209	37120	61725	74384

Use of buffaloes for tillage operation

The study revealed that indigenous (wooden) plough and planker are the main animal drawn implements. Three types of indigenous plough (locally made) are being used in the preparation of seedbed and sowing. These types of plough have very low field capacity (0.025-0.033 ha/h). Minimum three to six passes are made for land preparation of paddy. Wooden puddlers are used for puddling. Post paddy crops require more time for tillage with high drudgery. The dropping seed behind the plough does the sowing/planting. This method not only requires more labour but it adversely affects the crop yield.

Table 29. Major sources of farm power in Islands

Source of power	Number	Average power (hp)	Available power (hp)
Agricultural worker	19514	0.1	1951.4
Male cattle over 3 years	16048	0.5	8024.0
He-buffalo over 3 years	4729	0.5	2364.5
Tractor			
a) Agriculture Office	65	45.0	2925.0
b) Farmers owned	56	30.0	1680.0
Power Tiller			
a) Agriculture Office	05	12.0	60.0
b) Farmers owned	18	12.0	216.0
c) Farmers (subsidy basis)	22	12.0	264.0
d) Panchayat (Agril, Deptt)	21	12.0	252.0
Diesel engine	881	5.0	4405.0
Electric motor	36	1.0	36.0
Total available power			22177.9 hp
Net cropped area			40382.00 ha
Per Hectare Power Available			0.41 kW

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Under the scheme "Mechanization of agriculture farming", tractor was introduced in the islands in 1954 and till now, total 121 tractors and 62 power tillers have been provided to the farmers including panchayats and co-operative societies of these islands. At some places hiring of tractors from Agriculture Department and tractor owners was being done. A very substantial increase in tractor and power tiller was observed during the period 1995-96 and 2001-2002.

In these islands conventional rice hullers are used for removing the husk from the paddy, but there is high breakage of grain in such hullers. These hullers are powered by diesel engines of 5 hp. Grain quality is poor and hulling efficiency is also low. Due to poor processing, there is no demand of this rice in the market. The farmers use head rice for their own consumption, while the broken rice is mixed with animal feeds or further processed. Modern rice mill has not been reported in these islands.

At present, the availability of farm power is 0.41 kW/ha in islands (Table 29) whereas the national average is about 1.29 kW/ha. Farmers in Punjab and Haryana are using more than 3 kW/ha power and modern techniques. Study revealed that share of animate power was more (55.6%), followed by inanimate (44.4%). It showed that the availability of farm power in the islands has very low and hadmuch scope for further mechanization.

Testing of manual transplanter

Transplanting of paddy

Paddy was transplanted by five methods, viz. manual mechanical transplanter [T1], line transplanting [T2], conventional random transplanting [T3], IRRI direct seeding [T4] and manual broadcasting [T5]. For mechanical transplanter, 15 wooden frames, each having four mats of size 28x15x3 cm, were fabricated. Mat type nursery of paddy variety S1P1-681032 was raised for manual mechanical transplanter by following the prescribed standard procedure. In this method, nursery required for 1 ha can be raised on 1/10 th area (i.e. 100 sq. m). The nursery for the other transplanting methods of S1P1-681032 was raised by the usual practice followed in Bloomsdale.

Time required for transplanting/seeding per unit area is least in case of

broadcasting [T5], followed by IRRI direct seeding [T4], random transplanting [T3], line transplanting [T2] and mechanical transplanter [T1], as shown in Table 30. Mechanical transplanter required more time for transplanting due to worn out parts of and frequent breakdowns of the finger and chain assembly and hence, reduced the field efficiency. In anaerobic condition, the furrow openers are required for seeding. In aerobic seeding, there is danger of washing away of seeds by rain whereas in anaerobic condition there is no such problem. Direct wet seeding provides more yield than broadcast system while at par yield with the transplanted crop.

Table 30. Time (in seconds) required by different methods of transplanting / seeding

Replication	Treatment				
	T1	T2	T3	T4	T5
R1	920	1200	600	321	135
R2	2022	1980	900	222	95
R3	1800	720	660	175	130
R4	1680	900	1020	281	92
Avg.	1605.5	1200	795	249.75	113

Testing of paddy threshers

Threshing of the paddy was done by manual pedal operated hold-on and electric motorized hold-on threshers. The traditional variety C-14-8 and CARI released varieties like BTS-24, QL No. 1, S1P1-681032 etc. were easily threshed by threshers. But for Super rice varieties, the threshing was very difficult.

Comparison of threshers

From Table 31, it is clear that both hold-on threshers thresh the 16 series varieties

Paddy thresher

easily than the super rice varieties. Pedal operated thresher has average output capacity of 138.34 and 39.84 kg/h and threshing efficiency of 96.40 and 77.83 %, for 16 series and super rice varieties, respectively, at the grain moisture content between 8.09-10.47 %[wb], for both varieties.

Electric operated thresher has average output capacity of 121.36 and 53.12 kg/h and threshing efficiency of 96.68 and 96.1%, for 16 series and super rice varieties, respectively, at the grain moisture content between 4.52-22.76 %[wb], for both varieties.

In case of super rice, the threshing efficiency is very less and the time required for cleaning after threshing is more, because very less grains separated from the panicle. The output capacity of the electric operated thresher is higher than pedal operated threshers.

PTO operated thresher threshed the super rice variety easily, with 100% cleaning efficiency and more than 99% threshing efficiency. The output capacity of this thresher is 230.6 kg/h, which is much less than the recommended output capacity. It may be due to under feeding by unskilled person. The moisture content of grain ranged from 7.43 to 8.27 % whereas the moisture content of straw ranged from 6.58 to 6.75%.

Testing of KAU coconut dehusker

An experiment was conducted for comparative evaluation of local dehuking tool ['sabbal'] and KAU coconut dehusker. Time was noted down for dehusking of a batch of 10 nuts. The time required for dehusking was in the range of 190-316 seconds and 307-486 seconds for 'sabbal' and dehusker, respectively. It was observed that the KAU tool is simple and effective for easy dehusking of coconuts. The tool is light, very simple to use and handy and can be used both at indoors and outdoors. Operator felt comfort in operating dehsuker, because safety is ensured. With 'sabbal', the operator felt pain in thumb roots of hands and shoulder pain after prolonged dehusking work. There is scope for improvement in the available KAU deshuker. The analysis shows that there is significant difference in the time required to dehusk the coconuts.

Testing of copra-dryer

Survey work regarding the drying of coconut was undertaken in South Andaman villages namely Chouldhari, Ograbraj, Tusnabad, Habadipur, Burma Nalla and Makka Pahad. It was observed that farmers dry their copra on the mud floor by using solar energy. This operation takes 6-8 days and quality deteriorated due to deposition of dirt and dust of wet kernel. The copra-dryer was tested. Dry Coconut shell was used as fuel. It took 20-24 hours for drying of 400 coconuts per batch. The quality of copra was good at upper surface whereas at bottom the quality of dried copra was not good. It may be due to direct contact of heat at bottom surface. There is need to develop good copra-dryer.

Table 31. Performance of threshers

Thesher	Pedal operated thresher		Electric operated thresher		Tractor PTO operated thresher	
Parameter	16 series	Super rice	16 series	Super rice	Super rice	Swarnadhan
Feed rate, kg/h	288.52	58.35	295.94	77.02	-	-
Threshing efficiency, %	96.40	77.83	97.68	96.1	99.1	99.6
Output capacity, kg/h	138.34	39.84	121.26	53.12	—-	230.6
Time in cleaning, s	594.6	492.2	534	332.5	—	—
Cleaning efficiency, %	0	0	0	0	100	100

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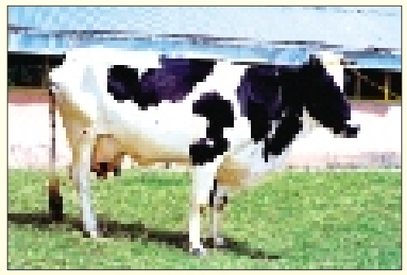
GENETIC UPGRADATION AND EVALUATION OF INDIGENOUS CATTLE OF ANDAMAN

R.N. Chatterjee, S. Senani, S. Jeyakumar, S.P. Yadav and A. Kundu

Production of F3 generation

Production of F3 generation with different grades of Jersey and Holstein Friesian is in progress, after selection and culling in F2 generation on the basis of their phenotypic performance, disease tolerance and adaptation in this climate.



Holstein Friesian cross

Growth, production and reproductive performances

The body weights of the calves upto 7 months of age at monthly interval were taken and analysed for differences between indigenous and genetically upgraded calves. The pooled (for male and female) body weights of genetically upgraded calves were significantly ($P<0.05$) higher than indigenous calves. The male calves were heavier than female calves in each genetic group. Daily milk yield, peak yield, lactation yield and lactation length were significantly ($P<0.05$) higher in genetically upgraded cattle than local cattle. Dry period was higher in local cattle, while peak period was not significantly different between genetic groups. Service period and service per conception were higher among local cows, while calving interval was higher among genetically upgraded cows.

Molecular characterization

A total of 45 cattle, 15 of each three genetic groups, viz. local cattle of Andaman (GG1), crossbreds (50% exotic inheritance) of local cattle of Andaman with Holstein-Friesian (GG2) and crossbreds (50% exotic inheritance) of Sahiwal with Holstein-Friesian (GG3) maintained at the Institute's farm were selected at random for this study. Blood samples of some local cattle of the villages were also collected for this purpose. High molecular weight template DNA was prepared from peripheral blood. The concentration of the DNA and its purity was determined by Spectrophotometer at 260nm and 280nm absorbance, respectively. All the primers were of random sequences and have CG content in the range of 60-80 percent. Seven out of 25 primers, which showed a good degree of polymorphism, were used for the present study. Random Amplified polymorphic DNA-PCR (RAPD-PCR) was carried out with the mixed pooled genomic DNA sample. The PCR products were electrophoresed at a constant voltage of 10V/cm in 1.6% agarose gel containing ethidium bromide. RAPD patterns were visualized and documented using Gel documentation system. The genetic similarity between the genetic groups was calculated from

band sharing (BS) of RAPD patterns from the pooled DNA samples. Mean average percentage difference (MAPD) between genetic groups was calculated using pooled samples for each genetic groups. The RAPD profiles generated from 7 primers were used to study the genetic variation based on band sharing. The three genetic groups of cattle differed in their RAPD patterns in all the 7 primers used. The average band sharing in the present study varied between 0.61 and 0.72. The genetic similarity between the breeds based on band sharing indicated the maximum (0.742 ± 0.09) similarity of crossbred of local cattle of Andaman with Holstein-Friesian (GG2) and crossbreds of Sahiwal with Holstein-Friesian (GG3). It was also observed that local cattle of Andaman and crossbred of local cattle with Holstein-Friesian are more distant to each other than other two groups.

DEVELOPMENT OF A SYNTHETIC LAYER SUITABLE FOR BACKYARD FARMING IN BAY ISLANDS

R.N. Chatterjee, R.B. Rai, A. Kundu, S. Senani, Jai Sunder, S. Jeyakumar and S.P. Yadav.

Production of progeny of different crosses

In the last two years the progeny of direct and reciprocal crosses of Brown Nicobari with ILI-80 in sufficient number could not be produced for evaluation under intensive and backyard. A total of 356 progeny of the cross of Brown Nicobari

Synthetic layers under intensive system

male with ILI-80 female (direct cross) and 487 progeny of the cross of ILI-80 male with Brown Nicobari female (reciprocal cross) in a total of 14 hatches at weekly interval were produced.

Growth performance under backyard

The birds were reared under deep litter up to 5 weeks of age and at this age these birds were supplied to the farmers. The body weights of the birds were noted from 6 weeks to 14 weeks of age at 2 weeks interval. At 6,8,10,12 and 14 weeks of age the body weights were around 400, 460, 535, 670 and 775 g, respectively.

Feed consumption during growing phase

The average daily feed consumption of the progeny of direct and reciprocal crosses of ILI-80 with White Nicobari under deep litter system were measured between 4 weeks to 11 weeks of age at weekly intervals. The average daily feed consumption of the progeny of the cross of ILI-80 (male) with White Nicobari (female) varied from 21.5 g to 74.44g, while, for the reciprocal cross the feed consumption varied from 23.47g to 58.15g, respectively.

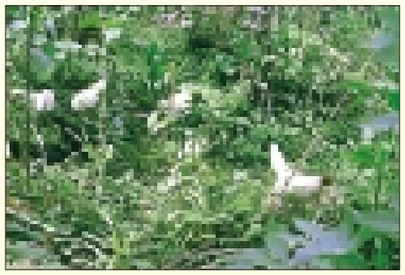
Production performance under backyard system

Brown Nicobari with ILI-80

The average age and weight at sexual maturity of the progeny of direct and reciprocal crosses of Brown Nicobari with ILI-80 were around 185 days and 900g respectively under backyard management systems with low input. The average annual egg production and egg weight were 164-168 eggs and 50-51g, respectively.

White Nicobari with ILI-80

The average age and weight at sexual maturity of the progeny of direct and reciprocal crosses of White Nicobari with



Synthetic layers under backyard system

ILI-80 were 175-185 days and 850-900 g, respectively, under backyard with low input system. The mean annual egg production and egg weight of these progeny were 170 eggs and 51g, respectively, under same system of management.

Feed efficiency under intensive system

Feed efficiency of the birds were measured as average feed consumption (in kg) per dozen of eggs. This trait was measured under intensive (cage) management system. The average feed consumption per dozen of eggs for the progeny of the cross of ILI-80 (M) x Brown Nicobari (F), Brown Nicobari (M) x ILI-80 (F), ILI-80 (M) x White Nicobari (F), White Nicobari (M) x ILI-80 (F), ILI-80 (M) x Black Nicobari (F) and Black Nicobari (M) x ILI-80 (F) were 2.01, 2.34, 1.94, 2.44, 1.98 and 2.42, respectively.

Laying period mortality under cages and backyard

The laying period mortality of different crosses of Brown Nicobari with ILI-80 was 5.82 and 7.96%, ILI-80 with White Nicobari was 7.04 and 13.38% and ILI-80 with Black Nicobari was 10.51 and 12.52% under intensive management. Under backyard system, the laying period mortality of the cross of ILI-80 with White Nicobari was 14.26 and 15.31% and ILI-80 with Brown Nicobari was 8.56% and 9.29%.

Carcass quality traits

Six male chickens from each crossbred group of the direct and reciprocal crosses of Black and White Nicobari with ILI-80 were selected and slaughtered at 16 weeks of age. The live and eviscerated weight of all these chickens were recorded. The weight of the head, back, shank, thigh, wings, chest, liver, gizzard, lungs, heart, and testis were recorded and expressed as percentage of live weight. The eviscerated carcass were cut into four parts, viz. wings, back+neck, legs and breast and expressed as percentage of eviscerated weight. The live and eviscerated weights were highest among the birds of the cross of ILI-80 X Black Nicobari. The weight of the head was

significantly (P<0.05) higher among the birds of the crosses of White Nicobari with ILI-80 than the crosses of Black Nicobari with ILI-80. The weight of thigh and chest were significantly (P<0.05) higher among the birds of the crosses when ILI-80 was used as male parent. However, weight of the gizzard was significantly (P<0.05) higher among the birds when Black Nicobari was used as male parent. There was no significant difference between the crosses in the weight of wings, liver, lungs, heart and testis. Among the cut parts only the weight of back + neck showed significant (P<0.05) difference between the crosses. The percentage of visceral organs as compared to live weight varied between crosses.

Egg quality traits

A total of 80 eggs, 20 each from direct and reciprocal crosses of Black and White Nicobari with ILI-80 were studied for different egg quality traits. The egg weight (at 30 weeks of age) was lowest in the progeny of cross of ILI-80 with Black Nicobari. Albumen height was significantly (P<0.05) higher among the progeny of the cross of Black Nicobari male with ILI –80 female than other genetic groups. Albumen weight and index and the ratio of albumen: yolk weight was significantly (P<0.05) lower among the progeny of the cross of ILI-80 male with Black Nicobari female than other genetic groups. The yolk height and index and yolk % were significantly higher (P<0.05) in the progeny of the cross of ILI-80 male with Black Nicobari female. No significant difference was observed for shape index, yolk weight, shell weight, albumen % and shell % between any genetic groups.

RAPD-PCR profile

RAPD-PCR profile of some purebred and crossbreds were carried out using pooled genomic DNA. A total of 7 primers were screened for this purpose which have given polymorphisms for all pure and crossbreds. Brown Nicobari, Black Rock, Black Nicobari and Giriraja as purebreds and Brown Nicobari (M) x ILI-80 (F) and Black Rock (M) x Black Nicobari (F) as crossbreds were taken for this study. The genetic similarity between different genetic groups was calculated from band sharing (BS) of RAPD patterns. Mean average percentage difference (MAPD) between genetic groups was calculated using pooled samples for each group. All these genetic groups differed in their RAPD patterns.

Conclusion

The body weights of the Black Nicobari crosses at any stage were higher than other crosses. The production performances of White Nicobari crosses were higher than other crosses under farm and field conditions but with poor survivability. The survivability of Brown Nicobari crosses was best under both the systems. The performance of the progeny of the crosses of ILI-80 (M) with Brown Nicobari (F) found to be better keeping in view their survivability and production under backyard.

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ADAPTABILTY AND PRODUCTIVITY OF JAPANESE QUAIL *(COTURNIX COTURNIX JAPONICA)* IN ANDAMAN AND NICOBAR ISLANDS

A.Kundu, S. Senani, R.N. Chatterjee, S. Jeyakumar, S.P. Yadav and R.B. Rai

The initial body weight was low (125g) but through several generation of selection programme the body weight has been improved to 175g. The egg production was initially low (200eggs per annum) but now the egg production has been improved to 250 eggs per annum after adopting mass selection programme. The managemental practices have been standardized in this hot and humid climate. The low cost locally available materials have been utilized for quail rearing in these islands.

The performance of Japanese quail under cage and deep litter system was evaluated. The study revealed that cage reared birds excelled over deep litter-reared birds in early egg laying, reaching the age at 50% egg production earlier, more egg production (Hen day egg production), and significantly (P<0.05) more hatchability%(TES). Though the Egg weight, Fertility % and hatchability % on (FES) were numerically higher in cages than deep litter reared birds, the differences were not statistically significant. It is concluded that in the climate of Andaman and Nicobar it is better to rear quails in cages than deep litter system.

Table 32. Effect of cage vs deep litter rearing on performance of Japanese quail

S. No.		Traits	Cage	Deep litter
1		Age at first egg	44.75±1.55	58.25±2.17
2		Age at 50% Production	59.5±2.02	75.25±3.04
3		Henday egg Production	48.00±0.82	39.50±3.30
4	(a)	Egg weight at 16th Week	10.6±0.42	9.8±0.33
	(b)	Egg weight at 18th Week	10.8±0.36	9.95±0.44
5	(a)	Hatchability % (TES) at16th Week	55.25±3.77	45.75±2.17
	(b)	At18th Week	58.50±2.25	50.5±2.60
6	(a)	Hatchability % (FES) at 16th Week	87.58±1.59	78.62±4.23
	(b)	At18th Week	86.38±2.51	83.72±2.09
7	(a)	Fertility % at 16th Week	63±3.62	58.5±3.12
	(b)	At 18th Week	68±1.77	60.25±2.13
8		Body Weight		
	(a)	Male at 4th week	63.04±2.66	52.4±1.84
	(b)	Female at 4th week	67.76±2.16	56.32±2.20
	(c)	Male at 8th week	142.67±5.75	131.65±5.16
	(d)	Female at 8th week	157.1±6.84	142.1±4.89

DEVELOPMENT OF ECONOMIC RATION BY USING LOCALLY AVAILABLE ENERGY AND PROTEIN SOURCES

S. Senani

In the recent times several potential food and feed resources were screened for their nutrient composition so as to decide their possible use as feed/ food for use. In an experiment *Mycosorium punctum* was screened for its nutrient composition and later on evaluated as a source of herbafge in rabbit feeding. The nutrient composition of the fern shows CP, EE, CF, Ash and CA and P %. In the study 12 rabbits were divided in to groups of six each and given concentrate feed and hybrid Napier grass or edible as source of roughage. Initial body weight, daily intake of concentrate and roughage were recorded. Over a period of two months the intake of mycosorium punctum decreased gradually. In a battery cage, 3 rabiits were housed and given 140 g of concentrate feed and hybrid Napier or edible fern ad-lib. Intake of edible fern gradually decreased from maximum 50 g tpo 7 g.

Colocasia tubers were harvested, chopped, sundried, oven dried and milled to make a powder. In another experiment Colocasia tuber was used as a source of energy in the ration of quail replacing maize from the ration at 50 and 100%. The composition of the experimental ration and the control ration is presented in Table 3.

Table 33. Composition of the control ration and the experimental ration

Ingredients	Control	Experimental
Maize	42	
Groundnut oilcake	44	44
Fish Meal	13	13
Colocasia powder		42
Mineral mixture	0.3	0.3
Bio-boost	0.3	0.3
Salt	0.4	0.4

In another study Lactobacillus was used as a supplement to Standard ration in the one day old Chara-chamballi ducklings of Kerala. Ducklings received Lactobacillus culture@ 3ml/100g of feed having 120x10-6 c.f.u/ml of NCDC-014. And in the control group, there was no supplementation. During the growth period no significant improvement in the growth was observed. The feed intake in the control and experimental groups were also similar. Later on serum samples were collected from the 10 ducks in each group to see their protein profile. Currently egg production studies are on the way. Daily egg produced in each group are recorded and weighed and quality parameters would also be studied to determine over all effects of addition of lactobacillus in the Duck feeding.

