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Annual Report 2025

भा.कृ.अनु.प. - केंद्रीय रोपण फसल अनुसंधान संस्थान
कासरगोड़ - 671124 केरल, भारत

ICAR - CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
KASARAGOD 671124, KERALA, INDIA

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ANNUAL REPORT 2025

भाकृअनुप
ICAR

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ICAR-CENTRAL PLANTATION CROPS RESEARCH INSTITUTE
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March 2026

CONTENTS

प्रस्तावना

यह खुशी की बात है कि प्रस्तुत वार्षिक प्रतिवेदन 2025, जो वर्ष के दौरान भाकृअनुप-कें.रो.फ.अ.सं. की महत्वपूर्ण अनुसंधान प्रगति और संस्थागत गतिविधियों का व्यापक रूप से दस्तावेजीकरण करती है। पाठकों और हितधारकों के लाभ के लिए विभिन्न कार्यक्रमों और उपलब्धियों को व्यवस्थित रूप से अध्यायवार और विषयगत रूप से आयोजित किया गया है।

लंबे समय के बाद वर्ष 2025 में नारियल और कोको के लिए अनुकूल बाजार मूल्य देखे गए। पिछले कुछ वर्षों में सुपारी की कीमतें लगातार ऊंची बनी हुई हैं। हालाँकि, अधिकांश किसान जलवायु परिवर्तन के प्रतिकूल प्रभावों के साथ-साथ कीट और रोग की घटनाओं के कारण कम उत्पादकता के कारण इन लाभों को पूरी तरह से महसूस नहीं कर सके है।

संस्थान ने इन चुनौतियों को कम करने के लिए जलवायु अनुकूल प्रौद्योगिकियों को विकसित करने में सराहनीय प्रगति की है। नारियल और कोको की जलवायु अनुकूल किस्मों को विकसित किया गया है, जारी किया गया है और विभिन्न कृषि-जलवायु क्षेत्रों में खेती के लिए अधिसूचित भी किया गया है। गुणवत्तापूर्ण रोपण सामग्री की आपूर्ति बढ़ाने के लिए, कई नारियल और सुपारी किस्मों और संकरों को मातृ बागों की स्थापना के लिए लाइसेंस दिया गया है। कोको में, दक्षिण भारत और उत्तर पूर्वी क्षेत्र में पॉलीक्लोनल बाग स्थापित किए गए हैं। जबकि बड़े पैमाने पर नारियल गुणन के लिए ऊतक संवर्धन प्रौद्योगिकी को व्यावसायीकरण से पहले और अधिक परिष्कृत करने की आवश्यकता है, सुपारी के लिए प्रौद्योगिकी ने आशाजनक परिणाम दिखाए हैं।

संस्थान ने जलवायु परिवर्तन के प्रभावों को कम करने और खेती की लागत को कम करने के उद्देश्य से कई कृषि-तकनीकों का मानकीकरण भी किया है। फसल और खेती प्रणाली मॉडल में वैज्ञानिक अंतर्दृष्टि ने मिट्टी के स्वास्थ्य में सुधार करने, सूक्ष्म जलवायु को विनियमित करने और पोषण और आजीविका सुरक्षा बढ़ाने में उनकी भूमिका का प्रदर्शन किया है। बाग के कचरे का कुशल उपयोग एक कम लागत वाली इनपुट रणनीति के रूप में उभरा है। इसके अतिरिक्त, पोषक तत्वों के उपयोग की दक्षता में सुधार करने और इनपुट लागत को कम करने के लिए अनुकूलित उर्वरक और सूक्ष्मजीव संघ विकसित किए गए हैं। इष्टतम जल और पोषक तत्व प्रबंधन के लिए स्वचालित उर्वरक प्रणालियों को तैनात करने के प्रयास भी जारी हैं।

भाकृअनुप-कें.रो.फ.अ.सं. ने एकीकृत कीट प्रबंधन और एकीकृत रोग प्रबंधन रणनीतियों के हिस्से के रूप में पर्यावरण अनुकूल परजीवी और जैविक नियंत्रण एजेंट विकसित किए हैं। संस्थान ने क्षेत्र स्तर पर कीट और रोग प्रबंधन में बाधाओं की पहचान करने में राष्ट्रीय वैज्ञानिक समिति और केंद्रीय विशेषज्ञ टीम में अग्रणी भूमिका निभाई है। शीघ्र पहचान को सक्षम करने, निगरानी को मजबूत करने और हस्तक्षेपों की सटीकता में सुधार के लिए, कृत्रिम बुद्धिमत्ता (एआई), सूचना और संचार प्रौद्योगिकी, मानव रहित हवाई वाहन (यूएवी) और रिमोट सेंसिंग जैसी उन्नत तकनीकों का सक्रिय रूप से पता लगाया जा रहा है।

उप-उत्पादों के बेहतर उपयोग को बढ़ावा देने वाले नीरा-इन्फ्यूज्ड नारियल फ्लेक्स और स्वादयुक्त नारियल-आधारित उत्पादों सहित कई मूल्य वर्धित उत्पादों के विकास और परिष्करण के माध्यम से नारियल मूल्य श्रृंखला को और मजबूत किया गया है। प्रौद्योगिकी हस्तांतरण के माध्यम से संस्थान का प्रभाव काफी बढ़ गया है, जिसमें 67 उद्यमियों को 32 प्रौद्योगिकियों का व्यावसायीकरण किया गया है, जिससे ₹28.95 लाख का लाइसेंसिंग राजस्व उत्पन्न हुआ है और सतत प्रथाओं को व्यापक रूप से अपनाने को बढ़ावा मिला है। प्रसंस्करण पर बढ़ते जोर को देखते हुए, संस्थान मूल्य श्रृंखला में मानकों की स्थापना पर भी ध्यान केंद्रित कर रहा है। ऐसे समय में जब विश्व स्वास्थ्य संगठन सहित वैश्विक स्वास्थ्य एजेंसियां सुपारी के सेवन के संबंध में चिंताएं बढ़ा रही हैं, कें.रो.फ.अ.सं.ने सुपारी और स्वास्थ्य पर मजबूत वैज्ञानिक साक्ष्य उत्पन्न करने के लिए बहु-संस्थागत अनुसंधान का समन्वय करने में सक्रिय नेतृत्व किया है।

बागान फसलों में हासिल वैज्ञानिक प्रगति को विभिन्न मंचों के माध्यम से प्रसारित किया गया है, जिसमें जलवायु अनुकूलन पर एक राष्ट्रीय संगोष्ठी, अंतर्राष्ट्रीय नारियल समुदाय (आईसीसी) के सहयोग से एक अंतर्राष्ट्रीय कार्यशाला और बागवानी विज्ञान कांग्रेस के दौरान एक साइड इवेंट के रूप में आयोजित बागान फसल कार्यशाला शामिल है। ये निष्कर्ष उच्च प्रभाव वाली पत्रिकाओं में प्रकाशित किए गए हैं, कई पेटेंट दायर किए गए हैं और कॉपीराइट सुरक्षित किए गए हैं। संस्थान ने प्रशिक्षण कार्यक्रमों, किसान मेलों और डिजिटल और सोशल मीडिया प्लेटफॉर्म के माध्यम से हितधारकों को प्रौद्योगिकियों का सक्रिय रूप से प्रसार भी किया है।

संस्थान की प्रगति महानिदेशक, भा.कृ.अनु.प., नई दिल्ली और सचिव, डेयर; उप महानिदेशक (बागवानी विज्ञान); सहायक महानिदेशक (एफपीसी); विषय वस्तु प्रभागों के सदस्यों; और विभिन्न संस्थान समितियों के निरंतर समर्थन और मार्गदर्शन से संभव हुई है। इस वार्षिक रिपोर्ट को प्रकाशित करने में उनके ईमानदार और सूक्ष्म प्रयासों के लिए संपादकीय समिति को विशेष रूप से सराहना की जाती है।

के.बी. हेब्बार

(के बालचंद्र हेब्बार)
निदेशक

कूडलु

Preface

It is a pleasure to present the Annual Report 2025, which comprehensively documents the significant research advancements and institutional activities of ICAR–CPCRI during the year. The various programmes and achievements have been systematically organized chapter-wise and thematically for the benefit of readers and stakeholders.

After a prolonged period, the year 2025 witnessed favourable market prices for coconut and cocoa. Arecanut prices have remained consistently high over the past few years. However, a majority of farmers could not fully realize these benefits due to low productivity, largely attributed to the adverse impacts of climate change, as well as pest and disease incidences.

The Institute has made commendable progress in developing climate-resilient technologies to mitigate these challenges. Climate-resilient varieties of coconut and cocoa have been developed, released, and notified for cultivation across diverse agro-climatic zones. To augment the supply of quality planting material, several coconut and arecanut varieties and hybrids have been licensed for the establishment of mother orchards. In cocoa, polyclonal orchards have been established in South India and the North Eastern region. While tissue culture technology for large-scale coconut multiplication requires further refinement prior to commercialization, the technology for arecanut has shown promising results.

The Institute has also standardized several agro-techniques aimed at mitigating climate change impacts and reducing the cost of cultivation. Scientific insights into cropping and farming system models have demonstrated their role in improving soil health, regulating microclimate, and enhancing nutritional and livelihood security. Efficient utilization of orchard waste has emerged as a low-cost input strategy. Additionally, customized fertilizers and microbial consortia have been developed to improve nutrient use efficiency and reduce input costs. Efforts are also underway to deploy automated fertigation systems for optimal water and nutrient management.

ICAR–CPCRI has developed eco-friendly parasitoids and biological control agents as part of integrated pest management (IPM) and integrated disease management (IDM) strategies. The Institute has played a leading role in the National Scientific Committee (NSC) and central expert team (CET) in identifying constraints in pest and disease management at the field level. To enable early detection, strengthen surveillance, and improve the precision of interventions, advanced technologies such as artificial intelligence (AI), information and communication technology (ICT), unmanned aerial vehicles (UAVs), and remote sensing are being actively explored.

The coconut value chain has been further strengthened through the development and refinement of several value-added products, including neera-infused coconut flakes and flavoured Kalparasa coconut and milk residue based products, promoting enhanced utilization of by-products. The Institute's impact has been significantly amplified through technology transfer, with 32 technologies commercialized to 67 entrepreneurs, generating a licensing revenue of ₹28.95 lakh and fostering wider adoption of sustainable practices. In view of the increasing emphasis on processing, the Institute is also focusing on establishing standards across the value chain. At a time when global health agencies, including the World Health Organization (WHO), are raising concerns regarding arecanut consumption, CPCRI has taken a proactive lead in coordinating multi-institutional research to generate robust scientific evidence on arecanut and health.

The scientific progress achieved in plantation crops has been disseminated through various platforms, including a National Seminar on climate resilience, an International Workshop in collaboration with the International Coconut Community (ICC), and a Plantation Crops Workshop conducted as a side event during the Horticulture Science Congress. These findings have been published in high-impact journals, with several patents filed and copyrights secured. The Institute has also actively disseminated technologies to stakeholders through training programmes, kisan melas, and digital and social media platforms.

The Institute's progress has been made possible through the continued support and guidance of the Director General, ICAR and Secretary, DARE; the Deputy Director General (Horticultural Science); the Assistant Director General (FPC); members of the Subject Matter Divisions; and various Institute Committees. A special word of appreciation is placed on record for the editorial committee for their sincere and meticulous efforts in bringing out this Annual Report.

Kudlu

(K. Balachandra Hebbar)
Director

कार्यकारी सारांश

भा.कृ.अनु.प.-केन्द्रीय रोपण फसल अनुसंधान संस्थान (भा.कृ.अनु.प.- के.रो.फ.अ.सं.), कासरगोड ने वर्ष 2025 के दौरान नारियल, सुपारी, कोको और ताड़ के लिए अनुसंधान, विकास और विस्तार के अपने अधिदेश को आगे बढ़ाया। संस्थान ने कृषि प्रणालियों में उत्पादकता, लाभप्रदता और स्थिरता बढ़ाने के उद्देश्य से मांग-संचालित, जलवायु-अनुकूल और बाजार-उन्मुख नवाचारों को आगे बढ़ाया। सीमांत अनुसंधान, प्रौद्योगिकी हस्तांतरण, क्षमता निर्माण और संस्थागत भागीदारी में ठोस प्रयासों ने राष्ट्रीय रोपण क्षेत्र को मजबूत किया है।

पादप आनुवंशिक संसाधन उपयोग

नारियल के 464 प्रविष्टियों में से 173 सुपारी और 531 कोको हैं, किस्मों और संकरों के विकास के लिए आशाजनक जननद्रव्य का उपयोग किया जाता है। क्रायो जीन बैंक के तहत, दीर्घकालिक संरक्षण के लिए 17 भ्रूण अभिगम और अठारह पराग अभिगम जमा किए जा चुके हैं।

इस वर्ष दो नारियल किस्मों, 'कल्प नक्षत्र', 'कल्प सुवर्ण' और दो कोको संकर, और 'वीटीएल सीएच 3' और 'वीटीएल सीएच 4' को खेती के लिए जारी किया गया था। सीवीआरसी विमोचन के लिए अधिसूचित दो नारियल किस्म 'कल्प शताब्दी' और 'कल्प सुवर्णा' थी। दीर्घकालिक मूल्यांकन के आधार पर, बेहतर डाब की गुणवत्ता और उपज के साथ हाइब्रिड पीऐचओटी × जीबीजीडी को विमोचित करने के लिए संस्थान स्तर पर सिफारिश की गई है।

क्षेत्रीय जर्मप्लाज्म में 4 प्रवेश जोड़े गए, जिसमें आंध्र प्रदेश से जारी की गई दो नारियल की किस्में, केरल और पश्चिम बंगाल के किसानों के खेतों से सुपारी की एक-एक किस्म शामिल है।

जमीनी परागण तकनीक परागण के लिए आशाजनक पाई गई, जबकि चरित्रांकन के लिए उपक्रम के रूप में पत्ती फेनोलॉजिकल अवलोकन आशाजनक सिद्ध हुआ।

कोको किण्वन तकनीक को चॉकलेट बनाने के लिए अच्छी गुणवत्ता वाले बीन्स का उत्पादन करने के लिए परिष्कृत किया गया है। क्रियोलो क्लोन (वीटीएलसी 532, वीटीएलसी 533) और ट्रिनिटारियो क्लोन (वीटीएलसी 537, वीटीएलसी 538) को बढ़िया / स्वाद वाले कोको, बायोफोर्टिफाइड चॉकलेट और प्रीमियम गुणवत्ता वाले कोको उत्पादों के उत्पादन के उद्देश्य से कोको प्रजनन और खेती के लिए आशाजनक पाया गया।

ताड़ी (पामिरा ताड़) के लिए 120 लक्षणों वाले वर्णनात्मक लक्षण की पहचान की गई है ताकि परिवर्तनशीलता को रेखांकित किया जा सके, जिनमें 31 वानस्पतिक, 20 प्रजनन, 26 गुणवत्ता और 13 अंकुरण लक्षण शामिल हैं, और वर्गीकृत वर्णनकर्ता के दिशानिर्देश प्रकाशित किए गए हैं।

कुल 5.51 लाख गुणवत्तापूर्ण रोपण सामग्री का उत्पादन और वितरण किया गया, जिसमें 0.96 लाख नारियल, 3.87 लाख सुपारी और 0.58 लाख कोको शामिल हैं, जिससे 2.81 करोड़ रुपए राजस्व अर्जित हुआ है।

मास मल्टीप्लिकेशन प्रोटोकॉल का अनुकूलन

शूट पुनर्जनन में महत्वपूर्ण मेटा-टोपोलिन और पिक्लोराम समृद्ध वाई3 माध्यम का उपयोग करके नारियल सोमैटिक भ्रूणजनन के आशाजनक सफलता परिणाम हैं। मूल प्रेरण और समर्थन करने की दिशा में, आर्द्रता और पोषक तत्वों की डिलीवरी को नियंत्रित करने के लिए पर्याप्त सुविधाओं के साथ एक आर्द्रता नियंत्रण के साथ संवर्धन विकास कक्ष स्थापित किया गया।

अरेकेनट में, पिकलोरम और मेटा-टोपोलिन का उपयोग करके एक कुशल अप्रत्यक्ष दैहिक भ्रूणजनन प्रोटोकॉल को बौने संकर वीटीएलएएच-2 के लिए मानकीकृत किया गया था, जिसमें एससीओटी मार्करों के माध्यम से 100% आनुवंशिक निष्ठा की पुष्टि की गई थी। सुपारी के अपरिपक्व पुष्पक्रम संस्कृति से लगभग 5000 एक्सप्लांट और बौने पौधे प्राप्त किए जाते हैं, जिन्हें प्रयोगशाला में रखा जाता है। सुपारी के बड़े पैमाने पर गुणन की दिशा में कदम हाइड्रोपोनिक रूप से कठोर पौधों के बेहतर परिणामों के साथ एक्स विट्रो को समेकित किया जा रहा है जो उच्च बायोमास और शारीरिक लक्षण दिखाते हैं। भ्रूण संवर्धन और बौने और वाईएलडी-सहिष्णु प्रकार के 1,100 से अधिक पौधे इन विट्रो रखरखाव संस्कृति के अधीन हैं।

फसल प्रणाली और संसाधन प्रबंधन प्रणाली उत्पादकता के लिए

नारियल के बीच-बीच में मल्टी कट चारा ज्वार (सीओ 31) को 25 किलो प्रति पाम एफवाईएम / मुर्गी पालन / बकरी खाद + डेयरी इकाई और मुर्गी पालन के साथ गाय के गोबर की घोल लगाने से आय रु. 6,27,581/- उपलब्ध हुआ है।

फर्टिगेशन अध्ययनों से प्रति वर्ष 169 नारियल की उपज के साथ समान संकेत मिला। कोको के उच्च घनत्व वाले रोपण से फलों की संख्या में वृद्धि का संकेत मिलता है।

10, 20 और 40 साल पुराने बागानों में सुपारी-कोको प्रणाली में कार्बन पृथक्करण क्रमशः 14.8 सी टी प्रति हेक्टेयर, 23.2 सी टी प्रति हेक्टेयर और 37.2 सी टी प्रति हेक्टेयर था। नारियल के बगीचे में 7-10 वर्षों के बीच यह प्रति वर्ष 1.11 टन प्रति हेक्टेयर था।

राइजोस्फीयर सूक्ष्माणु बैसिलस सेरेसियस, बैसिलस प्यूमिलस और बैसिलस सेफेन्सिस ने 1 से 3% नैकलियम आयन सांद्रता और अनुकूल तापमान 37-45^{O}C पर संतोषजनक वृद्धि दिखाई।

नारियल पानी से बैक्टीरियल सेलुलोज और नाटा डी कोको विकसित करने की तकनीक विक्सित की गई । जैविक मल्चिंग के प्रभाव ने बेसिन के तापमान को काफी कम कर दिया है और भूसी, पत्ती और संयोजनों के साथ मल्चिंग का अध्ययन किया जा रहा है।

कृत्रिम बुद्धिमत्ता और सूचना एवं संचार प्रौद्योगिकी

नारियल के बागानों के लिए एक एआई-संचालित स्मार्ट निगरानी प्रणाली विकसित की गई थी जिसमें कीटों, बीमारियों और कैनोपी असामान्यता का पता लगाने के लिए ड्रोन-आधारित हवाई इमेजिंग को स्वचालित गहन शिक्षण विश्लेषण के साथ एकीकृत किया गया था। यह प्रणाली प्रत्येक ताड़ -वार स्वास्थ्य वर्गीकरण और भू-स्थानिक मानचित्रण प्रदान करने के लिए YOLOV8 ऑब्जेक्ट डिटेक्शन और डीप सॉर्ट ट्रैकिंग का उपयोग करती है, जो मैनुअल स्काउटिंग की सीमाओं से परे तेजी से, बड़े क्षेत्र की निगरानी को सक्षम बनाती है। मॉडल ने उच्च सटीकता (एमएपी @ 0.5 से 0.95 तक) का प्रदर्शन किया और फ्लास्क-आधारित वेब प्लेटफॉर्म के माध्यम से इसे चालू किया गया जो लक्षित हस्तक्षेपों के लिए एनोटेटेड वीडियो, रोपण मानचित्र और सस्य-स्तरीय स्वास्थ्य रिपोर्ट तैयार करता है।

नारियल में सटीक छिड़काव के लिए एक `रोबोटिक हाथ'-सहायता प्राप्त ड्रोन प्रोटोटाइप भी संवर्धन किया गया। अनुकूलित प्रणाली कलियों, स्पिंडल और आंतरिक केनोपी के लिए बहु-दिशात्मक अनुप्रयोग को सक्षम बनाती है, जो पारंपरिक नीचे की ओर ड्रोन स्प्रे की बाधाओं को दूर करती है। फ़ील्ड प्रदर्शनों ने प्रमुख कीटों और बीमारियों के प्रबंधन के लिए सटीक, बहाव-कम और साइट-विशिष्ट वितरण की पुष्टि की।

सुपारी में यूएवी छिड़काव के लिए मानक संचालन प्रक्रियाओं को अनुकूलित किया गया था, बेहतर बूंद जमाव और कैनोपी प्रवेश के लिए आदर्श उड़ान ऊंचाई, गति और स्प्रे मात्रा की पहचान की गई थी। तुलनात्मक मूल्यांकन से पता चला कि ड्रोन छिड़काव बेहतर एकरूपता, कम जमीनी नुकसान और बेहतर ऑपरेटर सुरक्षा प्रदान करता है, हालांकि मैनुअल छिड़काव बारीकी से लक्षित गुच्छे के उपचार के लिए बेहतर बना हुआ है। सामूहिक रूप से, ये प्रौद्योगिकियां बागान फसलों में कुशल निगरानी और सटीक पौध संरक्षण के लिए स्केलेबल डिजिटल और मशीनीकृत समाधान स्थापित करती हैं।

सतत उत्पादन के लिए एकीकृत कीट और रोग प्रबंधन

2025 के दौरान, भाकृअनुप-केंद्रीय रोपण फसल अनुसंधान संस्थान ने बदलते जलवायु के तहत नारियल, सुपारी और कोको की सुरक्षा के लिए समग्र आईपीडीएम दृष्टिकोणों को उन्नत किया। निगरानी ने नारियल गैंडा भृंग के गुआम हैप्लोटाइप की अनुपस्थिति की पुष्टि की, जबकि क्षेत्र-व्यापी अनुप्रयोग ने *मेटारिज़ियम माजस* द्वारा पत्ती क्षति को 50% से अधिक कम कर दिया। लाल ताड़ के घुन के लिए अनुकूलित पालन और अस्थिर-आधारित निदान विकसित किए गए थे, और एक प्रभावी आईपीएम मॉड्यूल ने नारियल सफेद ग्रब आबादी को लगभग 90% तक दबा दिया था, साथ ही उपज में भी लाभ हुआ था। कल्प एनास्टैटस अंडे कार्ड ने उभरते हुए कोरीड कीट के क्षेत्र-स्तरीय जैविक नियंत्रण को सक्षम किया, और द्वीपों में आक्रामक सफेद मक्खियों के नए रिकॉर्ड दर्ज किए गए। सुपारी में, लाल ताड़ के कीट के लिए पर्यावरण अनुकूल विकल्पों को मानकीकृत किया गया था, और कोको में, सिलिकॉन पोषण और एक उपन्यास एंटोमोपैथोजेनिक फ्यूजेरियम ने चाय मच्छर कीड़े के खिलाफ आशा दिखाई। रोग के मोर्चे पर, *कोलेटोट्राइकम सियामेंस* के कारण नारियल का एन्थ्रेक्नोस फल सड़न और सुपारी में *फाइटोफ्थोरा मीडी* की विस्तारित रोगजनकता पहली बार दर्ज की गई थी। किसान-अनुकूल बायो फॉर्मूलेशन जैसे ट्राइको-ब्लॉक, ट्राइकोडोल और कोको ट्राइकोलेट; आरपीए-आधारित वायरल डायग्नोस्टिक्स; और बड़े पैमाने पर प्रदर्शनों ने लचीले, कम-रासायनिक बागान स्वास्थ्य प्रबंधन को मजबूत किया।

जैवसक्रिय यौगिकों का निष्कर्षण और लक्षण वर्णन और मूल्य संवर्धन, ताड़ और कोको में पूर्व और उत्तर-कटाई मशीनीकरण

2025 के दौरान अनुसंधान में जलवायु-अनुकूल सुपारी जीनोटाइप विकसित करने, नारियल में मूल्य संवर्धन और खेत पर प्रसंस्करण के लिए मशीनीकरण पर ध्यान केंद्रित किया गया। ग्रेडेड नमी तनाव के तहत प्रमुख सुपारी किस्मों के मूल्यांकन में मंगाला को अत्यधिक जल-उपयोग-कुशल, बेहतर पत्ती जल स्थिति, ऑस्मोटिक समायोजन और 25% मिट्टी की नमी पर भी चयापचय स्थिरता बनाए रखने के रूप में पहचाना गया। इस जीनोटाइप ने न्यूनतम उपज दंड के साथ एक मजबूत जल-संरक्षक रणनीति का प्रदर्शन किया, जिससे यह सूखा-प्रवण क्षेत्रों के लिए एक आशाजनक उम्मीदवार बन गया।

15 सुपारी जीनोटाइप की व्यापक जैव रासायनिक प्रोफाइलिंग ने विकासात्मक चरणों में एल्कलॉइड संचय में महत्वपूर्ण भिन्नता का खुलासा किया। मंगला ने सबसे अधिक एरेकोलाइन और गुवाकोलाइन सामग्री दर्ज की, जबकि शतमंगला ने कम स्तर प्रदर्शित किया, जो विशिष्ट अंतिम उपयोगों के लिए संकर चयन के लिए एक वैज्ञानिक आधार प्रदान करता है। पुष्पक्रमों के केमोटाइप विश्लेषण ने समृद्ध फेनोलिक और एंटीऑक्सिडेंट क्षमता की पुष्टि की, जिससे न्यूट्रास्युटिकल उपयोग के रास्ते खुल गए।

मूल्य श्रृंखला विकास में, एक पोर्टेबल नारियल के रस सांद्रक को परिष्कृत किया गया और कई स्थानों पर सफलतापूर्वक क्षेत्र-परीक्षण किया गया, जिससे कम श्रम और ऊर्जा आवश्यकताओं के साथ स्वच्छ, यथास्थान नारियल के रस सांद्रण का उत्पादन संभव हो सका। सौर ऊर्जा से चलने वाले संचालन की दिशा में प्रयास जारी हैं। कई नारियल आधारित खाद्य उत्पादों को मानकीकृत किया गया था, जिसमें कम वसा वाले नारियल के आटे से समृद्ध गेहूं उत्पाद, वेफर शंकु, नारियल दूध कुल्फी और स्वादयुक्त कलपरसा शामिल थे, सभी ने बेहतर पोषण गुणवत्ता और उपभोक्ता स्वीकार्यता दिखाई।

हरित शक्ति का उपयोग करके कुशल कर्नेल निष्कर्षण के लिए डीसी संचालित स्नोबॉल नारियल मशीन विकसित की गई थी। एक रोटरी ड्रायर-एवं कोटिंग मशीन, और एक स्वचालित कोको किण्वक, जिन्हें मूल्य संवर्धन के लिए उद्यमियों को हस्तांतरित किया गया था।

सामाजिक आर्थिक और संस्थागत अनुमान

बागान फसलों के क्षेत्र में कुल 499 प्रशिक्षण आयोजित किए गए जिससे 16500 व्यक्तियों को लाभ हुआ। प्रगतिशील कृषि क्षेत्रों में संस्थागत विकास को ले जाने के लिए जिम्मेदार लगभग 1050 विभागीय अधिकारियों को भी प्रशिक्षित किया गया।

संस्थान ने 2025 के दौरान केंद्रित एससीएसपी कार्यक्रमों को लागू किया, जिसमें नारियल, सुपारी और कोको प्रौद्योगिकियों में 114 एससी युवाओं के लिए 32 कौशल विकास प्रशिक्षण आयोजित किए गए। पूर्वोत्तर क्षेत्र को उन्नत प्रौद्योगिकियों का ज्ञान देने के लिए सात राज्यों में 44 प्रशिक्षण और जागरूकता कार्यक्रम आयोजित किए गए। भाकृअनुप- के.रो.फ.अ.सं., अनुसंधान केंद्र, काहिकुची द्वारा

भाकृअनुप -डीएमएपीआर और भाकृअनुप -आईआईएसआर असम के सहयोग से एक किसान मेला आयोजित किया गया।

कोको क्षेत्र में अंतर्राष्ट्रीय व्यापार परिदृश्य के फायदे और नुकसान तथा व्यापार नीतियों के प्रभाव पर चर्चा की गई। ताज़ा नारियल, परिपक्व नारियल और छिले हुए नारियल जैसे विभिन्न चरणों में एक किलो नारियल बनाने के लिए आवश्यक परिवर्तन कारक क्रमशः 0.88, 1.19 और 2.1 पाई गई।

भाकृअनुप-कें.रो.फ.अ.सं. ने अनुसंधान, प्रौद्योगिकी वितरण और हितधारक सहभागिता में 2025 के दौरान उल्लेखनीय प्रगति दर्ज की। वैज्ञानिकों ने कुल 92 शोध लेखों में से 53 उच्च प्रभाव वाले प्रकाशनों (7 एनएएएस स्कोर से अधिक) का योगदान दिया और ज्ञान प्रसार को मजबूत करने के लिए तकनीकी बुलेटिन और लोकप्रिय लेख प्रकाशित किए। तीन पेटेंट और कॉपीराइट दायर किए।

इस वर्ष, तीन वैज्ञानिकों को दौरे पर विदेश में अपने शोध पत्र प्रस्तुत करने का अवसर मिला। 9 वैज्ञानिक, 3 तकनीकी और 1 प्रशासनिक कर्मियों ने अपनी व्यावसायिक क्षमता और कौशल को बढ़ाने के लिए प्रशिक्षण लिया।

संस्थान को प्रतिष्ठित राष्ट्रीय और अंतर्राष्ट्रीय मान्यता मिली, और अनुसंधान टीमों ने वैज्ञानिक मंचों पर सर्वश्रेष्ठ प्रस्तुति पुरस्कार अर्जित किए। भाकृअनुप-कें.रो.फ.अ.सं., कासरगोड़ में एलएसजी संस्था से ग्रीन कैंपस प्रमाणपत्र अग्रसारित हुआ। व्यापक प्रशिक्षण, किसान मेला, किसान दिवस और अंतर्राष्ट्रीय कार्यक्रमों ने क्षमता निर्माण और प्रौद्योगिकी प्रसार को बढ़ाया है।

कुल 72 अनुसंधान परियोजनाओं को मजबूत राष्ट्रीय और वैश्विक सहयोग के साथ कार्यान्वित किया गया। संस्थान ने 70 प्रौद्योगिकियों का व्यावसायीकरण किया, जिससे लाइसेंसिंग के माध्यम से 28.95 लाख और क्षेत्रीय स्टेशनों में कृषि उत्पादों की बिक्री से 84.63 लाख रुपये प्राप्त हुए।

स्वच्छ भारत अभियान 2025 को के.रो.फ.अ.सं. और केवीके में स्वच्छता अभियान, वृक्षारोपण अभियान, प्रतियोगिताओं और जागरूकता कार्यक्रमों के अंतर्गत मनाया गया।

III

Executive Summary

The ICAR–Central Plantation Crops Research Institute (ICAR-CPCRI), Kasaragod, continued to advance its mandate of research, development, and extension for coconut, arecanut, cocoa and palmyrah during the year 2025. The Institute pursued demand-driven, climate-resilient, and market-oriented innovations aimed at enhancing productivity, profitability, and sustainability in plantation farming systems. Concerted efforts in frontier research, technology transfer, capacity building, and institutional partnerships strengthened the national plantation sector.

Plant Genetic Resources Utilization

Out of the 464 accessions of coconut, 173 arecanut and 531 cocoa, promising ones are utilized for development of varieties and hybrids. Under cryo gene bank, 17 embryo accessions and eighteen pollen accessions were deposited for long term conservation.

This year two coconut varieties, Kalpa Nakshatra, Kalpa Suvarna and two cocoa hybrids, and VTL CH 3 & VTL CH 4 were released for cultivation. Two coconut varieties Kalpa Shatabdi and Kalpa Suvarna notified for CVRC release. Based on long-term evaluation, the hybrid PHOT × GBGD with its superior tender nut quality and yield was recommended at the Institute level for release.

Accessions were added to the field germplasm, which include two released coconut varieties from Andhra Pradesh, one each of arecanut from farmers' fields of Kerala and West Bengal.

Ground pollination technology was found promising for pollination, while leaf phenological observations as tools for characterization.

Cocoa fermentation technology has been refined to produce good quality beans for chocolate making. The Criollo clones (VTLC 532, VTLC 533) and Trinitario clones (VTLC 537, VTLC 538) were found promising for cocoa breeding and cultivation aimed at producing fine/flavour cocoa, biofortified chocolates, and premium-quality cocoa products.

Descriptor characteristics for palmyrah palms numbering 120 traits with 31 vegetative, 20 reproductive, 26 quality and 13 seedling characters identified for delineating variability and classified descriptor's guidelines published.

A total of 5.51 lakh quality planting materials were produced and distributed, which includes 0.96 lakh coconut, 3.87 lakh arecanut and 0.58 lakh cocoa, earning a revenue of Rs. 2.81 crores.

Optimization of Mass Multiplication Protocols

Coconut somatic embryogenesis has promising breakthrough results by using meta-topolin and picloram enriched Y3 medium, vital in shoot regeneration. Towards root induction and hardening, a novel growth chamber was setup with built-in facilities to control humidity and nutrients delivery. In arecanut, an efficient indirect somatic embryogenesis protocol using picloram and meta-topolin was standardized for the dwarf hybrid VTLAH-2, with 100% genetic fidelity confirmed through SCoT markers. Around 5000 explants and dwarf plantlets are derived from immature inflorescence culture of arecanut are maintained in the laboratory. Steps towards mass multiplication of arecanut are getting consolidated ex vitro with better results of hydroponically hardened plants showing higher biomass and physiological characters. Embryogenic cultures and over 1,100 plantlets of dwarf and YLD-tolerant types are under in vitro maintenance culture.

Cropping Systems and Resource Management for System Productivity

Multi cut fodder sorghum (CO 31) in the interspaces of coconut receiving 25 kg per palm FYM/poultry/goat manure + cow dung slurry along with dairy unit and poultry, net returns of Rs. 6,27,581/- has been achieved.

Fertigation studies indicated uniform nuts with 169

nuts yield per year. High density planting of cocoa indicated increased number of pods.

Carbon sequestration in arecanut-cocoa system was 14.8 C t per ha, 23.2 C t per ha, and 37.2 C t per ha, in 10-year, 20-year and 40-year-old plantations. It was 1.11 t per ha per year between 7-10 years in coconut garden.

Rhizosphere microbial isolates Bacillus cereus, Bacillus pumilus and *Bacillus safensis* showed optimum growth at 1 to 3 % NaCl concentrations and favourable temperature 37-45 ^{o}C.

Technology for developing bacterial cellulose and nata de coco from coconut water refined. Effect of organic mulching significantly reduced basin temperature and mulching with husk, leaf and combinations are being studied.

Artificial Intelligence and Information and Communication Technology

An AI-driven smart surveillance system for coconut plantations was developed by integrating drone-based aerial imaging with deep learning analytics for automated detection of pests, diseases, and canopy abnormalities. The system employs YOLOv8 object detection and Deep SORT tracking to provide palm-wise health classification and geospatial mapping, enabling rapid, large-area monitoring beyond the limitations of manual scouting. The model demonstrated high accuracy (mAP@0.5 up to 0.95) and was operationalized through a Flask-based web platform that generates annotated videos, plantation maps, and palm-level health reports for targeted interventions.

A robotic arm–assisted drone prototype was also designed for precision spraying in coconut. The customized system enables multi-directional application to buds, spindles, and the inner canopy, overcoming constraints of conventional downward drone sprays. Field demonstrations confirmed accurate, drift-reduced, and site-specific delivery suitable for managing major pests and diseases.

Standard operating procedures for UAV spraying in arecanut were optimized, identifying ideal flight height, speed, and spray volume for improved droplet deposition and canopy penetration. Comparative evaluation showed that drone spraying offers better uniformity, reduced ground loss, and enhanced operator safety over manual methods, though manual spraying remains superior for closely targeted bunch treatments. Collectively, these technologies establish scalable digital and mechanized solutions for intelligent surveillance and precision plant protection in plantation crops.

Integrated Pest and Disease Management for Sustainable Production

During 2025, ICAR-CPCRI advanced holistic IPDM approaches to safeguard coconut, arecanut, and cocoa under changing climate. Surveillance confirmed the absence of the Guam haplotype of the coconut rhinoceros beetle, while area-wide application of *Metarhizium majus* reduced leaf damage by over 50%. Optimized rearing and volatile-based diagnostics were developed for red palm weevil, and an effective IPM module suppressed coconut white grub populations by nearly 90% with concurrent yield gains. The Kalpa Anastatus egg card enabled field-level biological control of the emerging coreid bug, and new records of invasive whiteflies were documented in the Islands. In arecanut, eco-friendly options for red palm mite were standardized, and in cocoa, silicon nutrition and a novel entomopathogenic Fusarium showed promise against tea mosquito bug. On the disease front, anthracnose fruit rot of coconut caused by *Colletotrichum siamense* and expanded pathogenicity of *Phytophthora meadii* in arecanut were first reported. Farmer-friendly bio formulations such as Tricho-block, Trichodol, and Cocoa Tricholate; RPA-based viral diagnostics; and large-scale demonstrations strengthened resilient, low-chemical plantation health management.

Extraction and Characterization of Bioactive Compounds and Value Addition, Pre and Post-harvest Mechanization in Palms and Cocoa

Research during 2025 focused on developing climate-resilient arecanut genotypes, value addition in coconut, and mechanization for on-farm processing. Evaluation of major arecanut varieties under graded moisture stress identified Mangala as highly water-use-efficient, maintaining superior leaf water status, osmotic adjustment, and metabolic stability even at 25% soil moisture. This genotype demonstrated a strong water-conservative strategy with minimal yield penalty, making it a promising candidate for drought-prone regions.

Comprehensive biochemical profiling of 15 arecanut genotypes revealed significant variation in alkaloid accumulation across developmental stages. Mangala recorded the highest arecoline and guvacoline contents, while Shatamangala exhibited lower levels, providing a scientific basis for cultivar selection for specific end uses. Chemotypic analysis of inflorescences confirmed rich phenolic

and antioxidant potential, opening avenues for nutraceutical utilization.

In value chain development, a portable coconut sap concentrator was refined and successfully field-tested across multiple locations, enabling hygienic, in-situ production of coconut sap concentrate with reduced labour and energy needs. Efforts toward solar-powered operation are in progress. Several coconut-based food products were standardized, including low-fat coconut flour–enriched wheat products, wafer cones, coconut milk kulfi, and flavoured Kalparasa®, all showing improved nutritional quality and consumer acceptability.

A DC-operated snowball tender coconut machine was developed for efficient kernel extraction using green power. A rotary dryer-cum-flavour coating machine, and an automated cocoa fermenter, which were transferred to entrepreneurs for value addition.

Socio economic and institutional projections

A total of 499 trainings were conducted benefitting 16500 persons in the plantation crops sector. About 1050 departmental officials, responsible to take institutional developments to the progressive farmlands were also trained.

The Institute implemented focused SCSP programmes during 2025, conducting 32 skill development trainings for 114 SC youth in coconut, arecanut, and cocoa technologies. To impart advance technologies to north eastern region, 44 training and awareness programmes were conducted in seven states. A kisan mela was conducted by ICAR-CPCRI, Research Centre, Kahikuchi, in collaboration with ICAR-DMAPR and ICAR-IISR in Assam.

Pros and cons of international trade scenario and impact of trade policies were discussed in the cocoa sector. Conversion factors required to make one kg nut from number of coconuts at various stages such as fresh nuts, mature nuts and husked nuts varied 0.88, 1.19 and 2.1, respectively.

ICAR-CPCRI recorded notable progress during 2025 in research, technology delivery, and stakeholder engagement. Scientists contributed 53 numbers of high-impact publications (>7 NAAS score) out of the total 92 research articles and brought out technical bulletins and popular articles to strengthen knowledge outreach. Filed three patents and copyrights.

This year, three of the scientists had the opportunity to present their research papers abroad on deputation. 9 scientific, 3 technical and 1 administrative personnel underwent trainings to enhance their professional capacity and skills.

The Institute received prestigious national and international recognition, and research teams earned best presentation awards at scientific forums. The Green Campus certificate received from LSG institution at Kasaragod. Extensive training, Kisan Mela, Farmers' Day, and international programs enhanced capacity building and technology dissemination.

A total of 72 research projects were implemented with strong national and global collaborations. The Institute commercialized 67 technologies, generating ₹28.95 lakh through licensing and ₹84.63 lakh from sale of farm produce across regional stations.

Swachh Bharat Abhiyan 2025 was observed through cleanliness drives, tree planting campaigns, competitions, and awareness programmes across CPCRI and KVKs.

IV

Vision, Mission And Mandate

Vision

Develop ICAR-CPCRI as a technology generation and repository centre, wherein the Institute strives to showcase, demonstrate and compare world-wide technologies in the commodity chains to make India the global leader.

Mission

To develop technologies that enhance resource use efficiency, profitability and livelihood security of people who depend on plantation crops.

Mandate

- Basic, strategic and applied research to enhance sustainable productivity, quality and utilization in coconut, arecanut, cocoa and palmyrah,
- Repository of genetic resources and scientific information,
- Transfer of technology, capacity building and impact assessment of technologies, and
- Coordinate research and validate technologies through AICRP on Plantation Crops.

V

Institute Profile

ICAR-Central Plantation Crops Research Institute (ICAR-CPCRI), the premier research institution in the National Agricultural Research System of India, is presently mandated to conduct research on plantations crops (coconut, arecanut, cocoa and palmyrah). It had a modest beginning as Coconut Research Station in 1916 under the erstwhile Madras Presidency. Since its inception, it has served the farming community with a distinction through exemplary research, generation of appropriate technologies and development of the skilled human resource.

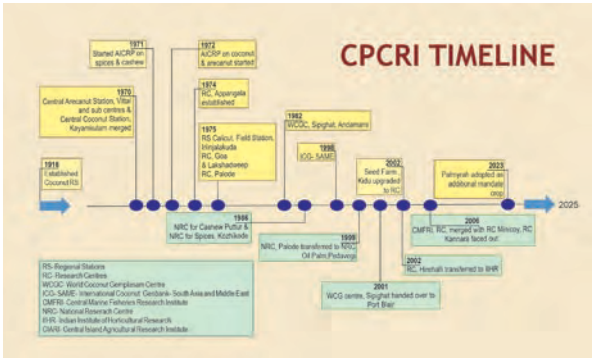
Historical Perspective

The Coconut Research Station at Kudlu (Kasaragod) was taken over by the Indian Central Coconut Committee and established the Central Coconut Research Station (CCRS), Kasaragod in 1947 and the Central Coconut Research Station (CCRS) at Kayamkulam was also established exclusively for tackling diseases in coconut. Coconut research became an integral part of the national agricultural research system in 1966 when the Indian Central Coconut Committee was abolished and the coconut research was taken over directly by the Indian Council of Agricultural Research. In 1970, the Central Plantation Crops Research Institute was established with the headquarters at Kasaragod, by merging the Central Coconut Research Stations at Kasaragod and Kayamkulam and the Central Arecanut Research Station at Vittal along with its five substations at Kannara, Mohitnagar, Kahikuchi, Hirehalli and Palode.

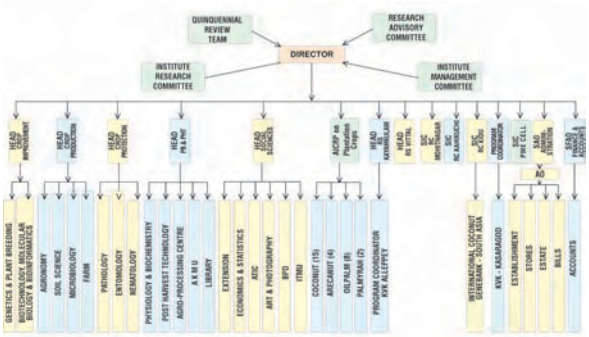
Since 1986, crops like spices, cashew, and oil palm were taken out of the purview of the institute with the formation of dedicated research institutions like Indian Institute of Spices Research, Kozhikode, Directorate of Cashew Research, Puttur and Indian Institute of Oil Palm Research, Pedavegi. Some of the erstwhile Research Centres at Hirehalli, Palode, Appangala, Kannara, Port Blair and Minicoy were either handed over to sister ICAR institutions or phased out. At present, the mandated crops are limited to coconut, arecanut, cocoa and palmyrah and the research and frontline extension aspects of these crops are undertaken under five divisions *viz*., Crop Improvement, Crop Production, Crop Protection, Physiology, Biochemistry and Post-Harvest Technology and Social Sciences at the Institute. The Regional Station at Kayamkulam (Kerala) is mandated to work on pests and disease problems in coconut, while the Regional Station at Vittal (Karnataka) caters to research and extension in arecanut and cocoa. The Research Centres at Kahikuchi (Assam) and Mohitnagar (West Bengal) undertake location-specific research in these crops, while the Research Centre at Kidu (Karnataka) hosts the International Coconut Gene Bank for South-Asia and the Middle East (ICG-SAME) and also caters to the large-scale production of quality planting materials in the mandate crops. Besides, there are two KVKs (at Kasaragod and Kayamkulam) functioning under the Institute.

All India Co-ordinated Coconut and Arecanut Improvement Project (AICCAIP) started functioning from 1972 at CPCRI, Kasaragod which was later renamed as All India Coordinated Research Project (AICRP) on Palms in 1986 and during 2025 its name is further revised as AICRP on Plantation Crops in 2025. The AICRPP has 15 centres working on coconut, six on oil palm, four on arecanut, four on palmyrah and seven on cocoa.

CPCRI Timeline



Organogram



Achievements at a Glance

Phenotyping and Genotyping for Climate Resilient Traits/Genotypes and Quality Parameters

- ICAR- CPCRI maintains the world largest repository in coconut with 464 accession of (332 indigenous and 132 exotic genotypes) from 28 countries, 173 germplasm collections in arecanut of which 23 are exotic and 160 indigenous, 536 cocoa germplasm collections (475 exotic and 61 indigenous).
- Through intensive breeding and evaluation, 24 improved coconut varieties including 7 hybrids involving talls and dwarfs as parents 12 arecanut variety including 3 dwarf hybrid and 8 Cocoa variety 5 hybrids have been released.
- Two coconut varieties Kalpa Shatabdi and Kalpa Suvarna notified by the Central Sub-Committee for Notification of Crop Varieties.
- Kalpa Nakshatra, a D×T hybrid between Chowghat Orange Dwarf and West African Tall was recommended by SVRC for cultivation in Kerala. It is a multipurpose variety suitable for copra, oil, tender nut and Kalparasa production.
- Zygotic embryos from 17 accessions and pollen from 18 accessions were cryo-preserved at NBPGR. During the year, IC numbers were obtained for 34 indigenous accessions conserved in the NAGS.
- Variety registration proposals of coconut varieties *viz*., Kalpa Ratna and Kalpa Srestha submitted to PPVFRA for registration and published in Plant Variety Journal.
- Coconut varieties, Kalpa Suvarna, Kalpa Samrudhi, Kalpa Shatabdi and arecanut variety Shatamangala were licensed to Entrepreneurs.
- The Institute has produced quality planting materials one lakh of coconut, four lakhs of arecanut and 0.5 lakhs of cocoa along with others seedlings of local importance.
- The whole genome of male palmyrah plant has with a size of 6.93 Gb.

Optimization of mass multiplication protocols

- Woody Plant Medium (WPM) with TDZ (5 mg L^{-1}) alone or in combination with NAA was best suited for culture initiation in terms of minimum browning and enhanced vegetative bud formation. Maximum number of multiple shoots (12.5) were recorded in MS media supplemented with 1 mg per L of NAA and BAP (2 mg L^{-1}).
- Sixty-five sweet endosperm-type coconut embryos were rescued and grown in a culture medium. Thirty plantlets from previous cultures are in the rooting medium. Ten hardened plantlets are in the greenhouse. Embryos from 29 accessions, pollen from 20 accessions and DNA from 16 accessions have been cryopreserved.
- The first successfully hardened tissue culture WCT palm, planted on 27 November 2020, began flowering in April 2024, with new bunches emerging at 25-28 day intervals, showcasing the potential for accelerated growth and increased yield. About 100 dwarf and 25 Yellow leaf disease tolerant inflorescence cultured plants are ready for planting in field.

Input use efficiency for higher productivity and environmental security

- Three *Bacillus* isolates were screened for their tolerance to high temperatures and varying NaCl concentrations. *Bacillus safensis* tolerated up to 14% NaCl, while *Bacillus cereus* tolerated up to 10% NaCl.
- Four Komagataeibacter isolates were effective for producing *nata-de-coco*, bacterial cellulose, and vinegar, yielding higher bacterial cellulose output.
- Organic nutrient management resulted in the highest green multi-cut fodder sorghum yield (CO 3) in successive years (79.9 t ha^{-1} in Year and 70.7 t ha^{-1} in Year) surpassing yields from chemical and integrated nutrient management (INM) methods.
- The pentagonal method of high-density planting (0.6m × 1.2m) for cinnamon as an intercrop in coconut resulted in higher quill yield (631.9 kg ha^{-1} in the first, 900 kg ha^{-1} in the second, and 971.0 kg ha^{-1} in the third harvest) compared to the traditional 2m x 2m planting method.
- Geographical variability in the heavy metal

content of cocoa beans was observed across major cocoa-growing regions in India. All values were within the safe limits set by EU food safety standards.

- Applying 150-200 per cent of the recommended soil test based nutrient application through fertigation to hybrid coconut (Kalpa Sankara) resulted in significantly higher yields, reduced puny coconuts, and improved copra size.
- Soil moisture conservation practices, such as husk incorporation combined with leaf mulching, resulted in higher soil moisture retention and lower soil temperature compared to individual husk or leaf treatments.
- In organic coconut cultivation, applying organic manure alone reduced the potassium (K) content in leaves below the critical level. Therefore, supplementing with 50 per cent K through sulfate of potash was found effective in increasing the leaf K content.
- Diagnosis and severity evaluation of nutrient deficiency symptoms in cocoa was successfully carried out using machine learning and deep learning approaches.

Integrated Pest and Disease Management for sustainable production

- Molecular and morphological characterization of fourth valid *Steinernema* sp *(S. keralense)* in India.
- Development of invert emulsion formulation of *Beauveria bassiana* (CPCRI Bb-045) for the management of red palm weevil with over 90% mortality.
- IPM module for the management of rhinoceros beetle through integration of biocontrol agents *viz.*, *Oryctes rhinoceros* Nudivirus (OrNV), Green Muscardine Fungus (GMF), *Metarhizium anisopliae,* botanicals (leaf axil filling with neem/ marotti/ pongamia cake @ 250 g mixed with equal volume of sand) and aggregation pheromone embedded nanomatrix trap @ 1 trap per hectare has been developed. Area-wide (1575 ha) farmer-participatory experiments undertaken at Krishnapuram (Kerala), Semanampathy (Tamil Nadu), Voodimudi (Andhra Pradesh) and Doddenhally (Karnataka) significantly reduced the spear leaf and inflorescence damage to an extent of 81.2 per cent.
- Integrated management technologies involving complete destruction of infested palm, close monitoring and sustained surveillance for early diagnosis, leaf axil filling of chlorantraniliprole sachet, curative management with imidacloprid (0.02%) and pheromone trap @1 trap per hectare were effective in the management of red palm weevil. Community level technology convergence and large-area adoption of IPM technologies conducted in 2150 ha in Bharanikavu (Kerala), Palladam (Tamil Nadu), Ambajipet (Andhra Pradesh) and Bidramamandi (Karnataka) could reduce the pest incidence to 56.8 per cent.
- An acoustics-sensor based red palm weevil detector in coconut was developed with 80 per cent accuracy.
- IPM technologies for the suppression of eriophyid mite developed by the Institute involving 2 per cent neem oil-garlic emulsion spray, root feeding of azadirachtin 10000 ppm @ 10 mL + 10 mL water and soil and palm health management practices reduced pest incidence to the tune of 71.4 per cent.

Use of artificial intelligence (AI) and information and communication technology (ICT) for increased efficiency and reduced costs

- A UAV spraying configuration of 2 m height with an 8 s duration was recommended as the most effective strategy for tall crops with dense canopies, such as coconut trees. This approach maximizes pesticide application efficiency while minimizing environmental contamination and resource wastage.
- Installed automated fertigation system in coconut-based cropping system.
- CPCRI entered into a collaboration with Amrita University, Kollam, to develop an innovative system for ground-assisted detection and delivery of pest control measures at the tree canopy level, using fiber poles to enhance reach and effectiveness.
- Species Distribution model was used to predict the potential current and future distribution of lepidopteran pest, *Opisina arenosella,* under three typical emission scenarios in 2050 and 2070 with 19 bioclimatic variables in India. Potential suitable areas for *O. arenosella* establishment were mostly found in all coastal and southern states of India. Model predicted that the unsuitability areas are found to increase under future changing climate scenarios in contrast to the current scenario indicating that this pest will not be spreading and expanding to newer areas

in the future climate scenarios. However, the pest will continue to pose as a major problem in the southern states necessitating the need for refining management strategies under changing climate scenarios.

- Temperature plays a crucial role in the pathogenicity and survival of *Phytophthora* isolates, impacting their ability to spread and cause disease.
- An Android-based whitefly detection system was developed utilizing deep learning techniques, specifically leveraging the YOLOv5 algorithm.

