



ANNUAL REPORT 2024

**वार्षिक प्रतिवेदन
AICRP ON PALMS**



भा.कृ.अनु.प. - अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना
भा.कृ.अनु.प. - केंद्रीय रोपण फसल अनुसंधान संस्थान
कासरगोड़, केरल, भारत - 671 124

ICAR- ALL INDIA CO-ORDINATED RESEARCH PROJECT ON PALMS
ICAR-CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD, KERALA, INDIA - 671 124

<https://aicrponpc.org>

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I. प्रस्तावना

रोपण फसलें भारतीय कृषि में महत्वपूर्ण भूमिका निभाती हैं और ये कृषि उत्पादन, रोजगार सृजन, ग्रामीण आजीविका, औद्योगिक कच्चे माल की आपूर्ति और निर्यात से होने वाली कमाई में काफी योगदान देती हैं। रोपण फसल क्षेत्रखेती, प्रसंस्करण, मूल्य संवर्धन और विपणन से जुड़े लाखों किसानों और श्रमिकों को सहारा देता है, और इस तरह राष्ट्रीय अर्थव्यवस्था में महत्वपूर्ण योगदान देता है। इसलिए किसानों का कल्याण सुनिश्चित करने और कृषि क्षेत्र को मजबूत करने के लिए रोपण फसल क्षेत्र की उत्पादकता, लाभप्रदता और स्थिरता में सतत सुधार अत्यंत आवश्यक है।

सन 1972 में स्थापित अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना देश के विभिन्न कृषि-जलवायु क्षेत्रों का प्रतिनिधित्व करने वाले 28 अनुसंधान केंद्रों के नेटवर्क के माध्यम से नारियल, सुपारी, कोको, तेल ताड़ और पॉमैरा (पामीरा) पर समन्वित और स्थानीयविशेष अनुसंधान के लिए एक राष्ट्रीय मंच के रूप में कार्य करता है। वर्ष 2024 के दौरान, फसल सुधार, अनुवांशिक संसाधन, फसल उत्पादन, फसल संरक्षण, फसल कटाई के बाद की तकनीक, अनुसंधान कार्यक्रम तथा प्रौद्योगिकी प्रसार में महत्वपूर्ण प्रगति दर्ज की गई।

इस वर्ष के दौरान, तेल ताड़ के NRCOP-9 और NRCOP-37 संकर ताजे फल गुच्छों तथा तेल की उच्च उपज प्राप्त होने से क्रमशः तमिलनाडु और आंध्र प्रदेशराज्यों के तटीय क्षेत्रों में खेती के लिए जारी करने की सिफारिश एक बड़ी उपलब्धि है। कोको में, केरल, तमिलनाडु, कर्नाटक, आंध्र प्रदेश और गुजरात में खेती के लिए अनुशंसित और जारी VTLCN-1 और VTLCN-2 संकर किस्मों को केंद्रीय किस्म विमोचन समिति (CVRC) द्वारा अधिसूचित किया गया है।

मृदु फल गुठली नारियल के उत्पादन और संकर विकास के लिए बेहतर पैतृक पहचान करने के उद्देश्य से, सात केंद्रों पर 13 बौने नारियल जर्मप्लाज्म का बहु-स्थान परीक्षण शुरू किया गया तथा 15 आशाजनक लंबी नारियल जीनोटाइप्स को उपज और चक्रवाती हवाओं सहनशीलता के समन्वित मूल्यांकन के अंतर्गत लाया गया। पॉमैरा के ओडिशा और बिहार से जल्दी फूलने वाले जननद्रव्य (एक्सेसंस) की पहचान बहु-स्थान परीक्षणों में संवर्धन और शामिल करने के लिए एकत्र की गई। समन्वित अनुसंधान ने पोषक तत्व प्रबंधन, एकीकृत रोग प्रबंधन और पर्यावरण-अनुकूल कीट प्रबंधन परस्थान-विशिष्ट सिफारिशें भी तैयार कीं। प्रमुख कीटों और बीमारियों की राष्ट्रव्यापी निगरानी के साथ-साथ जैविक नियंत्रण के बड़े पैमाने पर उत्पादन और उन्हें खेतों में छोड़ने के कदम ने अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना नेटवर्क में टिकाऊ फसल सुरक्षा रणनीतियों को और मजबूत किया।

अनुसंधान की प्रगति की समीक्षा करने, उभरती शोध प्राथमिकताओं पर विचार-विमर्श करने, भविष्य के कार्यक्रमों के लिए सिफारिशें तैयार करने और नेटवर्क में सहयोगात्मक अनुसंधान को मजबूत करने के लिए 21 दृ 23 अगस्त, 2024 के दौरान बिहार कृषि महाविद्यालय, सबौर में अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना की 33वीं वार्षिक समूह बैठक आयोजित की गई थी।

इस परियोजना को सतत प्रोत्साहन और समर्थन के लिए मैं डॉ. हिमांशु पाठक, सचिव (डेयर) एवं महानिदेशक (ICAR), कासहृदय आभार व्यक्त करना अपना सौभाग्य मानता हूँ। मैं डॉ. एस. के. सिंह, उप-महानिदेशक (बागवानी विज्ञान), तथा डॉ. वी. बी. पटेल, सहायक महानिदेशक (फल एवं रोपण फसलें), आईसीएआर (ICAR), नई दिल्ली द्वारा दिए गए मार्गदर्शन और सहयोग का कृतज्ञतापूर्वक स्वीकार करता हूँ। इसके अलावा, मैं इस कार्यक्रम के सफल क्रियान्वयन में निरंतर सहयोग और प्रोत्साहन देने के लिए डॉ. के. बी. हेब्बार, निदेशक, भा. कृ. अनु. प. – केंद्रीय रोपण फसल अनुसंधान संस्थान (ICAR CPCRI), कासरगोड, तथा डॉ. के. सुरेश, निदेशक, भा. कृ. अनु. प. – भारतीय तेल ताड़ अनुसंधान संस्थान (ICAR IIOPR), पेदावेगी, का भी हार्दिक धन्यवाद व्यक्त करता हूँ।

मैं समन्वित अनुसंधान कार्यक्रम की गतिविधियों को सफलतापूर्वक निष्पादित करने में दिए गए अमूल्य योगदान के लिए अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना केंद्रों के सभी वैज्ञानिकों, तकनीकी कर्मियों, प्रशासनिक कर्मचारियों और सहायक कर्मचारियों के समर्पित प्रयासों की सराहना करता हूँ। इस अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना के वार्षिक प्रतिवेदन की गतिविधियों की निगरानी, संकलन और तैयारी में डॉ. सुमिता एस., वैज्ञानिक (चै) के निष्ठावान प्रयासों के लिए उनका आभार व्यक्त करता हूँ। रिपोर्टों की निगरानी, संकलन और उन्हें अंतिम रूप देने में श्रीमती एलिजाबेथ मैथ्यू, तथा श्रीमती आरती ए. आर., निजी सहायक, पीसी सेल, भा. कृ. अनु. प. दृ केंद्रीय रोपण फसल अनुसंधान संस्थान, कासरगोड, द्वारा दी गई सहायता को कृतज्ञतापूर्वक स्वीकार किया जाता है।

I. PREFACE

Plantation crops play a vital role in Indian agriculture by substantially contributing to agricultural production, employment generation, rural livelihoods, industrial raw material supply, and export earnings. The plantation sector supports millions of farmers and other stakeholders engaged in cultivation, processing, value addition, and marketing, thereby making a significant contribution to the national economy. Sustainable improvement in the productivity, profitability, and resilience of plantation crops sector is therefore essential for ensuring farmers' welfare and strengthening the agricultural sector.

The All India Coordinated Research Project (AICRP) on Palms, established in 1972, serves as a national platform for coordinated, location-specific research on coconut, arecanut, cocoa, oil palm, and palmyrah through a network of 28 research centres representing diverse agro-climatic regions of the country. During 2024, the research programme recorded significant progress in the areas of crop improvement, genetic resource conservation, crop production, crop protection, post-harvest technology, and technology dissemination. Among the major outcomes of the year, two oilpalm hybrids NRCOP-9 and NRCOP-37 were identified for release for cultivation in the coastal regions of Tamil Nadu and Andhra Pradesh, respectively, considering their higher fresh fruit bunch and oil yield. In cocoa, the recommended and released hybrids VTLCH-1 and VTLCH-2 for cultivation in Kerala, Tamil Nadu, Karnataka, Andhra Pradesh, and Gujarat, and were notified by the Central Varietal Release Committee (CVRC). A new multi-location trial comprising 13 dwarf coconut genotypes was initiated across seven AICRP centres to identify superior parental lines for tender nut production and hybrid development, while 15 promising tall coconut genotypes were brought under coordinated evaluation for yield potential and tolerance to cyclonic winds. In palmyrah, early-flowering accessions collected from Odisha and Bihar were identified for multiplication and inclusion in multi-location trials. Coordinated research also generated location-specific recommendations on nutrient management, integrated disease management, and eco-friendly pest management. Large-scale production and field release of biological control agents, together with nationwide surveillance of major pests and diseases, further strengthened sustainable crop protection strategies across the AICRP network.

The XXXIII Annual Group Meeting of the AICRP on Palms was organized at Bihar Agricultural College, Sabour, during 21–23 August 2024 to review the progress of research, deliberate on emerging research priorities, formulate recommendations for future programmes, and strengthen collaborative research across the network.

I consider it a privilege to express my sincere gratitude to Dr. Himanshu Pathak, Secretary, DARE and Director General, ICAR, for his constant encouragement and support. I gratefully acknowledge the guidance and support extended by Dr. S. K. Singh, Deputy Director General (Hort. Science), and Dr. V. B. Patel, Assistant Director General (Fruits and Plantation Crops), ICAR, New Delhi. I also express my sincere thanks to Dr. K. B. Hebbar, Director, ICAR–Central Plantation Crops Research Institute, Kasaragod, and Dr. K. Suresh, Director, ICAR–Indian Institute of Oil Palm Research, Pedavegi, for their continuous support and encouragement in the successful implementation of the programme.

I place on record my appreciation for the dedicated efforts of all the scientists, technical personnel, administrative staff, and supporting staff at the AICRP on Palms centres for their valuable contributions in successful execution of the AICRP activities. The sincere efforts of Dr. Sumitha S., Scientist (SPMA) in monitoring AICRPP reporting activities, compilation and preparation of this Annual Report is appreciated. The assistance rendered by Mrs. Elizabeth Mathew, Senior Research Fellow, and Mrs. Arathi, PA, PC Cell, ICAR–CPCRI, in monitoring, compiling, and finalizing the reports is gratefully acknowledged.



Dr. B. Augustine Jerard
Project Coordinator

Date : 25-09-2025
Place : Kasaragod

II. कार्य सारांश

अखिल भारतीय समन्वित ताड़ अनुसंधान परियोजना के अंतर्गत वर्ष 2024 के दौरान नारियल, ऑयल पाम, कोको तथा पामेरा ताड़ पर क्षेत्र-विशिष्ट अनुसंधान को और अधिक सुदृढ़ किया गया है। इस अवधि में फसल सुधार, फसल उत्पादन, फसल संरक्षण तथा कटाई उपरांत प्रौद्योगिकी के क्षेत्रों में महत्वपूर्ण उपलब्धियाँ प्राप्त हुई हैं। नारियल फसल के अंतर्गत फसल सुधार, फसल उत्पादन एवं फसल संरक्षण पर कुल 30 समन्वित प्रयोग संचालित किए गए हैं। फसल सुधार के अंतर्गत भुवनेश्वर में मूल्यांकित संकर SKL x GBGD ने सर्वाधिक 137 फल प्रति वृक्ष प्रति वर्ष उपज, 455 मि.ली. प्रति फल कोमल नारियल जल, 192.35 ग्राम प्रति फल गरी (खोपरा) तथा 66.28 प्रतिशत तेल की मात्रा दर्ज की, जो स्थानीय किस्म सखीगोपाल लोकल की तुलना में उल्लेखनीय रूप से अधिक थी। वेप्पनकुलम में गुलाबी भूसी (Pink Husk) विशेषता वाले संरक्षित नारियल के तीन समूहों की पहचान की गई तथा उनकी संततियों का पंजीकरण आईसीएआरद्वारा राष्ट्रीय पादप आनुवंशिक संसाधन ब्यूरो (NBPGR) में कराया गया है। नवीन बहु-स्थानिक परीक्षणों के लिए VPM 6, Seychelles Tall, Gandevi Tall, Kamarupa तथा Odisha Giant सहित नौ लंबे तथा ग्यारह बौने नारियल जननद्रव्यों का चयन किया गया है। बौना x बौना संकरों के मूल्यांकन में COD x MYD तथा GBGD x MOD को कोमल नारियल उत्पादन के लिए आशाजनक संयोजन पाया गया है। रत्नागिरी में COD x MYD ने सर्वाधिक 95.6 फल प्रति वृक्ष प्रति वर्ष कोमल नारियल उपज तथा 602.7 मि.ली. प्रति फल जल की मात्रा दर्ज की, जबकि GBGD x MOD में सर्वाधिक 5-7⁰ Brix कुल घुलनशील ठोस पाए गए। वेप्पनकुलम में GBGD x MOD ने सर्वाधिक 95.56 फल प्रति वृक्ष प्रति वर्ष उपज तथा 628.10 मि.ली. प्रति फल कच्चे नारियल जल की मात्रा दर्ज की है।

फसल उत्पादन के अंतर्गत भुवनेश्वर के तटीय बलुई मृदा क्षेत्र में नारियल आधारित बहुफसली प्रणाली के मूल्यांकन में समेकित पोषक तत्व प्रबंधन के साथ नारियल + गार्सिनिया इंडिका + अनानास प्रणाली सर्वाधिक लाभकारी पाई गई। इस प्रणाली से Rs. 4,63,857 प्रति हेक्टेयर शुद्ध आय तथा 2.38 का लाभ:लागत अनुपात प्राप्त हुआ। जैविक खेती के अंतर्गत खेत में उपलब्ध कार्बनिक पदार्थों का पुनर्चक्रण, PGPR Consortia, हरी खाद, गोबर, भूसी के अवशेषों को जमीन में दबाना तथा अनुशंसित Sulphate of Potash की

50 प्रतिशत मात्रा वाले उपचार से सर्वाधिक प्रणाली उत्पादकता एवं लाभप्रदता प्राप्त हुई।

फसल संरक्षण के अंतर्गत प्रत्येक तीन माह के अंतराल पर प्रोपिकोनाजोल (100 मि.ली. पानी में 5मि.ली.) द्वारा जड़ उपचार से 36माह के बाद पर्ण झुलसा रोग की तीव्रता में 27प्रतिशत की कमी दर्ज की गई तथा उपज बढ़कर 138फल प्रति वृक्ष प्रति वर्ष हो गई। इस उपचार से 3.7 का लाभ:लागत अनुपात प्राप्त हुआ। जैविक नियंत्रण कार्यक्रमों के अंतर्गत तमिलनाडु, आंध्र प्रदेश, कर्नाटक तथा महाराष्ट्र में नारियल के प्रमुख कीटों के प्रबंधन हेतु 17.26 लाख *Bracon hebetor*, 8.46 लाख *Goniozus nephantidis*, 44,000 *Encarsia guadeloupae*, 34,000 *Pediobius imbreus*, 242 ट्राइको कार्ड तथा 3.47 लाख *Apertochrysa astur* के अंडों का उत्पादन एवं वितरण किया जा चुका है।

ऑयल पाम पर अनुसंधान छह AICRP केन्द्रों में जारी रहा, जहाँ चार समन्वित परीक्षणों के अंतर्गत 38 संकरों का मूल्यांकन किया जा रहा है। विजयाराय में NRCOP-37 (Pedavegi-1) संकर ने 29.69 टन प्रति हेक्टेयर ताजा फल गुच्छा उपज तथा 19.9 किलोग्राम औसत गुच्छा भार दर्ज किया है। पट्टकोट्टई में NRCOP-9 (Pedavegi-2) ने 30.62 टन प्रति हेक्टेयर ताजा फल गुच्छा उपज, 20.20 किलोग्राम औसत गुच्छा भार तथा 21.50 प्रतिशत तेल की मात्रा दर्ज कर अपनी उच्च उत्पादन क्षमता प्रदर्शित की है।

कोको के संकरों एवं क्लोनों का मूल्यांकन सात AICRP केन्द्रों पर नारियल, सुपारी तथा ऑयल पाम आधारित फसल प्रणालियों में जारी रखा गया है। बहु-स्थानिक परीक्षणों के आधार पर VTLC-2 तथा VTLC-1 को नारियल आधारित प्रणाली के लिए श्रेष्ठ संकर पाया गया तथा विमोचन हेतु अनुशंसित किया गया। प्रारंभिक मूल्यांकन परीक्षणों में VTLC-16, VTLC-17, VTLC-20 तथा VTLC-57 विभिन्न कृषि-जलवायु क्षेत्रों एवं उत्पादन प्रणालियों के लिए आशाजनक जननद्रव्य के रूप में उभरे हैं।

पामेरा ताड़ पर अनुसंधान चार एआईसीआरपी केन्द्रों में फसल सुधार तथा कटाई उपरांत प्रौद्योगिकी पर केंद्रित रहा। एचआरएस, पंडिरीमामिडी में कुल 272 तथा एसी एंड आरआई, किल्लीकुलम में 265 जननद्रव्य अभिगमों का संरक्षण किया गया। मूल्य संवर्धन एवं कटाई उपरांत प्रौद्योगिकी के क्षेत्र में भी उल्लेखनीय प्रगति हुई है। 10 प्रतिशत या उससे

अधिक माल्टोडेक्सट्रिन के साथ तैयार किया गया फ्रीज-ड्राइड ताड़ नीरा पाउडर उत्कृष्ट घुलनशीलता, बेहतर भंडारण स्थिरता तथा 5प्रतिशत से कम नमी के साथ गुणवत्ता मानकों के अनुरूप पाया गया है। ताड़ नीरा सान्द्र (सिरप) त्वरित भंडारण परिस्थितियों में 90दिनों तक स्थिर रहा। संशोधित ताड़ कंद स्टार्च ने इंस्टैंट सूप निर्माण में गाढ़ापन प्रदान करने वाले पदार्थ के रूप में उपयोग की संभावना प्रदर्शित की है। इसके अतिरिक्त, ताड़ फल के गूदे से प्राप्त पेक्टिन की प्राप्ति 5.8से 20.4प्रतिशत के मध्य रही तथा इसके भौतिक एवं रासायनिक गुण व्यावसायिक स्रोतों से प्राप्त पेक्टिन के समान पाए गए, जिससे ताड़ फल के गूदे को पेक्टिन के वैकल्पिक स्रोत के रूप में उपयोग की संभावना सिद्ध हुई।

किसान प्रशिक्षण, अग्रिम पंक्ति प्रदर्शन, किसान दिवस, अध्ययन भ्रमण तथा एससीएसपी, टीएसपी एवं एनईएच कार्यक्रमों के अंतर्गत विभिन्न विस्तार गतिविधियों के माध्यम से प्रौद्योगिकी प्रसार को निरंतर बढ़ावा दिया गया, जिससे रोपण फसलों में उन्नत तकनीकों को अपनाने में सहायता मिली है। विगतवर्ष के दौरान एआईसीआरपी नेटवर्क के समन्वित प्रयासों से नई किस्मों के विकास, आनुवंशिक संसाधनों के संरक्षण एवं उपयोग, सतत फसल प्रबंधन तथा भारत में रोपण फसलों की उत्पादकता बढ़ाने में महत्वपूर्ण योगदान

II. EXECUTIVE SUMMARY

The AICRP on Palms continued to strengthen location-specific research on coconut, oil palm, cocoa and palmyrah, generating significant achievements in crop improvement, crop production, crop protection and post-harvest technology during 2024. Under coconut, 30 coordinated experiments were undertaken on crop improvement, crop production and crop protection. In crop improvement, the hybrid SKL × GBGD evaluated at Bhubaneswar recorded the highest nut yield (137 nuts palm⁻¹ year⁻¹), tender nut water content (455 ml nut⁻¹), copra content (192.35 g nut⁻¹) and oil content (66.28%), with substantial improvement over the local variety Sakhigopal Local. Three conserved coconut populations possessing the novel pink husk trait were identified at Veppankulam, and their progenies were registered with ICAR–NBPGR. Promising tall coconut varieties including VPM 6, Seychelles Tall, Gandevi Tall, Kamrupa and Orissa Giant, along with nine tall and eleven dwarf genotypes, were identified for new multi-location trials. Evaluation of Dwarf × Dwarf hybrids identified COD × MYD and GBGD × MOD as promising combinations for tender nut production. At Ratnagiri, COD × MYD recorded the highest tender nut yield (95.6 nuts palm⁻¹ year⁻¹) and tender nut water volume (602.7 ml nut⁻¹), whereas GBGD × MOD recorded the highest total soluble solids (5.7°Brix). At Veppankulam, GBGD × MOD recorded the highest nut yield (95.56 nuts palm⁻¹ year⁻¹) and tender nut water volume (628.10 ml nut⁻¹).

In crop production, evaluation of coconut-based multispecies cropping systems under coastal littoral sandy soils at Bhubaneswar, identified the Coconut + *Garcinia indica* + Pineapple system with integrated nutrient management as the most profitable, recording a net return of Rs. 4,63,857 ha⁻¹ and a benefit:cost ratio of 2.38. Under organic cultivation, the treatment comprising *in situ* organic

matter recycling, PGPR consortia, green manuring, cow dung, husk burial and 50% recommended sulphate of potash recorded the highest system productivity and profitability.

In crop protection, root feeding of propiconazole (5 ml in 100 ml water) at three-month intervals effectively reduced leaf blight incidence by 27% after 36 months and increased nut yield to 138 nuts palm⁻¹ year⁻¹, with a benefit:cost ratio of 3.7. Biological control programmes were strengthened through the production and supply of 17.26 lakh *Bracon hebetor*, 8.46 lakh *Goniozus nephantidis*, 44,000 *Encarsia guadeloupae*, 34,000 *Pediobius imbreus*, 242 Tricho cards and 3.47 lakh *Apertochrysa astur* eggs for the management of major coconut pests across Tamil Nadu, Andhra Pradesh, Karnataka and Maharashtra.

Research on oilpalm was continued at six AICRP centres, where 38 hybrids are under evaluation in four coordinated trials. At Vijayarai, the hybrid NRCOP 37 (Pedavegi 1) recorded a fresh fruit bunch (FFB) yield of 29.69 t ha⁻¹ with an average bunch weight of 19.9 kg. At Pattukkottai, NRCOP 9 (Pedavegi 2) recorded an FFB yield of 30.62 t ha⁻¹, average bunch weight of 20.20 kg and an oil content of 21.50%, demonstrating its superior yield potential.

Evaluation of cocoa hybrids and clones was continued across seven AICRP centres under coconut, arecanut and oil palm-based cropping systems. Based on multi-location evaluation, VTLCH-2 and VTLCH-1 were identified as superior hybrids under coconut-based systems and recommended for release. Among the younger evaluation trials, VTLC-16, VTLC-17, VTLC-20 and VTLC-57 emerged as promising genotypes under different agro-climatic regions and production systems.