STUDIES ON MYCOTOXIN IN FEED STUFFS, SEASONAL VARIABILITY AND DETOXIFICATION

S.Senani, Deepa Bhagat, R.B.Rai, A.Kundu, R.N.Chatterjee and Jai Sundar

In the earlier studies, growth inhibition of *Aspergillus flavus* in the solid media was studied using *Lactobacillus* and *S. cerevisae*. *Aspergillus flavus* was grown on the feed by increasing the moisture content of the feed between 15-20 % and leaving the feed open to the environment. In the treatment group *Lactobacilus* and yeast were added and every 15 days aflatoxin content was measured. The result of the study is presented in Table 34.

The experiment was redesigned to confirm the result in the culture media. As detection of the aflatoxin in the feed is sample dependent and it's always not easy to have a representative sample. Aspergillus fungus was isolated from the poultry feed, identified and confirmed. The strains were grown on Sabourod's dextrose agar plates at 25°C for 5 to 7 days and stored at 40°C. The test organism, *Lactobacillus acidophilus 014* was obtained from NCDC culture collection (NDRI- Karnal).

It was grown on B12 (Himedia) agar plates at 37°C in anaerobic jar under a $CO_2 + N_2$ atmosphere. The culture was stored anaerobically on B12 agar plates at 40°C. Liquid cultures were grown in nutrient broth.

Table 34. Effect of NCDC culture on *Aspergillus flavus*

Sample No.	Sample treatments	Aflatoxin content		
		5th day	12th day	27th day
1,2,3	Negative control (Simple feed)	1.4 ppb	0 ppb	0 ppb
4,5,6	Positive control (Feed with 20% moisture)	3.0 ppb	14.8 ppb	3.96 ppb
7,8,9	Feed with 20% moisture + 2% NCDC-008	2.4 ppb	14.13 ppb	26.0 ppb
10,11,12	Feed with 20% moisture + 2% NCDC-014	10.2 ppb	12.8 ppb	0 ppb
13,14,15	Feed with 20% moisture + 2% NCDC-015	17.4 ppb	16.6 ppb	0 ppb
16,17,18	Feed with 20% moisture + 2% NCDC-044	2.6 ppb	7.4 ppb	4.66 ppb

The identification of *Aspergillus sp.* was done by gross morphological features and by microscopical examination. The colonies show white at first but later turn green to dark green, flat and velvety. Characterization of Lactobacillus was done based on biochemical and sugar fermentation characteristics.

Determination of antifungal activity

For determining antifungal activity, Magnusson and schnurer (2002) method was followed. *L. acidophilus-014* inoculated in one 5cm line on B12 agar plate incubated under anaerobic condition at 30°C for 48 hours. The plates were then overlaid with 10ml of Sabourod's dextrose agar containing 103 and 104 fungal spores (conidia) per ml. The plates were then incubated aerobically at 30°C for 48 hours. The plates were examined for clear zones of inhibition around the bacterial streaks and the area of the zones was scored. The *L.acidophilus* streak and *Aspergillus sp* culture contact each other, colony growth is restricted.

Agar gel diffusion assay of the live culture

L.acidophilus 014 had a broad antifungal inhibitory spectrum, with activity against

Aspergillus sp.. The inhibition zone by LAB was obtained in both the plates containing 103 and 104 dilution of spores/ml. After 2 days of bacterial growth, the pH values in the inhibitory zone between and out side the bacterial streak was recorded as 4.3 and 4.7 respectively. Outside the inhibition zone, the pH in the *Aspergillus sp* containing B12 plates was 5.7.

Spectrum of antifungal activity of culture filtrates

The maximum antifungal activity was observed as a distinct peak after about 48 hours growth at 30°C in the plate contain 104 dilution spores/ml. Very less activity was found in 103 dilution spores/ml plate. A clear zone around the well was formed. This indicates the presence of some metabolite, which inhibit the growth of *Aspergillus sp*. The size of the zone approximately was proportionate to the toxicity of the test substance – but zone size will also depend on the diffusion rate. The minimum inhibitory effect of cell free culture supernatant in 104 spores/ml was

Preparation of culture filterate

L.acidophilus 014 was inoculated into nutrient broth in one-liter flask, and incubated anaerobically at 37°C for 48 hours in anaerobic condition. The culture was then centrifuged a 10,000 rpm, for 10minutes. The sterile cell free supernatant was transferred to the tube and membrane filtered through membrane filter paper (0.45 micrometer pore size). This culture filterate was concentrated under compressed air and was stored at 40°C and antifungal activity was tested with different assay.

Spectrum of antifungal activity of sonicated suspension

The less / no inhibitory effect was observed in both plates having 103 and 104 spores/ml. It reveals that there are some secreatory metabolites, which are responsible for the antifungal effect as no inhibition/less inhibition was observed in sonicated suspension.

SERO SURVEILLANCE & ANTIGENIC CHARACTERIZATION OF ETIOLOGICAL AGENTS OF MAJOR LIVESTOCK & POULTRY DISEASES OF A&N ISLANDS

Jai Sunder, R.B.Rai, A.Kundu, R.N.Chatterjee, S.P.Yadav and B.Ganesh Kumar.

Survey and health camps

During the last year 11 health camps and survey were conducted in different villages of these islands for collection of blood samples and for collection of samples for isolation and identification of different causative organisms. The villages surveyed during the year are Indranagar, Austincreek, Sippighat, Newbimblitan, Manjeri, Makkaphad, CarNicobar, Havelock and Rangat. During the survey, health camps and infertility camps were also organized. As a part of the routine survey work and disease screening, on spot faecal examination was conducted. The examination revealed the presence of Humpsore (38.26%) to be highest in areas of Ograbraj and Guptapara. The incidence of Strongylosis was found to be

Tabel 35. Prevalence of major livestock diseases in A & N Islands

District	Tehsil	Humpsore	Strongylosis	Fascioliasis	Amphistomiasis
	Port Blair	44	20.5	5.5	16.5
	Ferrargunj	46	27.82	16.52	24.6
Andaman	Diglipur	20	13	8.8	21.5
	Mayabunder	15	23.5	11.5	29.5
	Rangat	25	27	7.25	24
	Car Nicobar	41.5	32.5	10	25
Nicobar	Nancowry	60	29.16	10.42	27.08
	TOTAL	35	23	10.5	24.5

higher (27.82%) than Fascioliasis (16.52%) and the incidence of Taeniasis (2.6%), Schistosomiasis (0.86%) and Trichuris (0.86%) were found to be sparsely scattered in South Andaman

Sero surveillance by ELISA, SAT, AGPT, TAT as diagnostic techniques

Sero surveillance was conducted by employing ELISA, SAT, AGPT, TAT etc as diagnostic tools in the year 2003- 04. The sera samples were collected from the different islands of Diglipur, Rangat, Mayabunder, Car Nicobar & South Andaman & the following results were observed.

Total number of sera screened and result of the seroscreening

Cattle (106)
- Brucella abortus : 3
- IBR : 6

Goat (54)
- Brucella melitensis : 8
- Mycoplasma capri : 2

Swine (14)
- Swine fever : 2

Poultry (83)
- M.gallisepticum : 34
- IBD : 81

Studies on diagnosis and development of immunoprophylactic measures against IBD.

Infectious Bursal disease is a contagious viral disease of poultry .The out break of IBD was found to occur in the months of October & May and the mortality per cent was found to be about 50%.

Affected birds showed signs of depression, drowsiness, vent pecking, whitish diarrhea, huddling convulsions & prostration during death. On postmortem, carcass revealed pathognomonic lesions with pinpoint/paint brush hemorrhages on the thigh and breast muscles along with enlargement and hemorrhages on incision of Bursa. The prevalence of IBD in A&N Islands was confirmed by PM lesions, isolation of virus and serological tests (AGPT).

Standardization of bursal antigen for AGPT test

Bursa of fabricious were collected from affected birds, processed by adding 20 g in 40 ml NSS (pH 7.2).The sample was centrifuged at 8000 rpm at 40°C, the supernatant was collected and formalin

(1%) was added and incubated at 37°C for 1 hr. Antibiotics {penicillin (10,000 IU/ml), Streptomycin (10 mg/ml) and Amphotericin B (25 ug/ml)} was added to check any bacterial and fungal contamination. The content was filtered through 0.22 m membrane filter and was used as antigen for AGPT and for rasiing of antisera in rabbit.

Raising of hyper immune sera against IBD in rabbits

Prepared inactivated IBD antigen was mixed with FCA (Equal amount) and inoculated into healthy rabbit @ 1ml S/C. The adjuvant was administered on 0 day, 3 day, 7 day, 14 day and 21 day. The prepared IBD antigen was again mixed with FICA @ 1:1 given on 28 day, 35 day, 42 day and 49 day to same rabbit. After the final injection, the HIS was collected and the titre was checked by AGPT and the sera was stored for further use. HIS was raised successfully against IBD and can be effectively used as a diagnostic tool for AGPT.

Trial of inactivated vaccine in chicks

The formalized vaccine was inoculated into 300 chicks of 0-1 week old @ 2 drops by I/N and orally. The inoculated chicks were kept in the room with the earlier history of IBD outbreak. One group of chicks consisting of 40 number of Nicobari chicks were challenged with the IBDV infected bursal suspension at the dose of 0.5 ml through oral and s/c route at 2-3 weeks of age. The control group (25 chicks) was also kept in the room with earlier history of IBD outbreaks. The mortality percentage in the vaccinated group, unvaccinated group and the challenged group was recorded. The sera samples from the vaccinated chicks were also collected to check the presence of IBD antibodies by employing AGPT.

No mortality was observed in vaccinated birds, while in the challenged group all the chicks died and the PM examination revealed the typical IBD lesions such as pin point hemorrhages on the thigh and breast muscle, enlargement of bursa with hemorrhages and presence of exudates.

In the control group, which was not given any vaccination, 80 % of birds succumbed to the IBDV infection and showed typical lesions of IBD. A total of 75 % of the vaccinated birds showed the presence of precipitating antibodies till the 20th week of age, which varied from 1-3 lines in AGPT. Formalized IBD vaccine was found to be effective as almost all the vaccinated birds survived and the confirmation was assessed by AGPT, which revealed the development of effective antibody against IBD virus. HIS was raised successfully against IBD and can be effectively used as a diagnostic tool for AGPT.

Isoaltion and identification of causative organism of mastitis and its control measures

Mastitis is emerging as grave problem in bovines resulting in decreased milk production, reduced economic performances and productivity in these islands. The study was conducted with an objective to develop diagnostic kits for mastitis in its sub clinical and clinical form, isolation and identification of the causative organisms and to develop control measures by employing ABST etc, to develop an effective vaccine against mastitis.

A total of 64 milk samples were collected from bovines of South Andaman and were screened by Microbiological examination. A series of diagnostic tests like CMT, WST, Chloride test, pH estimation and ABMRT were conducted. Cultured samples were subjected to ABST to choose effective antibiotic against mastitis.

Out of 64 milk samples, 29 samples were found to be positive for Streptococcal mastitis. The percentage prevalence of Streptococcal mastitis was found to be 48%. The percentage prevelance of Brucella mastitis is 3.6%. Series of diagnostic tests like CMT, WST, Chloride test, Ph estimation and AMRT were conducted for diagnosis of sub clinical mastitis. California Mastitis test and Chloride test were found to be highly specific in diagnosing sub clinical Mastitis. The milk samples were subjected to ABST and Gentamicin was found to be effective against both form of Streptococcal and staphylococcal mastitis. A research to develop a vaccine against mastitis is understudy

Test	No of positive sample
CMT :	32
WST :	26
Chloride test :	31
Milk ring test :	16

Bacterial isolates

Streptococcal	48%
Staphylococcus	25%
Gram negative (including E.coli)	20%
Brucella mastitis	3.6%
Yeast, candida etc	10%
Gram positive bacilli	5%

Study on disease prevalence in Rabbits

Ear canker

Ear canker was observed in rabbits with exfoliation of skin layer, itching, reddening, erythematic lesions, along with oozing of serous fluids from the ear. The skin scrapping was taken and was subjected to treatment with 40% KOH, centrifuged for sediment. The sediment revealed the presence of a mite, *Sarcoptes scrapie*. The treatment with Ivermectin 0.2ml/s/c gave complete cure.

Correlation of passive disease data with weather parameters

The passive disease data (Distomiasis and Hump sore) and weather parameters viz. Max and Min temperature, rainfall and relative humidity have been correlated by multiple linear regression analysis. The independent variables considered were temperature, rainfall and humidity.

The multiple linear regression equation fitted for this study was as follows :

$Y = a + b1x1 + b2x2 + b3x3$

Where, Y = No. of animals affected by the disease;

x1 = Temperature (°C);

x2 = Rainfall (mm); and

x3 = Relative humidity (%).

The independent variables considered for the disease Distomiasis, explained about 30 percent of variation in the number of animals affected by that disease in Andaman. The remaining 70 percent of the variation might have been caused by other factors. But, the regression equation was found to be statistically good fit. Number of animals affected by Distomiasis was positively related with humidity. This was found to be highly significant ($P<0.01$), whereas the relationship with temperature was not significant. Conversely, the number of animals affected was negatively related with the amount of rainfall in Andaman. The relationship was found to be highly significant ($P<0.01$). Hence, it was concluded that high relative humidity predisposes this disease to occur in these islands. Similarly, the independent variables considered for Hump sore explained about 57 percent of the variation in the number of animals affected by that disease in Andaman during the study period. The regression equation was also found to be statistically good fit. It was found from the analysis that the number of animals affected by Hump sore was having positive relationship with temperature and humidity and negative relationship with rainfall. But, only the relationship with temperature was found to be statistically significant. Hence it was concluded that the Hump sore incidence was high during non-rainy, summer months (dry periods) in A & N Islands.

STUDY ON THE STATUS OF MINERAL PROFILE IN BOVINES IN RELATION TO DISEASE AND PRODUCTION

R.B.Rai, Jai Sunder, A.Kundu, S.Senani, R.N.Chatterjee and S.Jeyakumar

In A&N Islands, chronic progressive debility and infertility or delayed anoestrous in high producing cows are very common and the analyses indicated about mineral imbalance. However, no systematic work could be done so far. Supplementation of trace mineral mixture was able to correct or retard chronic progressive debility syndrome. Lower mineral level (not classified as deficiency) may impair growth and such animals may be more susceptible to diseases or disease conditions. Thus, if the mineral profile and its availability to animals are known, a correlation input as critical input can be developed for optimizing the production which may be cheaper and based on the level already available. This once developed will also avoid individual screening of animals.

For this, a routine survey was conducted in the following villages, viz. Indranagar, Newbimlitan, Sippighat, Manjeri and Makka Pahad. Camps were organized in these areas and soil, fodder water and serum samples were collected and analysed for mineral deficiency / toxicity by AAS. Analysis of serum samples suggested that the animals were free from any infectious causes of infertility (IBR, Brucella). The villages were selected for survey work based on random sampling model and infertile zones were identified. For survey work, a format was prepared and the information included name of tehsil, village, name of owner, number of livestock. Personals were trained for collection of blood samples, separation of serum, collection of soil, water and fodder samples from valleys, slopes and hillocks for mineral, pH, moisture analysis in different seasons, viz. dry, heavy rainy and light rainy seasons.

Among all the villages surveyed Newbimblitan and Indranagar was selected for further detailed study and identification of causative factors. Camps were organized in these areas. Initially the problematic animals were dewormed and mineral mixtures supplemented. Animals were kept under close observation and those which came to heat were inseminated. Remaining animals which failed to come to heat were then administered Illerin (Bruselin acetate, 5ml i/m) and tonophosphon (10ml i/m). Animals, which responded to Illerin, were then inseminated.

In different villages surveyed 106 animals were detected, 30 animals were found infertile, out of which 13 had come to heat after deworming and supplementation of mineral mixture and 20 responded and came to heat after the injection of Illerin.

POULTRY POST HARVEST TECHNOLOGIES

Different post harvest products as value addition have been developed. Simple, cost effective and efficient technologies like chicken pickle, gizzard pickle, quail egg pickle, chicken samosas have been developed and perfected for commercial exploitation. The products prepared were initially placed before a panel of experts for the sensory evaluation. Laboratory evaluation on the microbial load and the keeping quality of the product has been studied. These technologies are being now imparted among the farmers, small-scale entrepreneurs, unemployed youth and among the women folk and has gained lot of popularity and become a major source of income for the farmers.

Table 36. Mineral profile of soil, water and fodder (in ppm)

Area Surveyed New	pH	Cobalt			Maganese			Potassium			Zinc			Iron			Copper	
		S	F	W	S	F	W	S	F	W	S	F	W	S	F	W	S	F
Bimblitan	6.8	6.3	16.7	0.5	69.5	16.8	0.1	10.6	112.4	4.7	1.6	75.4	0.02	70.9	43.7	1.7	0.2	14.1
Manjeri	7.2	5.8	15.8	0.4	70.8	27.8	0.2	19.4	152.3	4.3	1.7	96.7	0.02	68.0	47.8	1.5	0.9	12.4
MaccaPahar	6.5	1.5	14.2	0.3	80.7	12.5	0.1	34.1	138.3	0.9	3.2	14	0.01	58.7	37	1.8	1.6	10.1
Indra Nagar	7.4	9.5	16.1	0.2	53.8	50.1	0.2	47.8	183.6	1.9	2.2	19.3	0.02	74.2	66.1	2.1	0.01	14.5
Austin	7.2	0.2	81.9		100.5	169.6		85.3	241.3		3.3	35.4		91.2	153.4		17.5	7.7

DIVISION OF FISHERIES SCIENCE

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STUDIES ON RECRUITMENT, CULTURE AND NUTRITIVE VALUE OF EDIBLE OYSTERS OF ANDAMAN WATERS

R. Soundararajan, S. Dam Roy and S. Senani

Since edible oysters occur in good abundance, as revealed by earlier surveys in North, Middle and South Andamans, two dominant species, namely, *Crassostrea rivularis* from Chidiatapu coast and *Saccostrea cucullata* from Marine Hill coast, were selected for studies to evaluate their sex-ratio, gonadial maturity, spat settlement, growth and nutritive value of meat, so that technology for culture of edible oysters, under local conditions, can be developed and standardized for dissemination.

The details of the size range, average oyster weight, average meat weight and sex-ratio of *C. rivularis* and *S. cucullata* in the monthly samples are given in Tables 37. The length of the *C. rivularis* ranged from 36 to 115 mm and the average weight of oysters varied from 49 to 115 g in different months. The average meat weight ranged from 2.89 to 6.08 g. The meat weight was greatest in August and lowest in October. The female ratio ranged from 0.6 to 4.2 with overall average of 2.1 for each male. The females were recorded in substantial numbers during May to July and in October. In *S. cucullata*, the length of oysters in different months ranged from 22 to 75 mm and the average weights ranged from 6 to 14g. The average meat weight in different months ranged from 0.40 to 4.0 with an overall average of 1.4 for each male.

In *C. rivularis*, matured gonads were dominant in both sexes during July, December and January. The ripe gonads were dominant in August, October and March. Large numbers of spent gonads were observed in February. The analysis indicated that ripe gonads all through the year and species showed continuous breeding with a peak during December-March. In *S.cucullata*, the matured gonads were dominat during September - January and ripe gonads were dominant in June, September and November. The spent gonads were found maximum in February - April. This species also is a continuous breeder with peaks in June - July and January - February.

The spat settlement of edible oysters was assessed at Marine hill (in-shore seawater) and Sippighat (Creek brackishwater) and details are given in Table 38. At Marine Hill, the spat settlement was observed throughout the year with peaks in June, August and October. This corresponds to the maturity cycle of both sexes of edible oysters observed off Marine Hill. At Sippighat also, the spat settlement occurred throughout the year with primary peak during February - April and secondary peak during September - November. This corresponds to the maturity cycle observed for *C. rivularis*.

The growth of spats into adults of marketable size was observed for *C. rivularis* and *S. cucullata*. The oyster spats of *C.rivularis* settled in the month of April

measured around 5 to 6 mm and in about 7-8 months they grow to sizes between 60 and 69 mm. However, in *S.cucullata*, the growth was very slow, being smaller species and spats measuring around 3 mm in September grew to 23-27 mm in five months. Due to rough conditions of the sea, the trials could not be continued.

The edibility (Percentage of meat weight in relation to total weight of oyster) of *C. rivilaris* was between 3.4 and 7.86 and in *S. cucullata* the same varied between 5.60 and 8.19. In both the species edibility was maximum during December - January. When the oysters with gonads of different maturity stages were examined, the edibility was maximum in females with matured gonads, while it was maximum in males with ripe gonads (Table 39).

Preliminary studies on proximate composition of the two species were done separately for both sexes. Moisture content varied between 73.1 to 85.1%. The protein value varied between 50.2 to 63.2; carbohydrate from 19.6 to 35.0 mg per gram dry weight and lipid from 4.1 to 8.5% The analysis in the tissues namely hepatopancreas, gonad, aductor muscle and mantle indicated that carbohydrate and lipid were maximum in gonad and protein was maximum in hepatopancreas. While carbohydrate was minimum in aductor muscle and fat and protein were minimum in mantle. When gonads in different stages of maturity were analysed for their proximate composition, it was found that carbohydrate was maximum in developing stage and protein and fat were maximum in matured stage.