Extraction and characterization of bioactive compounds and Value addition

- Kalpa Crown Observatory helps recording for the first time the physiological parameters of intact coconut leaves of adult palms.
- System analysis revealed distinct differences in soil and leaf nutrient status, leaf metabolites, and rhizosphere microbiome in water-stress-resistant adult coconut palms in farmers' fields.
- Major alkaloids, arecoline, arecaidine and guvacine, in mature arecanuts estimated for 13 genotypes.
- Geographical differences in cocoa beans for functional molecules *viz.* theobromine, epicatechin, and caffeine detected.
- A positive impact of Virgin Coconut Oil (VCO-Hot) in arresting cell cycle observed in Triple-Negative Breast Cancer Cell lines (CPCRI-KSHEMA).
- CMR plus cereal flour composites being analyzed for in vivo glycemic index in human trials (CPCRI-MDRF).

Pre and post-harvest mechanization in palms and cocoa

- Developed and commercialized rotary dryer cum flavor coating machine to produce coconut chips
- Developed and commercialized process technology to produce flavoured coconut milk
- Developed coconut slicing cum flaking machine
- Optimized two variants of carbonated coconut water-based beverage
- Developed spice infused frozen coconut delicacy
- Developed coconut milk residue incorporated bean-to-bite dark chocolate.
- Developed infrared assisted hot air dryer to produce coconut chips.
- Development dynamics of alkaloids in arecanut (*Areca catechu* L.) genotypes.
- Development of low-fat coconut flour incorporated wheat flour and puttu powder.

Technology evaluation, impact and entrepreneurship development

- FFP activities were scaled up: crop varieties were enhanced to 54 from 8, cropping intensity to 163 from 106, and livelihood index to 75.62 from 62.57.
- Completed field survey in 5 states for standardization of conversion factor of coconut fruit number to weight.
- Developed computer/mobile apps like Ask Kalpa & CPCRI Bill desk.
- Developed/refined term sheet for Restructured weather-based Crop Insurance in coconut.
- Delineated the reasons for price fluctuations experienced in the coconut sector and strategies were suggested.
- Field study in perspective value chain of arecanut was conducted in the major trade hubs across the country.
- Global value chain analysis of coconut sector in perspective of food safety standards was conducted among coconut manufacturing exporters.
- Brain storming was conducted on issues of declining coconut productivity with the participation of 52 stakeholders.
- ICAR-CPCRI organised 44 training programmes along with frontline demonstration. It comprises 15 numbers of training programmes and stakeholders' meetings conducted in Assam, 10 in Meghalaya, 8 in Tripura, 2 in Mizoram, 6 in Arunachal Pradesh and one in Nagaland during 2025.
- As a part of Viksit Krishi Sankalp Abhiyan, ICAR-CPCRI organized interaction meetings, demonstrations and skill trainings for enhancing crop productivity, farmer profitability, and environmental sustainability. ICAR-CPCRI, RC, Kahikuchi participated in VKSA programme in Chirang district Assam and trained around 7,700 farmers.

Other Events

- Conducted Kisan Mela, farmer interfaces, seminars, workshops and field demonstrations to popularize the technologies.
- The Institute has commercialized more than 68 technologies, signed 446 MoAs for transfer of technology know-how and realized a revenue of Rs. 1.224 cr.
- Procured high end equipments *viz*., Atomic Absorption Spectrophotometer, Texture analyser, Microscopes etc.

Crops, Area, Altitude and Research Undertaken at Different Locations

Headquarters

KASARAGOD (Estd.: 1916), Crops: Coconut, Arecanut, Cocoa and Palmyrah, Area 71.17 ha; 10.7m MSL

Priority areas of research: Genetic resources management, breeding, biotechnology, water and nutrient management, organic cultivation, cropping/ farming system, microbiology, pests and diseases management, physiology and biochemistry, value addition and farm mechanisation, economics, statistics and transfer of technology. Various activities are envisaged under five divisions *viz*., Crop Improvement, Crop Production, Crop Protection, Physiology, Biochemistry and Post Harvest Technology and Social Sciences.

Regional Stations

KAYAMKULAM (Estd.: 1947), Crops: Coconut and palmyrah, Area 24.17ha, 3 m MSL

Priority areas of research: Palmyrah collections, etiology and management of root (wilt) and other diseases, pests and nematodes management

VITTAL (Estd.: 1956), Crops: Arecanut and Cocoa, Area 68.34 ha; 58 m MSL

Priority areas of research: Genetic resources management, breeding, production and protection, cropping systems and drought tolerance.

Research Centres

KAHIKUCHI (Estd.: 1958), Crops: Arecanut Area 15.76 ha; 48 m MSL

Priority areas of research: Cropping system, crop protection and production of quality planting materials.

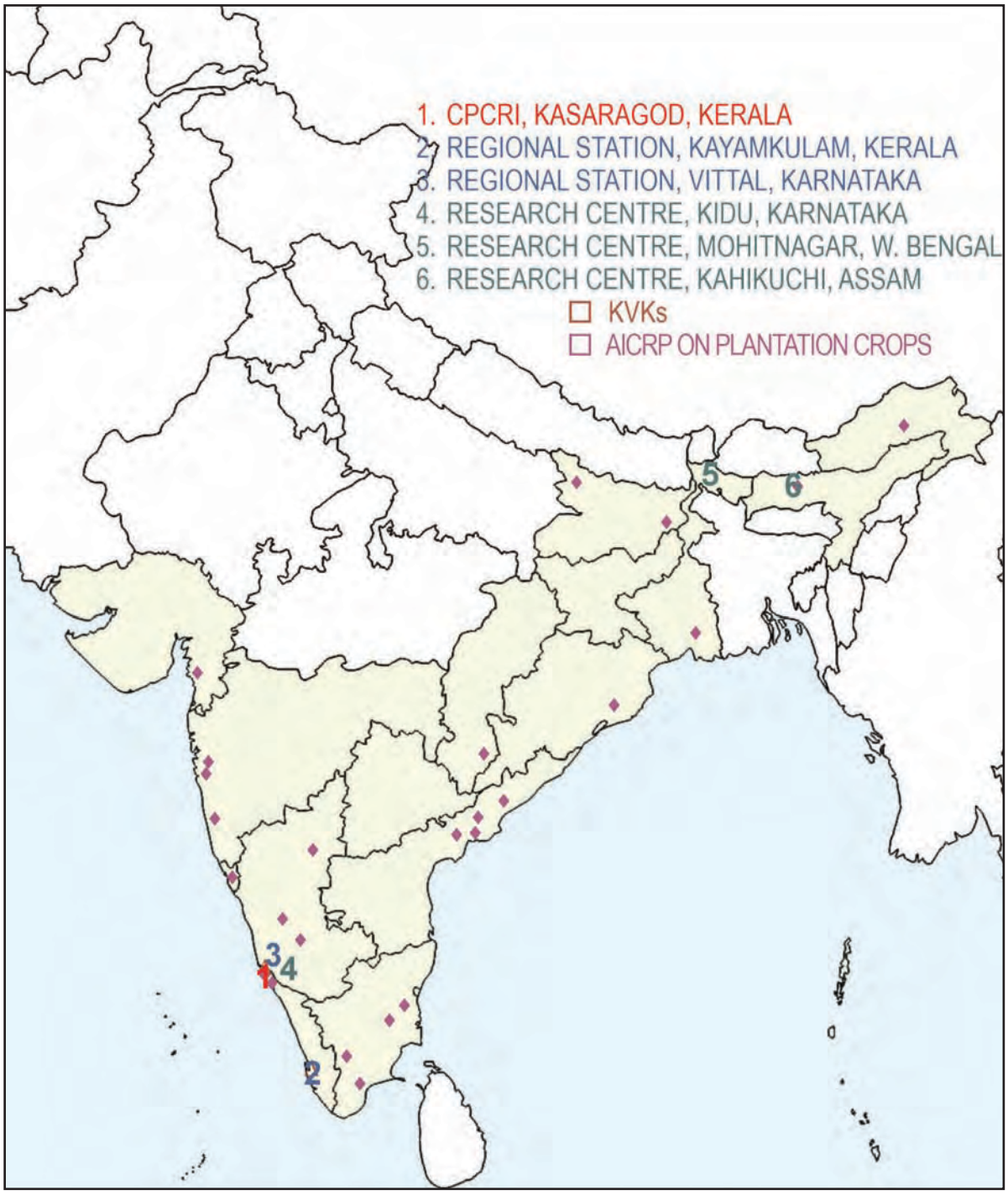
KIDU (Estd.: 1972), Crops: Coconut, Arecanut and Cocoa, Area 120 ha; 281 m MSL

Priority areas of research: National coconut gene bank, International Coconut Gene bank for South Asia (ICGSA), soil and water conservation, quality planting material production.

MOHITNAGAR (Estd.: 1958), Crops: Coconut and Arecanut, Area 25.99 ha; 91.3 m MSL

Priority areas of research: Genetic resources management, cropping system, soil, water and nutrient management.

Location of Stations / Centres under ICAR-CPCRI



STAFF STRENGTH AS ON 31-12-2025

ICAR-CPCRI, KASARAGOD

Category	Sanctioned	In position	Vacant
Scientific	65	49	16
Technical	74	57	17
Administrative	50	34	16
Supporting	132	34	98
Total	**321**	**175**	**146**

Details in chapter XVII – Personnel

ICAR-KVK, KASARAGOD

Category	Sanctioned	In position	Vacant
Scientific	1	1	-
Technical	11	8	3
Administrative	2	0	2
Supporting	2	0	2
Total	**16**	**09**	**7**

ICAR-KVK, ALAPPUZHA

Category	Sanctioned	In position	Vacant
Scientific	1	1	-
Technical	11	10	1
Administrative	2	0	2
Supporting	2	2	0
Total	**16**	**13**	**3**

BUDGET AND EXPENDITURE (Rs. in lakhs)

Head	Allocation	Expenditure
Budget	1331.67	1331.67
Revenue generation	338.91	

Details in chapter XXIII – Budget and Expenditure

VI. RESEARCH ACHIEVEMENTS

6.1

Phenotyping and Genotyping for Climate Resilient Traits / Genotypes and Quality Parameters

Germplasm collection and conservation

ICAR-CPCRI hosts the National Active Germplasm Site (NAGS) for plantation crops. In addition, hosts the International Coconut Gene Bank for South Asia and the Middle East (ICG-SAME), at Research Centre in Kidu. During the year, NAGS was strengthened through addition of pink-husked coconut germplasm (Fig. 1) and two released varieties from CRS Ambajipeta *viz.*, Abhaya Ganga and Vynateya Ganga; two bold fruited arecanut germplasm, one from Kerala (Fig. 2) with an average fresh nut weight of 91.65 g and nut dimensions of 6.43 cm (length) and 5.59 cm (breadth) and another from West Bengal (Fig. 3) with an average fresh nut weight of 82 g and nut length of 7.2 cm; seven cocoa germplasm (Fig. 4) - five from Kadaba region and two with high dry bean weight from Manimalai; and 18 palmyrah germplasm (six from Killikulam, two each from Sabour, Assam, Andaman and Nicobar Islands and one each from Gujarat, Chhattisgarh, Tamil Nadu, Tenkasi, Kerala, Vittal). The NAGS currently maintains 464 coconut, 182 arecanut, 536 cocoa and 18 palmyrah germplasm.

Fig. 1. Pink husked germplasm from Karnataka

Fig 2. Arecanut germplasm with very bold nuts collected from Kerala

Fig. 3. Arecanut germplasm collected from Kalimpong, West Bengal

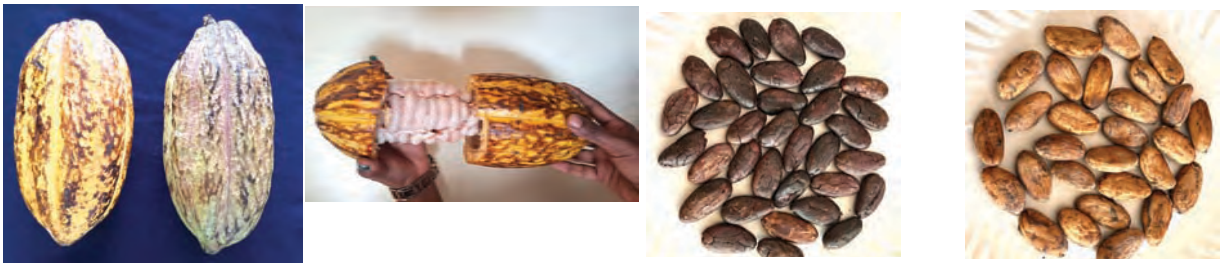


Fig. 4. Cocoa germplasm collection

Complementary cryo-conservation was enhanced to 30 coconut accessions, with the conservation of zygotic embryos from 17 accessions and pollen from 18 accessions at NBPGR. During the year, IC numbers were obtained for 34 indigenous coconut germplasm accessions conserved in the NAGS. Passport data and Indigenous Collection (IC) numbers were assigned to 14 cocoa accessions *viz*., 10 from Kahikuchi, four from Vittal, and two Cola nitida (kola) accessions.

Characterization and evaluation of germplasm

COCONUT

Germplasm characterization and evaluation in NAGS

Evaluation of the germplasm conserved in the field gene bank at Kasaragod, for fruit/copra yield, indicated higher yield potential in the accessions *viz*., Gangapani Tall, Jamaica Tall, Kappadam Tall, Lifou Tall, Markham Tall, Laccadive GreenTall, Benaulim Tall, Nadora Tall, Guam Tall, Calangute Tall, Nadora Tall, Verikobbari Tall, Nugli Tall, Nuwehung Tall, Nuwallis Tall, Surinam Tall, Nufella Tall, Niu Hake Tall, Fiji Tall, Federated Malay States Tall, Fiji Longtongwan Tall, Nigerian Dwarf, Dhanei Tall, Goja Tall, Narangi Tall and Gole Tall. Three trait specific germplasm *viz*., SNRT, BSIT, FMST were approved by IGRC for submission to NBPGR for germplasm registration.

Fruit component analysis in conserved germplasm

Sixteen coconut accessions, comprising new germplasm collected from Kerala, Tamil Nadu, Andhra Pradesh, Assam, Meghalaya and Andaman Islands and conserved in 2012, at CPCRI, Kasaragod were studied for fruit component traits (Fig. 5). AP01 Aromatic collected from Andhra Pradesh, had the smallest fruits with significantly lesser fruit weight (800 g), husked fruit (385 g) and copra weight (120 g), while NEH NA 09 from Assam recorded higher fruit weight (1376 g), husked fruit weight (980 g) and copra content (229 g). Higher copra content, above 200 g, was recorded in two more accessions *viz*., JD 05 from Andaman Islands (218 g) and NEH NA 11 (208 g) from Assam.

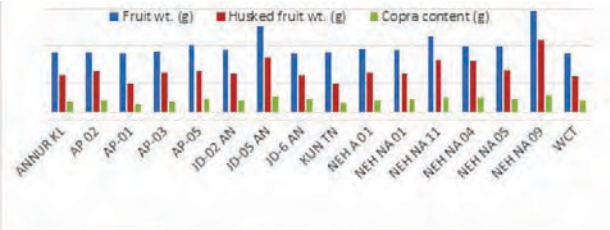


Fig. 5. Fruit component traits in conserved indigenous germplasm

Comparative evaluation of 25 dwarf accessions

Comparative evaluation of 25 dwarf accessions, planted during 2011 and 2013 at Kasaragod, indicated significant variations. INGR13065, GBGD, PRD03, SPYD, AGD02 and MGD recorded comparatively higher fruit weight. Husked fruit weight also showed wide variation (184-534 g), with AOD, COD, MGD, SPYD and PRD03 recording >530 g husked fruit weight, while SYD and NGOD recorded very low husked fruit weight. Accessions, SPYD, AGD 03, AOD, GBGD recorded relatively higher fresh endosperm weight (>280 g), while husk weight was relatively higher in AGD 02 and INGR13065.The evaluation of tender nut water revealed significant variation in both quantity (182-780 mL) and quality. PEGD and PRD03, recorded higher tender nut water content (>500 mL), while significantly lesser volume was recorded in NGOD and RRD (<185 mL). Sodium content in tender nut water ranged from 10 ppm (LCOD) to 45 ppm (SUBD) and potassium content from 1010 (RTB 04) to 2335 ppm (AGD 01). Estimation of ascorbic acid and flavonoid content in tender nut water indicated values ranging from 1.4-3.0 mg per 100 ml and 0.2-1.1 mg per 100ml, respectively.

Variation in DNA content, estimated through flow cytometry, varied from to 5.4 pg in MYD 6.06 pg in CRD, with intermediate values recorded for CGD

(5.93 pg), SUBD (5.82 pg), and COD (5.81 pg). Observations on sprout initiation and average days required for seed germination indicated relatively early germination in AGD 01, AOD 03, and PRD 03, and late germination in RRD, NGOD, SYD, SPYD and ANYD.

Evaluation of sweet kernel population

Studies on the accession Guhagar sweet Tall, comprising seed generated progenies from nine palms of Mohacho Narel, conserved at Kasaragod, indicated differential recovery of sweet kernel fruits ranging from 0-45.6 per cent (Fig. 6). Palm 30 (progeny of NSD 4) showed highest recovery(45.6 per cent), followed by Palm 25 (NSD 27) with 40.5 per cent, Palm 1 (NSD 1) with 37.9 per cent, Palm 26 (NSD 4) with 37.3 per cent, and Palm 7 (NSD 1) with 33.3 per cent. Palms 18 (NSD 15), 23(NSD 1), 11(NSD 14), and 32(NSD 14) showed moderate performance. Palm progenies belonging to NSD 15, NSD 28, NSD 6, and NSD 24 recorded consistently low or zero sweet kernel recovery, indicating that

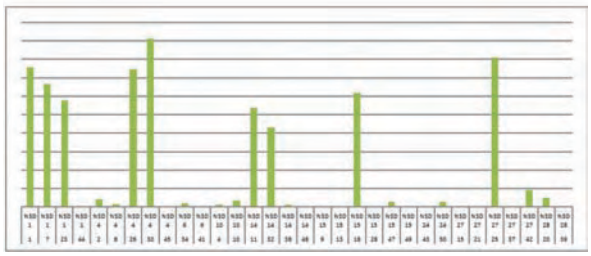


Fig. 6: Sweet kernel recovery of Guhaghar Sweet Coconut

Evaluation of endosperm/copra texture through study of cutting force, indicated high cutting force in non-sweet coconut (cutting force 1846.65 grm for fresh endosperm and 2994.88 grm for dry endosperm) as compared to sweet kernel nuts (cutting force 1332.23 grm for fresh endosperm and 2731.63 grm for dry endosperm). This indicates, sweet kernel fruits are not economically viable for commercial copra production.

Palms showing higher sweet kernel recovery were *inter se* mated and 315 seedlings were produced, and 240 seedlings were supplied to Regional Coconut Research Station, Bhatye, Ratnagiri for performance assessment in traditional tracts.

Assessment of germplasm for abiotic stress tolerance

Leaf anatomical characteristics (Fig. 7, 8), namely stomatal density, epidermal cell count, laminar thickness, and cuticular thickness as well as physiological parameters, *viz*., stomatal resistance and chlorophyll index, were recorded in seedlings of 24 accessions, comprising 16 talls (FMST, AGT, WCT01, TPT, CCNT, LMT, SNRT, PLNT, JSBT, AP01, KLWT, PHOT, JAMT, WCT, JVT, LCT) and eight dwarfs (CRD, MYD, COD, MGD, KGD, CGD, LCOD, GBGD). Wide variation was observed for epidermal cell count (ranging from 2444 mm^{-2} in AGT to 4091 mm^{-2} in LCOD) and stomatal frequency (157 mm^{-2} in TPT to 276 mm^{-2} in PLNT). The leaf laminar thickness ranged from 193.56 µm (MGD) to 272 µm (LCT) and cuticular thickness (Fig. 8) varied from 8.00 µm (JSBT) to 11.50 µm (TPT). Based on pooled trait performance, SNRT showed higher stress tolerance potential, followed by LCT, WCT and PLNT, indicating their potential in breeding for climate resilience. At RC Kidu, another set of 31 accessions have been selected and 336 seedlings raised for screening for moisture stress tolerance.

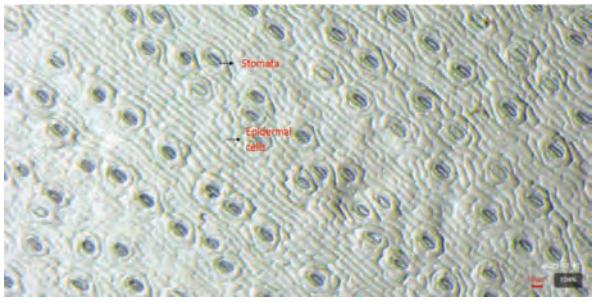


Fig. 7: Leaf impression showing stomata and epidermal cells of LCOD

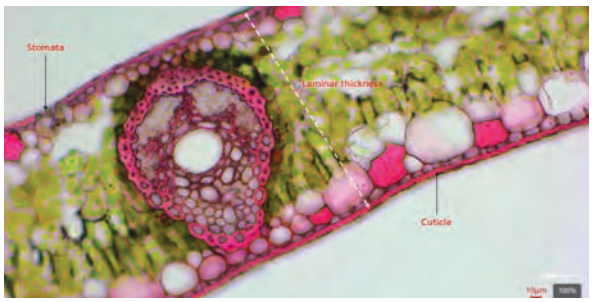


Fig. 8: T.S. of seedling leaflet of LCT

Assessment of pollen characteristics

Pollen morphology using SEM-EDS of 20 genotypes, 3 dwarfs (COD, MOD, MYD), 1 semi-tall (MGD), 11 tall (KGD, WCT, LCT, JVT, PHOT, FMST, FJT, CCNT, TPT, AGT, SNRT) and 5 hybrids (LCT × COD, COD × WCT, MYD × TPT, MYD × WCT, WCT × COD) illustrated monosulcate-elongated pollen grains with a boat-like shape, showcasing unique exine ornamentation patterns across the studied genotypes (Fig. 9, 10). The faveolate exine ornamentation was predominant, with

exceptions found in KGD (perforate with granular aggregations) and PHOT (regulate), where distinct patterns prevailed. COD, MGD, and FJT exhibited a faveolate pattern coupled with granular aggregations on the exine, while JVT displayed a unique faveolate exine ornamentation with deeper and wider lamina. Distinctive colpus edge characteristics, including frilled or waved edges, was observed in MGD, LCT, PHOT, FJT and Kera Sankara (WCT × COD) indicating possibility of utilizing micro-morphological variation for varietal differentiation.

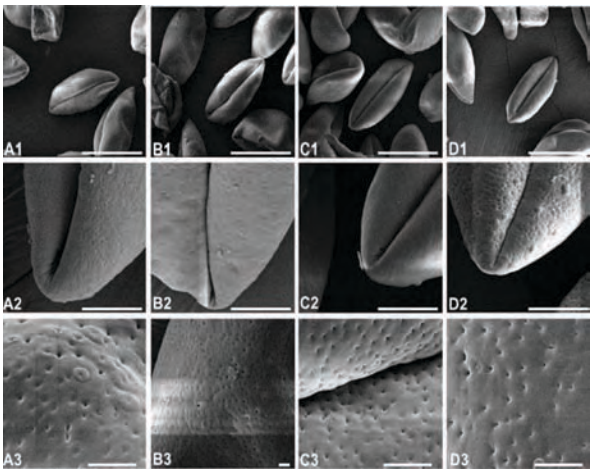


Fig. 9. SEM micrographs of pollen grains of dwarf accessions viz COD, MOD, MYD, MGD at different magnifications. Scale bars: 50 µm (A1, B1, C1, D1), 10 µm (A2, B2, C2, D2), 2 µm (A3, B3, C3, D3).

The polar axis length of pollen grains, ranged from 57.74 µm in Chandra Sankara (COD × WCT) to 70.08 µm in PHOT, while equatorial axis spanned from 25.01 µm in Kera Sankara (WCT × COD) to 32.53 µm in SNRT. Statistically significant variation was observed in the P/E ratio, which increased from 1.94 in CCNT to 2.52 in MGD. The size index values varied from 15.51 in JVT to 22.40 in SNRT. The number of pores per µm² of exine exhibited significant variability, ranging from 2.60 in TPT to 9.86 in LCT. Cluster analysis based on pollen morphological parameter, revealed two clusters: Group 1 characterised by longer polar axis length, size index, and a lower number of pores on the exine; Group 2 exhibited shorter polar axis length and P/E ratio. The grouping did not show clustering based geographical origin, stature, and breeding habit. Further WCT and TPT similar in terms of palm growth characters showed different pollen characteristics.

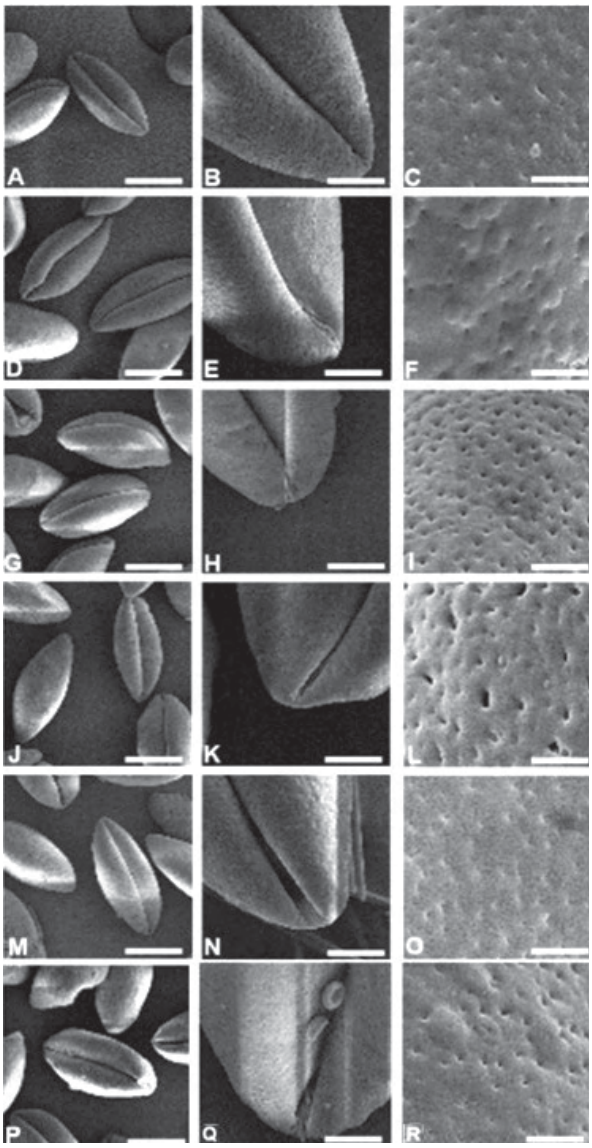


Fig. 10. SEM micrographs of pollen grains of some tall accessions viz., WCT, KGD, JVT, LCT, PHOT, FJT at different magnifications. Scale bars 30 µm (A, D, G, J, M, P), 8 µ(B, E, H, K, N, Q), 2µm (C, F, I, L, O, R).

Pollen viability was observed to range between 92.02 per cent in PHOT and 98.85 per cent in LCT (Fig.11). Significant variations were observed in the percentage of pollen germination (30.69% in MYD to 54.03% in Kalpa Samrudhi – MYD × WCT) and rate of pollen tube growth, 2 hours after incubation in germination medium (386.87 µm in MYD to 735.86 µm in SNRT).

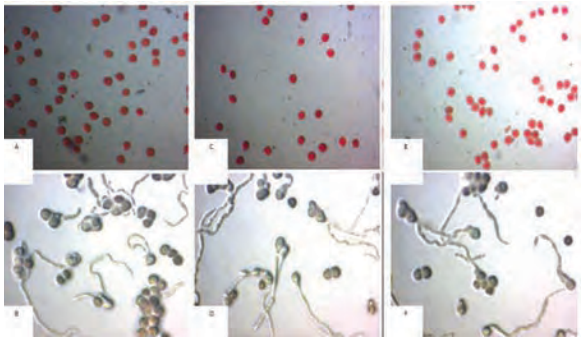


Fig. 11. Microscopic images of viability test and germination of pollen grains: MYD (A-B), WCT (C-D), Kalpa Samrudhi (E-F)

SEM–EDS analysis was carried to determine mineral composition of pollen grains. Potassium was the most abundant mineral in pollen of all varieties, with concentrations ranging from 26.5 per cent (FJT) to 33.45 per cent (MOD). Phosphorus was the second most abundant nutrient which ranged from 17.59 per cent (CCNT) to 29.06 per cent (COD). A significant difference in calcium content was also observed with highest in pollen of LCT (23.24%) and lowest in COD (14.43%). Sulphur, Chlorine and Magnesium are present in the ranges of 7.16-12.23 per cent, 4.48–10.53 per cent and 4.85–9.77 per cent, respectively. Boron, Copper and Iron were present in lower percentages but still showed distinct variations (B: 1.11–2.99%, Cu: 0.92–2.83%, Fe: 0.09–0.32%).

Observation on bulbil palms at Vittal

Bulbils from the two bulbil producing palms at RS Vittal, were successfully separated and field planted at the centre during 2016. The palms commenced flowering, nine years after planting (Fig. 12). However, these inflorescences produced only bulbils, confirming the earlier report that progenies of such palms continue to produce only bulbils. Hence, the feasibility of utilizing these palms for regular harvesting of cabbage and also for extraction of rooting hormones for use in coconut tissue culture need to be explored.

Twin coconut palms producing bulbils

Rooted bulbils (2016)

Emergence of spathe

Production of bulbils

Fig. 12. Bulbil producing palm progenies at CPCRI, RS, Vittal

Evaluation of germplasm at Kidu

During the period, 17 coconut accessions were characterized for vegetative, reproductive, yield, and mature fruit component traits, revealing substantial diversity (Fig.13). Plant height ranged from 539 cm in Pattukottai Green Dwarf to 1312 cm in Malayan Tall, with notable variation in trunk girth, internode length, and crown architecture. Reproductive traits showed pronounced variability, particularly in number of spikelets per inflorescence (16.6–33.2), female flowers per inflorescence (12.3–27.1), and total fruits per palm (60.7–164.4), indicating differences in yield potential. Fruit component traits also varied significantly, with fruit weight ranging from 733.5 g (Standard Kudat Tall) to 1181.3 g (Borneo Tall), fruit cavity volume from 106.75 mL to 251.60 mL, and copra yield from 9.62 kg per palm per year (Kalpawangi Tall) to 23.30 kg (Seychelles Tall). Accessions such as Seychelles Tall, Zanzibar Tall, Guam I Tall, and Car Nicobar Tall exhibited superior performance for growth, yield, and nut quality traits.

Evaluation of germplasm at Mohitnagar

Among talls, highest nut yield was recorded in BARI Narikel 1 (97.6 nuts palm^{-1} year^{1}), followed by Agalijhora (95.8) and LMT (93.5), which were statistically at par. These were followed by SKGT and Chinnasukhania (87.6), while SYT recorded the lowest yield (53.0). Agalijhora produced highest copra yield (20.79 kg palm^{-1} year^{1}), significantly surpassing other varieties, whereas BARI Narikel 1, despite its high nut yield, recorded a comparatively lower copra yield (15.62 kg). Among hybrids, Chandra Laksha recorded highest nut yield (61.4 nuts palm^{-1} year^{1}), followed by Kera Sankara (58.2). However, the highest copra yield was obtained from Kera Sankara (14.83 kg), with copra yields

Fig. 13. Variation in fruit component traits in different accessions

of Chandra Laksha and Chandra Sankara being statistically at par. Among dwarfs, COD recorded the highest nut yield (71 nuts palm^{-1} year^{-1}), followed by MYD (63.3) and MGD (61.1). Higher copra yield was recorded in MGD (9.26 kg), while MOD recorded the lowest copra yield (5.96 kg).

Catalase and peroxidase activities in coconut leaves were lower under cool conditions but increased with rising temperatures in February, while proline content peaked in January and declined thereafter. Of the 21 coconut accessions, Kalpatharu had the tallest trunk (210.8 cm), followed by MNR III (154.3 cm); SLYD was the shortest (56.0 cm). PALT recorded highest trunk circumference (131.6 cm). Leaf number ranged from 17.0 to 22.3 per palm. Leaf length was greatest in LAGT (5.5 m), followed by WCT and PALT (5.3 m each), while SNRT recorded higher number of leaflets (212.7). The highest nut yield was observed in MNR III (38.7 nuts palm^{-1}), followed by SSGT (33.3). Fifteen coconut lines from Jalpaiguri and Kalimpong districts of West Bengal were evaluated for cold tolerance. All lines initiated bearing, with higher yield in Mohitnagar III (66 nuts palm^{-1}), followed by ECT (53). Minimal cold injury was observed in MNR III, while other lines showed mild cold injury in 10–17 per cent of the palms.

Evaluation of coconut accessions under Assam conditions

Fifteen coconut varieties representing tall, dwarf, and hybrid types were evaluated at the Research Centre, Kahikuchi. The hybrid Kera Sankara recorded the highest nut yield (132.07 nuts palm^{-1} year^{-1}). Among local coconut populations, ten-year yield data (2014–2023) from 22-year-old palms showed that accession KKHC 4 produced the highest average yield (48.13 nuts palm^{-1} year^{-1}). Evaluation of tender nut quality identified KKHC 6 as superior, with higher fruit weight (2688.46 g), tender nut water volume (548.73 mL), and potassium content (2445.33 ppm).

Evaluation of germplasm for resistance/ tolerance to coconut root (wilt) disease

In an evaluation of thirteen tall accessions planted in 2014, root (wilt) disease incidence was lowest in Tiptur Tall (8.3%), followed by San Ramon Tall and Cochin China Tall (12.5%), while Andaman Ordinary Tall recorded the highest incidence (41.7%). Tiptur Tall also produced the highest mean nut yield (60 nuts palm^{-1} year^{-1}), followed by St. Vincent Tall (55.3). Among six green dwarf varieties planted in 2013, Kalpasree showed the lowest disease incidence (3.7%), followed by Gudanjali Green Dwarf (25.9%). Kalparaksha recorded the highest mean yield (99.5 nuts palm^{-1} year^{-1}), with Andaman Green Dwarf ranking second (91.8). After 13 years, *inter se* mated WCT progenies exhibited lower root (wilt) incidence (12.67%) and slightly higher yield (65 nuts palm^{-1} year^{-1}) than selfed progenies (21% incidence; 63.77 nuts), indicating the advantage of inter se mating. A new trial comprising three D × D (CGD × GBGD, CGD × MGD, CGD × AGD) and five D × T (CGD × ADOT, AGT, STV, TT, CCT) crosses was established at RS Kayamkulam, with three replications.

Molecular characterization of green dwarf accessions using 26 SSR markers revealed 19 polymorphic loci, indicating moderate to high genetic variability and effective genotype discrimination. SEM analysis in these dwarfs, showed pollen grains as monads with prolate, boat-shaped morphology (Fig. 14). Based on shape, CGD and GDD were elliptical, while MGD, GBGD, NLGD, and AGD were ellipsoidal. CGD, MGD, and GDD had monocolpate pollen with thick polar caps, whereas GBGD, NLGD, and AGD showed monosulcate pollen with granular polar caps. All accessions exhibited bilateral, tenuimarginate pollen, facilitating pollen tube emergence.

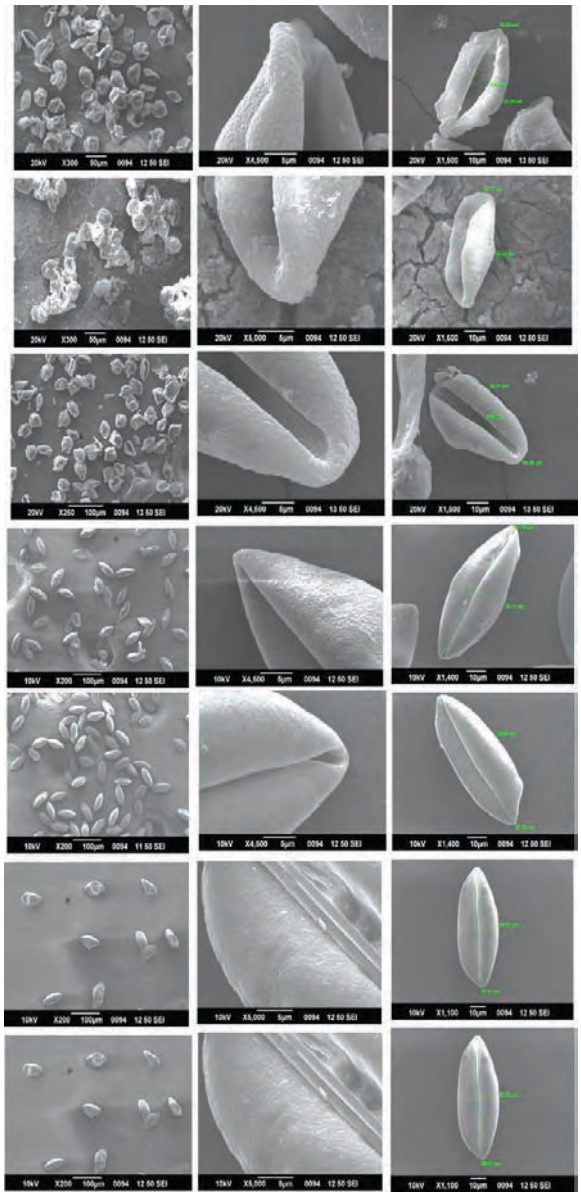


Fig. 14. SEM analysis of pollen from green dwarfs of coconut

Hybrid evaluation trial

Among the 14 D x D hybrids planted at Kasaragod in 2016, significant variations in plant height, stem girth as well inflorescence and fruit characters (Fig. 15) were observed. COD × NLGD, MOD × NLGD and MYD × NLGD recorded higher plant height, compared to CGD × MYD, CGD × MOD and CGD × GBGD. COD × GBGD recorded higher nut yield followed by MYD × CGD, while higher copra yield was recorded in MOD × NLGD, COD × GBGD, MYD × CGD, MYD × NLGD.The hybrids showed variation in quantity as well as quality of tender nut water, COD × GBGD, GBGD × CRD, CRD × CGD, MYD × CGD and COD × NLGD recording high tender nut water content (>400 mL). Sodium content ranged from 10 to 47 ppm and potassium from 1097 to 2651 ppm. Initial studies on ascorbic acid and flavonoid content in tender nut water, revealed values ranging from 1.5 to 2.9 mg per 100 mL and 0.24 to 0.94 mg per 100 mL, respectively. Variation was observed in neera yield (10-54 L inflorescence^{-1}) and tapping duration (29-48 days), with MYD × NLGD recording highest yield (54 L) and longest tapping period (48 days).

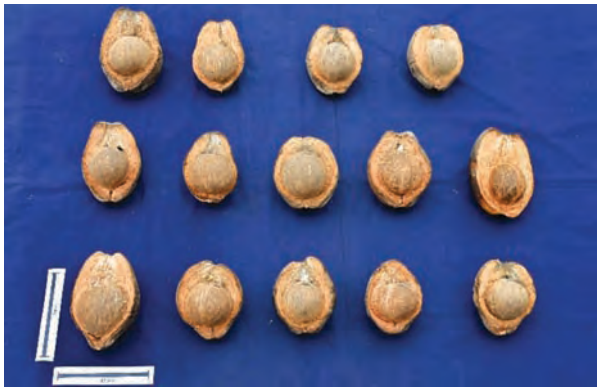


Fig. 15. Fruit morphology of different D×D hybrid combinations

In the hybrid evaluation trial established in 1996 (Old Area) at ICAR–CPCRI Research Centre, Kidu, the hybrid PHOT × GBGD was identified and recommended for release due to its superior tender nut quality and yield.

Inter-se pollination and hybridization activities

For initiating a new MLT, under AICRP Plantation Crops, *inter se* mating was undertaken in selected accessions and during the year a total of 1719 seed nuts were provided, including selections and check varieties, *viz*. Kalpa Ratna and Kalpa Suvarna (Table 1).

Table 1. Seed nuts provided to AICRP on PC Centres for MLT

Dwarfs	Seed nuts provided	Talls	Seed nuts provided
NLAD	160	LFT	60
CRD	160	KPDT	60
NIGD	160	LAGT	60
LCOD	178	MVT	60
HPOD	111	WAT	60
GDD	90	NGT	60
CHYD	160	ROT	60
Kalpa Suvarna (check)	160	NHKT	60
		Kalpa Ratna (check)	60

Further, at RC Kidu, 1,212 seed nuts were produced in 18 cross combinations towards development of new hybrids for evaluation.

Studies on phenology of coconut genotypes in different climatic zones

At Mohitnagar, 74 West Coast Tall (WCT) seed nuts were sown in polybags to study the phenology. Germination commenced between 59 and 154 days after sowing. The first lanceolate leaf emerged at 81 days after sowing (22 days after germination), with initiation ranging from 81 to 147 days and bifurcation occurring at 95 days after sowing. The second lanceolate leaf emerged between 85 and 167 days, with bifurcation between 104 and 173 days, while the third leaf initiated between 100 and 139 days and bifurcated between 116 and 221 days after sowing. Variation in germination and leaf development may be attributed to differences in seed nut quality, embryo development, and nutrient reserves.

ARECANUT

Floral biology studies in arecanut varieties

Floral traits were recorded in 17 arecanut varieties/ genotypes, including released varieties. The number of inflorescences per palm ranged from 1.75 to 4.5, with lowest in HD and the highest in Mangala, Sumangala, and Thirthahalli. The duration from spadix initiation to splitting varied from 5.35 days in Swarnamangala to 10.79 days in Ratnagiri. Spadix length ranged from 21.99 cm (VTLAH-1) to 68.06 cm (Mangala), while spadix breadth was lowest in VTLAH-1 (11.48 cm) and highest in Ratnagiri (21.31 cm). Inflorescence length was maximum in Shatamangala (86.07 cm) and minimum in HD (25.6 cm), with corresponding breadths of 85.08 cm and 30.39 cm, respectively. The number of female flowers per inflorescence varied widely, from 71 in VTLAH-1 to 334 in Shatamangala, while male flower number ranged from 21,2119 in HD to 48,401in Sumangala. Male flower dehiscence lasted for 21.5–37.87 days, being shortest in VTLAH-1 and longest in S.K. Local. Female receptivity ranged from 3.48 days in Mangala to 4.9 days in Nalbari.

Estimation of fat content from dry kernels of arecanut germplasm

Fat content was estimated in dry kernels of arecanut germplasm including Mandalpara 1–4, Sweet Areca, Marigoan, East Garo Hills, Asud, Mahuva B, Thirthahalli OB, Ganapathipule, Dudina, and Devadarshini. Fat content ranged from 9.20 per cent to 13.67 per cent, with the highest in Marigoan (13.67%), followed by Dudina (12.83%) and East Garo Hills (12.40%). The lowest fat content (9.20%) was recorded in Husludanga and Mahuva B.

Tender nut processing studies

Tender nut processing studies were conducted in released arecanut varieties. The recovery of processed dry tender nuts from fresh kernels ranged from 14.22 percent to 22.96 percent.

Multi-location testing of arecanut hybrid combinations

To establish multi-location testing of arecanut hybrids, hybridization was undertaken between Hirehalli Dwarf (HD) and high-yielding varieties, namely Shatamangala, Madhuramangala, Mohitnagar, and Sumangala. Inter se mating among parental lines (Hirehalli Dwarf, Shatamangala, Mohitnagar, and Sumangala) was also carried out. *Inter se* mating was also carried out in the arecanut varieties Shatamangala and Swarnamangala. The harvested nuts were sown in the nursery, and the seedlings will be supplied to AICRP on Plantation Crops centres.

Evaluation of arecanut germplasm

At Vittal, the highest chali yield was recorded in Devadarshini among collections from Karnataka, Maharashtra, and Gujarat. Among North Eastern collections, the highest yield was recorded in Shell Shella, followed by Ratnagiri, while in the North Eastern–III batch, Kalirhat and Goralbari were superior. From the Andaman and Nicobar Islands collections, Cal-32 showed the highest chali yield, and among Konkan collections, Diveagar-I exhibited high yield potential. In indigenous collections, Sirsi recorded the highest chali yield, followed by Mettupalayam, while sweet arecanut was superior among Assam–West Bengal collections. In another North Eastern batch, Amchup showed high yielding ability.

At Mohitnagar, among the 1988 planting, the highest chali yield was recorded in Mohitnagar (3.723 kg palm^{-1} year^{-1}), followed by VTL-5 (2.090 kg). In the 1992 planting, VTL-18C recorded the highest yield (3.218 kg). Among 19 North Eastern germplasm planted in 1994, Nalbari (3.825 kg) and Kahikuchi (3.465 kg) were superior. Among 15 accessions planted in 1997, Calicut-20 recorded the highest yield (3.013 kg), followed by Calicut-27 (2.938 kg) and Calicut-29 (2.797 kg palm^{-1} year^{-1}).

Establishing Hirehalli Dwarf mother block

Mother blocks were established at ICAR–CPCRI, Vittal and ICAR–CPCRI, Kidu, using Hirehalli Dwarf seedlings supplied from ICAR–IIHR, CHES, Hirehalli (Fig. 16).

Fig. 16. Hirehalli Dwarf mother block

COCOA

Characterisation of Exotic Cocoa Clones

Thirteen exotic cocoa clones collected through the International Cocoa Quarantine Centre (ICQC), UK, were characterized and catalogued for pod and bean traits. These clones exhibited substantial genetic variability, indicating their potential for further utilization in breeding and improvement programs.

Trait specific germplasm

Dry bean weight of 0.9 to 1.7 g was recorded among old collections and clones with white beans identified for selection of trait specific germplasm (Fig.17).

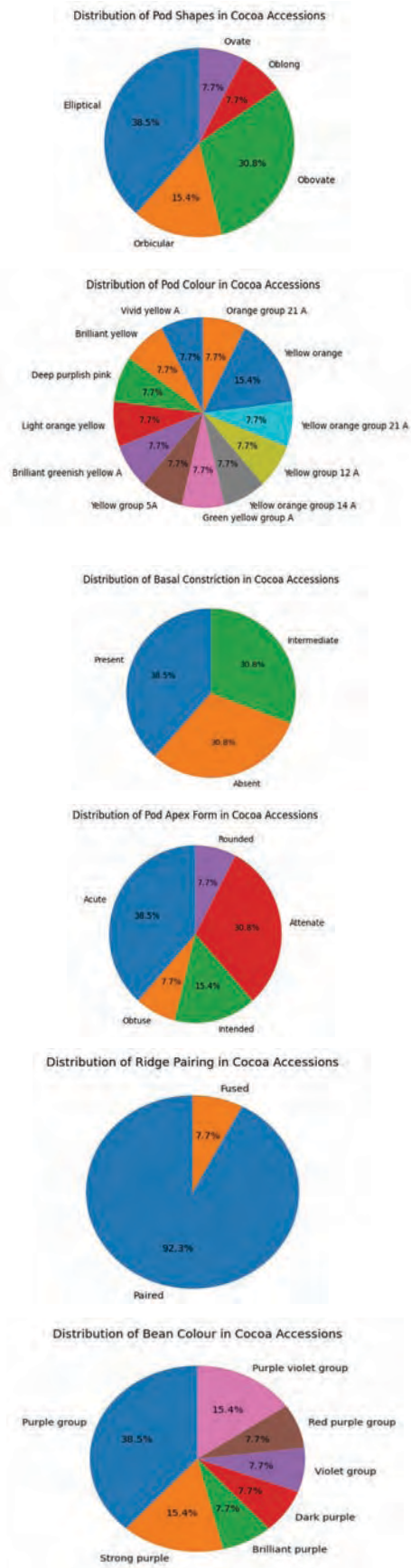


Fig. 17. Trait specific variability illustration from cocoa accessions

Evaluation of Peruvian Cocoa Clones for Biochemical Parameters

Evaluation of 19 Peruvian cocoa clones revealed significant variation in key biochemical traits influencing bean quality (Fig. 18). Fat content was highest in VTLC-72 and VTLC-225, while VTLC-207 showed the highest free fatty acid content. Antioxidant activity was greatest in VTLC-210 and VTLC-241. Total flavonoid content was highest in VTLC-196, VTLC-208, and VTLC-233.

Clones	Colour (RHS Chart)	Fat content (%)
VTLC 151	White Group N155 B (Pinkish White)	41-43
VTLC 174	White Group N155 B (Pinkish White)	42-45
VTLC 155	Red Purple Group 69 C (Very Pale Purple)	34-43
VTLC 187	Violet – Blue Group 92 D (Vey Pale Purple)	34-44
VTLC 154	Purple Group 76 A (Light Purple)	36-43
VTLC 156	Purple Group 77 D (Light Purple)	30-45

Fig. 18. Variability in Peruvian cocoa beans

Clones such as VTLC-207, VTLC-72, VTLC-199, VTLC-203, VTLC-205, VTLC-196, and VTLC-229 exhibited distinct and desirable traits. These findings highlight the potential of selected clones for sustainable cocoa production and the development of value-added products rich in health-promoting bioactive compounds.

Pollinator studies

Cocoa pod-setting dynamics were quantified in grafted (20 trees) and seedling-origin (20 trees) cocoa using a large dataset comprising 360 flower cushions and 2,422 flower buds distributed across the basal trunk (BT), mid-trunk (MT), and canopy branches (CB). This generated robust field-level evidence of reproductive behaviour. Distinct differences in vertical flowering distribution were observed, with grafted cocoa producing a higher number of open flowers (BT = 378; MT = 365; CB = 230; total = 973) compared with seedling-origin trees (BT = 219; MT = 182; CB = 86; total = 487) (Fig. 19, 20, 21). Pollination success was assessed 72 h after anthesis using natural abscission as an indicator of effective pollination, revealing considerable variability among canopy zones. Pollination and subsequent fruit-set ranged from 65–67 per cent and 16–18 per cent in BT, 46–98 per cent and 19–20 per cent in MT, and 33–62 per cent and 15–23 per cent in CB, respectively. Pollinator abundance within the cocoa ecosystem was confirmed through examination of leaf and pod litter, sticky traps, and aspirator collections. Midges were identified as the primary pollinators, with *Forcipomyia* spp. being the dominant taxa.

Fig. 19. Distribution of flowers and buds in a cushion

Fig. 20. Distribution of flowering cushions over main stem

Fig. 21. High fruit set in branches

Comparative Yield Tria-ls (CYT)

At Vittal, under arecanut-based cropping systems, the comparative performance of 12 cocoa genotypes comprising parental clones and their hybrids, evaluated both as clones and seedlings at 16 years of age, showed significant variation in yield performance (Fig. 22). Among these, VTLCH-3 recorded dry bean yields of 1.76 kg (clonal) and 1.88 kg (seedling), while VTLCH-4 produced 1.91 kg (clonal) and 1.82 kg (seedling).

At Kasaragod, under coconut-based systems, yield performance of 13 genotypes revealed superior performance of VTLCH-3 and VTLCC-1 when evaluated as clones, recording dry bean yields of 3.29 kg and 1.99 kg, respectively. In addition, VTLC-7 exhibited high productivity both as a clone (3.38 kg) and as a seedling (2.16 kg) (Fig. 23).

At Vittal and Kidu, under coconut-based systems, evaluation of nine cocoa clones indicated dry bean yields of 1.82 kg and 1.04 kg in VTLCH-3, while 1.78 kg and 1.15 kg, in VTLCH-4, respectively.

Fig. 22. Dry bean yield of cocoa genotypes at genotypes Vittal under arecanut

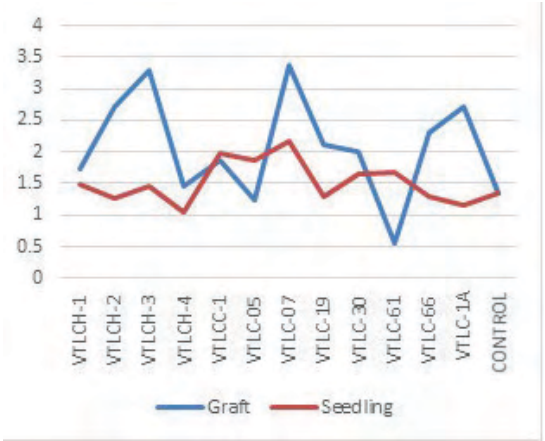


Fig. 23. Dry bean yield of cocoa at Kasaragod under coconut

Multi Location Trials (MLT) at CPCRI Centres

Among the 25 cocoa clones evaluated at CPCRI, RS Kayamkulam, Kerala, VTLCP-1 recorded the highest pod yield (64.4 pods tree^{-1} year^{-1}), followed by VTLCP-10 (54.2), indicating superior yield potential (Fig. 24). The highest number of beans per pod was observed in VTLCP-19 (45), with six other clones producing more than 40 beans per pod. Single dry bean weight was highest in VTLCP-20 (1.15 g), which was statistically comparable to VTLCP-10 (1.13 g) and VTLCP-12 (1.11 g). These clones were also screened for physiological traits related to climate resilience during the post-monsoon season.

At CPCRI, RC, Kahikuchi, Assam, VTLCC 1 with 66 pods per tree (2.58 kg tree^{-1}) and VTLC 11 with 63 pods per tree (2.31 kg tree^{-1}).

Fig. 24. (a) VTLCP 1 and (b) VTLCP 10 cocoa clones

At CPCRI, RC, Mohitnagar, West Bengal, under arecanut based cropping systems, among the 14 cocoa accessions evaluated, VTLC-5 recorded the highest number of pods per plant (232.3), followed by VTLCC-5 (205.3). Under coconut plantations, the maximum pod yield per plant (171) was observed in VTLCH-4, followed by VTLC-5 (150). In addition, VTLCC-1, VTLCH-2, and VTLCH-3 exhibited consistently high pod numbers and dry bean yields, each producing more than 100 pods per plant with corresponding dry bean yields of 3.37 kg, 3.10 kg, and 3.01 kg, respectively (Fig. 25).

