

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना  
ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

# वार्षिक प्रतिवेदन

**ANNUAL REPORT**

**2022**

परियोजना समन्वयकर्ता  
डा. टी.एन. रविप्रसाद

PROJECT COORDINATOR  
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## प्राक्कथन

यह, अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 38 वीं वार्षिक प्रतिवेदन है। यह प्रतिवेदन में जनवरी – 2022 से दिसम्बर – 2022 तक का शोध परिणाम और अन्य जानकारी को शामिल किया गया है।

परियोजना के अंतर्गत 14 केंद्र हैं, जैसे, भारत के पूर्वी तट में चार; बापट्ला (आंध्र प्रदेश), भुवनेश्वर (उड़ीसा), झारग्राम (प.बंगाल) और वृद्धाचलम् (तमिल नाडु); पश्चिम तट पर तीन केंद्र और एक उपकेंद्र जैसे, माडकतरा (केरळ), पिलिकोड उपकेंद्र (केरळ) तथा वेंगुर्ला केंद्र (महाराष्ट्र); नवसारी (गुजरात); मैदानी भाग में तीन केंद्र, एक चिंतामणि (कर्नाटका), दूसरा जगदलपुर (छत्तीसगड) तीसरा दारीसई (झारखण्ड) में स्थित हैं और इस परियोजना का अनुसंधान कार्यसूची को कार्यान्वयन करते हैं।

इस के अतिरिक्त 3 सहयोगी केंद्रों भी परियोजना के अंतर्गत कार्य कर रहे हैं। अरबावी (कर्नाटका), बारापानी (मेघालया) और गोवा में एक – एक केंद्र हैं।

विभिन्न अनुसंधान परियोजनाएँ, प्रमुख विषयानुसार जैसे जनन द्रव्य संग्रहण एवं फसल सुधार, फसल प्रबंधन और फसल संरक्षण जारी हैं। हर एक केन्द्र द्वारा दी गई परिणामों को संकलित कर यह प्रतिवेदन में प्रस्तुत किया गया है। इस प्रतिवेदन में दो प्रमुख अध्याय हैं, एक है, परियोजना और क्षेत्रीय तौर पर प्राप्त प्रायोगिक उपलब्धियों की तकनीकी जानकारी और दूसरा है इतिहास, कर्मचारियों की विवरा, वित्तीय प्रावधान, मौसम की आँकड़ें, शोध प्रकाशन से संबंधित संस्थानीय जानकारी।



[ टी.एन. रविप्रसाद ]

प्रभारी निदेशक एवं परियोजना समन्वयकर्ता

स्थान : पुत्तूर

दिनांक : 1.2.2023

## ABOUT THIS REPORT

This is the thirty eighth Annual Report of the All India Coordinated Research Project on Cashew. This report covers the research results and other information pertaining to the period from January 2022 to December 2022.

There are a total of fourteen centres ie., four in the East Coast of India, namely, Bapatla (Andhra Pradesh); Bhubaneswar (Odisha); Jhargram (West Bengal) and Vridhachalam (Tamil Nadu), four centres in the West Coast, namely, Madakkathara (Kerala) and Pilicode (Kerala) (Sub centre); Vengurla (Maharashtra), Navsari (Gujarat) and one each in Plains Region, namely, Hogalagere (Karnataka), Jagdalpur (Chhattisgarh) and Darisai (Jharkhand) which are implementing the research programmes. Besides, 3 cooperating centres are also functioning under AICRP-Cashew one each in Arabhavi (Karnataka), Barapani (Meghalaya) and Goa.

There are various ongoing research projects under major theme areas such as Germplasm Conservation and Crop Improvement, Crop Management and Crop Protection. The results reported by each centre are compiled region-wise and theme-wise and presented in this report. This report consists of two major chapters ie., Technical consisting of project wise and region wise experimental results from different centres and Organisation consisting of history, staff, budgetary provisions, functioning, meteorological data and research publications.



**[ TN RAVIPRASAD ]**

DIRECTOR & PROJECT COORDINATOR (ACTING)

Puttur

Dated : 1.2.2023

## INTRODUCTION

The All India Coordinated Spices and Cashewnut Improvement Project (AICS & CIP) was started during the fourth five-year Plan in 1971. The AIC & CIP had five centres (four University Centres and one ICAR Institute based centres) identified for conducting research on cashew. These centres were located at Bapatla (Andhra Pradesh), Vridhachalam (Tamil Nadu), Anakkayam (Kerala) (Later shifted to Madakkathara), Vengurla (Maharashtra) and CPCRI, Regional Station, Vittal (Karnataka). During the fifth Plan period, one centre at Bhubaneswar (Orissa) and in sixth plan period two centres one at Jhargram (West Bengal) and another at Chintamani (Karnataka) were added. During VIII Plan period one centre at Jagdalpur (Chhattisgarh) and a Sub Centre at Pilicode (Kerala) was started. During the period of XI plan, two new centres were added – one in Paria in Gujarat in 2009 and another in Darisai in Jharkhand in 2010. Further three co-operating centres are also functioning under AICRP-Cashew at Arabhavi, Barapani and Goa since 2009.

The Headquarters of the project was located at Central Plantation Crops Research Institute, Kasaragod. During the Seventh Plan period, the project was bifurcated into:

1. All India Coordinated Cashew Improvement Project and
2. All India Coordinated Spices Improvement Project.

The headquarters of the independent cashew project was shifted to National Research Centre for Cashew, Puttur in 1986. Presently, there are ten coordinating Centres and one sub-Centre, four in the East Coast viz., Bapatla, Bhubaneswar, Jhargram, Vridhachalam, four in the West Coast viz., Pilicode, Madakkathara, Vengurla, Paria and three centres, one each in the plains region at Hogalagere in Karnataka, at Jagdalpur in Chhattisgarh and at Darisai in Jharkhand and three co-operating centres.

The objective of the Project was to increase production and productivity through:

1. Evolving high yielding varieties with good kernel quality and tolerance to biotic and abiotic stresses.
2. Standardizing agro techniques for the crop under different agro-climatic conditions;
3. Evolving cost effective and efficient pest and disease management practices.

# CHAPTER 1: TECHNICAL

## परियोजना समन्वयकर्ता की रिपोर्ट

डॉ. जे. दिनकर अडिग

निदेशक, आईसीएआर-डीसीआर और परियोजना समन्वयकर्ता, एआईसीआरपी-काजू

मुझे परियोजना समन्वयकर्ता की रिपोर्ट प्रस्तुत करते हुए खुशी हो रही है। काजू पर एक स्वतंत्र अखिल भारतीय समन्वित अनुसंधान परियोजना वर्ष 1986 में स्थापित की गई थी, जिसका मुख्यालय पुत्र में राष्ट्रीय काजू अनुसंधान केंद्र में था, जिसे वर्ष 2009 के दौरान आईसीएआर-काजू अनुसंधान निदेशालय का नाम दिया गया था। वर्तमान में, काजू पर एआईसीआरपी है 14 केंद्र पूरे देश में पूर्वी तट, पश्चिमी तट और मैदानी क्षेत्रों में फैले हुए हैं।

काजू पर एआईसीआरपी के केंद्रों के साथ-साथ काजू पर काम करने वाले अन्य केंद्रों ने अब तक विभिन्न कृषि-पारिस्थितिकी-क्षेत्रों में व्यावसायिक खेती के लिए 34 उच्च उपज वाली काजू किस्मों को विकसित किया और जारी किया है। इन किस्मों की उत्पादन क्षमता बहुत अच्छी है और इन्होंने देश में कच्चे काजू के उत्पादन को बेहतर बनाने में महत्वपूर्ण भूमिका निभाई है। एआईसीआरपी केंद्र पोषक तत्वों की आवश्यकता, सिंचाई और उच्च और अति उच्च घनत्व रोपण प्रणाली जैसे फसल प्रबंधन पहलुओं पर काम कर रहे हैं। वे मौसमी विविधताओं के संबंध में उनकी गणना के अलावा टीएमबी और सीएसआरबी जैसे कीटों के प्रबंधन पहलुओं पर भी काम करते हैं और महत्वपूर्ण उपलब्धियां हासिल की हैं।

मैं वर्ष 2022 के दौरान किए गए कार्यों के कुछ प्रमुख परिणामों पर प्रकाश डालना चाहूंगा।

### फसल सुधार

विभिन्न केंद्रों पर संरक्षित कुल जर्मप्लाज्म अक्सेशन 1417 है। वर्ष के दौरान विभिन्न केंद्रों द्वारा कुल 35 नए जर्मप्लाज्म अक्सेशन एकत्र किए गए हैं। जहां तक जर्मप्लाज्म अक्सेशन के मूल्यांकन का सवाल है, वर्ष के दौरान, विभिन्न केंद्रों द्वारा उपज और उपज के गुणों के

लिए 195 परिग्रहणों का मूल्यांकन किया गया है। वेंगुर्ले केंद्र में बिना सीएनएसएल के बीज का परीक्षण प्रगति पर है, जहां पाक प्रयोजनों के लिए नरम काजू की मांग है। जारी किस्मों के प्रदर्शन परीक्षण में, बापटला और दारीसाई में बीपीपी-8, होगलागेरे में वी-7 और जगदलपुर में वी-4 को बेहतर पाया गया।

संकरण और चयन पर परीक्षण में, विभिन्न केंद्रों पर कुल 391 F1 संतानों का मूल्यांकन किया गया और कई आशाजनक प्रकारों की पहचान की गई। जगदलपुर, वेंगुर्ला, मडक्कथारा, गोवा, वृद्धाचलम, भुवनेश्वर और झाड़ग्राम में 32 नए क्रॉस संयोजन विकसित किए गए, जिसके परिणामस्वरूप 608 एफ1 संतानें मिलीं। एक तीव्र क्लोनल हाइब्रिड मूल्यांकन परीक्षण, जिसका उद्देश्य आशाजनक जर्मप्लाज्म अक्सेशन से वांछनीय लक्षण लाना है, भुवनेश्वर, मडक्कथारा, वृद्धाचलम और वेंगुर्ला केंद्रों में प्रगति पर है। इसके अलावा, दस केंद्रों में होनहार बोल्ड नट, बड़े आकार के सेब के प्रकार और उच्च उपज देने वाले काजू जीनोटाइप के मूल्यांकन पर परीक्षण प्रगति पर है। काजू में बौने जीनोटाइप पर परीक्षण वर्ष 2022 में चार केंद्रों - वेंगुर्ला, मडक्कथारा, पिलिकोड और कनबर्गी में शुरू किया गया है। अन्य छह केंद्रों में, यह 2023 के दौरान शुरू होने जा रहा है।

### **फसल प्रबंधन**

काजू में उपज अधिकतमकरण के लिए पोषक तत्व प्रबंधन पर परीक्षण में, एफवाईएम के साथ उर्वरकों की अनुशंसित खुराक और प्रमुख और छोटे पोषक तत्वों के पत्तेदार स्प्रे ने बुभानेश्वर और होगलागेरे में सर्वोत्तम परिणाम दिए। ड्रिप सिंचाई परीक्षण में, जगदलपुर केंद्र में 80% संचयी पैन वाष्पीकरण पर सिंचाई सर्वोत्तम पाई गई। उच्च घनत्व वाले काजू बागान प्रयोग में उर्वरक अनुप्रयोग में, 10 मीटर x 5 मीटर की दूरी और 225 किलोग्राम एन: 75 पी2ओ5 और 75 किलोग्राम के2ओ प्रति हेक्टेयर पर होगलागेरे केंद्र में उच्चतम उपज दर्ज की गई।

बापटला में इंटरक्रॉप गेंदा, दारिसाई में हल्दी, झारग्राम में क्लस्टरबीन, जगदलपुर में कोलाकेसिया, वृद्धाचलम में अफ्रीकी गेंदा, कानाबर्गी में गेलार्डिया, मडक्कथारा में एरोरूट, पारिया में धनिया, वेंगुरले केंद्रों में यार्ड लॉन्ग बीन ने इंटरक्रॉपिंग प्रयोग में सबसे अधिक शुद्ध रिटर्न दिया। जैविक प्रबंधन परीक्षण में, वर्मीकम्पोस्ट और जैव उर्वरक के रूप में 100% एन ने बापटला केंद्र में सबसे अधिक अखरोट की उपज दी, जबकि 10 किलोग्राम एफवाईएम के साथ उर्वरक की अनुशंसित खुराक ने दारिसाई में लागत अनुपात में सबसे अधिक लाभ दिया। हालाँकि, FYM के रूप में 25% N + जैविक अवशेषों का पुनर्चक्रण + यथास्थान हरी खाद + जैव-उर्वरक (200 ग्राम) होगलागरे में सबसे अच्छा उपचार था।

इसके अलावा, बापटला, भुवनेश्वर, झारग्राम, मडक्कथारा और वेंगुर्ले केंद्रों में अति-उच्च-घनत्व रोपण पर परीक्षण प्रगति पर है। वेंगुर्ला केंद्र में, चौथे वर्ष में 3 मीटर x 3 मीटर की दूरी (2.68 टन/हेक्टेयर) और किस्म वी-9 (2.71 किलोग्राम/पेड़) बेहतर पाई गई। भुवनेश्वर में, तीसरे वर्ष में एनआरसीसी सिलेक्शन-2 किस्म के साथ 2.5 मीटर x 2.5 मीटर में उच्चतम उपज दर्ज की गई। झारग्राम में, एनआरसीसी चयन-2 ने चौथे वर्ष में सभी रिक्तियों में सर्वश्रेष्ठ प्रदर्शन किया। विभिन्न किस्मों की छंटाई प्रतिक्रिया पर परीक्षण पांच केंद्रों में शुरू किया गया है। वृद्धाचलम और होगलागरे केंद्रों में सितंबर में 25% पार्श्व छंटाई में सबसे अधिक उपज देखी गई। मडक्कथारा और वेंगुर्ला केंद्रों में, अगस्त महीने के दौरान 25% लीडर प्रूनिंग में सबसे अधिक उपज देखी गई।

### फसल सुरक्षा

एल-साइहेलोथ्रिन (0.6 मिली/लीटर) जगदलपुर, वेंगुर्ला, कानाबर्गी और वृद्धाचलम केंद्रों में टीएमबी, शूट टिप कैटरपिलर, सेब और अखरोट छेदक और पत्ती खनिक और थिक्लोप्रिड (1.5 मिली/लीटर) के खिलाफ अन्य कीटनाशकों की तुलना में अधिक प्रभावी पाया गया। मडक्कथारा में, हालाँकि, बुप्रोफेज़िन को पारिया सेंटर में प्रभावी पाया गया। जहां तक

वनस्पति विज्ञान का सवाल है, एज़ाडिरेक्टिन 1% (1 मिली/लीटर) होगलागेरे और कानाबर्गी में, धतूरा मेटल काढ़ा @ 5% जगदलपुर में, नीम के बीज की गिरी का अर्क @ 5% पिलीकोड में, एकोरस कैलमस @ 2% मदक्कथारा में प्रभावी पाया गया। , वेंगुर्ला में वानस्पतिक सूत्रीकरण AAVYA (4 ग्राम/लीटर), वृद्धाचलम में एडाथोडा, धतूरा, विटेक्स, कैलोट्रोपिस और नीम की संयुक्त पत्ती के अर्क का छिड़काव गैर-लक्षित जीवों के लिए कम से कम विषाक्तता के साथ टीएमबी के खिलाफ प्रभावी पाया गया।

जहां तक काजू के तने और जड़ छेदक का सवाल है, मदक्कथारा, वेंगुर्ला और होगलागेरे केंद्रों में फिप्रोनिल (2 मिली/लीटर) प्रभावी पाया गया। हालाँकि वृद्धाचलम और जगदलपुर केंद्रों में, क्लोरोपाइरीफॉस 10 मिली/लीटर प्रभावी था। दूसरी ओर, बापटला केंद्र में इमिडाक्लोप्रिड (2 मिली/लीटर) प्रभावी था।

### **प्रौद्योगिकी का स्थानांतरण**

एआईसीआरपी के समन्वय केंद्र प्रौद्योगिकी हस्तांतरण गतिविधियों में भी शामिल हैं और 2022 के दौरान लगभग 2.02 लाख काजू ग्राफ्ट का उत्पादन किया है जो काजू किसानों, सरकारी और गैर-सरकारी संगठनों को वितरित किए गए थे। आवश्यक तकनीकी मार्गदर्शन के बैकअप के साथ नवीनतम उत्पादन तकनीकों का प्रसार करने के लिए विभिन्न केंद्रों द्वारा फ्रंटलाइन प्रदर्शन प्लॉट तैयार किए गए हैं। उल्लेखनीय है कि काजू पर एआईसीआरपी के केंद्रों ने एससीएसपी, टीएसपी और अन्य कार्यक्रमों के तहत काजू की खेती और प्रबंधन प्रथाओं के विभिन्न पहलुओं पर 19 प्रशिक्षण कार्यक्रम आयोजित किए हैं, जिसमें 2000 से अधिक किसानों ने भाग लिया है।

मुझे पूरी उम्मीद है कि एआईसीआरपी-काजू के सभी वैज्ञानिक अपने केंद्रों के लिए अनुमोदित तकनीकी कार्यक्रमों के साथ-साथ इस वार्षिक समूह बैठक में लिए गए निर्णयों को ईमानदारी से लागू करेंगे। मैं माननीय उप महानिदेशक (बागवानी) डॉ. ए.के. सिंग के प्रति अपनी गहरी कृतज्ञता व्यक्त करना चाहता हूँ। सिंग और डॉ. वी.बी. पटेल, सहायक महानिदेशक (फल और रोपण फसलें) को परिषद की ओर से उनके निरंतर मार्गदर्शन और समर्थन के लिए धन्यवाद।

अपनी रिपोर्ट समाप्त करने से पहले, मैं काजू पर एआईसीआरपी के समन्वय केंद्रों के अपने सभी वैज्ञानिक सहयोगियों, अनुसंधान निदेशकों, डीन और अन्य विश्वविद्यालय प्राधिकारियों को उनके संबंधित केंद्रों में एआईसीआरपी कार्य के प्रभावी कामकाज के लिए सहयोग देने के लिए धन्यवाद देना चाहता हूँ। काजू विस्तार और विकास गतिविधियों के संचालन में निदेशक, डीसीसीडी-कोचीन, डॉ. वेंकटेश एन. हुबली द्वारा दी गई वित्तीय सहायता और समय पर मदद की कृतज्ञतापूर्वक सराहना की जाती है। मैं डीसीआर, पुत्तूर में अपने सहयोगियों विशेष रूप से डॉ. मोहना जी.एस., प्रधान वैज्ञानिक और पीसी सेल के प्रभारी वैज्ञानिक और श्रीमती रेशमा निजी सचिव, जिसने मुझे परियोजना समन्वयक कक्ष का दैनिक कार्य सुचारू रूप से चलाने में सक्षम बनाया है, से प्राप्त सहयोग और तकनीकी सहायता के लिए से धन्यवाद देता हूँ।

# PROJECT CO-ORDINATOR'S REPORT

**Dr. J. Dinakara Adiga**

Director, ICAR-DCR and Project Coordinator, AICRP-Cashew

I am happy to present the Project Coordinator's Report. An independent All India Coordinated Research Project on Cashew was established in the year 1986 with its headquarters at the National Research Centre for Cashew at Puttur, which was renamed as ICAR-Directorate of Cashew Research during the year 2009. At present, AICRP on Cashew has 14 centers spread across the country in east coast, west coast, and plain regions.