Table 37. Details of length, width, total weight, meat weight and sex ratio of edible oysters

Year	Month	Length (mm)	Width (mm)	Average total weight (g)	Average meat weight(g)	Sex ratio
C. rivularis						
2003	Apr	45-100	37-75	79.32	4.4	01:01.8
	May	48-100	65-30	84.64	4.36	01:04.2
	Jun	50-115	36-80	92.18	5.81	01:03.2
	Jul	50-95	35-78	114.54	4.33	01:04.0
	Aug	50-110	40-85	94.26	6.08	01:02.6
	Sep	37-96	45-74	111.86	3.83	01:01.2
	Oct	40-78	32-60	49.15	2.89	01:03.2
	Nov	53-101	38-75	114.45	4.13	01:00.6
	Dec	48-94	30-87	60.28	4.74	01:00.8
2004	Jan	36-98	36-75	69.22	3.55	01:00.6
	Feb	50-95	34-70	51.44	3.58	01:00.5
	Mar	40-95	30-70	58.57	3.55	01:01.9
S. cucullata						
2003	Apr	32-56	15-32	8.45	0.61	1: 0.4
	May	32-65	19-40	10.30	0.75	1: 2.2
	Jun	32-68	22-46	14.19	1.14	1: 2.9
	Jul	31-60	15-40	11.82	0.84	1: 1.4
	Aug	22-58	15-40	9.30	0.61	1: 4.0
	Sep	26-57	15-30	8.12	0.54	1. 0.9
	Oct	29-75	20-38	11.70	0.91	1: 0.7
	Nov	25-50	12-44	8.21	0.46	1: 0.6
	Dec	25-51	15-30	6.51	0.47	1: 1.3
2004	Jan	25-66	15-40	7.57	0.62	1: 0.5
	Feb	24-65	12-32	6.35	0.40	1: 1.9
	Mar	38-70	24-45	9.31	0.65	1: 0.2

Table 38. Spat (<10mm) settlement on Oyster shell cultches

Year	Month	No. of ropes	Total spats	No. of spats per rope
Marine Hill				
2003	Feb	7	66	9.43
	Mar	9	87	9.67
	Apr	11	107	9.73
	May	12	114	9.50
	Jun	3	37	12.33
	Jul	3	27	9.00
	Aug	3	34	11.33
	Sep	9	78	8.67
	Oct	9	111	12.33
	Nov	6	55	9.17
	Dec	9	85	9.44
2004	Jan	9	83	9.22
Sippighat				
2003	Jan	5	-	-
	Feb	5	60	12.00
	Mar	9	95	10.56
	Apr	12	126	10.50
	May	15	87	5.80
	Jun	15	89	5.93
	Jul	15	29	1.93
	Aug	15	42	2.80
	Sep	18	111	6.17
	Oct	18	131	7.28
	Nov	18	133	7.39
	Dec	15	83	5.53
2004	Jan	12	76	6.33

Table 39. Edibility (% of meat weight in total weight of animal) for *C. rivularis* and *S. cucullata*.

Sex	Stage	S. cucullata	C. rivularis
Female	Developing	6.5	5.37
	Mature	**6.62**	**6.41**
	Ripe	5.62	6.36
Male	Developing	7.55	5.16
	Mature	6.07	6.47
	Ripe	**8.29**	**6.52**

CULTURE OF MILKFISH, SEABASS AND PRAWN IN TIDE FED BRACKISH WATER PONDS IN ANDAMANS

S.Dam Roy, R. Soundararajan, N.Sarangi, Rema Madhu and K.Madhu

15000 nos. of Milk fish seeds were collected on 10th May '03 from Pamban, Rameswaran with the help of staff of Department of Fisheries, Tamilnadu. Milkfish seed (14 - 18 mm size) were stocked in (three) brackishwater ponds of Sipighat, having water area of 0.10 ha each, with stocking densities 23400/ha, 24420/ha. and 25600/ha respectively. After a culture period of 7 months, the milkfish have grown to the size of 215 - 410 mm (average 310 mm); weight range (120 - 510 g) with an average of 228 g in pond No I.

In Pond No. II the milkfish have grown to the size range of 210 -295 mm (average size 236 mm) and weight range of 60 -190 g with an average weight 97 g.

In Pond No. III, the milkfish have grown to the size range of 222 - 290 mm with an average being 252 mm and weight range of 80 - 210 g with an average of 123 g.

DOCUMENTATION AND ANALYSIS OF FISHERIES INFORMATION AND FORECASTING OF FISHERIES IN BAY ISLANDS

S.Dam Roy, M.Balakrishnan, R.Soundararajan, N.Sarangi and B.Ganesh Kumar

Molluscan Fishery Resources and shell craft industries

A general account of Bivalve and Gastropod resources of Andaman & Nicobar Islands was delineated with particular emphasis on *Trochus* and *Turbo* resources. The fishery of Trochus and Turbo resources of these islands were documented incorporating data since 1930 onwards. The notable decline of the fishery till date was also recorded.

The resource potential of Pearl oysters, Green mussels, Giant clam of Andaman & Nicobar Islands has also been recorded. The present status of the shell craft industry has been described. The detail of shell fishing in allotted zones has also been documented.

Marine Fishery Resources

The coastal fisheries involving commercially important species like mullet, sardine, mackerel, anchovies etc. were recorded. The gears used by traditional fishermen of A & N islands has also been documented. The fishery of Tuna, Elasmobranch, Crustaceans, Reef fishes etc. have also been described. Some detail with regard to offshore fisheries also has been given. The infrastructure facilities with respect to fisheries of A& N Islands has also been documented.

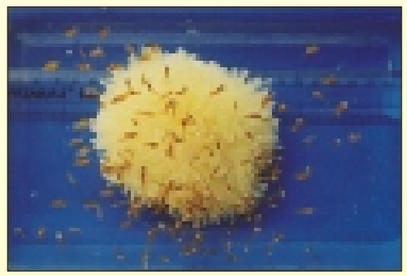
Results of various brackishwater aquaculture experiments conducted in Bay Islands involving milkfish, mullets, seabass, prawn, tilapia etc. have also been recorded.

CULTURE POSSIBILITY OF MARINE ORNAMENTAL FISHES (*AMPHIPRION SPECIES*) IN ANDAMAN AND NICOBAR ISLANDS

K.Madhu, Rema Madhu and R.Soundrarajan

Through different feed management experiments, spawning of *A.percula* was achieved at every 10-15 days interval. The spawning of this species is strongly correlated with lunar periodicity. Egg hatchability was 100%. In 51 larval rearing events, the average survivability of larvae was 90%. Three types of rotifer (SS, S, L Type) were used to feed the larvae. The feeding schedule and ration for different larval stages was standardized. Most of the larvae showed colouration between 8th and 9th day after hatching and a feeble opercular band was noticed to appear between 15th and 17th day when the larvae metamorphosed to juveniles. The larvae settled on the sea anemones between 17th and 19th day and began to shift from partially pelagic to epibenthic, and started eating minced shrimp, fish flesh, mussel meat, clam meat and formulated diets. Feeble middle band developed between 30th and 40th day, and the opercular band became prominent during this period whereas feeble caudal band (third) appeared in 60 to 70 days, and became prominent in 80 to 90 days. The juveniles reached marketable size in approximately 6 months.

Through histological studies, the gonad structure of *A. percula* was categorized into seven phases such as Immature phase (Stage I), Pre-ripe male phase (Stage II), Ripe male phase (Stage III), Gonads in the Transitional phase (Stage IV), In Pre-ripe



Hatchery produced juveniles of *Amphiprion percula* (30 days old)

Hatchery produced juveniles of *Amphiprion percula* (1 year old)

female phase (Stage V), Ripe female phase-I (Stage VI). The observations indicated that *A. percula* is a protandrous hermaphrodite.

The influence of social structure on sex inversion in *A. percula* was studied under captive environment. Two adults (male and female) and a juvenile were reared in each aquarium with optimal environmental factors and feeding was with 15% of their body weight. It was observed that there was a strong correlation between sex inversion and social structure. During the absence of active female, the active male converts into an active female after 5 weeks. Like wise juvenile also converts into adult male.

BIOCHEMICAL GENETICS STUDIES ON ECONOMICALLY IMPORTANT SHELL AND FIN FISHES OF ANDAMANS

K.Madhu, Rema Madhu, N.Sarangi,
R. Soundrarajan and S.Dam Roy

The stock structure of finfish, mullet, *Liza tade* was compared from 19 locations such as Junglighat, Chouldari and Coriyaghat of South Andaman; Rangat Bay, RRO, Errata, Golpadam and Curt Bert bay of Middle Andaman; Pukkadara, Tokkapur, Karmatang, Rampur, Baconbay, Mohanpur, Aerial Bay of North Andaman; Campbel bay, Katchal, Nancowry and Car Nicobar of Nicobar group of Islands. 25 enzymes and general protein of this species have been analyzed. Tissues such as muscle, hepatopancreas and eyes were used. Poly acrylamide gel electrophoresis (PAGE) was carried out in continuous buffer system using Tris-Glycine. The tissue (100 mg) was ground with 1 ml of double distillated water and centrifuged at 10,000 rpm for 20 minute at 50 C. The histochemical staining was followed. Most common allelic distance reported as 100. Nei genetic distance (D) and genetic identity in the present study of the samples were calculated. Total genetic diversity was partitioned into its components at two level of geographic sub division. Tissue and enzyme combination were tested by using four electrophoretic buffer differing in pH and molarity to determine the most suitable system for subsequent electrophoretic examination. Population structure of the species have been assessed by FIS, FST, FIT. Year wise sampling has been done from 2000 onwards to study the temporal stable loci, and various tissues have been observed to find out the heteroplasmy. Different age group of young juvenile and adults species have also been analyzed to find out the ontogenetic variation of the species in Andaman waters. Isozyme banding patterns were interpreted as genotypes when the observed enzyme variation was consistent with model of Mendelian inheritance. Homogeneity of allels was analysed using contingency test. The balancing of polymorphism of all samples from various location was calculated by Hardy -Weinberg law. The log likely hood ratio of spatial heterogeneity of all allelic frequency was examined by comparing the different areas. Analysis of the temporal changes in allelic frequency were carried out between 2000-2001, 2001-2002 and 2002-2003. In each species minimum three years data have been taken to assess the stable polymorphic loci. The individual heterozygosities were calculated for all polymorphic loci and that of average heterozygosity was calculated as the mean of all individual locus heterozygosities (including monomorphic loci). Wright's index of fixation FIS, FST, FIT was calculated from all localities to find out the population structure of the species. Out of 47 loci observed, 14 loci such as ACP-V', AK AO AKP AAT G3 PDH GPI HK-3, IDH-1, MDH P-3, PGM-1, SDH-1, XDH-1, PROT- 4* have been noticed as unstable loci in *L. tade*. The study indicated two distinct populations in Andaman and Nicobar group of islands, respectively.

MICRO ALGAL CULTURE FOR LARVAE OF SELECTED MARINE SHELL FISHES OF ANDAMANS

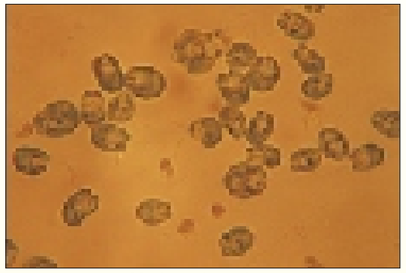
Rema Madhu, K.Madhu and R.Soundrarajan

Under this project, the isolation, identification, culture, biochemical analysis and estimation of shelf life of the marine micro algal species from Andaman islands waters have been carried out. The marine species such as *C. coccoides, C. ellipsoidea, Chaetoceros calcitrans, Chromulina pleoides, Chiorella miniala, Isochrysis albana, Monochrysis lutheri, Tetraselmis chuii, T. carteriformis, Thalassomonas caeca* and *Dicroteria sp.* and fresh water micro algae *Scenedesmus quadricauda* were isolated from the water samples collected from Havelock, Maybunder, Diglipur, North bay, Bombooflat, Niel islands and Kodiaghat.

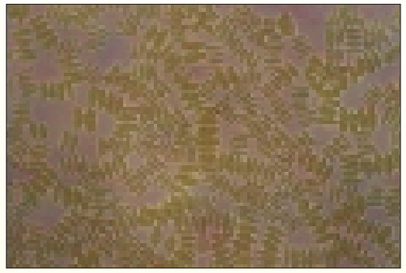
Biochemical analysis of the different growth phases of isolated marine unicellular algae were carried out. The experiment revealed that the protein content of Tetraselmis species during Log phase, Exponential phase, Stationary phase and Death phase varied between 30-32, 34-36, 39-42 and 32-35%, respectively whereas the lipid content ranged between 14.8, 15.2, 11.8 and 14.2% respectively. In the case of *Nannochloropsis occulata,* maximum protein (48.3 to 52.1%) and fat (22 to 25.54%) were observed during the exponential phase. Biochemical analysis of *C. coccoides, N. occulata, D. inornata, C. elipsoidea, M. lutheri, T. chuii, C. plithora* during different growth phases were also analyzed. (Table 40)

Stock culture

In order to find out suitable stock culture



Marine micro algae
Scenedesmus quadricauda (Scale : 6mm = 10µ)



Freshwater micro algae
Scenedesmus quadricauda (Scale : 6mm = 10µ)

media for maximum multiplication of microalgae various media were tested. Stock culture of *N. oculata* showed that Walnes media gave the highest population growth (18.625 lakh cells/ml) and attained peak on 7th day of culture. The media which gave better growth are in the following order : Walnes (18.625 lakh cells /ml on 7th day), Guillard 172 (16.75 lakh cells /ml on 8th day), Guillard 174 (16.05 lakh cells /ml on 8th day), Miquels (15.125 lakh cells /ml on 8th day); TMIRL (13.75 lakh cells /ml on 8th day); SEAFDEC (12.35 lakh cells /ml on 8th day); PM (11.55 lakh cells /ml on 9th day); Guillard f (10.75 lakh cells /ml on 9th day); Suto (9.95 lakh cells /ml on 9th day) and control (7.27 lakh cells /ml on 9th day). Out of the 9 media tested, Walnes media was suitable for the stock culture of *N. occulata*.

The results of the mass culture of *Nitzschia vitrea* showed that Walnes media gave the highest population growth (10.725 lakh cells per ml) and attained peak on 6th day of culture. The media which given better growth are in the order of Walnes (10.725 lakh cells /ml on 6th day); Suto (10.1 lakh cells /ml on 6th day); Guillard 172 (9.675 lakh cells / ml on 6th day); Guillard f (8.675 lakh cells / ml on 7th day); Guillard 174 (8.2 lakh cells / ml on 6th day); TMRL (7.5 lakh cells /ml on 6th day); SEAFDEC (6.875 lakh cells / ml on 6th day); Miquels (6.05 lakh cells / ml on 6th day); PM (5.1 lakh cells /ml on 6th day); Control (3.45 lakh cells / ml on 7th day) (Table 8). Out of 9 media tested, Wales media gave the highest population growth *Chlorella miniata* (16.32 lakh cells /ml on 9th day).

Mass culture

Mass culture experiment revealed that *Chlorella miniala* could be cultured to a cell density of (14.175 lakh cells / ml) on 9th day in Walnes media. The media namely, Guillard 174 (14.075 lakh cells / ml on 10th day); SEAFDEC (13.225 lakh cells / ml on 8th day); TMRL (12.95 lakh cells / ml on 8th day); Guillard f (12.875 lakh cells / ml on 8th day); Miquels (12.75 lakh cells / ml on 9th day); Guillard 172 (12.525 lakh cells / ml on 10th day); PM (12.4 lakh cells / ml on 8th day) and Suto (9.325 lakh cells / ml on 9th day) could be used for cell multiplication.

Evaluation of Rotifer multiplication

Among the three microalgal species such as *Nanochloropsis occulata, Chlorella miniata* and *Nitzschia vitrea*, *N. oculata* has given maximum multiplication of rotifer (420/ml).

Shelf life

Shelf life studies on isolated microalgal species from Andaman waters were carried out under 200 lux (Table 41)

Table 40. Biochemical composition (%) on dry weight basis of different algae.

Species	Dry weight	Protein	Carbohydrate	Lipid
C. coccoides	10.9	34.5	5.8	11.3
N. oculata	72.8	11.8	4.6	7.4
D. inornata	12.3	27.1	8.9	12.8
C. elipsoidea	50.2	14.2	2.6	23.6
M. lutheri	95.8	31.3	21.0	22.0
T. chuii	26.9	32.2	12.6	16.2
C. plithora	28.3	29.9	11.8	24.0

Table 41. Shelf life of different micro algal species.

Species	Shelf life Period
N. elegans	1 week
I. galbana	1 months
C. salina	2 months
C. gracilis	2 weeks
C. regularis	3 weeks
C. lorenziamus	5 days
S. costatum	No shelf life

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TECHNOLOGY ASSESSMENT AND REFINEMENT THROUGH INSTITUTION VILLAGE LINKAGE PROGRAMME

S.C. Pramanik

Technology 1 : Assessment of Butachlor for control of grassy weeds in low land transplanted rice

Infestation of grassy weeds in low lying paddy was identified as the most serious problem in the farmers field during PRA. Weeds caused 25-30% yield loss in paddy in farmers field. Considering the higher rate and non availability of labourer, application of post emergent herbicide butachlor @1.5 kg a.i./ha was recommended. Thus the technology was evaluated in 20 farmers field in 3 villages in South Andaman on low lying micro-farming situation. Post emergence application of butachlor @ 1.5 kg a.i/ha in rice recorded 25.5% higher grain yield and net return of Rs 5245/- over control. The weed density in treated plot was also significantly less than control. Despite the higher productivity and profitability of the technology, adoptability of the technology was low due to less technological flexibility and also due to due to excessive rain causing washing away of the herbicide. As rice is not sold in the local market, farmers were also not interested to make additional investment in rice cultivation also.

Table 42. Performance of Butachlor on weed control in paddy.

Performance Indicator	Control	Butachlor
Weed density at 30 DAT (g/m2)	120.5	30.4
No. of hills/m2	45.0	47.5
EBT per hill	7.0	8.5
Spikelet fertility (%)	60.4	85.8
Grain yield (q/ha)	39.7	45.4
Gross return (Rs./ha)	23820	27240
Net return (Rs./ha)	11070	13740
B:C ratio	1.87	2.01

Table 43. Farmers participatory matrix ranking of the technology

Preference matrices	Control	Butachlor
Yield	4	5
Labour requirement for weeding	5	1
Crop growth	3	4
Technical knowledge required	No	Yes
Availability of Input	NR	Less
Awareness about the technology	-	Low
Flexibility of the Technology	-	Less

Technology 2 : Evaluation of medium duration salt tolerant rice variety for improving productivity

Successful paddy cultivation was not possible in Dasrathpur village due to soil salinity and acidity. BTS 24, salt tolerant variety developed by the Institute, was recommended as the suitable high yielding variety for these areas. Therefore, the technology was intervened in 20 farmers field in the village. This is the third year of technology intervention in the village. Observing the success of the variety, the seeds were multiplied by the farmers from the first year onward. This year, BTS-24 recorded 55.5% higher yield over the local variety. There was no seedling mortality due to salinity and acidity. Through successful cultivation of the variety, farmers could

achieve 60% self sufficiency in food production. At present, more than 75% of the low lying area in the village is under cultivation of this variety. Also, there is horizontal expansion of the technology through farmer-farmer seed distribution in the neighbouring areas.

Table 44. Performance Indicator of salt tolerant paddy variety in the farmers field in Dasrathpur, Middle Andaman.

Performance Indicator	Farmers variety	BTS 24
Seedling mortality due to salinity and toxicity	65%	Nil
Plant height (cm)	106.5	114.2
EBT / hill	6.8	12.8
Spikelet fertility (%)	54.8	74.5
Av. Yield (q/ha)	22.5	35.0
Gross return (Rs./ha)	13,500/-	21,600/-
Net Return (Rs./ha)	1590/-	9450/-
Benefit cost ratio	0.8	1.7

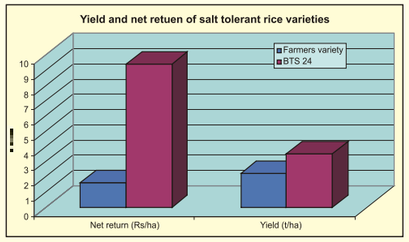


Table 45. Impact indicator of adoption of BTS 24 in Dasrathpur village.

Impact Indicator	Before adoption	After adoption
Self sufficiency in food grain (paddy)	<10%	>60%
Major occupation of farmer	Agril labour	Cultivator
Area under paddy cultivation of individual farmer	<10	>75

Technology 3 : Evaluation of medium duration high yielding variety for improving rice productivity

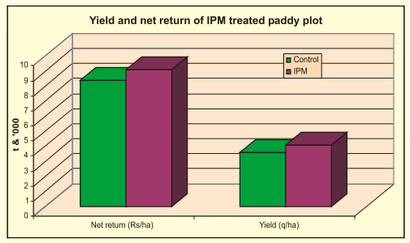
Low productivity of traditional paddy variety was one of the important problems identified in the villages. The Institute recommended several high yielding medium duration paddy variety to solve the problem. Through cultivation of medium duration paddy variety, paddy land could be vacated ealier for the next rabi season vegetables. Therefore, 4 medium duration HYV was assessed in the farmers field over the last three years. Among the four high yielding varieties tested, Ponni (46.5 q/ha) and SIPI (43.7 q/ha) recorded the maximum grain yield which was 32% higher than the farmers variety. Among the varieties tested Q.L.No.1 and Taichung Sen Yu were preferred by the farmers over the others due to good taste, tolerance to lodging and insect pest and diseases. Farmers participatory matrix ranking revealed that under the existing condition, tolerance to insect pest and diseases, tolerance to lodging, fodder availability and profitability were more important selection criteria of the variety than yield alone.

Technology 4 : Assessment of Integrated Pest Management in paddy

Yellow stem borer, leaf folder, case worm, Gundhi bug and bacterial blight were identified as the major insect pest diseases in paddy in the farmers field. Even after application of the recommended chemical pesticides, the insect pest problem could not be solved as they were less effective during rainy season. Therefore, Integrated Pest Management practices, as recommended by the Institute as well NARS, were evaluated in paddy in the farmers' field during this year. The IPM practices adopted were basal application of potash (MOP) @ 60 kg /ha and neem cake @ 40 kg/ha, roping of paddy field at 30 DAT, use of Tricho-card, spraying of neem oil @ 15ml/lit and herbal pesticides at frequent interval. Results revealed that the damage due to YSB was reduced to 10% only and case worm was fully controlled. However, through IPM methods, pesticide applications were reduced by 85.0%. The tested variety Heera recorded an yield of 40.6 q/ha with higher benefit cost ratio.