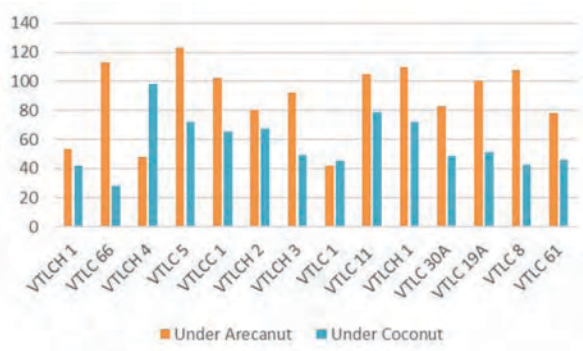


Fig. 25. Pod yield of cocoa genotype at RC, Mohitnagar

Screening cocoa clones for tolerance to biotic and abiotic stress

During the current year, continuous rainfall significantly affected pod harvest due to increased incidence of Phytophthora infection. During the main harvest season, disease incidence was recorded at 20 per cent in Amazon clones, 15 per cent in Peruvian clones, 11 per cent in Ghana clones, 10 per cent in mixed exotic clones, 8 per cent in Nigerian clones, and 5 per cent in Wayanad/Shiradi clones. Among the hybrids, VTLCH-2 and VTLCP-9, and among the clones, VTLCC-1 consistently exhibited lower levels of infection over the past three years under both arecanut- and coconut-based cropping systems. As a preventive measure, Trichoderma paste was applied to cut branches following pruning during the post-monsoon season.

Tea mosquito bug infestation increased during the post-monsoon period across all germplasm blocks. However, pods of Ghana Red, Red Amelonado, Trinitario selections, and Jerangau Red Axil continued to exhibit relatively lower levels of infestation. Among the clones/hybrids, VTLCH-4, VTLCP-8, VTLCP-9, and VTLCS-1 showed reduced infestation under both arecanut and coconut canopies at Vittal. Comparatively, a considerable reduction in infestation was observed at Kidu and Kasaragod. At Vittal, selected trees of Criollo and Trinitario types were protected by covering pods with net to minimize damage from sucking pests Fig. 26).

Trichoderma pasting at cut ends after pruning

Net covering of Criollo trees

Net masking of Trinitario pods

Fig. 26. Protection of cocoa plants from diseases and pests

Quality improvement

To identify processable cocoa varieties suitable for small and marginal farmers, minimal and low-cost processing methods were evaluated by fermenting different quantities of cocoa beans (Fig. 27). Fat content varied among the processing methods, and a higher incidence of fungal infection was observed under the gunny bag fermentation method. Changes in

bean colour during successive days of fermentation were monitored to determine the fermentation end point, with fully fermented beans exhibiting a uniform brown colour. During fermentation, total soluble solids (TSS) decreased from 20 to 7 °Brix, and pH declined from 5.0 to 3.1.

1st Day *3rd Day* *5th Day* *7th Day*

Heap Fat- 30-50%

Box 41-50%

Basket 35-52%

Tray 42-50%

Gunny bag 39-55%

Fig. 27. Different stages and methods of cocoa bean fermentation

Evaluation of fine cocoa types

Cocoa types are grouped as fine, basic, and bulk cocoa, respectively, according to their biochemical composition and suitability for dark chocolate and fortified health products. Four clones each of Criollo and Trinitario, with Forastero as the control, were evaluated for DUS traits, yield components, and biochemical parameters (Fig. 28). Criollo beans had white to pale-white cotyledons, Forastero showed purple to violet beans, while Trinitario exhibited mixed bean colours. Fat content ranged from 35–55 per cent. Significant variation was observed in ash, moisture, reducing sugars, and total sugars. Criollo clones showed lower acidity compared to Trinitario and Forastero. Phytochemical profiling using HPLC confirmed the presence of appreciable levels of caffeine and theobromine across all types. Trinitario clones recorded a low pod index (20 pods kg-¹ dry beans), high yield potential (3 kg dry beans tree-¹ year-¹), large bean size (>1.2 g), mixed pink to pale-purple cotyledons, and comparatively higher polyphenols and flavonols. The Criollo clones (VTLC 532, VTLC 533) and Trinitario clones (VTLC 537, VTLC 538) are promising for cocoa breeding and cultivation aimed at producing fine/flavour cocoa, biofortified chocolates, and premium-quality cocoa products.

Criollo

Forastero

Trinitario

Fig. 28. Cocoa types from the germplasm collections

PALMYRAH

Studies on seednuts of germplasm collected during the year, revealed wide variation among accessions in seed size and weight (Table 2; Fig. 29), fibre attachment, germination period, tuber development, root length, scaly leaf (tuber) weight, and number of roots. One year after planting, seedling height ranged from 11 to 144 cm, with 2–13 leaves per plant. Split-leaf formation was observed at 18 months in accessions from Assam, Kallakuruchi, Jagdalpur, and Kasaragod, indicating substantial variability in early growth and developmental traits among the germplasm.

Table 2. Variation in seed weight of palmyrah germplasm collected from different regions

Germplasm	Seed weight (g)
Navsari	62.24 – 115.04 g
Assam (black fruits)	215.50 - 301.50 g
Assam (yellow fruits)	89.46- 225.25 g
Andaman	166.07- 281.03 g
Kallakuruchi	95.30 – 129.53 g
Tenkasi	105.40 – 350.00 g

Fig. 29. Diversity in seed characters among palmyrah germplasm

Development of descriptors

A comprehensive preliminary descriptor framework was developed for palmyrah to enable systematic characterization and documentation of its genetic resources. The descriptors were grouped into four categories: vegetative (31 traits), reproductive (20 traits), fruit, yield and quality (26 traits), and seed and seedling traits (13 traits). These covered key features such as palm morphology, flowering behaviour, fruit characteristics, yield, quality parameters, and early growth traits. In total, 120 descriptor traits were finalized to facilitate germplasm characterization. This framework will support genetic diversity assessment, identification of elite and region-specific palms, and future crop improvement programmes.

Growth dynamics of tuber and haustorium in palmyrah seedlings

Palmyrah seeds typically require 30–100 days for germination. Studies on tuber development across growth stages revealed significant variation in tuber length, weight, haustorium development, and endosperm quality. Fresh kernel weight increased rapidly and peaked at 30–45 days after sowing (DAS), reflecting active reserve utilization, then declined from 60 DAS due to depletion. In contrast, haustorium weight increased steadily from 15 to 90 DAS, indicating its key role in nutrient mobilization during seedling establishment (Fig.30 and 31). At three months, seedlings showed notable variation in underground traits, with mean tuber and root lengths of 32.85 cm and 18.58 cm, respectively, and an average fresh tuber weight of 70.29 g, highlighting active early growth and biomass accumulation.

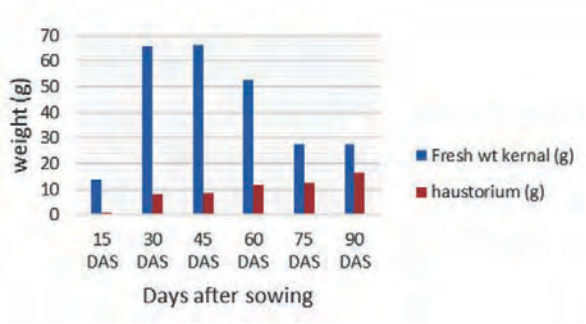


Fig. 30. Changes in fresh kernel and haustorium weight at different days after sowing (DAS)

Fig. 31. Fresh kernel and haustorium development during different growing stage

Germination behaviour of palmyrah seeds under controlled tray method

Tray method was used to study germination behaviour under controlled conditions (Fig. 32). Mature fruits were collected, and the peel and adhering fibres were removed to promote uniform germination. The cleaned seeds were maintained under dark conditions with daily moisture regulation. Under this method, germination commenced as early as 20 days after sowing and continued up to 56 days, indicating a shorter and more synchronized germination period compared to field conditions.

Early seedling growth and tuber development in palmyrah

In April 2024 sowing, initial growth was slow, with the first leaf appearing about four months after sowing, reflecting the prolonged juvenile phase of palmyrah (Fig. 33). Thereafter, growth progressed steadily, and by ten months the seedlings developed four to five leaves, indicating gradual establishment. Well-developed underground growth was observed, with both tuber and root lengths exceeding 60 cm. The above findings provide useful insights into early seedling development and support the standardization of nursery practices and early evaluation protocols in palmyrah.

Fig. 32. (a) Cleaned palmyrah seeds (b) Seeds covered to maintain moisture and dark conditions. (c and d) Seeds showing initiation of germination under tray method.(e) Development of tube

Seeds sown in glass Container

First emergence of leaves after four month

Ten month old seedling

Fig. 33. Growth and root system development of ten-month-old palmyrah seedlings

Variety Notification, Registration and Licensing

Variety proposal of Kalpa Nakshatra, a D×T hybrid between Chowghat Orange Dwarf and West African Tall Variety was submitted to CVRC for notification. Registration proposal of Kalpa Suvarna, and Kalpa Shatabdi submitted to PPVFRA. During the year, two extant varieties were registered with *viz*., Kalpa Ratna (IND-010S) and Kalpa Sreshta (IND 446).

DUS Centre on Coconut

Data generated on DUS descriptor traits in 14 example/reference was submitted to PPVFRA for updating DUS database. Seed nuts of reference/ released/extant varieties *viz*., COD, WCT, CGD, MYD, MOD, GBGD, Kalparaksha, Kalpa Dhenu, Kalpa Pratibha, Kalpa Mitra, Chandra Kalpa, Kerachandra, Kalpatharu, SNRT, Spicata Tall, LMT, were sown for generating seedlings for DUS testing. About 120 palms of reference varieties planted during 2013 under 4 m × 4 m spacing was removed and the area was replanted with new seedlings of candidate/reference/example varieties.

On-site DUS descriptor data of the farmer's variety Edava Long Fibre Coconut (Reg. No. 2014/1949), along with the reference variety data recorded at the DUS centre, was compiled and submitted to PPVFRA, facilitating issue of first farmers' variety

certificate in coconut. DUS descriptor data recorded on candidate variety Konkan Bhatye Coconut Hybrid-1 (REG /2015/415) and reference varieties planted in DUS nodal center, along with on-site data earlier recorded at RCRS, Bhatye was compiled and submitted to PPVFRA. In addition, two farmers varieties are under on site evaluation, and recording of DUS descriptor data, was initiated in Deejay Yellow Dwarf (REG/2013/760) and UCHC 1 (REG/2016/219). Seedlings of UCHC 1, received from applicant were planted at DUS nodal centre for recording DUS descriptive data (Fig. 34). Three seedlings each of Kalpa Shatabdi and Kalpa Suvarna were also planted in DUS maintenance plot.

Fig. 34. Seedlings of coconut variety UCHC 1 (left) and new planting in DUS nodal centre

DUS Centre on Cocoa

To facilitate, registration of farmers' varieties, DUS descriptor traits were recorded on two farmers' varieties *viz*., MANIMALAI 1 (CT 40) and MANIMALAI 2 (Brown Gold).

Planting material production

Seed production of released varieties as well as parental lines was undertaken at different centres (Table 3).

Table 3. Planting material produced and revenue generated during the year

Centre	Planting material produced					Revenue (Rs. in lakhs)
	Coconut	Arecanut	Cocoa	Others	Total	
Kasaragod	41475	-	-	-	41475	85.71
Kayamkulam	17306	-	-	-	17306	46.28
Vittal	13	26929	47890		74832	26.85
Kidu	36688	155732	4217	45	196682	87.69
Mohitnagar	520	93380	5488	8938	108326	27.63
Kahikuchi	-	111000	1000	75	112075	6.82
Total	**96002**	**387041**	**58595**	**9058**	**550696**	**280.98**

Kasaragod

21999 hybrid seed nuts were produced and sown in the nursery from the flowers pollinated during the period. 94209 female flowers from 487 WCT, 26 LCT and 25 COD, 6 MYD palms were pollinated. Breeder seed production was undertaken in released varieties. For ground pollination studies, 38 WCT palms were selected and pollinated.

Kidu

Large-scale controlled pollination was carried out for hybrid and inter-se seed production. 18 WCT mother palms were ground pollinated with COD, and 23 LCT mother palms have been ground pollinated with COD pollen for production of hybrid seed nuts of Kera Sankara and Chandra Laksha, respectively.

Further, an experiment on pro-tray nursery technique



Seed pods | Scion sticks | QR code

Fig. 35. Various stages of production of quality cocoa planting meterial

(with different growing media) for raising arecanut sprouts/seedlings was initiated, to evaluate its efficiency over conventional nursery beds. Seed nuts of Mohitnagar and Swarnamangala recorded 100% establishment, whereas nursery bed seedlings suffered root damage and reduced establishment (72%). Based on these encouraging results, the study has been scaled up to more than 80 pro-trays with different media and varieties. germination. Seedlings assessed at 3, 6, 9, and 12 months showed good growth and root development comparable to nursery bed-raised seedlings. Pro-tray seedlings retained intact root systems during transportation, resulting in 100% establishment, whereas nursery bed seedlings suffered root damage and reduced establishment (72%). Based on these encouraging results, the study has been scaled up to more than 80 pro-trays with different media and varieties.

Vittal

Activities like arecanut mother palm selection, inter-se mating/crossing, seed nut selection, sowing, nursery management and seedling selection were carried out for production of arecanut planting.

Cocoa planting material was supplied as seed pods (6462), seedlings (27,278), grafts (1454) and scions (3600). Further, QR code (quick response code) for cocoa varieties and clones are being tagged for authenticity and tracking.

Kayamkulam

A total of 19,288 seednuts of Kalpasree, Kalparaksha, Chowghat Orange Dwarf, Kalpasankara, WCT and Kalpa Vajra were collected for raising seedlings for distribution to farmers in the root (wilt) disease prevalent tracts. Artificial pollination was carried out on 238 dwarf parental palms for production of hybrid seed nuts. Pollination using modified ground pollination technique was carried out on 103 tall mother palms, with a fruit set of 23-25 per cent.

Kahikuchi

Quality planting materials of arecanut varieties and cocoa were produced for sale. In addition, planting material of black pepper (230) and cinnamon (584) were also produced.

Mohitnagar

Quality planting materials of arecanut, coconut and cocoa were produced for sale. Additionally, 4904 black pepper rooted cuttings, 676 bay leaf air layer and 425 acid lime rooted cuttings were produced and distributed.

6.2

Optimization of Mass Multiplication Protocols

Coconut Tissue Culture

Callus induction, formation of embryogenic calli and somatic embryos using novel growth regulators

Meta-topolin (mT), a potent aromatic cytokinin, has consistently outperformed traditional cytokinins in facilitating in vitro regeneration across diverse plant taxa. The study undertaken has demonstrated that the synergistic application of mT (5 µM) and picloram (200 µM) in Y3 medium significantly enhances callus induction and somatic embryogenesis in coconut embryonic shoot meristem explants. This protocol achieved a 48% somatic embryo production rate, followed by uniform rooting and successful field acclimatization (Fig. 36). The optimum mT-picloram combination provides a breakthrough for reliable mass production that effectively addresses the inherent recalcitrance of coconut tissue culture.

Fig. 36. Plantlet acclimatization stages: a rooted plant, b potted plant with polythene cover, c–e potted plantlet, f plantlet in the field

An efficient cell suspension culture system was established using coconut embryonic shoot meristem-derived calli. The research focused on optimizing inoculum selection and identifying critical factors for embryogenic potential and proliferation. Comparative analysis of five callus types and three inoculation techniques indicated that embryogenic calli containing initial somatic embryos, paired with a direct inoculation method, produced the most robust and viable cultures while minimizing browning and contamination. Furthermore, a two-day subculture cycle significantly mitigated oxidative browning by reducing phenolic accumulation. Among 18 media formulations tested, the combination of meta-topolin with either picloram or 2,4-D yielded the highest proliferation and differentiation rates. Specifically, the picloram and meta-topolin treatment demonstrated superior results, characterized by lower oxidative stress, reduced phenolic exudation, and enhanced physicochemical stability.

Regeneration efficiency could be enhanced with the inclusion of 15 µM 5-azaC, combined with 75 µM picloram and 4.54 µM TDZ, significantly enhanced regeneration efficiency. This treatment yielded superior results in callus induction (95.8%), embryogenic callus formation (87.5%), and the number of somatic embryos (4.7) and plantlets (4.0) per explant compared to the control.

Using quantitative real-time PCR (qRT-PCR), the expression profiles of five conserved miRNAs-cnu-miR166a, cnu-miR167c, cnu-miR169a, cnu-miR171a, and cnu-miR397-alongside their targets involved in hormone signaling and transcriptional regulation were analyzed. Distinct stage-specific expression was noticed: cnu-miR166a and cnu-miR167c predominated during early zygotic embryogenesis (ZE), whereas cnu-miR169a and cnu-miR397 were significantly upregulated during SE.

Axillary *in vitro* shoots in coconut

Zygotic embryos from indigenous coconut accessions were evaluated for the induction of proliferating masses and axillary shoot regeneration. Plantlets were first established from these embryos; after three months, they were trimmed to expose the meristems.

A 25 per cent success rate for proliferating mass initiation was achieved from these cut meristem cultures. Although plantlets were successfully regenerated, they have not yet initiated roots.

Immature Inflorescence Culture

Bud initiation

Immature inflorescence explants collected from 25- to 30-year-old West Coast Tall (cv) palms were cultured on different media combinations for bud initiation. The woody plant medium supplemented with 5 mg per L TDZ was the most effective treatment, yielding the highest number of vegetative buds (7.0 per explant) while minimizing the tissue browning. In contrast, addition of 2,4-D in certain concentrations increased browning and suppressed the bud induction (Fig. 38a & b).

Multiple shoot induction

To promote shoot development, vegetative bud clusters were first cultured under diffused light to induce chlorophyll synthesis. Once greening occurred, they were moved to a 16-hour photoperiod at 2,500 lux for further proliferation. The most effective treatment for the number of shoots (8.3 per explant) and length of the shoots (6.83 cm) was WPM supplemented with 1 mg per L each of NAA and BAP, along with 5 mg per L TDZ. These results were comparable to those obtained with ½ MS medium supplemented with 1 mg per L each of NAA and BAP, along with 5 mg per L 2iP (Fig. 37c).

Shoot elongation

Shoots were transferred to Y3-based elongation media to test combinations of growth regulators. Significant treatment effects on both shoot length and leaf count were evident. The most effective results were achieved using Y3 medium fortified with 2 mg per L NAA and 5 mg per L BAP, which produced the maximum elongation (8.03 cm) and the highest number of leaves (Fig. 37; Fig. 38d and e).

Rooting

Shootlets bearing more than three well-developed leaves were selected and transferred to rooting media consisting of either full-strength or half-strength Y3 or MS basal formulations supplemented with different auxins. Among the various rooting experiments evaluated, maximum root initiation was recorded on half-strength MS medium supplemented with NAA and IBA with 40 g per L sucrose (Fig. 38f).

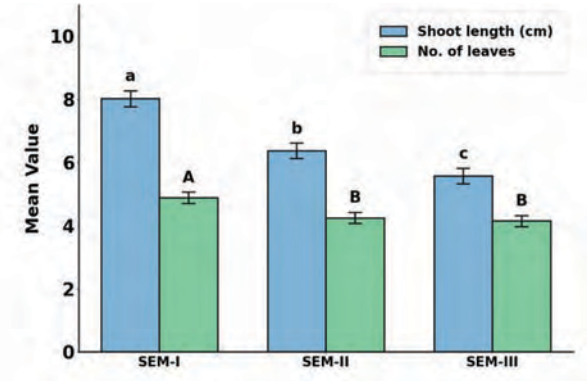


Fig. 37. Effect of treatments on shoot length and number of leaves

Hardening

Healthy rooted plantlets were utilized for acclimatization. The plantlets from the culture tubes were transplanted into small disposable cups containing a sterilized potting mixture of soil, cocopeat, and perlite (2:1:1) after being treated with a fungicide. After two months of primary hardening, the plantlets were transferred to plastic pots, covered with transparent polythene covers, and kept at room temperature. Fully hardened plantlets were finally transferred to polybags and maintained in the greenhouse for further growth and establishment (Fig. 38g).

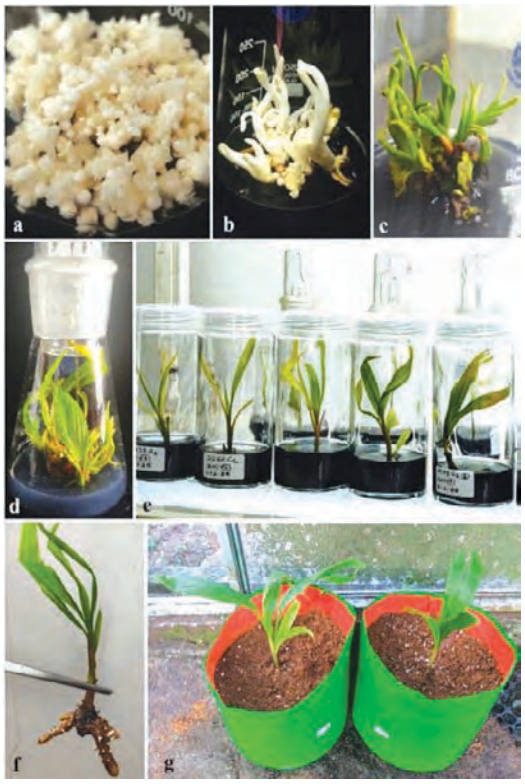


Fig. 38. Growth stages in immature inflorescence culture of coconut. a & b: culture initiation; c: shoot multiplication; d & e: shoot elongation; f: rooting; g: hardening

Clonal fidelity testing

Comparative analysis of SSR (10 coconut-specific markers) fingerprints revealed that the tissue culture-derived plantlets displayed monomorphic and identical allele patterns corresponding to their respective mother palms.

Design and fabrication of a mini chamber for rooting and hardening

The setup comprised a glass chamber with a fogging system the plantlets in grow bags containing a sterilized potting mixture were illuminated with LED lights ensuring sufficient light intensity for photosynthetic activity and gradual adaptation to external environmental conditions. However, after one month of incubation, the plantlets exhibited symptoms of senescence, suggesting failure in root initiation and establishment under the given conditions. Despite this, the structure could be successfully used for primary hardening of rooted plantlets (Fig. 39).

Fig. 39. Mini chamber for *ex vitro*

Field performance of tissue culture plantlet

The first tissue culture-derived coconut plantlet of variety West Coast Tall (WCT) planted at ICAR–CPCRI, Regional Station, Kayamkulam, in November 2020, initiated flowering in February 2024. The flowers exhibited good pollen viability, exceeding 75 per cent, suggesting normal fertility. The average whole-fruit weight was 1.9 kg, and the dehusked nut weight was 1.02 kg. The mean kernel thickness was 1.7 cm (Fig. 40). Average copra yield was 308 g per nut with an oil content of 66 per cent. The tender nuts contained approximately 500 mL of sweet-tasting water, with a total soluble solids (TSS) value of 8.7°Brix, indicating good quality and consumer acceptability.

Fig. 40. Features of nuts from tissue-cultured coconut palm

Arecanut Tissue Culture

Embryogenic callus cultures and somatic embryos, derived from the immature inflorescences of various arecanut cultivars (VTLAH-1, VTLAH-2, Hirehalli Dwarf, and YLD-tolerant), were sub-cultured at regular intervals to facilitate multiplication and maturation. Current inventories of embryogenic cultures include 150 for YLD-resistant palms, 100 for VTLAH-2, 30 for VTLAH-1, and 10 for Hirehalli Dwarf (HD). These cultures have yielded approximately 2500, 1500, 250, and 50 somatic embryos, respectively. Additionally, 600 dwarf hybrid plantlets and 500 YLD-resistant plantlets are currently maintained at various growth stages under a 16-h photoperiod.

Novel *in vitro* protocol for the clonal propagation of the VTLAH-2 dwarf arecanut hybrid via indirect somatic embryogenesis by utilizing immature inflorescence explants and a Y3 basal medium has been developed. The effective formulation consisted of picloram (200 µM) and meta-topolin (2.07 µM) and significantly optimized embryogenic callus induction and embryo formation. The SCoT marker analysis confirmed 100 per cent genetic fidelity between the regenerated plantlets and the mother palm, ensuring a reliable, true-to-type clonal propagation system.

Standardizing media combinations for potting mixture and standardizing various methods (e.g., hydroponics) for acclimatization and hardening

The hydroponic method for ex vitro hardening significantly enhanced the recovery of arecanut plantlets derived from immature inflorescence cultures (Fig. 41). Recovery rates improved more than two fold (~63%) compared to the direct potting method (~18%). Analysis of six-month-old plantlets revealed that those hardened

hydroponically exhibited superior growth compared to conventionally hardened individuals. Plant height increments were greater in the hydroponic group, and plant biomass showed a significant increase, reaching 56.5 g per plant compared to 21 g per plant in the conventional group. Furthermore, metrics such as collar girth, root spread volume, and maximum root length were notably higher. Physiological vigor was also enhanced in plantlets hardened through this novel technique, as evidenced by higher rates of net photosynthesis, stomatal conductance, internal CO_2 concentration, and Fv/Fm ratios.

Fig. 41. Arecanut plantlets derived from immature inflorescence cultures undergoing hardening in the misting chamber

6.3

Input Use Efficiency for Higher Productivity and Environmental Security

Screening of microbial cultures for stress tolerance

Microbial isolates were tested for tolerance to varying temperature and salt (NaCl) levels by measuring their growth, metabolic activity, and structural integrity. Results revealed strain-specific responses to temperature and salinity.

Bacillus cereus, *Bacillus pumilus* and *Bacillus safensis* could tolerate temperatures up to 55°C; however, optimum growth occurred at a temperature range of 37-45°C. Out of the three, *Bacillus pumilus* showed residual growth at 4°C. Others did not grow at low temperature. Microbes exhibit minimum, optimum and maximum growth temperatures. Temperatures above the optimum cause protein denaturation, while those below the minimum cause enzymatic inactivation and membrane rigidity.

Bacillus cereus, *Bacillus pumilus* and *Bacillus safensis* showed optimum growth at 1 to 3 per cent NaCl concentrations. Salt (NaCl) concentrations of 1-3 % are considered low to moderate allowing micro-organisms to exhibit normal metabolic activity; in some cases stimulated growth dynamics is observed.

Bacillus safensis and *Bacillus pumilus* showed tolerance up to 13-14 per cent NaCl concentrations, which is quite significant. Obviously, they were able to balance osmotic pressure and could be categorized as 'halotolerant'. In case of *Bacillus cereus*, severe growth restriction occurred above 5 per cent NaCl concentration. More than 5 per cent NaCl is considered as high, inhibiting growth by causing

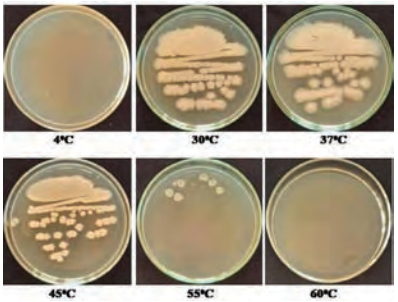


Fig. 42. Growth Bacillus cereus at different temperatures

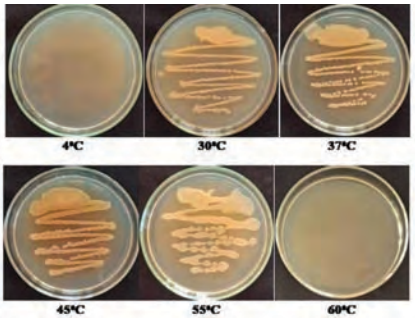


Fig. 43. Growth Bacillus safensis at different temperatures

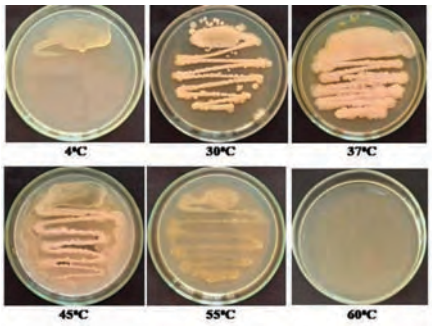


Fig. 44. Growth Bacillus pumilus at different temperatures

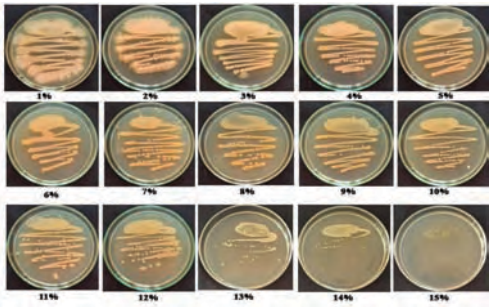


Fig. 45. Growth Bacillus safensis at different NaCI concentration

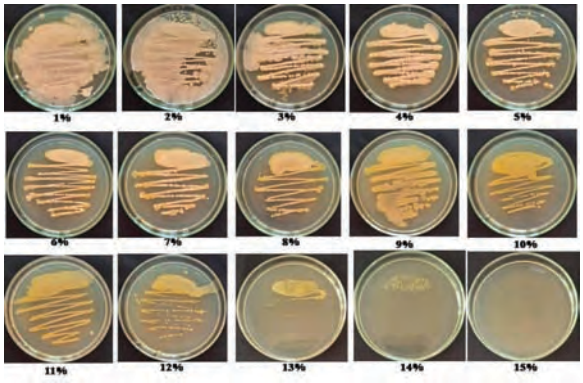


Fig. 46. Growth Bacillus pumilus at different NaCI concentrations

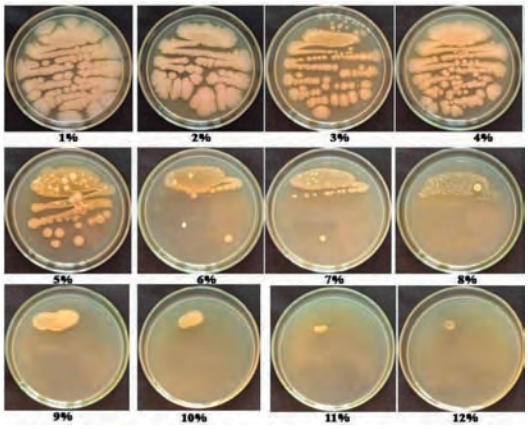


Fig. 47. Growth Bacillus cereus at different NaCI concentrations

Overall, temperature is a fundamental determinant of microbial growth rate and metabolic activity, affecting membrane fluidity, enzyme activity, and protein structure where as salt concentration regulates microbial growth by influencing osmotic pressure, water availability and ionic concentration. While moderate conditions allow for optimal growth and metabolic activity, deviations, particularly high salinity, serve as effective barriers to growth.

Bacterial cellulose production from mature coconut water using indigenous bacterial strains

Ten indigenous Komagataeibacter isolates that produced cellulose pellicle in coconut water medium were characterized for microbial valorisation of coconut water and are being maintained at ICAR-CPCRI. Basic characterization of all the ten bacterial cellulose (BC) producing isolates were carried out following standard procedures for acid production assay, pH and acetic acid tolerance. All the ten isolates were positive for acid production recording solubilisation index of more than 2.0 with a maximum read of 2.81 for the isolate BC4. Highest BC production was observed in the pH range of 3.5 to 4.5. Isolate BC3 tolerated the highest concentration of acetic acid tested (4%) while recording the maximum BC yield. BC production in synthetic broth was observed in temperature ranging from 15 to 35°C. Isolate BC 7 recorded maximum yield of BC at 22.30g per 100mL (wet weight) followed by isolate BC1 and BC8 (~12 g per 100 mL) at 15°C whereas isolate BC2 recorded the highest BC yield of 20.92 g per 100 mL at 35°C. FTIR spectra of BC produced by all the ten isolates were similar exhibiting characteristic bands of cellulose I (Fig. 48).

Scale-up studies on bacterial cellulose production/ nata de coco utilizing mature coconut water was conducted. Based on the BC yield in standard nata de coco production media utilizing mature coconut water three isolates BC3, BC5, BC6 were selected for further scale up studies. Inoculum strength and fermentation conditions are being standardized for each culture. Current developments in scaling-up approaches recorded yield ranging from 500g to 750g of wet bacterial cellulose pellicle per litre of mature coconut water at ambient culture conditions in an incubation period of 10 days (Fig. 49). Comparative evaluation of the fermentation process for bacterial cellulose production using the developed indigenous cultures and the commercial culture is in progress. Formulation of starter inoculum for BC production, development of nata de coco based premium food products and BC based bio composites for industrial

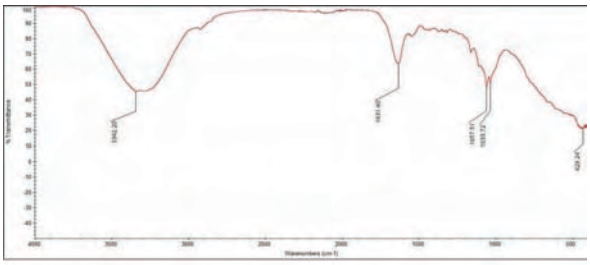


Fig. 48. FTIR spectrum of bacterial cellulose from BC5

Fig. 49. Scaling up of bacterial cellulose production utilizing mature coconut water

Bio priming effects of PGPR strains and consortia on juvenile coconut palms

Bio priming effects of PGPR strains and consortia on biotic stress (RWD) tolerance are being studied in field planted coconut seedlings treated/bio primed with different PGPR strains and consortium (planted in Block V, CPCRI, Regional station, Kayamkulam during March 2021).

Bio inoculant treatments included T1- *Pseudomonas* sp.- KH3PSB2 (multiple nutrient solubilizing rhizobacteria); T2-*Bacillus* sp.- CRE-9 (Root endophyte); T3- *Margalitia* sp.- CRE-15 (Root endophyte); T4- *Azospirillum* sp.-AzoL8; T5-Consortium (of above 4 strains), T6-Control. Significant improvement in soil pH, EC and soil nutrients except for OC (0.3%) in comparison to the initial parameters is observed with integrated nutrient management. General deficiency of calcium and magnesium noticed was taken care by liming and MgSO4 application. Biometric parameters, soil microbial population and physiological parameters such as stomatal conductance, photosynthesis and transpiration rate are being monitored at stipulated intervals. Plant health status, in terms of root (wilt) disease index, is better in treatments with individual bacterium in comparison to control and consortium. Multiple nutrient solubilizing coconut rhizosphere bacterium *Pseudomonas migulae* strain K3HPSB2 is found a suitable for bio priming coconut nursery seedling sand field application for growth promotion and soil health management in root (wilt) affected tracts. With the ability to solubilize phosphorus, potassium, silica, zinc and produce IAA, this bacterium is found to have growth promoting effects in maize, coconut and cocoa. It is found to have a wide range of pH adaptation (5.0-9.0) (Fig. 51) making it suitable for different soil types.

Fig. 50. Nutrient solubilisation potential of P. migulae strain K3HPSB2

Bioprospecting of phyllosphere bacteria in coconut and cocoa

About forty phyllosphere bacteria isolates were isolated from the phyllosphere and studied for their niche adoption traits *viz*, mono carbon utilization and polysaccharide production. Few elite isolates were identified as *Bacillus* sp, *Pseudomonas* sp. and *Methylobacterium* sp. based on 16S rDNA sequencing. Growth Promoting potential of the phyllosphere isolates were studied under *in vitro* conditions.

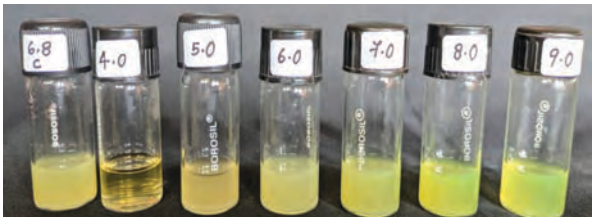


Fig. 51. pH adaptation of P. migulae strain K3HPSB2

Quality and Microbial safety of arecanut with reference to Food Safety Guidelines of India

Analysis of moisture status, water activity and microbial quality of chali arecanut at varied moisture levels (5 to 10%) and two package materials of storage conditions has been studied and at the studied moisture levels the chali arecanut samples satisfy the process hygiene and food safety criteria of FSSAI.

Natural farming in coconut based farming system - An analysis of farmers experiences and impact

The Natural and Non-natural farming coconut rhizosphere soil of Malappuram District, Kerala has been analyzed for bacteria, fungi, actinomycetes, P solubilizers and diazotrophs and the results revealed higher abundance of P solubilizers and diazotrophs in natural farming coconut rhizosphere over the non-natural farming fields.

Evaluation of organic cultivation of coconut-based farming system under coastal agro-ecosystem (Kasaragod)

The organic cultivation of coconut was evaluated, and the treatment involving in situ recycling of organic matter (fronds, leaves, inflorescence waste, and husk) in trenches, *in situ* green manuring, application of PGPR consortia and cow dung in the basin, along with 50 per cent of the recommended K2O dose using sulphate of potash, resulted in a coconut yield of 17,850 nuts per ha, the highest cocoa dry bean yield (1,062 kg ha^{-1}), and net returns of Rs. 3,84,398 per hectare.

Management of coconut based farming systems for sustainable productivity (Kasaragod)

From one hectare of coconut-based farming system comprising coconut, pepper trailed on the coconut

trunk, banana in the border of the plots, Multi cut fodder sorghum (CO 31) in the interspaces of coconut receiving combined application of 50% RDF and organics i.e., 25 kg per palm FYM/poultry/ goat manure + cow dung slurry along with dairy unit and poultry, net returns of Rs. 6,27,581/- has been achieved. Multi-cut fodder sorghum variety CO 31, can be successfully grown as an intercrop in coconut under 100 per cent organic management, with an average fodder yield of 80 to 100 t per hectare of coconut garden per year.

Coconut based HDMSCS under organic and integrated management

The coconut-based high-density multi-species cropping system (HDMSCS) at Kasaragod-including coconut, pepper, banana (Kadali and Robusta), cinnamon, and nutmeg-managed with 1/3rd of the recommended NPK, along with vermicompost, biofertilizers, green manuring, and vermiwash, achieved the highest coconut yield (20,592 nuts ha^{-1} year^{-1}), pepper yield (328 kg ha^{-1}), Kadali (Bunch weight 7.4 to 8.4 kg), robusta (13.8 to 15.7 kg), cinnamon (90.376 kg ha^{-1}) and net returns of Rs. 4,86,692 per ha, with a benefit-cost ratio of 3.78.

Fig. 52. Coconut based cropping/ farming systems

Simultaneous planting of dwarf jack in coconut gardens

Jack varieties Sindhoor Varikka, Gumless, Malaysian Dwarf and Thailand Pink were planted within the rows of coconut palms at a distance of 4.5m from the palm basin in 2021 at ICAR-CPCRI, Regional Station, Kayamkulam to identify suitable dwarf jack varieties as intercrop for simultaneous planting in coconut garden. The palms (var. Kalpa Sankara) were planted at a wider spacing of 9 m x 9 m. The jack varieties showed distinct characteristics in growth and flowering. Among the varieties, Sindhoor Varikka recorded robust growth with vigorous vertical and horizontal spread, which was pruned at 14, 24, 34 and 44 months after planting adding total biomass of 27.87±8.79 kg per tree. This variety recorded higher canopy density of 7.74 with strong photosynthetic capacity and biomass accumulation potential whereas var. Thailand Pink showed a balanced canopy density (5.9) resulting in better light penetration in the system. Overall, Thailand Pink appears most physiologically efficient and stress-resilient among the tested jackfruit genotypes, aligning with prior findings that genotypic variation in *Artocarpus heterophyllus* significantly influences stomatal conductance, photosynthetic efficiency, and chlorophyll fluorescence behavior under thermal and water stress. Var. Thailand Pink recorded Year-round fruiting with two fruiting seasons during June to August (lean season) and August to May (peak season). The peak fruiting season of the variety coincides with off-season of locally available cultivars fetching higher market price. It produced 7-8 fruits per tree with an average weight of 4.63 kg with 87 fruit lets per fruit during lean season and 19-22 fruits per tree with 6.02Kg with 124 fruitlets per fruit during peak season respectively.

Growing jack in the interspaces substantially improved the soil nutrient status and microbial population. Tree canopy and spatial arrangement in the coconut–jack intercropping system effectively buffer soil temperature extremes, creating a more favorable microclimate for root activity and microbial processes. Intercropping with perennial tree canopies significantly reduced soil surface temperature by 5-7 °C compared with open areas through increased shade and soil organic matter accumulation. The soil organic carbon content was higher under the canopy conditions indicating litter accumulation and increased biological activity. The palms in the system recorded 100 per cent harvest at 36 months after planting with an average yield of 124 tender nuts per palm and 86 mature nuts per

palm during the first year. The tender nuts produced in the system showed an average weight of 1.94kg per nut with tender nut water of 308.6 mL per nut and pH 5.2. De-husked mature nut recorded an average weight of 594g per nut with a copra content of 188g per nut.

Fig. 53. Simultanous planting of dwarf jack in coconut system

Fig. 54. Performance of coconut under Coconut + Jack system

Demonstration of cinnamon intercropping in coconut garden (DASD Project)

Cinnamon intercropping in coconut with Pentagonal method of planting at different spacing revealed that spacing had significant influence on growth and yield of cinnamon. Among the different spacings tried cinnamon planted with 0.6 ×1.2 m by following pentagon method of planting (5 plants pit^{-1}) generated net returns of Rs. 3,56,792 per hectare with a B:C ratio of 1.93, demonstrating its potential for efficient space utilization and profitability.

Palm based cropping system under Sub-Himalayan Terai region

A total of 11 betel vine lines/variety was planted as mixed crop in arecanut plantation with 6 vines per treatment with three replications. Growth observation was recorded for all the lines along with the yield of arecanut. Maximum plant height (380.1 cm) was recorded in Chalani Bangla followed by Bhavana (362.3 cm) and Bagerhat (355.9 cm). Minimum plant height (250.1 cm) was recorded in Katki. However average monthly (9 month) vine growth was also recorded maximum (266.6 cm) in Katki followed by MM 20 (246.1 cm). Monthly average number of leaves was produced maximum (173.4) in Chalani Bangla followed by Gayasukh (127.5), however minimum monthly leaf production (50.8) was in Katki. Number of branches per month was recorded maximum (8.2) in Chalani Bangla followed by Gole Bhavana and Bagerhat (6.6), however minimum monthly branches (3.7) was produced by Katki. In case leaf length, maximum leaf length (15.6 cm) was produced by Chalani Bangla followed by MM 20 (14.8 cm), Mohitnagar Local (14.5 cm), Gayasukh (14.3 cm) and Bidhan Pan 1 (14.2 cm) which were statistically non-significant. Leaf width was recorded maximum (12.6 cm) in MM 20 followed by Chalani Bangla (12.4 cm). The arecanut yield was increased (10-15%) where the betel vine was grown as mixed crop than the sole arecanut.

Fig. 55. Betelvine trailing on arecanut palms as intercrop

Arecanut based high density multispecies cropping system (HDMSCS) at Kahikuchi

Arecanut based high density multispecies cropping system (HDMSCS) at Kahikuchi with various crop components (pineapple, turmeric, Assam lemon and banana) and integrated nutrient and organic management indicated that application of 2/3rd recommended dose of fertilizer (RDF) and recycling of biomass resulted in higher chali yield per palm (1.51 kg) and fruit weight of banana per plant (12.39 kg) though no significant difference was observed among the treatments. In case of turmeric, application of 1/3rd recommended dose of fertilizer + recycling of biomass + biofertilizers + green manuring crops resulted in higher rhizome weight per plot (22.16 kg) though there was also no significant difference among the treatments.

Fig. 56. Arecanut HDMSCS

Enhancing nutrient and water use efficiency for sustained productivity in coconut, arecanut and cocoa.

Kalpa Poshak and Kalpa Vardhini for the growth and productivity of juvenile and adult coconut palms.

The performance of Kalpa Poshak and Kalpa Vardhini was validated through field demonstration trials. Kalpa Vardhini application continued after 3 years of growth in the palms treated with Kalpa Poshak. Kalpa Vardhani treated palms showed increase in nut setting and yield. Soil analysis at a depth of 30 cm showed average values of pH 6.5, EC 0.17 dS m^{-1}, organic carbon 0.30 per cent, available phosphorus 13 ppm, potassium 162 ppm, calcium 414 ppm, magnesium 99 ppm, manganese 0.81 ppm and zinc 2.59 ppm. At 60 cm depth, the corresponding values were pH 5.2, EC 0.12 dS m^{-1}, organic carbon 0.20 per cent, available phosphorus 33 ppm, potassium 160 ppm, calcium 187 ppm, magnesium 60 ppm, manganese 0.99 ppm and zinc 3.76 ppm respectively.

Demonstration of Kalpa Vardhini as component of integrated nutrient management in coconut for sustained soil and palm health

The project on evaluation of Kalpa Vardhini was initiated in November 2022 across five panchayaths of Alappuzha and Kollam districts, wherein 750 coconut palms were selected for on-farm demonstration. The study aimed to assess the effectiveness of Kalpa Vardhini in sustaining coconut palm productivity and to evaluate its role as a component of integrated nutrient management on soil fertility and overall palm health. Major nutrients along with Kalpa Vardhini were applied according to the recommended schedule in split doses. Soil samples were collected at the end of third year and analysed for various nutrients. The results indicated enhanced availability of nutrients, with mean available potassium, calcium and magnesium contents of 83.03 ppm, 368.67 ppm and 76 ppm, respectively, at 30 cm depth, and 59.65 ppm, 235.67 ppm and 48.4 ppm, respectively, at 60 cm depth. Compared to the control and the recommended dose of nutrients the tender nut nutrient concentration also improved in Kalpa Vardhani treated palms.

Hydroponics studies for understanding water and nutrient uptake in healthy and root (wilt) disease affected juvenile coconut palms

Healthy and root (wilt) disease–affected juvenile coconut palms were raised under hydroponic conditions in Hoagland nutrient solution for a period of two years. The objective of the study was to understand the patterns of nutrient and water uptake in both healthy and diseased palms. Two healthy and two diseased West Coast Tall coconut seedlings, each two years old, along with one healthy and one diseased Chowghat Green Dwarf (CGD) seedling, were grown in the nutrient solution. It was found that there was differential rate of nutrient uptake between healthy and diseased palms. The uptake of nutrients and water was higher in healthy palms, which could be attributed to better root development compared to diseased palms. The study further revealed that, irrespective of the nutrient element, water absorption rates and biomass production were consistently higher in healthy juvenile palms. It was also observed that the growth response of diseased plants in the Hoagland solution was not encouraging.

Development of a Composite Nutrient Mixture for Coconut

In order to prepare a composite nutrient mixture for coconut palms different fertilizer materials were

collected and 4 different combinations containing major, secondary and micronutrients were prepared. These materials were tried for their stability and storage life. Out of the four, one mixture was successful in maintaining its stability, physical form and nutrient content after six months. This mixture contains NPK in the 2:1:4 ratio with secondary and micronutrients. This will facilitate in using a single fertilizer material in place of different fertilizer materials applied separately for coconut palm. Laboratory studies are still in progress to assess nutrient solubility, stability and quality parameters of the mixture. Field application has been initiated in coconut gardens to study its influence on palm growth, nutrient uptake and yield attributes. The developed nutrient mixture is expected to improve nutrient use efficiency and provide a comprehensive nutrient supply tailored to the nutritional requirements of coconut.

Fig. 57. Nutrient mixture developed

Fertigation studies in Hybrid coconut (Kalpa Sankara)

In order to improve the resource use efficiency and productivity in hybrid coconut Kalpa Sankara, a field experiment with new planting was taken from July 2017 with 5 treatments: T1-50%, T2-100% T3-150%, T4-200% of soil test based nutrient recommendation of N and K through drip fertigation and T5 with basin application of nutrients with drip irrigation. Recommended dose of fertilizers were given in 20 split doses from July to May. Results of 2024-25 season are described. Nut yield recorded is 169 nuts in T3 and 167 nuts in T4 which were significantly higher than T5 (118nos). Good nuts were significantly high in T3 (164Nos) and T4 (163 Nos.) than in T5 (114Nos). Tender nut water volume (363 mL) and weight (364g) was significantly lower in drip irrigation with soil application treatment compared to fertigation treatments.

Rate of photosynthesis was 8.31µmol per m^2 pers in T4 and 7.95 µmol per m^2 per s in T3 which were not significantly different.

Fig. 58. Uniform and full bunches under fertigation

Water and nutrient management through fertigation for early flowering and harvest of tender nuts in dwarf palms

A field experiment is being carried out with the objective to study the combined effect of water and nutrients for standardizing a cost effective fertigation schedule for dwarf palms grown for tender nut purpose. The variety selected for the study is COD, the dwarf variety released by ICAR-CPCRI for tender nut production. The experiment was laid out in FRBD with nine treatments and one control (C: 100% STBNR (530:150:1200 NPK) as soil application in four splits + 66% PE drip irrigation). The treatments comprised of three levels of irrigation (66%, 100%, and 133% of evaporation) and three levels of nutrition (C+1/3C, C+2/3C and C+C). The nutrients were supplied in 20 equal splits at fortnightly intervals during August to May. The average number of days for scheduling irrigation treatments was 127 days per year. In general, the palms were showing alternated bearing nature. The palms supplied with 100% PE irrigation and 200 per cent nutrients (133 nuts $year^1$ and 57 nuts $year^{-1}$) recorded higher productivity which was at par with 100 per cent PE irrigation and 166 per cent nutrients (119 nuts $year^{-1}$ and 51 nuts $year^{-1}$) during first and second year of harvests respectively.

The tender nuts produced under fertigation recorded improved nutrient content (Fig.) Irrespective of irrigation levels, nitrogen fixing bacterial count was lower (16.5 to 21.29 x 105) at third level of nutrients. The rate of leaf transpiration and photosynthesis was recorded the lowest in treatments under highest nutrients and lowest water levels.

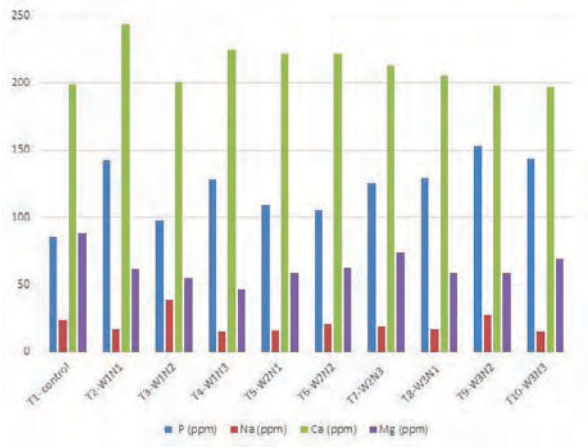


Fig. 59. Phosphorous, sodium, calcium and magnesium content of tendernut water under different treatments

Management strategies for production, health and nutrition of arecanut and cocoa

Identification and severity assessment of nutrient deficiencies in cocoa using machine learning and deep learning approaches

Nutrient deficiency is being observed in many cocoa-growing regions. Precise identification of the deficiency symptoms is of utmost importance for its effective management. However, farmers and extension personnel are often confused with deficiency symptoms. Deficiency symptoms for N, P, K, Ca, Mg, Fe, Mn, B, Zn and Mn were established in cocoa plants by growing them in hydroponic system without the specific nutrient. The images were taken and data set for deficient leaves and healthy leaves were created using image processing approaches. The study leveraged a dataset of 10,728 images of cocoa leaves, encompassing both healthy samples and those affected by nutrient deficiencies. The ConvNext model was utilized for detecting nutritional deficiencies, achieving an accuracy of 96 per cent with a macro average precision, recall, and F1-score of 96 per cent, 95 per cent, and 95 per cent, respectively, showcasing its robust performance. Severity levels—categorized as critical, moderate, and low—were predicted using the Random Forest Classifier, which achieved an overall accuracy of 91.61 per cent. Precision values ranged from 0.88 to 0.95, and recall values ranged from 0.82 to 0.97, demonstrating the model's reliability in severity prediction. Additionally, the system recommends the appropriate type and amount of fertilizer based on the identified deficiency, offering a comprehensive solution to improve cocoa plant health and productivity.

High-density planting system in cocoa for higher productivity

Grafts of cocoa variety Netra Centura were planted in five planting distances of 1.35 × 1.35 × 2.7 m, 1.35 × 2.7 m, 1.35 × 5.4 m, 2.7 × 2.7 m and 2.7 × 5.4 m with planting density ranging from 650 to 3712 plants per ha in 2016. The annual yield was 822-896 kg per ha in the closely planted cocoa grafts, which was 191-208 per cent higher than grafts under recommended spacing of 2.7 × 5.4 m, having low population density. Higher dry cocoa bean yield per hectare in closely planted grafts was due to higher plant population. The single bean weight was also higher in closely planted cocoa. The data indicates that, high density planting of cocoa can give bolder bean and significantly higher productivity in the initial years.

Interaction of nutrients with diseases in arecanut

The effect of boron on the incidence of bud rot disease in arecanut was assessed. Leaf analysis of the bud rot affected arecanut palms indicated that, 74 per cent of the palms had low boron in the leaves. Arecanut seedlings were grown in nutrient solution having varied levels of boron in a growth chamber. Seedlings grown in low- and high-boron succumbed to bud rot disease. *Phytophthora meadii*, a causal agent of bud rot was grown in different concentrations of boric acid. Boric acid at above 30 ppm completely restricted the growth of the fungus. The result indicated that, deficiency of boron could act as one of the pre-disposing factors for the occurrence of bud rot disease in arecanut and boric acid at >30 ppm would completely restrict the growth of *P. meadii* under *in vitro* condition.