The centers of AICRP on Cashew along with other centers working on cashew have so far developed and released 34 high yielding cashew varieties for commercial cultivation in different agro-eco-regions. The production potential of these varieties is very good and they have played a significant role in improving production of raw cashewnuts in the country. The AICRP centers are working on crop management aspects such as nutrient requirement, irrigation and high and ultra high density planting systems. They also work on management aspects of pests such as TMB and CSRB in addition to their enumeration with respect to seasonal variations and made significant achievements.

I would like to highlight some of the salient results of the work done during the year 2022.

## **CROP IMPROVEMENT**

The total germplasm accessions conserved at various centers is 1417. A total of 35 new germplasm accessions have been collected by different centers during the year. As far as evaluation of germplasm accessions is concerned, during the year, 195 accessions for yield and yield attributing characters have been evaluated by different centers. The trial on CNSL free accessions is under progress at Vengurle center where tender cashewnuts are in demand for culinary purposes. In the trial on performance of released varieties, BPP-8 at Bapatla and Darisai, V-7 at Hogalagere and V-4 at Jagadapur were found to be superior.

In the trial on hybridization and selection, a total of 391 F<sub>1</sub> progenies were evaluated at different centers and many promising types are identified. 32 new cross combinations each at Jagadapur, Vengurla, Madakkathara, Goa, Vridhachalam, Bhubaneshwar and Jhargram were developed resulting in 608 F<sub>1</sub> progenies. A rapid clonal hybrid evaluation trial which aims at bringing desirable characters from promising germplasm accessions is under progress at

Bhubaneswar, Madakkathara, Vridhachalam and Vengurle centers. Further, the trial on evaluation of promising bold nut, bigger size apple types and high yielding cashew genotypes is under progress in ten centers. The trial on dwarf genotypes in cashew is initiated in four centers -Vengurla, Madakkathara, Pilicode and Kanabargi in the year 2022. In another six centers, it is going to start during 2023.

### **CROP MANAGEMENT**

In the trial on nutrient management for yield maximization in cashew, recommended dose of fertilizers with FYM and foliar spray of major and minor nutrients gave best results in Bhubaneswar and Hogalagere. In drip irrigation trial, irrigation at 80% cumulative pan evaporation was found to be the best in Jagadpur center. In fertilizer application in high density cashew plantation experiment, 10 m x 5 m spacing and 225 kg N : 75 P<sub>2</sub>O<sub>5</sub> and 75 kg K<sub>2</sub>O per ha recorded highest yield at Hogalagere center.

The intercrop marigold at Bapatla, Turmeric at Darisai, Clusterbean at Jhargram, Colacasia at Jagadpur, African marigold at Vridhachalam, *Gaillardia* at Kanabargi, Arrowroot at Madakkathara, Coriander at Paria, Yard long bean at Vengurle centers gave highest net returns in the intercropping experiment. In organic management trial, 100% N as vermicompost and biofertilizers gave highest nut yield in Bapatla center, whereas recommended dose of fertilizer with 10 kg FYM gave highest benefit to cost ratio in Darisai. However, 25 % N as FYM + Recycling of organic residue + in situ green manuring + Bio-fertilizers (200 g) was the best treatment at Hogalagere.

Further, the trial on ultra-high-density planting is under progress in Bapatla, Bhubaneswar, Jhargram, Madakkathara and Vengurle centers. In Vengurla center, 3 m x 3 m spacing (2.68 t/ha) and variety V-9 (2.71 kg/tree) were found to be superior in the fourth year. In Bhubaneswar, highest yield was recorded in 2.5 m x 2.5 m with NRCC Selection-2 variety in the third year. In Jhargram, NRCC Selection- 2 performed best in all spacings in the fourth year. The trial on pruning response of different varieties is initiated in five centers. The highest yield was observed in 25 % lateral pruning in September in Vridhachalam and Hogalagere centers. In Madakkathara and Vengurla centers, highest yield was observed in 25 % leader pruning during August month.

### **CROP PROTECTION**

L-Cyhalothrin (0.6 ml/litre) found to be more effective compared to other insecticides against TMB, shoot tip caterpillar, apple and nut borer and leaf miner in Jagdalpur, Vengurla, Kanabargi and Vridhachalam centers, and Thiclopid (1.5 ml/l) in Madakkathara. However, Buprofezin was found effective in Paria center. As far as

botanicals are concerned, Azadirachtin 1% (1 ml/l) was found effective at Hogalagere and Kanabargi, *Datura metel* decoction @ 5 % at Jagadapur, Neem seed kernel extract @5% at Pilicode , *Acorus calamus* @2% at Madakkathara, Botanical formulation AAVYA (4g/l) at Vengurla, spraying of combined Leaf extracts of *Adathoda*, *Datura*, *Vitex*, *Calotropis* and Neem at Vridhachalam were found effective against TMB with least toxicity to non target organisms.

As far as Cashew Stem and Root Borer is concerned, Fipronil (2ml/litre) was found to be effective in Madakkathara, Vengurla and Hogalagere centers. However in Vridhachalam and Jagdalpur centers, Chloropyriphos 10ml/litre was effective. On the other hand, Imidachlopid (2ml/l) was effective in Bapatla center.

### **TRANSFER OF TECHNOLOGY**

The coordinating centers of AICRP are also involved in transfer of technology activities and have produced about 2.02 lakh cashew grafts during 2022 which were distributed to cashew farmers, government, and non-government organizations. Frontline demonstration plots have been laid out by different centres to disseminate the recent production techniques with backup of necessary technical guidance. It is worth mentioning that the Centres of AICRP on Cashew have conducted 19 training programmes on different aspect of cashew cultivation and management practices under SCSP, TSP and other programs in which more than 2000 farmers have participated.

I sincerely hope that all scientists of AICRP-Cashew will be earnestly implementing the approved technical programmes for their centres as well as, the decisions that are taken in this Annual Group Meeting. I would like to express my deep sense of gratitude to the Hon'ble Deputy Director General (Hort.) Dr. A.K. Singh and Dr. V.B Patel, Assistant Director General (Fruits and Plantation crops) for their continued guidance and support from the Council.

I would like to thank all my scientist colleagues of the coordinating centres of AICRP on Cashew, Directors of Research, Deans and other University authorities for extending cooperation for the effective functioning of the AICRP work in their respective centres. The financial assistance and timely help extended by Director, DCCD-Cochin, Dr. Venkatesh N. Hubballi in conducting cashew extension and development activities is gratefully acknowledged. I sincerely acknowledge the cooperation and technical support received from my colleagues at DCR, Puttur particularly Dr. Mohana G.S., Principal Scientist & Scientist-in-charge of PC Cell and Mrs. Reshma K., Personal Secretary which has enabled me to smoothly run the day-to-day work of the Project Coordinator's Cell.

## CENTRES OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW



### HEADQUARTERS OF AICRP ON CASHEW

- ▲ **ICAR - Directorate of Cashew Research, Puttur 574 202, Dakshina Kannada, Karnataka**

#### **AICRP on Cashew Centres:**

1. Cashew Research Station, (Dr. YSRHU), Bapatla-522 101, Guntur District, Andhra Pradesh.
2. Cashew Research Station, (OUAT), Bhubaneswar-751 003, Odisha.
3. Zonal Research Station, (BAU), Darisai-832 304, Barakhursi, East Singhbhum Dist., Jharkhand.
4. ICAR - Central Coastal Agricultural Research Institute, Ela, Old Goa, Goa – 403 402.
5. Horticultural Research Station, (UHS), Hogalagere-563 138, Srinivasapura, Kolar Dist., Karnataka.
6. SG College of Agricultural and Research Station, (IGAU), Jagdalpur-494 005, Chattisgarh.
7. Regional Research Station, (BCKV), Jhargram - 721 507, Midnapore West District, West Bengal.
8. Horticultural Research Station, (UHS), Kanabargi – 590 016, Belagavi Dist., Karnataka.
9. Cashew Research Station, (KAU), Madakkathara - 680 651, Thrissur Dist., Kerala.
10. Agricultural Experimental Station (NAU), Paria-396 145, Valsad District, Gujarat.
11. Regional Agricultural Research Station, (KAU), Pilicode - 671 353, Kasaragod District, Kerala.
12. Regional Fruit Research Station, (Dr. BSKKV), Vengurla - 416 516, Sindhudurg Dist., Maharashtra.
13. Regional Research Station, (TNAU), Vridhachalam-606 001, Cuddalore District, Tamil Nadu.

14. ICAR Research Complex for North Eastern Hilly Regions, Tura-794 005, West Garo Hills Meghalaya.

## EXECUTIVE SUMMARY

The total germplasm accessions conserved at various centers is 1417. A total of 35 new germplasm accessions have been collected by different centers during the year.

In the trial on hybridization and selection, a total of 391 F<sub>1</sub> progenies were evaluated at different centers and many promising types are identified. 32 new cross combinations each at Jagadapur, Vengurla, Madakkathara, Goa, Vridhachalam, Bhubaneshwar and Jhargram were developed resulting in 608 F<sub>1</sub> progenies. In fertilizer application in high density cashew plantation experiment, 10 m x 5 m spacing and 225 kg N : 75 P<sub>2</sub>O<sub>5</sub> and 75 kg K<sub>2</sub>O per ha recorded highest yield at Hogalagere center.

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L-Cyhalothrin (0.6 ml/litre) found to be more effective compared to other insecticides against TMB, shoot tip caterpillar, apple and nut borer and leaf miner in Jagdalpur, Vengurla, Kanabargi and Vridhachalam centers, and Thicloprid (1.5 ml/l) in Madakkathara.

As far as botanicals are concerned, Azadirachtin 1% (1 ml/l) was found effective at Hogalagere and Kanabargi, *Datura metel* decoction @ 5 % at Jagadapur, Neem seed kernel extract @5% level at Pilicode , *Acorus calamus* @2% at Madakkathara, Botanical formulation AAVYA (4g/l) at Vengurla, spraying of combined Leaf extracts of *Adathoda*, *Datura*, *Vitex*, *Calotropis* and Neem at Vridhachalam were found effective against TMB with least toxicity to non target organisms. As far as Cashew Stem and Root Borer is concerned, Fipronil (2ml/litre) was found to be effective in Madakkathara, Vengurla and Hogalagere centers. However in Vridhachalam and Jagdalpur centers, Chloropyriphos 10ml/litre was effective.

AICRP centers have conducted 19 training programmes on different aspect of cashew cultivation and management practices under SCSP, TSP and other programs in which more than 2000 farmers have participated.

### Production of Planting Material

A total of 202761 grafts were produced during 2022 and distributed to several government and non-government organizations as well as to cashew farmers. The centre wise production of cashew grafts is given below:

Centre	No. of grafts produced during 2022
Bapatla	40000
Bhubaneswar	15000
Hogalagere	2500
Jagdapur	10500
Jhargram	6000
Kanabargi	8000
Madakkathara	24041
Paria	250
Pilicode	7500
Vengurle	35000
Vridhachalam	52320
Darisai	1650
<b>TOTAL</b>	<b>202761</b>

## **REPORT OF THE ANNUAL GROUP MEETING OF SCIENTISTS OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW - 2022**

The annual group meeting of the AICRP on cashew was held at Dr. YSR Horticulture University, Andhra Pradesh during 19 – 21<sup>st</sup> January 2023. The inaugural session was presided by Dr. T. Janakiram, Vice Chancellor, Dr. YSRHU, AP. The chief guests included Dr. A. K. Singh (Hort.Sci.) (online), Dr. V. B. Patel, ADG (Fruits & Plantation Crops), Dr. J. Dinakara Adiga, Director, ICAR-DCR, Puttur, Dr. M.R. Dinesh, Former Director, IIHR, Bangalore and Dr. P.C. Lenka, Former Professor, OUAT, Bhubaneswar. Issues such as by product utilization, high density planting, quality planting material production, management of TMB were highlighted by the DDG (Hort. Sci.). During the session, an AI based app - Cashew Protect and the database on Beneficial arthropods for cashew pollination developed by ICAR- DCR were released.

The technical session on crop improvement was chaired by Dr. M. R. Dinesh, Former Director of ICAR- IIHR, Bangalore. Recommendations pertaining to germplasm collection, register maintenance, conduct of diversity fairs, registration of germplasm with NBPGR and the progenies to be raised per cross combinations were given. Comprehensive recommendations were also given on various aspects center wise. Two varieties viz, OUAT Kalinga Cashew-1 and Bidhan Bonsai Kaju were presented for varietal release. After thorough discussion, these two varieties were recommended for release by the house.

The session on crop management was chaired by Dr. P.C. Lenka, Former Professor, OUAT, Bhubaneswar. Recommendations pertaining to cashew based cropping system, nutrient management, ultra-high density, and organic management were given center wise. The session on crop protection was chaired by Dr. C.R. Satapathy, ICAR-Emeritus Scientist and Former Professor (Entomology) and Principal Investigator, AICRP on Honey bees and Pollinators, OUAT, Bhubaneswar. Aspects such as regionally important insects and observations to be recorded in insecticide trials were discussed and recommendations were given center wise. Further, a new experiment on pollinators on cashew was approved for execution by 9 centers.

After this, interaction between development departments and research centers was held. This session was chaired by Dr. E. Karunasri, Director of Extension, Dr. YSRHU. During the session, many farmers shared their experiences in cashew cultivation, varieties of cashew, irrigation, pests, and diseases. They also demanded minimum support price for cashew by the state of Andhra Pradesh. Recommendations pertaining to minimum support price, management of pests and diseases, processing of cashew by FPOs were made during the session. The plenary session was chaired by Dr. V.B. Patel, ADG (Fruits and Plantation crops) and the recommendations of each session were presented by the rapporteurs. Many specific recommendations and suggestions were given by the Chairman and the VC of Dr. YSR Horticultural University. The Cashew Research Station, Madakkathara was honoured with the Best AICRP center award for the year 2022.



Inaguration of the AICRP AGM -2022



Participants of the AGM- 2022

# EXPERIMENTAL RESULTS

# CROP IMPROVEMENT

## I. CROP IMPROVEMENT

### Gen 1: Germplasm collection, conservation, evaluation, characterization, and cataloguing

<b>Centres: East Coast :</b>	Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
<b>West Coast :</b>	Goa, Paria, Pilicode, Madakkathara and Vengurle
<b>Plains / others:</b>	Darisai, Hogalagere, Jagdalpur, Kanabargi and Tura

The objectives are:

- To evaluate the existing germplasm of cashew in different centres
- To collect local germplasm material with desirable characters such as high yield, cluster bearing habit, bold sized nuts, duration of flowering, off season flowering types from different cashew growing regions and,
- To establish clonal germplasm conservation blocks in different centres

**Table 1: Cashew germplasm holding in different centres**

Centre	No. of accessions		
	Earlier existing	Collected during 2022	Total
<b>East Coast</b>			
Bapatla	111	5	116
Bhubaneshwar	114	3	117
Jhargram	173	14	187
Vridhachalam	110	-	110
<b>West Coast</b>			
Goa	88	Nil	88
Madakkathara	148	4	152
Paria	11	2	13
Pilicode	104	1	105
Vengurla	321	02	323
<b>Plains tract/others</b>			
Darisai	26	02	28
Hogalagere	87	0	87
Jagdalpur	76	2	76
Kanabargi	4	0	4
Tura	9	0	9
<b>Total</b>	<b>1382</b>	<b>35</b>	<b>1417</b>


## BAPATLA

### Germplasm collection:

During the year 2021-22, 5 new germplasm lines were collected from the Rajavaram (2 nos) village of Koyalagudem Mandal , K Kannapugudem (1no) Village of Buttaya Gudem Mandal west Godavari District, cashew plantation of Forest corporation area of Andhra Pradesh. Scion sticks were collected and grafted.



**1. K Kannapugudem 1:** Apples are red in colour, with big size ( 68 g). TSS is more 11.9<sup>o</sup> Brix. The nuts are bold with nut weight of 9.56 g having shelling percentage of 28.98. The special feature of this genotype is early flowering , fruit set and cluster bearing. Flowering and fruit set was observed during the month of january where there is no flowering in other cashew gardens. It is collected from farmers field namely Bakka

Venkataswami, K Kannapugudem, Buttayagudem Mandal , West Godavari district.

**2 Rajavaram-1:** The cashew germplasm identified on hill top near by Rajavaram. The nut weight is 8.26 g and apple weight is 55.6 g having shelling percentage of 29.23 %. Average yield of the cashew tree is 35 kg per tree . Name of the farmer is Kalidindi yesopu .



**3. Rajavaram-2:** This cashew germplasm is identified on hill top near by Rajavaram. The nut weight is 7.31 g and apple weight is 58.55 g having shelling percentage of 28.27 %.



Bark of the tree is very smooth. Average yield of the cashew tree is 35 kg per tree . Name of the farmer is Chandra Kamamma.

**4. Pullari palem-1 :**  
The plants are medium in height and high yielding type in sea coast ,nut weigh is 8.86 g . Apple is yellow in colour . Canopy is compact. Average

yield of the tree is 35-40 kg. It is collected from farmers field Namely P setty, Pullaripalem , Vetapalem, Bapatla district.

**5. Karedu-1 :**This cashew tree is from cashew plantation of APFDC, AP at Karedu ,singarayakona Mandal of Prakasam Dist. Age of the cashew tree is around 45 years. The average nut yield per tree is 50-60 kg. Nut weight is 8.97g . Apple colour is yellow with weight of 76.45 g.

#### **Germplasm characterization and evaluation:**

Mean nut weight, mean apple weight, shelling percentage and mean annual nut yield per tree was found to be significant. Among the three genotypes, the mean nut weight was found maximum in Gangavaram-1 (9.83g) followed by Gangavaram-2 (9.35g ) and Gangavaram-3 (8.67g ). The maximum mean annual nut yield per tree during the year was recorded in Gangavaram-2 (2.24kg/tree) followed by Gangavaram-1(1.97 kg/tree) and Gangavaram -3 ( 1.65kg/tree). With regard to the mean apple weight, the highest was recorded in Gangavaram -2 (71.3 g) followed by Gangavaram-1 (67.80 g) and Gangavaram-3(61.09g). The shelling percentage was recorded highest in Gangavaram-1 (30.01) followed by Gangavaram-2 (29.86).