Palmyrah research continued at four AICRP centres focusing on crop improvement and post-harvest technology. A total of 272 germplasm accessions were conserved at HRS, Pandirimamidi, and 265 accessions at AC & RI, Killikulam. Significant progress was made in value addition and post-harvest technology. Freeze-dried palmyrah neera powder prepared using 10% or more maltodextrin exhibited excellent solubility, good storage stability and moisture content below 5%, conforming to quality standards. Palmyrah neera concentrate (syrup) remained stable for 90 days under accelerated storage conditions. Modified palmyrah tuber starch demonstrated potential as a thickening agent for instant soup formulations. In addition, pectin extracted from palmyrah fruit pulp

recorded yields ranging from 5.8 to 20.4%, and its physicochemical properties were comparable with pectin obtained from conventional commercial sources, highlighting the potential of palmyrah fruit pulp as an alternative source of pectin.

Technology dissemination continued to be a major focus through farmer trainings, frontline demonstrations, field days, exposure visits, and extension programmes under SCSP, TSP, and NEH, facilitating the adoption of improved technologies across plantation crops. The coordinated efforts of the AICRP network during the year substantially contributed to varietal development, conservation and utilization of genetic resources, sustainable crop management, and enhanced productivity of plantation crops in India.

III. PROFILE OF AICRP ON PALMS

The present day All India Coordinated Research Project on Palms came into existence in the year 1972 as The All India Coordinated Coconut and Arecanut Improvement Project. The project was subsequently designated as AICRP on Palms following the incorporation of oil palm and palmyrah during the seventh and eighth plan periods. Later, cocoa was also added as one of the mandate crops and arecanut centres included during 2014. The mandate crops, coconut (*Cocos nucifera* L.), arecanut (*Areca catechu* L.), oil palm (*Elaeis guineensis* Jacq.), palmyrah (*Borassus flabellifer* L.) and cocoa (*Theobroma cacao* L.) play a significant role in strengthening the livelihood of millions of small and marginal farmers in the country in a sustainable way. The project is headquartered at ICAR-CPCRI, Kasaragod to carry out the location specific research on mandate crops with the following objectives:

- Identification, conservation and utilization of elite genetic resources for useful traits in palms and cocoa from different agro-climatic regions.

- Evaluation of varieties/hybrids under different locations and to facilitate release of varieties/hybrids of palms and cocoa through multi-location testing (MLT).
- To improve input use efficiency and develop location-specific palm based integrated farming systems to enhance the productivity per unit area.
- Evolving cost effective integrated insect-pest and disease management practices besides survey and surveillance of pests and diseases for forewarning.
- Development of post-harvest technologies in palmyrah.

List of Centres

The project is implemented in 28 centers with its headquarters at ICAR-CPCRI, Kasaragod among which, 15 centres are undertaking research trials on coconut, six on oil palm, four on arecanut, four on palmyrah and seven on cocoa. The centers are hosted at thirteen State Agricultural / Horticultural Universities, one Central Agricultural University and four ICAR institutes in fourteen states and one union territory.

State	Research Centre(s)	Crop(s)	Institution
Andhra Pradesh	Ambajipeta, Pandirimamidi, Vijayarai, Pedavegi	Coconut, Palmyrah, Oil Palm, Cocoa	Dr. Y.S.R. Horticultural University; ICAR-IIOPR
Andaman & Nicobar	Sri Vijaya Puram	Coconut, Arecanut	ICAR-CIARI
Arunachal Pradesh	Pasighat	Oil Palm	Central Agricultural University
Assam	Kahikuchi	Coconut, Cocoa	Assam Agricultural University
Bihar	Sabour	Coconut, Palmyrah	Bihar Agricultural University
Chhattisgarh	Jagdalpur	Coconut	Indira Gandhi Krishi Vishwavidyalaya
Goa	Old Goa	Coconut, Arecanut	ICAR-CCARI

Gujarat	Navsari	Coconut, Cocoa	Navsari Agricultural University
Karnataka	Arsikere, Sirsi, Bavikere, Shivamogga	Coconut, Cocoa, Oil Palm, Arecanut	University of Horticultural Sciences; KSNUAHS
Kerala	Kasaragod, Pilicode, Thrissur	Coconut, Cocoa	ICAR-CPCRI; Kerala Agricultural University
Maharashtra	Mulde, Ratnagiri, Wakawali	Oil Palm, Coconut, Cocoa, Arecanut	Dr. BSKKV
Odisha	Bhubaneswar	Coconut, Cocoa	Odisha University of Agriculture & Technology
Tamil Nadu	Aliyarnagar, Killikulam, Pattukkottai, Veppankulam	Coconut, Cocoa, Palmyrah, Oil Palm	Tamil Nadu Agricultural University
Telangana	Konda Malleshpally	Palmyrah	Sri Konda Laxman Telangana State Horticultural University
West Bengal	Mondouri	Coconut	Bidhan Chandra Krishi Viswa vidyalaya

Budget

The budget for the year 2024 was Rs 716.33 lakhs (ICAR Share)

(Rs. in lakhs)

Sl. No.	Head	Expenditure
1.	Pay and allowances	460.49
2.	T.A.	22.27
3.	RC	167.06
4.	HRD	2.3675
5.	NRC	9.89
6.	NEH	23.25
7.	TSP	10.00
5.	SCSP	21.00
	Total	716.33



Staff strength

Category	Present strength
Scientific	31
Technical	14
Supporting	13
Total	58

Centre wise budget for 2024 (01.01.2024 to 31.12.2024) (ICAR share Rs. in Lakhs)

Centre	Pay	TA	RC	HRD	Eqpt.	Works	NEH	TSP	SCSP	Total
Aliyamagar	67.50	0.90	9.90	0.00	0.00	0.00	0.00	1.72	2.25	82.27
Ambajipeta	39.30	0.80	10.00	0.00	0.00	0.00	0.00	0.00	7.00	57.10
Arsikere	37.70	0.70	8.50	0.00	0.00	0.00	0.00	1.70	1.20	49.80
Jagdapur	16.50	0.53	7.03	0.00	0.00	0.00	0.00	1.67	0.00	25.73
Kahikuchi (NEH)	23.32	0.00	0.00	0.00	0.00	0.00	14.00	0.00	1.20	38.52
Bhubaneswar	12.80	0.20	8.50	0.00	0.13	0.00	0.00	0.00	1.40	24.03
Mondouri	2.80	0.20	5.05	0.35	0.00	0.00	0.00	0.00	0.00	8.40
Ratnagiri	55.50	0.76	9.25	0.00	0.00	0.00	0.00	1.67	1.50	68.68
Veppankulam	52.00	1.11	7.25	0.00	0.00	0.00	0.00	0.00	2.15	62.51
Killikulam	25.76	0.16	5.40	0.00	0.00	0.00	0.00	0.00	0.70	32.02
Pandirimamidi	33.00	0.70	8.00	0.00	1.10	0.00	0.00	1.59	0.00	44.39
Pattukotai	23.25	0.70	5.35	0.35	2.00	0.00	0.00	0.00	0.00	31.65
Mulde	18.76	0.45	11.35	0.35	0.00	0.00	0.00	0.00	0.00	30.91
Vijayarai	17.80	0.50	6.00	0.00	0.00	0.00	0.00	0.00	1.90	26.20
Navasari	11.50	0.20	6.25	0.00	0.00	0.00	0.00	1.65	0.00	19.60
Sabour	15.50	0.30	10.58	0.00	0.00	0.00	0.00	0.00	0.50	26.88
Shivamogga	7.50	0.70	5.00	0.39	2.16	0.00	0.00	0.00	0.00	15.75
Wakawali	0.00	0.10	2.80	0.35	0.00	0.00	0.00	0.00	0.00	3.25
Pilicode	0.00	0.76	5.10	0.20	0.00	0.00	0.00	0.00	0.00	6.06
Bavikere	0.00	0.50	5.12	0.30	3.50	0.00	0.00	0.00	0.00	9.42
K Mallapally	0.00	0.15	3.00	0.08	0.00	0.00	0.00	0.00	1.20	4.43
Sirsi	0.00	0.20	3.10	0.00	0.00	0.00	0.00	0.00	0.00	3.30
Thrissur	0.00	0.15	1.45	0.00	0.00	0.00	0.00	0.00	0.00	1.60
Pasighat (NEH)	0.00	0.00	0.00	0.00	0.00	0.00	9.25	0.00	0.00	9.25
Sri Vijaya Puram(ICAR)	0.00	0.00	6.10	0.00	0.00	0.00	0.00	0.00	0.00	6.10
Goa (ICAR)	0.00	0.00	5.75	0.00	0.00	0.00	0.00	0.00	0.00	5.75
IIOPR, Pedavegi (ICAR)	0.00	0.00	5.25	0.00	0.00	0.00	0.00	0.00	0.00	5.25
Kasaragod (ICAR)	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PC cell (ICAR)	0.00	11.50	5.98	0.00	0.00	0.00	0.00	0.00	0.00	17.48
Total	460.49	22.27	167.06	2.37	9.89	0.00	23.25	10.00	21.00	716.33

The project is implemented through the respective State Agricultural/Horticultural Universities on 75:25 basis of which 75% is ICAR

share and 25% share is from State Agricultural Universities.

IV. GENETIC RESOURCES AND CROP IMPROVEMENT

The All India Coordinated Research Project (AICRP) on Palms plays a pivotal role in the conservation, characterization, evaluation, and utilization of genetic resources of major plantation crops, namely coconut, arecanut, cocoa, oil palm, and palmyrah. Through its multi-location network of research centres across diverse agro-climatic regions, the project facilitates the collection and maintenance of valuable germplasm, identification of superior genotypes, and evaluation of promising accessions and hybrids for yield, quality, adaptability, and tolerance to biotic and abiotic stresses. These coordinated efforts contribute to broadening the genetic base, supporting crop improvement programmes, and developing high-yielding, climate-resilient varieties and hybrids for sustainable plantation crop production in India.

Coconut

A total of 11 experiments were undertaken on coconut genetic resources and crop improvement across the 14 AICRP centres located in diverse agro-climatic regions of the country. The programme included collection, conservation, characterization, and evaluation of location-specific and elite germplasm, involving 113 location-specific accessions, 12 elite germplasm accessions, 16 dwarf genotypes, and 13 promising tall genotypes, in addition to the evaluation of conserved germplasm maintained at Bhubaneswar (16), Navsari (19), and

Sabour (15). Crop improvement efforts focused on the evaluation of 43 location-specific hybrid combinations ($T \times D$ and $D \times T$), 21 location-specific Tall $\times$ Tall hybrids and multi-location trials involving five Tall $\times$ Tall and five Dwarf $\times$ Dwarf hybrid combinations to identify stable, high-yielding, and widely adaptable genotypes. To strengthen the quality planting material programme, 10 released coconut varieties were evaluated across different agro-climatic regions, while 21 released varieties were maintained in nucleus seed gardens for the production and supply of genetically pure planting material.

Conservation and evaluation of coconut genetic resources in different agro climatic regions

Evaluation of conserved germplasm

This trial is ongoing at Bhubaneswar, Navsari and Sabour centres for the evaluation of coconut germplasm accessions for yield and their response to biotic and abiotic stresses. The experiment was laid out as an unreplicated observational trial with five palms per accession at Bhubaneswar and Navsari, and 5–10 palms per accession at Sabour. The growth and developmental characters of the evaluated germplasm were found to be satisfactory across the centres. The superior -performing germplasm based on nut yield and copra yield at the respective centres are presented in Table 1.



Fig. 1. Field view of Conserved germplasm at Bhubaneswar

Table 1. Nut and copra yield of promising conserved coconut germplasm

Centre	Germplasm Evaluated	Better Performing Dwarf	Better Performing Tall	Highest Copra Yield
Bhubaneswar (2004)	12 Tall + 4 Dwarf	Gangabondam Green Dwarf (GBGD) – 98.50 nuts palm ⁻¹ year ⁻¹	Tiptur Tall – 100.54 nuts palm ⁻¹ year ⁻¹	Tiptur Tall – 18.41 kg palm ⁻¹
Navsari (2011)	15 Tall + 4 Dwarf	Gangabondam Green Dwarf (GBGD) – 80 nuts palm ⁻¹ year ⁻¹	Kappadam Tall – 80 nuts palm ⁻¹ year ⁻¹	–
Sabour (2011)	11 Tall + 4 Dwarf*	Dwarf genotypes did not perform satisfactorily under local conditions and were removed.	Sakhigopal Tall – 64 nuts palm ⁻¹ year ⁻¹	–

Collection, Conservation and evaluation of location specific germplasm

The evaluation of location-specific coconut germplasm was continued across 12 AICRP centres to identify superior accessions adapted to diverse agro-climatic conditions. A total of 113 germplasm accessions were maintained and evaluated under randomized block design (RBD), observational trials, or a combination of both, depending on the land availability and year of establishment of the experiment. The trials, established between 2003 to 2020, comprised 5–12 accessions per centre. The highest number of accessions was maintained at Kahikuchi (12), followed by Bhubaneswar (11), Pilicode (8), Sabour (7) and Veppankulam (7). The remaining centres, namely Aliyarnagar, Ambajipeta, Arsikere, Jagdalpur, Mondouri, Navsari, and Ratnagiri, maintained 4–6 location-specific accessions. The location-specific germplasm

maintained at all centres, except Pilicode and Sabour, have been registered with the ICAR-NBPGR and assigned IC numbers, facilitating their documentation and long-term conservation. These evaluations provide valuable information on the performance, adaptability, and yield potential of locally adapted coconut germplasm, thereby facilitating their effective utilization in crop improvement and conservation programmes. At Aliyarnagar, IC 610370 and IC 610371 were identified as promising dual-purpose accessions suitable for both tender coconut and copra production. At Ambajipeta, three elite local accessions, namely IC 610309, IC 610306 and IC 610307, exhibited superior performance under local conditions.

Based on their superior yield performance, IC 599264 (Adirampattinam Sln) from Veppankulam was released as the variety VPM 6 in 2023 for commercial cultivation (Fig. 2). Similarly, Odisha



(TKT- IC599263; AMM- IC 599264; KGU- IC599265; KGU- IC599266; TMT – IC599267; ALR- ALRCN1; WCT- VPM4)

Fig. 2. Fruit traits of location specific germplasm at Veppankulam centre

Giant (IC 612457) from Bhubaneswar exhibited consistently superior performance over a seven-year evaluation period (2017–18 to 2023–24), recording the highest cumulative yield of 466 nuts palm⁻¹ (Fig. 3), along with a high copra yield of 14.85 kg palm⁻¹. Owing to its stable yield performance and adaptability, Odisha Giant (IC 612457) and VPM 6 (IC 599264) was identified as a promising location-specific genotype and included in the multi-location trial (MLT) for evaluation in three other centres.



Fig. 3a. Odisha Giant (IC 612457)

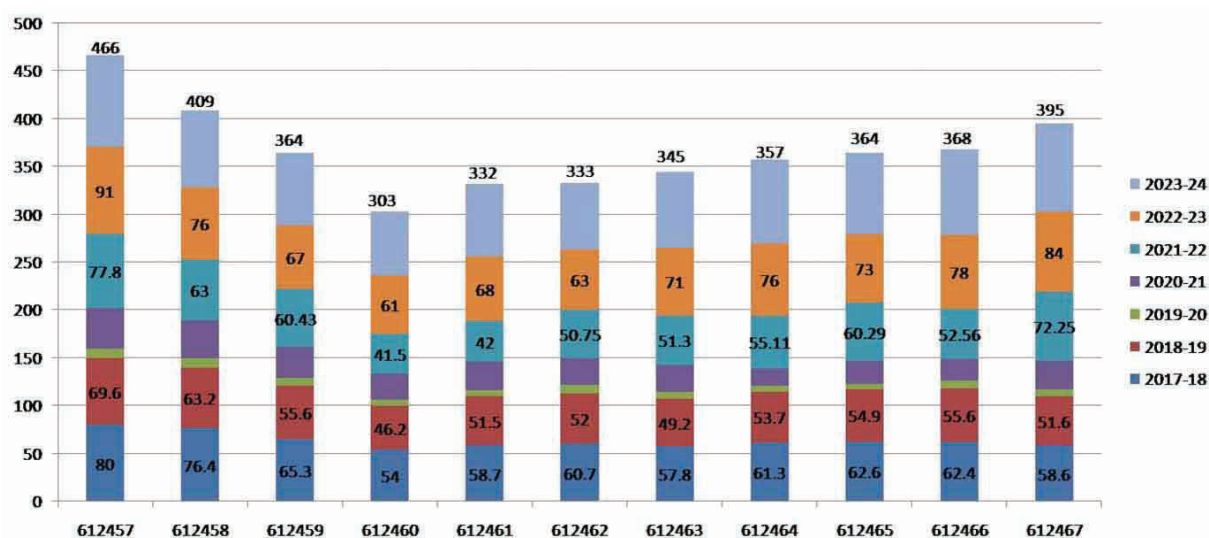


Fig. 3 b. Yield of location specific coconut germplasm at Bhubaneswar centre

Evaluation of elite germplasm

The trial was undertaken to evaluate the performance of elite exotic coconut germplasm for yield potential and their response to biotic and abiotic stresses under diverse agro-climatic conditions. Inter-se mated seed nuts of selected exotic accessions were supplied by ICAR–CPCRI to the participating AICRP centres. The experiment consisted of six elite exotic germplasm accessions and one local check, laid out in a Randomized Block Design (RBD) with three replications and four palms per accession per replication. The trial was established at Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Ratnagiri, and Veppankulam, with

planting carried out during 2014–2016. The trial has now entered the bearing phase, and yield evaluation is in progress. The common exotic accession, Verrikobari Tall exhibited variation in the age at first flowering across the six AICRP centres, reflecting the influence of agro-climatic conditions. The earliest flowering was recorded at Bhubaneswar (34 months), followed by Veppankulam (40 months), Aliyarnagar (42 months), Ambajipeta (42 months), Ratnagiri (48 months), and Arsikere (58.3 months). Verrikobari Tall exhibited consistently superior performance for nut yield across AICRP centres (Fig. 4) except Arsikere centre, where all the entries performed poorly.

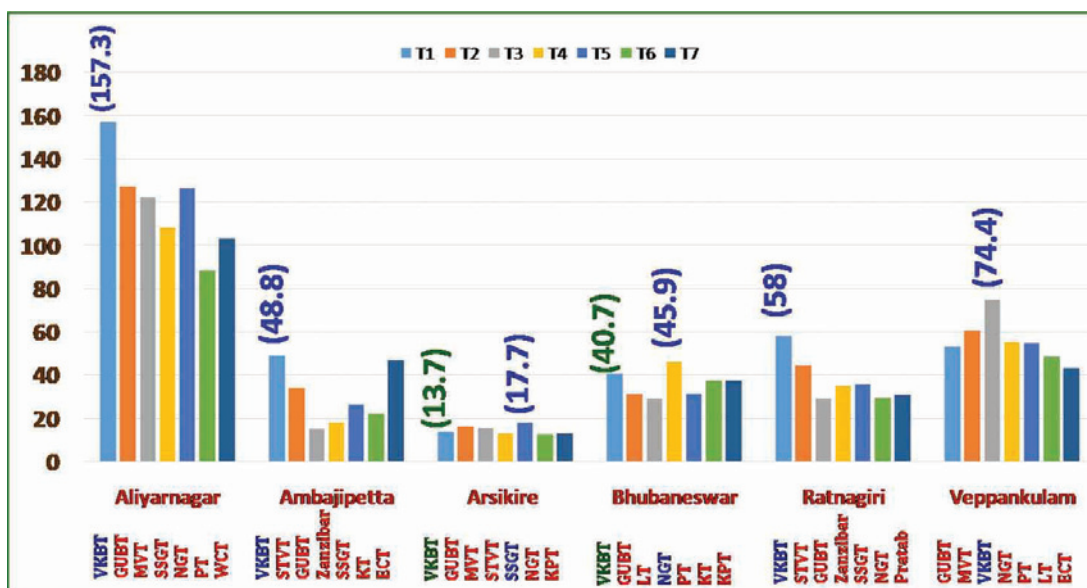


Fig. 4. Yield Performance of elite coconut germplasm - Verrikobari Tall across location

New trials

Based on the recommendation of the XXXIII Annual Group Meeting (AGM), an online meeting was organized on 19 January 2024 at ICAR–AICRP on Palms, ICAR–CPCRI, Kasaragod, to reorient the ongoing crop improvement trials and strengthen the coordinated trials under breeding programme. Following detailed deliberations, it was decided to initiate two new multi-location experiments for the evaluation of dwarf and tall

coconut germplasm across diverse agro-climatic regions of the country. The dwarf genotype trial comprised 13 germplasm accessions sourced from ICAR–CPCRI, Kasaragod and ICAR–CIARI, Sri Vijaya Puram, namely Cameroon Red Dwarf, Niu Leka Dwarf, Nigerian Green Dwarf, Laccadive Orange Dwarf, Dweep Haritha, Dweep Sona, Hari Papua Orange Dwarf, Gudanjali, Chowghat Yellow Dwarf, Kalpa Suvarna, Andaman Orange Dwarf, Nikkore Dwarf, Chowghat Orange Dwarf (Fig. 5).



Fig. 5. Seed nuts of dwarf accessions

The tall genotype trial comprised 16 selected germplasm accessions, including nine exotic accessions—Kappadam, Lifou, Markham, Laguna, Niu Hake, Rotuma, New Guinea, West African Tall, Rennel Tall, Niu Drau and Kalpa Ratna from ICAR–CPCRI, Kasaragod, along with five elite indigenous accessions/ selections/ released varieties, namely Gandevi Tall (Navsari), Kamrupa (Kahikuchi), Odisha Giant (Bhubaneswar), VPM 6 (Veppankulam), and Seychelles Tall (Pilicode). Inter-se pollination and seed nut production will be undertaken during the current year, and the resulting seed nuts will be supplied to the AICRP centres during the following year for raising seedlings and establishing multi-location trials.

Evaluation of coconut Hybrids in different agro climatic regions

The hybrid evaluation programme comprised four experiments, namely (i) Evaluation of new coconut hybrids of location-specific cross combinations, (ii) Evaluation of Tall $\times$ Tall coconut hybrids, (iii) Evaluation of location-specific Tall $\times$ Tall coconut hybrids, and (iv) Evaluation of Dwarf $\times$ Dwarf coconut hybrids. These experiments were undertaken to assess hybrid performance for earliness, yield, adaptability, and stability under diverse agro-climatic conditions and to identify promising hybrids for region-specific cultivation and future varietal recommendation.

(i) Evaluation of new coconut hybrids of location-specific cross combinations

The trial was conducted at eight AICRP centres viz., Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Kahikuchi, Mondouri, Ratnagiri, and Veppankulam to evaluate 43 location-specific coconut hybrid combinations (Tall $\times$ Dwarf and Dwarf $\times$ Tall) developed by the respective centres

under diverse agro-climatic conditions. The experiment was laid out in a Randomized Block Design (RBD) with four replications at each location. The objective was to assess the yield potential, adaptability, and response to biotic stresses of these hybrids and to identify superior region-specific hybrid combinations for commercial cultivation. The best performing hybrid combinations identified at different AICRP centres based on nut yield and copra during 2023–24 are presented in Table 2.