Carbon sequestration potential of arecanut-cocoa cropping system

Arecanut and cocoa are perennial crops with enormous potential to sequester atmospheric carbon. The carbon stock in arecanut palms (var. Mohitnagar) at different ages was assessed, and it was 14.8 C t per ha, 23.2 C t per ha, and 37.2 C t per ha, in 10-year, 20-year and 40-year-old plantations. It indicates that, arecanut can store >136 t CO_2 per ha and long-term

storage is possible as C storage in stem accounts for 77 per cent of the above ground C stock. The annual increment in the C stock was estimated to be 0.829 t per ha per year. The C stock in cocoa trees was estimated as 1.46 t per ha, 3.62 t per ha and 8.08 t per ha in 3-year, 6 year and 10-year-old plantations. The annual increment in the C storage was 0.72 t per ha per year up to 6 years and it increased to 1.11 t per ha per year between 7-10 years. The potential carbon emission in a 20-year-old arecanut plantation was estimated under different management practices. Resource recycling could make the system carbon negative (-16.12 to -18.47 kg kg^{-1} dry kernel). The result indicates that, arecanut-cocoa cropping system can considerably accumulate atmospheric carbon, and resource recycling can make the system carbon negative. This has a greater significance in the era of climate change.

Fig.60 Estimation of coconut palm biomass

Participatory Demonstration Plots of Cinnamon intercropping in coconut

ICAR–CPCRI developed a technology for cinnamon intercropping in coconut gardens under high-density pentagonal planting system. Demonstrations were initiated in farmers' fields with financial support from the Directorate of Arecanut and Spices Development. A survey was conducted in Bhatkal, Moodbidri, Bantwal, Tiptur, and Tamil Nadu, where two, two, one, twenty-eight, and two farmers' gardens, respectively, were identified as beneficiaries. Based on the availability of planting material, cinnamon was successfully established as an intercrop in a total of twenty coconut gardens.

Effect of long term INM and organic nutrient management practices on soil potassium supplying capacity under coconut cultivation

Potential buffering capacity of potassium (PBCk) were determined in the soils under INM and organic nutrient management practices to understand the long term effect on the potassium supplying power under coconut based HDMSCS in red sandy loam soil. INM practices (T1: 2/3rd RDF + Organic management; T2: 1/3rd RDF + Organic management) showed higher soil potassium supplying capacity compared to the fully organic nutrient management. Among INM practices, higher fertilizer K application along with organics improved PBCk. Result indicates INM improves sustained supply of K. Higher PBCk was observed in the surface soils than the subsurface soil under the fully organic management system indicating that the high organic carbon content improved the exchange property and thereby improved PBCk in the surface soil.

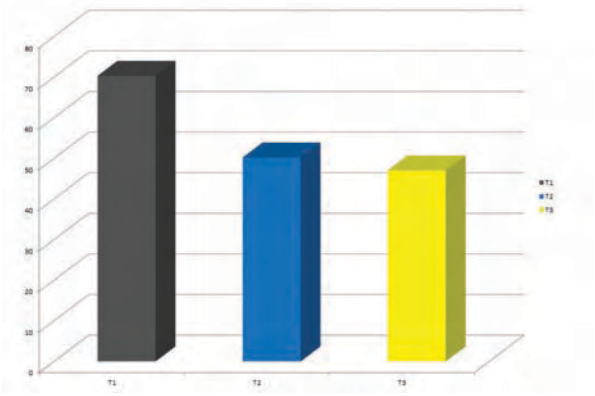


Fig. 61. Potential buffering capacity of potassium of the surface soils under different nutrient management in coconut based high density multispecies cropping system

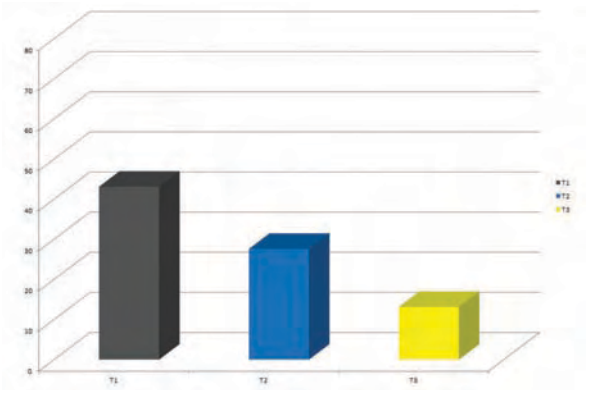


Fig. 62. Potential buffering capacity of potassium of the subsurface soils under different nutrient management in coconut based high density multispecies cropping system

Effect of Organic Mulching on Basin Moisture Dynamics in Coconut

During the year 2025, basin moisture levels were systematically monitored under four treatments—coconut husk mulch, leaf mulch, husk combined with leaf mulch, and an un mulched control—to assess seasonal variation and moisture stability in coconut basins. The data clearly demonstrate that organic mulching significantly improved soil moisture retention throughout the year, with the magnitude of benefit varying across seasons.

On an annual mean basis, mulched treatments consistently recorded higher basin moisture compared to the control (Fig. 63). The annual mean moisture under husk mulch was 14.44, while leaf mulch and husk + leaf mulch recorded 14.79 and 14.81, respectively. In contrast, the control registered a lower annual mean of 12.23. Thus, mulching resulted in approximately 18 per cent higher annual basin moisture compared to the unmulched condition, indicating a clear moisture conservation advantage.

The most pronounced treatment effect was observed during the dry period from January to April 2025. During this critical moisture stress phase, husk mulch maintained a mean basin moisture of 10.41, whereas the control recorded only 7.38. This represents a 41 percent improvement in moisture under husk mulch compared to control. February and March showed sharp moisture depletion in control plots, while mulched basins exhibited comparatively moderated declines. This clearly highlights the buffering capacity of coconut husk mulch in mitigating soil moisture stress during prolonged dry spells.

During the pre-monsoon month of May 2025, moisture levels improved across treatments, but mulch treatments still maintained a distinct advantage over control. With the onset of the monsoon (June to September), basin moisture increased substantially in all treatments due to high rainfall. Differences among treatments narrowed during this period, indicating that rainfall temporarily masked the mulch effect. However, moisture levels under mulched treatments remained comparatively more uniform.

Following the withdrawal of monsoon rains, post-monsoon observations (October to December 2025) revealed that mulched basins retained residual moisture more effectively than the control. Husk + leaf mulch recorded the highest post-monsoon mean (16.82), while the control declined more rapidly to 13.01. This indicates that mulching not only enhances moisture during rainfall periods but also prolongs moisture availability after rainfall cessation.

Moisture stability analysis further strengthened these observations. The Moisture Stability Index (MSI), calculated as the ratio of mean to standard deviation, was highest under husk mulch (2.84), followed by husk + leaf (2.65) and leaf mulch (2.61), whereas the control recorded the lowest MSI (2.20). The coefficient of variation was also highest in the control (45.49 %), indicating greater seasonal fluctuation. Thus, mulching reduced moisture variability by nearly 22–25 per cent compared to control, confirming its stabilizing effect.

The superior performance of coconut husk mulch can be attributed to its high lignocellulosic composition, spongy structure, and high water-holding capacity. Coconut husk is capable of absorbing several times of its weight in water, gradually releasing stored moisture during dry periods. Additionally, mulch reduces direct soil exposure to solar radiation, lowers evaporative losses, moderates soil temperature, enhances infiltration, and improves soil structure through gradual organic matter addition. These combined mechanisms contribute to improved moisture retention and stability.

Overall, the 2025 findings clearly underscore the critical role of organic mulching, particularly coconut husk mulch, in buffering moisture stress and enhancing climate resilience in coconut-based systems. The substantial improvement during dry months and the marked reduction in seasonal variability highlight mulching as a low-cost, sustainable moisture conservation strategy suited for tropical plantation ecosystems experiencing increasing climatic variability.

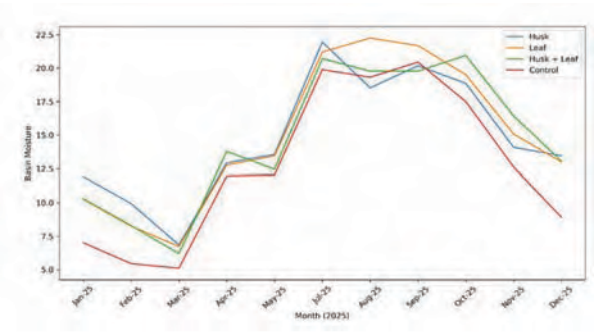


Fig. 63. Monthly basin moisture dynamics under organic mulching 2025

Effect of Organic Mulching on Basin Soil Temperature Regime

During the reporting period, basin soil temperature was monitored under four treatments—coconut husk mulch, leaf mulch, husk combined with leaf mulch

(H+L), and an unmulched control—to evaluate their influence on root-zone thermal dynamics (Fig. 65 & 66). Temperature observations were recorded during both forenoon (FN) and afternoon (AN) periods to assess diurnal variation and seasonal stability.

Across all months, afternoon temperatures were consistently higher than forenoon temperatures, reflecting normal daily solar heating (Fig. 64). However, clear treatment differences were observed. The un mulched control consistently recorded the highest basin temperatures in both FN and AN measurement, particularly during peak summer months (April–May). During this period, control plots exhibited substantially higher temperatures compared to mulched treatments, indicating greater exposure to direct solar radiation and higher soil heat accumulation.

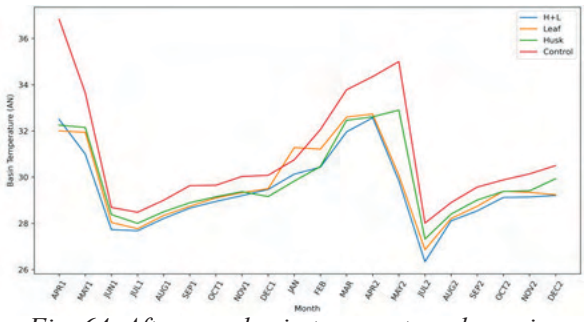


Fig. 64. Afternoon basin temperature dynamics

Fig. 65. Soil moisture conservation measures with husk mulching in coconut basin.

Fig. 66. Soil moisture conservation measure with leaf + husk mulching in coconut basin

6.4

Artificial Intelligence and Information and Communication Technology

AI-enabled drone-based smart surveillance system for large-scale pest, disease and abnormality detection in coconut plantations

An AI-based smart monitoring system for pest and disease detection and abnormality analysis in coconut plantations was conceptualized, developed and validated by integrating drone-based live aerial surveillance with advanced deep learning algorithms, addressing major limitations of conventional manual scouting and tree-wise CNN-based mobile diagnostic applications. The system enables rapid, large-area and above-canopy monitoring of coconut plantations, overcoming constraints related to labour intensity, subjectivity and poor scalability of existing methods. High-resolution aerial videos captured using drone platforms were analyzed through a robust deep learning pipeline integrating YOLOv8-based object detection models for identifying pest and disease symptoms and Deep SORT-based tracking algorithms for ensuring unique palm identification and elimination of double counting across video frames. The technology enabled tree-level classification and quantitative assessment, categorizing individual palms as healthy, pest-affected, disease-affected or dead, while accurately detecting crown- and canopy-specific abnormalities such as bud rot, leaf rot, black headed caterpillar damage, rhinoceros beetle infestation, spindle damage and other stress symptoms that are otherwise difficult to diagnose through ground-based inspection.

A major technological advancement achieved was the geospatial mapping and tagging of individual coconut palms, accomplished by integrating drone imagery with IMU data and Kalman filtering techniques, thereby enabling precise palm-level localization for targeted field interventions. The coconut palm detection model demonstrated high accuracy with precision of 0.90, recall of 0.88, F1-score of 0.87 and mAP@0.5 of 0.95, while the pest and disease detection model achieved reliable performance with precision of 0.84, recall of 0.70, F1-score of 0.73 and mAP@0.5 of 0.86, confirming its suitability for operational deployment. To translate analytical outputs into actionable decision-support tools, a web-based application developed using the Flask framework was created, enabling seamless processing of drone videos and IMU logs and generating user-friendly outputs including annotated aerial videos, 2D spatial plantation maps and CSV-based palm-wise health reports. Overall, the developed system represents a scalable, objective and automated AI-driven decision-support technology for coconut plantation health surveillance, facilitating early detection, precise quantification, and targeted pest and disease management interventions. The technology holds strong potential for future upscaling to regional and national surveillance programs.

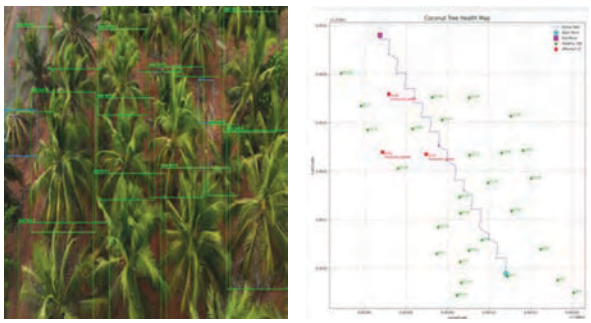


Fig. 67. Output aerial image and output 2D spatial

Development of a robotic arm assisted drone prototype for precision spraying in coconut

A robotic arm assisted customized drone prototype was designed, developed and successfully demonstrated for precision spraying in coconut plantations. The prototype was developed by modifying a VAJRA agricultural drone platform

with a 5-litre spray tank capacity and integrating a remote-controlled, telescopic robotic spray arm for target-specific pesticide and fungicide application. The spray arm prototype was engineered to provide 0-90° vertical nozzle tilt and 0-180° horizontal rotation, enabling accurate and controlled delivery of spray fluid to critical and otherwise inaccessible regions of coconut palms such as the bud and spindle area the undersurface of leaves and nut bunches. This design overcomes the limitations of conventional drone spraying systems that rely primarily on downward spraying and are ineffective for crown and inner canopy focused plant protection in tall perennial crops (Fig. 68).

The prototype supports multiple spray orientations, including a near-vertical (90°) spray mode for targeted bud and spindle treatment, which minimizes wind drift, reduces gravity-induced spray loss and ensures efficient chemical utilization. An angled (>45°) spray mode was optimized for precision spraying on leaf axils, nut bunches and the lower surface of fronds, making the system suitable for managing bud rot, fruit rot, mite infestation, whiteflies and rhinoceros beetle damage. The prototype was further equipped with a smart onboard camera to assist real-time visual alignment of the robotic arm with the target region during flight, improving spray accuracy and operator control. The successful development and field demonstration of this prototype establishes a proof-of-concept for robotic arm assisted precision spraying in coconut, with strong potential for further refinement, standardization and large-scale deployment as a precision plant protection technology.

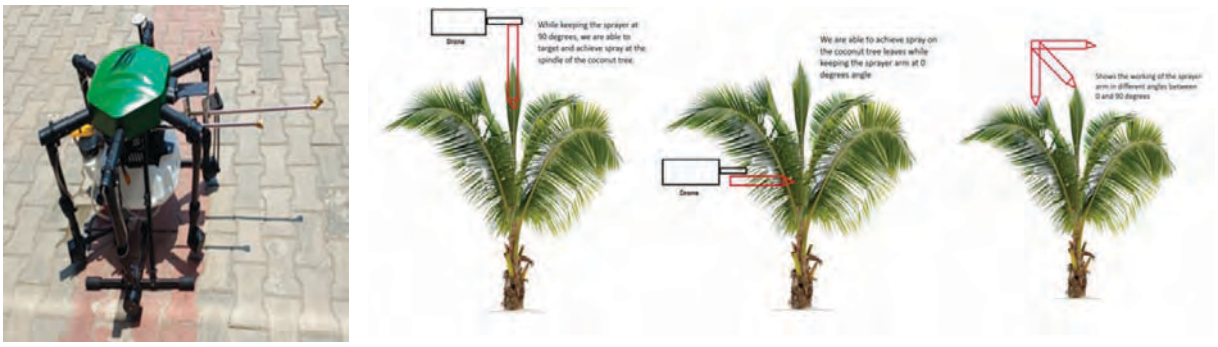


Fig. 68. Customized drone prototype with an adjustable sprayer arm for targeted spraying of coconut leaves and crown at variable angles (0°–90°).

Standard operating procedures (SoPs) for drone-based spraying in arecanut plantations

With the increasing adoption of unmanned aerial vehicles (UAVs) for precision spraying, optimizing spray parameters is critical to improve spray efficacy and minimize environmental losses. The influence of key UAV operational parameters—flight speed, flight height, and spray volume—on droplet characteristics and spray performance in an arecanut plantation was evaluated. Nine treatment combinations were tested, and key metrics, *viz*., volume mean diameter (VMD), droplet density, penetrability, distribution uniformity, and ground losses, were evaluated at three canopy positions: periphery, inflorescence, and fruit bunch. Among all treatments, flying a UAV at a height of 2.5 m above the canopy with a flight speed of 3 m per s^{-1} and a spray volume of 75 L per ha^{-1} consistently produced coarser droplets (VMD > 430 µm at the periphery), the highest droplet density (~95 drops/cm^2), superior canopy penetration (~42%), and the highest uniformity (~82%), though it also exhibited the greatest ground losses (~51 drops per cm^{-2}). In contrast, flying the UAV at 2.5 m above the canopy with a flight speed of 5 m per s^{-1} and a spray volume of 75 L per ha^{-1} generated finer droplets (~250 µm) with lower ground losses and better penetration but reduced uniformity and density. Droplet density and VMD decreased markedly from the upper to the lower canopy layers, indicating limited deposition in the inner zones. Spray volume had the strongest influence on VMD, uniformity, and penetration, while lower flight speed and moderate height improved deposition. These findings highlight the importance of optimizing UAV spray settings to achieve effective and sustainable crop protection in tall-growing arecanut plantations.

Comparison between manual and drone-based sprays
The conventional manual spray using a carbon fiber telescopic pole generated substantially coarser droplets with much higher VMD values across the canopy, ranging from 1003 µm at the top canopy to 924–1452 µm at the lower canopy and inflorescence. Droplet density (DD) in the top and mid canopies was comparatively higher (81 and 102 drops cm^{-1}, respectively); however, higher deposition occurred

in the mid and bottom canopies, resulting in greater overall penetrability (51.46%). Despite this advantage, the spray pattern was highly non-uniform, characterized by overlapping droplets and large blotches on water-sensitive papers, leading to higher ground losses, as evidenced by increased DD (45 drops cm^{-2}) and VMD (700 µm) on ground samples. The non-uniformity and spray wastage can be attributed to higher spray volumes, gravity-driven settling of coarse droplets, and operator-dependent spray motion.

From an application point of view, the drone sprayer has marked advantages. Drone-based spraying protects the operator from hazardous agrochemicals, enables spraying in tall, dense arecanut plantations, and provides accurate, uniform leaf coverage. However, target spraying on the fruit bunches, inflorescences, and the lower leaves using drones is hindered by canopy shielding. For fruit bunches and inflorescences, the manual spray is better because of its closer, targeted spraying; however, this advantage comes at the cost of severe drudgery, chemical wastage, and pesticide exposure to the worker.

Overall, the comparative analysis shows that the drone sprayer provides better spray uniformity, optimal droplet-size distribution, less ground loss, and greater worker safety than the manual spray, but lesser spray deposition on the middle and lower leaves, bunches, and inflorescences.

6.5

Integrated Pest and Diseases Management for Sustainable Production

Pest Management

In an era of climate extremes, pest management has become so dynamic and evolved a transformative phase in which, a minor pest evolves a major status of economic significance in a shorter period of time. Environmentally responsible farming through innovative biological solutions have taken a centre stage with emergency preparedness as a key to tackle potential non-native invasive species waiting at the doorsteps.

Coconut

Coconut rhinoceros beetle

Surveillance for the occurrence of the OrNV-insensitive Guam haplotype of the coconut rhinoceros beetle continued using adult beetle samples collected from Little Andaman, where OrNV was released during the early 1980s. The beetles were subjected to cytochrome c-oxidase subunit I (COI) gene analysis, and at the MseI restriction site (288 bp), the 'A' nucleotide remained intact with no A→G transition detected (Fig. 69), indicating the absence of the Guam haplotype in all samples analyzed to date, including those collected from Kerala, Andhra Pradesh, Karnataka, Tamil Nadu, Maharashtra and Little Andaman.

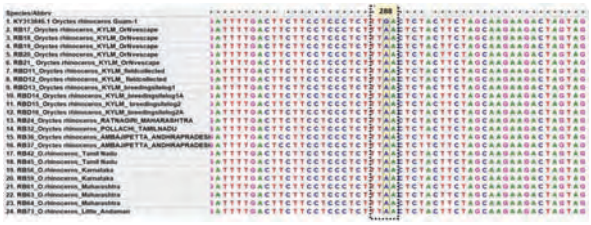


Fig. 69. COI gene analysis of coconut rhinoceros beetle

Area-wide application of the green muscardine fungus, *Metarhizium majus* (MM-610) @ 5 × 10^{11} spores per m^3 in Valikunnam Panchayat, distributed through dairy farmers, resulted in a reduction of leaf damage from 21.5 per cent to 10.4 per cent (51.6% reduction). Similarly, spear leaf damage declined from 40.8 per cent to 19.8 per cent, demonstrating the technological impact and enhanced farmer awareness generated through the intervention.

Red palm weevil

Determination of larval instars and standardization of laboratory rearing method for the red palm weevil *(Rhynchophorus ferrugineus* Olivier)

Larval development of the red palm weevil *(Rhynchophorus ferrugineus)* showed 11 instars on artificial diet, with a larval period of 62.0–66.6 days and life cycle completed in 77.0–80.6 days. Larvae grew from 3–4 mm to 38–40 mm, reaching 1.98–2.61 g at the final instar.

Exclusive artificial diet resulted in smaller size and reduced fertility, while sole sugarcane feeding caused high early mortality. An optimized protocol—oviposition on sugarcane, rearing up to 5th instar on artificial diet, then shifting to sugarcane—reduced larval duration (36.7–51.5 days), minimized mortality, and improved biomass, enabling efficient mass rearing.

Volatile signatures from red palm weevil infested arecanut palms

C–MS analysis showed higher volatile emission in RPW-infested arecanut palms compared to healthy ones. Infested palms uniquely emitted acetic acid hexyl ester and phenyl ethyl ester as major compounds, along with carbonic acid propargyl cyclohexyl ester and alloaromadendrene.

Healthy palms, however, released compounds like butanoic acid butyl ester and benzoic acid ethyl ester, which were absent in infested samples. Some

compounds (e.g., dodecanoic and hexadecanoic acid ethyl esters) were present in both but were more abundant in healthy palms. These distinct volatile profiles clearly differentiate infested from healthy arecanut palms.

Root grubs

IPM

ICAR–CPCRI developed an IPM module for coconut white grub *(Leucopholis coneophora)* based on its bioecology. It included adult beetle removal, imidacloprid application, use of *Steinernema carpocapsae*, and ploughing.

Demonstrated over three years (2023–2025) in Kerala (8.5 ha), the module reduced grub populations by an average of 89.7 per cent and improved soil health. Yield increased from 63 to 76.3 nuts per palm per year, confirming its effectiveness for sustainable management.

Coreid bug

Kalpa Anastatus egg card- for the sustainable management of coreid bug in coconut

The coconut coreid bug *(Paradasynus rostratus)* has become a serious pest in southern Kerala, causing up to 65 per cent damage during the monsoon. The egg parasitoid *Anastatus ramakrishnai*, identified from Kayamkulam, was found to be an effective biocontrol agent and was mass-reared using eggs of the eri silkmoth *(Samia cynthia)*.

Laboratory studies showed up to 70 per cent parasitism, with preference for fresh eggs, a development period of 20 ± 2 days, female longevity of 60–70 days, and fecundity of 120–140 eggs. For field use, the 'Kalpa Anastatus' egg card was developed. Deployment (one card per five palms or release of 10 females per palm) effectively reduced infestation, offering a practical and efficient biocontrol strategy.

Fig. 70. Kalpa Anastatus egg card; A. ramakrishnai emerging from egg of coreid bug

Invasive whiteflies in coconut system

Expansion of invasive whiteflies in Andaman and Nicobar Islands on coconut and allied intercrops were recorded using surveillance surveys, as part of investigation led by the Central Team. The Neotropical palm whitefly, *Aleurotrachelus atratus* was recorded from South Andaman for the first time on coconut. Furthermore, the non-native nesting whitefly, Paraleyrodes minei as well as the spiraling whitefly, *Aleurodicus disperses* were recorded on palms from Little Andaman. Besides the field interception of rugose spiralling whitefly, *Aleurodicus rugioperculatus* and Bondar's nesting whitefly, *Paraleyrodes bondari* on coconut from Car Nicobar Island, as well as occurrences of woolly whitefly, *Aleurothrixus floccosus* and pepper whitefly, *Aleurotrachelus trachoides* were also recorded from guava and chillies, respectively from coconut system. The aphelinid parasitoid, *Encarsia* spp. was recorded from the parasitized nymphs of *A. rugioperculatus* from the region.

Aschersonia sp. – a potential entomopathogenic fungus against palm whitefly

Palm whitefly, *Aleurotrachelus atratus*, was recorded in coconut during field surveys conducted in Tura, Meghalaya, and Kayamkulam, Kerala. Entomopathogenic fungus *Aschersonia* sp. was observed naturally associated with palm whitefly populations, in Kayamkulam and Kidu (Karnataka), suggesting its possible role in the natural regulation of the pest. *Aschersonia* sp. was also found to be associated with whiteflies in nutmeg and guava in coconut-based cropping system.

Fig. 71. a) Different stages of Aschersonia infection on palm whitefly in coconut b) and c) Aschersonia sp on coconut and guava d) Aschersonia sp isolated from guava

Arecanut

Comprehensive Characterization and Management of Red Palm Mite on Arecanut

The mite complex on arecanut was investigated with emphasis on the invasive red palm mite (*Raoiella indica)*. Detailed SEM-based morphological and morphometric characterization of all developmental stages was carried out, generating baseline taxonomic reference data, including documentation of a distinct egg stipe (Fig.72). The complete life cycle and reproductive biology were elucidated (Fig.73), revealing an 18–29 day developmental period, male guarding behaviour, arrhenotokous parthenogenesis and quantified mating duration.

A simple, low-cost laboratory rearing technique using arecanut leaf discs was standardized, supporting stable mite colonies for bioassays and biological studies. Bio-efficacy studies showed that spiromesifen 22.9% SC was effective against immature stages with ovicidal and fecundity-suppressing effects. Screening of essential oils and Wedelia *(Sphagneticola trilobata)* leaf extract generated baseline data for the development of eco-friendly mite management options.

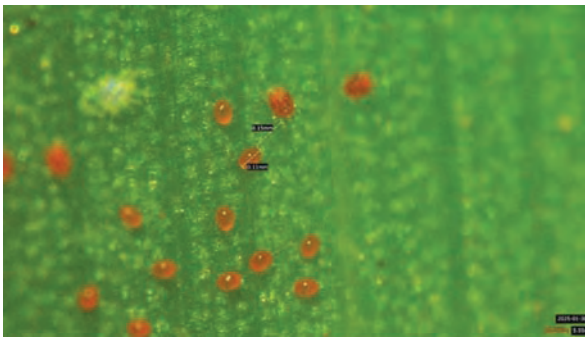


Fig. 72. Eggs of Red Palm Mite (Raoiella indica)

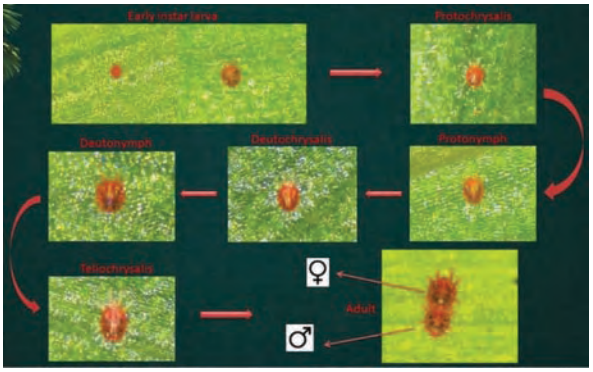


Fig. 73. Life cycle stages of R. indica

Documentation of new pest incidence

A new micro-lepidopteran leaf defoliator in arecanut seedlings, morphologically resembling the oil palm leaf webworm *Acria meyricki*, was documented for the first time (Fig. 74), and its morphological and molecular identification is currently in progress.

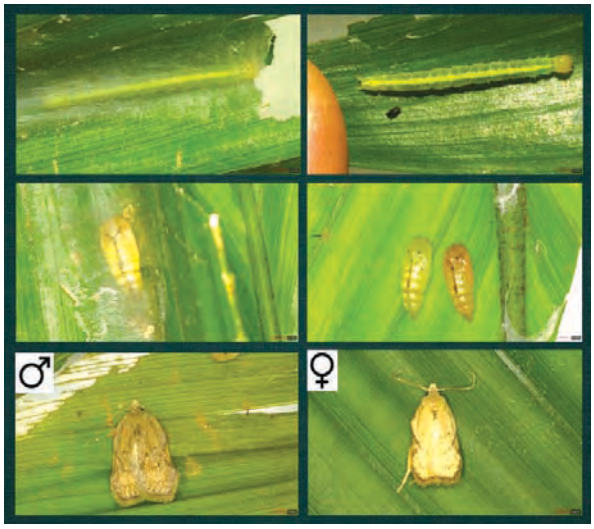


Fig. 74. Acria sp. affecting arecanut seedlings

Cocoa

Application of silicon for the defense against tea mosquito bug (TMB), *Helopeltis theivora (Hemiptera: Miridae)*

Foliar application of silicon dioxide and potassium silicate (250–1000 ppm) significantly reduced the feeding and oviposition of tea mosquito bug (TMB) in cocoa ($p \leq 0.05$). Silicon-treated plants recorded lower feeding damage and 16–28 per cent reduction in egg laying, with the strongest effects at 1000 ppm. The suppression of TMB activity was associated with enhanced phenols, antioxidants and defense-related enzyme activity. The study confirms silicon application as an effective tool for TMB management in cocoa.

Fusarium pernambucanum: A new entomopathogenic fungi on TMB, H. theivora

Fusarium pernambucanum was isolated from a naturally infected TMB adults collected from cocoa gardens located at ICAR-CPCRI, Regional Station, Vittal, and identified based on morphological features and molecular analysis. *In vitro* pathogenicity tests showed up to 80 per cent mortality at 2×10^8 conidia per mL within six days. This is the first report of *Fusarium* sp. Infecting TMB, suggesting its potential as a biocontrol agent in cocoa pests management.

Detection and Documentation of Emerging Pest Problems

Pest surveillance efforts led to the identification of *Spodoptera litura* as an emerging major pest in

cocoa nurseries, causing severe defoliation with infestation levels exceeding 70 per cent, although field-level incidence remained low. The tea tortrix, Homona coffearia, was recorded causing damage in both cocoa nurseries and open fields, with recent observations of pod rind feeding. Notably, an ichneumonid parasitoid (Family: Ichneumonidae) was observed parasitizing *H. coffearia* larvae, indicating potential scope for biological control.

Entomopathogenic nematodes

Diversity of entomopathogenic nematodes

A total of 300 soil samples collected from coconut-based cropping systems in Kerala and Tamil Nadu were baited with *Galleria mellonella* for the isolation of entomopathogenic nematodes (EPNs). Fifteen EPN isolates were recovered, comprising eleven *Heterorhabditis*, four *Steinernema* and one *Metarhabditid* isolate based on cadaver coloration. These isolates enrich the native EPN resource base for biological control in plantation crops.

Temperature tolerance of EPN isolates

Seven EPN isolates were evaluated for survival at 15–35°C over a 90-day storage period. All isolates showed 100 per cent survival up to 10 days across temperatures. Complete survival up to 60 days at 20–25°C was observed in most isolates, while SK1 *(Steinernema* sp.*),* S0804 *(S. keralense),* S2401 *(Steinernema* sp.*),* S0905 *(S. hermaphroditum)* and M2020 *(Metarhabditis* sp.*)* recorded 100 per cent survival at 30°C for 90 days, indicating better adaptability to ambient temperatures. However, H12H *(Heterorhabditis indica)* recorded 8.3 per cent and 100 per cent mortality at 20 and 25°C after 3 months of storage, respectively. Prolonged exposure to 35°C was detrimental to all isolates, although SK1 showed comparatively higher short-term tolerance. The study revealed marked inter-isolate variability, highlighting the need for isolate-specific temperature optimization for tropical deployment.

Selective pressure of agrochemicals on EPN, *Steinernema keralense*

The effect of commonly used agrochemicals on *Steinernema keralense* infective juveniles was evaluated. All treatments caused host mortality within 24 h, indicating no loss of pathogenicity. However, imidacloprid supported early IJ emergence and higher progeny production, while chlorantraniliprole and chlorothalonil caused moderate reductions. Hexaconazole and fipronil significantly delayed IJ emergence and reduced progeny, with fipronil showing the highest negative impact. The results indicate that agrochemical compatibility varies and must be considered for effective integration of EPNs in IPM programmes.

Integrated management of root grub in palms using EPN

Soil application of an aqueous suspension of native isolate of EPN, *Heterorhabditis indica* @ 20 lakh infective juveniles (IJs) at the base of arecanut palms (5–10 cm depth), combined with imidacloprid (Confidor) @ 0.25 mL per litre during September–October, showed a higher reduction of root grub (Leucopholis spp.) populations by 73.8 per cent which was significantly higher than EPN application alone. The combined curative treatment reduced the dosage of imidacloprid in root grub management (Fig. 75).

Fig. 75. Application of imidacloprid (Confidor) @ 0.25 mL per litre water in the palm basin along with EPN H. indica @ 20 lakh IJs per palm basin

Disease Management

Under changing climate and intensified weather extremes, disease dynamics in plantation crops are rapidly shifting, leading to the emergence of new pathogens and expansion of disease complexes.

Sustainable disease management now emphasizes early detection, surveillance, and integrated, eco-friendly strategies to ensure crop resilience and long-term productivity.

Changing pathogen dynamics and disease symptoms
First report of anthracnose-type fruit rot of coconut
During the peak southwest monsoon (August 2025), a distinct anthracnose-type fruit rot characterized by sunken dark necrotic lesions and nut mummification was observed in dwarf coconut varieties at ICAR–CPCRI, Kasaragod. The disease differed from *Phytophthora* and *Lasiodiplodia*-induced fruit rots and was caused by *Colletotrichum siamense*, confirmed through pathogenicity tests and multilocus (ITS, ACT, TUB2, GAPDH) phylogenetic analysis. This constitutes the first report of anthracnose-type fruit rot of coconut caused by *C. siamense*, with significant implications for disease diagnosis and management under humid monsoon conditions (Fig.76).

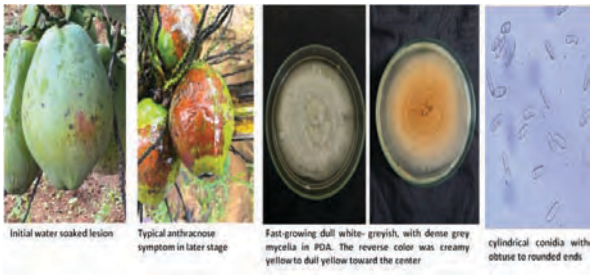


Fig. 76. Fruit rot of coconut caused by Colletotrichum siamense

Phytophthora meadii: Expansion of Disease Complex in Arecanut

During the 2024–25 monsoon seasons, increased cyclonic activity and prolonged wet spells in Coastal Karnataka were associated with severe leaf, spindle and stem rot outbreaks in arecanut. Disease symptoms included water-soaked necrotic lesions on leaves, irregular grey-centred spindle rot, and extensive stem and sheath rotting leading to tissue constriction. The pathogen was isolated and identified as *Phytophthora meadii* through cultural, microscopic, pathogenicity tests and multilocus phylogenetic analysis (cox1, cox2, ras-related GTPase, β-tubulin and EF-1α). This study newly establishes P. meadii as the causal agent of leaf, spindle and stem rot in arecanut, expanding its known disease spectrum beyond fruit, bud and crown rot and underscoring the need for strengthened surveillance and revised management strategies

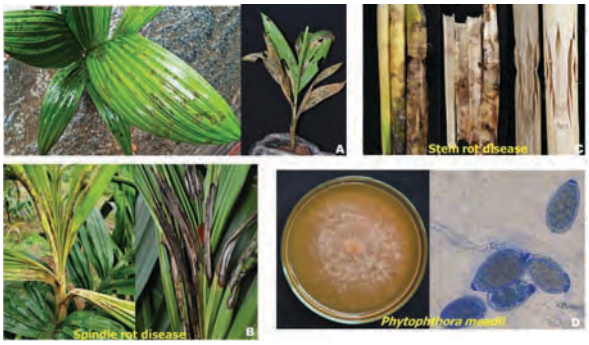
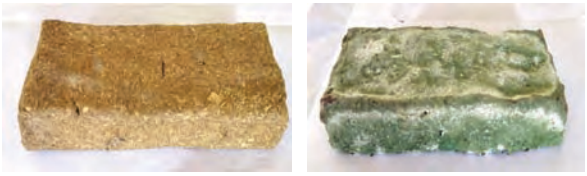


Fig. 77. A. Field symptoms of A) Leaf rot disease; B) Spindle rot disease; C) Stem rot disease; D) Culture plate & Sporangia of Phytophthora meadii

Ecofriendly biological formulations for disease management

Arecanut Leaf Sheath–Based Tricho-block for Eco-friendly Management of Soil-borne Diseases

An eco-friendly and cost-effective Tricho-block formulation was developed using arecanut leaf sheath powder (an agro-industrial by-product) and a native isolate of Trichoderma harzianum (CPTD28). The brick-shaped Tricho-blocks (16.5 × 3.5 cm) showed a shelf life of one year at room temperature with high viability (≈3.0 × 10^{11} cfu) and could be easily reactivated before use. Field application through enrichment of FYM/neem cake (1 block : 100 kg substrate) significantly reduced stem bleeding and basal stem rot of coconut over two consecutive years, while untreated palms showed increased disease incidence. The formulation was also effective against damping-off and wilt in vegetables and sudden wilt of black pepper, demonstrating its potential as a sustainable biocontrol delivery system for soil-borne disease management.



A *B*

Fig. 78. Arecanut leaf sheath powder Tricho block: Dried Tricho-block (A) and Moistened Tricho-block with reactivated T. harzianum (B)

Development of Thermo-Tolerant *Trichoderma harzianum* CPTD 28

In order to develop higher temperature tolerant *Trichoderma harzianum* (CPTD 28), culture population was acclimatized to different temperature

regimes. *T. harzianum* population was incubated initially at 25°C, subsequently increased by 1°C till 39°C and estimated colony growth rate and spore load at each temperature. Observed that 26°C is congenial for both colony growth rate and sporulation. Similar trend of colony growth rate was observed till 34°C while there is a slight decline in spore load. Good colony growth rate and sporulation of *T. harzianum* was noticed till 39°C. While, in case of direct culture there is a significant reduction in colony growth rate and spore load from 36°C onwards (Fig.79).

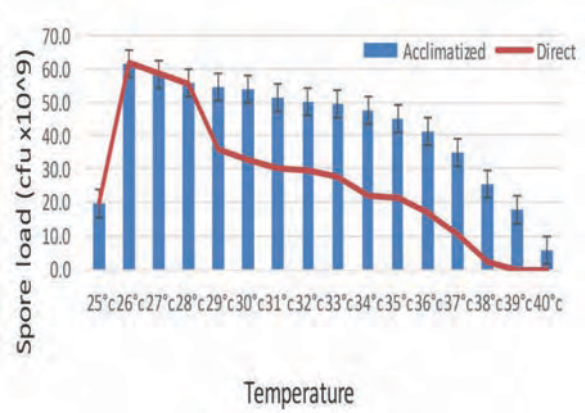


Fig. 79. Trichoderma harzianum (CPTD 28) colony growth and sporulation pattern at different temperature regimes

Trichodol: *Trichoderma*–Dolomite Pellet Formulation

Trichodol, a *Trichoderma*-enriched dolomite pellet formulation, was developed as a farmer-friendly alternative to conventional dust-based products (Fig. 80). The pellets provide slow and sustained disintegration in soil, enabling gradual pH correction in the rhizosphere and prolonged biocontrol activity, particularly suited to perennial plantation crops. Unlike powder formulations prone to rapid dissolution and losses, Trichodol ensures improved soil conditioning and sustained Trichoderma performance.

The formulation exhibited a shelf life of six months under ambient storage, maintaining Trichoderma viability and functional stability. The dust-free pellets allow safe, uniform application and offer superior soil placement and retention, especially in sandy and coastal coconut soils. Controlled dolomite release avoids abrupt pH shifts, creating a favorable microenvironment for Trichoderma establishment and enhanced suppression of soil-borne pathogens, making Trichodol a robust and sustainable disease management option in coconut-based systems.

Fig. 80. Trichodol: Trichoderma–Dolomite pellet formulation

Cocoa Tricholate: A Waste-to-Wealth *Trichoderma* Bioformulation

Cocoa Tricholate is a sustainable *Trichoderma*-based bioformulation developed using cocoa pod husk and bean shell, major cocoa processing wastes, as carrier substrates (Fig. 81). The technology converts an environmental liability into a value-added agricultural input, addressing issues of waste accumulation, odour, pest incidence and carbon footprint in cocoa plantations. Standardized protocols were developed for block and pellet formulations, which showed excellent shelf life, retaining high *Trichoderma* viability for up to 11 months and outperforming conventional talc-based carriers.

The nutrient-rich cocoa substrates supported enhanced bioagent stability and significantly improved plant biomass compared to standard formulations. Field-ready recommendations include basal application of 100–150 g blocks or ~150 g pellets per coconut or arecanut palm basin, and use in organic manure enrichment. Cocoa Tricholate exemplifies a circular bioeconomy approach by integrating sustainable disease management with effective waste valorization in plantation cropping

Fig. 81. Cocoa Tricholate block (from husk) and pellets (from shell)

Development of Diagnostics

Devlopment of recombinase poymerase amplification (RPA)-based diagnostic assay for the rapid detection of areca palm necrotic ringspot virus 2 (ANRSV2)

Recombinase Polymerase Amplification (RPA) and RT-RPA assays were developed for rapid detection of Areca palm necrotic ring spot virus 2 (ANRSV2) in arecanut. A specific primer set from the coat protein gene showed amplification only in infected samples, with no cross-reactivity.

Optimal conditions included 16 mM magnesium acetate, 15 min incubation, and 35–42°C. The RPA assay showed higher sensitivity than PCR, detecting up to 10^{-6} dilution in cDNA and up to 10^{-3} using crude extracts. RT-RPA enabled direct detection from RNA. Both assays were validated with field samples, offering a rapid, sensitive, and reliable alternative to PCR for ANRSV2 detection.

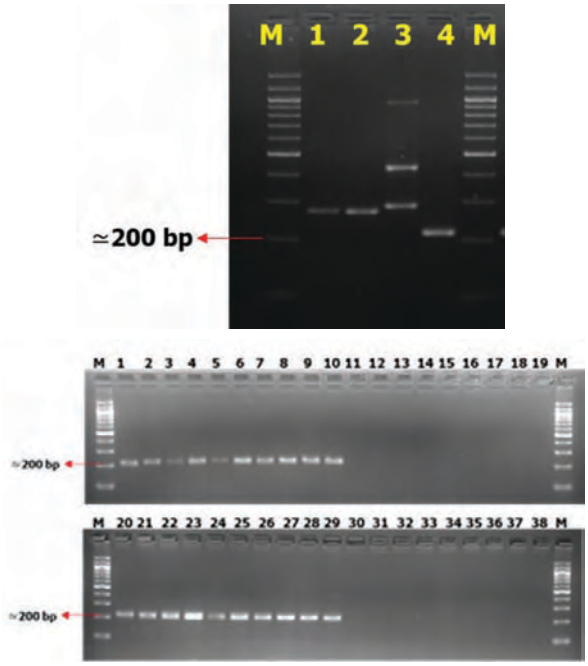


Fig. 82. A. Validation of RPA-specific primers targeting CP gene of ANRSV2; B. Validation of RPA for the detection of Arecanut Necrotic Ringspot virus – 2 (ANRSV2) in field samples

Detection of phytoplasma in coconut palm and putative insect vectors

The spear leaf, inflorescence and root samples collected from root (wilt) diseased (RWD) palms were subjected to PCR using universal/species specific primers reported for various vascular bacterial and viral pathogens. None of them gave significant amplification. An upsurge in the population of the vector lace bug Stephanitis typica was observed in juvenile palms in institute farm. Molecular characterization of lace bugs using COI primers (GenBank acc. No. PV687325) showed >99 per cent similarity to *S. typica* sequences in database. DNA extracted from lace bugs and rugose spiraling whiteflies (50 adults each) collected from RWD affected palms were subjected to PCR using phytoplasma specific P1/P6 -R16F2n/R16R2 primers. None of them showed amplification at desired base pair level.

Large Scale Demonstrations on Disease Management

Large scale demonstrations on management of leaf spot disease of arecanut

The MIDH scheme on large-scale demonstration of leaf spot disease (LSD) management in arecanut was implemented in March 2025. ICAR–CPCRI, Kasaragod is executing the project in Dakshina Kannada and Uttara Kannada districts, while KSNUAHS, Shivamogga is implementing it in Shivamogga and Chikkamagaluru districts. Initial observations (May 2025) showed 85–100 per cent disease incidence with 5–35 per cent disease intensity. During June–September 2025, three sprays of Bordeaux mixture (1%) were applied at 35–45 day intervals. Soil and leaf samples (143) were analyzed, and lime and fertilizer applications were recommended and supplied. All required inputs, including fungicides, fertilizers, neem cake and Trichoderma talc formulation, were provided in time, along with labour support. Most farmers have completed five sprays, and some have completed the sixth spray. Regular monitoring of marked palms indicated a reduction in disease intensity from 30–35 per cent to 20–30 per cent, with improved palm health in demonstration plots compared to other gardens.

Fig. 83. Leaf spot disease management activities undertaken in Uttara Kannada demonstration plots (Sirsi and Siddapura) and Dakshina Kannada (Sullia and Belthangady)

Establishment of Demonstration plots to showcase technologies for integrated management of root (wilt) disease of coconut

The LoDP programme launched in November 2024 is being implemented in 100 ha in four clusters with 25 ha each in Puliyarai, Kadayanallur, Vadakara and Kanakkupillaivalasai villages of Tenkasi district. The RWD incidence was quite higher in Tenkasi block compared to Senkottai and Kadayanallur blocks. Leaf rot disease in the selected plots ranged from 12-24 per cent. The results of the soil test data indicated that soil is neutral in reaction in all the sites except for certain plots in Kanakkupillaivalasai. Organic matter content was low to medium in most of the gardens with high exchangeable base nutrients. Micronutrients such as copper, zinc and manganese were found deficit in several gardens warranting application of customized nutrient mixtures.

6.6

Extraction and Characterization of Bioactive Compounds and Value Addition / Pre- and Post- Harvest Mechanization in Palms and Cocoa

Trait identification for climate-resilient adaptation

Water use efficiency of arecanut *(Areca catechu L.)*

Climate projections indicate increasing vulnerability of low-rainfall arecanut-growing regions in India, highlighting the need for drought-resilient genotypes. Water-stress experiment conducted with three prominent arecanut genotypes *viz*. Mangala (Ma), Shatamangala (Sh), and Swarnamangala (Sw) (Fig. 84) indicated Mangala with a clear advantage under water-deficit conditions. Effective stomatal regulations with high proline accumulation were the main factors governing tolerance. The findings underscore Mangala's strong adaptive potential for water-limited environments and suggest its utility as a candidate genotype for climate-resilient arecanut cultivation.

Mangala *Shatamangala* *Swarnamangala*

Fig.84. Arecanut genotypes evaluated for water use efficiency (WUE)

Extraction and characterization of bioactive compounds

Developmental dynamics of alkaloids in arecanut (*Areca catechu* L.) genotypes

The temporal accumulation patterns of four major alkaloids-arecoline, guvacoline, guvacine, and arecaidine-were analyzed in 15 arecanut genotypes (Fig. 85) between 6 and 12 months after anthesis. Mangala proved to be richest source of alkaloids. Additionally, variations in physicochemical properties, fatty acid composition, antioxidant activity, and total polyphenol content were assessed among the genotypes. Based on arecoline content, the genotypes were subsequently categorized, with Shatamangala recording the lowest level and Mangala exhibiting the highest. These results offer valuable biochemical insights to support cultivar selection, value addition, and breeding programs focused on optimizing alkaloid profiles in arecanut.

a) *b)*

Fig. 85. Fruits of arecanut varieties (a) Shatamangala and (b) Mangala at 12 months post anthesis

Chemotypic diversity and antioxidant properties of *Areca catechu* L. inflorescences

The phytochemical composition, alkaloid profiles, and antioxidant capacity of inflorescence (Fig. 86) of four arecanut genotypes-Vittal Arecanut Hybrid 2, Shatamangala, Kahikuchi, and Mangala were examined. GC–MS analysis revealed genotype-dependent variations in the abundance of fatty acids, esters, alcohols, and other metabolites. Several compounds such as dodecanoic acid, n-hexadecanoic acid, and oleic acid were commonly detected across genotypes, while, trans-2-undecenoic acid, trans-sinapyl alcohol, and citronellol epoxide were genotype-specific. Quantitative analysis using HPLC–DAD identified multiple phenolic acids—gallic, chlorogenic, p-coumaric, ferulic, syringic, ellagic, 3,4-dihydroxybenzoic, and trans-cinnamic acids—as well as the alkaloids arecoline, arecaidine, guvacine, and guvacoline, with significant variation observed among genotypes.

Fig. 86 Representative inflorescence images of arecanut varieties Mangala and Shatamangala, respectively

Value Chain Management in Palms and Cocoa

Design, fabrication and field demonstration of portable electrical coco sap concentrator

The Sap concentrator (Fig. 87 a to e) represents an innovative technology designed for the production of coconut sap concentrates directly on the top of coconut trees. This device integrates the collection and processing of sap, mitigating the rapid perishability of the sap by facilitating in line in-situ processing. Performance evaluation of the concentrator was done both in the Institute and in the farmers' field. The 3L capacity prototype was tested under field conditions for twenty hours and was found to perform very well. The concentrators were distributed to farmers / stakeholders for evaluation in their fields across different geographical and climatic regions, viz. Coimbatore (Tamil Nadu), Kundapura (Karnataka) and Harihar (Karnataka).

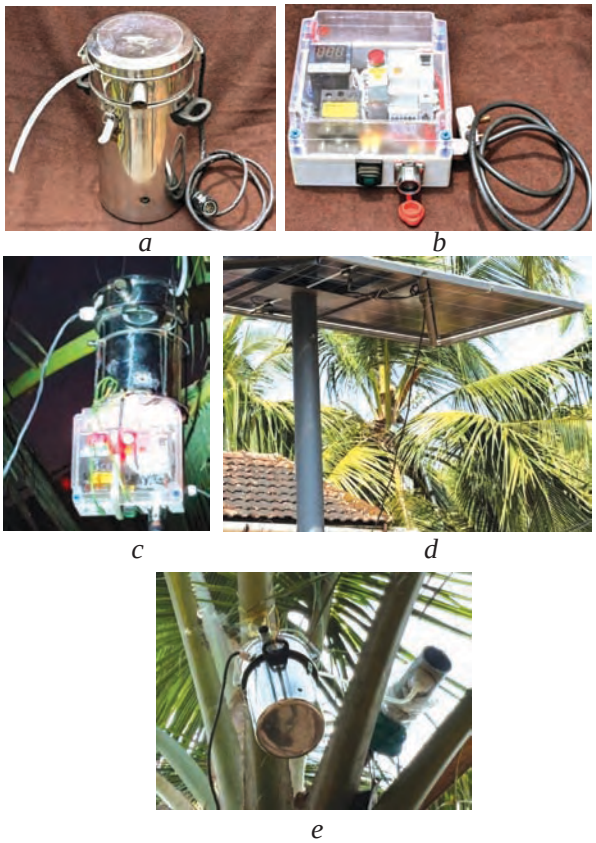


Fig. 87. (a), (b): Portable Coco-sap concentrator and the control box; (c): The Cocosap concentrator operated effectively during night; (d), (e): Trial is on using solar power for concentration purpose

Development of low fat coconut flour incorporated wheat flour and puttu powder

The low-fat coconut flour, a by-product of VCO and milk industries, was incorporated to wheat flour and puttu powder to improve its nutritional value and sustainability. These composite flours packed in LDPE pouches were shelf-stable up to three months under ambient conditions. The addition of low fat coconut flour increased the fibre, protein and fat. Storage studies for three months indicated low microbial presence hinting low-fat coconut flour was not a favourable medium for microbial growth. The acceptability of these composite flours was confirmed by sensory evaluation of chapathi and puttu (Fig. 88 a and b). The findings proved that low fat coconut flour can be used to enhance nutritional quality and decrease food processing waste in conventional food formulations.

Fig. 88 a. Low fat coconut flour-wheat chapathi, b. Low fat coconut flour incorporated Puttu

Low fat coconut flour incorporated wafer cone

A wafer cone enriched with low fat coconut flour was developed to enhance its nutritional and sensory attributes while promoting sustainable utilization of coconut-based byproducts (Fig. 89). The optimized formulation consisted of refined wheat flour, coconut milk, low fat coconut flour, cocoa powder, sugar, salt, and baking powder. The low moisture content supports extended shelf stability, while the improved nutrient profile underscores its functional value. The low-fat coconut flour-enriched wafer cone demonstrated significantly higher sensory acceptability than the control across appearance, flavour, texture, and overall acceptability.

Fig. 89. Low fat coconut flour incorporated wafer cone

Coconut milk based kulfi

Coconut milk kulfi (Fig. 90) is a frozen dessert formulated using coconut milk as the primary ingredient, offering a rich and creamy mouth feel with a distinctive natural coconut flavour. The product has been developed as a plant-based alternative to conventional dairy kulfi, catering to lactose-intolerant consumers, health-conscious individuals, and those preferring non-dairy foods. The formulation utilizes coconut milk and coconut sugar, along with permitted flavouring ingredients.