Table 46. Performance of IPM practices in paddy (var. Heera)

Performance Indicator	Control	IPM
Damage due to YSB infestation	20%	10%
Damage due to leaf folder	10%	Nil
Damage due to Gundhi bug	40%	35%
Reduction in chemical pesticide use	nil	85%
Yield (q/ha) (cv. Heera)	36.5	40.6
Gross return	21900	24360
Net return	8400	9160
Benefit cost ratio	1.60	1.60



Technology 5 : Evaluation of Integrated Pest Management practices in Brinjal

Fruit and shoot borer was found to be the major problem in brinjal in the farmers field. The frequent applications of chemical pesticides in the field resulted in less profitability with higher environmental pollution. In most of the cases, the chemicals did not prove effective due to washing away with rain and the tolerance of the target pest to the insecticide. Therefore, IPM practices in brinjal were recommended for assessment of their effectiveness in the farmers field. The IPM practices adopted were basal application of MOP @ 60 kg/ha and neem oil cake @ 40 kg/ha, use of 5 gm carbofuran per pit along with neem cake and cowdung, growing of maize as border crop and marigold as inter crop, use of pheromone trap and spraying of neem oil @ 15ml/lit and herbal pesticides frequently. The fruit and shoot borer infestation in brinjal was reduced to significant extent due to adoption of IPM practices by the farmers. The aphid infestation in brinjal was also reduced simultaneously. Though there has been marginal increase in yield (11.5 q/ha), the net returns and benefit cost ratio was increased to significant extent by Rs.96300 and 1.5, respectively. The damage due to fruit borer in brinjal was reduced to 5% only. The more important effect of IPM was the severe reduction in chemical pesticide use by the farmers.

Table 47. Performance indicators of IPM practices in brinjal

Performance Indicator	With chemical	With IPM
Plant affected by fruit and shoot borer /m2	30.0	2
Aphid infestation (No. of affected leaf / plant)	2	1
Average fruit weight (g)	155	750
Yield (q/ha)	450.0	461.5
Gross return (Rs./ha)	2,85,320	3,70,250
Net return (Rs./ha)	1,80,450	2,76,750
Benefit cost ratio	2.0	3.50

Technology 6 : Evaluation of Integrated Pest Management in tomato

Tomato was the economic life line of the farmers in Neil Island villages. However, among the major insect pests and diseases, basal rot at seedling stage, fungal rot at flowering and fruiting stage, leaf curl diseases and fruit borer at fruiting caused severe yield loss in the farmers field. The recommended chemical control methods were able to contain these problems to a limited extent. However, the excessive use of chemical pesticides was detrimental for the fragile environment of these islands as well as to the human health. Therefore recommended IPM practices (seed, seedling and soil treatment of *Trichoderma viridae,* basal application of MOP @ 60kg/ha and neem cake @ 20 kg/ha, growing maize as border crop and marigold as inter crop, use of pheromone trap, spraying of NPV and neem oil were assessed in the farmers field against the chemical control methods in 3 villages in Neil Islands. Result revealed a significant reduction in fungal diseases by 65.5% due to use of bio control agent, *T. viridie*. Also the percent infestation of fruit borer was reduced to 2 per 25 m^2 area and the problem of leaf curl was completely controlled. Plant mortality due to fungal disease was severely reduced to 3 due to IPM practices against 38 under chemical methods. Simultaneously, fruit yield (203.0 q/ha) increased by 12.8% over chemical practices. The net return due to IPM practices were higher by Rs.30000/ ha over the chemical control methods. Though there was not much difference in Benefit cost ratio, bio control agents like *T. viridae* and NPV were very much effective in controlling the diseases.

Table 48. Performance indicator of Tomato under IPM in Neil islands.

Performance Indicator	With chemical	With IPM
No. plant affected by fungal rot /25m2	29	10
No. of fruit affected by pod borer / plant	5	2
No. of leaf curl affected plant / 25m2	3	Nil
Mortality due to diseases	38	3
Average fruit weight (g)	433.7kg	400
Fruit yield/plant (g)	2.5 kg	3.0 k.g
Yield (q/ha)	387.0	476.0
Gross return (Rs/ha)	3,09,600	3,80,800
Net return (Rs./ha)	2,14,600	2,85,800
Benefit cost ratio	4.5	5.2

Table 49. Impact indicator of IPM practices in Tomato in Neil islands

Impact indicator	Before adoption	After adoption
Use of neem oil in tomato	Nil.	34.0 lit/ha
Use of neem cake in tomato	Nil.	125.0 kg/ha
Reduction in application of pesticide	Nil.	35.0%
Sale of MOP from Agril Sale Depot	Nil.	400 kg
Sale of neem cake from agril depot.	Nil.	550 kg

Technology 7 : Evaluation of disease tolerant high yielding varieties of okra

Over the last three years, Arka Abhay (65.0 q/ha) recorded the maximum yield than Arka Anamika (53.8 q/ha). The incidence of yellow vein mosaic disease in these varieties was also negligible this year. The variety was adopted by the farmers through its entry in the seed production chain. Post intervention survey revealed that both these varieties replaced farmers variety by 65%.

Technology 8 : Evaluation of short duration HYV of green gram

The performance of short duration high yielding green gram variety PDM 54 was evaluated in 10 farmers field of South Andaman villages. Plant growth and yield attributes of green gram variety PDM 54 was higher than the local variety. PDM-54 recorded 66.7% (7.5 q/ha) higher grain yield than the local variety (4.5 q/ha). The net return and benefit cost ratio was also significantly higher with the high yielding variety. However, participatory assessment showed that variety having 60-75 days duration are more preferred by the farmers for safe harvesting of crop before onset of early monsoon (1st week of May) in these islands.

Table 50. Performance of High yielding green gram variety in Paddy fallow

Performance Indicator	Local variety	PDM 54
Plant height (cm)	32.5	50.5
Length of pod (cm)	5.3	7.8
Seeds per pod (no.)	9.0	11.0
Yield (q/ha)	4.5	7.5
Gross return (Rs./ha)	7200	12000
Net return (Rs./ha)	3700	7800
Benefit cost ratio	2.6	4.1

Technology 9 : Evaluation of low cost rainwater harvesting technique for supplemental irrigation to dry season vegetable crops

This is the second consecutive and successful year of technology intervention on low cost checkdam for supplemental irrigation to the dry season vegetables in paddy fallow. This year the checkdam was constructed by the farmers themselves without the financial help from IVLP project. However, technical guidance was provided during construction of structures. The volume of collection, irrigation depth and frequency was recorded. The yield of vegetables were increased by 15 - 20% through supplemental irrigation from dam. Seeing the success of the dam, farmers in the neighbouring areas also constructed similar dam and harvested runoff water for irrigation purposes.

Table 51. Structural details of water harvesting structures (WHS)

Parameter	WHS
Top Length (m)	4.00
Bottom length (m)	2.80
Width (m)	0.60
Height from base (m)	1.45
Depth of impounding (m)	
First irrigation (end of January)	1.40
Final irrigation (end of April)	0.10
Average no. of irrigation provided	9
Water storage (m3)	
First irrigation (end of Jan)	860.0
Final irrigation (end of April)	85.0

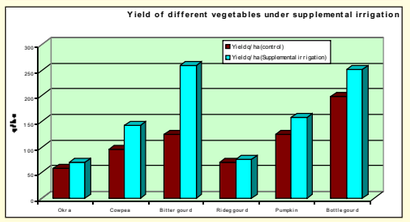


Table 52. Economics of vegetables through supplemental irrigations from check dam

Crop	Yield (q/ha)		Gross return (Rs/ha)		Net return (Rs/ha)		Benefit :Cost Ratio	
	Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed	Irrigated	Rainfed
Okra	70.7	58.6	56600	46800	45450	37715	4.1	3.9
Cowpea	142.5	94.6	114040	75680	100575	64690	7.4	5.9
Bitter gourd	258.6	125.2	388350	187800	360715	164550	13.0	7.1
Ridge gourd	75.0	70.0	72045	63045	59370	51565	4.6	4.4
Pumpkin	157.9	125.5	77960	50220	69525	43570	8.2	6.5
Bottle gourd	251.1	198.4	125575	99275	115860	91930	12.9	12.5

Technology 10 : Assessment of high yielding cut flowers variety, viz marigold, tuberose and crossendra for improving house hold economy.

Technology was assessed in 3 farmers field in Calicut village of South Andaman. Three cut flowers variety viz Crossendra var. Aboli, Tuberose var. single, double and Marigold var. African dwarf and local were evaluated in the farmers field for cultivation in commercial scale in improving household economy of the rural women folk. Crossendra, tuberose and marigold recorded an average yield of 29.5 q/ha, 24.5 q/ha and 62.4 q/ha under field condition. Consequently, the average net return of the family were increased by Rs 30,000/- over the years. The farmer's wife and children were also engaged in value addition of flowers through making of garlands and thereby more employment was generated along with more empowerment of the farm women. Commercial cultivation of cut flower became very popular in the village.

Technology 11 : Assessment of composite fish culture in farm ponds

The need for improving household economy and nutrition through composite fish culture in farm pond was realised in the farmers field under IVLP programme. Therefore, the performance of Indian major carps (Rohu, catla and mrigal) through composite fish culture was assessed in 5 farmers pond in two villages. Results revealed that better management through regular use of cow dung, rice husk recorded better fish growth and higher yield in the field. However, the regular application of lime for pH correction of pond water and growth of unwanted fish like Tilapia was a major problem in the farmers field. Through fish culture, the farmers earned a net profit of Rs 30,000 - 50,000/-/ha based on the fish productivity.

Technology 12 : Assessment of indigenous Nicobari fowl under backyard poultry farming system

This is the third year of successful intervention of the technology in the farmers field. The technology was highly adopted by the farmers because improved Nicobari bird laid higher egg (137) and had less broodiness as compared to local nondescript desi poultry bird. Nicobari bird was also found tolerant to prevalent diseases in the rural areas. On an average, the farmers earned Rs 250 - 300/bird/annum. For wider adoption, it was refined through supply of fertile eggs than chicks. Depending on the survivability and management, the net return varied from farmers to farmers.

Table 53. Yield and benefit of composite fish culture

Farmer	Fish species	Management practices	Growth (cm)		Weight (gm)		Yield (t/ha)	Net benefit (Rs/ha)
			Initial	Final	Initial	Final		
Swaminathan	Rohu, catla	Weeding	1 - 2	23.5	50	150	-	-
Pacchamuthu	Catla, rohu	Cowdung, rice bran + coconut + kitchen waste for 5 months	1 - 2	39.5	50	391.6	0.9	29,500
Bhagat Ram	Rohu, catla	- Do -	1 - 2	28 .0	50	350	1.7	61,000
P.K.Moidu	Rohu, catla	Weeding	1 - 2	8.0	50	150	-	-

Table 54. Performance traits of Nicobari vis-à-vis local nondescript breed under backyard rearing

Spieces	Performance Traits						
	Age at Sexual maturity (days)	Wt. at sexual maturity (gm)	1st egg wt. (gm)	Egg production/ yr	Disease tolerance (1-5 scale)	Broodiness	Mortality
Nicobari fowl	180	1275	55.0	137.0	4.5	Very less	Low
Nondescript local breed	195	1190	45.0	78.0	5.0	High	Least

ECONOMIC ANALYSIS OF POULTRY FARMING ENTERPRISE IN ANDAMAN & NICOBAR ISLANDS

B.Ganesh Kumar, M.Balakrishnan and S.K.Zamir Ahmed

Layer farm under cage system

This study was taken up to work out the investment pattern on different fixed assets, cost of production and broiler and eggs and performance efficiency measures in commercial broiler and layer farming in Andaman district. Under this project, about 40 broiler farms of having different sizes, viz. small (< 300 birds), medium (301 - 900 birds) and large (> 901 birds) were selected in Garacharma, School line, Chouldhari, Bathubasti, Sippighat, Saithankhari, Calicut, Wandoor and Birdline chowk of South Andaman island by random sampling and data colected using pretested interview schedules. There was only two layer farms in South Andaman island, one in Tylerabad and another in Wandoor. Both were surveyed for the study. Data on inputs and outputs used in both broiler and layer farming, investment required for purchase of land, construction of poultry sheds, purchase of equipments such as feeder, waterer, buckets, metal and plastic utensils, weighing balance etc., prices of egg, broiler meat and feed were collected. Apart from these, various socio-economic details of the poultry farmers such as age, education status, occupation, experience and agency, because of whom they were in the business were also collected. It was found that deep litter system was practiced for rearing broilers in these islands by all the small and medium category farmers and some large farmers, some of whom having batch size of more

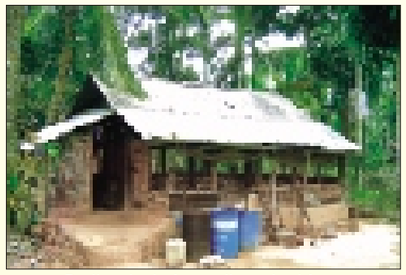
Large broiler farm under deep litter system

than 3000 birds reared them under cage system. Farmers made use of company feed available in the market.

Broiler farming

Investment pattern

In case of broilers, the total investment for small farms was found to be Rs. 1, 26, 024, of which 59.53 per cent was on land, 38.09 per cent on buildings and 2.38 per cent on poultry equipment. The investment for medium sized farms was found to be Rs. 4, 85, 280, of which 56.46 per cent was on land, 40.96 per cent on buildings and 2.58 per cent on poultry

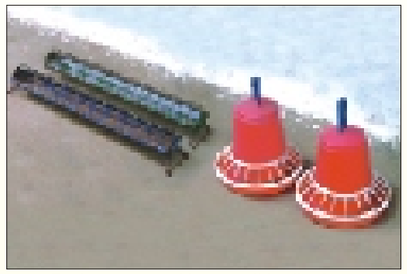


Broiler shed of a medium sized farm

equipment. Similarly, the same for large sized farms was found to be Rs. 5, 23, 500, of which 38.20 per cent was on land, 57.31 per cent on buildings and 4.49 per cent on poultry equipment. Thus, the major part of total investment was found to have been made on land in case of small and medium farms, followed by those on buildings and equipment, whereas in case of large farms the major investment was on poultry sheds, followed by on land and equipment (Table 55).

Cost of production

In the estimation of cost of production of broilers, the variable costs such as chick



Equipments used in a small broiler farm

cost, feed cost, labour cost, medicine cost, electricity cost and miscellaneous cost were estimated. Similarly, fixed costs such as depreciation on broiler sheds and poultry equipments and interest on fixed investment were also calculated. Total cost was derived by summing both variable cost and fixed cost components. The cost of production per broiler was worked out by dividing the total cost with number of birds in the respective farm and it was worked out to be Rs. 67.94, 64.88, 62.17 for small, medium and large farms, respectively.

Total returns from the broiler farms were calculated by adding the returns from sale of birds and gunny bags. By subtracting the total cost from total return, net return was arrived and the net return per bird was found to be Rs. 9.26, 12.32 and 15.03 for small, medium and large farms, respectively. The net return per Rs 100 invested was found to be Rs. 2.20, 2.29 and 4.31 respectively (Table 56). Hence, it could be inferred that the profit would increase as the size of the unit increase, because of economies of scale operating in the broiler farming in Andaman islands.

Performance efficiency measures

Feed conversion ratio was found to be 2.23, 2.12 and 1.98; meat-feed price ratio 2.96, 3.23 and 3.75 and benefit cost ratio 1.13, 1.19 and 1.24 for small, medium and large broiler farms respectively.

Optimum size of broiler unit

The optimum size of broiler unit was calculated using break even analysis. For this, the total cost curve and total revenue curve were estimated first. By simultaneous derivation, the optimum size of farms for small, medium and large broiler farms was estimated and they were 166, 505 and 2436 respectively (Table57).

Brooder shed of a broiler farm

Table 55. Investment pattern on fixed assets in broiler farming

Items	Investment (Rs.) Small	Medium	Large
Land	75, 024 (59.53)	2, 74, 000 (56.46)	2, 00, 000 (38.20)
Building	48, 000 (38.09)	1, 98, 780 (40.96)	3, 00, 000 (57.31)
Electrical fitting	3, 000 (2.38)	12, 500 (2.58)	23, 500 (4.49)
Total	**1, 26, 024**	**4, 85, 280**	**5, 23, 500**

Figures in the parantheses indicate percentages to total

Table 56. Cost of production of broilers per batch (Rs.)

Items	Category Small (Size=300)	Medium (Size=900)	Large (Size=1500)
Dep. on buildings	267	1104	1250
Dep. on equipments	26	37	62
Interest on fixed investment	840	3235	2618
Chick cost	4500	13500	22500
Feed cost	13632	38273	59670
Labour cost	500	1000	4600
Medicine & vaccine cost	450	980	2210
Electricity	150	200	312
Miscellaneous	18	62	40
TC	20383	58391	93262
TC/bird	**67.94**	**64.88**	**62.17**
Sale of birds	22950	68850	114750
Sale of gunny bags	210	630	1050
TR	23160	69480	115800
NR/batch	**2777**	**11089**	**22538**
NR/bird	**9.26**	**12.32**	**15.03**
NR/Rs. 100 invested	2.20	2.29	4.31

Table 57. Optimum unit size for broiler farms of different size

Category	TC	TR	Break Even size
Small	Y = 2797.97 + 59.58 X	Y = - 550.93 + 79.76 X	166
Medium	Y = 14259.84 + 49.94 X	Y = -2453.48 + 83.03 X	505
Large	Y = 26020.60 124.27 X	Y = -2727.91 + 83.71 X	2436

Layer farming

Investment pattern

The total investment for the layer farms in the study was found to be Rs. 36, 000, Rs. 3, 60, 000 and Rs. 8, 000 on land, buildings including all electrical and equipment settings and fencing respectively.

Cost of production

In the estimation of cost of production of layers, the variable costs such as chick cost, cost of chick mash, grower mash and layer mash, labour cost, medicine cost, maintenance cost, electricity cost and generator cost were estimated. Similarly, fixed costs such as depreciation on fixed assts and interest on fixed capital were also calculated. Total cost was derived by summing both variable cost and fixed cost components. The cost of production per layer was worked out by dividing the total cost with number of birds in a batch and it was worked out to be Rs. 481.

Total returns from the layer farms were calculated by adding the returns from sale of eggs and manure. By subtracting the total cost from total return, net return was arrived and the net return per bird was found to be Rs. 19.37 (Table 58).

Performance efficiency measures

The performance efficiency measures such as feed conversion ratio, egg-feed price ratio and benefit cost ratio were worked out to be 3.97, 1.39 and 1.04 in Andaman district.

A pucca layer shed of a large farm

Egg store room

Table 58. Cost of production of layers per batch (Rs.)

Items	Batch I	Batch II	Batch III	Total
Chick No.	21000	15000	25000	61000
Chick cost	420000	300000	500000	1220000
Chick mash	380965	272118	453530	1106613
Grower mash	952560	680400	1134000	2766960
Layer mash	6191640	4422600	7371000	17985240
Labour cost	130500	130500	130500	391500
Medicine cost	207900	148500	247500	603900
Maintenance Cost	50000	50000	50000	150000
Electricity	136000	136000	136000	408000
Generator	85000	85000	85000	255000
TVC	8575565	6240118	10132530	24948213
Depreciation on shed & equipment	540500	540500	540500	1621500
Interest on investment	929200	929200	929200	2787600
FC	1469700	1469700	1469700	4409100
TC	10045265	7709818	11602230	29357313
TC/bird	**478**	**514**	**464**	**481**
Sale of eggs	10461780	7472700	12454500	30388980
Sale of manure	50000	50000	50000	150000
TR	10511780	7522700	12504500	30538980
NR/batch	**466515**	**-187118**	**902270**	**1181667**
NR/bird	**22.21**	**-12.47**	**36.09**	**19.37**

Launching of KVK website by Zonal Co-ordinator

KRISHI VIGYAN KENDRA

TRAINING ACHIEVEMENT

A total of 44 training programme courses was conducted / facilitated for the Practising farmers, Farm women, Rural Youths and Extension Personnel, by the faculty members, wherein 627 men and 454 women totaling to 1081 got trained in agriculture and allied fields (Table 59).

Women in Agriculture Day

FLD on Pulses

Ten demonstrations with Greengram variety only PDM-54 were put in 0.4ha demonstration plots totaling to 4.0ha. The result showed that PDM-54 gave an average yield of 8.26q/ha in comparison to local check with an yield of 5.0q/ha registering 65.20 percent increase in yield.

FLD on Green gram

FLD on Oilseeds

Fifteen demonstrations with variety KBSH-1 were taken up in farmers field covering a total area of G.Oha with average yield of 7.86q/ha over the local check 5.0q/ha registering an yield increase of 20 per cent.

FLD on Sunflower

FLD on HYV of Rice

Under Kharif 2003-04 25 demonstrations of HYV of rice with four selected varieties namely, Quin Livan No.1, S1P1-681032, Taichung Sen Yu and Krishna Hamsa were taken up in an area of 0.40ha each covering a total area of 10.0ha in Beodenabad Panchayat of South Andaman. Among the four, Quin Livan No.1i gave an average yield of 5.40t/ha which showed 74.19 per cent

Table 59. Abstract of Training Programmes (April 2003 to March 2004)

Faculty	Courses	Duration (in Days)	Beneficiaries Men	Women	Total
Agronomy / Extension	16	58	269	98	367
Fisheries	1	3	5	10	15
Home Science	6	26	17	168	185
Horticulture	11	22	204	36	240
Animal Science	7	23	132	79	211
Art cum Audio	3	18	0	63	63
TOTAL	**44**	**130**	**627**	**454**	**1081**

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FLD on Taichung Sen Yu

increase in the yield against the local check (farmers variety) 3.10t/ha. S1P1-681032 gave an yield of 4.95t/ha, Taichung Sen Yu 4.70t/ha and Krishna Hamsa 4.20t/ha respectively.