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	Gangavaram-1	2019	1.6	21.3	2.2	1.8
2	Gangavaram-2	2019	1.9	22.7	3.4	2.8
3	Gangavaram-3	2019	1.75	26.0	2.65	2.25

**Germplasm conservation:** Three germplasm collected during 2018-19 and planted in gene bank.

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	Gangavaram-1	2019	3rd week of February (Mid)	76	9.83	67.8	30.01	1.97(1st Harvest)	-	Apple colour red and firm
2	Gangavaram-2	2019	3rd week of February (Mid)	75	9.35	71.3	29.86	2.24	-	Bark is smooth
3	Gangavaram-3	2019	1st week of February (Early)	84	8.67	61.09	28.44	1.63	-	

\*Flowering time: It can be mentioned like October (Early) or January (Late) depending on the region's time and its classification



## BHUBANESHWAR

### Details of germplasm collected during the fruiting season 2021-22

Sl.No.	Place of collection	Accession no. assigned	Special features
1.	Village :Gaiguali Block: Puri Dist: Puri	OC 177	The cashew plantation was very close to the sea. Aprox. within 500m from the sea. Germplasm collected may be tolerant/resistant to salinity It's a collection from cashew plantation owned by forest department
2.	Name: Bidyadhra Pradhan Village: Ampulakumpa Block:Jagannatha Prasad Dist: Ganjam	OC 178	Collected from farmers field Age of the plant:15 years(aprox.) Nut yield plant <sup>-1</sup> : 15-20 kg(aprox.) Nut weight: 12-14 g Bold nut and high yield
3.	Cashew Research Station, OUAT, Bhubaneswar Block: Bhubaneswar Dist: Khorda	OC179	This particular genotype was completely free from infestation of thrips and TMB even the adjacent plant was severely affected by thrips and TMB infestation

### Germplasm conservation:

During the fruiting season 2021-2022, three numbers of cashew germplasm were collected and conserved in germplasm block for future use. Hence, the total number of germplasm accessions conserved at the center has been enhanced to 117. A conservation block consisting of core germplasm has also been established on 11.01.2022.



## JHARGRAM

The germplasm accessions were collected in 2018 from morum land observing the bold nut and high yield on hard pan of lateritic soil. The germplasm collected from local areas had

medium size nuts. Among the germplasm JGM- 294 is found to have 6.55g nut weight and 1.85 kg yield per tree in the first year of harvest and therefore found promising among the 4 germplasm accessions.

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	JGM-367	2018	3.5	45.5	4.0	4.6
2	JGM-368	2018	3.4	38.0	3.55	3.4
3	JGM-394	2019	2.1	18.0	2.40	3.45
4	JGM-395	2019	2.85	18.5	2.95	2.75

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	JGM-367	2018	March Late	55	6.50	59.5	29.1	1.5	2.08(2nd Harv)	Tolerant to TMB
2	JGM-368	2018	February middle Mid	64	6.59	43.0	32.0	1.73	2.59 (2nd Harv)	Tolerant to TMB
3	JGM-394	2019	March Late	52	6.55	49.5	25.0	1.87	1.87	High Yields
4	JGM-395	2019	January last Early	85	5.75	54.0	31.7	0.85	0.85	High shelling %

## VRIDHACHALAM

### Germplasm collection:

The germplasm having bold nuts with good yield were collected during 2020 and grafted. The grafted plants were planted during 2021.

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	Modapuli(MP)	2021	1.53	17	1.37	1.32
2	Muthandikuppam(MTK)	2021	1.60	13	1.41	1.80
3	Elavathadi(ELV)	2021	1.73	15	2.25	2.15
4	Muthanai (MI)	2021	1.43	17	1.94	2.44

## GOA

Germplasm collection and maintenance: A field Germplasm bank having 84 germplasm Accessions representing the following groups is maintained.

- Jumbo nut type : 5 accessions
- Bold „ „ : 43 accessions,
- Medium nut and high yielders : 12 accessions
- High yielders / cluster bearers : 22 accessions
- Dwarf canopy types : 2 accessions
- Total germplasm collection : 84 accessions

### b. Evaluation of shortlisted bold nut accessions

Twelve bold nut accessions identified from the Field Germplasm bank were evaluated under a replicated trial along with two checks ( Goa cashew -1 and 2) for 8 harvesting seasons (2010 to 2022). The mean nut size varied from 7.46g (Bardez-8/98) to 11.86g (Tiswadi -3) with higher shelling percentage (>28%) and bigger apple size and higher TSS in most of the accessions.

Table. 1.Per se performance of Nut and apple quality of bold nut accessions( Pooled means)

Sl. No	Genotype	Mean Nut Wt. (g)	Shellin g (%)	Apple Wt (g)	TSS (°B)
1	Valpoi-1	8.28	29.22	76.55	10.22
2	Valpoi-2	11.56	28.86	92.66	9.82
3	Valpoi-3	8.18	28.02	82.54	11.44
4	Bardez-8/98	7.46	28.77	65.44	10.76
5	Bardez-9	9.78	27.21	96.85	12.24
6	Tis-3 (Goa Cashew-2) (C)	11.86	28.18	98.46	10.17
7	Tiswadi-7	7.66	29.24	71.64	9.16
8	Tudal-1	9.34	28.69	86.24	10.44
9	Tudal-3	9.55	28.44	77.64	9.46
10	Mayem-1	8.16	30.24	68.62	12.44
11	BKL-1	8.62	28.14	74.68	10.24
12	BKL-2	8.22	28.46	74.42	11.22
13	FMGDI-1	10.24	28.80	82.64	10.66
14	Goa-1 ( C)	7.74	29.54	72.58	11.82
	Sem +	0.86	0.38	3.62	0.56
	CD at 5%	2.44	1.14	10.85	1.66
	CV	12.46	16.24	12.44	16.84

Long term evaluation results of bold nut accessions led to the identification of an elite accession, Tudal – 1 , which consistently recorded promising performance, with 14.07kg/tree nut yield, followed by 10.72 kg/tree and 9.28kg/tree recorded in Goa Cashew-

1 and Bardez-9 respectively during 2022 season. The cumulative nut yield of 8 harvests of this accession is 56.28kg/tree with 7.03 kg /tree of average nut yield, 9.3g meanut weight , 28.69 % shelling, bigger apple size (86.24g) with higher TSS contents of 10.44 degree Brix. Tudal-1 accessions is short listed for its consistent performance of nut yield and quality, for submitting the variety release proposal for cultivation in the state of Goa. In this trial, Bardez-9 was also observed to be another high yielding promising accession for further confirmation of its shelling percentage.

Table 2. *Per se* nut yield performance of bold nut genotypes for 8 harvesting seasons.

Sl. No	Genotype	Nut yield (Kg/tree)							Cum. Yield (8 yrs)	Av. of 8 yrs
		1 <sup>st</sup> & 2 <sup>nd</sup>	2017	2018	2019	2020	2021	2022		
1	Valpoi-1	1.2	2.40	3.96	5.21	4.82	4.12	5.85	27.56	3.44
2	Valpoi-2	2.8	1.44	3.37	4.86	7.04	5.04	6.60	31.15	3.89
3	Valpoi-3	0.89	2.09	-	4.66	4.15	5.82	8.02	25.63	3.20
4	Bardez-8/98	2.1	4.22	5.33	9.4	7.44	6.86	8.67	44.02	5.05
5	Bardez-9	1.7	3.94	3.89	5.54	8.42	6.89	9.28	39.66	4.95
6	Tis-3 (C)	2.1	1.84	3.77	5.69	7.28	7.64	8.67	36.99	4.62
7	Tiswadi-7	0.89	1.50	2.64	4.44	6.94	5.86	6.78	32.21	4.02
8	Tudal-1	2.4	1.84	5.53	9.88	12.12	10.44	14.07	56.28	7.03
9	Tudal-3	0.9	1.48	3.55	5.88	7.68	7.60	6.67	33.76	4.22
10	Mayem-1	1.6	2.82	3.98	5.45	6.45	6.08	6.02	32.4	4.05
11	BKL-1	1.11	1.47	2.03	4.32	4.62	4.12	5.54	23.21	2.90
12	BKL-2	1.1	1.46	1.22	3.84	4.28	5.04	5.03	21.97	2.74
13	FMGDI-1	1.1	1.75	3.71	5.44	5.65	3.45	5.18	26.83	3.35
14	Goa-1(C)	2.2	3.03	4.19	6.28	8.87	9.67	10.72	44.96	5.62
	Sem ±		0.53	0.73	1.02	1.92	1.82	1.29		
	CD at 5%		1.54	2.18	2.98	5.74	5.58	3.89		
	CV		18.24	20.18	16.54	20.48	18.54	22.58		

## PARIA

**Germplasm collection:** Two cashew germplasm accessions (Vengurla -8 and Vengurla -9) were collected from RFRS, Vengurla. Vengurla-8 collected for the bold nut and Vengurla-9 collected for new one.

**Germplasm characterization and evaluation:**

**Table 3. Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Nut weight	Apple weight.	Shelling %	Nut Yield (kg/tree)	Cumulative Yield	Special features
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			(g)	(g)		(Kg/plant)	
1	NCA-1	2010	9.3	118.2		12.77	Bold nut
2	NCA-2	2010	4.2	38.8		8.59	cluster bearing
3	NCA-3	2010	3.5	27		2.56	cluster bearing
4	NCA-4	2010	5.3	74		9.15	cluster bearing

## PILICODE

### Germplasm collection:

A germplasm accession from Mayyil, Kannur was collected from the farmer's field. The germplasm was collected since it has less CNSL / CNSL free type.

### Germplasm characterization and evaluation:

New trial with a newer set of germplasm has been initiated in 2017. The promising variety from the earlier trial, PLD 4 was also included in the new trial. The observations recorded on plantlets are furnished hereunder. The germplasm showed significant differences in height, girth, spread in both NS and EW directions and canopy area.

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	PLD 83 (Thattukunnu)	2017	2.61	25.89	2.47	2.43
2	PLD 84 (Mannamkund)		2.41	19.28	1.90	1.84
3	PLD 85 (Valiyanadan)		2.19	16.33	1.78	1.71
4	PLD 86 (Kanakakkunnu)		1.41	12.22	1.03	1.05
5	PLD 87 Ponmalapallinadan)		2.51	21.00	2.35	2.28
6	PLD 88 (Kodolipram)		2.60	16.44	1.94	2.00
7	PLD 89 (PA-6)		1.74	14.83	1.25	1.52
8	PLD 90 (AY-M1)		2.22	20.33	1.59	1.64
9	PLD 91 (MCP- New)		2.29	16.17	1.34	1.38
	<b>F Test</b>		<b>**</b>	<b>**</b>	<b>**</b>	<b>**</b>

	<b>SEm</b>		<b>0.25</b>	<b>2.14</b>	<b>0.21</b>	<b>0.11</b>
	<b>CD@ p=0.05</b>		<b>0.74</b>	<b>6.41</b>	<b>0.62</b>	<b>0.33</b>
	<b>CV%</b>		<b>19.17</b>	<b>20.48</b>	<b>20.57</b>	<b>10.83</b>

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	PLD 83 (Thattukunnu)	2017						0.26	0.26	
2	PLD 84 (Mannamkund)							0.26	0.26	
3	PLD 85 (Valiyanadan)							0.26	0.26	
4	PLD 86 (Kanakakkunnu)							0.35	0.35	
5	PLD 87 (Ponmalapallinadan)							0.12	0.12	
6	PLD 88 (Kodolipram)							0.50	0.50	
7	PLD 89 (PA-6)							0.31	0.31	
8	PLD 90 (AY-M1)							0.13	0.13	
9	PLD 91 (MCP- New)							0.18	0.18	
	<b>F Test</b>							<b>**</b>	<b>**</b>	
	<b>SEm</b>							<b>0.04</b>	<b>0.04</b>	
	<b>CD@ p=0.05</b>							<b>0.11</b>	<b>0.11</b>	
	<b>CV%</b>							<b>23.55</b>	<b>23.55</b>	

## MADAKKATHARA

### Germplasm collection:

During the year, four cashew varieties have been collected from various AICRP centers. The cashew varieties, H 130, H 126 and Bhaskara from DCR, Puttur and Bidhan Jhargram-2 from BCKV, Jhargram were collected and planted in the germplasm conservation block of the station.

### Germplasm characterization and evaluation:

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	CRS 160	2013	4.95	85.00	6.45	6.35
2	CRS 161	2013	4.74	85.25	6.72	6.68
3	CRS 162	2013	4.85	77.00	6.60	3.40
4	CRS 163	2013	4.56	71.25	5.72	5.45
5	CRS 164	2013	4.54	76.00	6.57	5.76
6	CRS 166	2013	4.31	68.00	4.86	4.34
7	CRS 167	2013	4.39	68.10	5.52	4.94
8	CRS 168	2013	4.30	77.50	5.15	6.07
9	CRS 169	2013	4.75	70.50	6.22	5.42

10	CRS170	2013	4.05	54.08	5.17	6.80
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**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	CRS 160	2013	Dec (Mid)	91	10.32	56.82	28.88	1.09	*1.09	Bold nut
2	CRS 161	2013	Dec (Mid)	93	7.45	40.13	41.34	1.30	*1.30	High shelling percentage
3	CRS 162	2013	Dec (Mid)	97	6.80	30.00	30.15	1.50	**5.03	High shelling percentage
4	CRS 163	2013	Oct (Early)	106	7.27	37.52	36.73	2.48	**5.4	Early season, High shelling percentage
5	CRS 164	2013	Dec (Mid)	103	6.87	55.23	39.59	2.62	*2.62	High shelling percentage
6	CRS 166	2013	Dec (Mid)	89	14.47	140.92	21.98	1.84	**4.55	Bold nut
7	CRS 167	2013	Dec (Mid)	93	7.04	35.08	28.69	1.07	*1.07	Bold nut
8	CRS 168	2013	Dec (Mid)	89	8.14	34.07	28.75	1.98	**4.59	Bold nut
9	CRS 169	2013	Dec (Mid)	97	9.44	57.53	24.36	1.61	**4.84	Bold nut
10	CRS170	2013	Oct (Early)	109	6.05	32.59	37.69	1.79	**4.39	Cluster bearing type, high shelling percentage

\*Cumulative yield for 1 harvest; \*\* Cumulative yield for 2 harvests

#### Germplasm conservation:

A total of 152 germplasm accessions are conserved in the Gene Bank of the station

## VENGURLA

#### Germplasm collection:

During the year 2022, survey was conducted in Malvan *tehsil* of Sindhudurg district in Maharashtra and collected one germplasm from farmer field having bold nut, compact canopy and high shelling percentage. Another one genotype collected from the farmer field of Changadh area of Kolhapur district in Maharashtra having cluster bearing habit, high yield and medium nut size

#### Germplasm characterization and evaluation:

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	RFRS 196	2011	5.00	49.80	5.05	5.60
2	RFRS 197	2011	4.20	42.00	3.80	3.50
3	RFRS 198	2011	2.80	35.00	3.20	2.70
4	RFRS 200	2016	2.30	19.33	2.27	2.60
5	RFRS 201	2016	3.73	29.33	2.90	2.67
6	RFRS 202	2016	3.36	30.00	3.03	2.53

7	RFRS 203	2016	2.40	18.00	1.90	1.70
8	RFRS 204	2016	2.77	25.00	2.30	1.90
9	RFRS 205	2016	3.07	25.67	2.50	2.63
10	RFRS 206	2016	3.35	28.50	3.65	3.30
11	RFRS 207	2016	3.60	29.00	3.45	2.65
12	RFRS 208	2016	2.93	21.00	1.80	2.10
13	RFRS 209	2017	1.35	14.50	0.65	0.75
14	RFRS 210	2017	1.35	13.00	0.75	0.70
15	RFRS 211	2018	1.97	19.67	1.23	1.01
16	RFRS 212	2018	2.73	28.50	1.83	1.73
17	RFRS 213	2018	2.80	25.75	1.33	1.35
18	RFRS 214	2018	2.43	21.00	1.05	1.03
19	RFRS 215	2018	2.01	18.86	0.80	0.80
20	RFRS 216	2018	1.20	12.50	0.80	0.95
21	RFRS 217	2020	0.60	3.50	0.24	0.26
22	RFRS 218	2020	0.50	3.00	0.17	0.23
23	RFRS 219	2021	0.40	2.50	0.13	0.14

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	RFRS 196	2011	November(Early)	95	7.15	65.00	28.70	2.500	5.900*	High shelling%
2	RFRS 197	2011	November(Early)	94	8.5	70.50	28.25	1.300	3.680*	High shelling %
3	RFRS 198	2011	November(Early)	95.5	7.5	47.00	30.25	1.500	4.027*	High shelling %
4	RFRS 200	2016	November(Early)	94.5	9.6	82.00	26.8	1.583	2.843**	Bold nut
5	RFRS 201	2016	November(Early)	95	12.2	63.50	26.70	1.675	3.185**	Bold nut
6	RFRS 202	2016	November(Early)	92.5	7.2	54.5	27.8	1.740	2.520**	
7	RFRS 203	2016	November(Early)	96	6.8	50.00	31.5	1.150	1.600**	High shelling %
8	RFRS 204	2016	November(Early)	98	10.2	65.00	29.00	0.900	1.190**	Bold nut
9	RFRS 207	2016	November(Early)	98	7.75	85.00	30.10	1.130	1.520**	High shelling %
10	RFRS 208	2016	November(Early)	95.5	8.0	72.00	27.6	0.800	1.010**	Bold nut
11	RFRS 209	2017	November(Early)	93.5	9.5	80.0	28.8	0.750	0.750***	High shelling %
12	RFRS 210	2017	November(Early)	98.5	9	65.0	29.0	0.700	0.700***	High shelling %
13	RFRS 211	2018	November(Early)	95	5.8	41.00	29.6	1.820	1.820***	High shelling %
14	RFRS 212	2018	November(Early)	96.5	8.2	80.00	29.7	1.749	1.749***	High shelling %
15	RFRS 213	2018	November(Early)	97	11.1	65.00	28.8	0.610	0.610***	High shelling % with bold nut
16	RFRS 214	2018	November(Early)	96.5	8.1	65.00	26.9	0.980	0.980***	Bold nut
17	RFRS 215	2018	November(Early)	93.5	8.2	60.00	28.0	0.160	0.160***	High shelling %

\*Cum. yield for 6 harvests, \*\* Cum. yield for 2 harvests and \*\*\* Cum. yield for 1 harvest

### Germplasm conservation:

At present there are a total 323 Nos. of cashew germplasm accessions in the gene bank including 38 types collected from other centers.

## DARISAI

### Germplasm collection:

Germplasm accessions were selected from Dhalbhumgarh airport (old) area because of better yield attributes and performance.