Fig. 90. Coconut milk based kulfi

Flavoured Kalparasa®

Natural flavors derived from ginger, lime, and fresh mint leaves were infused in neera with a view to minimize the caramelized flavor in Kalparasa® (neera) (Fig. 91). Among the treatments, ginger-flavored neera showed stable total soluble solids, mild changes in acidity, and had the highest sensory acceptability. Mint essence demonstrated better retention of reducing sugars and vitamin C, along with favorable sensory attributes. Thus, ginger and mint essence-flavored Kalparasa® effectively minimized caramelized flavor and maintained better quality and consumer acceptability throughout the 12-day storage period.

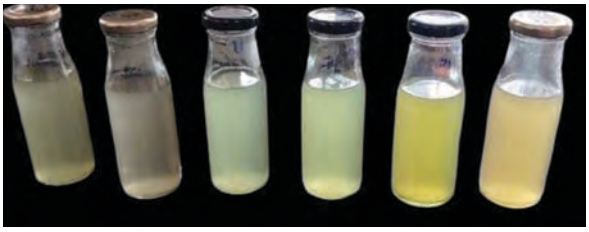


Fig. 91. Flavoured Kalparasa®

DC operated snowball tender coconut machine

The direct current operated snowball tender coconut machine was designed to facilitate green power to make a precise groove on the tender coconut shell for subsequent removal of kernel intact by scooping. The machine is equipped with an improved cutting blade which reduces mechanical loading on the motor. A pair of adjustable nut holders securely grips the coconut and allows accurate positioning of the blade at the centre. The system operates on direct current (DC) power. The cutting blade is driven by a permanent magnet direct current (PMDC) motor operating at a designated rpm. During grooving, the coconut is rotated manually using a handle attached to the holder. After grooving, the shell is removed with a scooper to obtain the white, globular tender coconut.

6.7

Technology Evaluation Impact and Entrepreneurship Development

The Farmer FIRST Program (FFP)

The Farmer FIRST Program (FFP) implemented in Alappuzha district, Kerala upscaled to six more panchayats, among more than 10,000 marginal landholder farmers and women farmers' Self-Help Groups (SHGs). The interventions were in six modules, *viz*., crop, horticulture, livestock and poultry, natural resource management, entrepreneurship and value-addition, and integrated farming systems (IFS). Through these modules 207 technologies were transferred, benefiting 10506 farmers. The convergence with state and central schemes resulted in horizontal spread of technology to 22000 farmers and area-wide large-scale adoption of technologies and HYV of intercrops to 950 ha.

Impact of ICAR-CPCRI FFP

Fully replavarieties of sesamum, turmeric, pulses, and fodder crops with high-yielding varieties/ hybrids. Revived the GI crop sesamum in the FFP Grama Panchayat to an area spread from 1.64 ha to 100 ha and also horizontal spread among 220 farmers and women self-help group members of non-adopted and neighbouring panchayats

Reduced mastitis incidence in milch cows by 78 per cent in Pathiyoor. Self-sufficiency in egg production achieved with 1553 eggs per day by 72 women-managed backyard poultry units adopting high-yielding poultry breeds. Doubled the crop diversity of FFP IFS plots compared to Non-FFP IFS plots (based on Simpsons Diversity Index) 0.29 in Non-FFP IFS and 0.55 in FFP IFS.

Access to training and participation: The average number of trainings per year before FFP was only two, which improved to 20 trainings in the FFP period. During the decade, the participation of FFP beneficiaries in training was 3181 men and 5259 women farmers in on-farm mode, totalling to 8440 farmers.

FFP- field extension system: A total of 1373 field visits were done with an average of 137 per year, compared to 11 visits in 2016. The outcome was a reduced economic loss of 73 per cent, due to early diagnosis of field problems and reduced loss.

Adoption of organic inputs for agro-ecological farming: The adoption of organic inputs and bio-fertilizer was more than 2.325 tonnes per year in the FFP. Farmers adopted organic inputs at an average of 2.8 tonnes per hectare for different crops in the FFP area, which was 48 per cent higher than the pre-FFP adoption level.

Community adoption of bio-management of pests and diseases

In the FFP panchayats, a total of 1200 rhinoceros breeding sites were treated with Metarhizium formulation, in combination with field sanitation, and mechanical methods, progressively reduced chemical pesticide application, in an area of 205.8 ha.

Crop diversity/intensity: The crop diversity index doubled in FFP-IFS plots, and the cropping intensity of the FFP locations showed 57 per cent improvement over the pre-FFP.

Livelihood improvement of FFP participants: The livelihood capitals, except for the physical capital, which showed significant improvement in financial, social, human and natural capitals and overall improvement in livelihood index as depicted in the fig. 92.

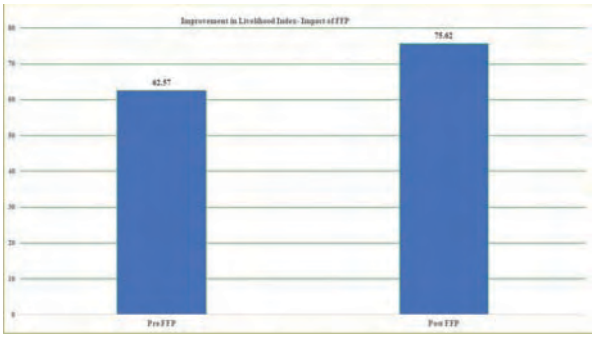


Fig. 92. Livelihood capital improvement in FFP (pre and post)

Upscaling-Spatial adoption approach through HYV seed villages in 8 panchayats during 2025 with crops/var ieties. The Integrated Coconut Community Programme in 51 wards, identified 967 mother palms producing 5982 polybag bio-primed seedlings in three community nurseries.

Women's Empowerment in Agriculture Index (WEAI): Feminization of agricultural extension was an important process of the ICAR CPCRI-FFP. The WEAI sub-index focuses on the Five Domains of Empowerment (5DE), such as decisions about agricultural production, access to and decision-making power over productive resources, control over the use of income, leadership in the community, and time allocation. In this study, a 5DE score of 0.804 indicated that women farmers, on average, achieved 80.4 percent of the weighted empowerment indicators, showing higher empowerment of women farmers of the ICAR-CPCRI FFP.

Connectivity and access to support and services in the FFP community: Increased connectivity and access to services to more than 55% in agricultural interventions, compared to non-FFP grama panchayats, a pointer to the social mobilization in FFP.

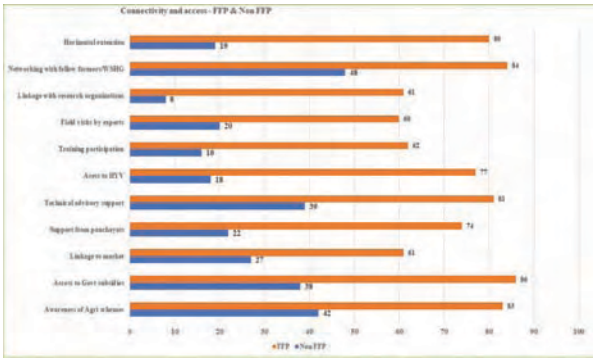


Fig. 93. Connectivity and access- Improvement in FFP

Economic analysis in Policy Perspectives

Analysis of trade policy and price analysis of mandate crops

The economic causes of the recent price rise regime have been studied from the policy perspective. The time series analysis revealed an inflationary movement of the coconut prices was following a cyclical pattern with varying recovery periods. Cointegration analysis of coconut prices among international markets was conducted through the Johansen procedure identified the major causes of the recent price rise are 1) supply-side weakness across growing regions worldwide 2) European Union Deforestation Regulations and resulting global speculations 3) shortage in copra supply in the domestic market 4) holding stock in anticipation of a further price rise, and 5) higher import duty for crude and refined vegetable oils.

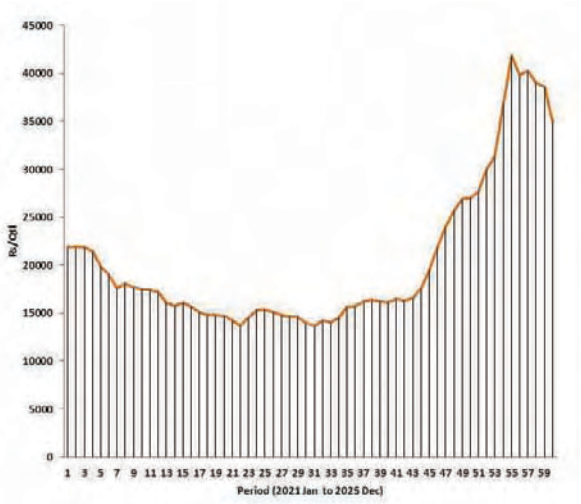


Fig. 94. Price Movement-Domestic (Coconut oil)

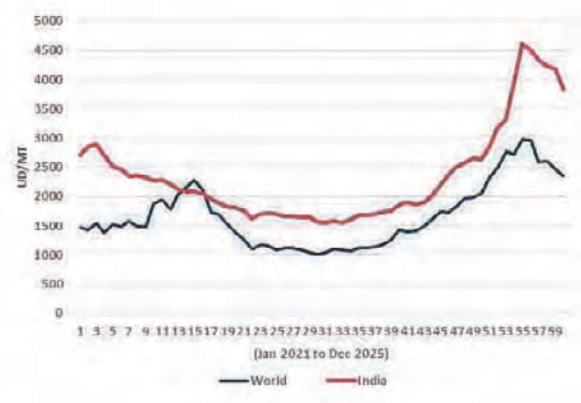


Fig. 95. Price comparison of coconut oil: Domestic & World

Analysing cocoa sector in the light of recent policies and price fluctuations

The following three issues have been analysed and reported to MIDH.

1. **Note on zero duty import of cocoa beans**
   India imposes a 35 per cent import tariff on cocoa beans, and global prices are likely to remain firm during 2025–26 due to continued production shortfalls in Côte d'Ivoire and Ghana.

   Reducing the import duty may allow cheaper imports, potentially depressing domestic cocoa prices and adversely affecting Indian cocoa growers. Hence, any decision on tariff reduction should be based on a careful assessment of its impact on farmers vis-à-vis processing industries.

2. **Note on inverted duty structure in cocoa**

   An inverted duty structure in cocoa discourages domestic processing.

   Zero-duty imports of processed cocoa products under ASEAN-FTA have increased since 2017, affecting competitiveness. Hence, duty rationalization is needed by keeping tariffs on raw beans lower than on processed products.

3. **Note on 100 per cent FDI through automatic route in cocoa**

   It is noteworthy that the 100 per cent FDI through automatic route in food processing sector had been enacted from 2016 onwards, and there was no significant investment happened in the processing sector of cocoa. The reason being the lack of cocoa bean availability and the inferior quality of the domestic beans. The major existing MNCs preferred to source the beans for superior chocolate making from the traditional African countries, and the Indian beans mainly used for the generic confectionary products. Hence it is imperative to source the FDI in the cocoa post-harvest processing and drying units. It is also suggested to encourage 100 per cent FDI in organic/specialty chocolate sector on an integrated manner with agglomerating the FPOs and imparting them with the perfect know-how coupled with specific buy-back arrangements.

Domestic value chain of arecanut and the policy issues

Despite 100 per cent FDI in food processing since 2016, cocoa processing has seen little investment due to limited and lower-quality domestic beans. Premium chocolate makers still prefer sourcing beans from African countries. Hence, FDI may be encouraged in post-harvest processing, drying, and specialty chocolate value chains with FPO linkages and buy-back support.

Global value chain of coconut products in the food safety perspective

A field survey of 75 coconut manufacturing and merchant export units documented the Global Value Chain (GVC) of coconut products in Kerala, Karnataka, and Tamil Nadu.

The GVC in Karnataka was found to be market-mediated and ball copra-centric, while in Tamil Nadu it was scale-driven, demand-oriented, and export-focused.

Compliance issues were also analysed using international food safety alerts and import rejection databases, documenting reasons and country-wise patterns of rejection for coconut products.

Fig. 96 Field study of coconut products manufacturing units

Fig. 97. FGD with small-scale manufacturers

Fig. 98. Diversified coconut products on display

Brainstorming: 'Strengthening social science research in the plantation sector from a value chain perspective'

The plantation sector is shaped by complex, socially embedded global value chains, necessitating multidisciplinary research for a sustainable plantation economy.

In this context, ICAR-CPCRI, Kasaragod organized a brainstorming on 24 January 2025 to strengthen social science research in the plantation sector from a value chain perspective. The deliberations emphasized a mission-mode approach, technology prioritization, holistic farm-level understanding, and need-based research planning.

Fig. 99. Brainstorming: Strengthening social-science research in the plantation sector

Statistical Investigations for Refinement of Research Methodology

AI- Driven Analytical Framework for Identifying Key Factors Impacting Crop Productivity and Environmental Sustainability

Spatial and temporal variability in plantation crop productivity, pest incidence, and area expansion was analysed using district-level statistics, geo-referenced occurrence data, and harmonized environmental datasets. Historical and projected climate data were integrated with AI-assisted machine learning models to assess present and future environmental influences.

The analysis identified key drivers of productivity decline, pest outbreaks, and emerging suitability in non-traditional regions under changing climatic conditions.

Ecological network analysis for Partitioning Insect Visitation in coconut

This study examined seasonal floral visitation and pollination networks of insect foragers on male and female flowers of dwarf coconut in Kayamkulam, Kerala. The analysis identified stingless bees, ants, Apis cerana, and Tetragonula iridipennis as key pollinators, with male flowers attracting greater diversity and female flowers showing stronger interactions with efficient pollinators. The pollination networks exhibited moderate nestedness, high robustness, and clear seasonal turnover, indicating ecological stability and functional resilience.

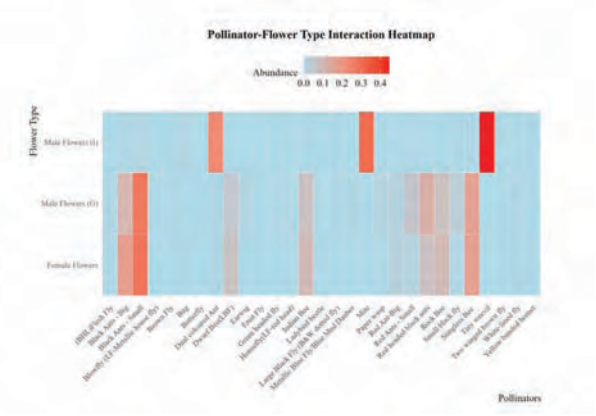


Fig. 100. Heatmap showing pollinator visitation across flower types

This study demonstrates the utility of ecological network analysis for disentangling complex pollinator–plant associations and provides new insights into optimizing pollinator support strategies in coconut-based agroecosystems.

Standardisation of fruit weight conversion factor in coconut

A field study was conducted with the objective of estimating the fruit weight to number conversion factor at national level for coconut production in India. It was carried out in nine major coconut growing regions with the support of various centres of AICRP (Plantation Crops). Three gardens each from randomly selected 15 panchayaths/villages were surveyed in the selected districts in four rounds. Variables on Farm characteristics were recorded from the each of the gardens. Important fruit characters were also recorded including fresh fruit weight, standardised fruit weight, Husked nut weight and Copra weight involving field visits and processing in institutions.

The major results from the study are: Considerable regional differences were observed in coconut fruit traits like coconut palms in the eastern coastal zones of TN and AP tended to produce smaller nuts and lower copra yield relative to western regions of TN and Kerala. Standardized weight varied from 70-80% of the fresh fruit weight. Based on the measured data, the following conversion factors were derived:

- For fresh fruit weight, the conversion factor is 0.877
- For standardized fruit weight, the conversion factor is 1.188.
- For husked nut weight, the conversion factor is 2.092.

It indicates the number of nuts required to make 1 kg fruit weight. The derived conversion factors (0.877, 1.188, 2.092) provide a framework to convert between nut counts and weights at various stages.

Assessment and Management of Coconut Pest and Disease Outbreaks in South Interior Karnataka

A Central Expert Team (CET) constituted by ICAR in August 2025 assessed major coconut pests and diseases in Karnataka and identified Black-headed caterpillar (BHC) and Rugose Spiralling Whitefly (RSW) as the most serious constraints. The survey showed that 11.06 per cent (53,629 ha) of the coconut area was severely affected by BHC, while 60.78 per cent (294,585 ha) was affected by RSW and other whiteflies. Based on stakeholder consultations, the CET estimated a requirement of ₹212 crore for biocontrol and pest management infrastructure and ₹578 crore for soil health interventions. The report was submitted to both Government of Karnataka and Ministry of Agriculture and Farmers's Welfare for consideration.

ICAR CPCRI Kasaragod and its regional stations and research centers conducted large number of training programs under ATMA, interstate farmers, students and other stakeholders as listed below.

Training Programmes

Sl No.	Institute	Programme	No. of programmes	No. of participants	No. of officials
1.	CPCRI, HQ Kasaragod	ATMA Interstate and within state Farmers	26	994	77
		Student visit	82	1246	137
2	CPCRI, RC, Kahikuchi	Farmers	44	5172	55
		Student visit	18	510	
3	CPCRI, RC, Mohit Nagar	Farmers	22	1055	12
		Student visit	2	59	4
4	CPCRI, RC, Kidu	Farmers	8	282	10
		Student visit	11	610	22
5	CPCRI, RS, Kayamkulam	Farmers (including FFP trainings)	149	5590	677
		Student visit	45	1170	50
6	CPCRI, RS, Vital	Farmers	2	80	3

Skill Development programmes

- A capacity-building programme was conducted for 10 community resource persons (Krishi Sakhis) on natural farming. A demonstration was organised on the preparation of bio-products at Neerchal village on 27 September 2025.

Fig. 101. Demonstration of preparation of Jeevamrut

RAWE programmes

Period	College/University	No. of students
11-15 February 2025	College of Agriculture, Padannakkad	20
8-12 December 2025	College of Agriculture Vellanikkara	17

Interface programmes and demonstrations in NEH

ICAR-CPCRI organised 44 training programmes along with frontline demonstration in NE states. It comprised 15 numbers of training programmes and stakeholders' meetings conducted in Assam, 10 in Meghalaya, 8 in Tripura, 2 in Mizoram, 6 in Arunachal Pradesh and one in Nagaland during 2025. A total of 17 numbers of demonstrations were conducted in all the NE states during 2025.

Fig. 102. Stakeholders workshop on building a sustainable coconut and arecanut sector

Fig. 103. Cocoa plot at Arunachal Pradesh

A review meeting on development and initiation in the agriculture sector was held with the Union Minister for Agriculture and Farmers' Welfare, Shri Shivraj Singh Chouhan, at Khanapara, Assam, on 15 May 2025.

Fig. 104. Hon. Union Minister for Agri. & FW at Khanapara, Assam

Research Centre, Mohitnagar

Fifteen capacity-building programmes for farmers were conducted in the year 2025. A total of 634 fa rmers received training in good agricultural practices for plantation crops and spices.

Two off-campus training and awareness programmes were undertaken in the Sadar and Matiali blocks of Jalpaiguri district. A total of 241 farmers benefited from these programs.

Four field diagnostic visits were undertaken this year in the MGMG village. A discussion was held regarding the management of diseases and pests affecting arecanut and coconut, along with demonstrations of pest and disease identification methods and control measures.

Organizing important national events and capacity building activities

Interface meet of ICAR-CPCRI Scientists with Tamil Nadu state horticulture officials to manage coconut pest and diseases

ICAR-Central Plantation Crops Research Institute

(CPCRI), Kasaragod, in collaboration with the Department of Horticulture, Government of Tamil Nadu, organised an interface meeting on whitefly management in coconut on 13.02.2025 at Coimbatore. Dr K. Balachandra Hebbar, Director of ICAR-CPCRI, inaugurated the meeting. Dr Hebbar noted that the productivity of coconut is being affected by climate change coupled with biotic stresses such as outbreaks of whiteflies, leaf-eating caterpillars, and root wilt disease in the region. He further emphasised that research institutes, universities, the horticulture department, CDB, and FPOs must collaborate to ensure sustainable coconut production. Scientists from CPCRI delivered expert lectures and also visited the Thondamuthur block of the district.

Entrepreneurship Development Programme on coconut processing and live demo of machinery

On March 9, 2025, ICAR-CPCRI, Kasaragod, and Pro B Products, Bengaluru, jointly conducted an Entrepreneurship Development Programme focused on coconut processing and value addition in Bengaluru. The programme showcased a real demonstration of machinery for coconut value addition, offering participants practical experience and insights into advanced technologies.

Viksit Krishi Sankalp Abhiyan

As part of the nationwide Viksit Krishi Sankalp Abhiyan (29 May – 12 June), ICAR- CPCRI took up spirited efforts to create stronger awareness among farming community by organising interaction meetings, demonstrations and skill trainings for enhancing crop productivity, farmer profitability, and environmental sustainability. The programme covered all the 14 districts of Kerala and five in Karnataka. ICAR CPCRI RC Kahikuchi participated in VKSA programme in Chirang district, Assam and trained around 7700 farmers.

Trainings-on-demand

Five different training programmes were organised for imparting systematic knowledge and skill to the interested and aspiring individuals

Facilitating FPOs to enhance technology utilization in mandate crops

ICAR-CPCRI is the Cluster-Based Community Organisation (CBBO) for two FPOs at Chavakkad and Mullaserry in the Thrissur district of Kerala. According to the Board of Directors (BoD) meeting at Chavakkad FPO on 29.04.2025, it was decided to organise the capacity-building programmes for both FPOs involving different developmental agencies. Subsequently, the progress and issues of two FPOs were presented at the review meeting conducted by the Registrar of Cooperative Societies in Thiruvananthapuram. The best practices of Odanadu FPC were adopted in Thrissur. Further, based on the progress presented, the NCDC has sanctioned Rs 40.50 lakhs to ICAR-CPCRI to carry out the FPO promotion as CBBO.

Table. 4. Details of training programmes

S. No	Title of the training	Course fee/ participant (excluding GST)	Dates of training	No. of participants
1.	Hybridization and quality planting material production in coconut	4000	13-15 October 2025	24
2.	Climate-Smart Palm based cropping Systems	5000	27-31 October 2025	3
3.	Plant health management in planation crops	5000	10-14 November 2025	12
4.	Post-harvest processing & value addition in coconut	4000	23-24 October 2025	3
5.	Prospects of business ventures in plantation crops	1000	26 November 2025	25

Exhibitions, frontline demonstrations and participation in fairs

S. No.	Place	Date
1	Twelve days -Karaduka Block Panchayath at Pawal	01.01.2025 to 12.01.2025
2	Three days at ICAR-CMFRI, Kochi during Matsyamela Exhibition	01.02.2025 to 03.02.2025
3	Three days-Tipani Nayaka Krishna Math University of National Science, Shimoga	26.04.2025 to 28.04.2025
4	One day - 97th Foundation Day of ICAR, New Delhi	16.07.2025
5	One day World Coconut Day Celebration at CPCRI, Kasaragod	02.09.2025
6	One day-32nd Foundation Day & Kisan Mela at ICAR-NRCB, Tiruchirappalli	21.08.2025
7	Industries exhibition and seminar to develop marketing opportunities for the MSME sector at Mangalore	18.09.2025 to 19.09.2025
8	Three days Swasraya Bharat 2025 at NIT Calicut	15.10.2025 to 17.10.2025
9	5 days- “Tropical Root and Tuber Crops for Nutrition, Agri-Food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES) at ICAR-CTCRI, Thiruvananthapuram	17.11.2025 to 21.11.2025
10	Four days– Indian Academy of Horticultural Sciences (IAHS) International Meet, at the UAS, Bengaluru	06.11.2025 to 09.112025
11	The IEDC Summit 2025 at LBS College of Engineering, Kasaragod	22.12.2025

LoDP on root (wilt) disease of coconut

Awareness campaigns were organized in all the villages to enlighten the identified farmers on the implementation of the scheme and the technologies developed by ICAR-CPCRI for integrated management of root (wilt) disease. Two major nutrients *viz*., nitrogen and potassium, cow pea seeds as well as Kera probio- a bioinoculant (Priestia megaterium) have been delivered in the first phase of the programme. In the second phase, Neem cake, Kalpa Vardhini (Micronutrient mixture developed by ICAR-CPCRI), EPN capsules of Steinernema keralense (prophylactic treatment against red palm weevil) and talc formulation of *Metarhizium majus* (entomopathogenic fungus) were distributed to improve the palm health. Periodic field visits were conducted by scientific teams to ensure the efficient utilization of inputs.

Fig. 105. Demonstration of technologies for integrated management of root (wilt) disease of coconut- Input distribution, Field demonstration, Awareness campaign

Demonstration of cinnamon intercropping in CBFS

Under this programme, a farmers training cum field day on 'Cinnamon intercropping in coconut gardens' was organized at KVK, Tumkur, on 18 October 2025. About >70 participants attended the programme. Dr. Surekha, Senior Scientist (Agronomy), coordinated the programme, presented the background of the cinnamon crop, and highlighted its potential as an intercrop in coconut-based cropping systems. The novel high-density pentagonal planting system of cinnamon was demonstrated to the farmers in the KVK farm fields.

Fig. 106. Pentagonal method of high density planting of cinnamon as intercrop in coconut

Entrepreneurship Development Programme

Four Entrepreneurship Development Programmes were conducted on coconut processing for the following students at CPCRI, Kasaragod.

B.Tech. Agricultural Engineering students from Dr. NTR College of Agricultural Engineering, Bapatla and College of Agricultural Engineering, Madakasira, Andhra Pradesh	14 July - 13 August 2025	20
Kelappaji College of Agrl. Engg & Food Technology, Tavanur, Kerala	24 November- 2 December 2025 04 -12 December 2025 15-23 December 2025	50

Farm Advisory Services through ATIC

Various farm advisory services were offered to farmers and other stakeholders through Agricultural Technology Information Centre during 2025 as per the following details.

Topic	Queries replied during2025			
	Phone	e-mail / Whatsapp / SMS	Postal	Total
Availability of planting materials	2663	1156	5	7345
Hybrids and improved varieties	1278	1+25	2	1306
Integrated nutrient management	1115	3+10	Nil	1128
Organic farming technologies	112	5	Nil	157
Irrigation and water management	1042	150	5	1197
Integrated pest management	965	100	10	1075
Integrated Disease Management	1266	110	10	1386
Post Harvest Technologies	1	Nil	Nil	1
Availability of printed farm literature	151	10	5	168
Training and other TOT programmes	42	25	Nil	68
Crop statistics	Nil	Nil	Nil	Nil
Other items	Nil	Nil	Nil	Nil
Total				**13791**

6.8

All India Coordinated Research Project (AICRP) on Plantation Crops

The All India Coordinated Research Project on Palms has been functioning since 1972 with an objective of conducting location-specific research in the mandate crops. The project has coconut, oil palm, arecanut, palmyrah and cocoa as mandate crops and it is implemented in 28 centres, of which 15 centers undertaking research on coconut, six on oil palm, four on arecanut, four on palmyrah and seven on cocoa with Headquarters at ICAR-CPCRI, Kasaragod. These centres are located across the country in 14 states and one union territory covering 13 SAUs/SHUs, one CAU and four ICAR institutes.

Fig. 107. Map showing coordinating centres of ICAR-AICRP on Plantation Crops

Map showing coordinating centres of ICAR-AICRP on Plantation Crops

The budget for the year 2025 (January -December) was Rs. 938.78 lakhs and the scheme is implemented through the respective state Agricultural/ Horticultural Universities on 75:25 basis, with 75 per cent share from ICAR and 25 per cent share from State Agricultural Universities. The centers of Central Agricultural Universities and ICAR Institutes have 100 per cent funding from ICAR.

Research achievements

During the year, the name of AICRP on Palms has been changed to AICRP on Plantation Crops consequent upon the approval of EFC for the period 2020-2026. Two voluntary centres *viz.*, Pasighat and Bavikere were upgraded as regular centres to strengthen research on oil palm.

COCONUT

Under coconut, 30 projects are in progress at various centres on Crop Improvement, Crop Production and Crop Protection. The salient achievements are as follows:

Crop Improvement

- Under the germplasm conservation trials, several accessions exhibited superior performance in terms of nut and copra yield. Accessions yielding more than 100 nuts per palm per year were identified at Aliyarnagar (610370 and 610371) and Ambajipeta [610309 (Jonnalarassi Brown), 610306 (Pillalakodi Green) and 610307 (Pillalakodi Brown)]. With regard to copra productivity, accessions producing more than 15 kg copra per palm were recorded at different centres, viz., Ratnagiri: 599115 (Rajapur) with 17 kg per palm; Bhubaneswar: 612457 (Odisha Giant) with 14.85 kg per palm; Kahikuchi: 610357 (Belsor) with 17 kg per palm; and Veppankulam: 599264 (Adirampattinam) with 18.1 kg per palm and 599267 (Thamarankottai) with 16.4 kg per palm. These accessions represent promising germplasm with high yield

potential for future breeding and conservation programmes.

- Location specific crosses at Bhubaneswar, the hybrid SKL × GBGD recorded higher nut yield (137 nuts palm^{-1} year^{-1}) and high quantity of tender nut water (455 mL nut^{-1}) with Total Soluble Solids content of 5.28. The hybrid nut recorded copra content of 192.35 g per nut with an oil content of 66.28 per cent (with an increased nut yield of 24.75 % and higher copra content 34.63 %) over the ruling variety Sakhigopal Local.
- Among the Dwarf × Dwarf combinations planted during 2011, COD × MGD at Ambajipeta centre had high nut yield (84.29 nuts palm^{-1} year^{-1}) and high quantity of tender nut water (447 mL nut^{-1}). At Ratnagiri Centre at 13 years of age, the COD × MYD recorded the highest mean annual tender nut yield of 91.58 nuts per palm per year (2022-23) and higher quantity of tender nut water (458.13 mL nut^{-1}). Veppankulam: At 13 years of age, the GBGD × MOD hybrid recorded the highest mean annual nut yield of 98 nuts per palm per year (2024-25).
- The better performing accessions/released varieties from different centres *viz*., VPM 6, Seychelles, Gandevi, Kamrupa and Orissa Giant were identified for MLT under different regions.
- Dwarf trial initiated: Seed nuts of coconut dwarf varieties, Dweep Haritha, Dweep Sona, LCOD, CRD, Nigerian Dwarf, Niu Leka, Gudanjali Dwarf, Hari Papua Dwarf were dispatched to eight AICRP centers during March 2025.
- Seed nuts of tall coconut genotypes, namely Orissa Giant Tall, Kamrupa Tall, Seychelles Tall, Gandevi Tall and VPM 6, were supplied to three AICRP centres, *viz*., Ambajipeta, Bhubaneswar and Veppankulam during September 2024 for multi-location evaluation. Subsequently, seed nuts of additional tall genotypes including Lifou Tall, Kappadam Tall, Philippines Laguna Tall, Markam Valley Tall and West African Tall were supplied to the same centres during March 2025 to strengthen the evaluation and conservation of diverse tall coconut genetic resources across locations.

CROP PRODUCTION

- Under Organic farming in coconut based farming system, application of organic manures along with 50 per cent potassium as sulphate of potash (T4) resulted in enhanced yield by 9 -12 per cent across different centres. Recalcitrant pool of carbon in the soil and Dodecanoic acid (lauric acid) in coconut oil was high in the treatments which receive organic manure application compared to conventional method of fertilizer application. However, energy profitability was higher for conventional method due to higher energy equivalent for organic inputs. Cost of production and gross returns were high for the treatment which received organic manures along with sulphate of potash but the benefit cost ratio was observed to be higher in conventional fertilization.
- Initiated studies on high density planting of cinnamon as intercrop in coconut garden (Veppankulam, Ratnagiri, Aliyarnagar, Ambajipeta, Jagdalpur)
- Trial initiated on testing Kalpa Vardhini and Kalpa Poshak, the nutrient mixture for the sustained growth and productivity of coconut palms (Ratnagiri, Mondouri, Kahikuchi, Jagdalpur, Pilicode)
- Initiated trial on evaluation of TNAU coconut tonic for its efficacy on productivity and quality of coconut (Kasaragod, Ambajipeta, Arsikere, and Bhubaneswar)

Crop protection

Production and supply of parasitoids

- At the Aliyanagar Centre, an area of 353 acres was reported to be infested with BHC, while whiteflies affected 433 acres. To evaluate the potential of *Bracon brevicornis*, field recovery study was conducted at Pugalur village located in Karur district. Twenty one days after release of parasitoids, BHC larvae were collected from the infested garden to work out the per cent parasitisation. Parasitisation ranged from 30.0 to 35.0 per cent.
- At Ambajipeta, approximately 184 acres of *Opisina arenosella*-infested gardens were covered under a biological control programme in Allipalli village. A total of 21,49,998 individuals of *Bracon hebetor*, 1,37,750 individuals of *Bracon brevicornis*, and 10,13,592 individuals of *Goniozus nephantidis* were released for the management of the pest. Additionally, to manage slug caterpillar infestations, 8,000 individuals of *Pediobius imbrues* parasitoids were released, covering 48 acres of affected gardens by Ambajipeta centre. For the

management of Rugose spiraling whitefly, approximately 335 acres were covered through the release of 3,80,000 eggs and 3,49,000 grubs of *Apertochrysa astur*.

Oil palm

Oil palm research under AICRP on Plantation Crops are in progress at seven centers on crop improvement and crop production. 38 hybrids are under evaluation in four trials. The salient achievements are as follows.

- Oil palm hybrid NRCOP 9 tested under AICRP on PC centre Pattukottai is recommended for release and cultivation in Coastal region of Tamil Nadu under assured irrigated condition. NRCOP 9 could gives an impressive oil yield of 6.58 tonnes per ha per annum.
- Oil palm hybrid NRCOP-37 tested under AICRP on PC Vijayarai is recommended for release in Coastal region of Andhra Pradesh. The hybrid recorded oil content of 18.45 per cent resulting in oil yield of 5.48 tonnes per ha per annum.

Cocoa

- Cocoa genotypes are under evaluation at seven AICRP (PC) centres across the west coast, east coast and North Eastern regions under arecanut, coconut and oil palm systems. Based on 14-year-old trials, VTLCH-2 and VTLCH-1 were identified and notified as superior performers under coconut in different regions. Preliminary evaluation of 12-year-old trees showed VTLCP-16, VTLC-17 and VTLC-20 as promising at Aliyarnagar, Ratnagiri and Kahikuchi, respectively, while VTLC-57 performed well at Vijayarai under oil palm.
- VTLCH-3, 4 and VTLCC-1 are identified as better performing at different centres.

Palmyrah

Palmyrah research under AICRP on PC are in progress at four centers on crop improvement and post harvest technology. So far, 272 germplasm at HRS Pandirimamidi and 265 germplasm at AC & RI, Killikulam, has been conserved. The salient achievements under post harvest technology are as follows

- Patent filed for Process technology on fresh natural palmyrah jaggery and jaggery powder protocol.
- Shelf life of palymyrah syrup determined. Palmyrah Neera Concentrate (PNC) or palmyrah syrup can be stored up to 90 days with glass bottle without affecting physicochemical properties at accelerated storage (90 % RH and 40 C).
- Palmyrah tuber is a cheap and rich source of starch. Modifications of native starches are carried out to provide starch products with specific properties and can be used as a thickener in instant soup.
- The yields and characteristics of pectin extracted from palmyrah fruit pulp (5.8 – 20.4 %) was comparable to extracted pectin from other sources

XXXIV Annual Group Meeting of AICRP on Plantation Crops

The XXXIV Annual Group Meeting of AICRP on Plantation Crops was organized at AC and RI, Madurai, (TNAU), Tamil Nadu during 7-9 May 2025 under the chairmanship of Dr. S. K. Singh, DDG (Hort.), ICAR, Dr. Irene Vethamoni, Dean (Hort.), TNAU welcomed the gathering. Dr. V.B. Patel, ADG (F& PC), ICAR, Dr. K.B. Hebbar, Director, ICAR-CPCRI, Dr. K. Suresh, Director, ICAR-IIOPR, and Dr. R. K. Mathur, Director, ICAR-IIOR, Dr. P. P. Mahendran, Dean (Agri.), TNAU were the Guests of honour for the inaugural session. Dr. P. Rethinam, Former Executive Director, ICC (APCC), Jakarta and Dr. R.V. Nair, Formerly Head, ICAR-CPCRI were the expert nominees of ICAR for the AGM.

Fig. 108. Dr. S. K. Singh, DDG (Hort.), ICAR, New Delhi, delivering the inaugural speech and releasing the publications

Technical programme for 2025-26 was finalized in the AGM. One coconut variety ALR-4 and one Oil palm hybrid NRCOP-37 were recommended for release during the AGM. Over 15 publications including three books and 3 technical bulletins were released during the AGM. Pandirimamidi Centre was adjudged as the best performing centre and Navasari centre was adjudged as the best resource-generating centre for the year 2024-25.

Major recommendations from the XXXIV AGM

- A coconut variety ALR- 4 has been recommended for release for cultivation in Tamil Nadu. The variety is a selection from the local tall accessions collected and evaluated under AICRP on PC centre, Aliyarnagar.
- Location specific crosses at Bhubaneswar, the hybrid SKL × GBGD recorded higher nut yield (137 nuts palm^{-1} year^{-1}) and high quantity of tender nut water (455 mL nut^{-1}) with total soluble solids content of 5.28. The hybrid nut recorded copra content of 192.35 g per nut with an oil content 66.28 per cent (with an increased nut yield of 24.75 % and higher copra content 34.63%) over the ruling variety Sakhigopal local.
- Oil palm hybrid, NRCOP 9 evaluated under AICRP on PC centre, Pattukottai has been recommended for release and cultivation in coastal region of Tamil Nadu under irrigated conditions. The hybrid gives an impressive oil yield of 6.58 tonnes per ha per annum.
- Oil palm hybrid, NRCOP-37 evaluated under AICRP on PC centre, Vijayarai has been recommended for release for cultivation in Coastal region of Andhra Pradesh. The hybrid recorded oil content of 18.45 per cent and oil yield of 5.48 tonnes per ha per annum.
- Patent application filed for process technology on fresh natural palmyrah jaggery and jaggery powder protocol by AICRP centre Pandirimamidi.
- Freeze-drying of fresh neera with maltodextrin with 10 per cent or more resulted in a sap powder with good stability at room temperature and excellent solubility. Sap powder shows an easy rehydration by water addition to its original characteristic of the process. The sap powder obtained meets the current legislation standards for fruits and vegetable products, with moisture value of less than 5.0 per cent.

6.9.1

Krishi Vigyan Kendra, Kasaragod

The ICAR- KVK, Kasaragod has initiated 4 OFTs, 12 frontline demonstrations one nutri garden programme, SCSP, TSP and various extension activities during 2025. The major achievements under these are given below.

Capacity Development Programmes

KVK Kasaragod organized 150 farmers' trainings with a participation of 5915 persons, 7 rural youth training with a participation of 173, one extension training with 21 participants and 8 vocational trainings with 85 participants. The trainings included scientific management practices in coconut and arecanut, entrepreneurship development programme on millets, vegetable cultivation, mushroom cultivation, nutri garden, beekeeping, fruit processing, composting techniques, etc. for income generation among farmers and rural youth.

On Farm Trials (OFTs)

Sahyadri Panchamukhi (33.6 q ha^{-1}, +47%) and KAU Mithila (30.2 q ha^{-1}, +32.2%) were identified as suitable for Kaipad conditions.

Arka Mangala and KAU Deepika yard long bean hybrids were high yielding with preference for Arka Mangala due to consumer preference.

Frontline Demonstrations

ICAR–KVK, Kasaragod implemented 15 Frontline Demonstrations (FLDs) across crops, horticulture and livestock to improve productivity, resource conservation, resilience and farm profitability in Kasaragod district.

Extension activities

The extension activities carried out by KVK Kasaragod during 2025 are 4633 benefitting 42120 participants of which 7620 were from SC / ST.

Other Important Events

KVK Kasaragod has participated in about ten programmes and showcased technologies, benefitting about 5600 farmers.

Kisan Mela and Farmer-Scientist Interface

The Farmer-Scientist Interface and Kisan Mela, jointly organized by ICAR-CPCRI and KVK-Kasaragod, was held from January 3 to 5, 2025, at the ICAR-CPCRI, Kasaragod. The event provided a platform for farmers, scientists, and entrepreneurs to exchange knowledge, showcase innovations, and explore opportunities in modern agriculture. The event was inaugurated by Dr. Himanshu Pathak, Secretary DARE and Director General, ICAR. During his visit, Dr. Pathak interacted with farmers, visited the exhibition stalls, and appreciated the innovative technologies, extension activities, and entrepreneurial initiatives promoted by KVK. He has also laid foundation stone for the new KVK building during the occasion.

A key highlight of the Kisan Mela was the exhibition, which showcased technologies developed by KVK and value-added products created by 10 KVK-trained entrepreneurs. The exhibition offered a glimpse into the innovative advancements and entrepreneurial efforts being fostered by KVK. The Kisan Mela drew an impressive turnout of approximately 5,000 farmers and members of the public, making it a resounding success.

Kisan Samman Samaroh

ICAR-KVK Kasaragod celebrated the Kisan Samman Samaroh in conjunction with the release of the 19th installment of the Pradhan Mantri Kisan Samman Nidhi (PM-KISAN) Scheme at ICAR-CPCRI, Kasaragod on 24 February 2025. The program was held in connection with the national-level launch

of the 19th installment of PM-KISAN, inaugurated by Hon'ble Prime Minister (PM) of India from Bhagalpur, Bihar. The event was inaugurated by Hon'ble MLA, Shri N. A. Nellikkunnu, Kasaragod Assembly Constituency, Keralam, in the esteemed presence of Dr. K.B. Hebbar, Director, ICAR-CPCRI, Shri Raghavendra P., Principal Agricultural Officer, Kasaragod District.

As part of the event, a seminar and exhibition on 'Sustainable Horticulture Production Technology' was organized to raise awareness and promote knowledge about innovative and sustainable agricultural practices. High-yielding vegetable seeds suitable for Nutri-gardens were also distributed to farmers by the MLA, further encouraging nutritional security and self-sufficiency. The event witnessed the participation of farmers, Farmer Producer Organizations (FPOs), Self-Help Groups (SHGs), SC-SP and TSP representatives, and students from the College of Agriculture, KAU, with over 80 attendees.

ICAR-KVK Kasara brates KVK Day in Honor of the Koraga Community

The Krishi Vigyan Kendra (KVK), Kasaragod, celebrated KVK Day on 6th December, 2025 with a special outreach program dedicated to the Koraga community. Beehives were distributed, accompanied by a practical demonstration on hive management and honey production.

Seed Village programme on Tuber Crops

As part of the Tribal Sub Plan (TSP) initiative, a seed village program on tuber crops was initiated in Ennappara village of Kasaragod district. Mainly small and marginal tribal farmers were empowered to adopt sustainable agricultural practices and improve income generation opportunities. A total of 12 farmers were distributed with elephant foot yam (var. Gajendra), greater yam (var. Sree Keerthi), and lesser yam (var. Sree Latha).

Viksit Krishi Sankalp Abhiyaan Outreach in Kasaragod

ICAR- KVK, Kasaragod, in association with ICAR–CPCRI and partner ICAR institutes, conducted a high impact series of farmer–scientist outreach and training programmes from 29 May to 12 June 2025. The campaign mobilized two dedicated teams including scientists from ICAR–CTCRI, ICAR–IISR, ICAR–CIFT, and ICAR– CMFRI. The meetings were conducted with intensive field engagements across 38 Gram Panchayat, culminating in more than 11,500 farmer participants and stakeholder interactions.

Empowering SC Farmers through Livestock and Apiculture Interventions under SCSP

Under the Scheduled Caste Sub Plan (SCSP), ICAR-KVK Kasaragod organized a demonstration and distribution of bee books and customized poultry cages to promote sustainable backyard poultry farming among Scheduled Caste benefiting 24 farmers. An on-campus training on scientific poultry cage rearing was also organised.

Farmer's Day Celebrations

KVK in association with Manjeshwar Krishi Bhavan celebrated Karshaka Dinam (Farmer's Day) on August 17, 2025. The meeting was inaugurated by Mr. A.K.M. Ashraf, the MLA of Manjeshwar at Manjeshwar Krishi Bhavan. As a part of the programme the best farmers from various categories were felicitated. A total of 140 farmers attended the program, where coconut seedlings and coconut climbing machines were distributed to 35 SC farmers, under the SCSP scheme.

Drone Technology Demonstration for Paddy Farming To popularize drone technology among farmers in the district, ICAR-KVK, Kasaragod, conducted a drone demonstration on August 12, 2025, in the 10-acre Balazhi Padashekarm under the Bedadka Krishi Bhavan, Kudamkuzhy.

Training on Natural Farming for Community Resource Persons/ Krishi Sakhis of Kasaragod

ICAR KVK Kasaragod in collaboration with SAMETI, Kerala and Department of Agriculture and Farmers' Welfare, Govt. of Kerala conducted a training programme on natural farming for Community Resource Persons (CRPs)/ Krishi Sakhis of Kasaragod district from 25-30 September 2025. Total 10 participants, attended the training. During the Director's address in the valedictory function Dr. K.B. Hebbar, Director, ICAR-CPCRI, Kasaragod mentioned that soil health management and biodiversity enrichment should be the core agenda of Natural farming.

Awareness programme on nutri mix supplement

An awareness programme on nutrition and health and the significance of nutri mix as a supplementary food for children was conducted on 10 October 2025 in coordination with ICDS Paivalike at the Kudumbashree Hall, Paivalike Grama Panchayat. A total of 110 participants actively participated in and benefited from the programme.

KVK exhibition at ICAR-CPCRI, Kasaragod

KVK-Kasaragod and KVK-Alappuzha participated in the technology exhibition as part of the National seminar on 'Harnessing Plantation Sector for Sustainable Development Goals' organized at ICAR-CPCRI, Kasaragod from 3 to 5 January 2025.

Fig.109. DG visiting KVK Exhibition stall

6.9.2

Krishi Vigyan Kendra, Alappuzha

Viksit Krishi Sankalp Abhiyan (VKSA)

Viksit Krishi Sankalp Abhiyan was organized from 29 May to 12 June 2025 covering 78 LSG units in the district reaching more than 26,000 farmers. The resource persons were from the KVK, ICAR-CTCRI, Thiruvananthapuram, ICAR-IISR, Kozhikode, ICAR-CIFT, ICAR-CMFRI, Ernakulum, Kerala Agricultural University and Agricultural officers. Dr. G. Byju, Director, ICAR-CTCRI attended the VKSA programme of the KVK on 31 May 2025.

Fig. 110.VKSA programme at Thykattussery

Fig. 111. Director, ICAR-CTCRI in VKSA programme

KVK-NABARD project launched

Launch of the KVK-NABARD project on 'Promotion of value chain in banana' was done by Shri. Byju N. Kurup, CGM, NABARD Kerala region at the KVK on 19 March 2025 by handing over tissue culture plantlets of banana to a partner farmer. About 80 farmers, entrepreneurs and input dealers participated. The programme is implemented in six panchayaths of Bharanikkavu block of Alappuzha district with the participation of 180 farmers formed into 6 clusters.

The KVK Alappuzha has organized more than 11 other extension programmes benefitting about 400 attendees.

Scientific Advisory Committee (SAC) meeting

23rd SAC meeting of the KVK was conducted on 20 March 2025 under the chairmanship of Dr. K.B. Hebbar, Director, ICAR-CPCRI, Kasaragod. The chairman in his introductory remarks highlighted the achievements of KVK. Smt. Sanju Susan Mathew, Project Director, ATMA, Dr. Sreevalsan J. Menon, Associate Director of Extension, KAU, Dr. Regi Jacob Thomas, Head, ICAR-CPCRI, Regional Station, Kayamkulam, Shri T. K. Premkumar, DDM, NABARD, Officers were present in the meeting.

KVK Day celebrated

KVK Day with the theme of 'Reaching the unreached', was celebrated with an orientation cum skill training on 'Operation of farm implements and plant protection equipments' for the SC farmers and youth at the KVK on 24 March 2025.

Webcast of Prime Minister's address on launching of new programmes

Webcast of the launching of Pradhan Manthri Dhan

Dhanya Krishi Yojana (PMDDKY) and Pulses Atmanirbharata Mission along was webcast on 11 October, 2025 at Regional Station, Kayamkulam. About 80 participants attended the program.

Rashtreeya Kisan Diwas Celebration

'Rashtreeya Kisan Diwas' was celebrated on 23 December 2025 in collaboration with Mararikulam (N) Krishi Bhavan in the 'Swachhta Pakhwada'. A capacity building programme on '*In situ* composting of farm wastes' followed by method demonstration of composting using EM solution was conducted in farmer's field. About 80 persons including farmers participated. The new Viksit-Bharat Guarantee for Rozgar and Ajeevika Mission (G RAM G) was explained to the participants.

Fig. 112. Launching of VCB project

Fig. 113. Kisan Diwas celebrations in campus

Frontline Demonstrations: Ten FLDs were implemented in Mararikulam (N), Kanjikuzhy, Muhamma, and Cherthala South panchayaths.

Programmes under SCSP: About 108 beneficiaries belonging to Scheduled Caste from different parts of the district were selected for improved technology interventions for livelihood improvement.

Skill Training cum Entrepreneurship Development (STED) programme for SC youth: 'Skill Training cum Entrepreneurship Development (STED) programme' for six scheduled caste youth was conducted for six months from 1 July to 31 December 2025. During the period they were exposed to hands-on agro techniques.

Skill training for operation of machineries under SCSP

Skill training on PP equipments and related agricultural machineries was conducted for SC youth of the district from 22 to 24 April 2025

Fig. 114. Skill training for SC youth

Fig. 115. Handing over of power weeder – SCSP

Field Experience Training for ARS Scientist probationers

Six ARS scientist probationers from the 114th FOCARS of ICAR-NAARM, Hyderabad underwent the Field Experience Training (FET) at the KVK from 11 August to 12 September 2025.

Fig. 116. ARS probationers on FET

DAESI programme: Second batch of the DAESI programme in the KVK (Fourth batch in Alappuzha district) was conducted from 24 July 2024 to 25 June 2025.

Regular training programmes: Eighty six regular training programmes were organized during 2025 for a total of 1798 participants as detailed below.

Training	No. of Programmes	Participants
Farmers/Farm women	25	647
Rural Youth	30	522
Extension Officials	1	38
Vocational/Skill	3	23
SCSP	11	161
Sponsored	16	407
Total	**86**	**1798**

Fig. 117. Visit to progressive young farmer

Fig. 118. RAWE students

External funded projects

National Innovations in Climate Resilient Agriculture (NICRA) - Phase II

Technology Demonstrations under the project, 'National Innovations in Climate Resilient Agriculture' (NICRA) Phase II is being implemented at Edathua village of Kuttanad Taluk.

Promotion of Value Chain in Banana

KVK initiated a NABARD funded project on 'Promotion of Value Chain in Banana. The project has been implemented in Bharanikkavu block of Alappuzha district involving 180 farmers.

Fig. 119. Community Health Centre activities at Edathua

Fig. 120. Inauguration of value addition unit-VAICoS

Revolving fund activities of KVK

Different inputs were made available to the farmers of the district (as resource centre) through revolving fund activities viz., vegetable seeds and seedlings, planting materials, bio-agents, Methyl euginol, cue lure and yellow sticky traps, layer chicks, mushroom spawn, mother spawn, multi nutrient mixture for banana and vegetables, azolla, processed products, publications etc. Educational programmes like RAWE, project works and internship of students were also taken up on nominal fees.

VII

Publications

Research Articles

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VIII

Technologies Assessed and Transferred

Variety Registrations

Coconut tall variety, Kalpa Ratna

Kalpa Ratna is a high-yielding, moisture-deficit stress-tolerant tall variety suitable for copra, tender nut, and inflorescence sap (neera) production (Fig. 121). The fruits are large, oval, and green in colour, and the palms commence flowering 5–6 years after planting. The tender nut contains about 500 mL of water, with a copra content of around 184 g, oil content of 64 per cent, and an inflorescence sap yield of 31 L per inflorescence. Under good management practices, the variety yields 148–187 nuts per palm per year and is recommended for cultivation in Kerala, Tamil Nadu, and Karnataka by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties.

Fig. 121. High yielding Kalpa Ratna variety of coconut

Coconut hybrid, Kalpa Sreshta

Kalpa Sreshta is a high-yielding hybrid (MYD × TPT) suitable for copra and tender nut production (Fig. 122). The fruits are medium-sized, oval and green in colour, and the palms commence flowering in about four years after planting. The tender nut contains approximately 368 mL of water, with a copra content of around 216 g and an oil content of 64 per cent. Under good management, the hybrid yields 167–186 nuts per palm per year and is recommended for cultivation in Kerala and Karnataka by the Central Sub-Committee on Crop Standards, Notification and Release of Varieties.