FLD on Maize

During Rabi twelve demonstrations of Maize var. Mahidaval were taken up in the farmers field covering an area of 2.5ha. The average yield received was 1.67t/ha, which showed cent percent increase in the yield.

FLD on Maize (var. Mahidaval)

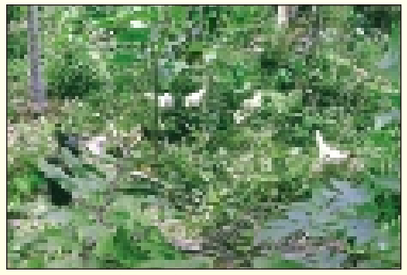
FLD on Vegetables

Three crops namely, Cowpea, Bittegourd and Elephant foot yam were) selected for taking up 25 demonstrations in farmers field. The result showed thatj in Cowpea var. Green Long gave an average yield of 90.08q/ha followed by^ Creeper Long (71.00q/ha). In Bittergourd var. NS-1024 gave an average yield ofl 69.10q/ha in comparison to Rakhuse which gave an

FLD on Bitter gourd

yield of 59.40q/ha. Inj Elephant foot yam var. Gajendra gave an yield of 82.50q/ha.

FLD on Livestock



FLD on Backyard poultry

Thirty eight demonstrations with Nicobari fowl (4), Khaki Campbell Duck (20), Broiler; (4) and Cross Nicobari (10) were undertaken. From the result, it could be| inferred that Nicobari fowl gave an average yield of 140 eggs/bird, which was 75% more than the local bird. The Khaki Campbell Duck yielded 210 eggs/bird, which was 61.53% more than the farmers breed.

FLD on Khaki Campbell duck

Broiler could give 1.8 kg/bird in 45 days. In case of Cross Nicobari could gave 180 eggs/bird.

OFT on HYV of rice for normal soil

NARDI-110, a HYV of rice was put into trial for the third consecutive year in a plot measuring O.OSha each following RBD with 15 replications and two treatments (recommended spacing and farmers method) covering a total area of 0.75ha. An average yield of 4.95t/ha with 54.68% increase in the yield was recorded which was higher when compared to the local variety Puttu-Jaya (3.20t/ha).

OFT on NARDI-110

OFT on HYV of rice for problem soil

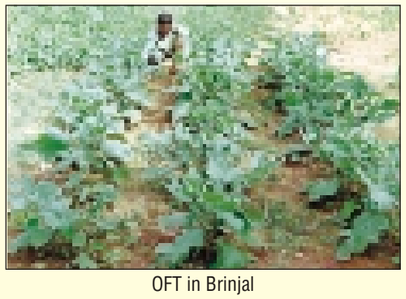
BTS-24, a variety for problem soil was put into trial in plots of 0.05ha each following RBD with 16 replications and two treatments (recommended spacing and farmers method) covering a total area of 0.75ha. The

OFT on BTS-24

average yield obtained was 3.10t/ha with 47.61% increase in yield in comparison to the local cultivar C-14-8 (2.10t/ha).

OFT on evaluation of bacterial wilt resistance in Brinjal

Brinjal varieties Arka Nidhi, Chandrika, Mukta, CO2 and Pusa Kranti were taken for evaluation of bacterial wilt resistant in farmers field. The result inferred that among the five varieties only Chandrika, Mukta and CO2 showed tolerance to bacterial wilt.



OFT in Brinjal

Table 60. Compatible intervention identified in farmers field

Crop	Problem Area	Compatible Intervention	Yield (Q/ha)
Paddy	Problem soil	Var. BTS - 24	35
Paddy	Normal soil	Var. Quin Livan No.1	55.6
Paddy	Weed infestation	Pre-emergence selective herbicide Butachlor	51
Pumpkin	More male flowers	Ethrel (growth regulator)	760
Frenchbean	Low yield	Var. Arka Komal	66.00
Cabbage	Low yield	Var. Sri Ganesh Gol	13.30
Cauliflower	Low yield	Var. Best early	21.62
Fowl	Low egg laying	Nicobari Bird	140/bird
Duck	Low egg laying	Khaki Campbell Duck	210/bird

EXTENSION ACTIVITIES

Activities	Date	Male	Female	Total
A. Field Days				
Low cost agriculture implementation for paddy crop	04.11.03	10	4	14
A success model plantation based cropping system	19.11.03	25	8	33
Fruit preservation	21.12.03	-	50	50
Suitable pulses and oilseed varieties	09.01.04	27	18	45
Mushroom units	28.01.04	-	20	20
Performance of Greengram	06.02.04	27	5	32
Ethrel a growth regulator on cucurbits	31.03.04	10	1	11
Improved pig farming, scientific duck farming, backyard poultry, quail farming and dairy farming		40	25	65

Field day on Mushroom cultivation


Field day on Improved piggery farming

B. Campaign / Mela / Meet

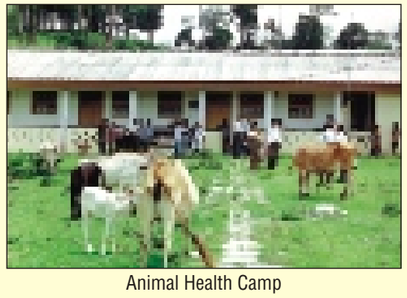
Activities	Date	Male	Female	Total
Kisan Mela	31.12.03	-	-	>500
Farmers Scientists Interaction	29.07.03	30	50	80
Rabi campaign	10.12.03	25	7	32
Rabi campaign	12.12.03	27	6	>290
Village level seminar (04)	-	-	-	70
National Science Day	28.02.04	45	25	50 (345)
Scientists visit to field	-	-	-	28(125)
Farmers visit to KVK	-	-	-	-
Farmers Meet (02)	5-6th 02.04	57	75	132
Kisan Mela	07.02.04	29	35	64
Animal health camp (08 Nos)	-	-	-	249 (Animals treated)

Kisan Mela


Farmers Meet


Village level Seminar


Scientists visit to farmer's field


Animal Health Camp


World Food Day

MEETING / WORSKHOP / SEMINAR ATTENDED

All the Senior Training Assistants and Training Assistants attended the programme for launching of Organic farming A & N Islands at KVK, Sipighat on 23 October, 2003.

All the Senior Training Assistants and Training Assistants attended the Seminar on Promoting spices cultivation in Bay Islands under Central Sector Scheme for Integrated Development of Spices held at KVK, Sipighat on 18 November, 2003.

All the Senior Training Assistants and Training Assistants attended the Scientific Advisory Committee Meeting held at KVK, Sipighat during 19 November, 2003.

Dr. S.K. Zamir Ahmed, Senior Training Assistant attended the Zonal workshop of Zone-II held at RAU, Pusa during 11-13 September, 2003.

Dr. S.K. Zamir Ahmed, Senior Training Assistant attended the State level meet on upscaling of SHGs held at NABARD, Port Blair on 20 November, 2003.

Smt. Kanak Lata, Senior Training Assistant attended the Workshop on Organic farming for sustainable production organised by Horticulture Society of India, New Delhi and CIST, Lucknow during 23-25 March, 2004.

Smt. Kanak Lata, Senior Training Assistant attended the Training cum Workshop on Methodology of formation and functioning of SHGs held at BCKV, Nadia, West Bengal during 29-31 March, 2004.

LECTURE DELIVERED

Topic	Date	Target group
Dr. S.K. Zamir Ahmed		
Role of KVK in upliftment of socio-economic status of farm women for SHGs leader	25.07.03	SHG Leaders
Assistance and incentives available in KVK-CARI for development of rural farmers through agriculture and allied activities	19.01.04	Directors and Paid Secretaries
Extension strategies and economics of backyard poultry	22.01.04	Para-veterrinarians
Strategies for changes agents	16.03.04	Nursing Tutors and CDPO
Role of KVK in development of EDP in agriculture and allied fields	26.03.04	Rural Youth
Smt. Kanak Lata		
Women empowerment through income generation	10.09.03	Women
Food system towards 'Nutrition for all'	23.10.03	Teachers
Preparation of milk product	21.11.03	Women
Scope of floriculture for rural women	01.12.03	Women
Organic farming and the scope of mushroom cultivation in these islands	18.12.03	GTTs
Post harvest technology of poultry products	22.01.04	Inservice
Technique of fruits and vegetable preservation	20.02.04	SHGs
Activities of KVKs for self employment	23.02.04	-
Promotion of Kitchen garden	24.02.04	SHGs
Empowerment of youth and women through KVK	08.03.04	Women
Mr. L.B.Singh		
Spices in backyard system	25.09.03	SHG Members
Scientific coconut cultivation	04.03.04	Farmers
Nutritional value of food and vegetables	16.03.04	Nursing Tutors

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TECHNOLOGIES ASSESSED AND TRANSFERRED

TECHNOLOGIES ASSESSED IN THE FARMERS FIELD

- Assessment of butachlor for control of grassy weeds in low lying transplanted rice.
- Evaluation of medium duration salt tolerant rice variety BTS 24 for improving productivity
- Evaluation of medium duration high yielding variety for improving rice productivity.
- Assessment of Integrated Pest Management in paddy.
- Evaluation of Integrated Pest Management practices in Brinjal.
- Evaluation of Integrated Pest Management in tomato.
- Evaluation of disease tolerant high yielding varieties in okra.
- Evaluation of short duration HYV of green gram.
- Assessment of composite fish culture in farm pond.
- Evaluation of varieties in bitter gourd for higher production and profit.

TECHNOLOGIES SUCCESSFULLY TRANSFERRED TO FARMERS FIELD

- Rainwater harvesting technique through lowcost chechdam or supplemental irrigation to dry season vegetables.
- Medium duration salt tolerant rice variety for improving productivity.
- High yielding cut flowers variety, viz. marigold, tuberose and crossendra for improving house hold economy.
- Integrated pest management in vegetables (tomato and brinjal).
- Improving household economy and nutrition security through Improved Nicobari fowl under backyard farming system.
- Cowpea varieties on rice fallow.
- Disease tolerant high yielding varieties of okra

EDUCATION AND TRAINING

Krishi Vigyan Kendra

A total of 44 training programme courses was conducted / facilitated for the Practising farmers, Farm women, Rural Youths and Extension Personnel, by the faculty members, wherein 627 men and 454 women totaling to 1081 got trained in agriculture and allied fields during the year 2003-2004.

Training on plant propagation technique to the practising farmers of adopted village

Training on "Collage Art" for self help group members

Computer Cell

Two training programmes on "MSOFFICE 2000" and "Internet and email" was organized in the Computer Cell from 21st May to 5th June 2003 and 9th to 19th June 2003 for school going children. 48 students participated in the training.

Dr. R.B. Rai, Acting Director giving away certificates to the school children

School children attending the practical classes in Computer Cell

INFORMATION ON OTHER SECTIONS

LIBRARY

Central Agricultural Research Institute has a well-organized library and plays an important role in this island as a centre for literature and information related to the institute mandate. The library serves and fulfills the needs of the scientists of this institute as well as scientist, research workers and students from other research and educational institute. The library had been enriched during the year with 196 Journal through subscription gifts and on exchange basis. It has 4354 books, 4170 gratis publications and 2395 bound journals. The existing collection of books was further enriched by adding more current, important scientific and technical books. The library has an extensive collection of resource materials in the fields of Animal Sciences, Horticulture, Field crops, Biotechnology, Social Science and many other related areas. The library has an user-friendly reference collection system under the NATO Scheme such as CD-ROM Discs of AGRIS databases (1975-2000), which can be accessed through LAN in all Divisions/Sections. The CARI library has a precious special collection of islands related books and publications alongwith reprographic facility. Besides, efforts have been made to acquire non-conventional literatures such as technical reports, reports on socioeconomic study and annual report from various institutions.

PLANNING, MONITORING AND COORDINATION CELL

The Planing, Monitoring and Coordinaiton cell serves as a coordinating link between the Institute and Council (ICAR), Government, Semi-Government and other R&D organizations in addition to providing information on various research, training and extension activities of the institute to these agencies. The section reviews and scrutinizes the research projects/proposals and coordinates the activities within and outside the institute. During the period under report, the section had :

Prepared the following reports

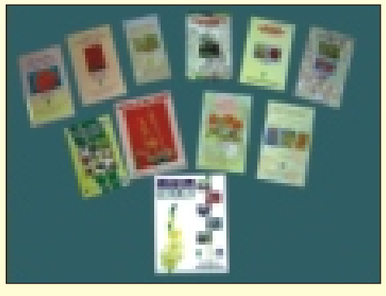
- CARI Annual Report 2002-2003
- Material for DARE's Report 2003-2004
- Monthly Reports to Cabinet Secretariat for the year 2003-2004
- Monthly Institute Progress Monitoring Reports to DG, ICAR for the year 2003-2004
- Half yearly Scientists Progress Monitoring Reports to DG, ICAR for the year 2003-2004

Processed the following documents

- Research articles, Abstracts and Popular articles of the scientists for publication in Indian as well as foreign journals
- Papers pertaining to various ICAR and other organisational awards applied from the Institute
- Material for updating the Directory of Agricultural Institutions in India
- Questionnaire regarding National survey on resource devoted to scientific and technological (S&T) activities by the Ministry of Science and Technology, Govt. of India.

Published the following items

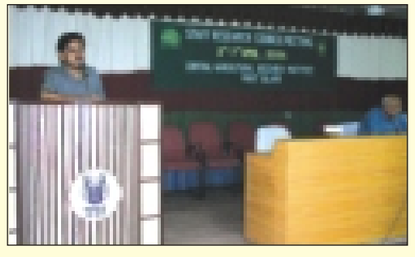
- Technical bulletins - 3
  - Orchids of Bay Islands
  - West Indian cherry cultivation in Andaman
  - Soursop cultivation in Andaman
- Book - 1
  - Two decades of Animal science research in Andaman & Nicobar islands
- Folders - 11



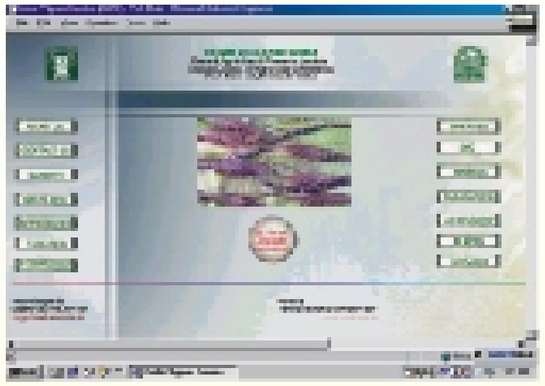
- Culture of mudcrab, *Scylla serrata* in Andaman
- Gerbera - A profitable cut flower for the Bay Islands
- Crossandra - A money spinner
- An endemic green orchid - *Eulophia andamanensis* in Bay Islands
- Value addition to home garden through black pepper cultivation on *Gliricidia* enclosure in Andaman & Nicobar Islands
- Dweepon mein greh vatica
- Buffalo management practices
- Pig rearing practices in Bay Islands
- Few tips about goat management
- Nutritional exploitation of underutilized fruits of Andaman
- Wild mangoes of Andaman & Nicobar Islands

Performed the following activities

- Monitoring and Coordination of research projects and maintenance of project files of the Institute
- Conducted one SRC meeting
- Assisted in research project auditing
- Provided information regarding projects (RPFs) as and when required by the Council
- Provided information on Seed Project to the Council
- Submitted the replies to parliament questions to the Council
- Assisted the Director in all research and scientific matters as well as in planning and policy making as per the directives of the Council.



COMPUTER CELL



Website

Website of Krishi Vigyan Kendra was developed by Computer Cell and it was launched by the Zonal Coordinator, Zone II on 18th November 2003. The website is hosted by National Informatics Centre, Port Blair. The website can be browsed at http://kvkcari.and.nic.in.

VSAT

VSAT has been installed as central facility for the use of scientists and staff. It is running with bandwidth of 64 kbps and it can be expandable up to 4 mbps. Presently, 60 nodes are connected. All the scientists and staff are using the internet facility through VSAT for downloading literatures, softwares and email. Computer Cell is also extending the internet training to children's of CARI staff on nominal costs using VSAT facility.

Training

Two training programmes on "MSOFFICE 2000" and "Internet and email" was organized in the Computer Cell from 21st May to 5th June 2003 and 9th to 19th June 2003 for school going children. 48 students participated in the training.

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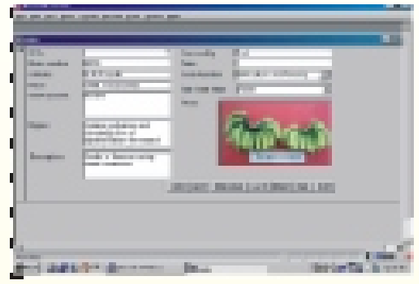
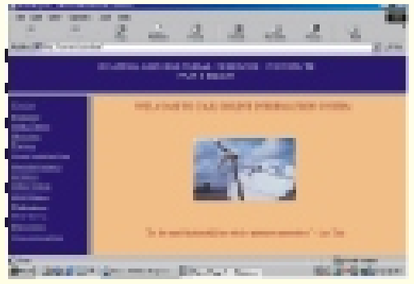
Database



Prepared database on digital photo library for easy searching/retrieval of the photographs of our institute. The database is prepared using Microsoft Access 2000. Apart from the photographs, it contains the fields namely Sl.No, Photo No., Collector, Place of collection, Title, Project, Description, Commodity, Date of collection, Code No and Sub Code No. The photographs can be searched and retrieved easily by entering any of the above mentioned criteria.

Intranet



Intranet of CARI was established. It contains circulars, proformas, utility forms, website addresses, training, symposium, conference, workshop, seminars, awards, vacancy, activities, office orders, ICAR orders, publications, user survey, discussion etc.

OFFICIAL LANGUAGE CELL

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

- To implement the official language policy, efforts have also been made to promote the same in our institute considerably. During this period, lots of bilingual scientific articles/publications were made.
- For the successful implementation of the official language policy and the targets fixed in the Annual Programme, efforts were made for doing maximum work in official language. Achieved the targets of using Hindi fully in the field of transfer of technology and extension. All the training materials used are bilingual. The effort has thus helped the transfer of technology.
- With a view to accelerating the pace of implementation, bilingual scientific bulletins/pamphlets for farmers and half yearly newsletter "SAMACHAR DARSHAN" in Hindi were published.
- Article 3(3) is being followed in toto in institute. All administrative meeting are being conducted in Hindi.
- Institute library has purchased scientific and literature books, magazines for staff/children. Beside this reference books for office like dictionary and help and reference literature were distributed among all sections, officers and staff.
- For the extension of new technologies developed by the institute, All India Radio, Port Blair is broadcasting agricultural article daily for the island farmers. Doordarshan is also telecasting agricultural programmes related to Institute activities.
- During 'Hindi Fortnight', various programmes like quiz, extempore, dictation and essay competition for scientist/staff were organized. During the year, Smt. Ashima Sana, Senior Clerk got special prize for his contribution and co-operation in implementation of the official language programme.

2003-2004 ANNUAL REPORT CARI

- During the year, scientific bulletins in Hindi were printed and distributed among the farmers of these islands.
- Motivated the employees of the Institute in writing original noting and drafting in Hindi.
- Hindi workshop was launched to increase the strength of the staffs for implementation of official language to bring awareness about the importance of increasing use of Hindi in official dealings.
- Under the Incentive scheme, Smt. Shibani Sengupta, Smt. Ashima Saha, Shri Karuppaiah and Shri Shyam Prakash Narayan was rewarded cash award and Smt. Kanaklata, Shri Haider Ali and Dr. S.C.Pramanic were also awarded special prize.

- **Once again the Institute was awarded II position among the all 75 Central Govt. Offices of Port Blair by TOLIC for special contribution and co-operation in implementing the official language programme during 2002-2003.**
- **Institute was awarded 'Rajshri Tandon award' (II position) by ICAR, New Delhi.**
- **Home magazine 'Krishika' was released during 'Rajshri Tandon award' at Krishi Bhawan, ICAR, New Delhi.**

Dr. R.B. Rai, Acting Director receiving 'Rajshri Tandon award'

AWARDS AND RECOGNITION

Dr. D.R. Singh

Got the merit award 2003 for the best paper on "Crop improvement on Anthurium" organized by Indian Society of Ornamental Horticulture, IARI, New Delhi held at KAU, Trichur on 12-14 November, 2003.

Dr. S. Dam Roy

Received the prestigious Hooker Award for the biennium 2000-2001during the convocation of IARI , New Delhi on 6 February, 2004.

Dr. S. Senani, R.N. Chatterjee, Jai Sunder and A. Kundu

Received the best poster presentation award in 1st Conference of Society for Conservation of Domestic Animal Biotechnology held at NBAGR, Karnal in February, 2004.