At Bhubaneswar, the location-specific hybrid Sakhigopal Local $\times$ Gangabondam Green Dwarf (SKL $\times$ GBGD) (Fig. 6) exhibited superior performance, recording a nut yield of 137 nuts palm⁻¹ year⁻¹, tender nut water content of 455 ml nut⁻¹ with 5.28° Brix TSS, copra content of 192.35 g nut⁻¹, and oil content of 66.28%.



Fig. 6. Crown view of SKL $\times$ GBGD at Bhubaneswar

Table 2. Performance of Location-Specific Coconut Hybrid Combinations across AICRP Centres (2023–24)

S. No	AICRP Centre	Hybrid combinations under evaluation	Year of start	Better performing cross	Nut yield 2023-24 (nuts palm ⁻¹ year ⁻¹)	Copra (kg/palm)
1	Aliyamagar	Arasampatti Tall x MGD, MGD x Arasampatti Tall, Kenthali x Arasampatti Tall, COD x Arasampatti Tall, COD x WCT	2012 and 2014	ALR x MGD	153.2	27.57
2	Ambajipeta	ECT x Cochin China, GBGD x Cochin China, ECT x PHOT, GBGD x PHOT, PHOT x GBGD	2011	ECT x CCNT	114.15	15.21
3	Arsikere	TPT x PHOT, TPT x LCT, LCT x MYD, LCT x MOD, TPT x MYD, TPT x MOD	2012	TPT x MOD	98	-
4	Bhubaneswar	Sakhigopal x COD, MGD x Sakhigopal, Sakhigopal x GBGD, GBGD x GUAM, COD x Bana (IC- 0612461)	2008	SKL x GBGD	137	16.52
5	Kahikuchi	Assam Green Tall (AGT) x CCNT, AGT x MYD, AGT x PHOT, Bengal Hazari x AGT, Assam Yellow Tall x PHOT	2009	AGT x PHOT	96	16.9
6	Mondouri	LCT x PHOT, PHOT x LCT, ECT x Java Tall, ECT x Jamaica, ECT x Bengal Hazari	2009	ECT x Java Tall	89.56	-
7	Ratnagiri	COD x Benaulim Yellow Round, COD x Pratap, COD x Benaulim Green Long, Benaulim Yellow Round x COD, Pratap x COD, Benaulim Green Long x COD	2006	COD x BYR	111	18.83
8	Veppankulam	WCT x Kenthali, WCT x MOD, MOD x WCT, ADOT x COD, WCT x MGD and Kenthali x WCT	2005	ADOT x COD, WCT x MGD	167.8 145.28	22.46 23.79

(i) Evaluation of Tall × Tall Coconut Hybrids

This ongoing experiment was started with the objective of assessing five Tall x Tall hybrids, viz., LCT x ADOT, ADOT x ECT, BENT x ADOT, ECT x LCT and WCT x TPT along with local check at various agro-climatic regions during 2011- 2013. The hybrids were produced at CPCRI, Kasaragod and supplied for evaluation at eight centres viz., Aliyarnagar, Ambajipeta, Arsikere, Bhubaneswar, Kahikuchi, Navsari, Ratnagiri and Veppankulam.

The trial has been planted in three replications and six palms per replication. Preliminary trends showed that the hybrid, BENT × ADOT is best-performing hybrid at three centres (Veppankulam, Navsari and Kahikuchi), while WCT × TPT (Fig. 7) performed better at two centres (Bhubaneswar and Ratnagiri), whereas LCOT × ADOT better performed at Ambajipeta and Arsikere centres. (table 3). Continued evaluation is required to assess yield stability and adaptability across locations.

Table 3. Centre-wise Performance of Tall × Tall Coconut Hybrids under Multi-location Trials

Hybrid	Centre(s) and corresponding yield (nuts palm ⁻¹ year ⁻¹)
BENT × ADOT	Veppankulam (151.61), Kahikuchi (68.70), Navsari (93.25)
LCT × ADOT	Ambajipeta (128.63), Arsikere (96.00)
WCT × TPT	Ratnagiri (104.64), Bhubaneswar (110.81)
ADOT × ECT	Aliyarnagar (130.70)



Fig. 7. Better performing hybrid WCT x TPT at Ratnagiri

(i) Evaluation of location-specific Tall × Tall coconut hybrids

The experiment was laid out in RBD with three replications and six palms per hybrids per replication to evaluate location specific Tall x Tall cross combinations for yield and reaction to biotic and abiotic stresses at three centres viz., Ambajipeta, Ratnagiri and Veppankulam. In Ambajipeta, seven Tall x Tall hybrids (Java Tall x ECT, PHOT x ECT, Fiji Tall x ECT, ECT x PHOT, LCT x ECT, CCNT x ECT, ECT x Fiji Tall) with one local check were planted during 2011. Due to Helen and Philin cyclone in the year 2013, some of the accessions were damaged and the gap filling was done during the month of February, 2014. There was no significant differences between the hybrids with respect to vegetative growth parameters. The data pertaining to yield attributes for the year 2024 showed that ECT × PHOT emerged as the better performing hybrids, with maximum nut yield (122.4 nuts palm⁻¹ year⁻¹), copra content (187.24 g nut⁻¹), copra yield (22.92 kg palm⁻¹), and oil yield (12.92 kg palm⁻¹). In Ratnagiri centre, among seven Tall x Tall hybrids (PHOT x BENT, BENT x PHOT, PHOT x BYR,

BYR x PHOT, BGL x PHOT, PHOT x BGL, LCT x BENT) planted during 2009, the highest nut yield (102 nuts palm⁻¹ year⁻¹) recorded in BGR x PHOT with copra content (177.50 g). At Veppankulam, seven T x T cross combinations viz., WCT x PHOT, ECT x Zanzibar, ECT x Java Giant, ECT x PHOT, San Ramon x Zanzibar, WCT x CCNT and PHOT x WCT along with a check variety VCH 3 were planted in 2009 as under planting and the old palms were removed during 2015. All the hybrid combinations produced more than 90 nuts palm⁻¹ year⁻¹, with ECT x Java Giant (148.08 nuts palm⁻¹

year⁻¹) and ECT x PHOT (147.66 nuts palm⁻¹ year⁻¹) recording the highest nut yields, respectively. However, the released hybrid VHC 3 recorded the highest copra content (177.4 g nut⁻¹) and oil yield (2.5 t ha⁻¹), indicating its continued superiority for copra and oil production under the prevailing agro-climatic conditions. The five-year mean yield data revealed that the hybrid ECT x PHOT at Veppankulam recorded the highest nut yield (100.0 nuts palm⁻¹ year⁻¹), followed by BGR x PHOT at Ratnagiri (92.8 nuts palm⁻¹ year⁻¹) and LCT x ECT at Ambajipeta (86.99 nuts palm⁻¹ year⁻¹)(Fig 8.)

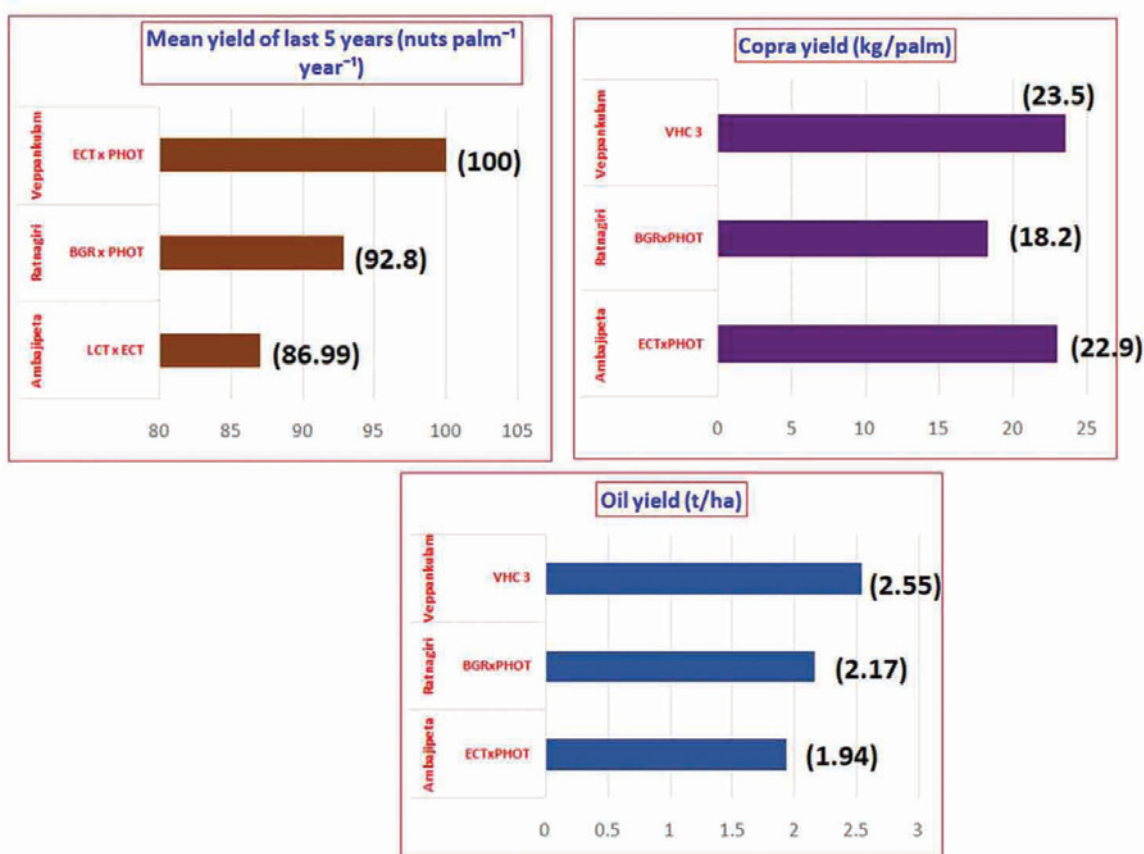


Fig. 8. Comparative performance of superior Tall x Tall hybrid combinations across AICRP centres

(i) Evaluation of Dwarf x Dwarf coconut hybrids in different agro climatic conditions

This experiment was laid out to identify and develop dwarf statured hybrids for tender nut yield and quality and to screen for pest and disease resistance. The experiment included five Dwarf x Dwarf hybrids viz., COD x MYD, COD x MGD,

MGD x CGD, GBGD x MOD and CGD x MGD (Table 4) supplied by ICAR-CPCRI, Kasaragod and a local check to three centres during 2011-12. The palms were planted in RBD with four replications and six palms per genotype per replication.

At Ambajipeta, the experiment was planted in 2011. Due to Helen and Philin cyclones in 2013, some of the accessions were lost. Gap filling was done with planting material received from CPCRI, Kasaragod in March, 2014. Initiated production of COD × MYD seed nuts in 2015 and seed nuts were harvested in 2016. These seedlings were raised in polypots during 2017 and the selected seedlings were planted in experimental plot in 2018. The

Dwarf × Dwarf coconut hybrids exhibited considerable variation in tender nut yield across the three evaluation centres over the last eight years (2016–17 to 2023–24). GBGD × MOD was superior under the Veppankulam, COD × MYD performed best at Ratnagiri, and COD × MGD exhibited consistently good performance across locations, supporting its relatively wider adaptability (Fig 9 a and 9 b).

Table 4. Centre-wise Comparison of Tender Nut Yield in Dwarf × Dwarf Coconut Hybrids during 2023–24

Hybrid	Ambajipeta	Ratnagiri	Veppankulam
COD × MYD	37.8	95.6	82.2
COD × MGD	110.8	76.7	89.3
MYD × CGD	85.3	81.6	90.2
GBGD × MOD	71.8	88.8	95.6
CGD × MGD	86.5	72.5	85.6
Local check	80.9	63.6	78.3

The GGE biplot-based stability analysis was carried out using data from Ratnagiri and Veppankulam, as the Ambajipeta data was excluded due to replanting following cyclone damage. The analysis revealed significant genotype × environment ($G \times E$) interaction among the Dwarf × Dwarf coconut hybrids, indicating differential responses of the hybrids across the two test environments. The “which-won-where” biplot identified two distinct mega-environments, with GBGD × MOD emerging as the winning genotype under the Veppankulam environment, while COD × MYD exhibited superior

performance under the Ratnagiri environment, demonstrating their specific adaptation to the respective locations. In the mean performance and stability view, COD × MGD was positioned close to the average environment axis with a relatively short projection, indicating comparatively greater stability and consistent performance across the two environments. The hybrids MYD × CGD and CGD × MGD were located near the biplot origin, suggesting comparatively lower genotype × environment interaction with moderate mean performance (Fig 9 c).

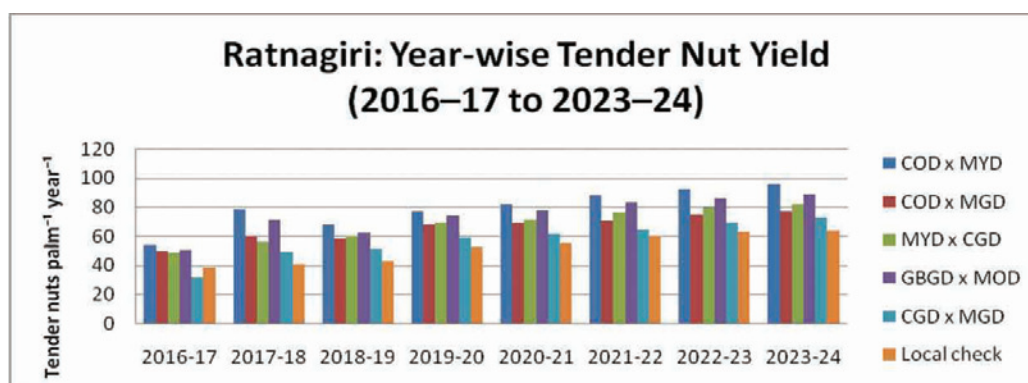


Fig. 9 a. Yield Performance of D × D hybrids at Ratnagiri

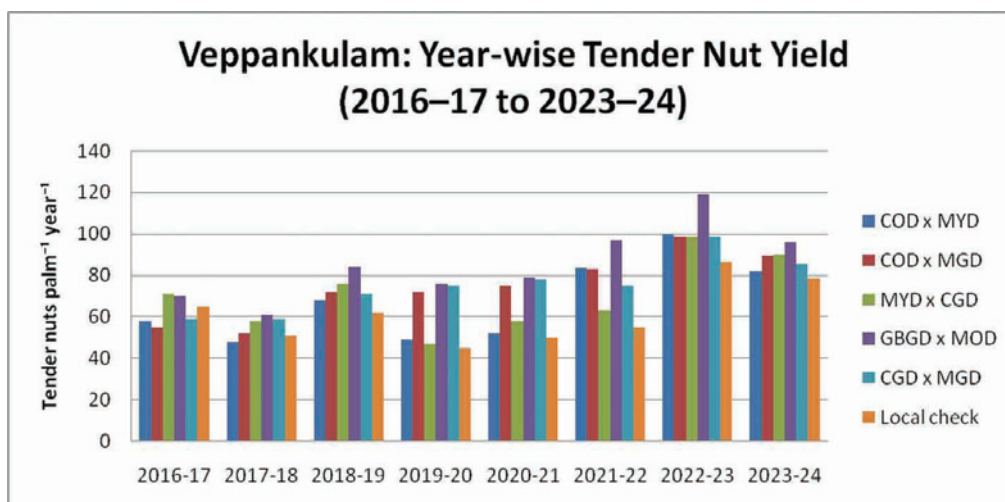


Fig. 9 b. Yield Performance of D x D hybrids at Veppankulam

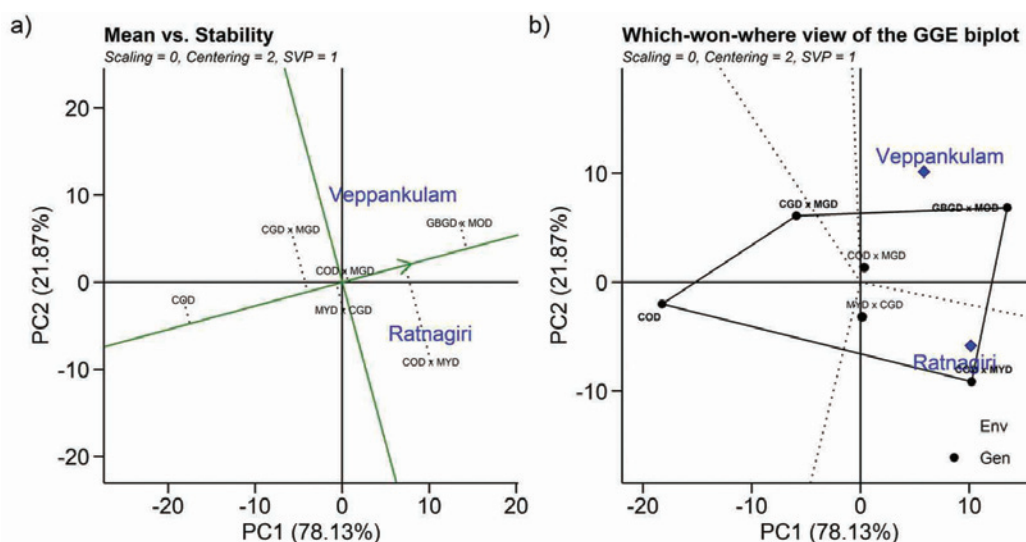


Fig. 9c. Mean vs. Stability view of GGE Biplot and b) GGE biplot identification of winning cultivars across two locations

Production of quality planting material in coconut

Evaluation of released coconut varieties in different agro-climatic regions

A multi-location trial was conducted (which commenced as a demonstration) to evaluate the performance of nationally released coconut varieties under diverse agro-climatic conditions. The trial comprised 10 nationally released varieties viz., Kalyani Coconut-1, Gautami Ganga, Konkan Bhatye Coconut Hybrid-1, Kera Keralam, Kera Bastar, Kalpa Samrudhi, Kalpa Pratibha, Kalpa Mitra, Kalparaksha, and Kalpa Dhenu along with a local check at eleven centre. The trial aims to exhibit

the adaptability, productivity, and suitability of the released cultivars across different coconut-growing regions of the country, to facilitate their wider adoption by farmers and to explore them for extended recommendations in other regions. The results demonstrate the region-specific adaptability of the released varieties and their potential for enhancing coconut productivity under diverse agro-climatic conditions. The centre-wise performance of the cultivars is presented in Table 5. At Arsikere, Jagdalpur, and Mondouri, Gautami Ganga emerged as the best-performing hybrid, recording 98.70, 61.00, and 86.00 nuts palm⁻¹ year⁻¹, respectively.

Table 5. Yield Performance of released coconut varieties across AICRP Centres

Name of center	Year of planting	Age of palm (Years)	Number of nuts harvested/Palm/year	Best performance of Hybrid/variety
Ambajipeta	2011	13	89.00	Kalpa Samrudhi
Aliyamagar	2011	13	162.30	Konkan Bhatye coconut hybrid 1
Arsikere	2012	12	98.70	Gautami Ganga
Bhubaneswar	2013	11	119.37	Kalpa Samrudhi
Jagdarpur	2012	12	61.00	Gautami Ganga
Kahikuchi	2013	11	58.80	Kalpa Samrudhi
Mondouri	2012	12	86.00	Gautami Ganga
Ratnagiri	2011	13	117.50	Kerakeralam
Sabour	2012-13	12	54.00	Kera Bastar
Veppankulam	2011	13	72.00	Konkan Bhatye coconut hybrid 1
Navsari	2013	11	93.33	Kalpa Dhenu

Nucleus seed gardens for released varieties

Production and distribution of quality planting material of released coconut cultivars and hybrids continued across AICRP centres to ensure the availability of genetically pure seedlings for farmers.

During 2024–25, quality seedlings of released varieties and hybrids were produced and distributed through the participating centres, thereby strengthening the supply of improved planting material for region-specific cultivation (Table 6).

Table 6. Production and distribution of quality planting material across centres

S. No.	Centre	Cultivar(s)/Hybrid(s)	Seedlings Distributed (Nos.)
1	Aliyamagar	Kera Keralam, ALR 1, COD, MGD, CGD, MYD, Kenthali Dwarf, Kalpa Sankara, Kalpa Samrudhi and Chandra Sankara	57, 970
2	Ambajipeta	Gautami Ganga, Double Century (PHOT), Kalpa Prathibha	2625
3	Jagdarpur	Kera Bastar	2380
4	Kahikuchi	Kamrupa	1230
5	Ratnagiri	Fiji Tall, East Coast Tall (ECT), Gangabondam Green Dwarf (GBGD), Konkan Bhatye Coconut Hybrid-1	2074

Oil palm

All the ongoing oil palm research trials under the ICAR–AICRP on Palms are being carried out with the contribution of entries from ICAR–IIOPR, Pedavegi, which serves as the nodal institute for oil palm breeding in the country. The AICRP centres

undertake multi-location evaluation of oil palm hybrids and progenies developed by ICAR- IIOPR to assess their regional oil yield potential, adaptability, and overall performance. The details of the ongoing experiments are presented in Table 7.

Table 7. Ongoing oil palm crop improvement trials under the ICAR–AICRP on Palms

Title of the experiment	AICRP Centre(s)	Hybrid/Progeny evaluated
Evaluation of new cross combinations in the North Eastern region	Pasighat	NRCOP 21–30
Evaluation of new progeny cross combinations in oil palm	Mulde, Pasighat, Pattukkottai and Vijayarai	NRCOP 31–40
Evaluation of D × P hybrids for dwarfness and yield in oil palm	Vijayarai	NRCOP 41–52
Evaluation of oil palm hybrids	Mulde, Pattukkottai and Pedavegi	IIOPR 53–59

Evaluation of new cross combinations in North East region

The experiment was initiated in 2010 at Pasighat centre to evaluate 10 oil palm cross combinations (NRCOP-21 to NRCOP-30) for growth, yield, and adaptability under the agro-climatic conditions of the North Eastern region. The trial was laid out in a Randomized Block Design (RBD) with three replications, comprising six palms per plot. The experiment is being continued to identify promising cross combinations with superior performance and wider adaptability. Significant differences were observed among the cross combinations for leaf production, flowering characters, sex ratio, bunch production and yield, whereas plant height and collar girth did not differ significantly. Among the hybrids, NRCOP-22 recorded the highest FFB yield of 153.05 kg palm⁻¹ (21.86 t ha⁻¹), followed by NRCOP-26 with 139.46 kg palm⁻¹ (19.92 t ha⁻¹) and NRCOP-23 with 129.64 kg palm⁻¹ (18.52 t ha⁻¹). with respect to flowering traits, NRCOP-26 recorded the highest number of female inflorescences (10.73 palm⁻¹) and the highest sex ratio (0.60), indicating greater reproductive

efficiency. The results indicated that NRCOP-22, NRCOP-26 and NRCOP-23 were the most promising cross combinations under the agro-climatic conditions of Pasighat and continued evaluation for yield stability and regional adaptability.