Fig. 122. High yielding Kalpa Sreshta coconut

Ten varieties released from ICAR-CPCRI, of which, eight coconut and three arecanut varieties were licensed to nurserymen, as detailed below:

Varieties Licensed

Sl. No	Varieties Licensed	Crops	Date of MoU	Licensee Name and address
1	Kalpa Shatabdi	Coconut	03.01.2025	Umapathy Coconut Hybrid Centre, Palladam, Tirupur, Tamil Nadu
2	Kalpa Suvarna	Coconut	03.01.2025	YGP Coconut Farmers Producer Company Ltd., Davangere, Karnataka
3	Shatamangala	Arecanut	03.01.2025	Mr. Deepak Mohandas, Kozhikode, Kerala
4	Kalpa Shatabdi	Coconut	09.02.2025	M/s Kalp Krushi Hybrid Centre, and Maliya, Junagadh Kalparaksha
5	Swarnamangala and Mohitnagar	Arecanut	24.10.2025	Mr. Gangadhara Alva, Integrated Rural Agri Nursery, Badiadka, Keralam
6	Kalpa Sreshta	Coconut	11.12.2025	Mr. V. Vasanth Kumar, Udumalpet, Tirupur, Tamil Nadu
7	Shatamangala	Arecanut	18.11.2025	Mr. Venkateshwara Sharma K. Ishwaramangala, D.K., Karnataka
8	Kalparaksha, Kera Chandra, Kalpa Haritha and Chandra Sankara	Coconut	24.11.2025	Mr. V.V. Surendra M/s Silpa Clonal Nursery Bapatla, Andhra Pradesh

Trichoderma Formulations

These are biocontrol product formulation of *Trichoderma harzianum* (CPTD 28), useful to control soil borne fungal pathogens. An arecanut leaf sheath powder-based formulation, 'Tricho-Block', was released on World Coconut Day at CPCRI, Kasaragod.

Trichoderma-enriched dolomite pellet formulation, Trichodol is another product developed, which has persistent biocontrol activity for longer time on soil, combined with soil conditioning effect. This has a longer shelf life of six months.

The cocoa pod husk and bean shell based Trichoderma formulation is also rich in organic carbon for the rhizosphere. This product named Cocoa Tricholate was developed in block as well as pellet forms.

Rotary Dryer cum Flavour Coating Machine

The rotary drum with a flavour-coating function is an advanced machine developed for simultaneous dehydration and flavour application in coconut chips. With a handling capacity of 5–7 kg of coconut slices, it is suited for producing salted and spicy coconut chips. Dehydrating 0.5 kg of coconut slices could be achieved in approximately 25–30 minutes. Using this setup, the production of 5 kg of coconut chips can be done in around 2 hours. In comparison, the conventional method requires a 4 kW heating coil running for nearly 6 hours to process 10 kg of chips. Thus, the rotary drum unit achieves about 50% reduction in both drying time and energy consumption, while enabling uniform flavour coating of the product. The technology was transferred to three entrepreneurs.

Fig. 123. Rotary dryer–cum–flavour coating machine

Cocoa Fermenter

The cocoa fermenter unit (35 kg batch^{-1} capacity) comprises a stainless steel longitudinal cylindrical drum housing an agitator with precise temperature controlling system featuring an optimal fermentation. A strategically positioned opening slot allows for easy deposition of raw materials, while a vertical pipe opening at the bottom ensures efficient mucilage drainage. Six heating coils on the drum maintain optimal fermentation temperatures. Temperature sensors at the drum's center monitor and control the heating system. Additionally, a collection tray near the bottom facilitates the gathering of fermented beans, with an option for drum rotation during the collection process.

Fig. 124. Cocoa bean fermenter device

IX

Awards and Recognitions

Awards

- Dr. M.R. Manikantan, Principal Scientist, received ISAE fellow 2025 award from Indian Society of Agricultural Engineers.
- Dr. V. Niral, Head Crop Improvement received certificate of appreciation awarded to ICAR-CPCRI for registration of varieties with PPV&FRA at National Agricultural Science Centre, (NASC) Complex, Pusa Campus, New Delhi on 12 November 2025 on the occasion of the Foundation Day of PPV&FRA, New Delhi.
- Dr. K. Ponnusamy, Head, Social Science was bestowed with Certificate of Appreciation by Society for Prevention of Cruelty to Animals (SPCA) during Animal Welfare Conference-2025 on 03 May 2025 in Thanjavur, Tamil Nadu in recognition of his exceptional dedication and contribution to the welfare and protection of animals.

Best Oral Presentation Awards

- The paper titled 'Exploring the bio-efficacy of tender coconut husk extract liquid suspension against *Meloidogyne incognita* (Kofoid & White, 1919) juveniles' authored by Rajkumar, Surekha, Prathibha V.H., Daliyamol and Vinayaka Hegde presented in the National Seminar on Harnessing Plantation Sector for Sustainable Development Goals held at ICAR – CPCRI, Kasaragod during 3-5 January 2025 was adjudged as the best oral presentation.
- The paper titled ' Geographical variability of heavy metal content in cocoa beans across major cocoa-growing regions in India' authored by Bhavishya, Varalakshmi, L.R., Somiya Raj, S.R., Nayana, H., Thavaprakasa Pandian, R., Anok Uchoi, Ravi Bhat, and Rajesh, M.K. presented in the National seminar on harnessing the plantation sector for sustainable developmental goals held at ICAR-CPCRI, Kasaragod during 3-5 January 2025 was adjudged as best oral presentation.
- The paper titled 'New distribution record of Mango mealy bug, *Rastrococcus iceryoides* Green *(Hemiptera: Pseudococcidae)* on coconut.' authored by Prathibha, P.S., Sujithra, M., Sunil Joshi, Josephrajkumar, A. and Jilu V. Sajan presented in the National Seminar on Harnessing Plantation Sector for Sustainable Development Goals held at ICAR – CPCRI, Kasaragod during 3-5 January 2025 was adjudged as best poster presented.
- The paper titled 'Influence of age of factitious host egg on parasitic potential of *Anastatus* sp., an egg parasitoid of coconut coreid bug, *Paradasynus rostratus* Distant' authored by Jilu V. Sajan, Merin Babu, Prathibha, P.S., Anes, K.M. and Josephrajkumar, A. presented in the Second International Conference on contributions to one health, Bangalore, 25- 28 February 2025 was adjudged as best poster presented.
- The paper titled 'Sustainable management of white grubs in palms using entomopathogenic nematodes' authored by Rajkumar, Surekha, Prathibha V.H., Joseph Rajkumar and Vinayaka Hegde presented during national symposium on 'Smart nematode management for climate-resilient agriculture: protecting soils, ensuring food security', held at ICAR-

IIOR, Hyderabad from 26-28 November 2025 was adjudged as third best presentation in rapid oral presentation.

Recognitions

- Dr. K. Balachandra Hebbar, Director, has been nominated as the chair Cogent Steering Committee of the International Coconut Community, Jakarta, Indonesia during 2025.
- Dr. K. Balachandra Hebbar, Director is the Chairman and Dr. Vinayak Hegde is the member Secretary in the Central Expert Team (CET) Ref: F. No.Hort.Sci..1-4/2025-HS-I dated 18 August 2025) for the Assessment and Management of Coconut Pest and Disease Outbreaks in South Interior Karnataka.
- Dr. K. Balachandra Hebbar, Director was the Expert Consultant to give recommendation on Low-Yielding Aromatic Coconut Plantations in Thailand from 26-28 April 2025, in response to a formal request from the Department of Agriculture, Government of Thailand.

Institute awards

On the eve of Foundation Day of the Institute, the best technical staff award was presented to Sri Bhavani Shankar Naik K.M. and Sri Dinesh Kumar N. Mr. Pradeep Kumar Vasu was awarded the best administrative staff and Mr. Sundaran C. received best skilled support staff award.

Ph.D. Awarded

Ph.D. Degree was awarded to Dr. Diwakar, Y., Sr. Scientist, ICAR-CPCRI, Research Centre, Kidu for his thesis, 'Genetic Diversity Study in Indigenous Coconut (*Cocos nucifera* L.) Germplasm Native to Island and Coastal Ecosystem' under the guidance of Prof. Vishnuvardhana, Vice Chancellor, University of Horticultural Sciences, Bagalkot, Karnataka in January 2025.

X

Training and Capacity Building

Scientific

Name & Designation	Title	Place & Date
Dr. Chaithra M., Scientist	Online training on 'Bio-agents based sustainable weed management for healthy ecosystem'	ICAR-DWR, Jabalpur 10-12 February 2025
Dr. Rajesh M.K., Pr. Scientist and Head	Virtual training programme on 'Analysis tools for association and QTL mapping in fruit crops'	ICAR-National Research Centre for Grapes, 10-14 February 2025 Pune
Dr. Ravi Bhat, Pr. Scientist	MDP on 'Priority setting, monitoring and evaluation (PME) of agriculture research projects'	ICAR-NAARM, Hyderabad 17-22 February 2025
Dr. S. Elain Apshara, Principal Scientist	Webinar on Gender smart agriculture: paving the path for women and climate change	MANAGE, Hyderabad, 5 March 2025
Dr. Thava Prakasa Pandian R., Scientist	Online workshop on 'Virome profiling in plants: Advanced methods for discovery and analysis'	ICAR-IARI, New Delhi 10-11 March 2025
Dr. Daliyamol, Scientist	International Online Training-cum-Summer School on 'Natural farming and emerging technologies (AI, Drones, loT)	Ministry of Agriculture Farmers Welfare, 16 August to 16 September 2025
Dr. Chaithra M., Scientist	Biosecurity and biosafety: Policies, diagnostics, phytosanitary treatments and issues	ICAR-NBPGR, New Delhi 19-28 August 2025
Dr. Minnu Sasi, Scientist	FOCARS 115 training	ICAR-NAARM, Hyderabad 22 August - 25 November 2025
Dr. Minnu Sasi, Scientist	FOCARS 115 (FET) training	Almora, Uttarakhand 11 September- 15 October 2025
Dr. Ponnusamy K., Head, Social Science	Kisan Sarathi 2.0 training programme	GKVK, Bangalore 06-07 November 2025
Dr. Ajith M., Scientist	Prospects of Business Ventures in plantation crops	ICAR-CPCRI, Kasaragod 26 November 2025
Dr. Jayasekhar S., Pr. Scientist	Rashtriya Karmayogi Jan Seva Program Phase II (Zone V)	ICAR-NAARM, Hyderabad 15-17 December 2025

Technical

Name & Designation	Title	Place & Date
Dr. Benjamin Mathew SMS	Soil, plant and water analysis for nutrient recommendation in horticultural crops	IIHR Bengaluru 06-10 February 2025
Smt. Poonam Khatri, Sr. Technical Assistant	Online training on 'Advances in mobile application development'	ICAR-NAARM, Hyderabad 17-21 March, 2025
Dr. Neelofar Illiaskutty, CTO	Building sustainable agri-business for women	MANAGE, Hyderabad 17-20 June 2025
Dr. Saritha Hegde and Dr. Benjamin Mathew SMSs	Natural farming	National Mission on Natural Farming 26-29 July 2025
Dr. Neelofar Illiaskutty CTO	Regular guidelines for establishment of agro and food processing industries	NAARM, Hyderabad 27-31 July 2025

Administrative

Name & Designation	Title	Place & Date
Shri R.N. Subramanian, SAO	Rashtriya Karmayogi Jan Seva Program Phase II (Zone V)	ICAR-NAARM, Hyderabad 15-17 December 2025

Karmayogi Capacity Building Programmes

The following officials in the Institute have attended the Karmayogi Portal based training during the period:

Category attended	No. of Personnel attended	No. of courses
Scientific	24	126
Technical	31	177
Administrative	8	17
Total	**63**	**320**

XI

Workshops, Seminars, Summer Institutes, Farmers Days, Organized

109th Foundation Day Celebration – 2025

ICAR-CPCRI, Kasaragod celebrated 109th Foundation Day on 5 January 2025. Foundation Day address was delivered by the Chief Guest, Dr. S. K. Singh, DDG (Hort. Science), ICAR, New Delhi. He highlighted the major share of plantation crops in the value chain. He expressed confidence that the myths associated with arecanut would be dispelled through a newly launched project, signalling a positive future for growers and stakeholders alike.

Dr. V.S. Korikanthimath, Former Director, ICAR-CCARI, Goa delivered Dr. K. V. Ahmed Bavappa memorial lecture. He delivered a talk on 'Spices and plantation crops for promoting agro-ecotourism sustainability'.

Dr. R.K. Mathur, Director, ICAR-IIOR, Hyderabad and Dr. R. Selvarajan, Director, ICAR-NRC Banana, Tiruchirappalli, offered felicitations.

The technologies *viz*., Frozen coconut delicacy and Kalpa Bliz- flavoured coconut milk were transferred to Shri Kusumadhar, South canara coconut producers company through exchange of MoAs.

Five publications *viz*., technical bulletin on 'Seasonal operations in arecanut plantation (Kannada)' and 'Integrated nutrient management in arecanut (Kannada)', extension folder on '*Simplicillium Ianosonivem:* A potential biocontrol agent for managing invasive whiteflies in coconut plantations' and 'Integrated management of white grubs' and a handbook on 'Improved coconut varieties' were released on the occasion.

Institute award for best technical staff were presented to Shri Bhavani Shankar Naik K.M. and Shri Dinesh Kumar N., Shri Pradeep Kumar Vasu was awarded the best administrative staff award and Shri Sundaran C., received best skilled support staff award.

DG inaugurates national seminar cum foundation day exhibition

A national seminar on 'Harnessing plantation sector for sustainable development goals' was inaugurated by Dr. Himanshu Pathak, Secretary, DARE, and Director General, ICAR at ICAR-CPCRI. The programme was presided over by Dr. K.B. Hebbar, Director, CPCRI on 3 January 2025.

Earlier on the day, Hon'ble DG laid the foundation stone of the new building of KVK Kasaragod at Chowki, Kasaragod. He also inaugurated a multi-utility hub including the SBI branch, ATM, Sales Parlour, and the Bharat Ratna MS Swaminathan Committee Hall and commissioned a 110 kw solar power grid. A Kalpa Agri-Expo 2025 exhibition was also inaugurated by him.

Dr. V.B. Patel, ADG (Fruit and Plantation Crops), ICAR, New Delhi, was the guest of honour. During the programme, MoAs were exchanged.

EPN technology to Shri Rajendra, Shatamangala arecanut variety to Mr Joice George, Bio agents *Trichoderma* coir pith cake, *Trichoderma harzianum* to Ms. Bindu from Karshika Sevana Kendram, Kalpa Shatabdi coconut variety to Mr Santhosh, Kalpa EPN technology to Mr Niranjan Prabhu, Carbonated tender coconut water to Mr Anantha Nayak, *Trichoderma* coir pith cake to Mr Prashanth P. Nayak, Cocoa fermentation technology to Mr Nithin Chordia, rotary dryer technology to Mrs. Shafeeja, and MTA with Dr. I. Karunasagar, Nitte University on microbial inoculants.

Releases were made during the occasion, which include the abstract book, Kalpa Bhooma product for circular bio economy, launch of Kisan Samridhi Portal and a Virtual website assistant to ICAR-CPCRI official website.

The DG had distributed seedlings and climbing devices to farmers on the occasion.

Dr. V. Venkatasubramanian, Director, ICAR-ATARI, Bangalore, Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur, Dr. George Ninan, Director, ICAR-CIFT, Cochin, Dr. Grinson George, Director, ICAR-CMFRI, Cochin also felicitated the seminar.

Fig. 125. Dr. Himanshu Pathak, Secretary, DARE, and Director General, ICAR, inaugurated the function by lighting the lamp.

97th ICAR Foundation Day

The 97th Foundation Day of Indian Council of Agricultural Research was celebrated on 16 July 2025 at ICAR-Central Plantation Crops Research Institute in collaboration with Krishi Vigyan Kendra through a seminar on "Connecting Frontier Technologies to Gen-Next. "Over 100 students from 23 colleges participated, with Dr. Alex P. James as Chief Guest and Unni Sankar as Guest of Honour. Discussions highlighted applications of AI and IoT in coconut research, including pest detection, seedling quality assurance, and precision farming technologies. Key lectures focused on emerging technologies such as drones, sensors, robotics, and deep-tech innovations in agriculture.

The event also featured technology releases, student competitions, and recommendations to integrate digital tools into future coconut research and education.

Fig. 126. Inauguration of 97th ICAR Foundation Day at ICAR-CPCRI, Kayamkulam

Workshop on Media in the Context of Changing Agriculture at Kayamkulam

A workshop on 'Media in the context of changing agriculture' was held on 27 January 2025 at ICAR-CPCRI, Regional Station, Kayamkulam. Dr. T. Pradeep Kumar, Vice-Chancellor of KUFOS, inaugurated the event and emphasized the role of media in inclusive technology dissemination for farmers. Three extension folders under the Farmer-FIRST project were released. Two technical sessions focused on the evolving role of print and digital media in agricultural communication. Over 100 media personnel and scholars participated in the event.

Fig. 127. Inauguration media workshop

Fig. 128. Media workshop group photo

Workshop on sustainable lifestyle

ICAR-KVK Kasaragod successfully organized a two-day workshop on 'sustainable lifestyle' on 21 January 2025 for 200 school students from Kasaragod district. The initiative was funded by the Ministry of Environment, Forest and Climate Change (MoEFCC) and supported by EEP Kerala-National Green Corps (NGC) under KSCSTE.

Fig. 129. Two-day workshop on sustainable lifestyle

Workshop on Entrepreneurship Conducted

One day workshop on 'prospects of entrepreneurship in agricultural sector and supporting Govt. schemes'

was organized in KVK-Alappuzha for the members of Global Entrepreneurship Mission (GEM), an offshoot of Kerala Government Contractors Association (KGCA) on 15 May 2025. About forty potential entrepreneurs also participated in the programme including field and unit visits.

International Workshop on 'Strengthening Coconut Genebanks for a Climate-Resilient and Sustainable Future'

The ICAR–CPCRI, in collaboration with the International Coconut Community (ICC), Jakarta, organized an International workshop on 'Strengthening coconut genebanks for a climate-resilient and sustainable future' from 02 to 05 September 2025 at Kasaragod.

The workshop was attended by 25 international delegates from 14 countries, including Dr. Jelfina C. Alouw, Director General of ICC and H.E. Ambassador Diar Nurbintoro, Director of the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM-CSSTC), Jakarta, Indonesia, along with leading researchers and representatives from the Crop Trust and FAO.

Around 42 national participants took part, comprising researchers from ICAR institutes, State Agricultural Universities (SAUs), entrepreneurs, and officials from developmental agencies such as the Coconut Development Board and State Departments of Horticulture. In addition, several ICC-COGENT ITAG (International Thematic Action Group) members joined online and actively participated in the technical sessions.

The inaugural function, held on 02 September 2025 to coincide with World Coconut Day, was graced by Dr. S.K. Singh, DDG (Horticultural Sciences), ICAR, and inaugurated by Shri Rajmohan Unnithan, Hon'ble Member of Parliament, Kasaragod. The workshop was coordinated by Dr. K.B. Hebbar, Director, ICAR–CPCRI, and Dr. V. Niral, Head, Division of Crop Improvement, ICAR–CPCRI, while Dr. S.V. Ramesh, Senior Scientist, ICAR–CPCRI, Kasaragod and Dr. Y. Diwakar, Senior Scientist, ICAR–CPCRI Research Centre, Kidu, served as convenors.

The four-day program featured national and international experts as resource speakers and panellists, and included country reports on the current status of germplasm collection and utilization in genebanks. Technical sessions, panel discussions, and field visits were organized around the following key themes:

- Harnessing genetic diversity for breeding programmes
- Best practices in long-term conservation and plant health management
- Strategic alliances and policy harmonization for global frameworks
- Leveraging AI, genomics, and digital systems for smart genebanks
- Young researchers flash talks and interactive working groups
- Field visits to the International Coconut Genebank – South Asia and Middle East (ICG-SAME) at ICAR–CPCRI, Research Centre, Kidu, Karnataka

During the deliberations, following major recommendations have emerged:

- Strengthening international collaboration in germplasm exchange with harmonized guidelines aligned to the agreement.
- Ensuring proper regeneration of accessions, maintaining pedigree records, securing adequate population size per accession, and ensuring safe duplication in at least two genebanks.
- Making effective use of cutting-edge technologies such as multi-omics, AI, and digital systems to enhance data collection and management of germplasm resources.
- Developing standardized methodologies for germplasm assessment with respect to climate resilience, pest and disease resistance, industrial processing suitability, and carbon sequestration potential.
- Identifying and characterizing genes governing specialty traits and developing robust trait-associated markers to support targeted breeding programs.
- Recent advances made in ovary or inflorescence culture may be shared among member countries and research intensified to upscale commercial production of true to type elite planting material.

This workshop marked a significant step toward ensuring scientific management of coconut genetic resources.

Fig. 130. Dr. Jelfina C. Alouw, Director General of ICC, inaugurating international workshop and coconut exhibition

Fig. 131. Dr. Jelfina C. Alouw, Director General of ICC and Dr. K.B. Hebbar, Director, ICAR-CPCRI, Kasaragod, along with scientists, visiting the ICG-SAME at ICAR-CPCRI, Kidu

Fig. 132. Delegates at the ICAR-CPCRI Research Centre, Kidu, during the field visit as part of the International workshop.

Fig. 133. Technical session of the International workshop at ICAR-CPCRI, Kasaragod

Kisan Mela

ICAR-Directorate of Medicinal and Aromatic Plants Research (DMAPR), Anand, organized a Mega Kisan Mela-cum-Training and Awareness Programme during 24-25 September 2025 at ICAR-CPCRI Research Centre, Kahikuchi, Assam. It was organised jointly with ICAR-CPCRI, Kasaragod, ICAR-DFR, Pune, ICAR-IISR, Kozhikode, and Assam Agricultural University, Jorhat to promote horticultural technologies like medicinal plants, spices, flowers, and plantation crops in the north eastern India.

The mela was inaugurated by Dr. K.V. Prasad, Director, ICAR-DFR, Pune, who emphasised on cultivation of flowers and business opportunities in the NEH region. Dr. Manish Das, Director, ICAR-DMAPR, Chief Guest, highlighted traditional healthcare and crop potential, pledging support for farmers. Guests of honor included Maheshwarappa H.P. from ICAR-CPCRI Kasaragod and Dr. Pradip Mahanta from AAU Guwahati.

Over 1,100 farmers (700+ women) participated in the Kisan Mela, which included demonstrations, scientist interactions, exhibition stalls from ICAR institutes and startups, and distribution of seeds/ planting materials.

Five progressive NEH farmers were felicitated for contributions in Medicinal and Aromatic Plants cultivation.

Fig. 134. A glimpse of Kisan Mela at ICAR-CPCRI Research Centre, Kahikuchi, Assam

Evidence-Based Research on Arecanut and Human Health

Three key review meetings of the multi-institutional project 'Evidence-based research on arecanut and human health' were convened, one at ICAR–NIANP 9 August, and rest two online 26 August and 17 September at ICAR–CPCRI, Kasaragod. Discussions addressed the U.S. ban on arecanut leaf-sheath plates, WHO's classification of arecanut as carcinogenic and the need for interim results within 3–6 months.

Progress was shared on varietal profiling, alkaloids validation, metabolomics and cohort studies, alongside collaborative strategies for data sharing and methodological standardization. Researchers emphasized dose–response studies, transcriptome analysis, animal model experiments and organoid assays to clarify health impacts of arecanut. Key decisions included adopting water or aqueous-alcoholic extracts for studies, resequencing Mangala and Shatamangala varieties, finalizing optimal dosages for animal models and formalizing inter-institutional MoUs for human research.

The meetings stressed the urgency of generating robust, evidence-based findings and publishing results in reputed journals to address international concerns, safeguard farmer interests, and guide science-driven policy.

Fig. 135. Participants of the 'Arecanut and human health' meeting held at ICAR–CPCRI, Kasaragod.

Celebration of National Farmers Day

National Farmers Day was celebrated on 23 December 2025 across ICAR-Central Plantation Crops Research Institute centres. Dr. K. Balachandra Hebbar inaugurated the programme at Puthige, highlighting sustainability, climate resilience, and soil–water conservation. The event featured awareness on the Viksit Bharat G-RAM-G initiative and training on natural farming. Programmes including demonstrations and farm visits were conducted at regional stations and research centres nationwide. About 580 participants benefited from the activities organized across locations.

Fig. 136. Director delivering a gathering

PM Kisan Samman Utsav

The 20th instalment of PM-Kisan Samman Nidhi was released by Narendra Modi on 02 August 2025. ICAR-Central Plantation Crops Research Institute observed the day as PM Kisan Utsav Diwas across its centres and KVKs. Programmes included farmer interactions, training on natural farming, and technology demonstrations. The event was inaugurated by N. A. Nellikunnu and presided over by Dr. K. Balachandra Hebbar. Over 700 participants attended the programme in both online and offline modes.

Fig. 137. A glimpse of the PM Kisan Programme

PM Dhan Dhaanya Krishi Yojana

The launch of PM Dhan Dhaanya Krishi Yojana (PMDDKY) and the Pulses Mission by Narendra Modi on 11 October 2025 at Pusa, New Delhi, was marked at ICAR-Central Plantation Crops Research Institute through a live webcast and farmer interaction programme. The event was inaugurated by Dr. K. Inbasekar and presided over by Dr. K. Balachandra Hebbar.

Fig. 138. Experts address a large gathering at CP-CRI during a national-level discussion on GST and the agriculture sector

The programme highlighted Rs. 42,000 crore worth of schemes aimed at agricultural modernization, convergence of programmes, and achieving self-sufficiency in pulses.

Discussions focused on priority areas such as drip irrigation, credit access, natural farming, and promotion of short-duration pulse crops suitable for Kasaragod.

Around 250 stakeholders participated, along with training, farmer–scientist interaction, and field visits.

Participation in State Level Seminar Organized by Land Use Board

Dr. P. Muralidharan, Head, KVK participated in the state level seminar on 'Coconut based land use and changing climate' organized by Kerala State Land Use Board (KSLUB) at Thiruvananthapuram on 6 January 2025. He was deputed as a resource person for the panel discussion in the seminar by the Director, ICAR-CPCRI.

Seminar Session Handled

Dr. P. Muralidharan, Head, KVK-Alappuzha delivered a talk on 'Climate resilient farming practices' in the district level agricultural seminar organized by the Dept. of Agriculture as a part of the 4 Anniversary celebrations of the Govt. of Kerala (Ente Keralam) at Alappuzha beach on 7 May 2025. The audience comprised of about 250 persons including progressive farmers, Govt. officials, people's representatives, media persons, and public.

Workshop on Plantation Crops and Oil Yielding Palms

A workshop on 'Plantation crops' was organized on 7 November 2025 (forenoon), chaired by Dr. Prabhat Kumar, Horticulture Commissioner, MoAFW, Government of India. Dr. K. Balachandra Hebbar, Director, ICAR-CPCRI; Dr. K. Suresh, Director, ICAR-IIOPR; Dr. Dinakara Adiga, Director, ICAR-DCR and Dr. Augustine Jerard, B., Project Coordinator (PC), served as Co-chairs. Dr. V. Niral, Head Division of Crop Improvement, ICAR-CPCRI and Dr. K. Manorama, Principal Scientist, ICAR-IIOPR served as rapporteurs.

The programme featured four keynote addresses, one lead talk and seven invited papers. It also included a panel discussion, including researchers from different organisations from India as well as five researchers from Coconut Research Institute, Sri Lanka led by Dr. Nayanie Arachitge, Director, covering all aspects of plantation crops research and development.

Although plantation crops occupy only about 5% of the total agricultural area, their contribution to agricultural income exceeds 10%. This underscores the need to strengthen research and development efforts and technology-driven interventions for sustainable and profitable production and ensure profitability of the sector.

The key recommendations emerging from the workshop are as follows:

1. Develop policy framework for the production and supply of quality planting material for rejuvenation and new area expansion program as well as promotion of underutilised oil yielding palms.
2. Establish scientific evidence on plantation products and health to remove the negative myths for better market and consumption.
3. Utilize cutting-edge technologies to accelerate genetic resources utilization for varietal development, enhance system resilience, support sustainable production, maximise economic returns and profitability of the sector.

XII

Participation in Conferences, Meetings, Workshops, Symposia, Webinars, etc. in India and Abroad

Participation Abroad

Name and Designation	Title	Place and Date
Dr. K. B. Hebbar, Director, ICAR-CPCRI	ICC's Side Event at the 81st UNESCAP Session and Consultative Meeting	DoA, Bangkok, Thailand 25 – 28 April 2025
Dr. M. K. Rajesh, Head, ICAR-CPCRI, RS, Vittal	Scientific Meeting organized by the International Coconut Community (ICC) and Badan Riset dan Inovasi National (BRIN) (National Research and Innovation Agency, Government of Indonesia)	BRIN Cibinong, Bogor, Indonesia 4 August 2025
	Eastern FKPTPI Meeting; International Conference organized by the Sam Ratulangi University (UNSRAT), Government of Indonesia	Manado, North Sulawesi, Indonesia 6-8 August 2025

Participation within India

Name & Designation	Title	Place & Date
Dr. K.B. Hebbar, Director Dr. Vinayaka Hegde, Dr. P. Subramanian, Dr. Murali Gopal, Dr. V. Niral, Dr. K. Ponnusamy, Heads, and Dr. T.S. Manojkumar, Head, KVK, Dr. S. Jayasekhar, Dr. K. Muralidharan, Dr. H.P. Maheswarappa, Dr. C. Thamban, Dr. Ravi Bhat, Dr. K. Samsudeen,	National seminar on 'Harnessing plantation sector for sustainable development goals'.	ICAR-CPCRI, Kasaragod 3-5 January 2025

Name & Designation	Title	Place & Date
Dr. Alka Gupta, Dr. M.R. Manikantan, Dr. K.P. Chandran, Dr. V. Selvamani, Dr. A. Josephrajkumar, Dr. M. Shareefa, and P. Anithakumari Principal Scientists, Dr. P.S. Prathibha, Dr. S. Neenu, Dr. R. Sudha, Dr. S.V. Ramesh, Dr. S. Paulraj, Dr. Panjavarnam, Dr. M. Sujithra, Dr. V.H. Prathibha, Dr. K.M. Anes, Dr. JIlu V. Sajan, Dr. Rajkumar and Dr. Surekha, Sr. Scientists. Dr. P.P. Shameena Beegum, Dr. Daliyamol, Dr. Diwakar, Y. and Dr. T.N. Ranjini, Scientists, Mayalekshmi, Technical Officer		
Dr. P. Muralidharan, Head, KVK.	Seminar on 'Coconut based land use and changing climate'.	Kerala State Land Use Board (KSLUB) Thiruvananthapuram, 6 January 2025
Shri M.S. Rajeev, SMS (Agron.) and Dr. S. Ravi SMS (Animal Science).	Workshop on 'Agro-climatic zone specific integrated farming system in Kerala and Karnataka'.	KVK - Kollam 20 -21 January 2025
Dr. P. Anithakumari, Principal Scientist (Agrl. Extension.)	Brainstorming sessions on 'Strengthening social science research in the plantation sector from a value chain perspective'	ICAR-CPCRI, Kasaragod 24 January 2025
Dr. Regi J. Thomas, Head, RS, Kayamkulam, Dr. P. Muralidharan, Head, KVK, Dr. P. Anithakumari, Dr. A. Abdul Haris, Dr. A. Joseph Rajkumar and Dr. M. Shareefa, Principal Scientist, Dr. Merin Babu, Dr. K. Nihad, Dr. S. Neenu, Dr. S. Indhuja and Dr. K. M. Anes, Sr. Scientists, Dr. Jilu V. Sajan, Scientist and Dr. T. Sivakumar SMS (Entomology)	Workshop on 'Media in the context of changing Agriculture.'	ICAR-CPCRI RS, Kayamkulam 27 January 2025
Dr. M. Sujithra, Dr. Surekha and Dr. Nihad K., Senior Scientists	Digital technologies for trans-forming the horticultural sector	ICAR-IARI, New Delhi 28-30 January, 2025

Name & Designation	Title	Place & Date
Dr. S. Elain Apshara, Principal Scientist	Webinar on Climate Smart Cocoa	University of Reading, 21 February 2025
Dr. Chaithra, M., and Dr. Madhu, T. N.	'Genomic and metabolomic characterization of *Beauveria bassiana* isolates for biological control of cassava mites'.	Radisson Blue, Atria, Bengaluru, Karnataka 25–28 February 2025
Dr. P.S., Prathibha, Sr. Scientist, Dr. Madhu T.N., and Dr. Jilu V. Sajan, Scientist.	2nd International conference on biological control: biocontrol contributions to one health	ICAR-NBAIR, Bengaluru, 25–28 February 2025.
Dr. Regi J. Thomas, Head, RS, Kayamkulam, Dr. P. Anithakumari, Dr. A. Abdul Haris, Dr. A. Joseph Rajkumar, Dr. M. Shareefa, Principal Scientists, Dr. Merin Babu, Dr. K. Nihad, Dr. S. Neenu, Dr. S. Indhuja and Dr. K. M. Anes, Senior Scientist and Dr. Jilu V. Sajan, Scientist	Seminar on 'Mentoring Leaders and Innovators in Science for Vikasit Bharat'	ICAR-CPCRI, RS, Kayamkulam 28 February 2025
Dr. Regi J. Thomas, Head, RS, Kayamkulam, Dr. P. Anithakumari, Dr. A. Abdul Haris, Dr. A. Joseph Rajkumar, Dr. M. Shareefa, Principal Scientist, Dr. Merin Babu, Dr. K. Nihad, Dr. S. Neenu and Dr. K. M. Anes, Dr. S. Indhuja, Senior Scientists and Dr. Jilu V. Sajan, Scientist	Seminar on 'Connecting frontier technologies to Gen-Next'	ICAR-CPCRI, RS, Kayamkulam 28 February 2025
Mr. Arunji G., Sr. Technical Assistant (Lib.)	Online national workshop on 'One nation one subscription', an initiative of Govt. of India	CUSAT, Kochi, 01 March 2025
Dr. K. Balachandra Hebbar, Director, Dr. Augustine Jerad B. PC (AICRPPC), Dr. Vinayaka Hegde, Dr. P. Subramanian, Dr. Murali Gopal, Dr. V. Niral, Dr. K. Ponnusamy, Dr. M. K. Rajesh, Heads, Dr. H.P. Maheswarappa, Dr. M.R. Manikantan,	34th AGM of AICRP on Plantation Crops 7-9 May 2025	AC&RI Madurai (TANU), Tamil Nadu

Name & Designation	Title	Place & Date
Dr. A. Joseph Rajkumar, Dr. K.P. Chandran, Pr. Scientists, Dr. M. Sujithra, Dr. V.H. Prathibha, Dr. N. R. Nagaraja, Dr. Surekha, Dr. Sandip Shil Sr. Scientists, and Dr. Daliyamol, Dr. Diwakar Y., Dr. Mahendran B., Scientists		
Mr Devaraj K., Technical Officer	International conference on Advancements in Power, Communication and Intelligent System (APCI 2025)	Government College of Engineering, Kannur 27-28 June 2025
Dr. K.B. Hebbar, Director Dr. B. A. Jerad Project Coordinator Dr. Vinayaka Hegde Pr. Scientist & Head	International Conference on technology innovation and sustainable development of date palm	ICAR-CIAH, Bhuj 29-30 June 2025
Dr. K.B. Hebbar, Director	One day brainstorming session on 'Management of Coconut Pests and diseases	Ramanagara, Bangalore 3-4 July 2025
Dr. B. A. Jerard, Project Coordinator, AICRP PC	Horti Utsav' 2025.	TNAU, Coimbatore 17 July 2025
Dr. K.B. Hebbar, Director	Brainstorming session on 'Understanding the current price volatility in coconut:Causes, varied impact, and the way forward'	CDB Kochi 18 July 2025
Dr. Manikantan, M.R., Principal Scientist	Workshop on 'Innovate, connect, grow, building a vibrant startup ecosystem'.	Online mode 8 August 2025
Dr. K. Ponnusamy, Head, Division of Social Science.	National Workshop on 'Transforming food, land, and water (FLW) systems to combat the climate crisis, with a specific focus on Karnataka state'.	ICAR-Indian Institute of Soil and, Water Conservation Research Centre, Ballary 13 August 2025.
Dr. B. Augustine Jerard, Project Coordinator, AICRP PC, and Dr. V. Niral, Head, Division of Crop Improvement	Coco health international conference	Jenneys Residency, Coimbatore, Tamil Nadu 19-22 August 2025
Dr. S. Elain Apshara, Dr. Alpana Das, Dr. Arun Kumar Sit, Principal Scientists, Dr. Merin Babu, Sr. Scientist, Chaithra, M., Scientist,	National Cocoa Conclave 2025.	AAU Jorhat campus Assam 20-21 August, 2025

Name & Designation	Title	Place & Date
Dr. B. Augustine Jerard, Project Coordinator, AICRP PC	'Coconut and tuber crops based agrifood systems for resilience and sustainable income'.	ICAR-CTCRI and KVK, Kamrup, Assam 22 August 2025
Dr. V. Selvamani, Scientist	Research and Development in Space Technology for Agricultural Transformation by ICAR.	ICAR at NASC Complex, New Delhi 23 August 2025
Shri T. Sivakumar, SMS (Ag. Ent.)	Workshop on 'Ground Truthing and Validation of farmers'	KERA Cell, Trivandrum 25 August 2025
Dr. K. B. Hebbar, Director, Dr. B. Augustine Jerard, Project Coordinator, AICRP PC, Dr. Vinayaka Hegde, Head, Division of Crop Protection and Dr. Ravi Bhat, Principal Scientist.	Brainstorming session on 'Management of coconut pests and diseases'.	Ramnagara, Bangalore 29 August 2025
Dr. K. B. Hebbar, Director, Dr. B. Augustine Jerard, Project Coordinator, AICRP PC, Dr. Vinayaka Hegde, Dr. P. Subramanian, Dr. Murali Gopal, Dr. V. Niral, Dr. K. Ponnusamy, Dr. Regi J. Thomas, Dr. M. K. Rajesh, Heads, Dr. Ravi Bhat, Dr. V. Selvamani, Dr. Maheswarappa, Dr. Alka Gupta, Dr. Manikantan M.R., Dr. Chandran K.P., Dr. S. Elain Apshara and Dr. Jayasekhar, S., Principal Scientists, Dr. Rajkumar, Dr. Ramesh, S.V., Dr. Prathibha V.H., Dr. Paulraj S., Dr. Prathibha P.S., Dr. Sujithra, M., and Sr. Scientists, Dr. Panjavarnam G., Dr. Mahendran B., Dr. Daliyamol, Dr. Diwakar, Y. Dr. Surekha, Dr. Ranjini T.N. and Dr. Hima John, Scientists.	International Workshop on 'Strengthening coconut genebanks for a climate resilient and sustainable future'.	ICAR-CPCRI,Kasaragod 2-5 September 2025

Name & Designation	Title	Place & Date
Dr. K. Ponnusamy, Head, Division of Social Science.	7th National Conference on 'Integrating extension strategies to boost livestock and farm productivity'.	College of Veterinary Science and Animal Husbandry (NDVSU), Mhow Madhya Pradesh 13-15 October 2025
Dr. K. Ponnusamy, Head, Division of Social Science	Kisan Sarathi 2.0	GKVK, Bangalore 6 -7 November 2025.
Dr. V. Niral, Head, Division Crop Improvement, Dr. K. Ponnusamy, Head, Division of Social Science, Dr. P. Subramanian, Division of Crop Production, Dr. Vinayaka Hegde, Division of Crop Protection, Dr. Murali Gopal, Head, Division of PB&PHT, Dr. Regi Jacob Thomas and Dr. M.K. Rajesh Heads. Dr. Diwakar, Y., Sr. Scientist, ICAR-CPCRI Research Centre, Kidu, Dr. B. Augustine Jerard, Project Coordinator, AICRP on Plantation Crops, Dr. Ravi Bhat, Dr. Elain Apshara S., Principal Scientists, Dr. Nihad, K., Senior Scientist, Dr. Chaithra M., and Dr. Daliyamol Scientists	11th Indian Horticulture Congress and International Meet, 2025	University of Agricultural Sciences, GKVK Campus, Bengaluru 06-09 November 2025.
Dr. K.B. Hebbar, Director	International Symposium on Tropical Root and Tuber Crops for Nutrition, Agri-Food Systems, Resilience, Entrepreneurship and Sustainability (ISTRTC 4 NARES)	ICAR-CTCRI, Thiruvananthapuram on 19 November 2025
Dr. M.R. Manikantan, Pr. Scientist, Division of PB&PHT and Dr. Hima John, Scientist, Division of PB&PHT.	59th ISAE Annual Convention and International Symposium	ICAR-CIAE, Bhopal 10-12 November 2025
Dr. Anithakumari, P., ICAR-CPCRI, RS, Kayamkulam.	2nd International Extension Education Congress 2025	Bhubaneswar, Odisha 24-26 November 2025
Dr. K.B. Hebbar, Director	6th International Conference on Plant Physiology 2025	TNAU, Coimbatore 16 December 2025
Dr. B. Augustine Jerard, Project Coordinator, AICRP on Plantation Crops	Centenary Day Celebration of CCRI and Conference on Coffee	CCRI, Balehonnur 20 December 2025

XIII

Linkages and Collaborations

International

International Coconut Community (ICC), Jakarta, Indonesia	Cooperation between coconut growing countries, Coconut genetic resources network, International Coconut Gene Bank for South Asia & Middle East and socio-economic collaboration
International Coconut Genetic Resource Network (COGENT)	Biotechnological activities related to coconut genetic resources

National

ICAR Institutes

ICAR-Central Institute of Fisheries Technologies, Kochi	Food processing R&D collaboration
ICAR-Central Tuber Crop Research Institute, Thiruvananthapuram	Cassava and coconut based value added products, intercropping of tuber crops in coconut gardens
ICAR- Central Island Research Institute, Port Blair	Coconut genetic resources collection, conservation and utilization
ICAR- Central Institute of Post-harvest Engineering & Technology, Ludhiana	Agricultural pre- and post-harvest machinery
ICAR- Central Research Institute for Dryland Agriculture, Hyderabad	Climate change network and NICRA
ICAR-Directorate of Cashew Research, Puttur, Karnataka	Nematological and entomological programmes, cropping systems, value addition
ICAR-Directorate of Mushroom Research, Solan	Agricultural pre-and post-harvest technology development
ICAR-Indian Agricultural Research Institute, New Delhi	Biochemical analysis of coconut produces and quality standards development
ICAR-Indian Institute of Horticultural Research, Bengaluru	Phytoplasma diseases, varietal screening, cropping systems, agricultural tools and machinery and horticultural IP related activities
ICAR-Indian Institute of Oil Palm Research (IIOPR), Pedavegi	Phytoplasma diseases, tissue culture and biotechnological investigations, cropping system
ICAR-Indian Institute Spices Research, Kozhikode	Cropping system studies, *Phytophthora* diseases in plantation crops

ICAR-National Bureau of Plant Genetic Resources, New Delhi	Germplasm registration and exchange of PGPR, Cryo-preservation of germplasm
ICAR- National Bureau of Agricultural Important Microorganisms, Mau	Microbial research network R&D
ICAR- National Bureau of Agricultural Insect Resources, Bengaluru	Biological control of pests and diseases R&D.
ICAR- National Research Centre for Orchids, Pakyong	Intercropping of orchids in coconut/ arecanut multispecies based cropping system
ICAR-Sugarcane Breeding Institute, Coimbatore	Cytological studies of in vitro cultures of coconut and arecanut and Food processing R&D

Universities

Central University of Kerala, Kasaragod, Kerala	R & D collaboration in Biotechnology
K.S. Hegde Medical Academy, NITTE – Deemed to be University, Deralakatte, Mangalore	Deciphering the biochemical machinery underlying in *vitro* regeneration in coconut and arecanut, Coconut oil and its major component lauric acid on cytoprotection and triple-negative breast cancer cell death
Kelappaji College of Agricultural Engineering and Food Technology, Kerala Agricultural University, Tavanur	Technology programmes, collaboration in agricultural food process engineering
Keladi Shivappa Nayaka University of Agricultural and Horticultural Sciences, Shivamogga	NSC of arecanut and academic programmes
Kerala Agricultural University	R & D collaboration
Kerala Veterinary and Animal Science University, Wayanad	Technology programmes
Nitte University, Mangalore	Research and frontier diagnostic collaboration
Onattukara Regional Agricultural Research Station, Kerala Agricultural University	KVK, Alappuzha for NICRA activities
University of Horticultural Sciences, Bagalkot	PG Research

Others

Agricultural Technology Management Agency	ToT activities
All India Radio, Kannur, Mangalore, Thiruvananthapuram, Doordarshan (Prasar Bharati)	Transfer of technology programme through media
Bannari Institute of Technology, Sathyamangalam, Tamil Nadu	Food technology R & D collaboration
CAMPCO, Mangalore	Arecanut/ cocoa research and development
Coconut Development Board, Kochi	Research and development in coconut
Council of Scientific and Industrial Research-National Institute for Interdisciplinary Science and Technology Thiruvananthapuram	Technology programmes
Department of Bio-Technology, New Delhi	Advancements in Biotechnology and Bioinformatics

Department of Agricultural Development and Farmers Welfare, Govt. of Kerala	ToT activities, Plating material production
Directorate of Arecanut and Spices Development, Kozhikode	Research and development in arecanut
Directorate of Cashew and Cocoa Research, Kochi	Research and development in cocoa
District Industries Centre, Kasaragod	Capacity building and entrepreneurship programmes
District Panchayath, Alappuzha	ICAR-CPCRI,RS, Kayamkulam ToT activities
District Panchayath, Kasaragod	ICAR-CPCRI, Kasaragod & KVK, Kasaragod ToT activities
Department of Information Technology, New Delhi	Bioinformatics programmes
Department of Science and Technology, New Delhi	Molecular biology research and women empowerment programmes
General Aeronautics Ltd., Bangaluru	Unmanned Aerial Vehicle (UAV- Drone) for palm spraying
Indian Institute of Plantation Management, Bengaluru	Technology programmes in plantations management
Kerala State Council for Science Technology & Environment, Thiruvananthapuram	R & D collaboration
Kerala State Planning Board	R & D collaboration
Mondelez India Foods Private Limited	Cocoa cropping system studies
National Remote Sensing Centre Regional Remote Sensing Centre-South, Bengaluru	Utilization of hyperspectral imagining techniques adulteration detection and disease spread monitoring in plantation crops
National Bank for Agriculture and Rural Development, Mumbai	Developmental programmes/ demonstrating model coconut clusters in root (wilt) affected areas
National Innovation Foundation, Gandhinagar, Gujarat	Evaluation of innovator's technology
National Institute of Food Technology, Entrepreneurship and Management, Thanjavur, Tamil Nadu	R & D collaboration in PHT
Protection of Plant Varieties and Farmer's Right Authority, New Delhi	DUS Centre on coconut, arecanut and cocoa
State Forest Development Agency	Assessment of impact of Green India Mission
Vegetable and Fruit Promotion Council, Kerala	R & D collaboration
Kerala Agricultural University, Andhra Pradesh Agricultural University, University of Agricultural Sciences Bengaluru, National Bank for Agriculture and Rural Development, Tamil Nadu, Agricultural University, Local governments (Grama Panchayats, Block and District panchayaths, Farmer NGOs, Krishi Vigyan Kendra, Women SHGs, Mahatma Gandhi National Rural Employment Guarantee Scheme program, Farmer Producer Organizations,	ICAR CPCRI Farmer FIRST Program (FFP)

ICAR Indian Institute of Spices, Kozhikode, ICAR Central Tuber Crops Research Institute Thiruvananthapuram, Department of Agriculture Kerala	
Karnataka Rajya Adike Belagarara Sahakara Sanbhagala Sahakara Mahamandala, Niyamita	R & D collaboration in the field of arecanut and moisture content
Directorate of Horticulture, Government of Meghalaya.	ICAR-CPCRI Outreach in Meghalaya: Improving Arecanut and Cocoa Farmers' Livelihoods
The Totgars Co-operative Sale Society (TSS) Limited, Sirsi (Uttara Kannada), Karnataka	R&D Collaboration in biochemical analysis of red and chali arecanuts
Madras Diabetes Research Foundation, Gopalapuram, Chennai, Tamil Nadu	Studies on in vivo glycemic index (GI) of cereal food products enriched with coconut milk residue

Linkages and Collaborations with educational institutes

- Dr. Y.S.R Horticultural University, Venkataramanagudem, Andhra Pradesh
- Jawaharlal Nehru Institute of Arts & Science, Idukki
- JSS Academy of Higher Education & Research, Mysuru
- K.S. Hegde Medical Academy, NITTE University, Mangaluru
- College of Horticulture and Forestry, CAU, Pasighat, Arunachal Pradesh
- Sree Sankara College, Kalady
- S.N College, Chathannur
- St. Berchmans College, Changanassery, Kottayam
- St. Joseph Engineering College, Mangaluru
- St. Mary's College for Women, Thiruvalla
- Alvas College, Moodbidri
- Amrita Viswavidyapeetham, Kollam
- Bishop Abraham Memorial College, Thuruthicad
- Bishop Chulaparambil Memorial College, Kottayam
- CHRIST (Deemed University), Bengaluru
- College of Indigenous Food Technology, Konni
- Govt. College, Kasaragod
- Hindustan College of Arts & Science, Coimbatore
- Hindustan College of Engineering and Technology, Coimbatore
- Kannur University
- Khansa Women's College, Kumbla, Kasaragod
- Kerala University of Fisheries & Ocean Studies, Kochi
- Lovely Professional University, Punjab
- M-E-S-M-K Mackar Pillay College for Advanced Studies, Aluva
- Mangalore University, Mangalore
- Mar Athanasios College of Advanced Studies, Thiruvalla
- Marthoma College of Science and Technology, Kollam
- Marthoma College, Thiruvalla
- National Center for Aquatic Animal Health, Cochin University of Science and Technology, Kochi
- Nehru Arts and Science College (Autonomous), Coimbatore
- National Institute of Food Technology Entrepreneurship and Management, Haryana
- Nitte Mahalinga Adyantaya Memorial Institute of Technology, Nitte, Karkala, Karnataka
- Dr. P. Dayananda Pai - P. Satisha Pai Government First Grade College Mangalore
- Pazhassi raja College, Pulpally, Wayanad

- PGP College of Arts & Science, Namakkal
- Sacred Heart College Thevara, Kochin
- SAFI Institute of Advanced Study, Vazhayur, Kozhikode
- St. Agnes College Autonomous, Mangalore
- St. Aloysius College (Autonomous), Mangalore
- St. George College, Aruvithura, Kottayam
- Tamil Nadu Agricultural University, Coimbatore
- University of Agricultural Sciences, Raichur
- University of Calicut, School of Health Science
- Uttar Banga Krishi Vidyalaya, West Bengal
- Vimala College, Thrissur
- Vivekananda College of Engineering & Tech., Puttur, DK, Karnataka
- Srinivas Institute of Technology, Karnataka
- College of Horticulture and Forestry, Pasighat
- Kasturba Medical College, Mangalore, (Manipal Academy of Higher Education), Karnataka
- CSIR - Central Food Technological Research Institute, Mysore
- National Institute of Mental Health and Neuro-Sciences (NIMHANS), Bengaluru, Karnataka
- All India Institute Of Medical Sciences, Delhi
- Shri Dharmasthala Manjunatheshwara (SDM) University, Dharwad, Karnataka
- Indian Institute of Science, Bangalore
- National Institute of Mental Health and Neuro-Sciences, Bangalore, Karnataka
- Manipal College of Dental Sciences (MCODS), Manipal, Karnataka
- Sri Shankara Cancer Hospital and Research Centre, Bangalore, Karnataka
- Institute of Forest Genetics and Tree Breeding, ICFRE, Coimbatore, Tamil Nadu

XIV

Research Projects (2025-26)

Institute projects

Project No.	Project title	Project leader	Co-PI / Associates
HORTPCSIL 202400100123	Genetic resources management and genetical investigations and breeding for improved varieties of coconut	V. Niral	Arun Kumar Sit, L.S. Singh, Alpana Das, Y. Diwakar, T.N. Ranjini, G. Panjavarnam, M. Sujithra, V.H. Prathibha, K.B. Hebbar, S.V. Ramesh, P. Subramanian, Shameena Beegum, Hima John, M.K. Rajesh, M. Chaithra (KHK), B. Augustine Jerard, ICAR-CIARI, Andamans, KVK Kundrakudi
1000761102	Studies on impact of high temperature stress on reproductive phase in coconut	G. Panjavarnam (kept in abeyance)	V. Niral, K.B. Hebbar, S.V. Ramesh, T.N. Ranjini
HORTPCSIL 202400200124	Genetic resources management and genetical investigations and breeding for improved varieties of arecanut	N.R. Nagaraja	V. Niral, M.K. Rajesh, Arun Kumar Sit, L.S. Singh, T.N. Ranjini, M. Suchithra, T.N. Madhu, B. Mahendran, S.V. Ramesh, R. Thava Prakasa Pandian

Project No.	Project title	Project leader	Co-PI / Associates
HORTPCSIL 202400300125	Genetic resources management and genetical investigations in Cocoa	S. Elain Apshara	T.N. Madhu, B. Mahendran, Y. Diwakar, M. Shareefa, K. Nihad, S. Neenu, Alpana Das, L.S. Singh, M. Chaithra (KHK), Arun Kumar Sit, M.R Manikantan, Murali Gopal, G. Panjavarnam, Daliyamol, Babli Mog, Jyothi Nishad - DCR, Puttur
HORTPCSIL 202400600128	Qualitative breeding for development of fine cocoa varieties	S. Elain Apshara	S.V. Ramesh, Hima John
HORTPCSIL 202400400126	Breeding for resistance/ tolerance to coconut root (wilt) disease	Regi Jacob Thomas	M. Shareefa, Sandip Shil, Merin Babu, A.Joseph Rajkumar
1000761101	Studies on phenology of coconut genotypes in different climatic zones	T.N. Ranjini/ Diwakar Y.	V. Niral, Arun Kumar Sit, L.S. Singh Y. Diwakar
1000761103	Development of descriptor and basic studies on growth and development of palmyrah	S. Sumitha	B. Augustine Jerard, S. Elain Apshara, A. Abdul Haris, M.R. Manikantan Scientists from AICRP on PC (Killikulam and Pandirimamidi)
1000761104	Phenotyping and gene expression studies for low moisture stress tolerance in cocoa genotypes	M. Suchithra/ S. Elain Apshara	S. Elain Apshara, S.V. Ramesh
HORTPCSIL 202400500127	Molecular Characterization of cocoa accession and Identification of Genotypes tolerant to *Phytophthora* disease	Alpana Das	M. Chaithra (KHK), S. Elain Apshara, Arun Kumar Sit, L.S. Singh Alpana Das
HORTPCSIL 202400700129	Genetic diversity assessment and development of markers for sex determination and dwarfness in palmyrah (*Borassus flabellifer* L.)	M. K. Rajesh	B. Augustine Jerard, S. Sumitha

HORTPCSIL 202400700130	Enhancing mass multiplication and germplasm conservation of coconut and arecanut through tissue culture and cryopreservation techniques	M. K. Rajesh	M. Shareefa, Regi Jacob Thomas, S. Paulraj, V. Niral, T.N. Ranjini, M. Suchithra, Y. Diwakar, G. Panjavarnam Surekha, R. Thava Prakasa Pandian, N.R. Nagaraja, Alpana Das
1000763055	Bioresources management in coconut, arecanut and cocoa	Alka Gupta	P. Anithakumari, Murali Gopal, S. Elain Apshara, H.P. Maheswarappa, S. Indhuja, A. Abdul Haris, Sandip Shil, Merin Babu, K. Nihad, S. Neenu, P.Subramanian, Surekha
1000763057	Cropping/ farming approaches for improving soil health and system productivity in coconut, arecanut and cocoa	P. Subramanian	Ravi Bhat, V. Selvamani, Alka Gupta, Surekha, K. Nihad, A. Abdul Haris, S. Neenu, S. Indhuja, S. Paulraj, Bhavishya, U.K. Priya, L.S. Singh, H.P. Maheswarappa
1000763106	Studies on carbon sequestration potential of coconut based fruit cropping system – A strategy to mitigate climate change	H.P. Maheswarappa	P. Subramanian, V. Selvamani
1000763058	Enhancing nutrient and water use efficiency for sustained productivity in coconut, arecanut and cocoa	V. Selvamani	P. Subramanian, Alka Gupta, Ravi Bhat, S. Neenu, A. Abdul Haris, Jeena Mathew, K. Nihad, Surekha, U. K. Priya, Bhavishya, S. Indhuja, S. Paulraj, Anok Uchoi, Merin Babu, Jilu V. Sajan, V. Niral, S.V. Ramesh, P.