LINKAGES AND COLLABORATIONS

ON GOING RESEARCH PROJECTS

EXTERNALLY FUNDED

Project	CCPI
NATP	
Analysis and development of homestead farms of Kerala and Port Blair A farmer's participatory approach. Mode: Production System Research	Dr. A. Venkatesh
Sustainable management of plant biodiversity. Mode: Mission mode	Dr. T.V.R.S. Sharma
Development of IPM technologies for palm based production system. Mode: Production System Research	Dr. G. Shyam Prasad
Development of rainwater management technology on water shed basis for high intensity - high rainfall areas of Andaman and Nicobar Islands. Mode: Competitive Grant Programme	Dr. S. Ghoshal Chaudhuri
Identification of molecular markers for natural disease resistance in Nicobar fowl by RAPD-PCR Mode: Competitive Grant Programme	Dr. S.P.S. Ahlawat
Productivity enhancement of ducks. Mode: Production System Research	Dr. S. Senani
Strategies for enhancing the productivity of pigs in Andaman & Nicobar Islands. Mode: Production System Research	Dr. S. Senani
Animal genetic resource biodiversity. Mode: Mission mode	Dr. R.N. Chatterjee
Animal health information system through disease monitoring and surveillance. Mode: Mission mode	Dr. Jaisunder
Mussel mariculture. Mode: Production System Research	Dr. R. Soundararajan
Breeding and culture of pearl oysters and production of pearls. Mode: Production System Research	Dr. R. Soundararajan
"Mangrove ecosystem": Biodiversity and its influence on the natural recruitment of selected commercially important finfish and shellfish species in fisheries Mode: Production System Research	Dr. S. Dam Roy
Nutrition and pathology in mariculture. Mode: Production System Research	Mrs. Rema Madhu
Institutes Village linkage programme (IVLP TAR) for Technical Assessment and Refine. Mode: Production System Research	Dr. S.C. Pramanik
Agricultural Technology Information Centre Mode: Production System Research	Dr. S.C. Pramanik

Project	Principal Investigator
AP CESS	
Promotion of research on protected cultivation of vegetables in a & N Islands	Dr. R.P. Medhi
Agroforestry for sustainable biomass production in Andaman and Nicobar Islands.	Dr. C.B. Pandey
Molecular tagging of excess salt tolerance gene(s) in rice and its significance in marker aided selection.	Dr. Asit B. Mandal
Epidemiological survey of livestock and poultry diseases in Andaman and Nicobar Islands.	Dr. A. Kundu
Meat quality assessment of different indigenous chicken breeds of Bay Islands	Dr. A. Kundu
Studies on important fish diseases in Bay Islands with special emphasis on isolation, identification, virulence factors, antigenic characterization and drug sensitivity of etiological agents.	Dr. S. Jeyakumar
Identification, isolation and culture of marine micro-algae in A & N Islands	Mrs. Rema Madhu
Genetic characterization of economically important prawns in A & N Islands.	Dr. K. Madhu
DBT	
Collection, characterization, conservation and enhancement of Ecologically and Economically important species in Bay islands.	Dr. Asit B. Mandal
Collection of the natural enemy resources of Andaman and Nicobar Islands and a production of promising species for utilization in biological control programmes.	Dr. G. Shyam Prasad
OTHER SOURCES	
Central Sector Scheme Integrated programme for development of spices	Dr. R.P. Medhi
Medicinal Plants Board (Ministry of Health and Family Welfare) Biodiversity characterization conservation and bioprospecting of four economically important medicinal plants species of Bay Islands in Andaman and Nicobar Islands	Dr. Asit. B. Mandal
Space Application Centre, Ahmedabad Coral reef health status using remote sensing	Dr. R. Soundararajan
Ministry of Environment & Forests Seed germination and natural regeneration in tropical rain forest of Andaman Islands.	Dr. C.B. Pandey

INSTITUTE FUNDED

Project	Principal Investigator
HORTICULTURE & FORESTRY	
Varietal evaluation and standardization of agro techniques for tropical fruits.	Dr. R.P. Medhi
Improvement and agro techniques of vegetable crops.	Dr. R.P. Medhi
Improvement of coconut and arecanut.	Dr. R.P. Medhi
Studies on plantation based spices crops for tropical region.	Dr. R.P. Medhi
Introduction and evaluation of exotic and less known indigenous fruit crops.	Dr. D.R. Singh
Collection, cataloguing and standardization of agro techniques of native and exotic orchids and other shade loving plants.	Dr. D.R. Singh
Collection and evaluation of tuberose, gladiolus, chrysanthemum, gerbera, Marigold, balsam and amaryllis.	Dr. D.R. Singh
Tree-soil-crop interactions in agro forestry practices in Andaman and Nicobar Islands.	Dr. C.B. Pandey
Macro propagation studies on some important timber species of Bay islands.	Dr. A. Venkatesh
FIELD CROPS	
Genetic modulation for increased productivity in rice with special reference to biotic and abiotic stress tolerance in Bay Islands.	Dr. A.B. Mandal
Development of IPM practices for key pests of brinjal, tomato, cole crops (Cauliflower, cabbage)	Dr. G. Shyam Prasad
In vitro propagation and molecular characterization of a few selected medicinal plants of Bay Islands.	Dr. T.E. Sheeja
Physiological approaches for improved biotic and abiotic stress tolerance in solanaceous vegetable crops.	Dr. R. Elanchezhian

Project	Principal Investigator
NATURAL RESOURCE MANAGEMENT	
Assessment of soil loss with biological control measures under different crops canopies in hilly slopes of Andaman islands.	Dr.S.Ghoshal Choudhuri
Runoff harvesting and recycling for crop production during dry season on rice fallow in Andamans.	Dr. S.C. Pramanik
Assessment of quality of soils in plots of known agricultural history in Andaman and Nicobar Islands for development of soil quality index.	Dr. R. Dinesh
Status and scope of farm mechanization in Andaman and Nicobar Islands.	Dr. M. Din
Evaluation of broad bed and furrow system for vegetable production in rice fields of Andaman and Nicobar Islands.	Dr. N. Ravisankar
Agro-techniques for direct seeded rice in Bay Islands.	Dr. N. Ravisankar
ANIMAL SCIENCE	
Study on the status of minerals profile in bovines in relation to disease and production.	Dr. R.B. Rai
Adaptability and productivity of Japanese quail in Andaman and Nicobar Islands.	Dr. A. Kundu
Studies on myotoxin in feedstuffs, seasonal variability and detoxification	Dr. Swaraj Senani
Development of economic ration by using locally available energy and protein sources.	Dr. Swaraj Senani
Genetic upgradation and evaluation of indigenous cattle of Andamans.	Dr. R.N. Chatterjee
Development of a synthetic layer suitable for backyard farming in Bay Islands	Dr. R.N. Chatterjee
Sero-surveillance and antigenic characterization of etiological agents of major livestock and poultry diseases of Andaman and Nicobar Islands.	Dr. Jai Sunder

Project	Principal Investigator
FISHERIES SCIENCE	
Studies on recruitment, culture and nutritive value of edible oyster of Andaman waters.	Dr. R. Soundararajan
Hatchery seed production of marine shellfishes of economic importance.	Dr. R. Soundararajan
Brood stock raising and maturity studies on groupers of Andaman	Dr. N. Sarangi
Culture of milkfish, sea bass and prawn in tide fed brackish ponds in Andamans.	Dr. S. Dam Roy
Documentation and analysis of fisheries information and forecasting of fisheries in Bay Islands.	Dr. S. Dam Roy
Micro-algal culture for larvae of selected marine shellfishes of Andamans.	Mrs. Rema Madhu
Culture of marine ornamental fishes in Andaman Islands.	Dr. K. Madhu
Bio-chemical genetics studies on economically important shell and finfishes of Andamans.	Dr. K. Madhu
SOCIAL SCIENCE	
Economic analysis of poultry farming enterprise in Andaman and Nicobar Islands.	Dr. B. Ganesh Kumar

LIST OF PUBLICATIONS

RESEARCH PAPERS

Agrawal, M.C, S. JeyaKumar and S.P.S. Ahlawat (2003). Helminthic infections of livestock in Andamans. *Journal of Veterinary Parasitology,* 17 (2): 143-45.

Balasubramanian, S., D. Kathiresan, Cecilia Joseph, T. Gnanasubramanian, S. JeyaKumar and S.R. Pattibiraman (2003). Clinical management of uterine invagination in bovines. *Indian Veterinary Journal,* 80: 687-688.

Balasubramanian, S., S. Jeya Kumar, K. Krishnakumar and S. R. Pattabiraman (2003). Modified percutaneous foetotomy technique in a cow - A case report. *Indian Veterinary Journal,* 80: 95-96.

Balasubramanian, S., S. Jeyakumar and S.R. Pattabiraman (2003). Reconstructive surgery of vulvo-vaginal tear in a buffalo heifer - A case report. *Indian Veterinary Journal,* 80: 683-684.

Balasubramanian, S., S. JeyaKumar, K. Shanthi, C. Veerapandian and S.R. Pattabiraman (2003). Laproscopic diagnosis of adhesion of uterus in a cow. *Indian Veterinary Journal,* 80 : 711-712.

Chatterjee, R.N., S.P. Yadav, R.B. Rai, A. Kundu and Jai Sunder (2003). Evaluation of carcass quality traits of Nicobari fowl. *Indian Journal of Animal Health,* 42: 129-132.

Chatterjee, R.N., S.P. Yadav, R.B. Rai and A. Kundu (2004). Evaluation of Nicobari fowl under backyard island millieu. *Indian Journal of Animal Science, 74 : 992-993.*

Dinesh, R. (2004). Long-term effects of leguminous cover crops on microbial indices and their relationships in soils of a coconut plantation of a humid tropical region. *J. Plant Nutr. Soil Sci.,* 167: 189-195.

Dinesh, R., A.N. Ganeshamurthy, S. Ghoshal Chaudhuri and G. Shyam Prasad (2003) Dissolution of rock phosphate as influenced by farmyard manure, fresh poultry manure and earthworms in soils of an oil palm plantation. *J. Indian Soc. Soil Sci.,* 51 : 308-312.

Dinesh, R., M.A. Suryanarayana, S. Ghoshal Chaudhuri and T.E. Sheeja (2004). Influence of leguminous cover crops on the general and specific biochemical characteristics in soils of a plantation. *Soil and Tillage Research,* 77: 69-77.

Dinesh, R., S. Ghoshal Chaudhuri, A.N. Ganeshamurthy and Chanchal Dey (2003). Changes in soil microbial indices and their relationships following deforestation and cultivation in wet tropical forests. *Applied Soil Ecol.,* 24: 17-26.

Dinesh, R., S. Ghoshal Chaudhuri and T.E. Sheeja (2004). Soil biochemical and microbial indices in wet tropical forests: Effects of deforestation and cultivation. *J. Plant Nutr. Soil Sci.,* 167: 24-32.

Elanchezian, R. and Asit B. Mandal (2003). Rice genetic resources indigenous to Bay Islands - A profile. *Tropical Agricultural Research & Extension,* 4 (2): 61-67.

Elanchezhian, R. and Asit B. Mandal (2003). Assessment of genotype

specificity for in vitro culture response in brinjal *(Solanum melongena)* varieties. *Indian Journal of Plant Physiology, 1:79-84.*

Elanchezhian, R. and Asit B. Mandal (2003). RAPD analysis of somaclones developed from a salt tolerant rice cultivar - Pokkali. *Indian Journal of Plant Physiology, (Spl. Issue - Part I): 310-314.*

Elanchezhian, R. and Asit B. Mandal (2004). Effect of salinity stress on agro-morphological parameters and water relations in tomato varieties. *Indian Journal of Coastal Agricultural Research.*

Ganesh Kumar, B. (2003). Technological change in Dairy farming : A case study of Tamil Nadu. *Productivity,* 44 (1):97 104.

Ganesh Kumar, B. and A.S.S. Pandian (2003). Cost of milk production in the milk shed area of Tamil Nadu. *Indian Journal of Animal Sciences,* 73 (8) : 920 923.

Ganesh Kumar, B. and N. Meganathan (2003). Annual credit flow for livestock development in Tamil Nadu: An Economic Analysis, *Indian Economic Panorama,* 13(2):43.

Ganesh Kumar, B. and Raj Vir Singh (2003). Economic efficiency of milk production in Tamil Nadu. *Productivity,* 44(4):642 645.

Ganesh Kumar, B., S.C. Pramanik and M. Balakrishnan (2004). Marketing of various agricultural commodities in Andaman and Nicobar Islands : An investigative survey. *Indian Economic Panorama,* 13(4):43-47.

Ghoshal Chaudhuri, S., S.C. Pramanik and R. Dinesh (2003). Effects of land uses on tropical moist evergreen forest soils of Little Andaman. *Indian J. Soil Cons.,* 31:92-94.

Jai Sunder, R.N. Chatterjee, R.B. Rai, S.P.S. Ahlawat, A. Kundu, S. Senani, S.K. Saha, S.P. Yadav and Deepa Bhagat (2004). Outbreak of Infectious Bursal Disease in poultry of A & N Islands. *Indian Veterinary Medical Journal, 28:23-25.*

Jeyakumar, S. and S.R. Pattibiraman (2003). Clinical management of uterine invagination in bovines. *Indian Veterinary Journal,* 80:687-688.

Kundu, A., S. Senani, S.P.S. Ahlawat, R.B. Rai, S.P. Yadav, R.N. Chatterjee, S.K. Saha, S. JeyaKumar and Jai Sunder (2003). Performance of Japanese Quails under cage and deep litter systems of rearing in Andaman and Nicobar Islands. *Indian Journal of Poultry Science,* 38(1):63-66.

Madhu, K., Rema Madhu and Deepa Divakaran (2004). Scope for the Establishment of Protected areas for Management of Marine bio diversity in Andaman and Nicobar Islands. In : *Protected Habitat and Bio diversity, Nature Conservators,* 8:69-76.

Mandal, A.B. and B. Roy (2003). In vitro selection of mature seed derived calli for increased tolerance towards Fe-toxicity in rice and their isozyme profiling. *J.Genet & Breed,* 57 : 325-340.

Pandey, C.B. (2003). Belwoground biomass dynamics in deciduous and evergreen tree species in a juvenile block plantation. *Indian J. Agroforestry,* 5:12-16.

Pandey, C.B. (2003). Belwoground biomass dynamics in deciduous and evergreen tree species in a juvenile block plantation. *Indian J. Agroforestry,* 5:12-16.

Pandey, C.B. and D.K. Sharma (2003). Interaction of shade, soil- water and nitrogen in wheat (Triticum aestivum L.) grown under Acacia nilotica L. willd. ex. Del in a traditional agroforestry system in Central India. *Range Mgmt & Agroforestry,* 24(2).

Pandey, C.B. and D.K. Sharma (2003). Residual effect of nitrogen on rice productivity following tree removal of Acacia nilotica in a traditional agroforestry system in Central India. *Agriculture, Ecosystem and Environment,* 96:133-139.

Pramanik S.C., S.S. Ghosh, R.L. Sagar, S. Nawaz and S. Ghoshal Chaudhuri (2003). Participatory assessment of medium duration, high yielding varieties for improved yield and efficient rice production in Bay Islands. *International Rice Research Notes,* 28(1):17-18.

Ravisankar, N., A.K. Nair, S.C. Pramanik, R. Dinesh and S. Ghoshal Chaudhari (2003). Effect of controlled release nitrogen on growth, yield, economics and energetics of medium duration 'Mansarover rice' (Oryza sativa) under lowland conditions. *Indian J. Agri. Sciences,* 73(4):289-290.

Rema Madhu, K. Madhu and Deepa Divakaran (2004). Prospects of breeding and sea ranching of economically important flora and fauna for conserving marine biodiversity in Andaman and Nicobar islands. In : Protected Habitat and Bio diversity, *Nature Conservators,* 8 : 95-101.

Rema Madhu, K. Madhu, Deepa Divakaran and T.K. Biswas (2003). Influence of culture media on the growth performance of marine centric diatom Chaetoceros gracilis in Andaman waters, *J. Indian Soc. Coastal Agric. Res.,* 211:37-44.

Rema Madhu, K. Madhu, T.K. Biswas and Deepa Divakaran (2004). Multiplication of marine unicellular algae Nannochloropsis occulata under different culture media in Andaman waters. *Environment and Ecology,* 22(Spl-1):46-51.

Selvakumar, K.N. and B. Ganesh Kumar (2003). Constraints in borrowing and repayment of livestock loans. *Indian Economic Panorama,* 14(1):44-46.

Singh D.R., Senani, S., R.P. Medhi, T.V.R.S. Sharma and R. Senthil Kumar (2003). Alligator's apple - An unexploited fruit of mangrove areas of Bay islands. In the compendium on Mangrove bio-diversity of Andaman and Nicobar Islands published by Director, CARI, Port Blair. pp:149-151.

Singh, D.R., and A. Sujatha Nair (2003) Establishment of new cultivar Eulophia andamanensis “Pretty Green Bay” The Orchid Review, U.K., London, 3(1251):48.

Venkatesh, A., K. Vanangamudi and R. Umarani (2003). Effect of seedling grade on growth and survival of pungam (Pongamia pinnata). *J. Trop For Sci.,* 15(1):231-233.

POPULAR ARTICLES

Chatterjee, R.N., S.P.S. Ahlawat and R.B. Rai (2003). Buffalo production in bay Islands *Livestock International,* 7 (5) : 2, 22-23.

Chatterjee, R.N. and R.B. Rai (2003). Goat biodiversity in Bay Islands. Livestock International, 7 (12) : 22-23.

Dam Roy, S., R. Soundararajan and N. Sarangi (2003). Fisheries as a Priority Sector for Development in A&N Islands. *Aqua International,* October, 2003. pp : 14-16.

Dam Roy, S., R. Soundararajan, N. Sarangi and B. Varghese (2004). Brackishwater aquaculture as an important component in integrated farming in Andaman Islands. *Fishing Chimes,* 23 (12) : 27-32.

Din, M. (2003). *Dweepon Ke Liya Upyukat Krishi Yantra*. In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 59-62.

Ganesh Kumar, B. (2003). Water A precious resource to value. *The Daily Telegrams,* 14 August, 2003.

Ganesh Kumar, B. and A. Venkatesh (2003). Mushroom : Veg or Non-Veg? *The Daily Telegrams,* 20 May, 2003. pp : 2.

Ghoshal Chaudhuri, S. and R. Dinesh (2003). Organic farming : Can India afford it? *The Daily Telegrams,* 11 December, 2003.

Mishra, H.S. and D.R. Singh (2003). *Kele mein poshak tatato ka mahatav avam prayog vidhi.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 34-35.

Pandey, C.B. (2003). *Krishi-vaniki ka jan kalyan mai yogdan.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 54-55.

Pandey, V.B., B.L. Attri and D.R. Singh (2003). *Phalloan ki tudai avam rakh rahahar.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 32-33.

Pramanik, S.C. (2003). *Vikas Kariyakram mein kisano ki bhagidari ek upekhita vishay.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 86-87.

Rai, R.B. and B. Ganesh Kumar (2003). CARI's 25 years of service to the island. *The Daily Telegrams,* 15 August, 2003.

Rai, R.B. and B. Ganesh Kumar (2004). Of CARI research activities and its benefits. *The Daily Telegrams,* 26 January, 2004.

Senthil Kumar, S. and B. Ganesh Kumar (2004). Information technologies in extension education and communication. *Indian Economic Panorama,* 14 (3) : 31 32.

Singh, D.R. and A. Sujatha Nair (2003). Sansevieria - A good hardy indoor plant. *Udayani Ki Jeevan,* 9 (9) : 1 & 6.

Singh, D.R. and R.P. Medhi (2003). A note on sensory quality of soursop fruit *(Annona muricata L.). Udayani Ki Jeevan,* 9 (11) : 1 & 4.

Singh, D.R., A. Sujatha Nair, B.L. Attri and V.B. Pandey (2003). *Dweepon mein phooloan ka bhawisya.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 35-36.

Singh, D.R., R.P. Medhi and B.L. Attri (2003). Seed germination of Carambola in Bay Islands. *Udayani Ki Jeevan,* 9 (8) : 2.

Singh, D.R., R.P. Medhi and R. Senthil Kumar (2003). A short note on wild mango-*Mangifera griffithi. Udayani Ki Jeevan,* Sept. pp : 4-5

Singh, D.R., R.P. Medhi, and S.C. Pramanik (2004). Marigold - Goldmine for upland farmers. *The Daily Telegrams,* 8 February, 2004.

Singh, D.R., S. Senani and R.P. Medhi (2003). A better use of bilimbi in powder form. *Udayani Ki Jeevan,* 9 (10) : 1 & 3.

Singh, D.R., S. Senani, R.P. Medhi and R. Senthil Kumar (2003). Sapida (Khattaphal) : Underutilised fruit. *SAIC Newsletter,* 13 (3) : 6.

Singh, D.R., S.C. Pramanik and R.P. Medhi (2004). Commercial cultivation of crossandra - A successful venture in South Andaman villages. *The Daily Telegrams,* 18 January, 2004.

Soundararajan, R. and B. Ganesh Kumar (2003). Honey and cinnamon mixture cures most diseases. *The Daily Telegrams,* 27 July, 2003.

Sreekumar, P.V. and S. Dam Roy (2003). Flower mimics Starfish. *The Dialy Telegrams,* 31 July, 2003.

Sreekumar, P.V. and T.E. Sheeja (2003). Jeeva - A new life in Andamans. *Navarun,* 4 (3) : 21-22.

Swaroop, K, M.A. Suryanarayana and D.R. Singh (2003). *Gunkari pattedar sabjiya.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 22-24.

Singh, D.R., B.L. Attri, R.P. Medhi and V.B. Pandey (2003). *Dweepon mein phalloan ki kheti ki sambhayane.* In *Krishika* (Hindi) published by Director, CARI, Port Blair, 1 (1) : 27-30.

Singh, D.R., R.P. Medhi and S. Senani (2003). Grow multivitamin plant in your kitchen garden. *The Daily Telegrams,* August, 25 January, 2004.

PAPER PRESENTED IN SEMINAR / SYMPOSIA / CONFERENCE / WORKSHOP

Balakrishnan, M., B. Ganesh Kumar., N. Ravisankar and A. Venkatesh (2003). Database for homegardens of Andaman and Nicobar Islands. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 116-117.

Dam Roy, S. (2004). Biodiversity of crabs found in the Mangrove areas of Andamans with particular reference to culture potential of mudcrab, Scylla serrata (Forskal). Abstract submitted in *National Seminar on New Frontiers in Marine Bioscience Research* held during 22-23 January, 2004.

Dam Roy, S. (2004). Fish faunal biodiversity in a mangrove stand of South Andamans. Abstract submitted in *National Seminar on New Frontiers in Marine Bioscience Research* held during 22-23 January, 2004.