Fig. 10. Field View of Oil Palm hybrid NRCOP 22 at Pasighat, Arunachal Pradesh
Evaluation of new progeny cross combination in oil palm

Multi-location experiment was initiated during 2011 at Pattukkottai, Mulde, Pasighat, and Vijayarai to evaluate ten oil palm progeny cross combinations

(NRCOP-31 to NRCOP-40). Fig. 11 illustrates the fresh fruit bunch (FFB) yield of the progeny cross combinations across the four AICRP centres. Considerable variation in FFB yield was observed among the progenies across the locations, reflecting genotype $\times$ environment interaction. At Pattukkottai, NRCOP-38 recorded the highest FFB yield (33.4 kg palm⁻¹), followed by NRCOP-33 (32.7 kg palm⁻¹) and NRCOP-32 (30.9 kg palm⁻¹). At Mulde, NRCOP-31 (Fig. 11a) emerged as the better performing progeny with 31.9 kg palm⁻¹, followed by NRCOP-40 (30.8 kg palm⁻¹) and NRCOP-34 (29.9 kg palm⁻¹). At Vijayarai, NRCOP-38

recorded the highest FFB yield (32.3 kg palm⁻¹), followed by NRCOP-33 (29.2 kg palm⁻¹) and NRCOP-37 (28.9 kg palm⁻¹). At Pasighat, NRCOP-37 recorded the highest FFB yield (8.8 kg palm⁻¹), followed by NRCOP-32 (6.2 kg palm⁻¹) and NRCOP-31/NRCOP-35 (6.0 kg palm⁻¹). However, the overall FFB yield at Pasighat was comparatively lower than at the other centres due to the rocky substratum of the experimental field, which adversely affected palm growth and productivity. Overall, NRCOP-38 exhibited superior performance at Pattukkottai and Vijayarai, and NRCOP-31 at Mulde (Fig 11).

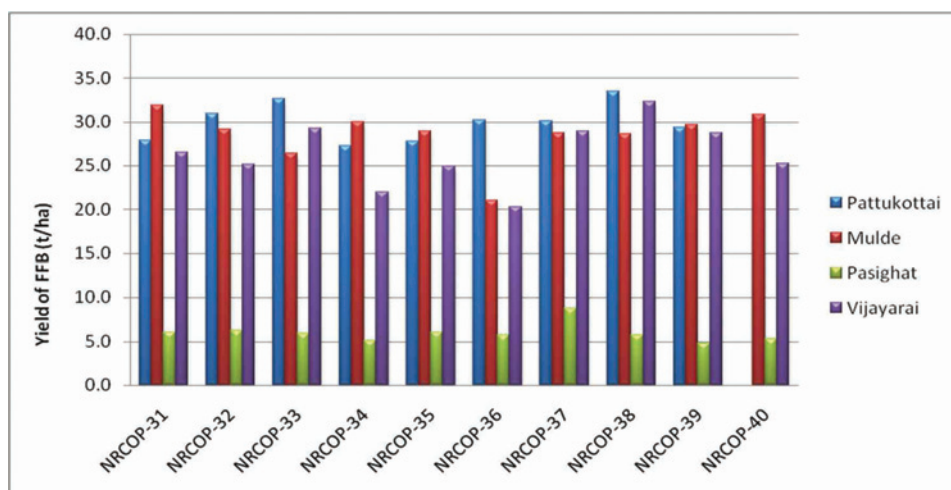


Fig. 11a. FFB yield of the progeny cross combinations across the four AICRP centres.



Fig. 11 b. Better-performing oil palm hybrid NRCOP-31 at Mulde.

Evaluation of D x P hybrids for dwarfness and yield in Oil Palm.

The Experiment was initiated during 2013 at Vijayarai to evaluate 11 D x P hybrids (NRCOP-41 to NRCOP-51) along with the control 646 for growth, yield, and dwarfness. The trial was laid out in a Randomized Block Design (RBD) with three replications, comprising nine palms per treatment planted in a triangular system at $9 \times 9 \times 9$ m spacing. No significant differences were observed among the hybrids for palm height, number of leaves produced per palm per year, number of bunches per palm per year, fresh fruit bunch (FFB) yield ($\text{kg palm}^{-1} \text{ year}^{-1}$) and FFB yield ($\text{t ha}^{-1} \text{ year}^{-1}$). However, significant variation was observed for collar girth, sex ratio and average bunch weight. The hybrid NRCOP-45 recorded the highest collar girth (3.02 m), which was statistically on par with NRCOP-43, NRCOP-44 and NRCOP-46. The highest sex ratio was recorded in NRCOP-42 (0.72), followed by NRCOP-41 (0.71), indicating a higher proportion of female inflorescences. NRCOP-44 recorded the highest average bunch weight (19.50 kg) with fresh fruit bunch (FFB) yield of $215.24 \text{ kg palm}^{-1} \text{ year}^{-1}$.

Evaluation of oil palm hybrids

A multi-location experiment was initiated at Pedavegi, Pattukkotai, and Mulde using planting materials supplied by ICAR–Indian Institute of Oil Palm Research (IOPR), Pedavegi during 2021 to evaluate seven dwarf tenera oil palm hybrids (IOPR-53 to IOPR-59), including one check, for reduced height increment and enhanced productivity. The experiment was laid out in a Randomized Block Design (RBD) with four replications, comprising nine palms per plot planted at 8.5 m spacing in a hexagonal (equilateral triangle) system. The objective of the trial is to identify high-yielding dwarf tenera hybrids with reduced height increment and wide adaptability for cultivation in different oil palm-growing regions of the country. The trial has

completed four years of field evaluation, and the hybrids have exhibited satisfactory growth and establishment across the centres.

Palmyrah

Research on the survey, collection, conservation and evaluation of palmyrah germplasm under the ICAR–All India Coordinated Research Project (AICRP) on Plantation Crops commenced in 1995 at Killikulam (Tamil Nadu) and Pandirimamidi (Andhra Pradesh). To broaden the genetic resource base and strengthen germplasm evaluation across diverse agro-climatic regions, Konda Mallepally (Telangana) and Sabour (Bihar) were included in the programme during 2017. By 2015, a total of 265 palmyrah germplasm accessions had been collected and conserved at Killikulam, while 272 accessions were maintained at Pandirimamidi, representing a valuable repository for genetic improvement and conservation efforts.

Pandirimamidi

Evaluation of the palmyrah germplasm collected during 1991–2015 revealed that most of the accessions exhibited a long juvenile phase before attaining reproductive maturity. However, germplasm collected during 2011 and 2012 showed comparatively precocious flowering, with first flowering observed at 13 and 12 years, respectively. Among the 2012 accessions, the height at first flowering ranged from 2.88 to 5.20 m, whereas the 2011 accessions flowered at heights ranging from 3.19 to 4.50 m. Notably, accessions 2012/Acc.9/4 (female) and 2012/Acc.9/1 (male) initiated flowering at heights of 2.88 m and 2.90 m, respectively, making them the shortest palms at first flowering (Fig 12). These accessions represent promising genetic resources for developing precocious and dwarf palmyrah varieties through future breeding and selection programmes.



Fig. 12. First flowering height observed at 3.20 to 3.75 m at conserved germplasm planted during 2012 in Pandirimamidi

Killikulam

The neera yield potential of selected palmyrah germplasm accessions maintained at the AICRP on Palms Centre, Killikulam, was evaluated. Considerable variation was observed among the conserved accessions for both average daily neera yield and total neera yield per palm. Among the 1995 accessions, 1995/3 recorded the highest average daily neera yield ($0.553 \text{ L palm}^{-1} \text{ day}^{-1}$) and total neera yield (52.6 L palm^{-1}), followed by 1995/1 (0.484 L day^{-1} and 46.0 L palm^{-1}) and 1995/22 (0.402 L day^{-1} and 38.2 L palm^{-1}). Among the 1997 accessions, 1997/21 recorded the highest average daily neera yield ($0.400 \text{ L palm}^{-1} \text{ day}^{-1}$) and total neera yield (38.0 L palm^{-1}), closely followed by 1997/18 (0.383 L day^{-1} and 36.4 L palm^{-1}).

Konda Mallepally

Evaluation of 30 *in situ* conserved palmyrah germplasm accessions at Konda Mallepally revealed considerable variation for neera yield. Among the evaluated accessions, HRSTSK-20 recorded the highest average neera yield ($13.99 \text{ L palm}^{-1} \text{ day}^{-1}$), followed by HRSTSK-10 ($13.06 \text{ L palm}^{-1} \text{ day}^{-1}$) and HRSTSK-21 ($12.58 \text{ L palm}^{-1} \text{ day}^{-1}$).

Sabour

Dwarf palmyrah palms identified in Nalanda and Patna districts continued to exhibit compact stature,

with plant height ranging from 6.00 to 7.15 m, representing an annual increment of 0.22–0.23 m over the previous two years (2023–2024). The average fruit set in female palms increased compared to the previous year's observations, with 77–80 fruits per palm recorded during 2024. The average neera yield ranged from 9.5 to 15.5 $\text{L palm}^{-1} \text{ day}^{-1}$ in male palms and 9.0 to 14.0 $\text{L palm}^{-1} \text{ day}^{-1}$ in female palms. The neera tapping season extended for 2.0–2.5 months, with the emergence of male inflorescences commencing during the first fortnight of April.

Cocoa

The experiment is being conducted at Aliyarnagar, Kahikuchi, Ratnagiri, and Vijayarai, where cocoa is grown as an intercrop under coconut and oil palm. The trial comprises 14–21 cocoa clones/hybrids, depending on the centre, and aims to identify superior genotypes with high dry bean yield, desirable yield attributes, and better adaptability under palm-based cropping systems. The centre-wise details of the experimental materials, main crop, and age of the plantations are presented in Table 8.

Table 8. Experimental materials, main crop, and age of the plantations

Centre	Clones	Main Crop	Age of Main Crop	Year of planting	Dry bean yield (Kg/ tree)	Best performing Clone
Aliyarnagar	14 Cocoa Clones (VTLC-1,3,5, 6,8,9,10,11,12,13, 14,15,16 & VTLC-9)	Coconut Var. WCT	20 Years	2013	2.70	VTLC-16
Kahikuchi	16 Cocoa Clones (VTLC-13,15, 17,18,20,23,25,28, 36, 38, 39, 40, 128, 4A, EYT, & VTLC-1)	Coconut Var. AGT	53 Years	2015	1.91	VTLC – 20
Ratnagiri	21 Cocoa Clones (VTLC-1,13, 15,17,18,25,37,128, VTLC-1,3,5,6,8,9,10,11,12,13, 14,15,16)	Coconut Var. D x T	34 Years	2012	2.22	VTLC – 17
Vijayarai	14 Cocoa Clones (VTLC-1,9,13, 17, 18, 20, 25, 36, 37, 57, 65, 128 & VTLC-3,4)	Oil Palm	33 Years	2012	2.22	VTLC – 36



Fig. 13. VTLC-16 at Aliyarnagar

Arecanut

Evaluation of released Arecanut varieties in different agro-climatic regions

Seven released arecanut varieties, namely Mangala, Sumangala, Sreemangala, Mohitnagar, Swarnamangala, Madhuramangala, and Shriwardhani, planted during 2015 were evaluated

for chali yield at Wakawali and Shivamogga. At Wakawali, Mohitnagar recorded the highest chali yield (2.38 kg palm⁻¹), followed by Shriwardhani (2.11 kg palm⁻¹) and Sumangala (1.93 kg palm⁻¹). At Shivamogga, Mangala recorded the highest chali yield (2.89 kg palm⁻¹), followed by Mohitnagar (2.68 kg palm⁻¹) and Sumangala (2.42 kg palm⁻¹).

Varieties Notified

A significant achievement of the ICAR–AICRP on Plantation Crops during 2024 was the notification of six superior varieties/hybrids of coconut and cocoa by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties (CVRC), Ministry of Agriculture and Farmers Welfare,

Government of India, vide Notification S.O. 4917(E) dated 13 November 2024. These varieties were notified for cultivation across different states, reflecting their adaptability and potential for enhancing productivity in diverse agro-climatic regions.

Sl. No.	Variety/Hybrid	Pedigree	Recommended area
Crop : Coconut			
1	Kalpa Shatabdi	Selection Sanramon Tall populations	Kerala, Karnataka and Tamil Nadu
2	Dweep Haritha*	Selection from Andaman Green dwarf	Andaman & Nicobar Islands and Kerala
3	Dweep Sona*	Selection from Andaman Yellow dwarf	Andaman & Nicobar Islands and Kerala
4	Kalpa Suvarna*	Selection from Gangadonbam Green dwarf	Karnataka and Kerala
Crop : Cocoa			
5	Vittal Cocoa Hybrid-1	-	Kerala, Karnataka and Tamil Nadu
6	Vittal Cocoa Hybrid-2	-	Kerala, Karnataka, Tamil Nadu, Andhra Pradesh and Gujarat

*Three coconut varieties, viz., Dweep Haritha, Dweep Sona and Kalpa Suvarna, were facilitated

for release through ICAR–AICRP on Plantation Crops during the Annual Group Meetings (AGM).



VTL CH 1



Kalpa Shatabdi

V. CROP PRODUCTION

Under the Crop Production programme of the ICAR–All India Coordinated Research Project (AICRP) on Palms, a total of 11 experiments were conducted across the 14 centres to develop and validate improved production technologies for coconut and oil palm. The ongoing trials focused on efficient nutrient and water management through micro-irrigation, coconut-based cropping and multispecies production systems, high-density planting of cinnamon as an intercrop, organic farming, management of root (wilt) disease, validation of nutrient formulations, optimization of coconut harvesting frequency, and nutrient and plant geometry studies in oil palm. These coordinated experiments aim to enhance productivity, resource-use efficiency and sustainability of plantation crop-based production systems under diverse agro-climatic conditions.

Coconut

Studies on fertilizer application through micro-irrigation technique in coconut

Sabour

Experiment was laid out with six fertigation levels viz., T_1 : No fertilizer; T_2 : 25% Recommended dose of fertilizer (RDF) (NPK) through drip system; T_3 : 50% RDF (NPK) through drip system; T_4 : 75% RDF NPK through drip system; T_5 : 100% RDF (NPK) through drip system; T_6 : 100% RDF (NPK) through soil application replicated four times in coconut variety Shakhigopal. The recommended dose of fertilizer was 500:320:1200 g N:P:K per palm per year. The fertilizers were split into 8 parts for application through fertigation. The application of 75% of the recommended dose of fertilizers (RDF) through fertigation (T_4) recorded the highest number of inflorescences (9.5 palm⁻¹), which was statistically on par with 100% RDF through fertigation (T_5). The lowest number of inflorescences

(7.2 palm⁻¹) was observed in the control (T_1 , without fertigation). Similarly, T_5 recorded the highest nut yield (63 nuts palm⁻¹), which was statistically comparable with T_4 (54 nuts palm⁻¹) and T_6 (100% RDF through soil application) with 52 nuts palm⁻¹.

Coconut based cropping systems for different agro-climatic regions

Coconut based multispecies cropping systems under coastal littoral sandy soil

The experiment on coconut-based multispecies cropping systems under coastal littoral sandy soils was continued at Bhubaneswar and Ratnagiri to evaluate the effect of cropping systems and nutrient management practices on coconut productivity and system profitability.

Bhubaneswar

The experiment on coconut-based cropping systems for different agro-climatic regions was continued at Bhubaneswar under littoral sandy soil to evaluate the performance of three cropping systems and nutrient management practices (Fig. 14). Among the cropping systems, Coconut + Sapota + Pineapple (CS_2) recorded the highest number of inflorescences (11.34 palm⁻¹ year⁻¹), female flowers (220.50 palm⁻¹ year⁻¹) and nut yield (73.87 nuts palm⁻¹ year⁻¹). Among nutrient management practices, green manuring + biofertilizers + organic recycling + soil test-based nutrient application (N_2) significantly improved coconut productivity, recording the highest number of inflorescences (11.94 palm⁻¹ year⁻¹), female flowers (251.20 palm⁻¹ year⁻¹) and nut yield (82.07 nuts palm⁻¹ year⁻¹). The interaction treatment $CS_1 N_2$ was superior, producing the highest number of inflorescences (12.47 palm⁻¹ year⁻¹), female flowers (256.22 palm⁻¹ year⁻¹), nut yield (89.94 nuts palm⁻¹ year⁻¹), sapota yield (12.78 q ha⁻¹) and pineapple yield (92.50 q ha⁻¹), while cowpea yield was highest

(4,632 kg ha⁻¹) under CS₁N₂. Economic analysis also revealed that CS₁N₂ recorded the maximum net return (Rs. 4,63,857 ha⁻¹) with a benefit: cost ratio of 2.38, demonstrating that integration of sapota

and pineapple with coconut, coupled with soil test-based nutrient management, substantially enhanced productivity and profitability under littoral sandy soils.



Fig. 14. Field view of coastal littoral sandy soils at Bhubaneswar

Ratnagiri

The experiment on coconut-based multispecies cropping systems under coastal littoral sandy soils was continued at Ratnagiri to evaluate different cropping systems and nutrient management practices. The cropping systems and nutrient management practices did not significantly influence coconut growth parameters or nut yield. However, Coconut + *Garcinia indica* + Pineapple (CS₂) recorded the highest number of female flowers (175.22 palm⁻¹) and the highest coconut yield (101.17 nuts palm⁻¹), while soil test-based nutrient management (N₂) recorded the highest female flower production (178.17 palm⁻¹) and coconut yield (99.89 nuts palm⁻¹). Among the treatment combinations, CS₂N₂ produced the highest coconut yield (106.00 nuts palm⁻¹), whereas CS₂N₃ recorded the highest pineapple yield (191.67 kg plot⁻¹) and CS₁N₃ produced the highest snake gourd yield (85.17 kg plot⁻¹). Economic analysis revealed that CS₂N₃ (Coconut + *Garcinia indica* + Pineapple

with green manuring, biofertilizers, organic recycling and 100% RDF) recorded the highest gross income (Rs.770,634 ha⁻¹), net income (Rs. 563,894 ha⁻¹) and benefit:cost ratio (3.73), followed by CS₂N₂ with a B:C ratio of 3.50, indicating that integration of *Garcinia indica* and pineapple with coconut significantly improved system profitability under coastal littoral sandy soils.

Employment generation varied among the cropping systems and nutrient management practices. The highest total employment generation (173.5 man-days ha⁻¹ year⁻¹) was recorded under CS₁N₁ (Coconut + *Garcinia*/Sapota + Vegetable with green manuring, biofertilizers, organic recycling and FYM), comprising 41.5 skilled and 132.0 unskilled man-days ha⁻¹ year⁻¹. Among the pineapple-based systems, CS₂N₁ generated the highest employment (171.5 man-days ha⁻¹ year⁻¹), followed by CS₁N₂ and CS₁N₃ (160.5 man-days ha⁻¹ year⁻¹ each). Coconut monocropping recorded comparatively lower employment generation, with

the minimum total employment (146.0 man-days ha⁻¹ year⁻¹) observed under CS₃N₂ and CS₃N₃.

Studies on high density planting of cinnamon as intercrop in coconut garden

A multi-location experiment was initiated in 2024 at Aliyarnagar (Tamil Nadu), Ambajipeta (Andhra Pradesh), Jagdalpur (Chhattisgarh), Ratnagiri (Maharashtra), and Veppankulam (Tamil Nadu) to evaluate the performance of high-density planting of cinnamon under coconut-based cropping systems. Air layers of the cinnamon variety ‘Konkan Tej’ were procured from the Ratnagiri centre and supplied to all participating centres. Planting has been successfully completed at all locations, and pre-experimental observations, including soil pH and other baseline site characteristics, have been recorded to facilitate future evaluation of growth, productivity, and economic performance under different agro-climatic conditions.

Organic farming in coconut-based farming system

Experiment was laid out in Randomized Block Design comprising of five treatments (Sole organic

manure treatments -2, Sole chemical fertilization – 1, Integrated options -2), each treatment replicated five times with six palms per treatment. A trench of 15 m length and 1.3 m (4 feet) width was excavated amidst six coconut palms for the treatments T₁ – T₄. PGPR consortia, organic manure, husk burial and 50% recommended K₂O (600 g K₂O) as sulphate of potash were applied as per the treatments. Sunhemp seeds were sown @ 40 kg /ha in the interspaces of the coconut palms in the treatments T₁ to T₄ and was incorporated *insitu* at 45 days after sowing. The pooled analysis of four centres revealed significant differences among the treatments for nut yield. Treatment T₄ recorded the highest nut yield (121 nuts palm⁻¹), which was significantly superior to all other treatments. This was followed by T₃ with 114 nuts palm⁻¹, while T₂, T₁ and T₅ recorded 110, 109 and 109 nuts palm⁻¹, respectively. The results indicated the superiority of T₄ in enhancing coconut productivity across locations (Fig. 15).

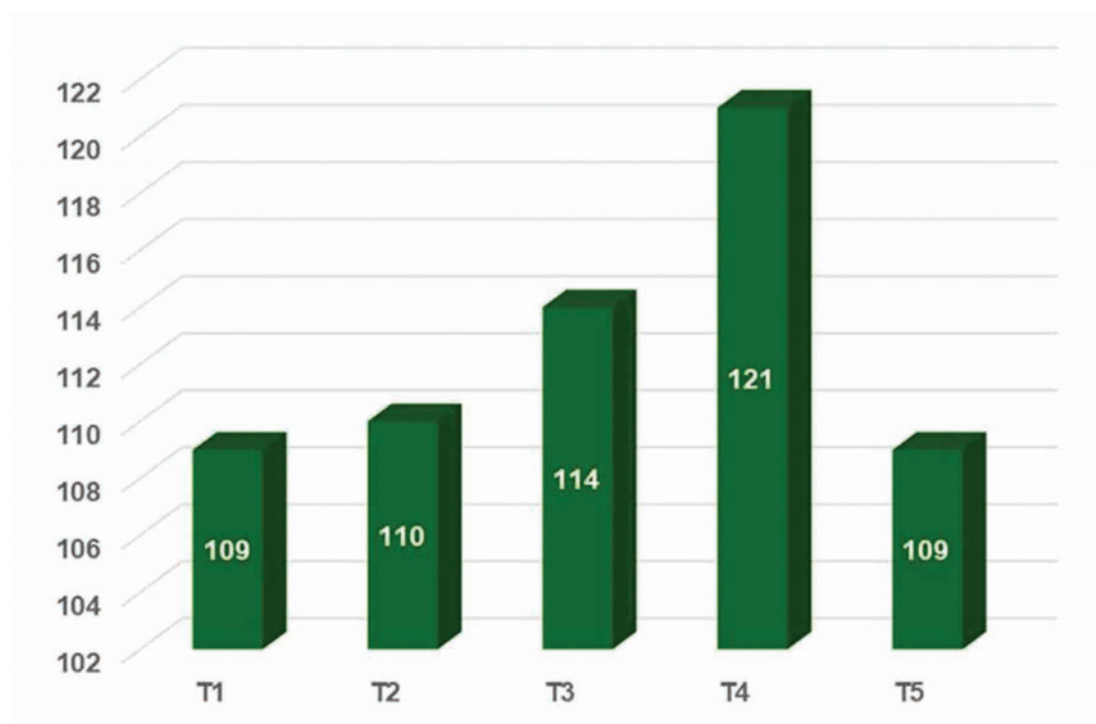


Fig. 15. Pooled analysis of yield performance across locations.