### Germplasm characterization and evaluation:

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	(DSI 101)	2012	3.83	46.64	4.68	4.29
2	(DSI 102)	2012	4.61	61.86	5.24	4.79
3	(DSI 103)	2012	3.77	52.30	4.49	4.15
4	(DSI 104)	2012	4.18	50.92	4.32	3.91
5	(DSI 105)	2012	4.34	55.65	4.43	3.78
6	(DSI 106)	2012	5.14	61.89	3.74	3.49
7	(DSI 107)	2012	5.03	65.64	3.65	3.32
8	(DSI 108)	2013	4.53	54.27	5.38	4.33
9	(DSI 109)	2013	5.18	68.91	4.32	3.12
10	(DSI 110)	2013	4.46	67.44	5.56	4.84
11	(DSI 111)	2014	5.27	69.64	5.21	4.78
12	(DSI 112)	2014	4.65	50.73	5.88	5.36
13	(DSI 113)	2015	3.95	45.02	6.22	5.54
14	(DSI 114)	2015	3.89	48.51	4.17	3.89
15	(DSI 115)	2015	3.61	45.32	4.81	3.44
16	(DSI 201)	2016	2.63	41.79	1.18	0.96
17	(DSI202)	2017	2.29	37.13	1.39	0.98
18	(DSI203)	2018	1.56	29.26	0.96	0.91
19	(DSI 204)	2019	1.32	22.38	0.84	0.78
20	(DSI205)	2020	1.18	16.54	0.72	0.65
SEm±			0.95	9.62	1.03	0.93
CD (5%)			2.76	26.43	2.96	2.64
CV (%)			15.19	14.57	14.89	15.23

**Table: Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	(DSI 101)	2012	Dec., Mid	71.09	7.28	62.83	24.62	3.52	25.41	Bold nut
2	(DSI 102)	2012	Dec., Mid	70.58	6.71	53.39	24.35	3.33	25.23	Bold nut
3	(DSI 103)	2012	Nov., Early	88.32	5.74	40.92	24.81	3.67	27.61	Cluster bearing

4	(DSI 104)	2012	Dec., Mid	72.20	6.79	63.54	24.06	2.89	21.13	Bold nut
5	(DSI 105)	2012	Jan., Late	63.44	6.81	43.93	25.03	3.69	26.54	Bold nut
6	(DSI 106)	2012	Jan, Late	65.89	7.58	53.05	25.12	3.47	25.06	Bold nut
7	(DSI 107)	2012	Nov., Early	88.72	8.12	27.92	26.57	4.12	29.59	Bold nut
8	(DSI 108)	2013	Jan., Late	64.40	6.54	37.43	24.13	2.92	21.27	Bold nut
9	(DSI 109)	2013	Dec., Mid	72.13	7.69	41.90	25.45	3.89	27.69	Bold nut
10	(DSI 110)	2013	Nov., Early	82.37	7.42	34.27	23.89	2.58	17.79	Bold nut
11	(DSI 111)	2014	Dec., Mid	71.22	7.69	67.32	24.02	3.34	22.68	Bold nut
12	(DSI 112)	2014	Dec., Mid	74.31	7.31	31.59	26.13	3.63	26.15	Bold nut
13	(DSI 113)	2015	Dec., Mid	67.27	7.64	51.23	24.79	3.27	24.58	Bold nut
14	(DSI 114)	2015	Dec., Mid	73.37	7.73	43.14	25.05	3.31	23.84	Bold nut
15	(DSI 115)	2015	Dec., Mid	72.25	7.18	29.76	23.78	2.52	20.12	Bold nut
16	(DSI 201)	2016	Jan., Late	65.16	5.32	31.67	23.58	0.73	3.17	Medium & Cluster bearing
17	(DSI202)	2017	Jan., Late	62.42	4.97	32.98	23.51	0.69	3.01	Medium & Cluster bearing
18	(DSI203)	2018	Dec., Mid	55.62	4.84	30.62	22.34	0.63	0.63	Bold nut
19	(DSI 204)	2019	Dec., Mid	51.54	4.63	32.53	21.72	0.58	0.58	Bold nut
20	(DSI205)	2020	Jan., Late	44.68	4.51	28.43	21.19	0.51	0.51	Bold nut
SEm±				5.98	0.64	7.26	0.36	0.39	0.78	
CD (5%)				16.07	1.82	20.17	0.89	1.19	2.04	
CV (%)				15.43	15.18	14.27	15.38	14.64	15.12	

Among the evaluated germplasm, three accessions DSI-107 (4.12 Kg nut /plant), DSI-109 (3.89 Kg nut /plant) & DSI-103 (3.67 Kg nut / plant) were identified for higher nut yield. It was observed that flowering in different germplasm ranged from 1<sup>st</sup> week of November to 3<sup>rd</sup> week of March with maximum mean flowering duration of 88.72 days, in accession DSI-107 & minimum of 62 days in accession DSI-202. Mean nut weight was recorded maximum in accession DSI-107 (8.12 g), followed by accession DSI-114 (7.73 g) and DSI-111 (7.69 g) , the cumulative yield was maximum in accession DSI-107 (29.59 Kg/plant) which was statistically at par with accession DSI 109 (27.69 Kg/ plant) and DSI-103 (27.61 Kg/ plant) of seven harvests.



## HOGALAGERE

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	HREC-1	2014	4.2	75.2	4.5	5.1
2	HREC-2	2014	3.9	59.5	4.6	4.5
3	HREC-3	2014	4.3	75.2	4.9	4.9
4	HREC-4	2014	4.3	65.2	5.1	5.0
5	HREC-5	2014	3.9	57.7	5.1	4.9
6	HREC-6	2014	4.1	64.8	5.0	5.1
7	HREC-7	2014	4.4	85.4	6.0	6.2
8	HREC-8	2014	3.7	62.3	4.7	5.1
9	HREC-9	2014	4.1	67.5	5.9	6.7
10	HREC-10	2014	3.5	64.6	4.0	4.6
11	HREC-11	2014	4.8	70.6	6.2	6.2
12	HREC-12	2014	4.1	72.1	4.3	5.1
13	HREC-13	2014	4.2	68.9	5.2	5.1
14	HREC-14	2014	3.6	57.8	6.3	6.6
15	HREC-15	2014	3.2	77.5	5.4	4.6
16	HREC-16	2014	3.9	71.8	5.0	5.2
17	HREC-17	2014	3.8	59.1	4.1	4.0
18	HREC-18	2014	3.9	66.5	5.4	4.4
19	HREC-20	2014	4.3	72.9	4.4	4.9
20	HREC-21	2014	4.3	64.5	4.8	4.3
21	HREC-22	2014	4.0	56.7	4.9	4.8
22	HREC-23	2014	4.8	88.7	6.7	7.1
23	HREC-24	2014	3.4	57.7	4.2	4.5
24	HREC-25	2014	3.2	57.1	4.4	4.0
25	HREC-26	2014	3.9	59.3	4.8	4.7
26	HREC-27	2014	3.2	45.2	3.6	3.0
27	HREC-28	2014	3.3	57.2	4.4	4.2
28	HREC-29	2014	3.4	56.4	4.2	4.4
29	HREC-30	2014	3.1	48.8	3.6	4.0
30	HREC-31	2014	3.7	76.1	4.2	4.2
31	HREC-32	2014	3.4	64.5	4.5	4.4
32	HREC-33	2014	3.9	71.1	5.4	4.5
33	HREC-35	2014	3.4	54.7	3.6	4.1
34	HREC-36	2014	3.6	63.8	5.3	4.6
35	HREC-38	2014	4.0	86.0	6.7	6.6
36	HREC-39	2014	4.4	72.1	6.2	7.0

37	HREC-40	2014	4.4	72.0	6.7	6.9
38	HREC-41	2014	4.4	78.1	6.3	5.9
39	HREC-42	2014	4.5	75.9	6.8	5.4
40	HREC-43	2014	4.4	70.1	6.0	6.0
41	HREC-44	2014	4.2	68.8	4.4	4.1
42	HREC-45	2014	4.3	71.4	5.0	5.2
43	HREC-46	2014	3.6	54.9	4.5	5.0
44	HREC-49	2014	4.2	70.0	6.7	6.8
45	HREC-51	2014	2.8	39.0	3.4	3.5
46	HREC-52	2016 (Dec)	3.6	42.7	3.3	3.3
47	HREC-53	2016 (Dec)	3.4	49.9	2.8	3.0
48	HREC-54	2016 (Dec)	3.0	44.8	4.1	3.8
49	HREC-55	2016 (Dec)	3.2	60.3	3.7	4.1
50	HREC-56	2016 (Dec)	2.9	42.2	3.2	2.9
51	HREC-57	2016 (Dec)	2.8	40.8	2.5	2.5
52	HREC-58	2016 (Dec)	2.9	42.2	3.2	3.2
53	HREC-59	2016 (Dec)	2.5	53.6	2.6	3.0
54	HREC-60	2016 (Dec)	3.6	55.7	3.8	4.3
55	HREC-61	2016 (Dec)	2.6	40.3	2.1	2.1
56	HREC-63	2016 (Dec)	2.7	43.9	2.5	2.9
57	HREC-64	2016 (Dec)	3.1	51.7	3.6	3.0
58	HREC-65	2016 (Dec)	3.1	49.4	3.5	3.4
59	HREC-66	2016 (Dec)	3.2	46.2	3.8	3.6
60	HREC-67	2016 (Dec)	3.0	43.1	3.5	3.2
61	HREC-68	2016 (Dec)	2.9	40.0	3.1	3.3
62	HREC-69	2016 (Dec)	2.6	47.2	3.7	3.4
63	HREC-70	2016 (Dec)	3.3	47.6	3.5	3.5
64	HREC-71	2016 (Dec)	3.0	50.6	3.3	4.0
65	HREC-72	2016 (Dec)	3.4	52.7	3.9	4.0
66	HREC-73	2016 (Dec)	3.2	43.3	3.2	3.0
67	HREC-74	2016 (Dec)	2.9	57.0	3.8	3.6
68	HREC-75	2016 (Dec)	3.3	47.5	3.5	3.5
69	HREC-76	2016 (Dec)	3.2	47.3	3.0	2.9
70	HREC-77	2016 (Dec)	3.1	40.3	3.4	3.4
71	HREC-78	2016 (Dec)	3.6	53.3	3.1	3.4
72	HREC-79	2016 (Dec)	3.2	48.3	3.4	3.4
73	HREC-80	2016 (Dec)	2.8	54.9	3.9	3.7
74	HREC-82	2016 (Dec)	3.2	43.5	2.2	2.8
75	HREC-83	2016 (Dec)	2.9	42.0	3.0	3.1
76	HREC-84	2016 (Dec)	2.9	50.3	2.9	2.8
77	HREC-85	2016 (Dec)	3.3	44.0	3.5	3.2
78	HREC-86	2016 (Dec)	3.4	52.4	4.0	3.7
79	HREC-88	2016 (Dec)	3.4	40.4	3.3	3.5
80	HREC-89	2016 (Dec)	2.8	47.0	3.3	3.2

81	HREC-90	2016 (Dec)	3.2	59.0	3.9	3.4
82	HREC-91	2016 (Dec)	3.5	50.9	4.0	4.1
83	HREC-92	2016 (Dec)	3.5	45.2	3.3	3.6
84	HREC-93	2016 (Dec)	3.2	46.1	3.4	4.0
85	HREC-94	2016 (Dec)	3.0	39.9	4.2	3.8
86	HREC-95	2016 (Dec)	3.3	50.4	3.2	3.1
87	HREC-96	2016 (Dec)	3.2	46.6	3.2	3.7

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
	HREC-1	2014	March(Mid)	63.7	6.2	37.1	29.2	6.3	17.43	Bunch
	HREC-2	2014	March(Mid)	66.7	6.8	47.8	30.2	7.5	17.7	Cluster
	HREC-3	2014	March(Early)	49.7	7.9	48.1	23.2	6.8	17.08	Bunch
	HREC-4	2014	March(Late)	34.3	6.4	51.4	23.7	5.4	13.44	Cluster
	HREC-5	2014	April(Early)	34.3	6.6	46.5	25.0	4.8	14.5	Cluster
	HREC-6	2014	March(Mid)	41.7	6.1	37.7	26.6	3.7	18.78	Bunch
	HREC-7	2014	March(Mid)	40.0	6.0	42.5	30.6	3.6	10.91	Bunch
	HREC-8	2014	March(Early)	60.0	6.9	41.0	31.6	3.9	10.23	Cluster
	HREC-9	2014	March(Mid)	38.3	6.7	45.1	25.1	4.7	16.13	Cluster
	HREC-10	2014	March(Mid)	41.0	7.7	47.2	27.3	7.4	22.15	Cluster
	HREC-11	2014	April(Early)	43.7	10.3	52.6	24.2	4.1	16.07	Bunch
	HREC-12	2014	April(Mid)	40.0	6.3	38.1	29.7	7.4	18.18	Bunch
	HREC-13	2014	March(Late)	53.0	7.8	42.6	30.5	4.5	14.44	Bunch
	HREC-14	2014	March(Late)	55.0	6.2	44.3	26.7	6.1	18.35	Bunch
	HREC-15	2014	April(Mid)	47.0	6.1	44.5	26.9	6.2	17.81	Bunch
	HREC-16	2014	April(Early)	33.0	6.4	45.1	30.2	5.2	20	Cluster
	HREC-17	2014	April(Early)	25.0	6.9	49.8	25.1	4.0	11.24	Bunch
	HREC-18	2014	March(Mid)	68.3	7.1	40.6	26.3	5.3	15.07	Bunch
	HREC-20	2014	March(Mid)	65.0	6.2	45.3	27.2	7.6	20.43	Bunch
	HREC-21	2014	March(Late)	48.5	6.8	46.7	31.4	6.2	18.7	Bunch
	HREC-22	2014	April(Early)	32.0	6.3	45.3	27.9	3.6	13.08	Bunch
	HREC-23	2014	April(Early)	43.5	6.8	51.1	26.0	5.7	16.55	Cluster
	HREC-24	2014	March(Mid)	42.3	8.1	43.2	29.7	8.4	18.2	Cluster
	HREC-25	2014	January (Late)	45.0	7.4	35.9	29.2	3.8	9.4	Bunch
	HREC-26	2014	March(Late)	44.0	7.2	44.1	28.6	8.0	22.13	Cluster
	HREC-27	2014	April(Mid)	39.0	6.6	43.0	30.9	6.2	24.94	Cluster
	HREC-28	2014	May(Early)	36.7	6.2	51.8	22.1	8.2	21.59	Bunch
	HREC-29	2014	April(Mid)	55.7	6.3	47.9	23.4	7.5	20.42	Bunch
	HREC-30	2014	May(Early)	33.7	6.3	38.5	27.9	5.9	14.2	Bunch
	HREC-31	2014	March(Mid)	51.0	6.6	36.0	27.5	5.7	19.13	Bunch
	HREC-32	2014	March(Early)	67.7	6.2	46.9	24.8	3.7	12.5	Cluster
	HREC-33	2014	April(Late)	30.0	6.6	51.4	22.9	4.3	12.36	Cluster
	HREC-35	2014	April(Late)	48.0	6.2	51.7	26.6	3.4	11.57	Bunch
	HREC-36	2014	March(Mid)	59.0	7.2	36.0	30.0	3.6	10.13	Bunch
	HREC-38	2014	March(Late)	52.0	6.1	47.6	23.3	5.9	15.01	Bunch
	HREC-39	2014	March(Late)	60.0	6.0	43.8	29.3	3.6	9.44	Cluster
	HREC-40	2014	April(Early)	40.0	6.5	44.4	28.7	4.7	13.9	Cluster
	HREC-41	2014	March(Mid)	70.5	6.2	46.4	28.4	4.9	14.44	Bunch
	HREC-42	2014	March(Mid)	53.0	6.9	40.2	30.0	5.9	17.66	Bunch

	HREC-43	2014	March(Mid)	64.0	6.2	37.4	27.1	4.3	13.61	Bunch
	HREC-44	2014	April(Early)	33.0	6.7	47.1	28.4	6.3	17.9	Bunch
	HREC-45	2014	April(Early)	43.0	6.3	48.3	29.0	5.0	18.08	Bunch
	HREC-46	2014	March(Late)	23.0	6.5	48.8	29.7	3.6	6.3	Bunch
	HREC-49	2014	April(Mid)	46.0	9.8	38.7	27.7	8.0	20.82	Bunch
	HREC-51	2014	April(Early)	53.0	6.1	40.9	28.8	4.1	14.2	Bunch
	HREC-52	2016 (Dec)	May(Early)	29.3	6.6	45.9	29.1	3.5	13	Cluster
	HREC-53	2016 (Dec)	March(Late)	38.0	9.4	53.0	25.7	3.5	13	Bunch
	HREC-54	2016 (Dec)	March(Late)	68.5	6.9	40.1	23.4	5.6	14.2	Bunch
	HREC-55	2016 (Dec)	May(Early)	51.0	6.7	36.8	24.4	2.4	8	Bunch
	HREC-56	2016 (Dec)	April(Mid)	34.0	7.8	45.5	27.4	3.0	9	Bunch
	HREC-57	2016 (Dec)	May(Early)	27.5	6.6	47.6	25.1	4.3	13.2	Bunch
	HREC-58	2016 (Dec)	March(Late)	70.7	7.1	47.5	26.9	2.9	9.8	Bunch
	HREC-59	2016 (Dec)	March(Mid)	63.0	6.4	44.1	24.1	2.9	11.6	Bunch
	HREC-60	2016 (Dec)	March(Late)	60.0	6.6	39.6	29.2	2.5	10.6	Bunch
	HREC-61	2016 (Dec)	April(Early)	48.5	7.6	39.8	26.9	3.0	10.6	Cluster
	HREC-63	2016 (Dec)	April(Mid)	39.0	6.5	49.9	25.2	2.6	9	Bunch
	HREC-64	2016 (Dec)	March(Early)	45.5	6.4	46.4	26.3	3.3	10.4	Bunch
	HREC-65	2016 (Dec)	March(Mid)	42.3	6.6	44.8	27.8	4.2	12.2	Bunch
	HREC-66	2016 (Dec)	March(Mid)	65.5	6.3	43.1	27.7	3.4	9.4	Bunch
	HREC-67	2016 (Dec)	March(Early)	58.7	6.0	39.0	29.4	2.5	15.2	Bunch
	HREC-68	2016 (Dec)	March(Late)	54.7	7.9	39.2	25.7	2.9	8	Bunch
	HREC-69	2016 (Dec)	April(Early)	36.0	6.0	47.4	28.5	3.4	12	Bunch
	HREC-70	2016 (Dec)	April(Early)	54.0	6.9	50.8	24.5	4.0	15.4	Bunch
	HREC-71	2016 (Dec)	March(Mid)	34.7	6.8	46.5	29.6	4.0	11.4	Bunch
	HREC-72	2016 (Dec)	March(Mid)	31.7	6.7	40.7	24.9	2.7	8.8	Bunch
	HREC-73	2016 (Dec)	March(Late)	48.7	6.3	41.0	30.7	3.6	10	Bunch
	HREC-74	2016 (Dec)	April(Late)	34.7	6.5	44.5	28.2	2.6	8.8	Cluster
	HREC-75	2016 (Dec)	March(Mid)	58.7	9.9	49.6	30.7	4.3	12.4	Bunch
	HREC-76	2016 (Dec)	March(Mid)	42.7	6.6	50.0	26.0	3.9	11	Bunch
	HREC-77	2016 (Dec)	April(Late)	31.0	6.5	52.4	30.4	2.8	9.8	Bunch
	HREC-78	2016 (Dec)	March(Mid)	53.0	7.0	35.8	27.5	2.9	9.4	Bunch
	HREC-79	2016 (Dec)	March(Mid)	62.0	6.3	36.4	31.3	2.9	9.4	Bunch
	HREC-80	2016 (Dec)	April(Late)	45.0	6.5	41.2	30.9	4.1	11.2	Bunch
	HREC-82	2016 (Dec)	April(Late)	34.0	6.0	52.6	24.0	3.2	11.4	Cluster

	HREC-83	2016 (Dec)	March(Late)	60.3	6.8	49.4	25.6	4.0	10.8	Cluster
	HREC-84	2016 (Dec)	March(Late)	75.7	6.1	36.2	29.1	2.4	10.6	Bunch
	HREC-85	2016 (Dec)	March(Mid)	66.0	6.7	37.7	28.6	3.7	9.8	Bunch
	HREC-86	2016 (Dec)	April(Early)	57.0	6.4	45.3	28.6	3.0	16.6	Bunch
	HREC-88	2016 (Dec)	April(Late)	38.3	6.8	48.0	29.9	3.1	9.8	Bunch
	HREC-89	2016 (Dec)	March(Mid)	38.7	6.4	53.3	30.2	3.1	10	Bunch
	HREC-90	2016 (Dec)	March(Mid)	33.3	6.1	41.6	25.2	3.3	10.4	Bunch
	HREC-91	2016 (Dec)	April(Mid)	38.7	7.4	40.9	27.6	2.8	9	Cluster
	HREC-92	2016 (Dec)	May(Early)	35.0	6.1	43.9	25.8	3.4	12.4	Cluster
	HREC-93	2016 (Dec)	May(Late)	35.3	6.2	43.4	27.0	3.4	11.4	Bunch
	HREC-94	2016 (Dec)	April(Late)	42.5	6.5	51.6	29.3	2.9	10.8	Bunch
	HREC-95	2016 (Dec)	May(Late)	31.0	6.4	45.4	29.2	2.5	9.8	Cluster
	HREC-96	2016 (Dec)	February (Late)	51.0	6.0	40.8	31.1	2.9	9.4	Cluster



**Cashew plants in germplasm evaluation block have been uprooted by high rainfall and winds (more than 40 plants have been uprooted)**

## JAGDALPUR

### Germplasm collection:

During the year 2022, survey was conducted in forest plantations of Kondagaon district of Chhattisgarh and Koraput District of Odisha with the help of Horticulture Department of Odisha State and observed two promising germplasm with cluster bearing and bold nut characters respectively. The germplasm observed for cluster bearing character from Kondagaon district was given collection name Adenga-1 and bold nut germplasm from Koraput district was given collection name Mokagam-1. Scion sticks were collected from

germplasm. Both the genotypes are under in-situ evaluation and will be again characterized from tree and nut parameters next year.