Dam Roy, S. and K.K. Gaur (2003). Observations on culture and breeding of mudcrab, Scylla serrata (Forskal) in Andamans. Abstract submitted in *National Seminar on New Frontiers in Marine Bioscience Research* held during 22-23 January, 2004.

Dam Roy, S. and K.K. Gaur (2003). Recruitment of mudcrab juveniles in mangrove habitats of Andaman and Nicobar Islands. Abstract submitted in *National Seminar on New Frontiers in Marine Bioscience Research* held during 22-23 January, 2004.

Dam Roy, S., R. Soundararajan and N. Sarangi (2003). Fishery component in Homestead Gardening in Andamans. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp:76-83.

Deshmukh, P.S., M. Din and A. Venkatesh (2003). Engineering inputs to home-gardens in Andaman and Nicobar islands. Presented in *38th Annual convention of Indian Society of Agricultural Engineers (ISAE)* held at CAET, Dapoli (M.S) during 16-18 January, 2004.

Deshmukh, P.S., M. Din and S. Ghoshal Chaudhuri (2003). Farm Equipments for homesteads. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp: 108-110.

Din, M., P.S. Deshmukh and N. Ravisankar (2003). A review of agricultural mechanization in Andaman and Nicobar islands. Presented in *38th Annual convention of Indian Society of Agricultural Engineers (ISAE)* held at CAET, Dapoli (M.S) during 16-18 January, 2004.

Din, M., R. Prasad, Jyotsana and P.K. Srivastava (2003). Assessing of work-rest cycles of camel under sustained working. Presented in *38th Annual convention of Indian Society of Agricultural Engineers (ISAE)* held at CAET, Dapoli (M.S) during 16-18 January, 2004.

Elanchezhian, R. and Asit B. Mandal (2003). Assessment of genotype specificity for in vitro culture response in brinjal (Solanum melongena) varieties. Presented in the *National Seminar on Physiological interventions for improved crop productivity and quality: opportunities and constraints* held at RARS & SV Agricultural College during 12-14 December, 2003.

Elanchezhian, R. and Asit B. Mandal (2003). In vitro culture response in brinjal (Solanum melongena). Presented in the *National symposium on Improving crop productivity in an ecofriendly environment : Physiological and Molecular approaches* held at GBPUAT, Pant Nagar during 15-17 October, 2003.

Elanchezhian, R. and Asit B. Mandal (2004). Effect of salinity stress on agro-morphological parameters and water relations in tomato varieties. Presented in *7th National seminar on Advances in coastal agriculture and value addition from national perspectives* held at CPCRI, Kasaragod during 21-24 January, 2004.

Elanchezhian, R. and G.S. Prasad (2003). High yielding solanaceous vegetables for homegardens. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 45-46.

Ganesh Kumar, B., P. Krishnan and R. Soundararajan (2003). Socio-economic status of fishermen in Andaman Islands. In the *Proceedings of the Conference on Rural Non-Farm Sector and its role in economic development in changing scenario* held at Pandit Jawaharlal Nehru College of Agriculture, Karaikal, Pondicherry during 12-13 December 2003. pp: 157.

Ghoshal Chaudhuri, S., R. Dinesh (2003). Physico-chemical, biochemical and microbial characteristics of mangroves of S.Andaman: Impacts of Anthropogenic disturbances. In *Compendium on Mangrove bio-diversity of Andaman and Nicobar Islands* published by Director, CARI, Port Blair. pp: 116-122.

Kundu, A. and R.B. Rai (2003). Livestock components in sustainable homestead farming in A&N Islands. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp: 67-71.

Kundu, A., Jai Sunder, R.B. Rai, S.P. Yadav, R.N. Chatterjee and S. Senani (2003). Prevalence of poultry diseases in Andaman and Nicobar Islands. Presented in the *XXI Conference of Indian Poultry Science Association* and *National Symposium on Diversification of Poultry for Nutritional Security* held at CARI, Izatnagar during 27-28 March, 2003.

Kundu, A., S.P. Yadav, R.B. Rai, Jai Sunder, R.N. Chatterjee and S. Senani (2003). Comparative evaluation of cholesterol among various breeds of poultry in Bay Islands. Presented in the *XXI Conference of Indian Poultry Science Association* and *National Symposium on Diversification of Poultry for Nutritional Security* held at CARI, Izatnagar during 27-28 March, 2003.

Kundu, A., R.B. Rai, Jai Sunder, R.N. Chatterjee, S.P. Yadav and S. Senani (2003). Innate immune response in Coturnix coturnix japonica (Japanese quail) of Bay Islands. Presented in the *XXI Conference of Indian Poultry Science Association* and *National Symposium on Diversification of Poultry for Nutritional Security* held at CARI, Izatnagar during 27-28 March, 2003.

Mandal, A.B. and R. Elanchezhian (2004). Advances in genetic management of coastal agricultural research: An Andaman - Nicobar perspective. Presented in *7th National seminar on Advances in coastal agriculture and value addition from national perspectives* held at CPCRI, Kasaragod during 21-24 January, 2004.

Medhi, R.P. and C.B. Pandey (2003). Horticulture based home garden in A&N Islands. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 13-16.

Pramanik, S.C., Shakila Nawaz and Kanak Lata (2004). Indigenous technical knowledge of farmers in Bay Islands (Andamans). Abstract presented in *National Conference on Traditional Knowledge Systems of India* held at Indian Institute of Technology, Kharagpur, West Bengal during 9-11 January, 2004.

Raja, R., N. Ravisankar, R. Dinesh and S. Ghoshal Chaudhari (2003). Soil,

water and nutrient management in homesteads. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 57-62.

Rajan, P.T. and S. Dam Roy (2003). Mangrove fishes of Andaman and Nicobar Islands. In the Compendium on Mangrove bio-diversity of Andaman and Nicobar Islands published by Director, CARI, Port Blair. pp : 123-135

Ravisankar, N., R. Raja, R. Dinesh and S. Ghoshal Chaudhari (2003). Crop diversification though broad bed and furrow land manipulation in coastal paddy lands. In *National Symposium on Crop production under changing environment* held at BCKV, Kalyani, Nadia, West Bengal during 27-29 November, 2003. pp : 52.

Senani, S. (2004). Buffaloes of Andaman and Nicoabr Islands. Presented as Lead paper in the *National Seminar on Economic feeding and rearing of buffaloes under different agro climatic regions* held at IGFRI, Jhansi during 12-13 March, 2004.

Senani, S., R.B. Rai, Jai Sunder, R.N. Chatterjee and A. Kundu (2004). Resource mapping and development of livestock intensification index for Andaman and Nicobar Islands. In Map India 2004. *http://www.gisdevelopment.net/application/miscellaneous/mi04120abs.htm*

Sheeja, T.E., Asit B. Mandal and T.V.R.S. Sharma (2003). Medicinal plants in Homesteads - Status and potential. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 41-44.

Sheeja, T.E., Sheeba and Asit B. Mandal (2003). Medicinal plants of the mangroves of the Bay Islands. In the *Compendium on Mangrove bio-diversity of Andaman and Nicobar Islands* published by Director, CARI, Port Blair. pp : 136-142.

Singh, D.R. (2003). Floriculture in Home Garden. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 51-52.

Singh, D.R. (2003). Orchids of Andaman and Nicobar Islands. Presented in the *Workshop on Environmental awareness* for training teachers of Tagore Govt. College of Education, Port Blair on 26 September 2003.

Singh, D.R. (2003). Scope of Floriculture in these Islands. Presented in the *Orientation programme for GTT's on Environmental education* held at Shiksha Sadan, Link road, Port Blair on 4 December, 2003.

Singh, D.R. and A. Sujatha Nair (2003). Anthurium under shade net conditions in Andamans. Presented in the *National Symposium on Recent Advances in Indian Floriculture* held at KAU, Trichur during 12-14 November, 2003.

Singh, D.R. and A. Sujatha Nair (2003). Effect of media on growth and yield of Dendrobium aphyllum. Presented in the *National Symposium on Recent Advances in Indian Floriculture* held at KAU, Trichur during 12-14 November, 2003.

Singh, D.R., A. Sujatha Nair and R.P. Medhi (2003). Anthurium under shade net condition at Andaman. In the compendium of *National Symposium on Recent Advances in Indian Floriculture* held at KAU, Trichur during 12-14 November, 2003. pp : 315 316.

Singh, D.R., R.P. Medhi, S. Senani, R. Senthil Kumar and A. Venkatesh (2003). Alligator apple - An unexploited fruit of mangrove areas of Bay Islands. In the *Compendium on Mangrove bio-diversity of Andaman and Nicobar Islands* published by Director, CARI, Port Blair. pp : 147 149.

Soundarajan, R., S. Dam Roy and S. Murugesan (2003). Preliminary studies on Growth and culture potential of green spiny lobster, Panulirus versicolor in Andamans. Abstract submitted in *National Seminar on New Frontiers in Marine Bioscience Research* held during 22-23 January, 2004.

Venkatesh, A., L.K. Bharathi., R.P. Medhi, R. Barkha, C.B. Pandey and Kanak Lata (2003). Homestead farming in Andaman and Nicobar Islands. In the *Proceedings of Workshop on Homesteads* published by NATP held at CARI, Port Blair during 12-13 August, 2003. pp : 25-31.

BOOKS / CHAPTERS

Dam Roy, S. (2003). A compendium on Mangrove Biodiversity of Andaman and Nicobar Islands published by Director, CARI, Port Blair and AED (Coastal Agro Ecosystem), NATP.

Mandal, A.B. and T.E. Sheeja (2004). Endemic and endangered rare plants of Bay island : Conservation through Biotechnological means. In : Book on Flora and fauna of Bay Islands published by Oriental Publishers, Aligarh Muslim University.

Mandal, A.B. and Aparna Maiti (2004). Comparative assessment of somatic embryogenesis and plantlet regeneration potential in salt toleratnt and salt susceptible indica varieties. In : *In vitro* application in crop improvement. (Eds) A. Mujib, Cho Myeong-je, S. Predieri and S. Banerjee published by Science Publishers Inc. Enfield, NH, USA and Plymouth, UK. pp : 253-260.

Mandal, A.B., N.D. Majumder, Bikash Chowdhury, Bidhan Roy and R. Elanchezhian (2004). Genetic improvement of rice varieties in Andaman and Nicobar Islands. In : Varietal Improvement of Rice in India. (Eds) S.D. Sharma and U. Prasad Rao published by Today and Tomorrow Printers and Publishers, New Delhi.

Pandey, C.B. and O.P. Chaturvedi (2003). Home gardens of Tropics : A Diversified sustainable cropping system. In : Agroforestry: potentials and opportunities (Eds.) P.S. Pathak and R. Newaj published by Agrobios and Indian Society of Agroforestry, India. pp : 121 134.

Senani, S., S.P.S. Ahlawat and R.B. Rai (2003). Two decades of Animal Science Research in Andaman and Nicobar Islands published by Director, CARI, Port Blair.

FOLDERS

Chatterjee, R.N., R.B. Rai, B. Ganesh Kumar and A. Kundu (2004). Buffalo management practices published by Director, CARI, Port Blair.

Chatterjee, R.N., R.B. Rai, B. Ganesh Kumar and S. Senani (2004). Pig rearing practices in Bay Islands published by Director, CARI, Port Blair.

Chatterjee, R.N., R.B. Rai, B. Ganesh Kumar and Jai Sunder (2004). Few tips about goat management published by Director, CARI, Port Blair.

Jai Sunder, R.B. Rai, S. Jeya Kumar and R.N. Chatterjee (2003). *Thanella-Roktham thatha Nyantran* published by Director, CARI, Port Blair.

Medhi, R.P. and D.R. Singh (2004). Wild mangoes of Andaman and Nicobar Islands published by Director, CARI, Port Blair.

Pandey, C.B., A. Venkatesh, R.P. Medhi and R.B. Rai (2003). Value addition to home garden through black pepper cultivation on *Gliricidia* enclosure in Andaman and Nicobar Islands published by Director, CARI, Port Blair.

Pandey, C.B., A. Venkatesh, R.P. Medhi and R.B. Rai (2003). *Dweepo mai grih vatika dwara aay barane hetu jindaballi rayling par kalimirch ki kheti* published by Director, CARI, Port Blair.

Senani, S., S.P.S. Ahlawat, Neeraj Srivastava and R.B. Rai (2003). *Deevpo mein batak palan* published by Director, CARI, Port Blair.

Singh, D.R., A. Sujatha Nair and R.P. Medhi (2003). Crossandra - A money spinner published by Director, CARI, Port Blair.

Singh, D.R., A. Sujatha Nair, R.P. Medhi and T.V.R.S. Sharma (2003). An Endemic green Orchid - *Eulophia andamanensis* in Bay Islands published by Director, CARI, Port Blair.

Sujatha, A. Nair, D.R. Singh and R.P. Medhi (2003). Gerbera - A profitable cut flower for the Bay Islands published by Director, CARI, Port Blair.

BULLETIN

Singh, D.R., A. Sujatha Nair and R.P. Medhi (2003). Orchids of Bay Islands published by Director, CARI, Port Blair.

Singh, D.R. and R.P. Medhi (2003). West Indian Cherry cultivation in Andaman published by Director, CARI, Port Blair.

Singh, D.R. and R.P. Medhi (2003). Sour Sop cultivation in Andaman published by Director, CARI, Port Blair.

Singh, D.R., R.P. Medhi, S. Senani and R.B. Rai (2003). Nutritional exploitation of Underutilized fruits of Andaman (I issue) published by Director, CARI, Port Blair.

OTHERS

Medhi, R.P. and R. Senthil Kumar (2003). High value agriculture. In Draft State Development Report of Andaman and Nicobar Islands, September, 2003.

Rai, R.B., R. Dinesh, N. Ravisankar and S. Senani (2003). Agriculture and allied sectors including Animal husbandry. In Draft State Development Report of Andaman and Nicobar Islands, September, 2003. pp: 4-28.

Soundararajan, R., P. Krishnan, S. Dam Roy, B. Ganesh Kumar and N. Sarangi (2003). Fisheries development. In Draft State Development Report of Andaman and Nicobar Islands, September, 2003. pp: 171-197.

PATENTS FILED

A low cost technology for *in vitro* liquid culture of *Bacopa monnieri* has been devised involving liquid MS medium in gro-tek culture vessels. Stem explants from field grown plants were initially cultured onto MS semi-solid medium for plantlet regeneration. Within 15 days direct plantlet regeneration was observed at the cut ends. Those shootlets were excised and transferred onto liquid MS basal in gro-tek culture vessels. The recovery of plantlets was found to be 35.68 g fresh weight within a period of two months of culture in comparison to 0.38 g in semi-solid medium and the corresponding dry weights were 4.54 and 0.046 g, respectively. No hormones were found to be essential. In gro-tek system, multiplication was 15.25 times more in comparison to semi-solid medium. The fresh weight was 93 times higher than in semi-solid medium. Plantlet regeneration and rooting occurred simultaneously. Keeping 2-3 cm of shootlets in horizontal position similar result was observed. The *in vitro* grown plantlets were well developed and transferred to plastic cups filled with soil under glass house condition. After a week they were transferred to the field. The plantlets showed high survival rate performed appreciably well *ex vitro*.

- Dr. Asit B. Mandal

PARTICIPATION OF DIRECTOR IN DIFFERENT COMMITTEES AND PANELS

The Acting Director, CARI, Port Blair served as

Member, Medicinal Plants Board, A & N Administration, Port Blair.

Member, State Level Committee for Identification of beneficiaries for supply of tractor on Loan-cum-subsidy basis, A & N Administration, Port Blair.

Member, Rural Programme Advisory Committee, A & N Administration, Port Blair.

President, Andaman Science Association, Port Blair.

Member, Pollution Control Board, A & N Administration, Port Blair.

Member, UT level Coordination Committee on watershed management, A & N Administration, Port Blair.

Member, UT Coordination Committee, A & N Administration, Port Blair.

Member, IX State Level Environment Council, A & N Islands, Port Blair.

Member, Committee for Health care and Treatment of Animals in Zoo, Haddo & Biological Park, A & N Islands, Port Blair.

Member, Society for Science Centre, A & N Islands, Port Blair.

Member, Conference for discussion of draft State Development Report of A&N Islands, Port Blair.

Member, Executive Committee of SOC, Andaman Nature Club, Port Blair.

Member, Central Advisory Committee for the Development of Sheep, Goats & Rabbits, A & N Islands.

Important Meeting / Workshop / Conference etc. attended by the Acting Director, CARI, Port Blair

Meeting of Internal Screening Committee for considering cases of retention of Scientists in ARS held at ICAR, New Delhi on 29 April, 2003.

DARE deputation to Maldives for Development of Reclaimed Land on Hulbumale including Greening of the Land from 23-27 June, 2003.

Directors' Conference held at Delhi from 29-31 July, 2003.

Divisional meeting of Horticulture held at ICAR, New Delhi on 1 August, 2003.

Meeting of SFC of Xth Plan related to CARI, Port Blair at DG's Committee Room, New Delhi on 6 August, 2003.

Meeting organized to work out modalities for conducting recruitment/examination of Administrative category of posts held at Kolkata on 18 August, 2003.

Meeting of UT Development Plan (Draft Report on State Development) called by DDG (Fisheries) at New Delhi on 5 September, 2003.

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Meeting on Finalization of Report of State Development Departments of A & N Islands called by DDG (Fisheries) at New Delhi on 18 September, 2003.

1st Directors' Management Workshop on Transience in organization - Change Management held at NAARM, Hyderabad from 26-30 October, 2003.

Meeting of the Directors of Horticulture Division held at ICAR, New Delhi on 5 November, 2003.

Award ceremony to receive the "Rajshri Tondon Raj Bhasha Puraskar" conferred on CARI and got released the Annual Magazine "Krishika" at NASC Complex, ICAR, New Delhi on 25 November, 2003.

Meeting of Internal Screening Committee for considering cases of retention of Scientists in ARS held at ICAR, New Delhi on 3 February, 2004.

International Conference on Organic Food held at Umian, Meghalaya from 15-17 February, 2004.

Discussion on infrastructure requirement under the project 'Seed production in agricultural crops and fisheries' held at NBPGR, New Delhi during 24-25 February, 2004.

Divisional meeting of Directors of Horticulture & Crop Science held at NBPGR, Pusa Campus, Delhi on 11 March, 2004.

National Conference on Vedic Krishi for sustainable production held at NASC Complex, ICAR, New Delhi during 23-24 March, 2004.

CONFERENCES/SEMINARS/SYMPOSIA ATTENDED BY SCIENTISTS

Mr. P. Krishnan, Scientist (Fish & Fishery Sciences) attended the 'Capacity Building and Training Workshop on Sea turtle Conservation' organized under GOI-UNDP Sea Turtle Project by the A&N Department of Environment and Forests, Port Blair during 26-27 June, 2003.

All the scientists attended the NATP Workshop on 'Homesteads' organised by and held at CARI, Port Blair from 12-13 August, 2003.

Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) attended the Training programme on 'Agricultural Research Prioritization Techniques' held at NAARM, Hyderabad from 21-27 August, 2003.

Dr. S. Ghoshal Chaudhuri, Senior Scientist (Soil Physics & Soil Water Conservation) attended the NATP workshop on Watershed management and presented the full project report on 'Development of rainwater harvesting technology on watershed basis for high intensity, high rainfall areas of Andaman Islands' at College o f Agriculture, Pune during 12-14 September, 2003.

Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) attended the Short course on 'Computer Applications in Social Sciences' at UAS, Dharwad from 14-23 October, 2003.

Dr. S. Dam Roy, Senior Scientist (Fish & Fishery Sciences) attended the Workshop on 'Mangrove Ecosystem : Biodiversity of Andaman & Nicobar Islands' organised by and held at CARI, Port Blair from 27-30 October, 2003.

Dr. K. Madhu, Scientist (Fish & Fishery Sciences) attended the Winter school on 'Recent Advances in Mariculture Genetics and Biotechnology' held at CMFRI, Cochin from 4-24 November, 2003.

Dr. D.R. Singh, Senior Scientist (Horticulture) attended the National Symposium on 'Recent Advances in Indian Floriculture' held at KAU, Trichur from 12-14 November, 2003.

Dr. T. Damodaran, Scientist (Horticulture) attended a 21 days training programme on 'Biotechnological approaches in diseases management of export oriented horticultural crops' at TNAU, Coimbatore from 3-21 December, 2003.

Dr. S. Ghoshal Chaudhuri, Senior Scientist (Soil Physics & Soil Water Conservation) acted as resource person in the workshop and interactive session on 'Application of Jute-Geo Textile for rainwater erosion control in road and hill slopes' held at Port Blair during 11-12 December, 2003.

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All the Scientists involved attended the Meeting to discuss 'Draft State Development Report of Andaman & Nicobar Islands' organized by National Institute of Public Finance and Policy on behalf of Planning Commission, Govt. of India held at JNRM College, Port Blair on 30 January, 2004.

Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) attended the Training Programme on 'Role of Information Technology in Office Management' organised by Indian Institute of Public Administration, New Delhi and Centre for Research, Planning and Action, New Delhi from 12-14 February, 2004.

Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) attended the 21 days Training Programme on 'Impact Assessment of Prevailing Technologies for Sustainable Agriculture via Econometric Empiricism' at IASRI, New Delhi from 17 February to 8 March, 2004.

ADDITIONAL QUALIFICATIONS OBTAINED

Shri T. Damodaran, Scientist (Horticulture) was awarded Ph.D. degree in Horticulture in the month of December, 2003 from TamilNadu Agricultural University, Coimbatore.

Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) was awarded Post Graduate Diploma in Human Resource Management in the month of January, 2004 from Pondicherry University, Pondicherry.

LECTURES DELIVERED

Dr. S. Dam Ray, Senior Scientist (Fish & Fishery Sciences) delivered the Hooker memorial lecture in IARI Auditorium on 4 February, 2004.

Dr. N. Ravisankar, Scientist (Agronomy) presented a lecture on 'Establishment methods and IWM in rice in training on rice production technology' for inservice extensive personal held at KVK, CARI, Port Blair during 27-29 May, 2003.