New experiments

A New experiment on the validation of *Kalpa Vardhini* and *Kalpa Poshak* for sustained growth, productivity and quality of coconut was initiated during 2024–25 at Ratnagiri, Mondouri, Kahikuchi, Jagdalpur and Pilicode. Experimental plots were established and pre-experimental observations on palm growth, yield and soil parameters were recorded at all the centres to generate baseline data. The treatments were imposed at Ratnagiri, Mondouri and Kahikuchi, while *Kalpa Poshak* was applied at Jagdalpur and Pilicode as per the experimental protocol (newly planted). The experiment is in the initial stage, and subsequent observations will be recorded to evaluate the effect of the nutrient formulations on palm growth, productivity and nut quality.

The experiment on the evaluation of TNAU Coconut Tonic for its efficacy on the productivity and quality of coconut was initiated during 2024–25 at Ambajipeta, Kasaragod, Arsikere and Bhubaneswar. Experimental plots were established and pre-experimental observations on palm growth,

yield and quality parameters were recorded at all the four centres to generate baseline data. The prescribed treatments were imposed as per the technical programme, and the experiment is in the initial stage. Subsequent observations will be recorded to evaluate the effect of TNAU Coconut Tonic on palm growth, productivity, nut quality and economics under different agro-climatic conditions.

Studies on coconut harvesting frequency on growth and yield of coconut

To elicit the impact of tender nut harvesting frequency on growth and yield of coconut, on quality of tender nut and to work out the economics of the system an experiment was initiated during 2022. Experiment was laid out in a Randomized Block Design with four treatments viz., T_1 : Harvesting of tender nuts throughout the year, T_2 : Harvesting of alternate bunches for tender nuts, T_3 : Harvesting of tender nuts from January to June and T_4 : Harvesting of matured nuts throughout the year, replicated five times each accommodating 6 palms per replication at five centres. The harvesting strategy influenced the annual nut yield across the centres (Fig.16).

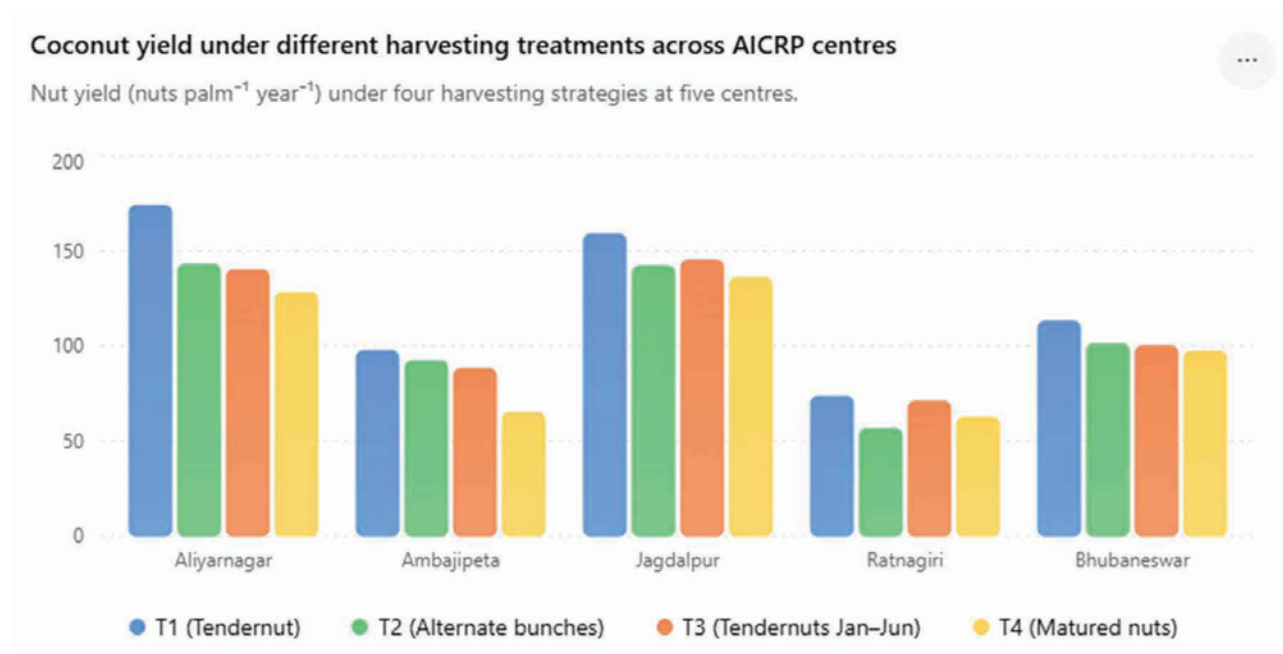


Fig. 16. Effect of tender nut harvesting frequency on nut yield across centres

Harvesting tender nuts throughout the year (T_2) recorded the highest yield at all the centres, with 174 nuts palm⁻¹ year⁻¹ at Aliyarnagar, 159 at Jagdalpur, 113 at Bhubaneswar, 97.5 at Ambajipeta and 73.5 at Ratnagiri. The alternate harvesting of tender and mature nuts (T_2) and harvesting tender nuts from January to June (T_3) also maintained comparable yields, whereas harvesting only mature nuts (T_4) generally recorded relatively lower yields across the centres.

Management of Root (wilt) disease in coconut (Farmer's garden)

The demonstration on the management of root (wilt) disease through soil test-based nutrient management was continued at Manakkadavu village, Coimbatore district. The disease index was assessed based on flaccidity, yellowing and necrosis symptoms. The average root (wilt) disease index declined from 15.86 during the pre-treatment period (2015–16) to 7.14 during 2024–25, indicating a substantial reduction in disease severity following the adoption of the recommended management practices. The disease index ranged from 0 to 40 before treatment to 4–44 after treatment. However, the nut yield decreased from 80 to 72 nuts palm⁻¹ year⁻¹, suggesting that although the management practices effectively reduced disease intensity, a corresponding improvement in yield was not observed during the reporting period. Long-term monitoring is required to assess the sustainability of disease suppression and its impact on productivity.

Oil palm

Nutrient requirement studies in oil palm under Northeast region

At Pasighat, application of 1500:750:1500 g N:P₂O₅:K₂O palm⁻¹ year⁻¹ recorded the highest fresh fruit bunch yield (137.44 kg palm⁻¹ or 19.64 t ha⁻¹), which was statistically on par with 1200:600:1200 g N:P₂O₅:K₂O palm⁻¹ year⁻¹ (30.62 kg palm⁻¹ or 4.37 t ha⁻¹). As the experiment is in the initial stage of establishment, the results should be

considered preliminary. The progress of the trial was also affected during the COVID-19 pandemic, when nutrient application could not be carried out as scheduled due to lockdown-related restrictions and non-availability of fertilizers.

Plant Geometry and Optimization of nutrients in Oil palm:

Nutrient optimization in oil palm studies began in 2019 at Bavikere center using a Factorial RBD design. The grading of NPK levels as 0, 1 and 2; N₁-1200g, N₂-2400g, P₁-600g, P₂-1200g, K₁-1800g and K₂-3600 g. The study is still in its early stages, but two years of data showed no significant changes in palm height and girth across the treatments.

Plant geometry studies in oil palm:

Plant geometry in Oil palm studies initiated during 2019 at Bavikere centre with four spacing viz., M₁: 9m x 9m x 9m (Triangular planting); M₂: 9m x 9m (Square planting); M₃: 10m x 10m x 10m (Triangular planting) and M₄: 10m x 10m (Square planting) in RBD design with five replications. The experiment is in initial stage and there are no significant differences among the treatments.

VI. CROP PROTECTION

The Crop Protection programme under the ICAR–All India Coordinated Research Project (AICRP) on Palms focuses on the surveillance, monitoring and management of economically important pests and diseases of coconut and arecanut through coordinated research across diverse agro-climatic regions. During the year, 14 experiments were conducted to generate location-specific information on disease and pest incidence, epidemiology, yield losses, and the efficacy of integrated management practices. The programme included roving and fixed-plot disease surveys, epidemiological studies, disease management strategies for stem bleeding and basal stem rot of coconut, assessment of root (wilt) disease incidence, surveillance of arecanut diseases, pest surveillance, conservation and augmentation of natural enemies, habitat diversification for pest suppression, and evaluation of a bio-control formulation of *Simplicillium lanosoniveum* (CPCRI SL 951) against exotic whiteflies.

Disease Management

Survey and surveillance of coconut diseases

Roving survey of coconut diseases

Roving surveys were conducted during 2024 in the major coconut-growing regions of Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra to assess the incidence of bud rot, stem bleeding, basal stem rot (BSR), stem bleeding, leaf blight, and leaf spot.

Tamil Nadu

Roving surveys were conducted in the major coconut-growing districts of Tamil Nadu to assess

the incidence of bud rot, basal stem rot, stem bleeding, leaf blight and leaf spot. Bud rot incidence was highest in Kanyakumari (district mean 1.44 ± 0.71 DI), followed by Coimbatore (0.53 ± 0.10 DI). Basal stem rot was predominant in Tiruppur with a district mean incidence of 2.20 ± 0.10 DI, followed by Kanyakumari (1.03 ± 0.21 DI). The highest disease severity (BSR index 8.15) was recorded in Gudimangalam block. Stem bleeding was also highest in Tiruppur (district mean severity 1.65 DI), followed by Kanyakumari, with maximum incidence recorded in Gudimangalam and Thovalai blocks. Among the foliar diseases, leaf spot severity was highest in Theni (1.86 ± 1.25 PDI), followed by Dindigul (1.67 ± 0.25 PDI) and Coimbatore (1.50 ± 0.34 PDI). Leaf blight severity was highest in Coimbatore (district mean 13.42 PDI), with the maximum severity (15.57 PDI) recorded in Kinathukadavu block. At Aliyarnagar, leaf blight remained the predominant disease during 2020–2024. Disease severity increased from 7.8 PDI in 2020 to a peak of approximately 8.7 PDI during 2022–2023, followed by a marginal decline to about 8.5 PDI in 2024 (Fig.17).

In the east coast districts (Thanjavur, Nagapattinam, Thiruvarur and Pudukkottai), basal stem rot was the only disease recorded with a regional mean incidence of 0.43%, while bud rot, stem bleeding, leaf blight, leaf spot and lethal wilt were not observed.

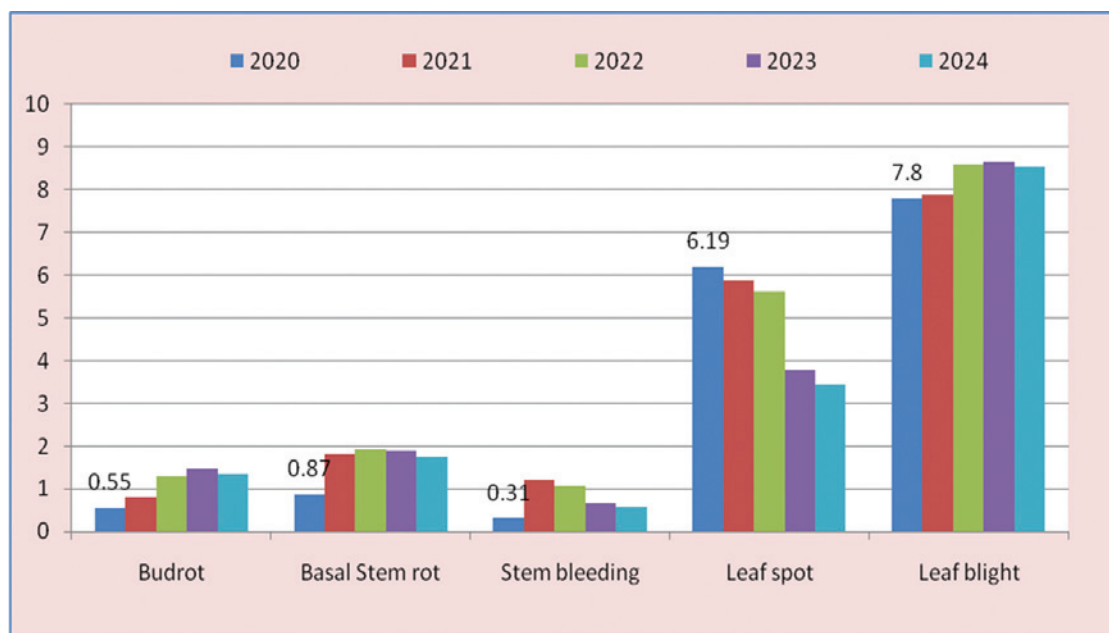


Fig. 17. Status of coconut diseases in Aliyarnagar from 2020-2024

Andhra Pradesh

Surveys conducted in East Godavari, Eluru, Dr. B.R. Ambedkar Konaseema and West Godavari districts revealed basal stem rot as the predominant disease with a mean incidence of 1.82%, followed by leaf blight (1.23 DI) and stem bleeding (0.51%). Dr. B.R. Ambedkar Konaseema recorded the highest incidence of basal stem rot (3.10%) and stem bleeding (1.17%), while Eluru recorded the highest leaf blight severity (4.94 DI). Leaf spot incidence was negligible during the survey period.

Karnataka

Roving surveys in the major coconut-growing districts of Chikkamagaluru, Hassan, Mandya and Tumakuru showed that basal stem rot incidence ranged from 0.14 to 4.17%, with the highest incidence in Tumakuru. Stem bleeding incidence ranged from 0.12 to 8.61%, with the maximum incidence recorded in Arsikere taluk of Hassan district. The highest bud rot incidence (2.92%) was recorded in Chikkamagaluru, while the maximum leaf blight (9.86 PDI) and leaf spot (14.72 PDI) severity were recorded in Tumakuru and Chikkamagaluru, respectively.

Fixed plot survey of coconut diseases

Fixed plot surveys were conducted at Aliyarnagar, Ambajipeta, Arsikere, and Veppankulam during 2024 to monitor the temporal and spatial dynamics of major coconut diseases and their relationship with prevailing weather parameters.

Tamil Nadu (Aliyarnagar and Veppankulam)

Fixed plot surveys were continued to monitor the temporal dynamics of major coconut diseases and their relationship with weather parameters. At Aliyarnagar, observations recorded in Puliyankandi and Aliyarnagar villages showed that leaf blight incidence was consistently higher in Puliyankandi, with a mean PDI of 21.50 ± 4.83 compared to 19.64 ± 4.63 at Aliyarnagar. Disease severity was highest during April–July 2024 (22.70–24.50 PDI). Pestalotiopsis leaf spot also recorded a higher mean PDI in Puliyankandi (9.73 ± 1.85) than in Aliyarnagar (9.17 ± 1.63), with peak incidence during July–October. Correlation analysis indicated a positive association between temperature and leaf blight and a negative association with relative humidity, whereas leaf spot showed a negative correlation with temperature and a positive correlation with relative humidity.

At Veppankulam, fixed plot observations at Andami village, Thanjavur district, indicated progressive development of basal stem rot during the study period. Horizontal spread of the disease increased from 36.0% in January 2024 to 38.67% in October 2024, while vertical spread increased from 24.50 to 27.20 cm. Temperature, rainfall and soil temperature showed positive correlations with disease spread, whereas morning relative humidity exhibited a negative correlation. The experiment is in progress.

Andhra Pradesh (Ambajipeta)

Fixed plot surveys conducted at Kesanapalli (basal stem rot) and Vanapalli (stem bleeding and bud rot) monitored disease progression and its relationship with weather and soil parameters. Basal stem rot incidence increased from 27.69% (January 2022) to 32.61% (Dec 2024), while the disease index increased from 19.68 to 25.69. Stem bleeding incidence increased from 11.65% to 13.01%, with the disease index ranging from 2.2 to 3.1 during the same period. Bud rot was not observed in the fixed plots. Correlation analysis indicated a significant positive association of basal stem rots incidence and disease index with relative humidity, while stem bleeding incidence also showed a positive correlation with relative humidity.

Karnataka (Arsikere)

Arsikere to monitor the temporal progression of basal stem rot, stem bleeding and leaf blight under natural field conditions. During the observation period (January 2024 to December 2024), the horizontal spread of basal stem rot increased from 17.50 to 20.00%, while the disease index increased from 24.17 to 26.29. Similarly, stem bleeding incidence increased from 20.00 to 22.50%, with the disease index increasing from 24.92 to 26.23. Leaf blight incidence also increased from 22.50 to 25.00%, and the disease severity (PDI) increased from 11.60 to 12.96. Correlation analysis indicated

that basal stem rot was positively associated with evening relative humidity and rainfall, whereas stem bleeding showed a positive association with temperature and a negative association with rainfall.

Alternate strategies for management of Basal stem rot disease

The trial evaluated four integrated disease management (IDM) modules comprising combinations of systemic fungicide application through root feeding and soil drenching, biological control agents (*Trichoderma* spp. and *Pseudomonas* spp.), neem cake enrichment, farmyard manure (FYM), and recommended nutrient and irrigation management practices. All modules were implemented under a common package of recommended agronomic practices, while the conventional fungicide treatment served as the check. At 24 months after treatment (MAT), all IDM modules significantly reduced disease incidence compared with the initial disease index at Ambajipeta. Among the treatments, Module III recorded the highest reduction over the initial disease index (20.21%), followed by Module I (15.28%) and Module II (13.62%), whereas the untreated control showed an increase in disease severity (34.85% reduction over initial). At Arsikere Module III was the most effective, reducing the disease index from 26.92 to 5.16 (84.25% reduction), followed by Module II (28.22 to 8.47; 80.88% reduction). In contrast, disease severity increased in the untreated control from 26.84 to 35.34. The integrated disease management modules were evaluated against basal stem rot under field conditions in Thanjavur district. Module III recorded the highest reduction in disease index over the initial value (23.08%), followed by Module II (22.45%) and Module I (17.87%), while disease severity increased in the untreated control. Module III also recorded the highest mean annual nut yield (115.64 nuts palm⁻¹ year⁻¹)

Alternate strategies for management of stem bleeding disease

Four Integrated Disease Management (IDM) modules were evaluated for the management of stem bleeding disease in coconut. The modules comprised root feeding and soil drenching with systemic fungicides (Azoxystrobin + Tebuconazole or Hexaconazole), application of wound protectants (Trichoderma coir pith cake, Bordeaux paste, or *Trichoderma* paste), soil application of neem cake enriched with *Trichoderma harzianum* or *T. reesei* alone or in combination with *Pseudomonas fluorescens*, and application of farmyard manure (FYM) fortified with *Trichoderma* and/or *Pseudomonas* formulations. All treatments were implemented in conjunction with the recommended package of nutrient, irrigation, and crop management practices.

At Ambajipeta, the experiment initiated during February 2023, demonstrated significant disease suppression following the imposition of IDM modules. Module I recorded the highest reduction over the initial disease index (50.74%), followed by Module III (45.95%) and Module II (31.40%),

whereas disease severity increased in the untreated control. All the IDM modules effectively reduced stem bleeding disease at Arsikere, Module II was the most effective, reducing the disease index from 27.11 to 4.99 (81.57% reduction), followed by Module III, which reduced the disease index from 27.36 to 7.31 (73.30% reduction), and Module I, which reduced the disease index from 26.93 to 7.60 (71.79% reduction). In contrast, disease severity increased in the untreated control from 27.33 to 40.42. The experiment is in progress.

Leaf blight disease of coconut

Yield loss estimation

A field study was conducted at Puliyanankandi village, Anaimalai Block, Coimbatore district, by selecting 25 healthy and 25 leaf blight-infected coconut palms to assess the impact of leaf blight on nut yield during January–December 2024 (Fig. 18). The per cent reduction in nut yield due to leaf blight infection coconut varied between 8.99 to 31.32 with an average of 23.48 per cent. In addition to leaf blight, rugose spiralling whitefly infestation ($\gg 10\%$) was also observed in the study area.

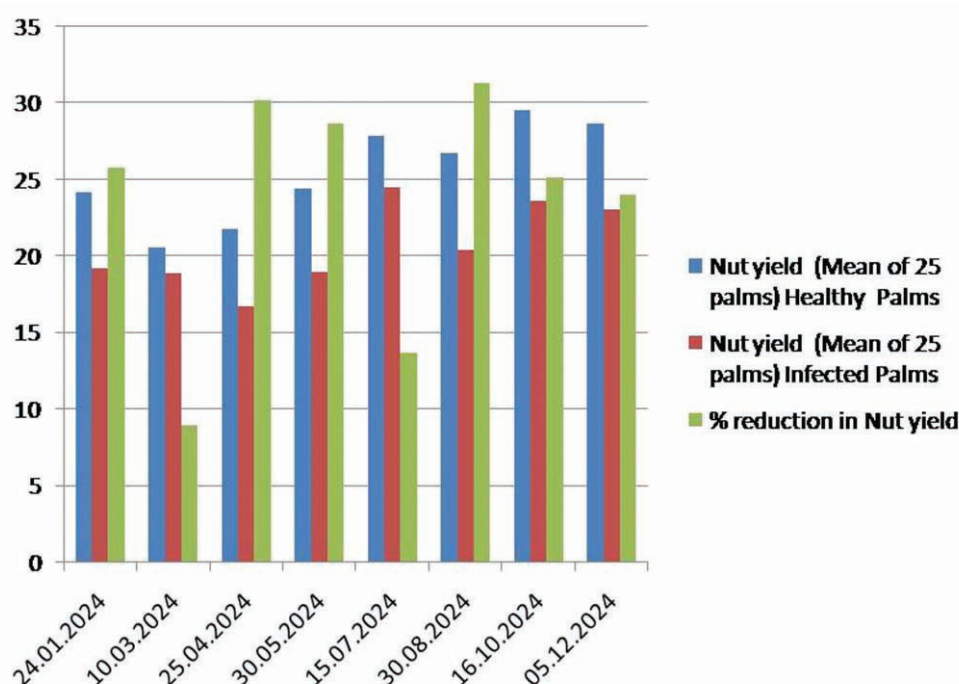


Fig. 18. Assessment of yield losses due to leaf blight disease

Epidemiology of leaf blight disease in coconut

Weekly observations on leaf blight disease were recorded during January–December 2024 to study its seasonal incidence in relation to prevailing weather parameters. Leaf blight incidence was observed throughout the year, with maximum disease severity during the warmer months (February–April 2024) and comparatively lower incidence during October–December. Disease incidence also declined during May owing to heavy rainfall. Correlation analysis revealed that leaf blight incidence was positively associated with maximum temperature ($r = 0.96$), minimum temperature ($r = 0.74$) and rainfall ($r = 0.65$), whereas it was negatively associated with morning relative humidity ($r = -0.66$). A weak negative association was observed with evening relative humidity ($r = -0.03$). These results indicate that higher temperatures favoured the development of leaf blight, while increased relative humidity was associated with reduced disease incidence. Correlation analysis revealed a positive association between leaf blight incidence and both maximum and minimum temperatures, whereas relative humidity

was negatively correlated with disease incidence, indicating that higher temperatures favoured disease development while higher relative humidity suppressed disease severity.