**Adenga-1 :**

Sl. No.	Item	Description	
1.	Name of collecting Centre	S. G. College of Agriculture and Research Station, Jagdalpur	
2.	Team/ Collector(s)	Vikas Ramteke, Narendra Kumar, P. K. Salam, Y. S. Nirala	
3.	Source of Collection	Forest Plantation	
4.	Name and address of farmer/ collection site	Adenga village, Block Keshkal, Dist. Kondagaon, Chhattisgarh, India - 494331	
5.	Latitude	Longitude	Altitude
	20.033131	81.625215	589 m
6.	Collector's number	2022-1	
	Name of collection	Adenga-1	
7.	Date of collection	27/04/2022	
8.	Age of tree	30 (year of plantation 1992)	
9.	Tree habit	Upright and Open	
10.	Branching pattern	Extensive	
11.	Season of flowering	Mid	
12.	Apple colour	Yellow	
13.	Apple Shape	Conical to obovate	
14.	Apple size	Medium	
15.	Nut size	Medium	
16.	No. of fruits/ panicle	9	
17.	Attachment of nut to apple	Intermediate	
18.	Estimated yield/ m <sup>2</sup>	-	
19.	Other notes from collector		
a)	Plant height (m)	5.2	
b)	Canopy spread (m)	6.1 (N-S), 5.4 (E-W)	
c)	Trunk girth (cm)	62	
d)	Trunk bark type	Rough	
e)	Flowering laterals/m <sup>2</sup>	8.75	

f)	Non flowering laterals/m <sup>2</sup>	5.5
g)	Yield per plant (kg)	6.1 (Estimated)
h)	Soil type	Red Sandy to Yellow silt
i)	Sex ratio	-
j)	TMB infestation	Low

**Mokagam-1 :**

Sl. No.	Item	Description	
1.	Name of collecting Centre	S. G. College of Agriculture and Research Station, Jagdalpur	
2.	Team/ Collector(s)	Vikas Ramteke, Y. S. Nirala, Sudipto Saurav Sahoo, A. K. Kerketta	
3.	Source of Collection	Forest Plantation	
4.	Name and address of farmer/ collection site	Mokagam village, Block Kotpad, Dist. Koraput, Odisha, India	
5.	Latitude	Longitude	Altitude
	19.029067	82.280047	561 m
6.	Collector's number	2022-2	
	Name of collection	Mokagam-1	
7.	Date of collection	07/05/2022	
8.	Age of tree	40-45 years	
9.	Tree habit	Upright and Open	
10.	Branching pattern	Extensive	
11.	Season of flowering	Late	
12.	Apple colour	Pink	
13.	Apple Shape	Conical to obovate	
14.	Apple size	Large	
15.	Nut size	Large	
16.	No. of fruits/ panicle	1-2	
17.	Attachment of nut to apple	Intermediate	
18.	Estimated yield/ m <sup>2</sup>	-	
19.	Other notes from collector		

1.	Plant height (m)	6.2
2.	Canopy spread (m)	-
3.	Trunk girth (cm)	78
4.	Trunk bark type	Rough
5.	Flowering laterals/m <sup>2</sup>	8.0
6.	Non flowering laterals/m <sup>2</sup>	6.25
7.	Yield per plant (kg)	5.3 (Estimated)
8.	Soil type	Red Sandy
9.	Sex ratio	-
10.	TMB infestation	Low

#### Germplasm characterization and evaluation:

The 24 cashew accessions collected from Bastar district were evaluated from biometric and yield characters. Among the 24 genotypes studied, the tree height (3.06 m) and stem girth (35 cm) were recorded highest in the genotype CARS-18. Canopy spread was recorded highest in the genotype CARS-19. Duration of flowering ranged from 73 days to 109 days. The shortest flowering duration was recorded in CARS-14 (73 days). The maximum nut weight was recorded in CARS-8 (10.97 g) followed by CARS-17 (9.54 g). Similarly, apple weight was also recorded highest in CARS-8 (79.82 g). Whereas, shelling per cent was highest in CARS-7 (32.21 g). Nut yield for the first harvest was recorded maximum in CARS-7 (1.22 kg) followed by CARS- 17 (1.12 kg) and CARS- 4 (1.10 kg).

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

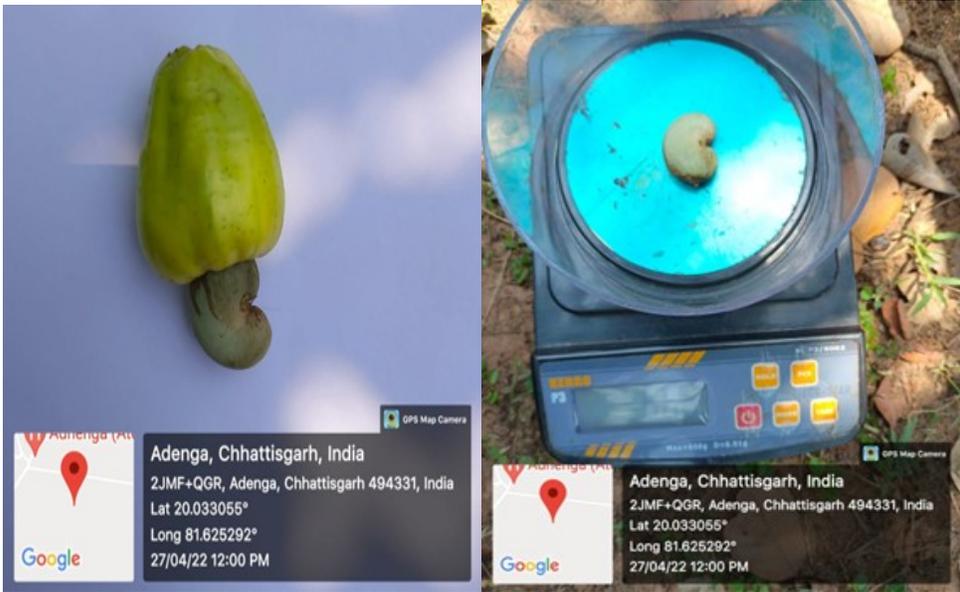
Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	CARS-1	2018	2.30	24	2.72	2.35
2	CARS-2	2018	2.65	24	2.44	2.90
3	CARS-3	2018	2.74	30	3.25	3.60
4	CARS-4	2019	2.12	20	2.25	1.80
5	CARS-5	2018	2.60	28	2.10	2.32
6	CARS-6	2019	2.05	22	2.40	2.56
7	CARS-7	2019	2.20	21	2.55	2.66
8	CARS-8	2018	2.70	30	3.65	3.28
9	CARS-9	2018	2.65	25	2.63	2.15
10	CARS-10	2018	2.40	28	2.67	2.95
11	CARS-11	2018	2.15	25	2.73	2.12
12	CARS-12	2019	2.13	26	2.75	3.47
13	CARS-13	2018	1.40	31	3.55	4.12

14	CARS-14	2019	1.75	13	1.00	1.08
15	CARS-15	2018	2.15	28	3.62	4.07
16	CARS-16	2019	2.17	23	3.43	3.02
17	CARS-17	2018	2.35	28	3.75	3.82
18	CARS-18	2018	3.06	35	2.65	3.27
19	CARS-19	2018	2.20	29	3.80	4.25
20	CARS-20	2018	3.05	21	3.35	3.85
21	CARS-21	2018	2.80	28	2.85	3.27
22	CARS-22	2019	2.16	24	1.98	2.53
23	CARS-23	2019	1.80	15	1.57	1.60
24	CARS-24	2019	1.18	23	2.43	1.85

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1.	CARS-1	2018	Mid	103	5.79	47.85	27.56	0.47	0.47	
2.	CARS-2	2018	Mid	107	6.34	57.55	30.11	0.65	0.65	
3.	CARS-3	2018	Mid	84	6.67	47.48	30.56	0.76	0.76	
4.	CARS-4	2019	Mid	86	5.91	49.44	31.21	1.10	1.10	
5.	CARS-5	2018	Late	77	6.21	60.23	30.56	0.56	0.56	
6.	CARS-6	2019	Mid	86	6.37	46.32	29.11	0.22	0.22	
7.	CARS-7	2019	Early	89	6.18	39.21	32.21	1.22	1.22	Early
8.	CARS-8	2018	Mid	84	10.97	79.82	27.98	0.89	0.89	Bold nut
9.	CARS-9	2018	Mid	76	9.01	71.83	27.11	0.46	0.46	Bold nut
10.	CARS-10	2018	Mid	76	9.18	51.12	29.23	0.79	0.79	Bold nut
11.	CARS-11	2018	Early	84	7.67	60.4	31.45	0.65	0.65	Early
12.	CARS-12	2019	Late	73	8.01	58.12	29.70	0.45	0.45	
13.	CARS-13	2018	Mid	84	7.49	50.87	30.78	1.04	1.04	
14.	CARS-14	2019	Mid	73	6.21	41.21	30.31	0.33	0.33	TMB indicator
15.	CARS-15	2018	Mid	107	6.87	48.50	28.98	0.77	0.77	
16.	CARS-16	2019	Late	84	7.43	73.18	31.12	0.12	0.12	
17.	CARS-17	2018	Early	102	9.54	64.23	29.67	1.12	1.12	Bold nut
18.	CARS-18	2018	Mid	95	8.85	73.60	30.46	0.78	0.78	
19.	CARS-19	2018	Mid	86	8.27	50.12	29.76	0.48	0.48	
20.	CARS-20	2018	Late	85	8.65	49.57	31.12	0.67	0.67	
21.	CARS-21	2018	Late	99	7.92	48.64	31.62	0.43	0.43	
22.	CARS-22	2019	Mid	109	9.02	55.42	30.12	0.28	0.28	Bold nut
23.	CARS-23	2019	Mid	89	8.32	53.59	28.67	0.18	0.18	
24.	CARS-24	2019	Mid	107	8.99	62.60	30.12	0.23	0.23	

\*Flowering time:Early – December-January, Mid – January – February, Late – February - March



Adenga-1 bunches and nuts

# KANABARGI

**Germplasm characterization and evaluation:****Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	KBG-1	2020	1.97	22.00	0.73	1.53
2	KBG-2	2020	2.24	26.67	1.63	2.05
3	KBG-3	2020	2.32	26.00	1.61	2.00
4	KBG-4	2020	2.14	27.67	1.83	2.30

**TURA**

Three genotypes of Cashew viz., RC Cashew-1(Baramasi 1), RC Cashew-2(Baramasi 2) and RC Cashew-3(Bold seeded) were characterized. The Morpho-physiological traits of the cashew genotypes are presented below:

**Table: Morpho-physiological traits of cashew genotypes**

Sl. no.	Characters	RC Cashew-1 (Baramasi 1)	RC Cashew-2 (Baramasi 2)	RC Cashew-3 (Bold seeded)
1	Tree habit	Spreading	Upright and open	Upright compact

2	Leaf shape	Oblong	Oblong	Obovate
3	Tree height	Tall	Tall	Tall
4	Cracks on trunk bark	Present	Present	Present
5	Crotch angle of main branch	Acute	Acute	Acute
6	Ease of peeling bark from twig	Difficult	Difficult	Difficult
7	Branching pattern	Intensive	Extensive	Extensive
8	Number of leaves per twig	8 nos.	15 nos.	9 nos.
9	Colour of mature leaves	Dark green	Dark green	Dark green
10	Odor of leaves	Turpentine type	Turpentine type	Turpentine type
11	Leaf apex shape	Round	Indented	Round
12	Leaf size	Intermediate	Intermediate	Intermediate
13	Brittleness of leaves	Brittle	Brittle	Brittle
14	Angle of leaf petiole relative to stem	Acute	Acute	Acute
15	Leaf cross section	Incurved	Incurved	Incurved
16	Season of flowering	Oct., March	Oct., March	Feb-March
17	Inflorescence shape	Pyramidal	Pyramidal	Pyramidal
18	Flower colour	Pink	Pink	Cream
19	Mature cashew apple colour	Yellow	Yellow Red	Yellow
20	Cashew apple shape	Conical obovate	Round	Conical obovate
21	Nut shape	Kidney	Kidney	Oblong ellipsoid
22	Compactness of inflorescence	Loose	Loose	Loose
23	Shape of cashew apple	Oblique flattened	Flattened	Angular

24	Ridges of cashew apple	Broken	Entire	Entire
25	Cashew apple apex	Level	Level	Level
26	Grooves on apex of cashew apple	Shallow	Shallow	Shallow
27	Cavity at apex of cashew apple	Deep	Shallow	Shallow
28	Skin of cashew apple	Smooth and glossy	Smooth and glossy	Rough and dull
29	Suture of nut	Angular	Round	Angular
30	Flanks of nut	Round	Round	Round
31	Stylar scar on nut	Large	Small	Small
32	Shape of nut apex	Intermediate	Intermediate	Pointed
33	Relative position of suture and apex	Infront	Infront	Behind
34	Nut weight	5.43 g	5.22 g	7 g
35	Weight of cashew apple	48.90 g	43.35 g	70.33 g
36	Shelling percentage	32.41 %	31.60 %	28.43%
37	Kernel weight	1.76 g	1.65 g	1.99 g
38	Cumulative nut yield per plant	7-9 kg	6-7 kg	22-26 kg

#### Germplasm characterization and evaluation:

The performance of the seven cashew genotypes at ICAR-KVK, West Garo hills, Tura, Meghalaya was studied.

**Table: Growth parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	<b>Dhana</b>	2010	3.78	56.5	5.60	5.23
2	<b>VRI (CW)H-1</b>	2011	4.4	50.2	4.55	4.36
3	<b>Bhaskara</b>	2015	5.83	60.4	4.82	4.80
4	<b>BPP-8</b>	2015	4.0	53.5	4.20	4.83
5	<b>VRI-3</b>	2015	3.5	40.5	3.50	3.60
6	<b>H-303</b>	2015	3.98	60.0	3.98	3.80

7	<b>V-4</b>	2015	3.45	53.7	4.50	4.47
	<b>SEM (±)</b>	---	0.29		0.17	0.21
	<b>CD (0.05)</b>	---	0.92		0.55	0.66
	<b>CV (%)</b>	---	15.15		8.59	10.45

**Table Reproductive parameters of cashew germplasm accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special features
1	<b>Dhana</b>	2010	January	55-60	7.3	72.67	26.02	5.50	9.06	
2	<b>VRI (CW)H-1</b>	2011	January	60-65	5.6	33.34	21.43	4	4.0	
3	<b>Bhaskara</b>	2015	-	-	7.41	65.1	25.65	3	5.5	
4	<b>BPP-8</b>	2015	March	60-62	8.0	66.67	31.25	2	2.0	
5	<b>VRI-3</b>	2015	January	50-55	6.50	30.69	30.76	2	2	
6	<b>H-303</b>	2015	March	60-70	8.1	37.34	31.49	4.50	4.5	
7	<b>V-4</b>	2015	March	50-60	6.7	46.33	28.36	2	2	
	<b>SEM (±)</b>	---			0.08	0.95	0.82	---	-	
	<b>CD (0.05)</b>	---			0.27	2.99	2.59	---	-	
	<b>CV (%)</b>	---			3.39	7.37	6.47	---	-	

\*Flowering time: It can be mentioned like October (Early) or January (Late) depending on the region's time and its classification

### Germplasm conservation:

A new mother block was established during 2022 at ICAR-KVK, West Garo Hills, Tura with an objective to conserve and evaluate the Varieties. The varieties/collections planted in an experimental block following RBD with 6 replications are as follows.

- |                 |                 |                 |
|-----------------|-----------------|-----------------|
| 1. BPP- 8       | 2.V- 4          | 3.Dhana         |
| 4.Vengurla – 9, | 5.VRI (CW) H-1, | 6.Baramasi – 1, |
| 7.Baramasi – 2  | 8. Bold Seeded, | 9.Rongatagre    |



## Evaluation of CNSL free germplasm accessions

<b>Centres: East Coast :</b>	Bapatla and Vridhachalam
<b>West Coast :</b>	Madakkathara and Vengurla
<b>Plains / others:</b>	Jagdapur and Hogalagere

**Objective:** To evaluate CNSL free accessions for yield and yield attributes

### MADAKKATHARA

#### Experimental details

Number of genotypes : 6 (NRC-116, NRC-188, NRC-189, NRC-281, NRC-285, RFRS-195)  
 Design : RCBD  
 No. of replications : 4  
 Spacing : 5m x 5m

#### Progress/Achievements

The grafts of CNSL free accessions, NRC-116, NRC 189, NRC 281 and NRC 285 were collected from DCR Puttur and planted during September 2022.

### VENGURLA

#### Experimental details

Number of genotypes: 6 (NRC-116, NRC-188, NRC-189, NRC-281, NRC-285, RFRS-195)  
 Design : RCBD  
 No. of replications : 4

Spacing : 5 x 5m

### Progress/Achievements

The replicated trial of six CNSL free types initiated at Vengurla centre during July, 2018. The vegetative growth observations for the year 2021-22 were recorded and tabulated. The data revealed that there were non-significant results with respect to all vegetative growth parameters except stem girth (cm). Cashew accession RFRS-195 recorded significantly the maximum stem girth (21.0 cm) and at par with NRC-189 (17.75 cm), NRC-188 (17.25 cm) and NRC-281(17.08 cm). However, the height of cashew accession ranged from minimum 1.25 m in NRC-281 to maximum 1.78 m in RFRS-195. The canopy spread (EW) ranged from minimum 0.82 m (NRC-285) to maximum 1.58 m (RFRS-195) while, NS canopy spread varies from minimum 0.90 m in NRC-281 to maximum 1.40 m in NRC-188. Significant variation was observed among the different accessions in respect of yield attributes. The maximum apple weight was recorded in NRC-189 (72.25 g) and minimum was recorded in NRC-281 (25.75 g). Whereas, the maximum nut weight was observed in NRC-189 (10.03 g).The highest yield was recorded in RFRS-195 (0.604 kg/tree) and found significantly superior over the rest of treatments. Shelling percentage was noted highest in NRC-281 (31.64 %) and found at par with RFRS-195 (31.12 %).