Project No.	Project title	Project leader	Co-PI / Associates
			Anithakumari, R. Thava Prakasa Pandian, M.K.Rajesh, G. Panjavarnam
1000763103	Bioprospecting of phyllosphere bacteria in coconut and cocoa	S. Paulraj	M.K. Rajesh, S.V. Ramesh, R. Thava Prakasa Pandian, Ravi Bhat, M. Sujithra
HORTPCSIL 202501000154	Characterization and diagnosis of nutrient deficiencies, and tailoring crop-specific nutrient formulations for cocoa and arecanut	Bhavishya	Ravi Bhat, M.K. Rajesh, R. Thava Prakasa Pandian
1000765039	Integrated approaches for management of fungal Thava diseases of palms and cocoa	Vinayaka Hegde	V.H. Prathibha, Daliyamol, R. Prakasa Pandian, M. Chaithra (VTL), M.K. Rajesh, Bhavishya, T. N. Madhu, M. Chaithra, (KHK), Rajkumar
1000765040	Diagnostics and management of root (wilt) disease (RWD) in coconut and yellow leaf disease (YLD) in arecanut	Vinayaka Hegde	A. Josephrajkumar, M.K. Rajesh, S.V. Ramesh, Merin Babu, S. Indhuja, R. Thava Prakasa Pandian, M. Chaithra (VTL), Jilu V. Sajan, Murali Gopal, B. Mahendran, Bhavishya, T.N. Madhu, M. Chaithra (KHK)
1000765101	Elucidating host pathogenic response against fruit rot disease in arecanut	V. H. Prathibha	N. R. Nagaraja, M. K. Rajesh, R. Thava Prakasa Pandian, Daliyamol, Vinayaka Hegde
1000765108	Biological management of *Phytophthora* diseases in cocoa with indigenous microbes	M. Chaithra (VTL)	S. Elain Apshara and M. Suchithra,R. Thava Prakasa

Project No.	Project title	Project leader	Co-PI / Associates
			Pandian, Bhavishya, Vinayaka Hegde, T.N. Madhu
1000765102	Epidemiology and management of *Colletotrichum* diseases in palms and cocoa	R. Thava Prakasa Pandian	Merin Babu, V.H. Prathibha, M. Chaithra (VTL), M. Chaithra (KHK), T. N. Madhu, N. R. Nagaraja, Y. Diwakar, K. P. Chandran, Vinayaka Hegde, M. K. Rajesh, Bhavishya, Daliyamol, S.V. Ramesh
1000765041	Integrated management pests and nematodes in palms and cocoa	A.P. S. Prathibha, M. Josephrajkumar	Sujithra, Rajkumar, Jilu V. Sajan, B. Mahendran, T. N. Madhu, Merin Babu, K. M. Anes, M. Chaithra (KHK), V. H. Prathibha, M. Chaithra, (VTL), R. Thava Prakasa Pandian, Daliyamol, Bhavishya
1000765104	Management of sucking pests using microbial volatile and essential oils in palms and cocoa	T. N. Madhu	B. Mahendran, Y. Diwakar, P.S. Prathibha, R. Thava Prakasa Pandian, A. Josephrajkumar, Jilu V. Sajan, M. Sujithra, Murali Gopal, M. Chaithra (KHK)
1000765105	Characterization of mite complex in arecanut and development of botanical based formulations for their management	B. Mahendran	P.S. Prathibha, M.K. Rajesh, N.R. Nagaraja, M. Sujithra, T.N. Madhu, A. Josephrajkumar, S.V. Ramesh, Daliyamol
1000765106	Biological control of coconut coreid bug, *Paradasynus rostratus* Distant using egg parasitoid, *Anastatus* sp.	Jilu V. Sajan	A. Josephrajkumar, P. S. Prathibha, Merin Babu, K. M. Anes, T. N. Madhu

Project No.	Project title	Project leader	Co-PI / Associates
1000765107	Studies on host plant expansion of Red Palm Weevil and IPM in arecanut	P.S. Prathibha	T.N. Madhu, M. Chaithra (KHK), B. Mahendran
1000766014	Physiological and biochemical investigations of yield and quality in palms and cocoa	Murali Gopal	S.V. Ramesh, S. Elain Apshara, Arun Kumar Sit, N.R. Nagaraja, L. S. Singh, Y. Diwakar, M.R. Manikantan, Hima John, V. Selvamani, T.N. Ranjini, Bhavishya, Sandip Shil
1000767018	Mechanization, processing, product diversification, and nutraceutical properties	M.R. Manikantan	Hima John, S.V. Ramesh, Murali Gopal, S. Paulraj, S. Neenu, Alka Gupta, G.S. Hareesh
HORTPCSIL 202501300156	Development of solar assisted snowball tender coconut machine (AICRP on PHET)	M. R. Manikantan	Hima John, S.V. Ramesh, Devaraj
HORTPCSIL 202501400157	Development of process technology for the production of shelf stable coconut milk residue based selected cereal and millet flours (AICRP on PHET	Hima John	M.R. Manikantan, S.V. Ramesh, Alka Gupta, Murali Gopal
1000769020	Technology transfer and co learning action research approaches	K. Ponnusamy	P. Anithakumari, K.P. Chandran, S. Jayasekhar, Sandip Shill, Alpana Das, Arun Kumar Sit, Bhavishya, N.R. Nagaraja, B. Mahendran, A. Josephrajkumar, P. Subramanian, A. Abdul Haris, B. A. Jerard, K.M. Anes, Merin Babu, Rajkumar
1000769019	Development of Statistical and Computational Techniques for Improving Research Methodology	K.P. Chandran	Sandip Shil, S. Jayasekhar, K. Ponnusamy,

Project No.	Project title	Project leader	Co-PI / Associates
			R. Thava Prakasa Pandian, Bhavishya, T.N. Madhu
1000769013	Socioeconomic dimensions and value chain dynamics in policy perspective	S. Jayasekhar	K. P. Chandran, Sandip Shil, K. Ponnusamy
1000767110	Use of Simulation models for the production system analysis of palms and cocoa	M. Sujithra/ V. Selvamani	K. B. Hebbar, B. A. Jerard, K. P. Chandran, Sandip Shil, P. Subramaniam, A. Josephrajkumar, V. Selvamani, Daliyamol, T.N. Ranjini, Surekha, Bhavishya, T. N. Madhu, B. Mahendran, Jilu V. Sajan
1000765103	Studies on acclimatization potential of *Phytophthora palmivora* under climate change scenario for prediction of disease risk	Daliyamol	V.H. Prathibha, M. Sujithra, Sandip Shil, M.K. Rajesh, K.P. Chandran, Vinayaka Hegde
1000765109	Development of standard operating procedures (SoPs) for drone based spraying operations in the management of pest and diseases in coconut and arecanut	Daliyamol	Vinayaka Hegde, R. Thava prakasa Pandian, B. Mahendran, Bhavishya, V.H. Prathibha and Diwakar Y.
1000765110	Developing standard operating procedures (SoPs) for drone-based spraying of nutrients in coconut and arecanut	Bhavishya	R. Thava Prakasa Pandian, K. Manjunatha Scientist, ICAR-DCR Puttur P. Subramanian, Vinayaka Hedge, Ravi Bhat, M.K. Rajesh, S.V. Ramesh, Y.
1000765111	Development of an AI based Mobile Application for detection and advisory of diseases in Coconut	Daliyamol	Vinayaka Hegde, V.H. Prathibha, Merin Babu, R. Thava Prakasa Pandian, M.

Project No.	Project title	Project leader	Co-PI / Associates
HORTPCSIL 202400900131	Development of sensor based smart farming system for coconut	V. Selvamani	P. Subramanian, Surekha, Ravi Bhat, S. Elain Apshara, Y. Diwakar, Alpana Das, L.S Singh, M. Chaithra (KHK)
HORTPCSIL 202401000132	Development of UAV-based foliar spray of nano urea for coconut	Surekha	S. Neenu, P. Subramanian, Ravi Bhat, Daliyamol

Externally funded projects

Project No.	Project title	Project leader	Co-PI / Associates
1050761086	DUS Centre for coconut (PPV & FRA)	V. Niral	Y. Diwakar
1050761114	DUS Centre for Arecanut (*Areca catechu* L.) – (PPV & FRA)	N.R. Nagaraja	Arun Kumar Sit, L.S. Singh
1050761115	DUS Centre for Cocoa (PPV & FRA)	S. Elain Apshara	—
2010760004	Seed production in Coconut, Arecanut, and Cocoa (Revolving Fund Scheme)	K.P. Chandran	V. Niral, S. Elain Apshara, N.R. Nagaraja, Regi Jacob Thomas, M. Shareefa, Y. Diwakar, T.N. Ranjini, Arun Kumar Sit, L.S. Singh, Alpana Das, G. Panjavarnam, M.K. Rajesh, K.M. Anes, M. Suchithra
HORTPCSOL 202500600149	Integrated approaches for sustainable management of cocoa vascular streak dieback (VSD) disease (ICAR-Corpus fund)	Regi Jacob Thomas	M. K. Rajesh, S. Elain Apshara, M. Shareefa, Merin Babu, K.M. Anes
1050761155	Demonstration of 'Kalpa Vardhini' as a component of integrated nutrient management for sustained soil and palm health in coconut (CDB)	A. Abdul Haris	S. Neenu, S. Indhuja

Project No.	Project title	Project leader	Co-PI / Associates
HORTPCSOL 202401600141	Comparative study on the performance of cocoa (*Theobroma cacao* L.) in intensive monocropping and mixed cropping systems (Mondelez CSR)	Ravi Bhat	B.A. Jerard, P. Subramanian, S. Elain Apshara, Alpana Das, Bhavishya, R. Thava Prakasa Pandian, T.N. Madhu
HORTPCSOL 202500500148	Demonstration of management of yellow leaf disease of arecanut using plastic mulching (DASD)	Bhavishya	Ravi Bhat, M.K. Rajesh, Rajkumar, R. Thava Prakasa Pandian
HORTPCSOL 202500400147	Large scale demonstrations on management of leaf spot disease in arecanut (DASD)	Vinayaka Hegde	Ravi Bhat, M.K. Rajesh, R. Thava Prakasa Pandian, M. Chaithra (VTL), Bhavishya, V.H. Prathibha, Rajkumar, Daliyamol
HORTPCSOL 202501000153	Diagnosis and management of yellow leaf disease (YLD) of arecanut (*Areca catechu* L.) (RKVY-Karnataka)	R. Thava Prakasa Pandian	Bhavishya, M. K. Rajesh, T. N. Madhu
HORTPCSOL 202401300138	Integration of beekeeping and mushroom cultivation to increase the income of farmers under plantation based cropping system in coastal region of Karnataka (RKVY - RAFTAAR**)	T.N. Madhu	M. K. Rajesh, S. Elain Apshara, B. Mahendran, R. Thava Prakasa Pandian, N. R. Nagaraja, Bhavishya, M. Chaithra (VTL), M. Suchithra
1050761166	Bio-suppression of red palm weevil *Rhynchophorus ferrugineus* Oliv in coconut using entomopathogenic nematodes (CDB)	K.M. Anes	A. Josephraj kumar, Merin Babu, Jilu V. Sajan
HORTPCCOP 202500200145	Biochemical analysis of metabolic face arecanut genotypes and of arecanut biomolecules in rodent models (MIDH)	K.B. Hebbar	S.V. Ramesh, Murali Gopal, N.R. Nagaraja

Project No.	Project title	Project leader	Co-PI / Associates
1050761158	Design, fabrication and field demonstration of portable electrical *in-situ* cocosap concentrator (CDB)	K.B. Hebbar	M.R. Manikantan, S.V. Ramesh
HORTPCSOL 202501500158	Quality and Microbial safety of arecanut with reference to Food Safety Guidelines of India (KRASSM)	S. Paulraj	Hima John, S.V. Ramesh, M.R. Manikantan, N. R Nagaraja
2010760007	Intellectual property management and transfer/ commercialization of agriculture technology scheme (NAIF)	K. Ponnu samy	M R. Manikantan, Rajkumar
1050761110	Establishment of Agri - Business Incubation (ABI) Centre at ICAR-CPCRI, Kasaragod (NAIF)	K. Ponnu samy	M R. Manikantan, Rajkumar
HORTPCSOL 202401400139	Laying out demonstration plots for demonstration of technologies for integrated management of root (wilt) disease of coconut (CDB)	A. Joseph Rajkumar	Regi Jacob Thomas, P. Anithakumari, A. Abdul Haris, M. Shareefa, Merin Babu, K. Nihad, S. Neenu, K.M. Anes, S. Indhuja, Jilu V. Sajan
HORTPCSOL 202401700142	Cocoa based FPO in Kottayam District with ICAR-CPCRI as POPI (NABARD)	Regi Jacob Thomas	K.M. Anes, M. Shareefa, Merin Babu, A. Josephrajkumar,
1050761117	Participatory technology integration to empower and ensure the livelihood security of farmers in Alappuzha district (FFP-ICAR Network)	P. Anitha kumari	A. Josephrajkumar, Merin Babu, Jeena Mathew, K. Nihad, M. Shareefa, S. Indhuja, K.M. Anes
HORTPCSOL 202401100136	Agricultural Technology-Based Entrepreneurship Incubation Centre for Integrated Development in Muthukulam Block Panchayat	P. Anitha kumari	M. Shareefa, S. Indhuja, K.M. Anes
1050761167	Natural farming in coconut based farming system – An analysis of farmers' experiences and impact (CDB)	Ravi Bhat	B. A. Jerard, P. Subramanian, S. Neenu,Surekha, K.P. Chandran, S. Jayasekhar, S. Paulraj, S. Sumitha Jagadeesha, C. Sudhalakshmi, A. Kireeti

Project No.	Project title	Project leader	Co-PI / Associates
1050761162	Global Value Chain analysis of plantation crops of India with special emphasis on food safety standards (NASF – ICAR)	S. Jayasekhar	K.P. Chandran
1050761168	Value chain analysis of arecanut in India: A Pilot Study (DASD)	S. Jayasekhar	K.P. Chandran
1050761153	Demonstration of effective and eco-friendly management of white grub using EPN in arecanut (DASD)	Rajkumar	N. R. Nagaraja, Bhavishya, Surekha M. Sujithra, V.H. Prathibha, T.N. Madhu, R. Thava Prakasa Pandian
HORTPCSOL 202401800143	Establishment of demonstration plots on Arecanut based multi species cropping system at Tripura (DASD)	L.S. Singh	Sajal Debbarma, SMS (Hort.), KVK North Tripura, Rajkumar
1050761145	Demonstration of integrated management of inflorescence dieback disease in arecanut (DASD)	R. Thava Prakasa Pandian	Bhavishya, V. H. Prathibha, M. Chaithra, (VTL), T. N. Madhu, Rajkumar
HORTPCSOL 202401200137	Participatory Demonstration Plots of Cinnamon intercropping in coconut (DASD)	Surekha	P. Subramanian, Ravi Bhat, Alka Gupta, V. Selvamani, S.V. Ramesh, Rajkumar
HORTPCSOL 202501600159	Integrated Farming for Productivity Improvement-Laying out Demonstartion Plots (LoDP) in the farmers-Tenkasi District	A. Joseph Rajkumar	—
1050761159	*In situ* structure for recording real time observation on coconut crown (CDB)	Ravi Bhat	V. Niral, Vinayaka Hegde, V. Selvamani, A. Kireeti (AICRPP, Ambajipeta) and Ruby Rani (AICRPP, Sabour), S. V. Ramesh

XV

Research and Organisational Management

Research Advisory Committee Meeting

The 27th Research Advisory Committee (RAC) meeting was held at ICAR-CPCRI, Kasaragod, on 8 April 2025 in hybrid mode. Dr. V.A. Parthasarathy, Chairman, and members Dr. George V. Thomas, Dr. H.B. Singh, Dr. R.N. Padaria, Dr. Pradeep Singh Negi, Mr H.M. Krishna Kumar, Dr. P.C. Tripathi, Dr. Tejaswi G. Gowda, Dr. K. Balachandra Hebbar, and Dr. Vinayaka Hegde, Member Secretary, were present in the meeting. Dr. Nirmal Babu and Dr. Vishwa Bandhu Patel attended the meeting online.

Dr. K.B. Hebbar, Director, made a brief presentation on the research achievements of the Institute during 2024–25. Major recommendations of the RAC include devising climate resilience and value chain strategies, refining technologies for commercialization, quality markers for tender coconut and coconut oil, pest and disease management with the biocontrol agents and precision delivery of agrochemicals, comparing microbiomes of high-density and mono-cropping systems, and brainstorming on coconut tissue culture leads. The RAC recommendations shall be incorporated in the Technical Programme 2025-26 of the Institute.

Fig. 139. Discussion during RAC Meeting

Fig. 140. RAC Members with the scientists of the Institute

Institute Research Committee Meeting

The 53rd Institute Research Committee (IRC) meeting of ICAR–CPCRI was held at Kasaragod during 26–30 May 2025, under the chairmanship of Dr. K. B. Hebbar, Director. A total of 69 ongoing research projects, comprising 40 Institute projects, 29 externally funded competitive grant projects, and 4 contract research projects under seven different programmes, were reviewed during the five-day IRC meeting.

The Plenary Session of the meeting was held on 30 May 2025. Shri Araga Jnanendra, MLA, Thirthahalli and President, Arecanut Marketing Cooperatives Mahamandala, was the Chief Guest, and Dr. Homey Cheriyan, Director, Directorate of Arecanut and Spices Development (DASD), Kozhikode, was the Guest of Honour. A brainstorming session on arecanut-related issues was also organised in conjunction with the Plenary Session, which was attended by various stakeholders, including farmers, medical professionals, cooperative marketing organisations, and developmental agencies.

All Programme Leaders presented the salient achievements of their mega projects along with

future lines of work. Dr. M. R. Manikantan, Principal Scientist (AS&P Engg.), presented a new research project on determining the optimum moisture content for the storage of arecanut, prepared at the request of CAMPCO. Dr. Prasanna Mitra presented the activities being undertaken under the Arecanut and Health Project.

Participants from CAMPCO, Mangalore; TSS, Sirsi, MAMCOS, Shivamogga, Arecanut Marketing Cooperatives Mahamandala, Shivamogga, NABARD, medical professionals from KMC, Mangalore and Nitte Medical Institute, officers from the Departments of Horticulture/Agriculture of Karnataka, Kerala and Tamil Nadu; and farmer members of the IMC, offered their comments and suggestions on the Institute's research activities.

Taking into account the expert recommendations, the recommendations of the 27th Research Advisory Committee (RAC), and national research priorities, future research activities were planned. A total of 15 new research projects were approved. The technical programme for 2025–26 will be refined and reformulated based on the project-wise recommendations and observations of the dignitaries.

Fig. 141. Shri Araga Jnanendra, MLA, Thirthahalli and the President, Arecanut Marketing Cooperatives Mahamandala, addressing the delegates

Fig. 142. Release of Publication by Shri Araga Jnanendra, MLA, Karnataka

XVI

Intellectual Property and Technology Management

Intellectual properties

Sl. No.	IP	Name	Ref. No./ Application No.	Date of filing	Date of grant of patent
1	Design	Tender coconut dehusking machine	448036-001	13-02-2025	Not granted
2	Patent	A Potable Electric Palm Sap Concentrator	202541073597A	01-08-2025	Not granted
3	Patent	A method for hardening of tissue-cultured plantlets of arecanut	202541131477	24-12-2025	Not granted
4	Design	Coconut Punching Machine	433372-001	09-10-2024	30-06-2025
5	Design	Solar Assisted Linear Actuated Tender Coconut Cutting Machine	433373-001	09-10-2024	Not granted
6	Copyright	Kalpa Genome Resource	SW-37905/2025 -CO	19-09-2025	Not granted
7	Copyright	Technical Bulletin on Good Agricultural Practices in Arecanut Cultivation	LD-37904/2025 -CO	19-09-2025	Not granted

Patent Field

A patent application, 'a method of hardening tissue cultured arecanut plantlets,' was filed from the institute at the Patent Office by K.B. Hebbar, K.S. Muralikrishna, S. Paulraj, M.K. Rajesh and V. Niral on 24 December 2025.

Certification of products/ technologies/ process/ methodology/ model/ policy, etc. by ICAR

The following intellectual innovations from the institute could gain certificates from the ICAR, New Delhi.

Sl. No.	Title of the products/ technology/ process/ methodology	Developer	Associate Developers
1	Detection of oil adulteration in virgin coconut oil (VCO) and coconut oil (Co) utilizing chemometrics	Dr. S.V. Ramesh	Dr. K.B. Hebbar, Mr M.B. Cariappa, Dr. G.S. Chikkanna, Dr. Vishnuvardhana, Dr. J. Venkatesh, Dr. A.K. Signh

Sl. No.	Title of the products/ technology/ process/ methodology	Developer	Associate Developers
2	Kalpa EPN: an aqua-formulation of entompathogenic nematode for integrated root grub management in coconut and arecnaut	Dr. Rajkumar	Dr. Vinayaka Hegde
3	Potassium-rich biochar from cocoa pod husks	Dr. Murali Gopal	Dr. S. Neenu, Dr. Alka Gupta, Dr. S. Elain Apshara
4	Methodology for identification of suitable reference genes for expression studies in different developmental stages of coconut rhinoceros bettle (*Oryctes rhinoceros*)	Dr. M.K. Rajesh	Dr. Tony Grace, Dr. Kumar Aravind, Dr. Ginny Antony, Dr. A. Jospeh Rajkumar
5	Nano-potassium intercalated composted coir pith: A slow-release fertilizer suitable for laterite soils of humid tropics of India	Bhavishya	Dr. K.S. Subramanian, Dr. Murali Gopal, Dr. Ravi Bhat, Dr. Swapna S. Nair, Dr. Malavika Radhakrishnan and Dr. M.K. Rajesh

Consultancy Services

The microbial quality of the areca nuts (34nos) received from the different stakeholders *viz*., Customs, Department of Horticulture and Food Processing of Assam etc has been evaluated as per the guidelines of FSSAI.

Sl. No.	Year	Consultancy service	Client	Amount (Rs.)
1	2025	Visit arecanut plantation and give guideline and advice to prevent it	Shri. V. Venkateasan, C1, First Floor, Rengas Triyambhava, Kalapatti Main Road, Civil Aerodrome, Coimbatore	69508
2	2025	Visit study and advice on Arecanut 'Manamel',150, Lavelli Road, Banglore-560001	M/s. Moodubagilu Estate,	16185

List of Analysis 2025

Sl. No.	Name of Technology/Know-How/ Service Provided	Name of Contracting Party	Letter Date
1	Analysis Of Supari- sample 1	Customs, HQ Patna	18-02-2025
2	Analysis Of Supari- sample 2	Customs (Prev Division, muzaffirpur	07-02-2025
3	Analysis Of Supari- sample 1	Customs (Prev Division, muzaffirpur	14-02-2025
4	Analysis Of Supari- sample 1	Ast.Commissioner,Customs(Preventive) Division, Forbesganj, Dist-Araria, Bihar	19-02-2025

Sl. No.	Name of Technology/Know-How/ Service Provided	Name of Contracting Party	Letter Date
5	Analysis of Liquid Bone Meal Fertilizer	Mr. Alen, Jeeva Promax Pvt Ltd, RS No.111/1, Industrial Development Area, Ananthapura, Kannur Village, Kasaragod - 671321	04-04-2025
6	Dry Arecanut Samples	The Superintendent, Office of The Additional Commissioner of Customs, bengaluru City Customs Commissionerate, Inland Container Deport, Whitefield, Bangalore-560066	16-04-2025
7	Manure Test	Maneesh Gambhira D, Gambhira Farms, Dambekana, Kattukukke Post and Village, Kasaragod, Keralam - 671552	27-06-2025
8	Analysis of Supari- sample 1	The Superintendent, Office of The Additional Commissioner of Customs, Bengaluru City Customs Commissionerate, Inland Container Deport, Whitefield, Bangalore-560066	25-06-2025
9	Analysis of Oil Palm Leaf Sample	Mrs. Prema Vasanth, Thodikana, Aranthode Village, Sullia taluk, DK, Karnataka - 671552	13-08-2025
10	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	22-08-2025
11	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	29-08-2025 to 01-09-2025
12	Analysis of Supari- sample 1	Department of Agriculture, office of the District Agricultural Officer, Kamrup, Ulubari, Guwahati - 07	06-09-2025
13	Analysis of Trichoderma Enriched Coir Pith Compost	State Seed Farm Kerala, Kasaragod	08-09-2025
14	Analysis of Supari- sample 1	Assistant Commissioner, Office of The Additional Commissioner of Customs, Bengaluru City Customs Commissionerate, Inland Container Deport, Whitefield, Bangalore-560066	16-09-2025
15	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	21-10-2025
16	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	21-10-2025

Sl. No.	Name of Technology/Know-How/ Service Provided	Name of Contracting Party	Letter Date
17	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	27-10-2025
18	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	03-11-2025
19	Analysis- Soil- sample 2 no's	Abraham S.S., Sthuthikattu House, Bheemanadi P/o Kurumcheri, Kasaragod	13-11-2025
20	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	18-11-2025
21	Analysis of Supari- sample 1	Office of the Superintendent, Customs (Preventive) Division, Sharif Colony, Sitamarhi, Bihar, 843302	25-11-2025
22	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	04-12-2025
23	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	04-12-2025
24	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive), Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	04-12-2025
25	Analysis of Supari- sample 1	Director of Horticulture & FP, Assam, Khanapara, Guwahati - 22	18-12-2025
26	Analysis of Supari- sample 1	Office of The Commissioner of Customs (Preventive) Hqrs, Patna, 5th Floor, Central Revenue Building, Birchand Patel Path, Patna- 800001	30-12-2025

Contract research projects

Project No.	Project title	Project leader	Co-PI/Associates
HORTPCSCL 202401500137	Evaluation of bio-efficacy and phytotoxicity of Nativo against leaf spot (*Colletotrichum spp.*) in arecanut	R. Thava Prakasa Pandian	Vinayaka Hegde, Bhavishya
HORTPCSCL 202401600138	Evaluation of Bio-efficacy and Phytotoxicity of Indaziflam 20 G/L Glyphosate-Isopropylammonium 540 G/L SC (Alion Plus) in arecanut plantation	Bhavishya	Surekha, P. Subramanian, Ravi Bhat, R. Thava Prakasa Pandian
HORTPCSOL 202401600141	A comparative study on the performance of cocoa (*Theobroma cacao* L.) in intensive monocropping and mixed cropping systems	Ravi Bhat	Augustine Jerad B., Subramanian P., Elain Apshara S., Alpana Das, Bhavishya, Tava Prakasa Pandian, Madhu T.N.
HORTPCSCL 202500800152	Evaluation of Green India Mission Project interventions in Kerala Funded by State Forest Development Agency, Kerala	K. Ponnusamy	K.P. Chandran, S. Jayasekhar

Technology commercialization

During 2025, total 32 technologies were commercialized by the institute to 35 entrepreneurs through sing and an amount of Rs. 28,95,000/- have been collected as technology transfer fees.

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
1	Swarnamangala	24-10-2025	80000	Mr. Gangadhara Alva Integrated Rural Agri Nursery, Badiadka – 671551 Kasaragod, Kerala
2	Mohitnagar	24-10-2025	80000	Mr. Gangadhara Alva Integrated Rural Agri Nursery Badiadka – 671551 Kasaragod, Kerala
3	Kalpa Sreshta	12-11-2025	45000	Mr. V. Vasanth Kumar S/o P. Veluswamy Naidu 7, Sairam Layout Udumalpet – 642126 Tirupur District, Tamil Nadu
4	Kalparaksha	24-11-2025	36000	Mr. V.V. Surendra M/s Silpa Clonel Nursery Bapatla -522257 Andhra Pradesh

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
5	Kalparaksha	02-09-2025	36000	M/s Kalp Krushi Hybrid Centre, Taluka – Maliya (Hatina) Junagadh – 362255
6	Kera Chandra	24-11-2025	36000	Mr. V.V. Surendra M/s Silpa Clonel Nursery Bapatla -522257, Andhra Pradesh
7	Kalpa Haritha	24-11-2025	36000	Mr. V.V. Surendra M/s Silpa Clonel Nursery Bapatla -522257, Andhra Pradesh
8	Chandra Sankara	24-11-2025	36000	Mr. V.V. Surendra M/s Silpa Clonel Nursery Bapatla -522257, Andhra Pradesh
9	Kalpa Shatabdi	03-01-2025	100000	Umapathy coconut hybrid centre, Nasuvanapalayam, Palladam, Tirupur, Tamil Nadu – 641664
10	Kalpa Shatabdi	02-09-2025	80000	M/s Kalp Krushi Hybrid Centre, Taluka – Maliya (Hatina) Junagadh – 362255
11	Shatamangala	03-01-2025	200000	Mr. Deepak Mohandas, Calicut, Kerala-673006
12	Shatamangala	18-11-2025	200000	Mr. Venkateshwara Sharma K. Ishwaramangala Post Dakshina Kannada – 574313 Karnataka
13	Kalpa EPN bio- agent, *Steinerma carpocapsae* (CPCRI-SC1) aqua suspesnsion	03-01-2025	25000	YGP coconut farmers producer company Ltd., Davangere, Karnataka-577003
14	Kalpa EPN bio- agent, *Steinerma carpocapsae* (CPCRI-SC1) aqua suspesnsion	03-01-2025	25000	M/s Ecophytocare India Pvt. Ltd., Bogadi, Mysuru, Karnataka-570026
15	Kalpa EPN bio- agent, *Heterorhabditis indica* (CPCRI- HI1) aqua suspesnsion	03-01-2025	25000	M/s Ecophytocare India Pvt. Ltd., Bogadi, Mysuru, Karnataka-570026
16	Kalpa Suvarna	03-01-2025	100000	YGP coconut farmers producer company Ltd., Davangere, Karnataka-577003
17	Flavoured coconut milk	03-01-2025	25000	YGP coconut farmers producer company Ltd., Davangere, Karnataka-577003
18	Flavoured coconut milk	03-01-2025	25000	YGP coconut farmers producer company Ltd., Davangere, Karnataka-577003

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
19	Flavoured coconut milk	02-06-2025	25000	Kudumbashree State Mission, Medical College P.O., Thiruvananthapuram 69501, Kerala
20	Kalpa Vardhini	03-01-2025	50000	M/s Karshika Sevana Kendram PO Kankole, Payyannur, Kannur, Kerala-670307
21	Kalpa Vardhini	26-08-2025	25000	Mr. P. Mahalingam M/s Linga Chemicals No. 3, B1, Police Station Lane East Maasi Street Madurai – 625001Tamil Nadu
22	Kalpa Poshak	03-01-2025	50000	M/s Karshika Sevana Kendram PO Kankole, Payyannur, Kannur, Kerala-670307
23	*Trichoderma* formulations (coir pith cake, arecanut leaf sheath, talc formulation)	03-01-2025	25000	M/s Karshika Sevana Kendram PO Kankole, Payyannur, Kannur, Kerala-670307
24	*Trichoderma* formulations (coir pith cake, arecanut leaf sheath, talc formulation)	03-01-2025	25000	Mr. Prashanth P. Nayak, Ambagilu, Udupi, Karnataka – 576105
25	Cocoa fermenter technology	03-01-2025	25000	M/s Chocoa Projects and Ventures, Anna Salai, Chennai, Tamil Nadu- 600006
26	Rotary dryer for the production of coconut chips	03-01-2025	25000	M/s Chocoa Projects and Ventures, Anna Salai, Chennai,Tamil Nadu- 600006
27	Rotary dryer for the production of coconut chips.	03-01-2025	25000	M/s GJ Enterprises, Palapatty, Malappuram,Kerala – 679579
28	Frozen coconut delicacy	05-01-2025	25000	Prasad Shetty, South Canara Coconut Farmers Producer Company Ltd., Vittal, Dakshina Kannada, Karnataka –574243
29	Frozen Coconut Delicacy	02-06-2025	25000	Kudumbashree StateMission, Medical College P.O., Thiruvananthapuram – 69501, Kerala

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
30	Frozen Coconut Delicacy	02-09-2025	25000	YGP Coconut Farmers Producer Company Ltd. Chitradurga Road Davangere – 577003, Karnataka
31	Flavoured coconut milk	10-02-2025	25000	Unycare products, Edakkad post, Kannur-670663, Kerala
32	Flavoured coconut milk	03-06-2025	25000	M/s Kasturi Coconut Processing Ramanagara District – 562160 Karnataka
33	Flavoured coconut milk	02-06-2025	25000	Kudumbashree State Mission, Medical College P.O., Thiruvananthapuram – 69501, Kerala
34	Coconut Chips	20-01-2025	25000	Ms. Babitha Kumari G. M/s Sri Krishna Coconut Products, Thanjavur – 613004 Tamil Nadu
35	Coconut Chips	02-06-2025	25000	Kudumbashree State Mission, Medical College P.O., Thiruvananthapuram – 69501, Kerala
36	Coconut Chips	11-04-2025	25000	Mrs. R. Jayabarathi M/s Pentaglow Enterprises Srirangam Trichy – 620006 Tamil Nadu
37	Coconut Chips	17-06-2025	25000	M/s Kasturi Coconut Processing Ramanagara District – 562160 Karnataka
38	Coconut Chips	15-10-2025	20000	Mr. Thulam Chandra Sekhar 26-13-346, Near Sai Baba Temple B.V. Nagar,Nellore – 524004 Andhra Pradesh
39	Coconut Chips	26-12-2025	25000	Mr. Gurulingaiah K.P. Shri Gurukrupavana Estate Javagal Hobli Hassan District – 573125 Karnataka
40	Matured coconut water based value added products	20-01-2025	Complementary with chips	Ms. Babitha Kumari G. M/s Sri Krishna Coconut Products, Thanjavur – 613004 Tamil Nadu

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
41	Matured coconut water based value added products	02-06-2025	Complementary with VCO	Kudumbashree State Mission, Medical College P.O., Thiruvananthapuram – 69501, Kerala
42	Areca leaf sheath powder *Tricho* - block	06-02-2025	50000	Mr. Rajaram C.G., Kodapadavu post, Bantwal Taluk, Karnataka- 574222
43	Virgin Coconut Oil (VCO)	10-02-2025	40000	Mr. Pramath J.K. Kalladka,Bantwal Taluk Karnataka – 574222
44	Virgin Coconut Oil (VCO)	06-03-2025	40000	Ashwin Sivagurunathan, Tenkasi Dist., Tamil Nadu-627862
45	Virgin Coconut Oil (VCO)	02-06-2025	40000	Kudumbashree State Mission, Medical College P.O. Thiruvananthapuram–69501 Kerala
46	Virgin Coconut Oil (VCO)	10-07-2025	40000	Mr. B. Venkat Rao M/s Coastal Engineering Industries Pvt. Ltd. Amalapuram East Godavari-533201 Andhra Pradesh
47	Virgin Coconut Oil (VCO)	30-12-2025	40000	Mr. R. Rajasekar M/s Koppanna Perumal Traders and Exports Udumalpet Tiruppur – 642201 Tamil Nadu
48	Renewal of – 'Collection of fresh and hygienic Kalparasa and production of natural coconut sugar'	12-03-2025	25000	M/s Udupi Kalparasa Coconut and All Spices Producer Company Limited C/o Bharathiya Kissan Sangha (Regd.), Udupi 518-A, Freds Complex, 1st Floor Kundapura Main Road Kundapura, Udupi – 576201 Karnataka
49	Collection of fresh and hygienic Kalparasa and production of natural coconut sugar	17-06-2025	100000	Mr. Sathya Jayachandran Managing Partner, M/s Solo Farms, 3N, Devi Kripa, 5th Street,Chandragandhi Nagar Sowripalayam Coimbatore – 641028 Tamil Nadu

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
50	Collection of fresh and hygienic kalparasa and production of natural coconut sugar	15-05-2025	100000	Kengal Horticultural Farmer Producer Company Ltd. Shri Sai Complex Doddamallur, Malur Kolar – 563130, Karnataka
51	Collection of fresh and hygienic Kalparasa and production of natural coconut sugar	22-07-2025	100000	Mr. C.P. Yogeeshwara Chairman M/s Coco Tonic Beverages (India) Pvt. Ltd. No. 27, 1st Main, Ward No. 5, 5th Cross Kuvempunagara, Channapatna Ramanagara – 562160 Karnataka
52	Collection of fresh and hygienic Kalparasa and production of natural coconut sugar	11-09-2025	100000	Mr. N. Karthikeyan General Manager, M/s Welso Life Asokapuram, Aluva – 683101 Kerala
53	Foam mat dried coconut milk powder	03-06-2025	25000	M/s Kasturi Coconut Processing Ramanagara District – 562160 Karnataka
54	Preservation protocol for trimmed tender coconut	09-07-2025	25000	Mr. Priyank R. Patel M/s Tribal Farms 534, Bhinar Faliya Kundi Valsad Taluk Valsad – 396375, Gujarat
55	Preservation Protocol for Trimmed Tender Coconut	23-07-2025	25000	Mr. Unnikrishnan P. Director M/s VQube Agro Private Limited 52, Samruddhi Lake Drive Nimbekaipura Village, Bidarahalli Hobli, Hoskote Main Road Bengaluru – 560049 Karnataka
56	Preservation protocol for trimmed tender coconut	30-12-2025	20000	Mr. N. Venugopal Proprietor Orga Agriculture Products 189, Guru Samy Nagar Thanneer Pandal, Peelamedu Coimbatore – 641004, Tamil Nadu
57	Preservation of coconut gratings	30-12-2025	20000	Mr. N. Venugopal Proprietor Orga Agriculture Products 189, Guru Samy Nagar Thanneer Pandal, Peelamedu Coimbatore – 641004 Tamil Nadu

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
58	Preservation of carbonated tender coconut water	02-09-2025	25000	Mrs. Kavitha G. Partner & COO Uvandus Farm Fresh Services LLP Mavyngal P.O. Anandashrama – 671531 Kanhangad Kasaragod District Kerala
59	Preservation of carbonated tender coconut water	02-09-2025	25000	Mr. Muhammed Razique K.A. Kottappurath House Kaipoorikkara, Marampilly Aluva P.O. Ernakulam District 683105, Kerala
60	Preservation of carbonated tender coconut water	15-10-2025	25000	Mr. Sahir P.T. M/s Aysan Foods 57/1482, Kuthukallu Maliyekkal Road, Kallai Kozhikode – 673003, Kerala
61	Preservation of carbonated tender coconut water	15-10-2025	25000	Mr. Jamsheed K.P. M/s Bluemount Foods LLP 10/392 C, Cheenadath Colony Road, Kakkancheri, Chelembra, Malappuram 673634, Kerala
62	Preservation of carbonated tender coconut water	15-10-2025	25000	Mr. Shiju Joseph M/s Master Oil and Flour Mill Karippal Road. Perumpadavu Kannur District – 670581 Kerala
63	Preservation of carbonated tender coconut water	15-10-2025	20000	Mr. Thulam Chandra Sekhar 26-13-346, Near Sai Baba Temple, B.V. Nagar Nellore – 524004 Andhra Pradesh
64	Preservation of carbonated tender coconut water	12-12-2025	25000	Mr. Noufal V.K. Proprietor M/s Diya Chocolate 11/80, thangal Vayal Valapattanam Kannur – 670010, Kerala
65	Kalpa Organic Gold	02-09-2025	50000	Directorate of Agriculture Andaman and Nicobar Administration Port Blair – 744102 Andaman & Nicobar Islands

Sl. No.	Name of Technology Commercialized	Date of Signing MOU	Value (In INR)	To Whom Commercialized
66	Bean to bite chocolate	12-08-2025	25000	Mr. Arjun Virudhachalam (T.K.) Cuddalore – 606001 Tamil Nadu
67	Modified Ground Pollination Technique for Hybrid Seed Production in Coconut	15-10-2025	25000	Mr. Mohan Raj K. M/s K.J. Coconut Farm Palani,Dindigul – 624615 Tamil Nadu
		Total	**28,95,000**	

Facilitating the supply of institute scientific products to stakeholders

Quality planting materials, bio-inputs, publications, exchange of MoUs, training programmes and demonstrations were undertaken through R & D project interventions and ATIC.

Sale of technology products

During 2025, seedlings and other farm inputs worth Rs. 3,16,34,188.3/- were sold to farmers and other stakeholders as per the following details.

Sl. No.	Item	Quantity (nos.)	Amount (Rs)
1	Coconut seedlings (hybrids)	30,528	94,19,550.00
2	Coconut seedlings (tall varieties)	34,084	46,72,140.00
3	Coconut seedlings (dwarf varieties)	17,684	38,78,390.00
4	Coconut seednuts	4310	557600.00
a	Dwarf	31	4340.00
b	Tall	155	15500.00
5	Coconut leaf vermicompost (kg) (Kalpa Organic Gold)- unsieved	633 kg	9495.00
6	Coconut copra 1st Coconut copra 2nd	427.05 kg 738.45 kg	26904.15 31014.90
7	VCO 1st VCO 2nd	131.5 L 20 L	69326.25 2520.00
8	Coconut chips	498 pkt	9082.00
9	Coconut sugar	227.4 kg	99236.00
10	Earthworms	15200	10944.00

Sl. No.	Item	Quantity (nos.)	Amount (Rs)
11	*Trichoderma* (kg)	1,081	1,08,100.00
12	Polybag seedlings	1,013	2,20,610.00
13	Hybrid	41	15170.00
14	Tall	371	74200.00
15	Dwarf	134	38860.00
16	Arecanut seed nuts	2,44,368	50,82,700.00
17	Arecanut hybrids	72	14400.00
18	Arecanut seedlings	47,644	23,82,200.00
19	Arecanut sprouts	80,353	28,12,355.00
20	Kalpa EPN (SC&H1) aqua suspension	248 (Pkt)	24000.00
21	Kalpa EPN Galleria cadaver formulation	410 (Pkt)	2050.00
22	Cocoa seed pods	7120	3,56,000.00
23	Cocoa seedlings	30,753	6,15,060.00
24	Cocoa grafts	3,454	1,72,700.00
25	Cocoa scions	3600	54,000.00
26	Black pepper cuttings	4,590	1,31,335.00
27	Black peper (kg)	97.5 kg	55575.00
28	Cinnamon 1st	101.36 kg	31,552.05
29	Cinnamon 2nd	7.5 kg	1575.00
30	Acid Lime cuttings	425	12750.00
31	*Metarhizium majus* (GMF talc form)	12 kg	1,200.00
32	Others	4,314	6,21,634.00
33	Cinnamon air layers	3	120.00
	Total		**3,16,34,188.3**

XVII

Personnel

SCIENTIFIC STAFF

Sl. No.	Name	Designation
	Headquarters, Kasaragod	
1	Dr. K. Balachandra Hebbar	Director
2	Dr. B. Augustine Jerard	PC (Palms)
3	Dr. Vinayaka Hegde	HoD (Crop Protection)
4	Dr. P. Subramanian	HoD (Crop Production)
5	Dr. Murali Gopal	HoD (PB & PHT)
6	Dr. V. Niral	HoD (Crop Improvement)
7	Dr. K. Ponnusamy	HoD (Social Science)
8	Dr. K. Muralidharan	Principal Scientist (Agril Statistics) (up to 05.03.2025 VRS)
9	Dr. H.P. Maheswarappa	Principal Scientist (Agronomy)
10	Dr. Ravi Bhat	Principal Scientist (Agronomy)
11	Dr. C. Thamban	Principal Scientist (Agril. Extension) (up to 31.01.2025)
12	Dr. Alka Gupta	Principal Scientist (Agril. Microbiology)
13	Dr. K. Samsudeen	Principal Scientist (Economic Botany &PGR) (up to 31.03.2025)
14	Dr. M.R. Manikantan	Principal Scientist (Agril. Structure & Process Engg.)
15	Dr. K.P. Chandran	Principal Scientist (Agril. Statistics)
16	Dr. S. Jayasekhar	Principal Scientist (Agril. Economics)
17	Dr. V. Selvamani	Principal Scientist (Soil Science)
18	Dr. R. Sudha	Principal Scientist (Fruit Science) (up to 08.01.2025)
19	Dr. S. Neenu	Senior Scientist (Soil Science) (up to 24.01.2025)
20	Dr. S. Paulraj	Senior Scientist (Agril. Microbiology)
21	Dr. S.V. Ramesh	Senior Scientist (Agril. Biotechnology)
22	Dr. Rajkumar	Senior Scientist (Nematology)
23	Dr. V.H. Prathibha	Senior Scientist (Plant Pathology)
24	Dr. M. Sujithra	Senior Scientist (Agril. Entomology) (up to 25.06.2025)
25	Dr. P.S. Prathibha	Senior Scientist (Agril. Entomology)
26	Dr. Surekha	Senior Scientist (Agronomy)
27	Dr. P.P. Shameena Beegum	Scientist (SPM & AP) (up to 13.06.2025)
28	Dr. Daliya Mol	Scientist (Plant Pathology)
29	Mrs. T.N. Ranjini	Scientist (SPM & AP) (up to 26.09.2025)
30	Dr. S. Sumitha	Scientist (SPM & AP)
31	Dr. Hima John	Scientist AS & PE (Agril. Engg) (w.e.f 13.01.2025)

Sl. No.	Name	Designation
32	Dr. Aparna Veluru	Scientist (SPM & AP) (up to 30.04.2025)
33	Dr. G. Panjavarnam	Scientist (Fruit Science) (up to 24.09.2025)
34	Dr. M. Suchithra	Scientist (SPM &AP) (w.e.f 26.08.2025 & up to 17.10.2025)
35	Dr. B. Mahendran	Scientist (w.e.f 22.08.2025)
36	Dr. Minnu Sasi	Scientist (Biochemistry) (w.e.f 07.07.2025)
37	Dr. Ajith M.	Scientist (Agricultural Chemicals) (w.e.f 27.10.2025)
38	Dr. Shilpa S. Selvan	Scientist (Agril. Structure & Process Engineering) (w.e.f 19.01.2026)
	KVK, Kasaragod	
39	Dr. T.S. Manojkumar	Principal Scientist (Agril. Structure & Processing Engg.) & Head, KVK
	Regional Station, Kayamkulam	
40	Dr. Regi Jacob Thomas	Head
41	Dr. P. Anithakumari	Principal Scientist (Ag. Extension)
42	Dr. A. Abdul Haris	Principal Scientist (Agronomy)
43	Dr. A. Joseph Rajkumar	Principal Scientist (Agril. Entomology)
44	Dr. M. Shareefa	Principal Scientist (Fruit Science)
45	Dr. Merin Babu	Senior Scientist (Plant Pathology)
46	Dr. K. Nihad	Senior Scientist (Horticulture)
47	Dr. Jeena Mathew	Senior Scientist (Soil Science) (upto 10.01.2025)
48	Dr. K.M. Anes	Senior Scientist (Agril. Nematology)
49	Dr. S. Neenu	Senior Scientist (Soil Science) (w.e.f 27.01.2025)
50	Dr. S. Indhuja	Senior Scientist (Agril. Microbiology)
51	Dr. Jilu V. Sajan	Scientist (Agril. Entomology)
52	Dr. U.K. Priya	Scientist (Soil Science) (On leave)
	KVK, Alappuzha	
53	Dr. P. Muralidharan	Principal Scientist (Soil Science) & Head, KVK
	Regional Station, Vittal	
54	Dr. M.K. Rajesh	Head
55	Dr. S. Elain Apshara	Principal Scientist (Fruit Science)
56	Dr. N.R. Nagaraja	Senior Scientist (Plant Breeding)
57	Dr. Bhavishya	Scientist (SPM & AP)
58	Dr. R. Thava Prakash Pandian	Scientist (Plant Pathology)
59	Dr. T.N. Madhu Scientist	(Agril. Entomology)
60	Dr. M. Chaithra Scientist	(Plant Pathology)
61	Dr. M. Suchithra	Scientist (SPM & AP) (up to 25.08.2025)
62	Dr. B. Mahendran	Scientist (up to 21.08.2025)
63	Dr. U.K. Priya	Scientist (Soil Science) (On leave)
	Research Center, Mohitnagar	
64	Dr. Arunkumar Sit	Principal Scientist (Hort.) & Scientist-In-charge
65	Dr. Sandip Shil	Senior Scientist (Agril. Statistics)
	Research Center, Kahikuchi	
66	Dr. Alpana Das	Principal Scientist (Agril. Biotechnology) & Scientist-In-charge
67	Dr. Leichombam Singhajit Singh	Scientist (SPM & AP)
68	Dr. M. Chaithra	Scientist (Plant Pathology) (up to 26.09.2025)
	Research Center, Kidu	
69	Dr. Y. Diwakar	Senior Scientist (SPM & AP) and Scientist-In-Charge

TECHNICAL STAFF

Sl. No.	Name	Designation
	Headquarters, Kasaragod	
1	Shri H. Muralikrishna	Chief Technical Officer (Technical Information)
2	Shri K. Shyamaprasad	Chief Technical Officer (Photography)
3	Shri G.S. Hareesh	Assitant Chief Technical Officer (Instrumentation Engg.)
4	Shri K. Ajith Kumar	Senior Technical Officer (Civil Engg.)
5	Shri Vikas Joon	Senior Technical Officer
6	Shri V.K. Gopalakrishnan	Senior Technical Officer (up to 31.10.2025)
7	Shri S. Manohara	Technical Officer (Vehicle) (upto 31.07.2025)
8	Shri K. Krishnan Nair	Senior Technical Officer (Field /Farm) (up to 31.05.2025)
9	Shri K. Devaraj	Technical Officer (Jr. Eng.)
10	Dr. K.S. Muralikrishna	Technical Officer (Lab)
11	Shri A.V. Satheeshkumar	Senior Technical Assistant (Vehicle)
12	Shri P. Santhosh Kumar	Technical Officer (Field /Farm)
13	Shri K. Bhavani Shankar	Technical Assistant(F/F)
14	Shri S. Sunil	Technical Assistant (Electrical Engineering)
15	Shri G. Arunji	Senior Technical Assistant (Lib)
16	Shri P. P. Anoop Kumar	Senior Technical Assistant (Field/Farm)
17	Shri N. Dinesh Kumar	Technical Assistant (Field /Farm)
18	Smt. E.P. Ashamol	Senior Technician (Field/Farm)
19	Shri P.S. Suvith	Senior Technician (Field/Farm)
20	Shri R. Ajith Kumar	Senior Technician (Field/Farm) (up to 15.10.2025)
22	Shri M. Krishnan	Technician (F/F)(up to 30.04.2025)
24	Smt. Chithralekha Kodoth	Technician(F/F)
25	Shri B. Sundara	Technician (F/F) (up to 31.01.2025)
26	Shri B. Chandrahasa	Technician(F/F)
27	Shri K. Sukumaran	Technician (up to 30.04.2025)
28	Shri Vishnu Pooniya	Technician (F/F)
29	Shri Pavan Kumar	Technician (F/F)
30	Shri Rahul Meena	Technician (F/F)
31	Shri Avdhesha Maurya	Technician (F/F)
32	Shri Vishal Singh	Technician (F/F)
33	Shri Raghavendra Kumar	Technician (w.e.f. 24.02.2025)
34	Shri Aman Kumar Gautam	Technician (w.e.f. 12.03.2025)
35	Shri Shivam Soni	Technician (w.e.f. 11.03.2025)
36	Ms. Swati Agarwal	Technician (w.e.f. 12.03.2025)
37	Smt. K. Lalitha Bai	Technician (w.e.f 11.09.2025)
38	Shri P.P. Prabhakaran	Technician(w.e.f 11.09.2025)
	KVK, KASARAGOD	
39	Dr. Saritha Hegde	Chief Technical Officer (SMS-Home Science)
40	Dr. Neelofar Illias Kutty	Chief Technical Officer (Programme Assistant) (Home Science)
41	Dr. M.P. Jayashree	Assistant Chief Technical Officer (SMS) (Agril. Extn.) (w.e.f 01.09.2025)