Root (wilt) disease in coconut

Assessing the incidence of root (wilt) disease in Tamil Nadu

A roving survey was conducted during January–December 2024 to assess the incidence of root (wilt) disease in major coconut-growing districts of Coimbatore, Tiruppur, Dindigul, Theni, Tenkasi, Tirunelveli, and Kanyakumari. The disease incidence varied considerably across locations. Among the districts surveyed, Coimbatore recorded the highest mean incidence (9.74%), followed by Tenkasi (9.50%) and Theni (8.85%). At the block level, Kuruthencode recorded the highest mean incidence (20.68%), followed by Anaimalai (18.25%) and Cumbum (17.24%). Root (wilt) incidence was low in Tiruppur (district mean 3.71%) and was not observed in the surveyed villages of Dindigul and Tirunelveli districts (Fig. 19).

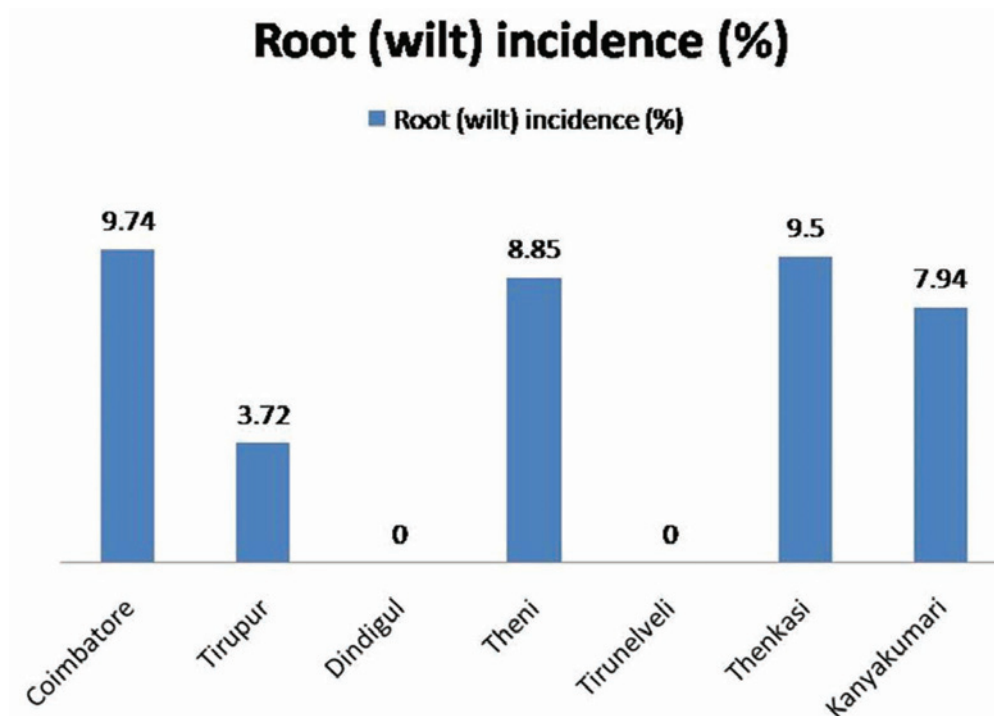


Fig. 19. Incidence of coconut root (wilt) disease in different districts of Tamil Nadu (Jan 204 - Dec 2024)

Pest Management

Pest surveillance in coconut

Roving surveys were conducted during 2024 in major coconut-growing regions of Tamil Nadu, Andhra Pradesh, Karnataka, and Maharashtra to monitor the incidence and intensity of major coconut pests. Rugose spiralling whitefly (RSW), Bondar's nesting whitefly (BNW), eriophyid mite, rhinoceros beetle (RB), red palm weevil (RPW), and black-headed caterpillar (BHC) were identified as the major pests across the surveyed regions.

Roving survey on major insect pests of coconut

Tamil Nadu: Roving surveys conducted in 13 districts revealed considerable variation in the incidence of major insect pests. Rhinoceros beetle incidence was highest in Thanjavur (11.0%), followed by Tirupathur (9.71%), Theni (8.90%) and Krishnagiri (8.73%). Rugose spiralling whitefly (RSW) incidence was highest in Thanjavur (32.37%), while nesting whitefly incidence was highest in Coimbatore (26.72%). Black-headed caterpillar (BHC) incidence was highest in Theni (46.33%), with 94.5 larvae per 100 leaflets. Red palm weevil incidence remained low (0.48–1.64%) across the surveyed districts, while moderate eriophyid mite infestation was observed in Kanniyakumari, Erode, Coimbatore and Krishnagiri. Localized outbreaks of slug caterpillar (35–40% incidence) were recorded in hybrid coconut plantations in Tiruppur district, and nut borer (*Cyclodes ommata*) incidence was observed in Thanjavur district.

Andhra Pradesh: Surveys conducted in Dr. B.R. Ambedkar Konaseema, East Godavari, West Godavari, Eluru and Anakapalli districts indicated that rhinoceros beetle, rugose spiralling whitefly, Bondar's nesting whitefly, eriophyid mite, black-headed caterpillar and red palm weevil were the major pests. Rhinoceros beetle incidence was

highest in Anakapalli (17.24%), while red palm weevil incidence remained low (0.39–1.43%). Rugose spiralling whitefly incidence ranged from 41.08 to 58.44%, with the highest incidence in West Godavari, whereas Bondar's nesting whitefly incidence ranged from 32.85 to 52.19%, with the highest incidence in East Godavari. Eriophyid mite infestation was moderate in all districts, with nut infestation ranging from 62.28 to 71.50%. Black-headed caterpillar incidence was recorded only in Dr. B.R. Ambedkar Konaseema (38.16%) and Eluru (44.23%), while slug caterpillar infestation (14.68%) was observed only in East Godavari.

Karnataka: Surveys across eight major coconut-growing districts showed that rhinoceros beetle incidence was highest in Mandya (18.4%), while red palm weevil incidence remained below 1%. Black-headed caterpillar was prevalent in all surveyed districts, with the highest incidence in Chitradurga (26.7%). Eriophyid mite incidence was highest in Tumakuru (23.3%). Rugose spiralling whitefly incidence was comparatively low during the survey period, ranging from 4.2 to 18.7%, with the highest incidence recorded in Hassan.

Maharashtra: Surveys conducted in Ratnagiri, Sindhudurg, Raigad, Palghar, Satara and Kolhapur districts revealed rhinoceros beetle incidence ranging from 5.6 to 16.8%, with the highest incidence in Sindhudurg (Fig. 20). Red palm weevil infestation remained below the economic threshold level in all districts. Black-headed caterpillar incidence was low and confined to Raigad, Palghar, Satara and Kolhapur. Eriophyid mite infestation ranged from 11.9 to 37.9%, with the highest nut damage in Kolhapur, while rugose spiralling whitefly incidence ranged from 5.1 to 14.2%, with the highest incidence in Sindhudurg. Minor pests such as arecanut blackfly, scale insects, mealybugs, termites and rats were also recorded at low levels.

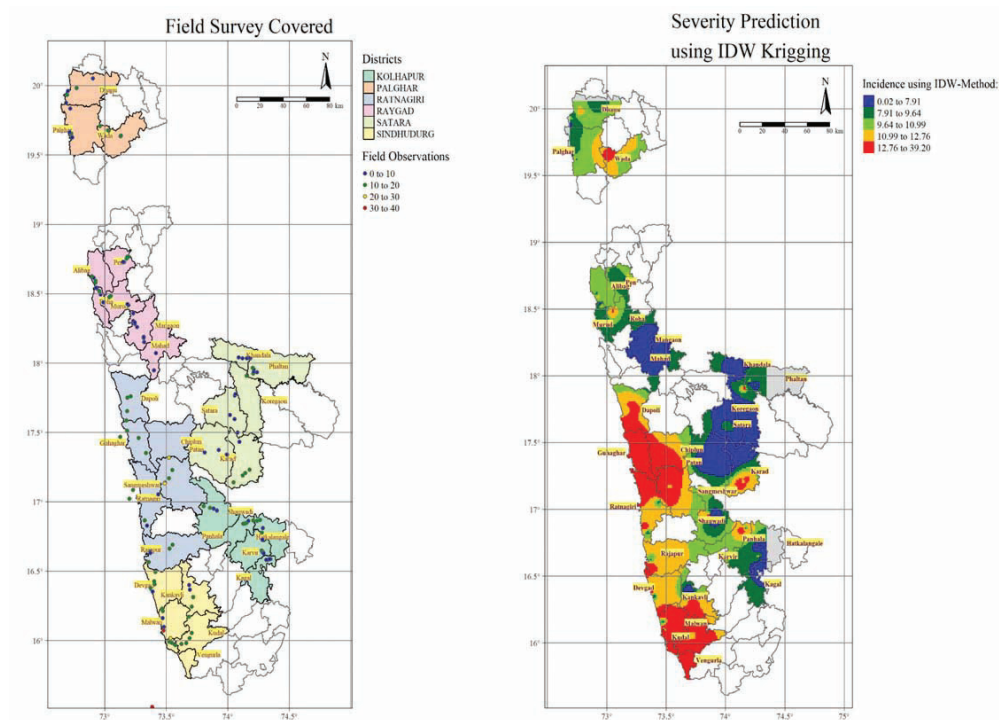


Fig. 20. Block level incidence of Rhinoceros beetle in Maharashtra

Production and supply of parasitoids and other natural enemies

Mass multiplication and field release of biocontrol agents for the management of coconut black-headed caterpillar (BHC) and the whitefly complex were continued at the AICRP centres located at Aliyarnagar, Ambajipeta, Arsikere and Ratnagiri. Major parasitoids and predators, including

Bracon brevicornis, *Bracon hebetor*, *Goniozus nephantidis*, *Pediobius imbreus*, *Encarsia guadeloupae* and *Apertochrysa astur*, were produced and supplied for augmentative biological control of key coconut pests. The production and supply of biocontrol agents during 2024 are presented in Table 9.

Table 9. Production and supply of Biocontrol agents across centres

Centre	Major natural enemies produced and supplied	Key outcome
Aliyarnagar	<i>Bracon brevicornis</i> (6,77,100); <i>Encarsia guadeloupae</i> (40,600)	Covered 322 acres (BHC) and 406 acres (RSW); field parasitization of BHC: 30–35%
Ambajipeta	<i>Bracon hebetor</i> (21,00,498), <i>Bracon brevicornis</i> (1,16,000), <i>Goniozus nephantidis</i> (9,97,092), <i>Apertochrysa astur</i> eggs (3,58,000) and grubs (3,09,400),	Covered 184 acres (BHC), 48 acres (slug caterpillar) and 335 acres (RSW)
Arsikere	<i>Bracon brevicornis</i> (22,800), <i>Goniozus nephantidis</i> (2,01,100), <i>Encarsia guadeloupae</i> (1,46,250 leaf clippings),	Released for the management of BHC and whiteflies in major coconut-growing districts
Ratnagiri	<i>Bracon brevicornis</i> (82,905), <i>Goniozus nephantidis</i> (77,100) and chrysopids (28,000)	BHC infestation reduced from 60% to 5% following parasitoid releases

Surveillance, assessment of natural enemies and management of whitefly complex in coconut

Monthly surveillance of rugose spiralling whitefly (RSW) and Bondar's nesting whitefly (BNW) was carried out at Aliyarnagar, Ambajipeta, Arsikere, and Ratnagiri during 2024 to monitor seasonal incidence, natural enemy activity, and alternate host plants. At Aliyarnagar, RSW incidence and intensity were highest during April 2024 (31.2 and 32.4%, respectively) and lowest during September 2024

(13.2 and 14.3%, respectively), with mean values of 21.68% and 23.15%, respectively. BNW also recorded the highest incidence and intensity during April 2024 (28.4 and 29.2%, respectively). *Encarsia guadeloupae* parasitization ranged from 38.22 to 50.42%, with the maximum recorded during December 2024 (50.42%). Among alternate hosts, the highest whitefly incidence was observed during April 2024 on banana (15.6%), custard apple (14.6%) and cocoa (6.3%).



Fig. 21. Survey of coconut whiteflies

RSW incidence and intensity reached a maximum during December 2024 (72.8 and 68.6%, respectively), whereas the highest *E. guadeloupae* parasitization (16.42%) was recorded during March 2024 in ambajipeta. Mean RSW incidence and intensity were 48.82% and 44.75%, respectively. BNW recorded the highest incidence (54.8%) and intensity (65.35%) during March 2024. Correlation analysis indicated that *E. guadeloupae* parasitization was positively associated with minimum temperature ($r = 0.829^{**}$) and negatively associated with maximum relative humidity ($r = -0.699^{*}$).

At Arsikere, RSW incidence and intensity were highest during December 2024 (18.8 and 10.2%,

respectively) and lowest during October 2024 (5.9 and 2.1%, respectively). Mean RSW incidence and intensity were 11.8% and 5.8%, respectively, with mean *E. guadeloupae* parasitization of 31.2%, which was highest during May 2024 (38.1%). BNW recorded the highest incidence (18.1%) during November 2024, while the highest intensity (9.4%) was observed during September 2024. Among alternate hosts, the highest whitefly incidence was recorded during April 2024 on banana (12.6%), guava (7.5%), mango (9.4%), jackfruit (8.3%) and papaya (4.5%).

At Ratnagiri, RSW incidence and intensity were highest during April 2024 (15.2 and 16.5%,

respectively) and lowest during August 2024 (1.65 and 0.66%, respectively). Mean RSW incidence and intensity were 8.03% and 6.75%, respectively, with mean *E. guadeloupae* parasitization of 20.6%, which was highest during April 2024 (45.0%). BNW also recorded the highest incidence (17.9%) and intensity (26.1%) during April 2024, while the lowest incidence (2.44%) and intensity (1.84%) were observed during August 2024. Among alternate hosts, the highest whitefly incidence during April 2024 was recorded on banana (8.0%), cocoa (8.67%), mango (6.67%) and cashew (5.33%), whereas ornamental areca palms recorded the highest incidence (25.8%) during December 2024.

Evaluation of oil-based formulation of *Simplicillium lanosoniveum* (CPCRI SL 951) for the bio-suppression of exotic whiteflies in coconut

A multi-location trial was conducted at Aliyarnagar, Ambajipeta, Arsikere, and Ratnagiri to evaluate the efficacy of an oil-based formulation of *Simplicillium lanosoniveum* (CPCRI SL 951) against rugose spiralling whitefly (RSW). The treatments included conservation/augmentative release of *Encarsia guadeloupae*, foliar application of *S. lanosoniveum*, neem oil (0.5%), and water spray as control. Pre-treatment observations indicated no significant differences in whitefly incidence, intensity and population among the treatments, confirming uniform pest infestation before treatment imposition. Across the centres, foliar application of *S. lanosoniveum* (CPCRI SL 951) effectively reduced rugose spiralling whitefly

incidence, intensity and the populations of eggs, nymphs and adults following two sprays. At Arsikere, *S. lanosoniveum* was the most effective treatment, reducing whitefly incidence from 25.1% to 2.3% and intensity from 20.8% to 3.5%, besides recording the lowest egg (3.3), nymph (3.1) and adult (2.5) populations per leaflet. At Ambajipeta, *S. lanosoniveum* significantly reduced the nymphal population to 9.97 nymphs leaflet⁻¹, which was comparable with neem oil (7.36 nymphs leaflet⁻¹) and substantially lower than the untreated control. At Ratnagiri, *S. lanosoniveum* reduced whitefly incidence and intensity to 25.2% and 24.9%, respectively, and was statistically at par with neem oil (23.3% incidence and 22.6% intensity), with both treatments performing significantly better than the water spray control.

Overall, the results demonstrated that *S. lanosoniveum* (CPCRI SL 951) consistently suppressed whitefly populations across diverse agro-climatic regions and performed on par with neem oil, the standard botanical treatment. The bio-formulation also reduced healthy nymph populations while promoting parasitization, indicating its compatibility with biological control. Economic analysis carried out at Aliyarnagar further demonstrated the feasibility of the technology, with a benefit:cost ratio of 1:5.3, indicating that *S. lanosoniveum* is an effective, eco-friendly and economically viable option for the integrated management of exotic whiteflies in coconut. The experiment is in progress.

VII. POST HARVEST TECHNOLOGY IN PALMYRAH

Spray drying of Neera

Process optimization studies were initiated to standardize the production of spray-dried inflorescence sap powder at Killikulam by optimizing key processing variables, including inlet temperature and the type and concentration of additives, to obtain a product with improved recovery, solubility, flowability, and reduced moisture content. Response Surface Methodology (RSM) was employed for experimental design and optimization using a Face-Centered Central Composite Design (FCCD). This approach enabled the prediction of response variables with a limited number of experimental runs by systematically varying the selected process

parameters within predetermined ranges. Statistical analysis and optimization were carried out using Design-Expert® Version 13, and response surface plots were generated to evaluate the interactive effects of the processing variables. The levels of the independent variables selected for the study are presented in Table 10. Based on the FCCD, a 13-run experimental design was generated to investigate the effects of inlet temperature and additives on powder recovery, solubility, flowability, and moisture content of the spray-dried inflorescence sap powder.

Table 10. Levels of different independent variables and Dependent variables selected for RSM

1.	Malto dextrin	Minimum :180 brix Maximum : 250 brix
2.	Inlet Temperature	Minimum : 1300 C Maximum :1600 C
Dependent Variables		
3.	Recovery (%)	Good recovery (98 to 99%)
4.	Solvability (%)	Max. Solvability up to 99 %
5.	Flowability	Good to Excellent
6.	Moisture (%)	1.75 to 3 %

Pandirimamidi

Freeze drying was performed at -50 o C to -55o C for 2h hours with matodextrin of 0, 5, 10 and 15 % of total weight and evaluated the physicochemical characterization of the raw sap and the powder obtained and to determine the powder solubility. From the results observed minimum 10 % of matodextrin required to get stable powder. The powder showed good solubility and satisfied the legislation requirements with respect to moisture. The water activity obtained (0.48) allowed inhibition

of bacterial growth and significant reduction of chemical and enzymatic reactions which will increase the shelf life.

Development of Value-added Products from Palmyrah Tuber Flour

A pretreatment protocol was standardized for the preparation of debittered palmyrah tuber flour at Killikulam. Fresh palmyrah tubers were boiled in 0.5% salt solution for 35 minutes, followed by cabinet drying and milling into flour. The debittered flour was subsequently utilized for the development

of value-added products, including cookies, noodles, pittu mix and soup cubes. Palmyrah tuber flour cookies were standardized using 20% palmyrah tuber flour, 30% foxtail millet flour and 50% whole wheat flour. Foxtail millet flour was incorporated to enhance the nutritional quality of the product owing to its higher dietary fibre, protein and mineral content. The cookies were baked at 185°C for 20 minutes and secured an overall acceptability score of more than 8.0 on a 9-point hedonic scale during sensory evaluation by a semi-trained panel.

Palmyrah noodles were developed using 50% palmyrah tuber flour and 50% whole wheat flour.

The developed noodles exhibited satisfactory cooking quality with a cooking time of 22 minutes, cooking loss of 7.5%, and a cooked weight of 25 g from 10 g of dry noodles. A ready-to-cook palmyrah pittu mix was standardized using 70% palmyrah tuber flour, 30% raw rice flour and 5% cardamom powder, while soup cubes were developed by incorporating 15% palmyrah tuber flour and 25% corn flour, with the optional addition of green leafy vegetables. Both products recorded an overall acceptability score exceeding 8.0 on a 9-point hedonic scale, indicating good consumer acceptance.



Fig. 22. Value-added Products from Palmyrah Tuber Flour

Popularisation of climbing device (Joseph model)

The Joseph model palmyrah climbing device was evaluated at Killikulam and Konda Mallepally. The average time required to climb a palmyrah palm was

11.54 minutes and 10.56 minutes. However, climbing was found to be more difficult than the traditional climbing method, indicating scope for further improvement in the design and ergonomics of the device (Table 11).

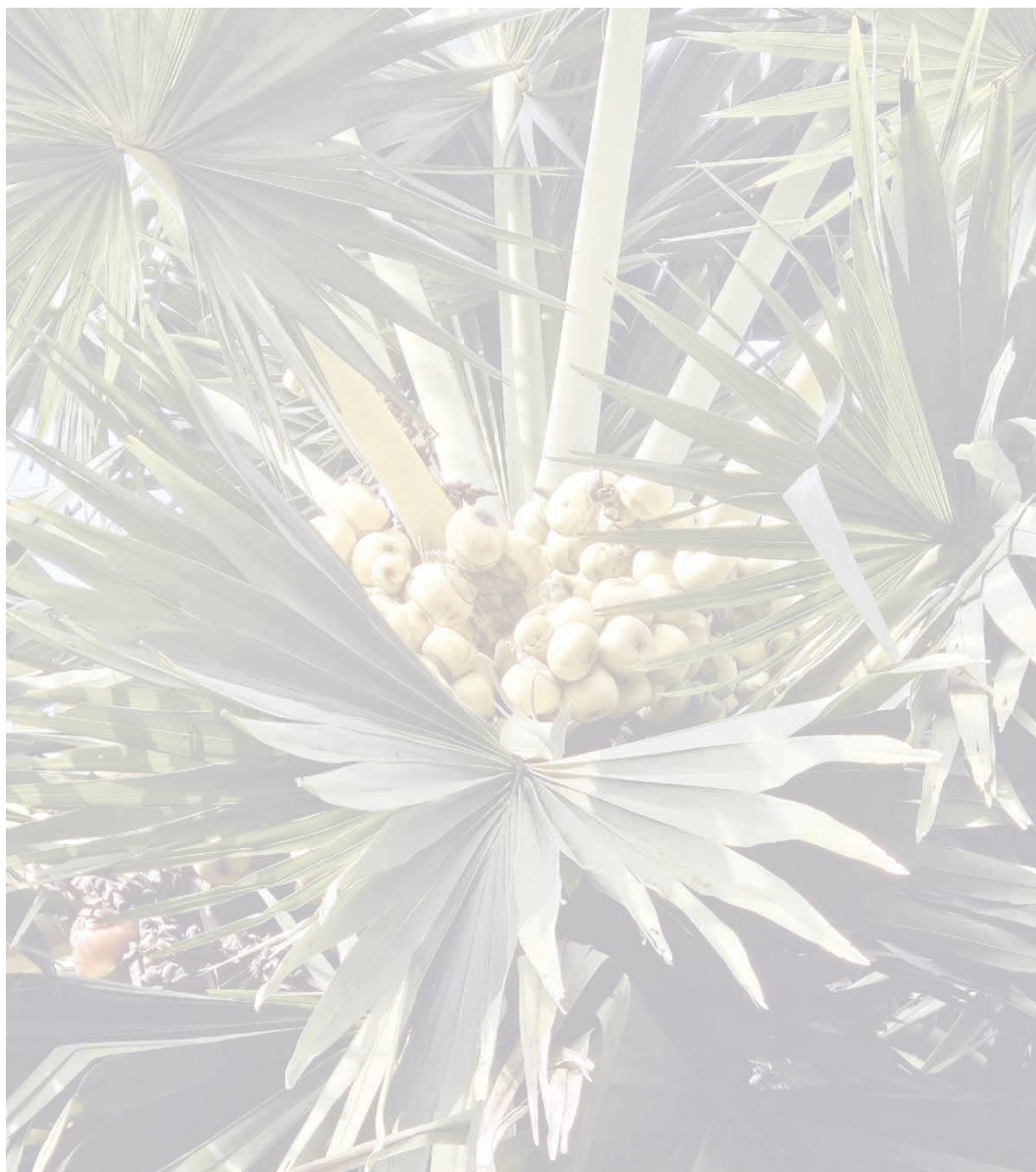
Table 11. Data on traditional method climbing and Joseph model climbing device (average values of 10 toddy tappers)

S. No.	Particulars	Killikulam		Konda Mallepally	
		Traditional method	Joseph Model device	Traditional method	Joseph Model device
1	Time taken to climb each tree	5.4 minutes	11.54 minutes	6.4 minutes	10.56 minutes
2	Ease of the climbing (Easy, Tough)	Easy	Tough	Easy	Tough
3	Safety features (Good, Average, Poor)	Average	Poor	Average	Poor

Studies on Pectin content and quality of pectin in Palmyrah fruit pulp and tender fruit endosperm (ice apple)

Palmyrah fruit pulp has the potential as a pectin source. Pectin has various applications such as gelling agent, adsorbent, thickener, emulsifier, and use in pharmaceuticals. This study extracted pectin from of local palmyrah fruit pulp through the conventional heating method. The extraction process was carried out with 0.03 N HCl solution (pH 1.5) with optimizations of temperature (70 - 90°C) and extraction time (60 - 180 min). The optimization was

designed by face-centered Central Composite Design (CCD) of Response Surface Methodology (RSM) with Design-Expert software. The results showed that the pectin yields derived from 5.8 - 18.4%. Characterization of extracted pectin includes methoxy content, anhydrouronic acid (AUA) content, degree of esterification (DE). At optimum extraction conditions, the AUA values of extracted pectin was 43.86%. Extracted pectin has DE of > 52%. Finally, the yields and characteristics of extracted pectin from palmyrah fruit pulp was comparable to extracted pectin from other sources.