**Table: Growth parameters of CNSL free accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	NRC-116	2018	1.38	15.09	1.33	1.07
2	NRC-188	2018	1.74	17.25	1.47	1.40
3	NRC-189	2018	1.63	17.75	1.33	1.37
4	NRC-281	2018	1.25	17.08	1.39	0.90
5	NRC-285	2018	1.33	13.67	0.82	1.01
6	RFRS-195	2018	1.78	21.00	1.58	1.36
	Mean		1.53	16.97	1.32	1.19
	SEm ±		0.15	1.36	0.22	0.19
	CD @5%		NS	4.15	N.S.	N.S.
	CV (%)		18.2	16.07	32.69	31.82

**Table Reproductive parameters of CNSL free accessions during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	CY(Kg/plant)	CNSL (%)
1	NRC-116	2018	November	96.53	5.40	49.50	25.43	0.143		
2	NRC-188	2018	November	97.63	4.75	34.75	30.00	0.144		
3	NRC-189	2018	November	93.45	10.03	72.25	24.75	0.112		
4	NRC-281	2018	November	97.88	4.50	25.75	31.64	0.125		
5	NRC-285	2018	November	95.25	6.88	45.50	25.00	0.098		
6	RFRS-195	2018	November	101.40	6.25	53.25	31.12	0.604		
	Mean			97.02	6.30	46.83	27.99	0.103		

	S <sub>Em</sub> ±			1.80	0.31	1.61	0.63	0.018		
	CD @5%			NS	0.94	4.90	1.92	0.05		
	CV (%)			3.71	9.84	6.88	4.51	18.08		

### Gen.3. Expt.1. Multi Location Trial – III

**Centres: Plains / others:** Hogalagere

The objective of the project is to evaluate promising hybrids identified and TMB tolerant accessions obtained from different sponsoring centres for their performance in different agro-ecological conditions.

## HOGALAGERE

### Experimental details

Accessions: 11  
 Design : RCBD  
 Replication: 3  
 Spacing : 6m x 6m

### Progress /achievements

**Table: Growth parameters of accessions during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	BH 6	2016 (Dec)	2.9	38.4	2.6	2.9
2	BH 85	2016 (Dec)	3.1	39.9	3.1	3.0
3	H 1597	2016 (Dec)	2.9	37.5	3.4	3.1
4	K 22-1	2016 (Dec)	2.8	42.3	3.2	3.2
5	H 662	2016 (Dec)	2.7	42.6	3.4	3.4
6	H 675	2016 (Dec)	3.6	43.3	4.2	4.0
7	H 11	2016 (Dec)	2.7	36.8	2.8	2.7
8	H 14	2016 (Dec)	2.8	40.3	3.6	3.2
9	H 32/4	2016 (Dec)	2.6	37.6	3.0	3.3
10	Chintamani-1	2016 (Dec)	2.7	42.5	3.5	3.5
11	Chintamani-2	2016 (Dec)	3.2	51.1	4.2	4.4
	Mean	-	2.91	41.12	3.36	3.34
	S <sub>Em</sub> ±	-	0.22	3.29	0.28	0.26
	CD @5%	-	0.65	9.70	0.81	0.77
	CV (%)	-	13.13	13.85	14.22	13.54

**Table Reproductive parameters of accessions during the year 2022**

Sl. No.	Accession	YOP	Flowering time (month followed by)	Duration of flowering	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	CY (Kg/plant)	TMB reaction
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			early/mid/late)	(days)						
1	BH 6	2016 (Dec)	March (mid)	64	6.2	62.6	25.8	3.71	9.47	Moderate (32%)
2	BH 85	2016 (Dec)	March (mid)	51	6.1	61.6	28.5	2.38	6.81	Moderate (26%)
3	H 1597	2016 (Dec)	March (Late)	75	6.6	81.0	27.7	2.88	7.66	Moderate (20%)
4	K 22-1	2016 (Dec)	April (Early)	50	6.1	62.9	29.6	3.33	8.29	Moderate (38%)
5	H 662	2016 (Dec)	February (Late)	57	6.4	43.4	29.0	4.05	10.07	Mild (9%)
6	H 675	2016 (Dec)	March (Late)	58	6.3	42.9	27.5	3.58	8.8	Mild (6%)
7	H 11	2016 (Dec)	March (Mid)	54	6.1	42.9	26.7	3.21	8.08	Moderate (45%)
8	H 14	2016 (Dec)	March (Early)	78	6.1	39.1	29.0	2.86	7.71	Moderate (39%)
9	H 32/4	2016 (Dec)	March (Late)	79	7.2	58.3	30.1	3.10	9.2	Moderate (43%)
10	Chintamani-1	2016 (Dec)	March (Early)	58	6.5	30.4	27.2	4.05	10.09	Moderate (25%)
11	Chintamani-2	2016 (Dec)	March (Late)	74	6.8	58.7	29.1	3.27	7.6	Mild (7%)
	Mean	-	March (Late)	63.5	6.48	53.1	26.9	3.3	5.22	Moderate (18%)
	SEm ±	-	-	4.57	0.27	3.59	1.23	0.22	-	-
	CD @5%	-	-	13.48	0.80	10.58	3.62	0.64	-	-
	CV (%)	-	-	13.18	8.35	11.71	7.90	11.39	-	-

**Visit of PC cell In charge to the center**





## Expt.2. Performance of Released Varieties

### (Multi Location Trial – V)

**Centres:**

**East Coast:**

Bapatla

**Plains / others:**

Darisai, Hogalagere and Jagdalpur

The objective of this experiment is to evaluate the performance of released cashew varieties from various centres for their suitability to different agro-climatic regions.

#### Experimental Details:

Design : RCBD  
 No of Replications : 3  
 No of Plants per replication : 4  
 Spacing : 7m x 7m

	No.	Released varieties
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State		
Andhra Pradesh	3	BPP-4,BPP-6 and BPP-8
Maharashtra	4	Vengurle-1, Vengurle-4, Vengurle-6 and Vengurle-7
Karnataka	5	Chintamani-1, Ullal-1, Ullal-3,Ullal-4, UN-50
Kerala	7	Madakkathara-1, Madakkathara-2, Priyanka, Dhana, Kanaka, Amrutha and K-22-1.
West Bengal	1	Jhargram-1
Orissa	1	Bhubaneswar-1
NRCC Puttur	2	NRCC sel-2, Bhaskara
Tamilnadu	1	VRI-3
Goa	1	Goa-1
<b>Total</b>	<b>25</b>	

## BAPATLA

25 released varieties of different centers of India were evaluated, significant difference was observed with respect to mean plant height, canopy height and stem girth.

**Table: Growth parameters of varieties during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	BPP-4	2014	3.60	61.77	5.68	6.59
2	BPP-6	2014	2.97	38.02	4.87	4.38
3	BPP-8	2014	3.15	47.76	4.95	5.02
4	BBSR-1	2014	2.36	40.43	3.68	3.83
5	CHINTAMANI-1	2014	2.39	39.18	4.57	5.10
6	JHARGRAM-1	2014	2.70	41.47	4.53	4.21
7	MADAKATHARA-1	2014	2.77	57.57	3.82	4.57
8	MADAKATHARA-2	2014	2.17	34.50	3.03	3.12
9	K-22-1	2014	2.86	44.87	4.69	5.11
10	DHANA	2014	2.62	43.67	5.91	5.12
11	KANAKA	2014	2.22	31.67	3.02	3.96
12	PRIYANKA	2014	2.57	35.75	4.45	4.47
13	AMRUTHA	2014	2.87	47.90	4.10	5.50
14	VENGURLA-1	2014	2.75	39.87	4.17	4.57
15	VENGURLA-4	2014	2.84	42.25	4.26	4.78
16	VENGURLA-6	2014	2.61	39.17	4.17	4.71
17	VENGURLA-7	2014	3.12	46.00	5.47	5.21
18	VRI-3	2014	2.60	40.87	4.59	4.60
19	NRCC SEL-2	2014	2.24	35.58	3.50	3.76
20	ULLAL-1	2014	2.81	42.75	4.61	4.47
21	ULLAL-3	2014	2.53	47.45	4.58	5.35
22	ULLAL-4	2014	2.54	38.27	4.89	5.00

23	UN-50	2014	3.02	39.92	4.76	4.99
24	GOA-1	2014	2.25	32.33	4.11	3.26
25	BHASKARA	2014	3.20	61.77	6.04	5.66
	Mean					
	SEm $\pm$		0.64	5.43	0.65	0.57
	CD @5%		0.22	NS	NS	1.63
	CV (%)		14.41	22.25	25.22	21.18

**Table: Reproductive parameters of varieties during the year 2022**

Sl. No.	Accession	YOP	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree) 5th Harvest	Cumulative Yield (Kg/plant)	Special Features
1	BPP-4	2014	feb (mid)	80	6.22	37.20	28.42	7.25	23.32	cluster bearing
2	BPP-6	2014	feb (late)	118	6.12	45.50	27.53	4.12	13.06	
3	BPP-8	2014	Jan (early)	82	7.89	53.70	29.20	7.97	23.98	bold nut
4	BBSR-1	2014	Jan (early)	113	5.83	53.40	30.11	3.52	12.41	
5	CHINTAMANI-1	2014	feb (mid)	116	6.12	40.13	26.67	3.11	10.67	
6	JHARGRAM-1	2014	Jan (early)	89	5.66	33.10	28.40	3.22	10.96	
7	MADAKATHARA-1	2014	Jan (early)	105	6.12	37.50	29.20	6.24	17.02	
8	MADAKATHARA-2	2014	Jan (early)	104	6.34	54.20	27.80	2.24	13.96	
9	K-22-1	2014	feb (mid)	104	7.32	46.00	29.22	5.35	16.52	
10	DHANA	2014	feb (mid)	84	7.35	61.80	28.20	3.30	12.97	
11	KANAKA	2014	feb (mid)	106	6.15	60.14	28.24	2.15	12.47	
12	PRIYANKA	2014	feb (mid)	110	9.78	95.63	28.12	3.27	11.91	
13	AMRUTHA	2014	feb (late)	103	7.12	38.60	30.13	3.26	10.90	
14	VENGURLA-1	2014	feb (mid)	102	6.12	45.90	28.23	4.29	15.34	
15	VENGURLA-4	2014	feb (mid)	102	7.34	94.00	27.30	3.40	12.64	
16	VENGURLA-6	2014	feb (mid)	113	7.56	91.00	30.12	2.37	9.78	
17	VENGURLA-7	2014	feb (late)	112	8.25	66.00	30.00	3.10	11.98	
18	VRI-3	2014	Jan (early)	99	6.33	35.00	29.06	3.10	13.27	
19	NRCC SEL-2	2014	Jan (early)	79	7.42	52.00	29.14	3.14	12.73	
20	ULLAL-1	2014	feb (mid)	92	4.60	34.50	29.27	4.67	16.81	
21	ULLAL-3	2014	feb (mid)	105	6.23	38.70	30.12	3.15	13.18	
22	ULLAL-4	2014	feb (mid)	102	5.67	43.00	29.27	4.12	11.07	
23	UN-50	2014	feb (mid)	104	7.24	59.50	28.62	2.97	11.22	
24	GOA-1	2014	feb	103	7.11	51.70	30.12	3.20	12.69	

			(mid)							
25	BHASKARA	2014	Jan (early)	88	5.92	43.00	28.18	7.20	17.92	cluster bearing
	Mean									
	SEm ±				0.24	5.30	0.66	0.68		
	CD @5%				0.67	15.11	1.90	1.72		
	CV (%)				6.08	17.49	3.99	15.56		

With respect to Mean nut weight, mean apple weight, shelling percentage and mean annual nut yield per tree was found to be significant. Among the 25 released varieties, the mean nut weight was found maximum, Priyanka (9.80 g) followed by Vengurla 7 (8.48g) and BPP-8 (7.79g) . The maximum mean annual nut yield per tree during the year was recorded in BPP-8 ( 7.97 kg) followed by BPP-4 (7.27 kg) and Bhaskara (7.20 kg). With regard to the mean apple weight, the highest was recorded in Priyanka (95.63 g) followed by Vengurla -4 (94.0) and Vengurla -1 (91.00 g). The shelling percentage was recorded highest in Amrutha (30.13) followed by Goa-1 (30.12) . The cumulative nut yield per tree during the year was recorded in BPP-8 ( 7.97 kg) followed by BPP(23.98 kg) and followed by BPP-4 (23.32 Kg) and Bhaskara (17.92 kg).

## DARISAI

### Progress/Achievement

The cumulative yield of variety BPP-8 (30.77 Kg/plant) on the basis of seven harvests recorded maximum yield, which was statistically on par with BPP-6 (28.97 Kg/plant) and VRI-3 (27.88 Kg/plant).

**Table: Growth parameters of varieties during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	BH6	2011	4.62	73.26	5.29	4.90
2	BH85	2011	4.87	71.63	3.36	3.92
3	H1597	2011	5.22	77.24	5.16	5.36
4	H662	2011	5.41	78.82	5.29	4.88
5	H675	2011	4.39	69.80	3.93	4.31
6	H11	2011	5.05	75.97	4.06	4.56
7	H14	2011	4.42	69.71	5.09	4.76
8	H32/4	2011	5.17	78.98	5.25	4.87
9	GOA11/6	2011	5.32	81.04	5.11	5.35
10	BPP-4	2011	4.62	71.08	4.79	5.02
11	BPP-6	2012	4.18	65.55	4.97	5.41
12	BPP-8	2012	4.33	67.45	4.59	4.96
13	DHANA	2012	3.94	69.64	5.10	5.71
14	MADAKATHRA-1	2012	4.27	67.67	4.29	4.52
15	MADAKATHRA-2	2012	4.33	69.12	4.43	5.44
16	KANAK	2012	5.30	64.95	5.70	4.32

17	VENGRULA-1	2012	4.98	64.95	5.91	5.61
18	PRIYANKA	2012	5.34	60.35	5.87	6.18
19	ULLAL-1	2013	5.46	63.14	4.23	3.88
20	GOA-1	2013	4.42	67.87	3.85	4.13
21	BHASKAR	2013	4.49	52.89	4.19	4.68
22	VRI-3	2013	4.13	48.70	4.24	4.75
23	K22-1	2013	3.96	48.92	3.89	4.18
24	JHARGRAM-2	2014	3.68	47.30	3.13	2.94
	Mean					
	SEm $\pm$		0.47	3.66	0.41	0.29
	CD @5%		1.32	9.95	118	0.81
	CV (%)		15.13	14.38	15.24	15.52

**Table: Reproductive parameters of varieties during the year 2022**

Sl. No.	Accession	YOP	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	BH6	2011	Nov., E	65.92	6.98	58.22	25.94	3.21	25.2	
2	BH85	2011	Nov., E	73.01	6.64	49.17	24.95	2.87	21.33	
3	H1597	2011	Dec., M	63.09	7.12	51.05	26.00	3.37	26.21	
4	H662	2011	Dec., M	61.32	6.64	59.24	25.45	3.08	23.28	
5	H675	2011	Nov., E	66.42	4.63	51.38	26.16	3.34	24.29	
6	H11	2011	Nov., E	82.41	5.05	57.43	25.89	3.42	26.09	
7	H14	2011	Dec., M	60.71	4.69	52.42	26.27	3.81	26.87	
8	H32/4	2011	Jan., L	56.50	6.19	50.26	26.33	3.18	23.57	
9	GOA11/6	2011	Nov., E	77.06	5.77	60.14	24.38	2.11	17.26	
10	BPP-4	2011	Dec., M	59.41	6.13	33.49	24.79	2.58	21.68	
11	BPP-6	2012	Dec., M	63.77	5.66	34.86	26.00	3.69	28.97	
12	BPP-8	2012	Nov., E	74.57	7.56	56.22	26.91	4.02	30.77	
13	DHANA	2012	Nov., E	73.91	7.65	54.72	24.73	2.19	21.27	
14	MADAKATHRA-1	2012	Dec., M	59.74	7.11	36.35	24.02	1.71	13.37	
15	MADAKATHRA-2	2012	Nov., E	73.05	7.11	41.11	23.72	1.38	12.88	
16	KANAK	2012	Nov., E	75.19	8.30	45.25	24.90	2.59	21.14	
17	VENGRULA-1	2012	Dec., M	62.22	8.07	51.89	24.40	2.17	18.63	
18	PRIYANKA	2012	Dec., M	59.40	8.96	64.43	24.60	2.38	21.42	
19	ULLAL-1	2013	Nov., E	86.85	7.01	34.01	23.47	1.19	13.02	
20	GOA-1	2013	Nov., E	77.51	6.89	41.67	24.40	2.42	18.02	
21	BHASKAR	2013	Nov., E	81.12	7.78	40.79	24.57	2.43	18.71	
22	VRI-3	2013	Jan., L	55.73	6.01	51.63	26.16	3.49	27.88	
23	K22-1	2013	Nov., E	85.56	7.73	88.46	24.11	1.79	15.38	
24	JHARGRAM-2	2014	Dec., M	62.60	5.47	40.19	24.55	2.29	17.52	
	Mean									
	SEm $\pm$			0.23	1.26	10.91	0.23	0.31	1.26	
	CD @5%			0.58	3.71	31.83	0.58	0.81	3.08	

	CV (%)			14.52	14.73	14.47	14.52	15.14	14.62	
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## HOGALAGERE

### Progress/achievements:

Reproductive parameters revealed that flowering mainly initiated during March and the duration extended up to 68 days in case of Vri-3, highest nut weight recorded was 7.9 g in NRCC-2 and V-7 and apple weight was up to 88.5 g in case of Goa-1. The nut yield per tree was higher in V-7 (7.9 kg/tree) and NRCC-2 (7.5 kg/tree) during fifth harvest and cumulative nut yield was highest in Ullal-3 (25.85 kg/tree), followed by V-7 (22.97 kg/tree) and Chintamani-1 (22.32 kg/tree) for first five harvests. The shelling percentage was highest in Goa-1 and was 31.9%.