Sl. No.	Name	Designation
42	Shri K. Manikandan	Senior Technical Officer (Programme Assistant) (up to 31.03.2025)
43	Dr. Benjamin Mathew	Senior Technical Officer (SMS – Horticulture)
44	Dr. Ramavath Pandu	Senior Technical Officer (SMS- Livestock Production Management)
45	Shri Dinesh Kumar Yadav	Senior Technical Officer (SMS - Agricultural Entomology)
46	Dr. Kiranmoy Patra	Senior Technical Officer (SMS-Agronomy)
47	Shri K.P. Lagesh	Senior Technician (Vehicle)
	Regional Station, Kayamkulam	
48	Shri Bikash Chowdhary	Chief Technical Officer (upto 28.03.2025)
49	Shri C.G. Narayanan Nampoothiri	Chief Technical Officer
50	Shri B. Anilkumar	Assistant Chief Technical Officer (Field Farm) (upto 31.05.2025)
51	Dr. (Mrs.) Maya Lekshmi	Technical Officer(F/F)
52	Shri Sunny Thomas	Technical Officer(F/F)
53	Shri V.P. Joy	Senior Technical Assistant (F/F)
54	Smt. Asha K. Chandran	Senior Technical Assistant (F/F)
55	Smt. Poonam Khatri	Senior Technical Assistant (F/F)
56	Shri V. Kamal Kumar	Senior Technical Assistant (F/F)
57	Shri S. Rajesh	Technical Officer (F/F) (Up to 09.08.2025)
	KVK, Alappuzha	
58	Smt. Jissy George	Chief Technical Officer (SMS –Home Science)
59	Smt. G. Lekha	Chief Technical Officer (SMS-Plant Pathology)
60	Shri M.S. Rajeev	Chief Technical Officer (SMS-Agronomy)
61	Shri S. Ravi	Chief Technical Officer (SMS-Animal Husbandry)
62	Dr. T. Sivakumar	Chief Technical Officer (SMS-Agricultural Entomology)
63	Dr. K. Sajnanath	Assistant Chief Technical Officer (SMS-Soil Science)
64	Shri K.M. Ansary	Assistant Chief Technical Officer (Computer)
65	Smt. P.V. Bijila	Assistant Chief Technical Officer (Horticulture)
66	Shri Dayanandan Unnithan	Technical Officer (Vehicle) (up to 31.05.2025)
67	Shri B.J. Sajin	Senior Technician
	Regional Station, Vittal	
68	Shri M. Narayana Naik	Technical Officer (F/F) (up to 31.10.2025)
69	Shri B. Tharanath Naik	Senior Technical Assistant (Vehicle)
70	Shri B.J. Nirmal Kumar	Senior Technical Assistant (F/F)
71	Shri Bisun Bhaskar	Senior Technical Assistant (Lab)
72	Shri D. Isubu	Technician(F/F)
73	Shri Dharmapala	Technician
74	Shri Mohana	Technician
75	Shri Priy Ranjan Bharti	Technician
76	Shri Niraj Verma	Technician (w.e.f 16.04.2025)

Sl. No.	Name	Designation
	Research Center, Mohitnagar	
77	Shri Avarjyothi Ghosh	Chief Technical Officer(F/F)
78	Shri Pratap Kumar Sarkar	Technical Officer(F/F)
79	Shri Jagadish Roy	Technical Officer (Vehicle)
80	Shri Prakash Burman	Senior Technician(F/F)
81	Shri Kartick Chandra Biswas	Technician(F/F)
	Research Center, Kahikuchi	
82	Shri Bikash Choudhary	Chief Technical Officer (w.e.f 01.04.2025)
83	Shri Gopinath Malakar	Technical Officer (Vehicle)
84	Shri Pradipta Mondal	Technician (F/F)
	Research Center, Kidu	
85	Shri A.S. Gopalakrishna	Technical Officer(F/F)
86	Shri V. Chennappa	Technician (F/F)
87	Shri V. Jathappa Gowda	Technician(F/F)
88	Shri Anjesh Kumar	Technician (F/F)
89	Shri Roshan Sharma	Technician (F/F)
	ADMINISTRATIVE STAFF	
	Headquarters, Kasaragod	
1	Shri Prashant Sharma	Comptroller (w.e.f. 04.08.2025)
2	Shri Ram Avtar Parashar	Chief Finance & Accounts Officer (up to 17.07.2025)
3	Shri P. Krishna Kumar	Senior Administrative Officer
4	Shri R.N. Subramanian	Senior Administrative Officer
5	Shri K.K. Sasi	Finance & Accounts Officer
6	Shri Arun N.K. Raj	Assistant Finance & Accounts Officer
7	Smt. Nalla Naveena	Assistant Finance & Accounts Officer (w.e.f. 09.06.2025)
8	Shri M. Ravindran	Assistant Administrative Officer
9	Shri A. Neil Vincer	Assistant Administrative Officer
10	Shri P. Narayana Naik	Assistant Administrative Officer (w.e.f. 02.08.2025)
11	Smt. K. Narayani	Principal Private Secretary
12	Smt. A.R. Arathi	Personal Assistant
13	Shri P.M. Thomas	Assistant
14	Smt. K.T.K. Sheenakumari	Assistant
15	Smt. Rupa Manikandan	Assistant
16	Shri Paulson Sam George	Assistant
17	Smt. K. Preethi	Assistant
18	Shri Aswin Reghunath	Assistant
19	Shri P.K. Mohammed Haneefa	Upper Division Clerk
20	Shri N. Udayakumar	Upper Division Clerk
21	Smt. A.J. Mary	Upper Division Clerk (on deputation)
22	Shri P.K. Pramod Kumar	Upper Division Clerk
23	Shri V. Jayarajan	Lower Division Clerk(on deputation)
24	Shri K.P. Ibrahim	Lower Division Clerk(on deputation)

Sl. No.	Name	Designation
25	Shri Satya Brata Moharana	Lower Division Clerk (Under deputation)
26	Shri M. Sree Vishnu Prabhakara Rao	Lower Division Clerk (w.e.f. 01.09.2025)
27	Shri Anish Kumar	Assistant (w.e.f 06.02.2026)
	KVK, Kasaragod	
28	Smt. K. Jayashree	Assistant (up to 30.06.2025)
	Regional Station, Kayamkulam	
29	Smt. Prasanna Sarngan	Private Secretary
30	Shri K. Venu Gopal	Assistant (up to 31.12.2025)
31	Smt. K. Sreelatha	Assistant
32	Smt. T. Deepa	Upper Division Clerk
33	Shri K.N. Sajeev	Lower Division Clerk (w.e.f. 01.09.2025)
34	Smt. K.R. Rejitha	Personal Assistant
	Regional Station, Vittal	
35	Shri P.K. Mohammed Haneefa	Upper Division Clerk
36	Shri Chandu Naik	Lower Division Clerk
37	Shri Laxmi Narayana	Upper Division Clerk
38	Shri K.N. Sajeev	Lower Division Clerk (up to 29.08.2025)
	Research Centre, Mohitnagar	
39	Shri Subash Paul	Assistant
	Research Centre, Kahikuchi	
40	Shri T.J. Saji	Assistant
	Research Center, Kidu	
41	Shri M. Durgesha	Lower Division Clerk

SKILLED SUPPORT STAFF

Sl. No.	Name
	Headquarters, Kasaragod
1	Shri K.G. Sureshbabu (up to 31.05.2025)
2	Smt. V. Thambai (up to 31.05.2025)
3	Shri M. Velayudhan (up to 31.03.2025)
4	Shri N. Bhaskaran
5	Shri K. Sureshan
6	Shri A. Madhu
7	Shri K.A. Madhavan
8	Smt. Vanamalini
9	Shri E.M. Aneesh
10	Shri Praveen Raj
11	Shri R. Ashok Kumar
12	Shri S. Sarath Kumar
13	Shri Kripesh Kumar
14	Smt. N. Rohini

Sl. No.	Name
	Regional Station, Kayamkulam
15	Shri M. E. Sivan
16	Shri K. Omanakuttan
17	Shri C. Sundaran (up to 31.05.2025)
18	Shri A.T. Harikuttan
19	Shri S. Rajesh (Up to 10.08.2025)
20	Smt. N. Suma
21	Smt. L. Leena
22	Smt. A.S. Aswathy
	KVK, Alappuzha
23	Shri R. Rajesh
24	Smt. Arathi R. Pillai
	Regional Station, Vittal
25	Shri Ibrahim
26	Smt. S. Suma
27	Shri M. Ananda
	Research Center, Mohitnagar
28	Shri Sailen Seal
29	Shri Krishna Kumar Mandal (Up to 31.12.2025)
30	Shri Nripendra Chandra Roy
31	Shri Mahadev Misra
32	Shri Sushanta Burman
	Research Center, Kahikuchi
33	Shri Sathish Baishya
34	Shri Pankaj Das
35	Shri Thanka Bahadur Thapa
	Research Center, Kidu
36	Smt. S. Rukmini
37	Smt. S. Chandravathi
38	Shri S. Bhojappa
39	Smt. Komalangi
40	Shri S. Neelappa
41	Smt. B. Meenakshi (up to 31.05.2025)
42	Shri J. Vignesh
43	Shri Sudharshana

XVIII

Distinguished Visitors

Sl. No	Visitors	Place & Date
1	Dr. Himanshu Pathak, Secretary, DARE, and Director General, ICAR, Dr. V.B. Patel, ADG (Fruit and Plantation Crops), ICAR, New Delhi Dr. V. Venkatasubramanian, Director, ICAR-ATARI, Bangalore Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur Dr. George Ninan, Director, ICAR-CIFT, Cochin Dr. Grinson George, Director, ICAR- CMFRI, Cochin	ICAR-CPCRI, Kasaragod 3 January 2025
2	Dr. S.K. Singh, DDG (Hort. Science), ICAR, New Delhi Dr. V.S. Korikanthimath, Former Director, ICAR-CCARI, Goa Dr. R.K. Mathur, Director, ICAR-IIOR, Hyderabad Dr. R. Selvarajan, Director, ICAR-NRC Banana, Tiruchirappalli	ICAR-CPCRI, Kasaragod 5 January 2025
3	Dr. T. Pradeep Kumar, Hon'ble Vice-Chancellor, Kerala University of Fisheries and Ocean Studies (KUFOS), Panangad, Kochi	ICAR-CPCRI, Regional Station, Kayamkulam, 27 January 2025
4	Shri K. Sethuraman, IPS and Director, Kerala Police Academy, Thrissur	ICAR-CPCRI, Regional Station, Kayamkulam, 28 February 2025
5	Mrs. D. Shilpa, IPS, District Police Chief, Kasaragod	ICAR-CPCRI, Kasaragod 10 March 2025 as part of Women's day celebration
6	Dr. Jelfina C. Alouw, Director General of ICC, and H.E. Ambassador Diar Nurbintoro, Director of the Non-Aligned Movement Centre for South-South Technical Cooperation (NAM-CSSTC), Jakarta, Indonesia, Dr. S. K. Singh (DDG–Horticultural Sciences, ICAR), Shri. Rajmohan Unnithan, Hon'ble MP, Kasaragod, Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur	ICAR-CPCRI, Kasaragod 02-05 September 2025

Sl. No	Visitors	Place & Date
7	Shri Nagesh Kumar Anumala, Chief General Manager, NABARD, Keralam Shri Reji Verghese, DDM, NABARD, Kottayam Shri S. Rajesh Kumar, Managing Director, SFAC, Thiruvananthapuram Shri K. J. Varghese, Chairman, BGCPCL Shri V. J. George Kulangara, Chairman, National Federation of Farmer Producer Organisations and Shri Sunny Sacharia, Past District Governor, Lions Club Shri Tom George, Executive Director, BGCPCL	ICAR-CPCRI, Regional Station, Kayamkulam 23 September 2025
8	Dr. K.V. Prasad, Director, DFR Pune, Maharashtra, Dr. Manish Das, Director, DMAPR, Anand, Gujarat, Dr. S. Hazarika, Director, ICAR Research Complex for NEH Region, Umiam, Meghalaya, Mr. Loken Das, CGM NABARD, Guwahati, Dr. V.K. Gupta, Director NRC on Pig, Guwahati	ICAR-CPCRI, RC, Kahikuchi 24-25 September 2025
9	Shri K. Inbasekhar, IAS, District Collector, Kasaragod	ICAR-CPCRI, Kasaragod 11 October 2025
10	Dr. Nayanie Samantha Aratchige, Additional Director/ Acting Director, Dr. Chaminda Shaman Herath, Head / Technology Transfer Division, Dr. Muhammed Khalid Fathima Nadheesha, Senior Research Officer, Dr. Atapattu Arachilage Anjana Jayasanka Atapattu, Senior Research Officer, Dr. Pasqual Handi Prasad Roshan De Silva, Research Officer, Coconut Research Institute (CRI), Sri Lanka	ICAR-CPCRI, Kasaragod 05 November 2025

XIX

SCSP Activities

The SCSP empowerment activities conducted by the Institute include long-duration skill development programmes of four to eight months for the benefit of unemployed rural SC youth. These programmes aim to develop high-value skilled manpower and also to improve the livelihood security of the communities. During the year, a total of 32 different skill development programmes covering various aspects of coconut, arecanut and cocoa were conducted and 114 candidates of SC community have successfully completed the training at CPCRI & its regional stations and centers.

Fig. 143. Dr. K.B. Hebbar delivering a lecture

Highlights of the skill programme conducted during 2025

A six-month duration skill development training programme was inaugurated on 22 July 2025. The skill training programme focused on the scientific cultivation and value addition of coconut and allied plantation crops, covering the entire chain from nursery management to post-harvest processing. Participants were trained in the selection of healthy coconut seedlings, nursery techniques, and eco-friendly disease management practices. Special emphasis was given to the mass production of bio-control agents, including *Trichoderma, Metarhizium,* and other bio-inoculants. During the programme, 50 litres of *Trichoderma* culture were prepared using coconut water and Potato Jaggery Broth (PJB) media. Additionally, 75 kg of *Trichoderma* talc formulation and 1,000 Trichoderma coir pith cakes were produced and supplied to the North Eastern region as part of the NE training programme organized by ICAR–CPCRI for the sustainable management of fungal diseases in coconut and arecanut. A total 2544 cocoa and 4000 arecanut saplings were distributed to 127 SC farmers of Vittal village of Karnataka. In collaboration with the Sri Kshetra Dharmasthala Rural Development Project (SKDRDP), Kidu research centre distributed 10,000 saplings of one-year-old Mangala and Sumangala arecanut varieties to 100 Scheduled Caste farmers were selected for the program, each of whom received 100 arecanut saplings. Nine trainings were organized by RC, Mohitnagar. The valedictory function of skill development programme for

Fig. 144. Demonstration of scientific method of coocnut planting

Fig. 145. Coconut chips making

Fig. 146. Trainees close involvement in the process of soil sample analysis

Fig. 147. Production of Tricoderma using coconut waste water

Fig. 148. Trichoderma cacke production for coconut bud rot disease control

Fig. 149. Training on modified ground polination

Fig. 150. Sri.C.P.Yogeshwaara, MLA, Karnataka handing over certificates to the trainees

Success of Scheduled Caste farmers group in commercial honey bee farming

Under the SCSP, Mr. Vishwanathan, a farmer from Neliyadaka Panchayat, successfully initiated backyard commercial honeybee farming over an area of 0.5 acre. He began the enterprise with three bee boxes installed near his residence and subsequently expanded to eleven bee boxes, including eight boxes provided by the CPCRI under the SCSP scheme. He demonstrated strong commitment as the freshly harvested honey, scientifically processed and hygienically packed following training received from the institute, gained good market demand in local shops. The honey is currently sold at ₹650 per kg (with an annual yield of 6–8 kg per colony), generating an additional annual income of ₹39,000.

Fig. 151. Stakeholder interactions on value-added products and marketing promotion

Fig. 152. Planting material distribution to SC farmers of West Bengal

XX

Swachh Bharat Abhiyan

Swachhta Hi Sewa 2025
Kasaragod

Swachhta Hi Sewa 2025, with the theme Swachhotsav, has been organized from 17 September to 02 October 2025, with the collective involvement of all the Regional Stations and Research Centres. The programme commenced online by a national launch by the Hon'ble Union Minister for Agriculture and Farmers' Welfare on 17 September 2025, and by taking the Swachhata Pledge at the Institute.

ICAR-CPCRI organized an outreach activity involving women self-help groups, non-governmental organisations and MSME Regional Centre at Mangalore on 19 September 2025.

A plantation drive 'Ek ped maa ke naam' was commenced by Dr. K.B. Hebbar, Director, ICAR-CPCRI, Kasaragod, at the Institute premises. Special swachhta clean-up activities have been carried out at CPCRI beach. Imaginative slogan writing competition, poster-making competition, and the 'Waste to art' activity were conducted for the school children of Kendriya Vidyalaya No.1, ICAR-CPCRI Kasaragod. ICAR-CPCRI organized a symbolic human chain event to raise awareness and demonstrate commitment to cleanliness and sanitation.

ICAR-CPCRI organized an event to honour the inspiring initiatives taken by the Kasaragod Municipality and the Uralungal Labour Contract Co-operative Society Ltd. related to Swachhata. The Chairman of the Kasaragod Municipality, Shri Abbas Begum, and the Safety Manager of the ULCCS Ltd., Shri Ranjith N., were honoured by the Director of ICAR-CPCRI on this occasion, and the Safai Mitras of CPCRI have been recognized and felicitated.

Fig. 153. A glimpse of Swachhta Hi Sewa programmes and activities

CPCRI, RC, Kidu

ICAR-CPCRI Research Centre, Kidu, actively participated in a cleanliness drive from 17 September to 02 October 2025 at the premises of Kukke Shri Subrahmanya temple, Dakshina Kannada District, Karnataka, one of the most prominent religious destinations in the region with heavy public footfall.

KVK, Kasaragod

Flagging off the campaign, KVK staff along with 40 farmers of an ongoing training programme at ICAR- KVK Kasaragod, took the pledge of Swachhta Hi Seva Campaign 2025. The programme had the presence of Smt. Sameera Faisal, President, Mogral Puthur panchayat. The trainees were part of the Capacity Building training on Meliponiculture jointly organised by ICAR KVK and Department of Agricultural development and Farmers' Welfare ATMA, Kasaragod.

Fig. 154. Participants standing united for an oath taking during the programme

Fig. 155. A lively session at the Kendriya Vidyalaya No.1, Kasaragod

A training on crown cleaning of coconut palms was conducted to the farmers as a part of Swachhta Hi Seva Campaign 2025 on 18 September 2025 by KVK Kasaragod at nearby farmer's plots in Mogral Puthur panchayat. Ex-trainee of KVK's FoCT 2012 ladies' batch, Smt. Krishnaveni K., who has now turned out to be a pollination expert at ICAR-CPCRI Kasaragod, was the resource person. 12 farmers were trained to climb up the palm using climbing device and to clean the crown.

ICAR KVK, Kasaragod, as a part of its Swachta Hi Seva 2025 Campaign activity implemented 'Ek ped maa ke naam' at the botanical garden of the Central University of Kerala, Kasaragod, on 25 September 2025. KVK contributed saplings of 10 tree plants to the botanical garden.

The programme was inaugurated by Dr. Jayaprakash R., Hon'ble Registrar, Central University of Kerala by planting a sapling of a guava tree. Students counting to nearly 100 formed a chain holding hands, symbolizing their support for Swachhtha hi seva campaign 2025.

Fig. 156. Coconut crown cleaning as a part of the cleanliness drive to overcome pests

Fig. 157. Chain formation to symbolise integration at CUK, Kasaragod campus

Then thulli (Honey drop) awareness programme

ICAR KVK Kasaragod, as a part of its Swachatha Hi Seva Campaign 2025 activities, organised 2 programmes in the district. One was an awareness programme on the goodness of honey at Pannikkunnu Anganwadi in Mogral Puthur panchayat.

Fig. 158. Awareness programme on goodness of

KVK, Alappuzha

'Swachhta Hi Seva' campaign was organized by the KVK from 15 September to 2 October 2025 with the theme of 'Swachotsav' as per the call of the Govt. of India. Awareness programmes on cleanliness and relevance of hygienic circumstances for healthy life were organized for farmers, farm women, rural youth and students in the campus and off-campus mode in the NICRA village and other operational areas. 'Swachhta Pakhwada' was also organized during 16-31 December 2025 starting with Swachhta pledge followed by cleanliness drive, promoting clean and green technologies, cleanliness and hygienic surroundings etc. Cleaning of office premises, demonstration units, input production units, training halls etc. were conducted by staffs and trainees.

Swachhta Rally

A swachhta rally was organized on 29 December 2025 with the participation of 50 farmers from Karnataka and entire institute scientists and staff.

Fig. 159. Swachhta rally to promote cleanliness and community awareness at Kasaragod

XXI

Women's Cell Activities

International Women's Day

Kasaragod

Ms. Shilpa, D., IPS, District Police Chief, Kasaragod, was the Chief Guest at the celebration of International Women's Day 2025 at ICAR-CPCRI, Kasaragod. In her inspiring address, she emphasized that women should perceive their role in society rather than their gender. This outlook will automatically improve one's position in society and also facilitate women's empowerment. She called upon all women to recognize their potential and strive to excel in their chosen field. Dr. K.B. Hebbar, Director, ICAR-CPCRI, in his presidential address, lauded the initiatives taken towards women's empowerment and encouraged continued efforts in this direction. He highlighted that CPCRI as an institute gives emphasis on women's empowerment and has a good percentage of women employees in its roles. He mentioned that performance is more important than individuality.

The chief guest felicitated a successful coconut-based woman entrepreneur, Mrs. Annamma T.M., proprietor of M/s. Bless Farm Flave, Parakkatta, Kasaragod, and two best women employees of CPCRI Kasaragod. The chief guest distributed certificates to successful trainees, followed by the distribution of prizes to the winners of various competitions.

Fig. 160. Ms. Shilpa Devaiah, IPS, inaugurating the Women's Day programme

Kayamkulam

ICAR-CPCRI, Regional Station, Kayamkulam, celebrated International Women's Day on 6 March 2025. The event was inaugurated by Smt. Kudassanad Kanakam, a renowned cine artist, with Smt. Bindhu R. Thampi, an esteemed poet and teacher, as the chief guest. Dr. Veena V.S., Young Scientist, Max Planck Institute for Radio Astronomy, Bonn, Germany, delivered an insightful online keynote address. A special session on drug abuse prevention was conducted by Smt. Thasni Kalam, Civil Excise Officer raising awareness on the dangers of substance abuse. All the staff and invited women farmers attended the programme.

XXII

Major Events and Other Information

Interaction of Director with Honourable Agriculture Minister

Shri Shivraj Singh Chouhan, Hon'ble Union Minister of Agriculture and Farmers Welfare, Govt. of India, and Dr. K. Balachandra Hebbar, Director of ICAR-CPCRI, interacted on 18 January 2025 while attending the Mega Farmers Meet in Sagara, Karnataka. The Director discussed with the minister the difficulties faced by the arecanut farmers. The event was attended by over 20,000 arecanut growers. According to the recommendations of the National Scientific Committee (NSC) on arecanut, the minister announced 67 crore rupees for the first year's grant to manage leaf spot disease (LSD) and yellow leaf disease (YLD) of arecanut. He also called for the arecanut and health project to start immediately.

Fig. 161. Interaction of Director with Honourable Agriculture Minister

Republic Day

ICAR-CPCRI, Kasaragod, celebrated the 76 Republic Day on 26 January 2025. The programme started with flag hoisting by Dr. K.B. Hebbar, Director followed by salutation of the national flag and thereafter the national anthem. Dr. K.B. Hebbar delivered the Republic Day message. Republic Day was also celebrated in all the Regional Stations and Research Centres of ICAR-CPCRI with national fervour.

Fig. 162. Director hoisting the natioal flag and delivering the Republic Day message

World Intellectual Property Day

ICAR-Central Plantation Crops Research Institute, Kasaragod, organized a seminar on 'Legal Implications of IP in Agriculture' on 05 May 2025 as part of the World Intellectual Property Day celebrations. Dr. K. Ponnusamy, Head, Division of Social Sciences, coordinated the event. Dr. K. Balachandra Hebbar, Director, ICAR-CPCRI, highlighted the rapid growth of India's agricultural sector driven by innovation and technology and emphasized the increasing relevance of intellectual property rights. Dr. P. K. Patil, Principal Scientist and I/c, ITMU, ICAR-CIBA, Chennai, delivered an online lecture on 'Legal Implications of IP in Agriculture.' Around 150 participants attended the programme.

Dr. P. K. Patil elaborated on various aspects of IP management and shared his experiences in the field. He pointed out key challenges, including strengthening mechanisms for IP protection and enforcement, facilitating technology transfer and licensing agreements, navigating complex regulatory frameworks, and building capacity and awareness among stakeholders. He further stated that India has a unique IPR framework through the PPV&FR Act, which protects the rights of both plant breeders and farmers. Dr. Patil also addressed the queries raised by the participants. He stressed that when innovators are confident about the protection of their rights, they are encouraged to invest and innovate further. He emphasized the need for a multi-faceted and collaborative approach toward building an effective policy and regulatory framework on IPR, involving legal reforms, capacity building, stakeholder engagement, and international cooperation to promote innovation and develop

Fig. 163. Participants of the World Intellectual Property Day at Kasaragod

World Environment Day

Kasaragod

The ICAR-CPCRI, Kasaragod, celebrated World Environment Day jointly with the Kerala Forest and Wildlife Department on 5 June 2025. The theme of the day was 'Ending Plastic Pollution'. A tree plantation drive was organized within the Institute campus.

The District Panchayat President, Smt. Baby Balakrishnan, was the chief guest. The programme was chaired by Dr. K. Balachandra Hebbar, Director, ICAR-CPCRI. The Institute has been recognized as a 'Green Campus' by the Haritha Mission, Government of Kerala.

The guest of honour of the event, Dr. Arun M. Isloor, Professor (HAG), NITK, Surathkal, delivered the keynote address on the theme 'Beat Plastic Pollution'. The other distinguished speakers included Shri P. Biju, Deputy Conservator of Forests, and Shri Ananda, Project Director, ATMA, Kasaragod District.

Fig. 164. World Environment Day Celebrated in ICAR-CPCRI, Kasaragod

Kayamkulam

World Environment Day was celebrated at ICAR-CPCRI, Regional Station, Kayamkulam on 5 June 2025. Students, farmers and staff of CPCRI and KVK, Alappuzha participated in the celebrations. Dr. Regi Jacob Thomas, Head, presided over the function. Shri C. Rajendran IFS, Deputy Conservator of Forests (Rtd.) was the Chief Guest. Dr. A. Joseph Rajkumar, Principal Scientist, delivered a lecture on the theme 'beat plastic pollution'. An elocution competition was conducted for the students of Krishnapuram Government U. P. School. AI based collage competition was organised for the staff. Saplings were planted for the establishment of a butterfly park.

Fig. 165. World Environment Day was celebrated in both Kayamkulam and KVK Alappuzha

National Science Day

Kasaragod

National Science Day was celebrated at ICAR-CPCRI, Kasaragod on 28 February 2025 with the theme 'Empowering Indian youth for global leadership in science and innovation for 'Vikasit Bharat'.

Fig. 166. Chief guest Prof. M. Gopalan addressing at the valedictory function

Prof. M. Gopalan, former Principal, EK Nayanar Memorial Govt. College, Elerithattu, Kasaragod was the chief guest for the function. He explained Prof. C.V. Raman did research when there were not much instruments to do practical research. In such a time, Raman explained the light effect with quantum theory. Even today, research results are explained using Raman spectroscopy.

In his presidential address, Dr. K. B. Hebbar, Director mentioned the recent progress in the last ten years in Indian scientific scenario. He hoped that it will lead to much technological advancements in the future.

College students participated in quiz competition and the winners were awarded during the programme by the chief guest.

Kayamkulam

ICAR-CPCRI, Regional Station, Kayamkulam convened a seminar on the theme 'Mentoring leaders and innovators in science for Vikasit Bharat' as part of the National Science Day (NSD) 2025 programme. More than 100 students including faculty from colleges and research institutes participated in the programme. Shri K. Sethuraman, IPS and Director, Kerala Police Academy, Thrissur, inaugurated the programme and emphasized that science alone can transform India in to a developed nation citing science advancements in other countries through

Fig. 167. NSD-2025 group photo

Fig. 168 Inauguration of National Science Day

state of art infrastructure. Dr. Santhosh J. Eapen, former Acting Director, ICAR-IISR, Kozhikode handled a technical session on 'Science in the era of Artificial Intelligence', elaborating the applications of different AI tools and recommending rational use of AI tool in the present-day context of information explosion and in the future mode of leaning.

The proceedings of the workshop on 'media in the context of changing agriculture' was released and a short video on the Kalpa Tech Snippets which highlighted the important technologies developed at the station was unveiled. A speech contest on the theme area was conducted and winners were awarded with prizes during the valedictory session.

World Coconut Day Celebration

The institute celebrated World Coconut Day 2025 with the theme 'Uncovering coconuts' power, inspiring global action'. The inaugural session was presided over by Dr. Sanjay Kumar Singh, Deputy Director General (Horticultural Sciences), ICAR. Dr. S.K. Singh emphasized the need for long-term planning, common thrust areas for researchers, and stronger collaboration and extension linkages to strengthen the coconut sector.

The event was also graced by Shri Rajmohan Unnithan, Member of Parliament, Kasaragod, H.E. Ambassador Diar Nurbiantoro, Director, NAM-CSSTC, Jakarta; Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur and Dr. B. A. Jerard, Project Coordinator, AICRP on Plantation Crops.
In his inaugural address, Shri Unnithan hailed coconut as the 'Kalpa Vruksha' that sustains livelihoods, while cautioning against challenges posed by climate change and volatile prices. He called for greater focus on value addition, product diversification, and exports to establish coconut products as a strong global brand.

In his welcome remarks, Dr. K. Balachandra Hebbar, Director, ICAR-CPCRI, highlighted the institute's global leadership in coconut research and collaborative initiatives. He underlined threats from climate variability, market fluctuations and emerging pests and diseases such as rugose spiralling whitefly and black-headed caterpillar. He stressed the importance of germplasm conservation, sustainable soil and water management, fertigation, carbon sequestration and waste-to-wealth technologies. Dr. Hebbar also stated that CPCRI's 469 germplasm accessions hold significant promise for future breeding programs.

Delivering the keynote address, Dr. Jelfina C. Alouw, Director General, ICC, Jakarta, described coconut as a climate-vulnerable crop facing global competition. She urged ICC member countries to collaborate closely, share technologies and germplasm and link resilience with value addition and shared prosperity. As part of the celebration, seven achievers including four innovative farmers and three entrepreneurs were felicitated with CPCRI awards. The programme also saw the release of three publications, launch of a new bio-product for soil health management, and signing of six MoUs for technology transfer.

The publication and bio-products were:

- Coconut Palm Sap – A natural beverage and source of value-added products Edited by: K.B. Hebbar, *et al*.
- Handbook for participants – International workshop on strengthening coconut gene banks for a climate-resilient and sustainable future, compiled by: CPCRI and ICC.
- Improved Varieties of Coconut released from ICAR-CPCRI. The book in Hindi, authored by Niral V., *et al*.

A product by ICAR-CPCRI, Arecanut leaf sheath powder 'Tricho-Block', was released.

In recognition of excellence, four awards were presented to the farmers who excelled in coconut farming:

- Sri. B. Natesan, producing hybrid coconuts from Thanjavur, Tamil Nadu.
- Sri. Omkar Murthy, with a high income through following GAP from Hassan, Karnataka.

- Sri. K.P. Cheriyan Kureekottil, managing a high-income cropping system in root (wilt) affected area of Kottayam, Kerala.
- Sri. Joseph Edutthu, Kolichal, Kasaragod as a plantation based eco-tourism venture in Kasaragod, Kerala.

Three awards were conferred for the Entrepreneurs who excelled in coconut-based business enterprises:

- Smt. Gomati, Gagani Foods, Erode, Tamil Nadu,
- Sri Sathyanarayana Udupa, Kalarasa and All Spices exporter from Udupi, Karnataka.
- Sri Abbas Ali, Malappuram, Kerala.

The technical sessions included a Stakeholder Meeting on farmer empowerment and an International Workshop on genetic conservation and climate-resilient strategies.

The event witnessed participation from about 300 delegates, including 30 foreign members of the International Coconut Community (ICC) representing Indonesia, the Philippines, Malaysia, Australia, Papua New Guinea, Thailand, Sri Lanka, Brazil, France, and the Caribbean islands. Stakeholders from NABARD, state extension agencies, entrepreneurs, scientists, farmers, FPOs, and NGOs also actively participated in the programme.

Fig. 169 Dignitaries addressing the gathering during the World Coconut Day celebration at ICAR–CPCRI, Kasaragod

Independence Day Celebration

The 79th Independence Day was celebrated at ICAR–Central Plantation Crops Research Institute, Kasaragod, on 15 August 2025. Dr. K. B. Hebbar, Director, hoisted the National Flag and addressed the gathering, highlighting the nation's remarkable progress and the vital role of agricultural research in national development. All staff members, including regular, scheme, contractual staff, and SCSP trainees, actively participated in the event, reaffirming their dedication to the nation's growth and institutional excellence.

Celebrating Independence Day

Field and Laboratory Visits

The delegation toured the CPCRI experimental farm and lab facilities. The laboratory heads briefed the delegates on ongoing processes and innovations. At the end of the meeting, Dr. Nayanie Samantha Aratchige (CRI, Sri Lanka) expressed gratitude for making the entire visit so purposeful, acknowledging the warm hospitality and productive interactions.

The delegation also visited farmers' field of Mr Radhakirishnan, Pollakkada and Vittal Agro Industries, Thattummal, Kanhangad, Kasaragod district to observe field-level implementations and production of desiccated coconut powder. Team helped by Dr. K. Ponnusamy, Head, Social Science visited, is the Horticultural Research and Extension Station, Arsikere located in the Hassan district, Karnataka on 06 November 2025 wherein they observed various ongoing experimental trials in coconut based farming system.

Fig. 170. Review meeting with scientists and staff at ICAR-CPCRI, Kasaragod

Fig. 171. Hands-on demonstration of coconut processing technology at ICAR-CPCRI

Review Meeting of the Multi-Institutional Project 'Evidence-Based Research on Arecanut and Human Health'

A review meeting of the multi-institutional research project 'Evidence-based research on arecanut and human health' was held on 06 November 2025 at the National Institute of Mental Health and Neurosciences (NIMHANS), Bengaluru. The meeting was chaired by Dr. Prabhat Kumar, Horticulture Commissioner, Ministry of Agriculture and Farmers Welfare, New Delhi. Dr. K. B. Hebbar, Director, ICAR-CPCRI, formally addressed the gathering and emphasized the significance of the review meeting. It was suggested to expedite experimental work while adhering to global standards and ensuring reproducibility, rigor, and timely completion. The project is expected to generate high-quality, peer-reviewed publications. Additionally, the exploration of other potentially beneficial components of arecanut was encouraged.

Vigilance Awareness Week –Integrity Pledge

The ICAR–CPCRI, Kasaragod, has observed vigilance awareness week from 27 October 2025 to 02 November 2025, as per instructions from the central vigilance commission. To launch the programme, an integrity pledge was administered to the personnel on 27 October 2025 under the chairmanship of Dr. P. Subramanian, Director (I/c), ICAR–CPCRI. The event emphasized the importance of transparency, honesty, and ethical conduct in all dealings. Dr. Jayasekhar S., Principal Scientist (Agrl. Econ.) and Vigilance Officer of the Institute, was the coordinator of the programme.

Vande Mataram Programme

Vande matharam programme was organized on 08 November 2025 at HQ, ICAR- CPCRI, Kasaragod. The vande mataram programme was organized on November 8, 2025, at ICAR-CPCRI as part of the nationwide '150 years of vande mataram' commemoration, involving mass singing and awareness campaigns at headquarters and its regional centers, to celebrate the national song's significance and foster patriotism. This event was a part of a larger, year-long national initiative by ICAR and the Ministry of Culture to honour Bankim Chandra Chatterjee's composition, highlighting its role in India's freedom struggle and promoting national unity and pride. CPCRI's participation reflected the broader spirit of patriotism across all ICAR institutes, with events recorded for the national campaign portal.

World Soil Day- 2025

Kasaragod

ICAR-Central Plantation Crops Research Institute (ICAR-CPCRI) observed world soil day with great enthusiasm, focusing on this year's theme, 'healthy

soils for healthy cities.' The event highlighted the crucial role of soil health in ensuring sustainable urban development and agricultural productivity.

Dr. P. Subramanian, Head, Crop Production and Director In-charge, delivered a detailed talk on soil nutrition and health. He highlighted the direct connection between soil quality and the production of high-quality agricultural products, pointing out that healthy soil is the foundation for good crop yield with better nutritional value. Furthermore, he underscored the significance of soil conservation for both environmental and human welfare.

The chief guest for the occasion was Dr. P.V. Sindhu, Associate Professor of Agronomy at the College of Agriculture, Padanakkad. She engaged in an interactive session with scientists and farmers and delivered an insightful lecture on 'sustainable soil management.' Her presentation emphasized practical approaches to maintaining and improving soil fertility while promoting environmentally friendly agricultural practices.

Following the presentations and interactions, participants joined a field visit to nearby experimental farms/ labs where sustainable soil management practices are being implemented.

An action plan of urban farming includes the development of green infrastructure and initiatives to promote sustainable soil management. Efforts to extend soil health practices to urban environments were strongly encouraged to support the creation of healthy cities.

Fifteen soil health cards were distributed to participating farmers to help them monitor and manage soil fertility effectively in their fields. This initiative aims to empower farmers with scientific data for better crop management decisions.

The event also featured a prize distribution ceremony for students who participated in a drawing competition themed around healthy soil for healthy cities, encouraging the younger generation to appreciate the significance of soil.

The program began with a warm welcome by Dr. Ravi Bhat, who greeted all attendees, including scientists, farmers, students, and staff members. In total, 80 participants were present for the event. The program concluded with a vote of thanks delivered by Dr. V. Selvamani, Principal Scientist and coordinator of the program, who acknowledged the contributions of all participants and organizers in making the event successful.

Fig. 172. Dr. Ravi Bhat, Principal Scientist, Delivering the address

Kayamkulam

Aligning with the global theme 'healthy soils for healthy cities', ICAR–CPCRI, Regional Station, Kayamkulam, in collaboration with ICAR–KVK, Alappuzha, jointly celebrated World Soil Day 2025 with a comprehensive set of academic, outreach, and field-oriented activities. The Chief Guest, Dr. Sam T. Kurumthottical, Retired Professor and Head, Department of Soil Science and Agricultural Chemistry, College of Agriculture, Vellayani delivered an insightful and inspiring talk. He elaborated on soil degradation issues in Kerala, challenges of urbanization and what is actually causing through the activities of urbanization, the results of land-use changes, and the need for continuous soil monitoring. He also narrated real-world examples of soil conservation successes and encouraged students to give more thrust on maintaining a healthy soil. Inter-college quiz, poster and collage competitions were conducted based on the current year theme. A total of 70 registered participants (65 students from four colleges and five interns/apprenticeship trainees) and staff members of Regional Station, Kayamkulam and ICAR-KVK, Alappuzha participated in the programme.

Fig. 173. World Soil Day is celebrated in

Kahikuchi

The world soil day was conducted on 05 December 2025 at Research Centre, Kahikuchi, Guwahati-17, Assam. About 50 participants from Maithabari, Uttar Kachi, Subankhata and Jamatapur from Baksa and Baliguri as well as adjoining areas from Baksa and Nalbari district took part in the programme. Dr. K. Ponnusamy, Principal Scientist, Head, Social Science highlighted the importance of soil in agriculture, soil testing and the importance of

macro and micronutrients in soil. Further, he stated that about 94% of food comes from soil and proper soil fertility management can enhance the income of farmers to the tune of 20-30 %. Dr. Alpana Das, Principal Scientist and Scientist in-charge of the Centre mentioned the problems of soil in Assam and the need for reclaiming the soil with proper management strategies. Dr. L. S. Singh, Coordinator of the programme highlighted the theme of this year's world soil day healthy soils for healthy cities. During the question-answer session, participants enquired about nut fall, acidic soil management in arecanut, site selection for growing coconut and arecanut, spoilage of endosperm in coconut without any outside visible symptoms and other management practices. Later, arecanut seedlings and literature related to arecanut cultivation were distributed to all the participants. It was also assured to the farmers that the scientific team from the centre will visit their fields for diagnosis of problems and advisory services on next day 06 December 2025.

Fig. 174. Glimpses of World Soil Day celebrated in Kahikuchi

Installation of Radar facility by Indian Coast Guard

Indian Coast Guard has taken over 25 cents of land on lease by the seashore at Kasaragod to establish a coastal surveillance network by establishing Radar facility, in collaboration with ICAR-CPCRI. ICG Commandant has signed a MoU with the Director, ICAR-CPCRI on 24 September 2025 to initiate commissioning of the facility.

Fig. 175. Dr. K.B. Hebbar, Director, ICAR-CPCRI exchanging MoU with Commandant, Coast Guard of India

Library and Information Centre

The ICAR-CPCRI Library and Information Centre, in keeping with its mission to acquire, organize, preserve, and disseminate information on the plantation crops coconut, arecanut, cocoa, and palmyra, holds a rich collection of resources catering to the information requirements of the scientific, technical, and administrative staff of the institute; the researchers from universities; undergraduate and postgraduate students; industries on plantation crops; and other related organizations.

The library operations are automated with Koha (ver. 16.05.05.000), an open-source integrated library system. The collection is barcoded for easy retrieval and housed in a spacious building with high-speed internet connectivity and sufficient independent nodes to cater to the demands of our clientele.

Services like Koha OPAC, CPCRI Digital Repository, and One Nation One Subscription (ONOS). ICAR-CPCRI has the IP-based accessibility of ONOS since March 2025 with the AISHE (All India Survey of Higher Education) code R-10160.

Library Holdings 2025

Station	Database/ Journal subscription			Books	Back volumes	Other publications
	Online database	Foreign Journals	Indian Journals			
Kasaragod	1	1	23	11947	13364	8210
Kayamkulam	-	-	-	3584	3255	3976
Vittal	-	-	-	5312	5801	3052
Mohitnagar	-	-	-	537	-	15
Kahikuchi	-	-	-	134	-	-

XXIII

Budget and Expenditure

The Budget and Expenditure for the period
1 April 2025 to 31 March 2026

(Figures in Rupees Lakhs)

Budget Head	**Plan Expenditure**
Revenue	
Estt. Charges	3229.1
OTA	Nil
Pension	4651.06
TA	65.52
Research & Operational expenses	491.34
Works: Repair & Maintenance	
Office Buildings	59.61
Residential Buildings	18.72
Minor Works	27.67
Other Administrative Charges	30.90
Total	**8573.92**
Miscellaneous Expenses (including HRD)	13.58
Tribal Sub Plan - General	15.00
Scheduled Cast/ Scheduled Tribe-General	65.00
NEH General	204.50
Total	**298.08**
Total	**8872.00**
Capital	
Equipments	73.89
Information Technology	7.53
Library	1.50
Furniture & Fixtures	16.77
Livestock	Nil
Works	89.61
Minor Work	15.00
NEH Capital	28.12
Total	**232.42**
TOTAL	**9104.42**

Other Projects

	Opening Balance	Receipts	Expenditure	Refund
Other Plan Schemes	2914.678	144073120	146596300	3262678
Deposit Schemes (Externally funded)	41756156	23061749	33977413	—
KVK, Kasaragod	1590489	21029373	22302856	343631
KVK, Alappuzha	1291844	26155914	34366545	—

Revenue receipts

Head	Achievement
Income from sales/ services (Schedule-8)	269.51
Fee/Subscription (Schedule-10)	2.56
Income from Royalty, Publication etc. (Schedule-12)	0.01
Other Income (Schedule-14)	23.78
STD Interest	Nil
Recoveries on Loans & Advances	5.57
TOTAL	301.43

Weather Data

Headquarters, Kasaragod

Month	Temp.		RH (%)		Wind velocity (km/h)	Sunshine (h/day)	Evaporation (mm)	Rainfall (mm)	Rainy days
	Max ^{0}C)	Min ^{0}C)	FN	AN					
January	33.5	21.3	75.5	59.8	-	7.7	3.4	0.02	0
February	33.9	23.1	80.9	62.2	-	8.0	4.1	0	0
March	34.3	24.2	80.2	63.4	-	6.6	4.1	0	0
April	34.0	24.8	81.1	71.6	-	7.0	4.1	89.3	4
May	32.9	24.6	87.0	81.9	-	5.2	3.6	1020.1	17
June	30.6	23.9	89.9	86.9	-	2.1	3.3	1002.4	23
July	29.1	22.9	92.4	86.4	-	0.6	2.0	1360.2	31
August	29.4	23.2	90.6	83.5	-	1.9	4.3	594.2	19
September	30.9	23.6	86.0	78.1	-	3.7	3.7	290.3	19
October	31.9	23.7	86.4	74.8	-	4.8	3.5	281.3	16
November	32.5	22.7	85.7	67.9	-	7.3	3.0	97.2	3
December	33.6	20.4	79.7	66.2	-	7.3	3.1	1.3	0

Regional Station, Kayamkulam

Month	Temp.		RH (%)		Wind velocity (km/h)	Sunshine (h/day)	Evaporation (mm)	Rainfall (mm)	Rainy days
	Max ^{0}C)	Min ^{0}C)	FN	AN					
January	34.2	24.1	86.9	66.4	0.2	8.8	4.0	0.0	0
February	33.4	24.3	95.8	72.5	2.0	9.8	4.4	6.8	1
March	34.2	24.2	95.5	70.8	1.0	9.8	4.2	46.6	4
April	33.4	24.3	95.3	72.0	4.8	9.6	4.1	112.2	12
May	33.7	24.3	95.5	72.4	9.5	8.5	4.0	431.7	14
June	32.2	24.1	94.5	72.1	11.0	8.0	3.8	550.4	22
July	31.7	24.4	95.4	72.0	9.8	7.8	3.7	538.5	25
August	31.1	24.4	96.2	72.5	13.5	8.6	4.1	228.4	16
September	31.2	24.3	95.1	73.5	9.5	8.1	3.9	205.4	10
October	30.8	24.4	95.7	71.3	9.0	6.5	3.6	352.7	15
November	32.0	23.8	94.9	71.6	2.4	6.5	3.9	194.7	08
December	32.5	22.6	95.2	71.3	0.6	5.2	3.6	31.2	02

Regional Station, Vittal

Month	Temp.		RH (%)		Wind velocity (km/h)	Sunshine (h/day)	Evaporation (mm)	Rainfall (mm)	Rainy days
	Max ^{0}C)	Min ^{0}C)	FN	AN					
January	34.3	17.1	90	37	1.5	7.2	3.5	0	0
February	35.3	19.6	92	38	1.9	7.2	4.3	0	0
March	36.1	22.2	93	49	2.5	6.3	4.2	14	0
April	35.6	22.7	89	54	2.5	5.6	4.3	60	3
May	34.2	22.6	94	65	2.3	5.2	3.6	740.3	13
June	30.3	22.3	96	83	2.3	2.0	1.5	811.3	22
July	28.4	22.1	98	89	1.5	2.6	1.0	1252	27
August	28.6	21.8	97	84	2.2	2.3	1.9	569.8	26
September	31.3	22.1	93	67	2.1	3.1	2.9	401	17
October	33.4	22.4	90	58	2.1	5.2	3.4	282	9
November	34.8	21.4	93	49	2	5.9	3.8	37	2
December	34.2	19.1	93	49	2	6.0	3.2	0	0

Research Centre, Kidu

Month	Temp.		RH (%)		Wind velocity (km/h)	Sunshine (h/day)	Evaporation (mm)	Rainfall (mm)	Rainy days
	Max ^{0}C)	Min ^{0}C)	FN	AN					
January	35.0	17.7	84.9	45.6	0.1	8.1	4.6	0.0	0.0
February	36.6	17.9	83.5	53.3	0.2	8.2	5.7	0.0	0.0
March	36.9	22.8	81.8	46.9	0.5	7.1	6.1	21.6	1.0
April	34.4	23.7	87.5	59.6	0.3	5.5	4.5	75.0	13.0
May	32.4	23.3	91.4	74.4	0.3	4.1	2.8	776.2	19.0
June	28.7	22.7	99.2	86.9	0.2	1.3	1.9	904.9	27.0
July	26.7	21.8	99.2	95.5	0.2	0.1	0.1	1275.2	31.0
August	28.3	22.1	99.2	89.4	0.1	0.4	0.5	851.2	30.0
September	29.2	22.4	99.1	88.0	0.1	1.2	1.8	594.2	25.0
October	32.1	22.0	97.1	79.7	0.0	3.0	4.5	317.4	22.0
November	33.6	20.2	92.6	63.6	0.0	5.9	3.8	47.0	5.0
December	33.7	17.3	91.9	54.5	0.0	6.1	4.9	0.0	0.0

XXV

राजभाषा कार्यान्वयन 2025

हिंदी पखवाड़ा समारोह

संस्थान में 14 से 29 सितंबर 2025 तक हिंदी पखवाड़ा उत्साहपूर्वक मनाया गया। सभी कार्यालयों के लिए हिंदी पखवाड़ा 2025 का संयुक्त उद्घाटन 14 सितंबर 2025 को गुजरात के गांधीनगर में माननीय गृह मंत्री द्वारा किया गया।

हिंदी पखवाड़े का समापन समारोह 29 सितंबर 2025 को निदेशक महोदय की अध्यक्षता में आयोजित किया गया, जिसमें श्रीमती भ्रमराम्बिका आर. के., शिक्षिका, एस.जी.के. हाई स्कूल, आर.डी. नगर, कुडलु, मुख्य अतिथि के रूप में उपस्थित रहीं।

अपने संबोधन में निदेशक महोदय ने सभी से हिंदी को अपनाने तथा अनुसंधान उपलब्धियों को विकास में रूपांतरित कर भारत को विश्वगुरु बनाने का आह्वान किया। मुख्य अतिथि ने राष्ट्र को एक सूत्र में बाँधने में हिंदी की भूमिका पर प्रकाश डाला तथा स्वच्छता के महत्व पर बल दिया। उन्होंने विभिन्न प्रतियोगिताओं के विजेताओं को पुरस्कार एवं प्रमाण पत्र भी वितरित किए।

हिंदी पखवाड़े के दौरान 16 से 26 सितंबर 2025 तक विभिन्न प्रतियोगिताओं का आयोजन किया गया, जिनमें कर्मचारियों एवं प्रशिक्षुओं ने उत्साहपूर्वक भाग लिया।

इसके अतिरिक्त, 22 सितंबर 2025 को एक हिंदी मल्टीमीडिया कार्यशाला का आयोजन किया गया, जिसमें सहज कृषि (प्राकृतिक खेती) पर आधारित एक फीचर फिल्म का प्रदर्शन किया गया, जिससे कर्मचारियों को कृषि से संबंधित हिंदी शब्दावली से परिचित कराया जा सके।

चित्र.176. कर्मचारियों को सम्बोधित करते हुए श्रीमती भ्रमराम्बिका

राजभाषा कार्यशाला

भाकृअनुप-केंद्रीय रोपण फसल अनुसंधान संस्थान, कासरगोड़ में 27 फरवरी 2025 को 'संस्थान में राजभाषा कार्यान्वयन की रणनीतियाँ' विषय पर एक कार्यशाला का आयोजन किया गया। इस कार्यशाला की अध्यक्षता निदेशक डॉ. के. बालचंद्र हेब्बार ने की। अपने उद्घाटन भाषण में उन्होंने सुझाव दिया कि कंप्यूटर का उपयोग करके नमूने तैयार करने, संस्थान की वेबसाइट पर उपलब्ध प्रपत्रों का उपयोग करने, तकनीक का प्रभावी ढंग से प्रयोग करने आदि के माध्यम से कार्य में हिंदी के प्रयोग का प्रतिशत बढ़ाया जाए।

अपने प्रारंभिक वक्तव्य में मुख्य वित्त एवं लेखा अधिकारी श्री राम अवतार पराशर ने उपलब्ध पदों के अनुवाद का उपयोग कर राष्ट्रीय एकता को सुदृढ़ करने, अधिनियमों के अनुपालन तथा राजभाषा के माध्यम से कार्य करने के लिए कुछ सुझाव दिए। उन्होंने कार्यालय में व्यवहार में लाए जा सकने वाले कुछ व्यावहारिक तरीकों की भी जानकारी दी।
इस कार्यक्रम में कुल 60 कर्मचारियों ने भाग लिया।

नगर राजभाषा कार्यान्वयन समिति के कार्यक्रम

संस्थान के संबद्ध अधिकारी नराकास, कासरगोड़ की बैठकों में निश्चित रूप से भाग ले रहे हैं। इन में मुख्यतः 25 नवंबर 2025 को आयोजित नगर राजभाषा कार्यान्वयन समिति (TOLIC) के संयुक्त हिंदी कार्यक्रम में चार अधिकारियों भाग लिया । इस में श्री अश्विन रघुनाथ, सहायक ने हिंदी गीत प्रतियोगिता में तीसरा स्थान प्राप्त कर सफल रहे।

भाकृअनुप
ICAR

भाकृअनुप
ICAR

हर कदम, हर डगर
किसानों का हमसफर
भारतीय कृषि अनुसंधान परिषद

Agrisearch with a human touch