VIII. MONITORING, REVIEWS AND MEETINGS

Approved technical programmes were regularly monitored by visit to the centers, reviewing the monthly progress report of the centres and online meetings. Time to time advice and direction was given for proper implementation of the technical programmes through online meetings, emails, personal contact and over direct contact via phone as and when required. Monthly progress report and budget utilization information were obtained from

centres regularly and the same were reviewed critically. During the review meetings, discussions were held with concerned scientists of centres for the smooth implementation of the research programmes. During review meeting by project coordinator, guidelines for proper utilization of budget, improving publications and the technical programmes were provided.

Dates	Place of visit
10.01.2024 to 12.01.2024	IIOPR, Regional Centre, Palode (Kerala)
21.1.2024 to 26.1.2024	AICRP on Palms Centre, Navsari (Gujarat), Ratnagiri and Mulde (Maharashtra)
4.02.2024 to 7.02.2024	AICRP on Palms Centre, Aliyarnagar (Tamil Nadu)
11.02.2024 to 14.02.2024	AICRP on Palm Centre, Sabour (Bihar)
11.03.2024 to 17.03.2024	AICRP on Palms Centre, Bhubaneswar (Odisha), Jagdalpur (Chhattisgarh) and Kalyani (WB)
27.05.2024 to 02.06.2024	JAU, Junagadh, and AICRP on Palms Centre, Navsari, Gujarat
12.06.2024 to 16.06.2024	ICAR-CPCRI Regional Station, Kayamkulam.
30.07.2024 to 03.08.2024	AICRP on Palms Centre, ICAR-CIARI, Port Blair
18.08.2024 to 24.08.2024	AICRP on Palms Centre, BAU, Sabour (Bihar)
15.09.2024 to 19.09.2024	AICRP on palms Centre, Aliyarnagar (Tamil Nadu)
03.10.2024 to 04.10.2024	AICRP on Palms Centre, Arsikere (Karnataka)
4.11.2024 to 5.11.2024	AICRP on Palms Centre, Killikulam (Tamil Nadu)
05.12.2024 to 06.12.2024	AICRP centre, Thrissur and NBPGR RS, Thrissur (Kerala)

XXXIII AGM of AICRP on Palms

The XXXIII Annual Group Meeting of All India Co-ordinated Research Project on Palms was organized at Bihar Agricultural University (BAU), Bhagalpur during 21st to 23rd August 2024. Dr. V.B. Patel, Assistant Director General (Fruits and Plantation Crops), ICAR, New Delhi presided over the inaugural session. Dr. D. R. Singh, Vice Chancellor, Bihar Agricultural University, Sabour was the Chief Guest of the event. Dr. P. Rethinam,

Former Director, Asian and Pacific Coconut Community, Jakarta, Dr. K.B. Hebbar, Director, ICAR, CPCRI, Kasaragod, Dr. K. Suresh, Director, IIOPR, Pedavegi and Dr. R.K. Mathur, Director, IIOR, Hyderabad were the Guests of honour.

The programme had a pleasant beginning with ICAR theme song highlighting the glory of farmers. As a mark of tradition, the dignitaries lighted the holy lamp and inaugurated the function. Dr. A.

K. Singh, Director of Research, Bihar Agricultural University, Sabour welcomed the gathering in which he narrated the research accomplishments of BAU for taking palm research to the next level. The Project Coordinator of AICRP (Palms), CPCRI, Kasaragod, Dr. B. Augustine Jerard in his report presented the mission of Project Directorate on five crops - coconut, oil palm, palmyrah, arecanut and cocoa distributed across 28 AICRP centres of 14 states and one Union Territory. Release of coconut varieties VPM6, Kalpa Survarna, cocoa varieties VTLCCH 1 and 2, enriching germplasm pool with pink husked coconut and pink nungu genotypes, fostering research for the development of T x T and D x D coconut hybrids, development of location specific Integrated Farming System models, developing pest and disease distribution maps for early forewarning besides developing Integrated Pest and disease management modules for leaf blight and Spiraling Whitefly in coconut, identification of promising VTLCPC cocoa cultures and oil palm varieties viz., NRCOP 9 and 37 were the noteworthy contributions of 2023-24. The Project Coordinator projected the new trials initiated on high density planting in cinnamon and on evaluation of crop boosters to scale up coconut productivity. On the value addition front, palmyrah sap powder, neera concentrate and osmotic dehydration of neera sap are being validated. Effective transfer of technology from lab to land, fostering tripartite Scientists-Officials of the State Department of Horticulture – Farmers’ linkage for curbing debilitating diseases like coconut root wilt, distribution of biocontrol agents across different centres adds hue to the programme. Thirty-four research papers, 43 conference papers, 19 extension folders, 41 popular articles and five technical bulletins were published through the concerted efforts of the palm scientists. He added that total budget outflow during last year was 755 lakhs.

Dr.P.Rethinam, Former Director, Asian and Coconut Pacific Community, Jakarta highlighted the

importance of the production of quality planting materials through composite mother palm gardens, value addition, product diversification and by product utilization in the plantation crops sector. He urged the scientists to develop location specific cropping system model to augment farm productivity. He also hinted the need for bringing a ‘Compendium of 50 years of Research Accomplishments’ of the constituent centres of AICRP on Palms.

Dr. K. B. Hebbar invited the scientists to develop economically feasible and socially viable technologies to empower the farmers. He also showcased the mission of palm scientists in developing biocontrol strategies to manage pests like black headed caterpillar. He underlined the importance of working in tandem with the officials of the State Department of Horticulture to provide suitable remedies for the maladies in the farm front.

Dr.K.Suresh, Director, IIOPR, Pedavegi lauded the scientists for their contributions and invited the scientists to use technological interventions to tide over the challenges in the farm front manifested in terms of price aberrations, pest and diseases, climatic vagaries etc., Dr.R.K.Mathur, Director, IIOPR, Hyderabad in his remarks advised the scientists to discourage monocropping, to bring real time surveillance reports of biotic stress and to be pro active in reaching out to the farmers through IoT applications.

Dr.V.B.Patel, ADG (F &PS) applauded the scientists for the contribution towards release of four varieties by Hon’ble Prime Minister of India. He also drew the road map that nontraditional coconut belts with climatic vulnerabilities can offer excellent platform for screening varieties for tolerance to abiotic stress which should be positively exploited. Production of quality planting materials is the need of the hour, he added. Dr. D. R. Singh, Vice Chancellor, BAU, Sabour gave a bird’s eye view of the accomplishments of the University and highlighted the status of coconut plantations in the state of Bihar. Farmers can tap tender nut market

during summer and matured nut demand during festival times in the state. Palmyrah of Bihar is unique with dwarf stature which eases climbing operations and neera tapping, which could be explored further for the betterment of the farming community. He besieged over the immense employment opportunities provided by the palm sector and spelled out the need for bioconversion of waste to wealth in the plantation crops.

Coconut Research Station, Veppankulam, Tamil Nadu was adjudged as the best AICRP (Palms) Centre for the year 2023-24. Hand full of

publications which include three books on coconut and oil palm, two technical bulletins and seven folders and pamphlets were released by the dignitaries.

Dr. S.Ruby Rani, SIC, Sabour proposed the vote of thanks. About 80 participants from different AICRP centres participated in the meet. The inaugural session was followed by technical sessions on variety release proposal, genetic resources and crop improvement, crop production, crop protection and post harvest technology.



Inaugural of XXXIII AGM at BAU, Sabour

Salient recommendations of the XXXIII Annual Group Meeting of All India Coordinated Research Project on Palms

1.VPM 6 – Coconut variety recommended

- Evaluation of local coconut germplasm undertaken under AICRP on Palms revealed the better performance of IV 599764 and recommended for release for cultivation in the state of Tamil Nadu. The variety is adapted in the East Coast region of Tamil Nadu and performed better with higher yield of 166.25 nuts per palm per year, 137.40 g copra content and 67.94 % Oil content under

several forms of stress (under planting, drought, cyclone) conditions due to its quick recovering habit.

2.VTLCH 1 – Cocoa hybrid recommended and subsequently notified.

- MLT undertaken under AICRP on Palms on evaluation of cocoa hybrids under coconut canopy revealed better performance of VTLCH 1 and recommended for Kerala, Tamil Nadu and Karnataka. Single dry bean weight of 1 to 1.10 g this variety recorded an average yield of 1.5 kg in 3 locations and the yield/ha is 750 kg (500 trees).

3. VTLCH 2 -Cocoa hybrid recommended and subsequently notified

- MLT undertaken under AICRP on Palms on evaluation of cocoa hybrids under coconut canopy revealed better performance of VTLCH 2 and recommended for Kerala, Andhra Pradesh, Karnataka and Gujarat. Beans are of international standard with >1 g bean size, suitable for chocolate industry with a shelling percentage of 13%, nib recovery of 87%, >50% fat and 1% free fatty acids. This variety is tolerant to black pod rot, tea mosquito bug, low moisture stress

4. Oil palm hybrid NRCOP 9

- NRCOP 9 tested under AICRP on Palms centre Pattukottai is recommended for release and cultivation in Coastal region of Tamil Nadu under assured irrigated condition. NRCOP 9 could give an impressive oil yield of 6.58 tonnes/ha/annum.

5. Oil palm hybrid NRCOP 37

- NRCOP-37 tested under AICRP on Palms Vijayarai is recommended for release in Coastal region of Andhra Pradesh. The hybrid recorded oil content of 18.45% resulting in oil yield of 5.48 tonnes/ha/annum.

6. Coconut hybrid Kalpa Nakshatra

- Hybrid developed by ICAR CPCRI is recommended for release and cultivation in Kerala for copra, tender nut purpose with higher nut yield potential of 151.41 nuts/palm/annum (26497 nuts per ha) and copra output of 31.28 kg/palm/year (5.47t/ha copra). The hybrid gives 40.61% more nut yield and 38.48% more copra yield over the present popular coconut hybrid "Chandra Sankara".

7. Arecanut hybrid Terai Shankar was recommended

- Hybrid developed by ICAR CPCRI is recommended for cultivation and release in homestead gardens of West Bengal and

Assam. The hybrid is dwarf in stature with medium thick stem and produces 2.19 kg dry kernel/palm/year.

8. D x D hybrid evaluation trial

- MLT of D x D hybrids planted in three locations, revealed better performance of three combinations at three centers, COD x MGD (Ambajipeta), COD x MYD (Ratnagiri) and GBGD x MOD (Veppankulam) with higher nut yield (84.29 nuts/palm/year), 91.58 nuts/palm/year and 98 nuts / palm / year respectively. These hybrids were identified for preparation of variety release proposal.

9. Early flowering in Palmyrah germplasm was observed in the two accessions collected from Bihar. The flowering observed at 8 to 9 years after planting in the AICRPP centres viz., Killikulam and Pandrimamidi locations. These accessions are identified for multiplication and for MLT.

10. Coconut lines identified for MLT

Better performing Tall and Dwarf lines developed by ICAR- CPCRI and AICRPP centers were identified for taking up new MLT under varied environment. The details are as follows

Evaluation of dwarf genotypes in different agro climatic regions of India

- Cameroon Red Dwarf, Laccadive Orange Dwarf, Nigerian Green Dwarf, Niu Leka Dwarf, Chowghat Yellow Dwarf, Dweep Sona, Dweep Haritha, Kalpa Suvarna, Nikkore Dwarf, Hari Papua Dwarf, Andaman Orange Dwarf, Gudanjili Dwarf and COD

Evaluation of promising tall genotypes for yield and wind tolerance

- Kamrupa, Orissa Giant, Kappadam, Lifou, Markham, Laguna, Niu Drau, Niu Hake, Rotuma, Rennel, New Guinea, VPM 6, Seychelles Tall, Gandeivi Tall and Check

Orientation training for newly joined scientists under AICRP on PC

Capacity Building of Scientists: To strengthen the technical expertise of newly Joined scientists in oil palm research, three scientists from the AICRP centres at Pasighat (Arunachal Pradesh), Bavikere (Karnataka) and Pattukottai (Tamil Nadu) participated in a one-week training programme on

“Oil Palm Production Technology” organized by ICAR–Indian Institute of Oil Palm Research (IIOPR), Pedavegi, during 18–25 September 2024. The training covered improved production technologies, crop management practices, and recent advances in oil palm cultivation, thereby enhancing the research and extension capabilities of the participating scientists.



AICRP on Palms Centre, CRS, Veppankulam adjudged as the best AICRP (Palms) centre 2023-24

IX. TRANSFER OF TECHNOLOGY & OTHER OUTREACH PROGRAMME

The AICRP on Palms continued its efforts to promote the dissemination and adoption of improved technologies through a wide range of extension and outreach activities across the centres. These activities included farmer training programmes, frontline demonstrations, field days, farmer–scientist interactions, exposure visits, awareness campaigns, diagnostic services, and advisory programmes. Emphasis was placed on the transfer of location-specific technologies related to improved production practices, integrated nutrient management, integrated pest and disease management, quality planting materials, post-harvest management, processing, and value addition in coconut, arecanut, cocoa, oil palm, and palmyrah. The AICRP centres conducted both on-campus and off-campus capacity-building programmes for farmers, extension personnel, rural youth, entrepreneurs, and other stakeholders to enhance their technical knowledge and facilitate the adoption of improved technologies. Frontline demonstrations under farmers' field conditions showcased the effectiveness of recommended varieties, nutrient and water management practices, integrated crop protection strategies, and cropping systems. Regular field visits, problem diagnosis, technical advisories, and distribution of extension publications further strengthened the linkage between research institutions and farming communities.

In addition to routine extension activities, several centres implemented special outreach programmes under the Scheduled Caste Sub Plan (SCSP), Tribal Sub Plan (TSP), and North Eastern Hill (NEH) initiatives. These programmes focused on capacity building, technology dissemination, and distribution of quality planting materials, skill development, and livelihood enhancement among farmers belonging to the targeted communities. Collectively, these initiatives contributed to improved awareness, enhanced technical capacity, and wider adoption of sustainable plantation crop production technologies across diverse agro-climatic regions.

Northeastern Hill (NEH)

The North Eastern Hill (NEH) Programme was implemented at two AICRP centres, Kahikuchi (Assam) and Pasighat (Arunachal Pradesh), with the objective of strengthening technology dissemination and capacity building among plantation crop farmers in the North Eastern region. During the reporting period, five training programmes were organized for farmers and extension functionaries, benefiting 242 participants, comprising 157 male and 85 female participants. In addition, three frontline demonstrations were conducted under farmers' field conditions, covering 85 beneficiaries, including 75 male and 10 female participants.



The Pasighat Centre actively promoted oil palm cultivation through several extension and outreach activities. A demonstration on oil palm plantation was organized for officials of the State Horticulture Department to familiarize them with improved cultivation practices. The centre also participated in a Kisan Mela by exhibiting oil palm technologies and delivered three technical lectures on oil palm cultivation during horticulture training programmes organized by the College of Horticulture and Forestry (CHF). Technical consultancy on oil palm cultivation was provided to 15 farmers, while four exposure visits were organized for farmers and students to the experimental fields, enabling them to gain first-hand knowledge of improved production technologies and recommended cultivation practices.

Scheduled Caste Sub Plan (SCSP)

Under the Scheduled Caste Sub Plan (SCSP), extension activities were undertaken across 10 AICRP on Palms centres—Aliyamagar, Ambajipeta, Arsikere, Kahikuchi, Bhubaneswar, Ratnagiri, Veppankulam, Killikulam, Vijayarai, and Sabour. The AICRP centres organized 35 training programmes for Scheduled Caste farmers and stakeholders, benefiting 1,018 participants. In addition, capacity-building programmes covered 612 male and 514 female participants. The training programmes focused on scientific cultivation practices, quality planting material production, integrated nutrient and pest management, post-harvest management, and value addition in plantation crops, thereby enhancing the knowledge and livelihood opportunities of the target beneficiaries.



Input distribution to the SCSP beneficiaries

Tribal Sub Plan (TSP)

The Tribal Sub Plan (TSP) programme was implemented through six AICRP on Plantation Crops centres—Aliyarnagar, Arsikere, Jagdalpur, Ratnagiri, Pandirimamidi, and Navsari. A total of 22

training programmes, benefiting 1,112 participants. The programmes focused on disseminating improved production technologies, integrated crop management practices, quality planting material production, and value addition in plantation crops

to tribal farmers and other stakeholders, thereby enhancing their knowledge, skills, and livelihood

opportunities. The reported participant profile comprised 685 male and 427 female participants



Input distribution to the TSP beneficiaries

Training Programmes

During the reporting period, the AICRP centres organized 163 training programmes benefiting 7,562 participants, comprising 4,718 male and 2,844 female participants. The programmes focused on disseminating improved production technologies,

integrated crop management practices, quality planting material production, and value addition in plantation crops to tribal farmers and other stakeholders, thereby enhancing their knowledge, skills, and livelihood opportunities.

Training Programmes Organized by AICRP on Palms Centres

AICRP Centre	No. of Training Programmes	Participants (Male)	Participants (Female)	Total Participants
Arsikere	7	185	143	328
Shivamogga	1	38	—	38
Navsari	3	611	495	1,106
Mondouri	3	120	70	190
Kahikuchi	5	157	85	242
Bhubaneswar	8	221	259	480
Jagdalpur	11	282	173	455
Sabour	10	400	200	600
Ratnagiri	35	542	408	950
Mulde	2	80	60	140
Veppankulam	7	244	120	364
Pattukottai	4	105	4	109
Aliyamagar	43	683	367	1,050
Killikulam	7	183	317	500
Vijayarai	7	160	40	200
Pandirimamidi	11	210	40	250
Ambajipeta	10	215	85	300
Kondamallepaly	1	42	8	50
Total	163	4,718	2,844	7,562

Frontline Demonstrations

A total of 110 frontline demonstrations were conducted across the AICRP centres, covering 3,041 beneficiaries, including 1,598 male and 1,443 female participants. These demonstrations showcased improved production technologies, integrated crop management practices, and recommended varieties under farmers' field conditions.

Scientists – Farmers – Officials of the Department of Horticulture Interface Meet

An Interface Meet captioned “Recent Technologies in Coconut Farming” with special reference to Root (wilt) disease and Rugose Spiraling Whitefly management, mustering Scientists of Tamil Nadu Agricultural University and Central Plantation Crops Research Institute (CPCRI), Kasaragod and Kayamkulam, Kerala, Officials of the Coconut Development Board (CDB), Chennai and Dhali and State Department of Horticulture and Plantation Crops, Government of Tamil Nadu together with progressive farmers of the state, was organized at Coconut Research Station, TNAU, Aliyarnagar, ICAR – AICRP (Palms), Tamil Nadu on 05.02.2024. Outcome of the meet ended with the following Action Plan for the future.

- Replanting/under planting in senile plantations should be encouraged by providing support to the farmers to increase productivity.
- Six-days training for the officials of the State Department of Horticulture should be organized three days each at Aliyarnagar Centre and at CPCRI (RS), Kayamkulam to get acquainted with the symptoms of Root(wilt) disease.
- Google spreadsheet bearing particulars on variety, age of the palm, soil type, pH, EC, organic carbon content, root(wilt) disease intensity along with GPS co-ordinates shall be framed and updated by the field level workers of the State Department of Horticulture once every 15 days
- Pamphlets on diagnosis, symptomatology and management technologies of coconut root wilt is to be prepared for distribution to the farmers and soft copy of the same should be circulated among the stakeholders and uploaded in CPCRI website (Training on production of quality planting materials comprising of disease tolerance capacity to be organized
- Strict ‘within the state’ internal quarantine may be enforced for transportation of coconut seedlings.
- Multi location trials are to be performed before recommending any technology through AICRP centres.
- Training may be imparted on identification of Encarsia parasitoids to the stakeholders and video of the same may be uploaded in social media.
- Systems Approach ensuring soil-water-plant health, Integrated Farming System, Integrated Cropping System and organic manuring to enrich soil microbiome may be advocated.