**Table: Growth parameters of varieties during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	Chintamani-1	2015	3.1	48.6	3.6	4.0
2	Madakathara-1	2015	2.7	55.6	3.4	3.6
3	Vengurla-1	2015	3.0	57.4	4.2	3.8
4	Priyanka	2015	3.1	44.3	4.0	4.0
5	Goa-1	2015	4.1	72.0	4.6	5.4
6	Bhaskara	2015	4.1	62.3	4.6	5.3
7	Ullal-3	2015	3.2	59.1	5.0	4.8
8	BPP-6	2015	3.8	60.9	5.3	5.3
9	Madakkathara-2	2015	3.3	58.3	4.6	5.3
10	Vengurla-6	2015	3.1	51.7	3.8	3.9
11	Vengurla-7	2015	3.6	61.6	5.2	5.3
12	k-22-1	2015	2.7	50.3	3.1	3.1

13	NRCC-sel-2	2015	3.5	54.6	5.2	4.4
14	Ullal-1	2015	3.0	49.5	4.3	4.0
15	Ullal-4	2015	3.9	65.6	5.1	5.4
16	UN-50	2015	3.9	63.7	5.6	6.6
17	Kanaka	2015	3.1	45.3	3.8	3.7
18	Jhargram -1	2015	4.1	61.3	5.3	5.2
19	chintamani-2	2015	3.5	67.7	6.4	6.1
20	Amrutha-10	2015	3.6	61.0	4.5	5.5
21	VRI-3	2015	3.5	67.6	4.3	5.2
22	BPP-4	2015	3.0	46.2	3.2	3.2
23	Dhana	2015	3.5	61.1	5.4	5.4
	Mean	-	3.41	57.64	4.54	4.72
	SEm $\pm$	-	0.16	4.30	0.32	0.29
	CD @5%	-	0.46	12.27	0.90	0.82
	CV (%)	-	8.22	12.93	12.02	10.60

**Table Reproductive parameters of varieties during the year 2022**

Sl. No.	Accession	YOP	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
1	Chintamani-1	2015	March (Mid)	64	7.1	37.6	29.8	6.2	22.32
2	Madakathara-1	2015	March (Late)	66	7.0	66.5	24.8	4.1	12.39
3	Vengurla-1	2015	March (Mid)	52	7.0	45.8	30.7	4.4	18.37
4	Priyanka	2015	March (Late)	45	7.8	31.1	29.2	5.5	18.26
5	Goa-1	2015	March (Late)	46	6.2	88.5	31.9	3.4	14.29
6	Bhaskara	2015	March (Mid)	50	6.6	58.4	27.4	5.6	17.32
7	Ullal-3	2015	March (Mid)	49	6.3	43.8	28.2	6.7	25.85
8	BPP-6	2015	March (Late)	56	6.1	36.7	30.5	5.4	19.56
9	Madakkathara-2	2015	March (Mid)	49	6.5	61.4	29.9	5.9	21.79
10	Vengurla-6	2015	March (Mid)	51	6.4	61.4	28.8	5.5	17.2
11	Vengurla-7	2015	March (Mid)	42	7.9	34.1	29.5	7.9	22.97
12	k-22-1	2015	March (Late)	49	7.0	41.4	29.1	3.3	12.54
13	NRCC-sel-2	2015	March (Early)	49	7.9	48.9	31.8	7.5	21.02
14	Ullal-1	2015	March (Late)	64	6.7	48.6	28.8	5.8	19.77
15	Ullal-4	2015	March (Late)	52	6.7	77.5	30.8	4.1	15.54
16	UN-50	2015	March (Early)	52	6.4	55.8	27.9	5.1	14.33
17	Kanaka	2015	March	40	6.3	65.1	31.3	5.1	17.15

			(Mid)						
18	Jhargram -1	2015	March (Late)	61	6.1	46.0	28.5	3.7	13.88
19	chintamani-2	2015	March (Mid)	49	6.9	28.5	28.9	5.5	18.65
20	Amrutha-10	2015	March (Early)	42	6.0	51.1	30.5	4.1	16.36
21	VRI-3	2015	March (Late)	68	6.6	28.7	29.7	6.2	20.3
22	BPP-4	2015	March (Late)	47	6.1	26.7	28.3	4.4	15.66
23	Dhana	2015	March (Late)	48	6.3	47.6	31.4	5.5	21.25
	Mean	-	March (Late)	52	6.69	49.2	29.8	5.2	18.07
	SEm ±	-	-	2.91	0.36	2.47	1.25	0.48	-
	CD @5%	-	-	8.30	1.02	7.05	3.56	1.37	-
	CV (%)	-	-	9.75	9.56	8.72	7.26	15.88	-





## JAGDALPUR

Nut weight (9.09 g) as well as apple weight (66.67 g) was highest in Priyanka. The shelling percentage was recorded maximum for Vengurle-1 (31.10%) followed by Bhubneswar-1. The maximum yield for the first harvest was recorded in the variety Vengurle-4 which was on par with Vengurle-1.

**Table: Growth parameters of varieties during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1.	BPP-4	2019	2.52	24.00	3.60	3.62
2.	BPP-6	2019	2.57	20.50	2.55	2.88
3.	BPP-8	2019	2.66	21.50	2.95	2.97
4.	Bhubaneswar-1	2019	2.23	18.50	1.96	2.05
5.	Chintamani-1	2019	1.45	19.50	2.56	2.60
6.	Jhargram-1	2019	2.19	18.00	2.20	1.77
7.	Madakathara-1	2019	1.64	14.00	1.35	1.47
8.	Madakathara-2	2019	1.55	18.00	1.82	1.76
9.	K-22-1	2019	2.09	17.00	1.80	1.76
10.	Dhana	2019	1.60	15.00	1.54	1.93
11.	Kanaka	2019	1.80	19.00	1.98	1.83
12.	Priyanka	2019	2.84	20.00	2.72	2.89
13.	Amrutha	2019	1.45	16.50	1.44	1.38
14.	Vengurle-1	2019	2.40	20.00	2.31	2.69
15.	Vengurle-4	2019	2.75	18.00	2.07	2.15
16.	Vengurle-6	2019	2.19	18.50	2.33	2.33

17.	Vengurle-7	2019	1.67	18.00	2.18	2.38
18.	VRI-3	2019	2.34	17.50	1.76	1.31
19.	Ullal-1	2019	2.52	24.00	3.60	3.54
20.	Ullal-3	2019	2.57	20.50	2.55	2.88
21.	Ullal-4	2019	2.66	21.50	2.95	2.97
22.	UN-50	2019	2.23	18.50	1.96	2.05
23.	NRCC Sel. 2	2019	1.45	19.50	2.56	2.60
24.	Bhaskara	2019	2.19	18.00	2.20	1.77
25.	Goa-1	2019	1.64	14.00	1.35	1.47
	Mean		2.17	18.62	2.16	2.21
	SEm $\pm$		0.41	2.37	3.68	3.44
	CD @5%		NS	NS	NS	9.77
	CV (%)		26.69	17.98	24.06	21.95

**Table Reproductive parameters of varieties during the year 2022**

Sl. No.	Accession	YOP	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1.	BPP-4	2019	Early	91.00	5.05	40.53	28.95	0.85	0.85	
2.	BPP-6	2019	Early	78.00	5.21	42.42	28.95	1.12	1.12	
3.	BPP-8	2019	Late	81.50	5.82	66.67	29.20	0.85	0.85	
4.	Bhubaneswar-1	2019	Mid	94.00	4.40	37.17	31.00	0.79	0.79	
5.	Chintamani-1	2019	Early	119.50	5.67	35.33	30.25	0.94	0.94	
6.	Jhargram-1	2019	Mid	105.50	4.80	39.00	29.45	0.58	0.58	
7.	Madakathara-1	2019	Late	82.00	6.40	46.43	30.15	0.66	0.66	
8.	Madakathara-2	2019	Late	90.00	6.37	45.33	30.20	0.65	0.65	
9.	K-22-1	2019	Late	87.50	6.24	40.43	29.10	0.61	0.61	
10.	Dhana	2019	Late	73.00	7.91	47.00	29.15	0.71	0.71	
11.	Kanaka	2019	Late	87.00	6.53	53.67	28.30	0.51	0.51	
12.	Priyanka	2019	Late	110.50	9.09	66.67	28.90	0.73	0.73	
13.	Amrutha	2019	Late	102.00	6.21	48.77	30.65	0.55	0.55	
14.	Vengurle-1	2019	Late	80.00	5.31	45.90	31.10	1.32	1.32	
15.	Vengurle-4	2019	Mid	91.00	7.86	50.83	29.65	1.31	1.31	
16.	Vengurle-6	2019	Late	85.00	7.78	52.23	29.20	0.77	0.77	
17.	Vengurle-7	2019	Mid	93.50	8.17	59.93	29.40	0.91	0.91	
18.	VRI-3	2019	Late	91.50	5.70	39.73	30.20	0.87	0.87	
19.	Ullal-1	2019	Mid	91.00	7.19	52.27	29.20	0.76	0.76	
20.	Ullal-3	2019	Mid	78.00	5.26	35.02	28.90	0.88	0.88	
21.	Ullal-4	2019	Mid	81.50	6.27	38.85	29.55	0.78	0.78	
22.	UN-50	2019	Mid	94.00	5.70	38.30	28.95	0.91	0.91	

23.	NRCC Sel. 2	2019	Mid	112.50	7.54	57.83	29.10	0.89	0.89	
24.	Bhaskara	2019	Mid	105.50	6.38	53.93	30.15	0.82	0.82	
25.	Goa-1	2019	Mid	82.00	6.43	45.53	28.10	0.78	0.78	
	Mean			91.16	6.37	47.19	29.51	0.82	0.82	
	SEm ±			3.99	0.08	0.85	0.23	0.07	0.07	
	CD @5%			11.35	0.23	2.42	0.65	0.20	0.20	
	CV (%)			6.19	1.76	2.55	1.10	12.38	12.38	





### Gen.3. Special Multi Location Trial – (MLT – VI)

**Centres:** Paria  
**West Coast:**  
**Plains / others:** Darisai, Kanabargi and Tura

The objective of this experiment is to evaluate selected released varieties in new centres started during XI Plan (2009).

## PARIA

### Trial Details:

Design	: RCBD
Replication	: Three
Spacing	: 7 m X 7 m
Number of entries	: 8
Details of entries	: V- 4, Bhaskara,BPP-8,NRCC Sel-2,Dhana,VRI-3,VRI-H-1,H-303

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)
1	V-4	2022	0.49	3.27
2	Bhaskara	2022	0.47	2.97
3	NRCC Sel-2	2022	0.47	2.83
4	VRI-3	2022	0.47	2.97
5	H-303	2022	0.44	2.73
	Mean			
	SEm $\pm$		0.02	0.12
	CD @5%		NS	NS
	CV (%)		5.88	7.10

## DARISAI

### Trial Details:

Design : RBD  
 Replication : 3  
 Spacing :  
 Number of entries : 24  
 Details of entries :

### Progress/ Achievements

The mean flowering duration ranged in variety NRCC Sel-2 to BPP-3/28 from 82.72 days to 67.32 days. The mean apple weight of variety H-367 (81.75 gram) was statistically superior to other variety tested. The mean nut weight of H-303 recorded the highest nut weight (5.92 gram) followed by BPP-3/28 (5.72 gram). The maximum nut yield was recorded in variety M-15/4 (3.78 kg/plant) followed by 3.27 kg in variety H-68 in seven harvests. The cumulative yield was also the highest in M-15/4 (27.62 Kg/plant) statistically at par with H-68 (25.96 Kg/plant) on the basis of seven harvests.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	NRCC sel-1	2010	4.66	60.87	5.86	5.51
2	NRCC sel-2	2010	3.94	71.06	4.24	3.87
3	M44/3	2010	4.99	62.02	3.92	4.33
4	M15/4	2010	4.17	57.88	5.93	4.87
5	BPP3/33	2012	4.50	52.95	5.71	5.47
6	BPP10/19	2012	3.94	65.71	4.35	4.14
7	BPP30/1	2012	5.13	74.06	5.65	5.34
8	BPPP3/28	2012	4.63	66.98	4.12	3.56
9	H303	2012	4.78	60.39	5.28	4.93
10	H255	2013	2.89	56.98	5.89	5.37
11	H367	2013	3.30	49.90	3.81	3.45
12	H68	2013	4.42	61.42	4.37	3.89
	Mean					
	SEm $\pm$		0.53	3.01	0.61	0.57
	CD @5%		1.37	8.04	1.63	1.48
	CV (%)		14.58	15.19	14.17	15.47

**Table Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	NRCC sel-1	2010	Dec., M	71.37	4.82	58.62	22.84	2.42	19.40	
2	NRCC sel-2	2010	Nov., E	82.72	5.61	52.39	23.68	3.12	24.21	
3	M44/3	2010	Dec., M	71.03	4.43	35.67	23.42	3.27	24.98	
4	M15/4	2010	Dec., M	75.98	5.67	68.42	24.56	3.78	27.62	
5	BPP3/33	2012	Dec., M	76.09	4.85	48.71	23.14	2.86	22.09	
6	BPP10/19	2012	Dec., M	71.97	4.79	45.83	22.76	2.38	19.31	

7	BPP30/1	2012	Dec., M	70.16	4.91	41.39	22.54	1.98	14.77	
8	BPPP3/28	2012	Jan., L	67.32	5.72	57.40	23.47	2.86	21.71	
9	H303	2012	Nov., E	79.86	5.92	56.81	24.14	3.15	23.55	
10	H255	2013	Nov., E	78.81	4.49	57.95	24.46	3.23	25.12	
11	H367	2013	Dec., M	74.46	5.18	81.75	23.12	2.81	22.49	
12	H68	2013	Dec., M	77.03	4.06	57.41	23.18	3.37	25.96	
	Mean									
	SEm $\pm$			1.07	0.34	3.32	0.23	0.26	0.78	
	CD @5%			2.83	0.83	9.82	0.58	0.59	1.82	
	CV (%)			14.34	15.18	14.19	13.68	14.83	14.57	



## KANABARGI

### Trial Details:

Design	: RBD
Replication	: Three
Spacing	: 6m x 6m
Number of entries	: Eight
Details of entries	: H-303, VRI (CW) H-1, NRCC Sel-2, Vengurla-4, Bhaskara, VRI-3, Dhana, BPP-8

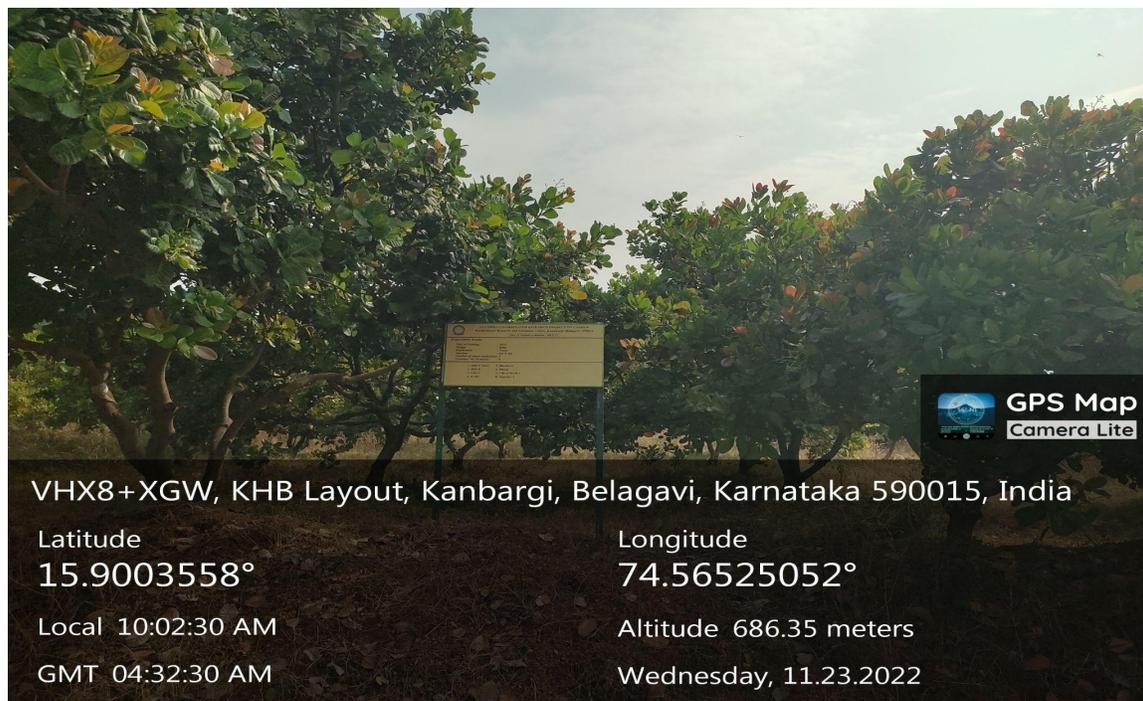
**Progress/Achievements:** Among the accessions Bhaskara is performed well for the vegetative characters followed by BPP-8 and V-4. For the yield characters, Bhaskara recorded more yield followed by NRCC-2 and V-4.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	H-303	2015	3.65	61.80	4.87	4.79
2	VRI (CW) H-1		2.85	39.53	3.44	3.17
3	NRCC-2		3.00	58.03	3.77	4.68
4	V-4		4.10	57.32	4.70	4.84
5	Bhaskara		4.73	66.75	5.45	5.69
6	VRI-3		4.09	56.16	4.27	4.32
7	Dhana		3.69	54.60	4.76	4.55
8	BPP-8		4.34	47.60	4.17	4.12
	Mean		3.81	55.22	4.43	4.52
	SEm $\pm$		0.36	2.33	0.33	0.25
	CD @5%		1.09	7.07	0.99	0.77
	CV (%)		16.34	7.31	12.80	9.77

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
1	H-303	2015	Dec-Jan Late			88.77		3.79	15.28
2	VRI (CW) H-1					85.40		4.17	13.40
3	NRCC-2					72.30		5.55	19.11
4	V-4					97.64		4.48	16.17
5	Bhaskara					101.00		5.57	18.53
6	VRI-3					62.70		3.77	14.27
7	Dhana					51.00		4.24	14.70
8	BPP-8					88.00		4.19	12.14
	Mean					80.85		4.47	15.45
	SEm $\pm$							0.36	
	CD @5%							1.09	
	CV (%)							13.99	



## TURA

### Trial Details:

Design	: RBD
Replication	: 5
Spacing	: 8 m x 8 m
Number of entries	: 7
Details of entries	: Dhana, VRI (CW)H-1, Bhaskara, BPP-8, VRI-3, H-303, V-4

### Progress/Achievements:

The performance of the seven cashew genotypes at ICAR-KVK, West Garo hills, Tura, Meghalaya was studied. Table indicated that highest plant height was recorded in Bhaskara (5.83 m) followed by VRI (CW)H-1 (4.4m) and BPP-8 (4.0m). Plant spread (NS x EW) was recorded highest in Dhana (5.60m x 5.23m), while lowest in VRI-3 (3.50m x 3.60m). Highest nut weight and shelling percent was recorded in H.303 (8.1g) and H-303 (31.49%) respectively while the apple weight was recorded highest in Dhana (72.67g). The nut yield was recorded highest in Dhana (5.50kg) followed H-303(4.50kg). Plant survival was recorded maximum in Dhana (60%) followed by Bhaskara (46%).