Dr. N. Ravisankar, Scientist (Agronomy) gave lecture on 'Improved package of practices for rice cultivation' at the training on 'Rice Production Technology' for In-service Extension Personnel organized by KVK, CARI, Port Blair during 27-29 May, 2003.

Dr. N. Ravisankar, Scientist (Agronomy) delivered a lecture on 'Integrated weed management in rice crop' in the training for IMP leaders at Central Integrated Pest Management Centre (CIPMC), Port Blair held during 9-10 October, 2003.

Dr. S. Ghoshal Chaudhuri, Senior Scientist (Soil Physics & Soil Water Conservation) delivered a lecture on Soil of Iodine (preservation for agricultural growth) to the medical professionals on Observance day of Iodine deficiency disorder & prevention held at G.B. Pant Hospital, Port Blair on 21 October, 2003.

Dr. D.R. Singh, Senior Scientist (Horticulture) delivered a lecture on 'Importance of nutrient contents in fruits and vegetables in human diet' organized by Ministry of HRD and Department of WCD community Food and Nutrition Extension unit, Port Blair on 15 March, 2004.

RADIO TALK

Title	Date of Broadcast	Expert
Deepon me gende ki kaste ki sambabanae	05.05.2003	Dr. D.R. Singh
Krishi Yantro Ka Rakh Rakhaw (In Hindi)	19.07.2003	Dr. M. Din
Krishi Me Upyukut Yantro Ki Ahmiyat (In Hindi)	09.11.3003	Dr. M. Din
Deepon me orchids ki sambabanae	11.09.2003	Dr. D.R. Singh
Power tiller maintenance (In Hindi)	27.09.2003	Mr. P.S. Deshmukh
Gaun phal	05.01.2004	Dr. D.R. Singh
Flower nursery for self employment	29.11.2003	Dr. S.K. Zamir Ahmed
Water conservation method on plantation crops	01.03.2003	Mr. L.B. Singh

RESEARCH CO-ORDINATION AND MANAGEMENT

RESEARCH ADVISORY COMMITTEE (RAC) MEETING

The fourth meeting of the third RAC was held under the Chairmanship of Dr. O.P.Pareek, Emeritus Scientist CIAH, Bikaner during 15th to 18th March, 2004 at CARI, Port Blair. Other members present were Dr. B. panda, Ex-Director, CARI, Izatnagar, Dr. J.P. Tandon, Ex-assistant Director General (FC), Dr. S. S. Acharyal, Ex-Chairman, Central Commission on cost & Pricing & Director, Institute of Development Studies Dr. M.J. Devraj, Emeritus Professor, CMFRI, Dr. R.B.Rai, Director, CARI, Port Blair and Dr.R.P.Medhi, Member Secretary. Directors of Agriculture, Fisheries and Animal Husbandry & Veterinary Services of A & N Group of Islands were also invited. All the scientists of the institute participated in the meeting. The research committee gave the detailed guideline for formulating new research project for next year and division wise recommendations.

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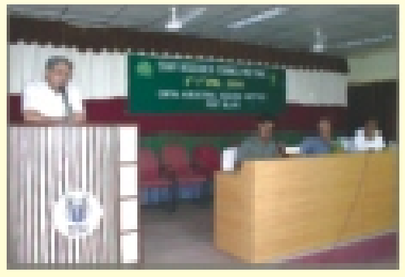
STAFF RESEARCH COUNCIL (SRC) MEETING

The Staff Research Council of CARI for the year 2004 was inaugurated at 10.00 a.m. on 5th April, 2004 at the Institute's Conference Hall. Dr. R.B. Rai, Acting Director, CARI was the Chairman for the SRC 2004. Dr. R. C. Tiwari, Professor Emeritus was the SRC Expert and Dr. Sailesh Nayak, Group Director, Space Application Centre, Ahmedabad was the special Guest for the occasion. Dr. B. Ganesh Kumar, Scientist (Agricultural Economics) & In-Charge, Planning, Monitoring & Coordination Cell was the Member Secretary, SRC 2004, who coordinated the whole proceedings. Dr. R.B. Rai in his presidential address, pointed out that a new era of organic farming was underway. While mentioning that the islands need innovative plans related to Agriculture and allied areas in order to tide over the problem of unemployment, he did not fail to add that CARI has to focus its efforts only on these areas where it has significant advantage over the mainland institutions. The Chairman requested the scientists to explore the best advantage of the multi-disciplinary expertise available in the institute by conceiving projects on agriculture, animal science, fisheries, forestry, biotechnology etc. It was also suggested that scientists have to take up strategic and adaptive research, in addition to basic research. The Chairman reiterated that research which does not have social or technological importance need to be given a second thought before continuing. Finally he requested all the scientists to participate in the discussion after each of the presentation and concluded his introductory speech. Dr. Sailesh Nayak in his special address highlighted the need for focusing on the environmental issues confronting in presently. He pointed out that most of the research data are not available at the time of need and suggested the adoption of modern technologies like GIS and Remote Sensing, as appropriate to the ongoing research projects for easy retrieval of the data.

All the 36 on-going projects were presented by the concerned PIs in the house highlighting the progress made in the last year. 8 new projects were also approved.



DISTINGUISHED VISITORS

Name	Date
Dr. J. Bojan, Director, MPEDA, Cochin, Kerala	24.04.2003
Dr. B.S. Rathore, Joint Director, IVRI, Izatnagar, U.P.	05.05.2003
Dr. H.O. Gupta, Principal Scientist (Biotechnology), IARI, New Delhi	17.05.2003
Dr. R.P. Johari, Head, Biotechnology Division, IARI, New Delhi	17.05.2003
Dr. A.K. Sharma, Senior Scientist, IVRI, Izatnagar, U.P.	19.05.2003
Dr. D.B. Saxena, Project Coordinator, AICRP (PR), IARI, New Delhi	29.05.2003
Dr. H.N. Verma, Director, WTCTR, Bhubeneswar, Orissa	24.07.2003
Shri. Sujit S. Choudhury, Chief Conservator of Forest, Port Blair	12.08.2003
Dr. Lal Krishna, ADG (AH), ICAR, New Delhi	02.09.2003
Dr. J.C. Jain, Scientist 'F',ADRDE, DRDO, Agra, U.P.	27.09.2003
Dr. Gurbachan Singh, ADG (Agro.), ICAR, New Delhi	30.09.2003
Shri. Shibadas Bhattacharya, Academic Council Member, West Bengal University of Animal and Fishery Sciences, Kolkata	07.10.2003
Dr. R.K. Jana, Director, CIFA, Bhubaneswar, Orissa	08.10.2003
Dr. Ramanjanyulu, Director, Directorate of Oilseeds Research, Hyderabad	19.10.2003
Dr. P. Rai, Acting Director, National Research Centre for Agro-forestry, Jhansi, U.P.	28.10.2003
Dr. S.K. Chakraborty, Reader (Zoology), Vidyasagar University, Midnapore, West Bengal	28.10.2003
Dr. M. Rajagoplan, Head, FEMD, CMFRI, Cochin, Kerala	28.10.2003
Dr. Sham Behari Upadhaya, (Retd.) Deputy Director of Agriculture, Rajasthan	11.11.2003
Dr. A. K. Dev Roy, Head, AG&B Division, CARI, Izatnagar, U.P.	13.11.2003
Dr. S.K. Das, Zonal Coordinator, Zone-II, Kolkata	19.11.2003
Dr. Balzor Singh, Principal Scientist, Division of Genetics, IARI, New Delhi	20.11.2003
Dr. B.S. Malik, Principal Scientist, Division of Genetics, IARI, New Delhi	20.11.2003
Dr. B.K. Mishra, Pricipal Scientist, Division of Genetics, ICARI, New Delhi	20.11.2003
Dr. D.D. Roy, Senior Scientist, Division of Parasitology, IVRI, Izatnagar, U.P.	15.12.2003
Dr. V.J. Menon, Deputy Secretary, Ministry of Rural Development, New Delhi	21.01.2004
Dr. A.D. Diwan, ADG (Marine Fishery), ICAR, New Delhi	28.01.2004
Prof. Ram Kapse, Lt. Governor, A & N Islands, Port Blair	15.03.2004

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IMPRESSION OF THE VISITORS

Prof. Ram Kapse, Lt. Governor, Andaman & Nicobar Islands

- *Congratulations! For success in various fields. Ultimate success lies with farmers who should take initiative in implementing new crops. One day, we will achieve this goal. Thank You. Best of Luck.*

Dr. Gurbachan Singh, Assistant Director General (Agro.), ICAR, New Delhi.

- *The institute research and activities are displayed in such an excellent manner that even a layman can understand effectively. Good scope for farming system research.*

Launching of Organic Farming in A & N Islands by Hon'ble Lt. Governor

PERSONNEL

ACTING DIRECTOR — **Dr. R.B. RAI**

Head / In-Charge, Divisions / Sections

Head, Division of Animal Science	Dr. R.B. Rai
Head, Division of Field Crops	Dr. T.V.R.S. Sharma
Head i/c, Division of Fish & Fishery Sciences	Dr. R. Soundararajan
Head i/c, Division of Horticulture & Forestry	Dr. R.P. Medhi
Head i/c, Division of Natural Resource Management	Dr. S. Ghoshal Chaudhuri
In-Charge, Social Science Section	Dr. S.C. Pramanik
In-Charge, Planning, Monitoring & Coordination Cell	Dr. B. Ganesh Kumar
In-Charge, Computer Cell	Dr. N. Ravisankar
In-Charge, Library	Shri. Gangopadhyay
In-Charge, Central Instrumentation Facility	Dr. Jai Sunder
In-Charge, Garacharma Farm	Shri. Gopal Nair
In-Charge, Sipighat Farm	Dr. C.B. Pandey
In-Charge, Bloomsdale farm	Dr. Asit B. Mandal
In-Charge, Desk Officer Estate	Dr. M. Din
In-Charge, Workshop	Dr. M. Din
In-Charge, Guest House	Dr. V.B. Pandey
Administrative Officer	Shri. Vivek Purwar
Finance & Accounts Officer	Shri. Mithlesh Kumar
Assistant Director, Official language	Smt. Sulochana
Security Officer	Shri. N.K. Pushp
In-Charge, Krishi Vigyan Kendra	Dr. N. Sarangi

LIST OF SCIENTIFIC STAFF

ACTING DIRECTOR
Dr. R.B. Rai, Principal Scientist (Veterinary Pathology) & Head, Division of Animal Science

DIVISION OF HORTICULTURE & FORESTRY
Dr. R.P. Medhi, Principal Scientist (Horticulture) and Head i/c
Dr. C.B. Pandey, Senior Scientist (Forestry)
Dr. D.R. Singh, Senior Scientist (Horticulture)
Dr.T. Damodaran, Scientist (Horticulture)
Dr. A. Venkatesh, Scientist (Forestry)

DIVISION OF FIELD CROPS
Dr. T.V.R.S. Sharma, Principal Scientist (Plant Breeding) & Head
Dr. Asit B. Mandal, Senior Scientist (Plant Breeding)
Dr. T.E. Sheeja, Scientist (Plant Biotechnology)
Dr. G. Shyam Prasad, Scientist (Entomology)
Dr. R. Elanchezhian, Scientist (Plant Physiology)
Shri. Someshwar Bhagat, Scientist (Plant Pathology)
Dr. V. Jayakumar, Scientist (Plant Pathology)

DIVISION OF NATURAL RESOURCE MANAGEMENT
Dr.S.Ghoshal Chaudhuri, Senior Scientist (Soil Physics & Water Conservation) and Head i/c
Dr. R. Dinesh, Senior Scientist (Soil Chemistry / Fertility & Microbiology)
Dr. M. Din, Senior Scientist (Farm Machinery & Power)
Dr. N. Ravisankar, Scientist (Agronomy)
Dr. R. Raja, Scientist (Agronomy)
Shri. Deshmukh Prasanth, Scientist (Farm Machinery & Power)
Dr. T.P. Swarnam, Scientist (Soil Physics & Water Conservation)

DIVISION OF ANIMAL SCIENCE
Dr. A. Kundu, Senior Scientist (Livestock Production & Management) and Head i/c
Dr. S. Senani, Senior Scientist (Animal Nutrition)
Dr. R.N. Chatterjee, Senior Scientist (Animal Genetics & Breeding)
Ms. Deepa Bhagat, Scientist (Organic Chemistry) *on Study Leave*
Shri. Satyapal Yadav, Scientist (Animal Biotechnology) *on Study Leave*
Dr. S. Jeyakumar, Scientist (Animal Reproduction) *on Study Leave*
Dr. Jaisunder, Scientist (Veterinary Microbiology)

DIVISION OF FISH & FISHERY SCIENCES
Dr. R. Soundararajan, Principal Scientist (Fish & Fishery Sciences) and Head i/c
Dr. S. Dam Roy, Senior Scientist (Fish & Fishery Sciences)
Mrs. Rema Madhu, Scientist (Fish & Fishery Sciences)
Dr. K. Madhu, Scientist (Fish & Fishery Sciences)
Shri. P. Krishnan, Scientist (Fish & Fishery Sciences)

SOCIAL SCIENCE SECTION
Dr. S.C. Pramanik, Senior Scientist (Agronomy) and In-charge
Shri. M. Balakrishnan, Scientist (Computer Applications) *on Study Leave*
Dr. B. Ganesh Kumar, Scientist (Agricultural Economics)

KRISHI VIGYAN KENDRA
Dr. N. Sarangi, Principal Scientist (Fish & Fishery Sciences) & In-Charge
Dr. S.K. Zamir Ahmed, Senior Training Assistant (Agronomy / Extension)
Shri. Nagesh Ram, Senior Training Assistant (Fisheries) on *Deputation as Director of Fisheries, A & N Administration*
Smt. Kanak Lata, Senior Training Assistant (Home Science)
Shri. L.B. Singh, Senior Training Assistant (Horticulture)
Shri. N.C. Choudhury, Training Assistant (Animal Science)
Shri. D. Bhaskar Rao, Training Assistant (Art cum Audio visual aids)

VARIOUS COMMITTEES OF THE INSTITUTE

OFFICIAL LANGUAGES IMPLEMENTATION COMMITTEE

Dr. R.B. Rai	Chairman
Dr. S. Senani	Member
Dr. S.C. Pramanik	Member
Dr. Jai Sunder	Member
Smt. Kanaklatha	Member
Shri. Phalguni Gangopadhyay	Member
Finance & Accounts Officer	Member
Administrative Officer	Member
Shri. Arvind Kumar Tripathi	Member
Smt. Sulochana	Member Secretary

INSTITUTE JOINT STAFF COUNCIL

(Staff Side)

Technical Staff

Shri. Benny Varghese

Shri. K. Babu Rao

Administrative Staff

Shri. Karapaya

Smt. Saida Bibi

Supportive Staff

Shri. K. Ali

Shri. T. Kurma Rao

(Official Side) **Nominated by Director**

Administrative Officer

Finance & Accounts Officer

Dr. S. Senani

Dr. Jaisunder

Shri. Phalguni Gangopadhyay

Dr. S.K. Zamir Ahmed

CONSTRUCTION COMMITTEE

Dr. S. Senani, Sr. Scientist	Chairman
Dr. C. B. Pandey, Sr. Scientist	Member
Desk Officer (Estate)	Member
Administrative Officer	Member
Finance & Accounts Officer	Member
Asst. Administrative Officer	Member Secretary

PURCHASE COMMITTEE

Dr. R. P. Medhi	Chairman
Dr. Jai Sunder	Member
Dr. R. Dinesh	Member
Administrative Officer	Member
Finance & Accounts Officer	Member

PRICE FIXATION COMMITTEE

Dr. S. Senani	Chairman
Administrative Officer	Member
Finance & Accounts Officer	Member
Secretary, IJSC	Member
Farm Manager (Garacharma Farm)	Member
Farm Manager (Sipighat Farm)	Member
Farm Manager (Broomsdale Farm)	Member
Farm Superintendent	Member

GRIEVANCE COMMITTEE

Dr. R. P. Medhi	Chairman
Dr. S. Senani	Member
Administrative Officer	Member
Finance & Accounts Officer	Member
Dr. S. Dam Roy	Member (Scientific Category)
Shri. Abdul Majeed, T-3 (Driver)	Member (Technical Category
Shri. S. K. Biswas, Jr. Clerk	Member (Administrative Category)
Shri. B. Mahadevaiah, S. S. Gr. IV	Member (S. S. Gr. Category)

ARS Scientists Forum

Dr. R. Soundararajan	President
Dr. S. Dam Roy / Dr. B. Ganesh Kumar	Secretary
Dr. A. Venkatesh	Jt. Secretary
Dr. R. Raja	Treasurer

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NEW ENTRANTS / TRANSFER / PROMOTION

New Entrants

Dr. (Miss) T.P. Swarnam
Scientist (Soil Science)
w.e.f. 11.11.2003

Dr. V. Jayakumar
Scientist (Plant Pathology)
w.e.f. 29.11.2003

Transfer

Name	Designation	Date
Shri. Prabir Saha	T-5	19.04.2003
Shri. T.N. Vidyadharan	Assistant	27.09.2003
Smt. Bindu Sanjeev	Jr. Steno	02.08.2003
Shri. Deepak Debnath	S.S.Gr.I	18.08.2003

Promotion

Name	Designation	Date
Mrs. Saida Bibi	Jr. Steno	30.07.2003
Shri. Karapaya	Jr. Clerk	30.07.2003
Mrs. Florence Toppo	Jr. Steno	03.08.2003
Shri. R.N. Tiwari	S.S.Gr.I	01.08.2003
Shri. Sayyuddin Khan	S.S.Gr.I	01.08.2003

Death

Name	Designation	Date
Shri. Bhoop Singh	S.S.Gr.II	08.12.2003

CARIEWA

On August, 2003, the new executive committee of Central Agricultural Research Institute Employees Welfare Association (CARIEWA) has been formed which was passed by General body meeting. The new executive committee of CARIEWA is as follows:

Dr. R. B. Rai	Patron
Dr. N. Sarangi/Dr. R. P. Medhi	Chairman
Dr. R. N. Chatterjee	Secretary
Sri Prashanth Deshmukh	Jt. Secretary
Sri. Phalguni Gangopadhyay	Cultural Secretary
Sri. S. K. Biswas	Canteen Secretary
Smt. Archana Sharma	Member
Sri. Prakash Mondal	Treasurer
Sri. B. Mahadeviah	Member
Sri. Ali. Akbar	Member
Sri Bikas Mondal	Member

During the year 2003-2004, CARIEWA organized various activities as follows.

- Distribution of loan
- Cultural programme
- Fresher's welcome
- Farewell function
- Sports

A sum of Rs. 30500/- as short term loan was distributed to 17 needy members. On the eve of New Year, CARIEWA organized a cultural programme on 3rd January, 2004 in CARI guest house. Staff and children had taken active participation and presented a colourful cultural programme. During the year under report, several functions like farewell to outgoing staff(6) and welcome to newly joined staff(2) were organized. The cultural team of CARIEWA had staged a drama "Aberdeen Ki Ladai" on 15thJanuary, 2004 at exhibition ground under the direction of Cultural Secretary of CARIEWA.

Several musical classes had been arranged for the children during the year. The CARIEWA is running a canteen under a contractor to provide snacks and meal on reasonable prices on all working days as well as on the holidays. CARIEWA had arranged a lecture on carrier guidance for the children in the guesthouse. Competitive cricket matches for the children were also arranged.

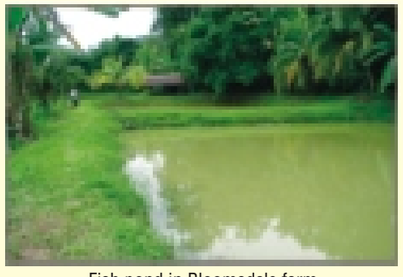
INFRASTRUCTURE DEVELOPMENT

- Construction of garriage shed at Garacharma Farm.
- Construction of cement concrete structure and installation of "V-SAT" Antena at Garacharma Farm.
- Construction of approach road to supporting staff quarter at Bloomsdale farm.
- Construction of field office cum godown at Garacharma Farm.
- Construction of cattle shed at Garacharma farm.
- Construction of two numbers of toilet block and a septic tank at Bloomsdale farm.
- Construction of an orchidarium at Garacharma Farm.
- Extension of Experimental fish pond at Bloomsdale farm.

Approach road in Bloomsdale farm

Field office in Garacharma farm

Cattle shed in Garacharma farm



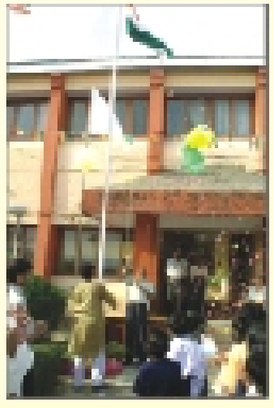
Fish pond in Bloomsdale farm

Orchidarium in Garacharma farm

INDEPENDENCE AND REPUBLIC DAY CELEBRATIONS

Independence Day and Republic Day were celebrated in the Institute with gaiety and fervour. On 15th August, 2003, Dr. R. Soundararajan, Director i/c hoisted the National Flag and all the staff of the institute attended the ceremony with patriotism. Similarly on the eve of Republic day on 26th January, 2004, Dr. R.B. Rai, Acting Director hoisted the National Flag and gave inspiring speech befitting the occasion. He lauded the effort of the scientists, technical and administrative staffs of the institute. He also impressed upon the staff to strive for further achievements in view of the changing demand and priorities in these islands.

Dr. R. Soundararajan, Director i/c saluting the National Flag on the eve of Independence day in 2003 and offering floral tributes to the Father of the Nation



Dr. R.B. Rai, Acting Director hoisting the National Flag on the eve of Republic day in 2004 and giving inspiring speech to the staff