X. PUBLICATIONS

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XI. WEATHER DATA OF AICRP CENTRES (2024)

ALIYARNAGAR					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.6	27.1	93.8	72.0	50.2
February	36.1	28.7	87.7	49.0	0
March	36.9	30.1	88.0	33.0	0
April	38.5	32.8	80.1	27.0	0
May	35.3	30.0	86.4	47.5	289.6
June	31.7	31.0	83.5	66.7	26.0
July	32.9	32.3	84.9	79.7	177.0
August	31.5	32.6	88.9	67.6	91.6
September	34.1	32.2	86.5	55.3	29.2
October	34.6	32.0	91.8	63.0	211.2
November	32.3	32.0	89.1	76.9	63.0
December	31.8	31.1	92.0	72.1	95.2

AMBAJIPETA					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	31.8	19.5	99.6	55.2	0
February	34.7	20.0	100.0	54.5	0
March	37.1	21.6	100.0	50.2	0
April	40.1	24.9	100.0	50.0	0
May	38.5	27.1	99.8	57.8	34.0
June	35.1	27.0	99.7	65.7	22.0
July	31.7	26.1	99.9	79.6	111.0
August	33.2	26.4	100.0	79.4	83.0
September	32.9	25.8	100.0	79.4	99.0
October	34.0	25.1	100.0	73.1	87.5
November	31.8	21.8	100.0	57.2	1.5
December	29.6	21.4	100.0	71.0	25.5

ARSIKERE					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.5	20.1	64.0	55.1	25.6
February	33.6	18.5	55.9	42.0	0
March	36.7	19.4	54.3	44.3	0
April	39.5	23.5	56.5	47.4	0
May	35.9	22.0	69.7	71.9	170.1
June	32.5	20.6	74.8	69.3	11.6
July	30.0	20.9	76.2	64.7	60.5
August	29.2	21.7	79.5	69.5	68.0
September	30.8	21.7	72.4	65.7	0
October	30.6	20.1	72.1	65.6	276.2
November	29.7	21.3	67.6	64.5	10.4
December	27.7	18.9	53.0	54.9	16.0

BAVIKERE					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.9	24.5	73.2	62.9	5.0
February	34.1	24.7	56.8	64.4	0
March	35.2	22.4	66.0	55.1	0
April	37.3	20.7	67.9	58.1	0
May	34.7	22.0	75.3	61.6	159.5
June	31.7	21.6	79.8	75.3	29.0
July	27.3	21.5	84.1	88.5	629.0
August	29.4	22.9	80.8	75.2	117.5
September	29.6	19.3	79.2	73.0	52.5
October	31.1	19.2	75.6	77.3	179.0
November	30.1	15.2	74.6	70.4	0
December	30.5	16.0	80.1	78.7	19.0

BHUBANESWAR]					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	27.4	16.2	91.0	55.0	22.6
February	32.4	20.1	90.0	50.0	6.2
March	34.3	23.3	92.0	56.0	50.2
April	39.6	25.6	83.0	42.0	24.2
May	37.9	26.9	86.0	55.0	115.4
June	37.2	26.8	89.0	64.0	203.7
July	32.2	26.3	96.0	88.0	318.5
August	32.5	25.6	96.0	88.0	383.6
September	32.8	25.7	96.0	90.0	234.8
October	33.6	24.9	91.0	70.0	125.0
November	30.9	19.6	88.0	54.0	9.3
December	28.1	17.8	86.0	58.0	92.9

GOA					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	34.3	21.3	86.2	40.5	7.6
February	35.6	21.2	90.0	42.7	0
March	34.9	22.9	88.3	49.3	0
April	35.0	25.7	86.8	56.1	38.8
May	34.8	26.0	87.0	60.6	151.2
June	31.3	24.7	93.5	79.5	832.2
July	29.0	24.0	93.6	90.2	2063.3
August	30.2	24.5	94.4	81.0	959.8
September	30.5	24.0	94.0	77.0	422.5
October	32.3	24.1	93.5	70.5	353.8
November	34.0	22.3	79.9	47.9	51.2
December	33.5	21.8	83.4	48.1	0.6

JAGDALPUR					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	28.9	12.5	87.0	38.0	1.4
February	21.5	14.7	83.7	31.4	0.5
March	34.0	18.3	84.0	31.1	18.6
April	36.7	21.4	77.1	36.7	122.9
May	35.6	22.5	80.4	46.0	117.2
June	33.6	23.1	84.7	60.7	273.6
July	28.4	22.4	92.0	80.3	434.1
August	29.9	22.2	92.1	74.0	331.7
September	30.5	22.4	91.9	74.5	284.1
October	32.0	21.0	90.2	57.7	32.2
November	29.7	13.9	89.8	42.0	0.2
December	28.3	15.0	89.6	49.2	1.6

KAHIKUCHI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	23.4	12.7	96.8	57.2	10.0
February	25.6	13.7	94.0	47.3	5.0
March	29.6	17.5	90.3	45.2	51.0
April	32.5	22.1	89.8	51.3	73.5
May	32.5	23.6	92.5	59.7	241.8
June	31.2	26.0	96.0	74.2	364.8
July	33.3	27.4	95.6	69.6	241.2
August	32.7	25.6	95.7	69.2	263.6
September	33.8	25.6	94.9	65.8	83.8
October	29.5	23.1	96.6	73.0	142.2
November	28.8	19.0	96.5	60.6	2.0
December	25.2	13.4	96.7	54.8	0

KILLIKULAM					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	31.0	16.2	68.9	52.0	29.6
February	34.2	16.3	68.9	47.4	0
March	36.0	16.5	69.6	45.1	6.6
April	37.8	18.7	67.8	39.2	5.0
May	37.2	19.2	65.8	45.1	33.0
June	37.5	19.0	63.5	42.8	3.8
July	37.1	20.0	57.2	38.4	3.0
August	36.9	18.6	60.9	39.4	67.0
September	37.5	19.0	60.4	38.7	117.8
October	34.4	17.0	68.6	50.9	41.4
November	31.7	15.6	72.6	57.8	201.0
December	32.1	14.8	73.4	55.4	152.8

KONDAMALLEPALLY					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	35.9	19.3	83.2	51.5	0
February	33.0	20.1	83.2	51.6	0
March	35.9	22.4	78.3	56.5	0
April	41.1	25.2	42.8	42.4	9
May	39.7	27.8	64.9	55.7	9
June	35.9	27.0	78.9	64.1	86.7
July	32.7	26.7	88.1	54.6	136.8
August	33.5	26.1	91.4	48.6	134.0
September	32.9	26.4	89.7	41.8	156.3
October	31.7	22.2	89.1	43.2	107.9
November	29.8	21.8	89.4	41.8	27.8
December	28.2	20.8	89.2	40.9	3.1

MONDOURI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	22.4	10.4	95.5	78.3	63.3
February	27.5	14.8	94.3	76.3	12.8
March	31.5	18.6	93.4	74.9	58.3
April	37.7	24.1	91.7	65.5	4.4
May	35.1	25.2	93.7	78.7	257.2
June	35.6	27.1	94.0	83.8	69.9
July	33.3	26.2	95.3	87.2	192.6
August	31.9	25.6	97.6	90.6	399.3
September	32.9	25.5	97.5	88.8	335.1
October	32.1	23.8	97.4	87.4	235.3
November	29.1	17.6	97.6	69.9	1.4
December	23.2	13.2	93.2	75.4	47.4

MULDE					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	34.6	15.8	94.0	43.0	12.4
February	36.4	15.9	93.0	39.0	0
March	37.0	19.0	90.0	43.0	0
April	37.4	21.9	86.0	47.0	0
May	37.1	22.9	87.0	52.0	78.6
June	31.1	21.9	94.0	83.0	1067.7
July	29.3	20.9	96.0	90.0	2041.3
August	30.4	21.4	94.0	82.0	1071.2
September	31.2	21.6	93.0	80.0	565.0
October	33.3	21.0	94.0	68.0	365.2
November	34.8	16.9	92.0	51.0	102.4
December	33.9	16.6	92.0	50.0	1.6

NAVSARI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.2	14.0	91.5	42.9	0
February	32.6	15.0	91.0	34.2	0
March	34.2	16.8	90.2	36.9	0
April	37.5	22.2	83.1	36.1	0
May	36.4	25.6	83.8	52.2	0
June	34.2	26.0	88.8	69.2	238.00
July	30.5	25.1	91.8	87.8	1281.0
August	30.0	24.8	94.1	86.8	387.0
September	31.2	24.1	97.2	80.1	368.0
October	34.4	23.2	95.7	61.4	120.0
November	33.7	17.8	81.8	37.6	0
December	30.8	15.2	80.9	41.5	0

PANDIRIMAMIDI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	28.8	19.8	93.0	44.0	0
February	31.2	20.2	94.0	37.0	0
March	37.3	21.6	93.0	36.0	8.0
April	40.4	25.6	90.0	38.0	16.0
May	40.6	24.8	81.0	45.0	103.6
June	39.5	25.5	67.0	65.0	157.0
July	34.5	23.4	76.0	71.0	340.8
August	35.7	22.5	80.0	77.0	268.5
September	34.3	22.0	90.0	73.0	243.9
October	34.1	20.9	90.0	70.0	147.2
November	30.2	20.8	94.0	65.0	87.7
December	30.5	16.8	100.0	39.0	0

PASIGHAT					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	20.2	10.0	47.7	44.7	11.6
February	18.8	10.4	62.0	61.1	163.5
March	22.4	18.0	62.2	66.6	97.5
April	23.8	18.3	73.5	76.5	209.0
May	26.4	22.0	73.4	64.4	171.3
June	29.0	25.2	83.2	78.1	810.4
July	29.8	25.5	81.6	80.3	728.9
August	30.6	26.0	79.0	70.4	400.4
September	32.4	27.1	66.0	68.6	227.1
October	25.7	20.4	62.9	68.8	165.7
November	26.3	17.1	53.8	49.7	0.5
December	21.9	14.3	55.5	49.9	44.3

PATTUKOTTAI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	38.8	32.8	91.1	66.8	0
February	38.8	35.1	94.3	55.2	0
March	39.0	35.1	91.1	56.5	0
April	39.0	34.9	90.4	51.4	0
May	39.0	34.9	86.5	64.9	246.9
June	39.0	35.0	87.4	67.0	47.5
July	39.0	35.0	92.2	58.5	15.7
August	39.0	35.0	83.5	67.2	106.3
September	39.0	35.0	83.8	62.9	30.0
October	39.0	35.0	88.8	64.5	329.3
November	39.0	35.0	92.6	74.7	369.4
December	39.0	33.0	90.3	66.3	168.2

PEDAVEGI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	31.7	16.0	88.1	41.5	0
February	34.2	16.6	86.4	24.1	3.0
March	37.2	19.9	85.5	30.0	13.2
April	40.2	20.7	82.2	31.7	1.0
May	43.5	22.8	84.6	32.3	39.8
June	40.2	24.0	88.4	42.8	194.0
July	36.1	23.4	95.2	59.7	385.8
August	36.9	23.8	92.0	55.3	244.0
September	37.1	23.0	92.7	42.8	240.2
October	36.5	20.4	91.7	46.9	71.8
November	34.0	17.1	85.8	37.2	4.2
December	33.9	15.5	89.7	42.0	11.6

PILICODE					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	33.9	24.0	85.0	74.0	50.8
February	34.5	24.0	83.0	66.0	0
March	34.5	24.6	81.2	61.6	0
April	35.3	25.4	79.4	61.8	0
May	33.6	24.5	85.4	80.8	515.1
June	30.8	24.2	93.2	88.1	1139.2
July	29.6	24.2	93.3	92.2	1603.2
August	29.5	24.1	95.0	85.0	579.5
September	30.5	23.7	94.8	83.3	377.4
October	31.3	23.8	94.3	76.8	150.1
November	33.2	23.4	92.7	68.3	75.2
December	32.5	23.0	94.7	68.1	152.2

RATNAGIRI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	32.7	19.9	71.0	54.5	18.7
February	32.9	19.1	68.9	55.5	0
March	32.8	21.9	70.1	61.9	0
April	33.6	24.9	73.8	63.8	0
May	33.9	26.2	72.9	67.1	58.7
June	31.4	25.2	88.1	82.4	1043.2
July	28.8	24.5	91.2	91.0	1944.8
August	30.4	25.1	87.6	82.9	582.1
September	30.4	24.5	88.2	80.5	443.3
October	32.5	24.4	88.6	80.0	165.8
November	34.5	21.9	60.4	58.8	5
December	33.3	21.1	67.0	60.4	0

SABOUR					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	19.9	7.4	96.7	73.5	0
February	25.5	11.3	85.5	58.3	3.7
March	29.7	15.9	69.6	60.7	6.5
April	38.0	21.3	46.9	40.2	0
May	35.6	24.6	68.0	57.7	81.9
June	37.1	27.3	75.2	68.1	4.1
July	33.7	27.2	83.9	77.4	230.0
August	33.1	26.4	83.9	77.9	241.4
September	32.7	26.12	84.7	77.5	242.0
October	30.5	23.61	85.45	78.71	47.1
November	28.9	16.9	86.6	80.2	0
December	24.4	9.6	87.3	80.9	0

SHIVAMOGGA					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	31.4	17.4	84.3	49.7	10.0
February	34.6	17.1	77.8	29.5	0
March	36.1	20.2	75.1	28.9	0
April	37.3	22.3	70.7	31.7	51.8
May	34.2	22.4	75.4	55.4	227.0
June	29.8	21.6	85.3	74.7	189.8
July	27.0	21.1	90.5	87.0	361.8
August	29.0	21.3	89.8	79.9	250.4
September	29.4	20.6	88.7	77.2	53.6
October	30.4	21.2	91.5	76.0	336.0
November	30.3	19.7	89.9	66.3	4.2
December	29.7	18.4	86.4	71.3	12.0

SIRSI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	31.7	16.9	80.0	73.0	4.0
February	35.0	18.9	69.0	57.0	0
March	37.2	22.1	66.0	55.0	0
April	38.5	23.8	64.0	51.0	12.0
May	36.3	22.6	78.0	68.0	162.2
June	30.8	21.9	94.0	90.0	404.0
July	28.1	21.0	97.0	95.0	1888.0
August	28.7	21.0	93.0	92.0	611.0
September	30.3	20.6	94.0	91.0	167.2
October	30.7	21.5	93.0	88.0	257.4
November	30.0	17.4	81.0	64.0	33.2
December	29.4	17.9	84.0	76.0	49.4

SRI VIJAYA PURAM					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.7	24.6	70.7	74.7	150.0
February	31.0	24.2	72.7	69.3	2.6
March	32.1	24.3	66.9	69.9	0
April	33.3	26.2	67.3	70.5	0
May	32.8	26.2	76.7	79.5	409.7
June	29.8	25.1	85.0	86.4	737.6
July	31.0	25.3	85.5	86.5	356.4
August	30.2	25.0	85.2	87.9	295.7
September	30.3	25.1	86.4	87.9	508.3
October	30.8	24.8	83.4	87.0	326.6
November	30.8	25.5	77.3	83.0	266.1
December	30.2	25.3	75.8	79.9	274.7

THRISSUR					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	35.0	20.9	75.0	50.0	124.1
February	37.7	21.9	80.0	40.0	8.1
March	39.9	23.1	88.0	46.0	0
April	40.0	23.1	85.0	50.0	7.3
May	39.5	23.3	91.0	71.0	491.3
June	33.7	23.4	96.0	80.0	628.9
July	32.8	22.7	96.0	82.0	984.8
August	34.5	22.9	95.0	74.0	341.0
September	35.4	23.4	94.0	69.0	168.9
October	36.2	22.7	94.0	75.0	206.6
November	34.9	22.5	85.0	57.0	91.5
December	34.5	20.7	89.0	62.0	170.9

VEPPANKULAM					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	38.8	32.8	91.1	66.8	43.5
February	38.8	35.1	94.3	55.2	0
March	39.0	35.1	91.1	56.5	4.6
April	39.0	34.9	90.4	51.4	0
May	39.0	34.9	86.5	64.9	193.2
June	39.0	35.0	87.4	67.0	26.0
July	39.0	35.0	92.2	58.5	45.0
August	39.0	35.0	83.5	67.2	106.6
September	39.0	35.0	83.8	62.9	36.0
October	39.0	35.0	88.8	64.5	357.5
November	39.0	35.0	92.6	74.7	346.4
December	39.0	33.0	90.3	66.3	182.6

VIJAYARAI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	30.0	19.0	70.2	68.7	7.8
February	33.0	20.0	69.3	66.5	3.3
March	36.0	23.0	64.6	62.3	13.7
April	37.0	27.0	69.3	60.7	14.4
May	39.0	29.0	65.6	59.9	46.0
June	36.0	29.0	61.3	59.0	161.2
July	32.0	26.0	82.5	79.3	299.5
August	32.0	26.0	81.6	80.5	244.3
September	31.0	25.0	79.1	78.6	243.3
October	31.0	24.0	74.4	70.7	122.6
November	30.0	22.0	72.6	69.5	86.4
December	29.0	20.0	70.8	68.3	28.2

WAKAWALI					
Month	Temperature (°C)		RH (%)		Rainfall (mm)
	Max.	Min.	Forenoon	Afternoon	
January	29.5	12.9	94.1	56.0	13.0
February	31.4	12.4	90.2	49.5	0
March	34.6	17.8	88.2	50.7	0
April	34.1	20.8	88.0	63.2	0.2
May	32.9	23.0	86.7	67.3	8.6
June	31.0	23.1	91.2	75.2	648.6
July	28.2	23.1	95.2	89.4	1213.8
August	28.2	22.5	95.0	90.6	1094.9
September	29.1	22.3	92.9	85.0	44.3
October	30.7	19.9	92.2	77.7	139.1
November	32.5	15.5	89.9	54.3	0
December	32.9	16.1	92.8	52.0	0

XII. STAFF POSITION

Head Quarters	
Project Coordinator's Cell, ICAR-CPCRI, Kasaragod, Kerala - 671 124	
Project Coordinator (Palms)	: Dr. B. Augustine Jerard
Scientist (SPMA)	: Dr. Sumitha S
PPS / PA	: Mrs. Narayani (upto April 2024) Mrs. Arathi A R (May 2024 onwards)
SRF	: Mrs. Ananya P. S. (from September 2024 onwards)
Clerical Assistant (On contractual)	: Mr. Suresh
ICAR- AICRP on Palms Coordinating Centres	
Horticultural Research Station, Ambajipeta	
1.	Dr. V. Govardhan Rao, Asst. Professor (Plant Pathology)
2.	Dr. Vadde Anoosha, Asst. Professor (Agri. Entomology)
3.	Sri. A. Kireethi, Asst. Professor (Horticulture)
4.	Dr. K. Mamatha, Associate Professor (Horticulture) (from 09.10.2024 onwards)
Horticultural Research Station, Pandirimamidi	
5.	Dr. K. Rajendra Prasad, Sr. Scientist (Horticulture) (up to 06.10.2024)
6.	Dr. J. Phani Kumar, Scientist (Horticulture) (from 07.10.2024 onwards)
7.	Dr. P. C. Vengaiah, Sr. Scientist (Food Science & Technology)
Horticultural Research Station, Kahikuchi	
8.	Dr. D. Chowdhury, Pr. Scientist (Plant Breeding) (from 01.11.2024 onwards)
9.	Dr. A. Borah, Scientist (Horticulture)
Saheed Gundadthur College of Agriculture & Research Station, Jagdalpur	
10.	Dr. Beena Singh, Asst. Professor (Horticulture)
11.	Dr. Bhujendra Kumar Kothari, Asst. Professor (Agronomy) (from 01.10.2024 onwards)
Horticultural Research & Extension Station, Arsikere	
12.	Dr. Kiran Kumar (Asst. Professor (Plant Pathology) (up to 30.07.2024 onwards)
13.	Dr. Sudharshan G. K, Asst. Professor (Plant Pathology) (from 30.07.2024 onwards)
14.	Dr. G.S. Chandrasekhar, Asst. Professor (Agri.Entomology)
15.	Dr. Jagadeesha, Associate Professor (Horticulture)
Regional Coconut Research Station, Bhatye, Ratnagiri	
16.	Dr. K. V. Malshe, Associate Professor (Agronomy)
17.	Dr. S. M. Wankhede, Asst. Professor (Agri. Entomology)

18.	Dr. S. L. Ghavale, Asst. Professor (Horticulture)
Department of Horticulture, OUAT, Bhubaneswar	
19.	Dr. A. K. Sahoo, Asst. Professor (Horticulture)
Coconut Research Station, Aliyarnagar	
20.	Dr. Arul Prakash, Associate Professor (Agri.Entomology)
21.	Dr. C. Sudhalakshmi, Associate Professor (Soil Science)
22.	Dr. J. Suresh, Professor (Horticulture) (up to 30.06.2024)
23.	Dr. G. V. Rajalingam, Professor (Horticulture) (from 24.07.2024 onwards)
24.	Dr. Latha, Associate Professor (Plant Pathology)
Coconut Research Station, Veppankulam	
25.	Dr. Arun Kumar, Associate Professor (Horticulture) (up to 18.12.2024)
26.	Dr. K. Kumanan, Associate Professor (Horticulture) (from 19.12.2024 onwards)
27.	Dr. M. Surulirajan, Associate Professor (Plant Pathology)
28.	Dr. N. Senthilkumar, Associate Professor (Agronomy)
Agricultural College & Research Institute, Killikulam	
29.	Dr. M. I. Manivannan, Assoc. Professor (Horticulture) (up to 11.03.2024 and from 13.08.2024 onwards)
30.	Dr. N. Richard Kennady, Professor (Horticulture) (from 11.03.2024 to 16.07.2024)
31.	Dr. V. Meenakshi, Assoc. Professor (FSN) (from 19.08.2024 onwards)
Department of Plantation Crops, BCKVV, Mondouri	
32.	Dr. D. K. Ghosh (LKN), Associate Professor (Agronomy) (up to 31.01.2024)
33.	Dr. A. B. Sarangi, Professor (Horticulture), (From February 2024 onwards)
Agricultural Research Station, Pattukkottai	
34.	Dr. M. Tamil Selvan, Associate Professor (Horticulture) (upto 16.03.2024 FN)
35.	Dr. V. Krishnamoorthy, Professor (Horticulture) (from 16.03.2024 AN onwards)
Regional Agricultural Research Station, Pilicode	
36.	Dr. Remya Rajan, Asst. Professor (Horticulture)
Cocoa Research Centre, KAU, Thrissur	
37.	Dr. Minimol, Professor & Head (upto 10.07.2024)
38.	Dr. Aswini A. Assistant Professor (Horticulture) (from 10.07.2024 onwards)
College of Horticulture, Mulde	
39.	Dr. Debaje, P. P., Asst. Professor (Horticulture)
Horticultural Research Station, Vijayarai	
40.	Dr. Madhavi Latha, Asst. Professor (Horticulture)
Bihar Agricultural College, Sabour	
41.	Dr. Ruby Rani, Asst. Professor (Horticulture)

42.	Dr. Ahmar Aftab, Associate Professor (Horticulture)
Navsari Agricultural University, Navsari	
43.	Dr. Pankaj P. Bhalerao, Asst. Professor (Fruit Science)
College of Horticulture & Forestry, Pasighat	
44.	Dr. Nimbolkar Prashant Kisan, Asst. Professor (Fruit Science) (upto 20.06.2024)
45.	Dr. C. Mukhim, Asst. Professor (Fruit Science) (from 24.07.2024 onwards)
UAHS, Shivamogga	
46.	Dr. Shreeshail Sonyal, Asst. Professor (Plant Pathology)
AHRS, Bavikere, College of Agriculture, Navile, Shivamogga	
47.	Dr. Sadashiv Nadukeri Assistant Professor (Horticulture) (upto March 2024)
48.	Dr. Pavithra A. H., Assistant Professor (Agronomy) (from 27.03.2024 onwards)
CES, Wakawali (Dapoli)	
49.	Dr. Prafula Mali, Assoc. Professor (Horticulture) (upto March 2024)
50.	Dr. R. C. Gajbhiye, Professor (Horticulture) (from 09.04.2024 onwards)
ICAR- CCARI, Goa	
51.	Dr. V. Arunachalam, Pr. Scientist (Horticulture) (upto 24.10.2024)
ICAR- IOPR, Pedavagi	
52.	Dr. G. Ravichandran, Principal Scientist (Seed Science)
ICAR- CIARI, Sri Vijaya Puram	
53.	Dr. Ajit Arun Waman, Scientist (SPMA)
HRS, Konda Malleshpally, Telangana (ASKLTSHU)	
54.	Dr. C. H. Raja Goud, Senior scientist (Entomology)
Horticulture Research and Extension Centre, Sirsi, Uttara Kannada	
55.	Dr. Sudheesh Kulakarni, Scientist (Horticulture)
ICAR-CPCRI, Kasaragod, Kerala	
56.	Dr. P. Subramanian, Principal Scientist and Head