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)
---------	-----------	------------------	-----------------	-----------------	-------------------

					E-W	N-S
1	<b>Dhana</b>	2010	3.78	56.5	5.60	5.23
2	<b>VRI (CW)H-1</b>	2011	4.4	50.2	4.55	4.36
3	<b>Bhaskara</b>	2015	5.83	60.4	4.82	4.80
4	<b>BPP-8</b>	2015	4.0	53.5	4.20	4.83
5	<b>VRI-3</b>	2015	3.5	40.5	3.50	3.60
6	<b>H-303</b>	2015	3.98	60.0	3.98	3.80
7	<b>V-4</b>	2015	3.45	53.7	4.50	4.47
	Mean					
	SEm ±		0.29	2.84	0.17	0.21
	CD @5%		0.92	8.42	0.55	0.66
	CV (%)		15.15	21.25	8.59	10.45

**Table Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
1	<b>Dhana</b>	2010	January	55-60	7.3	72.67	26.02	5.50	9.06
2	<b>VRI (CW)H-1</b>	2011	January	60-65	5.6	33.34	21.43	4	4.0
3	<b>Bhaskara</b>	2015	-	-	7.41	65.1	25.65	3	5.5
4	<b>BPP-8</b>	2015	March	60-62	8.0	66.67	31.25	2	2.0
5	<b>VRI-3</b>	2015	January	50-55	6.50	30.69	30.76	2	2.0
6	<b>H-303</b>	2015	March	60-70	8.1	37.34	31.49	4.50	4.5
7	<b>V-4</b>	2015	March	50-60	6.7	46.33	28.36	2	2.0
	Mean			50-60	7.09	50.31	27.85	3.29	4.15
	SEm ±				0.08	0.95	0.82	---	-
	CD @5%				0.27	2.99	2.59	---	-
	CV (%)				3.39	7.37	6.47	---	



#### Gen.4. Hybridization and Selection

**Centres: East Coast :**

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

**West Coast :**

Goa, Madakkathara, Pilicode and Vengurla

**Plains / others:**

Darisai, Hogalagere and Jagdalpur

The objective of this experiment is to utilize accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP centres as parents, to combine the desirable traits such as high yield, bold nut, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering and high shelling percentage in single genotype.

## BHUBANESHWAR

**Table Details of hybridization programme at Bhubaneswar Centre, 2021-2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	BBSR-1 x VTH711/4	525	58	32.75	42	71.41	42
2	VTH711/4 x BBSR-1	218	3	22.16	1	33.33	1
3	BhaskaraxVTH 711/4	51	-	16.27	-	-	-
4	VTH711/4xBhaskara	44	-	10.32	-	-	-
	<b>Total</b>	<b>838</b>	<b>61</b>				<b>43</b>



### Evaluation Details

#### Advanced varietal Trial (AVT)-2014

Design	: RBD
Replication/ Blocks (if augmented design followed)	: 02
Spacing	: 7mx7m
Number of entries	:15
Details of entries	: B-27(BH-27), C-30(BH-30), D-19(BH-19), C2-6(BH2-6), BH-105, Bhubaneswar-1, RP-1, RP-2, M-44/3, Kankadi, VTH-711/4, NRCC Sel.-2, H-320, Dhana and BPP8(check)

### Progress/Achievements

From the evaluation data, it is revealed that the evaluated genotypes exhibited significant differences for the characters viz. duration of flowering, nut weight, apple weight, shelling %, mean annual nut yield  $\text{plant}^{-1}$  and cumulative nut yield  $\text{plant}^{-1}$ . The evaluated genotypes exhibited early to medium flowering season except genotype Kankadi which recorded late flowering season. Duration of flowering was recorded highest in genotype, BH2-6(60.5 days) while the lowest duration of flowering was recorded in genotype, VTH711/4(49.5 days). Mean nut weight ranged from minimum 4.06g in RP-2 to maximum 14.33g in genotype, Kankadi. Mean apple weight was recorded in genotype, VTH711/4(75.0g) and the minimum was observed in genotype M44/3(31.65g). Shelling varied from minimum 24.6 % (Kankadi) to maximum 32.55 % (RP-2) during evaluation. Genotype, BH2-6 recorded significantly maximum mean annual nut yield ( $12.33 \text{ kg plant}^{-1}$ ) as well as cumulative nut yield ( $40.73 \text{ kg plant}^{-1}$  for 6 harvests) among the fifteen evaluated cashew genotypes. The genotype, BH2-6 recorded 13.73% higher nut yield than the check variety, BPP-8( $10.64 \text{ kg plant}^{-1}$ ). The genotypic mean for duration of flowering, nut weight, apple weight, shelling % and annual nut yield were 55.25 days, 7.56g, 47.92g, 30.23% and  $7.75 \text{ kg plant}^{-1}$  respectively.



**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	B-27(BH-27)	2014	4.65	49.62	5.5	4.9
2	C-30(BH-30)	2014	5.13	64.47	5.95	6.00
3	D-19(BH-19)	2014	6.10	65.9	6.22	6.65
4	C2-6(BH2-6)	2014	5.82	57.57	5.03	5.98
5	BH-105	2014	4.32	52.87	5.02	5.12
6	Bhubaneswar-1	2014	4.31	56.62	5.57	4.67
7	RP-1	2014	5.25	49.42	5.83	5.65

8	RP-2	2014	4.35	60.73	5.94	6.25
9	M-44/3	2014	3.87	47.36	4.07	4.14
10	Kankadi	2014	5.10	67.47	6.05	6.26
11	VTH-711/4	2014	5.25	55.00	5.78	6.16
12	NRCC Sel.-2	2014	3.90	44.67	4.72	5.77
13	H-320	2014	4.72	45.45	5.27	3.90
14	Dhana	2014	5.33	68.12	5.71	6.30
15	BPP-8	2014	4.46	58.17	6.06	5.77
	Mean		<b>4.83</b>	<b>56.23</b>	<b>5.51</b>	<b>5.57</b>
	SEm ±		<b>0.19</b>	<b>3.61</b>	<b>0.36</b>	<b>0.31</b>
	CD @5%		<b>0.59</b>	<b>10.95</b>	<b>1.11</b>	<b>0.96</b>
	CV (%)		<b>5.73</b>	<b>9.10</b>	<b>9.45</b>	<b>8.07</b>

**Table Reproductive parameters during the year 2022**

	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	B-27(BH-27)	2014	Medium	50.5	7.15	60.35	32.50	6.51	23.36	bold nut
2	C-30(BH-30)	2014	Medium	54.0	6.45	46.05	30.50	9.06	29.54	Cluster bearing
3	D-19(BH-19)	2014	medium	58.5	8.61	48.95	30.34	10.72	35.36	bold nut
4	C2-6(BH2-6)	2014	Medium	60.5	8.62	34.97	30.65	12.33	40.73	bold nut and high nut yield
5	BH-105	2014	Early	54.0	6.69	63.20	30.58	9.35	29.17	Early type and high yield
6	BBSR-1	2014	Medium	59.5	5.46	34.40	31.55	7.04	25.79	Cluster bearing and high shelling
7	RP-1	2014	Early	57.5	4.46	35.30	31.40	9.23	26.99	Cluster bearing
8	RP-2	2014	Medium	59.0	4.065	31.65	32.55	<b>9.78</b>	<b>31.07</b>	Cluster bearing
9	M-44/3	2014	Early	58.0	5.10	31.70	30.45	5.38	20.81	Ealy type and cluster bearing
10	Kankadi	2014	Late	46.5	14.33	72.25	24.60	<b>0.9</b>	<b>3.73</b>	Bold nut and big size apple
11	VTH-711/4	2014	Medium	49.5	12.4	75.00	29.20	1.14	6.43	Bold nut and big size apple
12	NRCC Sel.-2	2014	Medium	57.5	7.5	44.37	30.80	9.21	25.95	Bold nut
13	H-320	2014	Early	55.0	7.27	43.50	28.50	5.38	15.84	Early type
14	Dhana	2014	Medium	52.0	7.72	54.40	29.68	10.36	32.63	Bold nut
15	BPP-8	2014	Early	57.0	7.65	42.80	30.22	<b>10.64</b>	<b>32.98</b>	Early type and bold nut
	Mean			<b>55.26</b>	<b>7.56</b>	<b>47.92</b>	<b>30.23</b>	<b>7.90</b>	-	
	SEm ±			<b>2.85</b>	<b>0.24</b>	<b>1.68</b>	<b>0.31</b>	<b>0.52</b>	-	

CD @5%			8.62	0.73	5.11	0.96	1.59	-	
CV (%)			7.29	4.52	4.98	1.49	9.41	-	

### Evaluation of F<sub>1</sub> progenies (Year of planting 2017 and 2018)

F<sub>1</sub> progenies of year 2017 and 2018 planting were evaluated at 4mx4m spacing during the fruiting season 2022. The progenies A-1/17, B-5/18, G-6/18, H-2/18, H-3/18, K-1/18 and L-5/18 were found promising with respect to nut weight, shelling %, mean annual nut yield and cumulative nut yield. An advanced varietal trial has been laid out with these identified genotypes for further evaluation following standard package of practices. The important economic characters of the identified genotypes are presented below

### Yield attributing parameters and nut yield of promising F<sub>1</sub> progenies-2020-2021

Accession no.	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight(g)	Apple weight(g)	Shelling %	Mean annual nut yield (kg plant <sup>-1</sup> )	Cum. nut yield(kg plant <sup>-1</sup> )	Special features
A-1/17	2017			10.1	56.2	31.1	3.70	6.43	Bold nut & high yield
B-5/18	2018			8.5	55.6	30.7	2.27	3.74	Bold nut & high yield
G-6/18	2018			9.0	56.1	30.5	3.60	5.70	Bold nut & high yield
H-2/18	2018			10.1	66.4	29.0	1.53	2.34	Bold nut & high yield
H-3/18	2018			10.5	63.5	29.6	1.80	2.12	Bold nut & high yield
K-1/18	2018			9.0	97.2	30.5	1.10	1.45	Bold nut & high yield
L-5	2018			7.5	52.1	32.53	3.2	5.42	Early

### Advanced Varietal Trial (AVT)-2020

Design : RBD  
 Replication/ Blocks : 02  
 (if augmented design is followed)  
 Spacing : 6mx6m  
 Number of entries : 35  
 Details of entries :

<b>F1 progenies</b>	:	16(A-1, D-1, D-25, Q-5, B-58,D-28,F-32,F-40,C2-6,C7-10,E7-5,D6-8, A-7, E-20,B-77,E7-2)
<b>Parents:</b>	:	15(BBSR-1, BBSR Ç'-1, BBSR "C"-2,M44/3, VTH-711/4,Kankadi,RP-1,RP-2,Khurda-1, Kalyanpur bold nut, OS-5,BPP30/1, RP-4,RP-6, Ransinghpur bold nut)
Checks	:	04(BPP-8, Jagannatha, Balabhadra, V-9)
Spacing	:	6mx6m
Year of planting	:	2020

This experiment was laid out during the year 08.08. 2020 involving 16 F1 progenies, 15 parents and 04 check varieties. All the standard package of practices have been followed for laying out of the experiment. Now the plants are at vegetative stage. It will start bearing from the 2023 fruiting season.

#### **Advanced Varietal Trial (AVT)-2022**

Design	:	RBD
Replication/ Blocks x	:	02
Spacing (if augmented design is followed)	:	6mx6m
Number of entries	:	20
Details of entries	:	D-10, D-11, H3/18, C1-5,C2-5,A/17,B-5/18,G-6/18,H-2/18,L-5/18,H1593,BT-1,BT-4,BT-10,BT-65,BPP-8, V-7, Jagannatha, Blabhadra
Spacing:		6mx6m
Year of planting:		2022

This experiment was laid out on 2<sup>nd</sup> September,2022 following statistical design RBD and each genotypes were replicated twice.The F<sub>1</sub> progenies identified as promising from 2017 and 2018 hybridization programme have been planted in replicated trial following all the standard package of practices for further evaluation. Now the plants are at vegetative stage.

#### **Evaluation of F<sub>1</sub> progeny of 2020 hybridization programme**

Design	:	Augmented
Replication/ Blocks (if augmented design is followed)	:	
Spacin	:	6mx6m
Number of entries	:	
Details of entries progenies:48	:	F1

Parents:10  
 Checks:02  
 Year of planting : 2020

The experiment was laid out on 29.09.2020 following augmented design consisting of 96 genotypes distributed in 04 blocks for further evaluation. Plants are at vegetative stage.

### Evaluation of F1 progeny of 2021 hybridization programme

Design : Augmented  
 Replication/ Blocks :  
 (if augmented design is followed)  
 02  
 Spacing : 6mx6m  
 Number of entries : 102  
 Details of entries : F1  
 progenies : 102  
 Parents : 18  
 Checks : 03  
 Year of planting : 2021

The experiment was laid out on 18.08.2021 following Augmented design consisting of 123 genotypes distributed in 02 blocks. Now the plants are at vegetative stage.



## JHARGRAM

### Progress/achievements :

During 2018 crossing was done between JGM - 282 (a semi dwarf, pruning responsive, cluster bearing, early flowering type, TMB tolerant germplasm) and Bidhan Jhargram - 2 ( a bold nut type, early flowering tall variety). 21 F<sub>1</sub> progenies planted. 2019 different combinations with bold nut, cluster bearer, high yielder were crossed and 8 plants were planted. In 2021 crossing was done between H - 139 and JGM - 282, BPP - 8 and JGM - 282 and Bidhan Jhargram - 2 and JGM - 282. Total 64 F<sub>1</sub> progenies were planted.

### Evaluation Details

Design	:	Randomised complete block design
Replication/ Blocks (if augmented design is followed)	:	2
Spacing	:	7m X7m
Number of entries	:	10
Details of entries	:	H- 121, H- 132, H- 139, H- 33, H- 113, H- 35, H- 126, H- 37, H- 41 , BPP- 8 (Check Variety)

H- 35 and H- 113 hybrids were found to be promising among the 2015 planted replicated trial of hybrids with respect to nut weight and yield. H- 139 had bold nuts and 32 % shelling recovery but yield was too low. On the other hand H- 41 had high shelling % and heavy yielder but nut size was only 4.58 g.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	H- 121	2015	4.38	65.25	6.70	6.58
2	H- 132	2015	5.15	63.50	6.55	6.13
3	H- 139	2015	4.10	47.00	6.00	5.18
4	H-33	2015	4.58	66.50	7.41	6.78
5	H-113	2015	3.94	43.75	6.16	5.25
6	H- 35	2015	5.70	70.50	7.28	7.88
7	H- 126	2015	5.38	68.25	6.85	6.18
8	H- 37	2015	5.05	76.25	6.95	6.68
9	H- 41	2015	5.78	70.00	7.63	7.70
10	BPP- 8 (Check)	2015	3.65	42.75	4.83	4.73
	Mean					
	SEm ±		0.29	4.94	NS	0.56
	CD @5%		0.85	14.33		1.64
	CV (%)		12.34	16.09	18.75	17.89



**Table Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	H- 121	2015	March Late	55	6.10	44.00	29.63	7.31	19.71	High Yielder
2	H- 132	2015	March Late	60	5.20	56.00	31.47	10.48	22.77	Very High Yielder

3	H-139	2015	January middle Very Early	74	7.78	76.50	32.02	3.66	10.06	Bold nut, High sex ratio, Fruit drop is more.
4	H-33	2015	March Late	45	6.15	40.50	32.49	7.75	21.12	High Yielder
5	H-113	2015	March Late	50	6.69	64.75	29.81	6.38	22.27	Bold nut, High yield, Susceptible to TMB
6	H-35	2015	February middle Mid	52	7.40	43.75	31.50	6.44	15.05	Bold Nut, High yield, High Shelling%
7	H-126	2015	January Early	70	4.13	38.00	35.08	5.46	22.35	High Shelling%
8	H-37	2015	February Mid	62	5.05	33.25	33.69	9.87	29.97	High Yielder, Cluster bearer, High sh%
9	H-41	2015	January Early	70	4.58	13.50	39.30	16.36	22.85	High Yield, High sh%, Orange col very sweet , juicy, cashew apple
10	BPP- 8 (Check)	2015	March Late	64	5.85	45.00	35.09	11.02	14.20	
	Mean									
	SEm ±				0.22	0.62	1.08	0.77		
	CD @5%				0.64	1.81	3.14	2.24		
	CV (%)				7.54	2.75	6.55	18.20		

### Growth Parameters of Hybrids planted in 2018

Hybrid No	Cross combination	Height	Girth	E-W	N-S	area	Sex Ratio
H - 181	JGM - 282 x JGM - 216	3.6	40.0	3.4	4.4	20.89	0.14
H -182	JGM - 282 x JGM - 216	3.5	45.0	5.4	4.1	27.95	0.39
H - 183	JGM - 282 x JGM - 216	4.0	35.0	5.3	5.2	39.44	0.23
H -184	JGM - 282 x JGM - 216	3.0	39.0	4.1	2.9	15.88	0.21
H -185	JGM - 282 x JGM - 216	3.5	44.0	5.3	4.2	31.54	0.26
H -186	JGM - 282 x JGM - 216	3.3	35.0	4.6	3.4	24.23	0.23
H -187	JGM - 282 x JGM - 216	4.0	40.0	3.8	4.8	30.66	0.33
H -188	JGM - 282 x JGM - 216	3.6	37.0	4.6	3.7	27.07	0.30
H -189	JGM - 282 x JGM - 216	3.5	43.0	4.9	4.5	27.54	0.22
H -190	JGM - 282 x JGM - 216	4.0	50.0	5.2	4.6	34.78	0.24
H -191	JGM - 282 x JGM - 216	4.8	55.0	4.9	4.5	36.16	0.38
H -192	JGM - 282 x JGM - 216	4.0	40.0	5.7	6.3	45.61	0.29
H -193	JGM - 282 x JGM - 216	3.9	42.0	4.9	5.5	36.92	0.25
H -194	JGM - 282 x JGM - 216	4.0	43.0	5.4	4.6	37.03	0.33
H -195	JGM - 282 x JGM - 216	4.0	45.0	5.6	5.3	41.41	0.30
H -196	JGM - 282 x JGM - 216	3.9	45.0	6.1	4.6	39.72	0.41
H -197	JGM - 282 x JGM - 216	3.0	32.0	2.8	3.1	13.84	0.18
H -198	JGM - 282 x JGM - 216	4.0	46.0	5.2	4.3	29.72	0.22
H -199	JGM - 282 x JGM - 216	3.8	37.0	5.9	5.7	40.69	0.20
H -200	JGM - 282 x JGM - 216	3.0	34.0	3.8	3.2	17.22	0.21
H -201	JGM - 282 x JGM - 216	3.8	37.0	3.6	3.9	24.95	0.22

### Reproductive parameters of hybrids planted in 2018

Hybrid No	Cross combination	Flowering/ m2	Laterals/ m2	Nuts/ m2	Nuts/ panicle	Nut weight(g)	Shelling %	Apple Weight(g)	Yield /tree(Kg)	cum yield 3rd hvt.(Kg/tree)
H - 181	JGM - 282 x JGM - 216	12.0	7.0	7.8	2.8	6.7	35.0	60.0	1.01	1.61
H -182	JGM - 282 x JGM - 216	14.5	8.5	15.3	2.5	7.7	29.9	27.0	3.28	4.98
H - 183	JGM - 282 x JGM - 216	17.0	6.8	25.0	6.0	6.7	35.0	25.0	5.72	6.72
H -184	JGM - 282 x JGM - 216	13.0	8.0	21.5	6.0	5.3	31.1	44.5	1.82	2.82
H -185	JGM - 282 x JGM - 216	9.0	19.8	26.8	7.3	5.0	33.2	28.0	4.22	6.82
H -186	JGM - 282 x JGM - 216	12.5	11.0	23.5	9.5	7.0	33.3	40.0	3.99	4.69
H -187	JGM - 282 x JGM - 216	15.8	6.8	31.0	6.8	4.7	28.6	35.0	4.44	5.64
H -188	JGM - 282 x JGM - 216	15.8	9.3	21.5	3.8	6.0	31.7	45.0	3.50	4.20
H -189	JGM - 282 x JGM - 216	10.5	8.3	31.0	6.0	7.0	31.4	22.0	5.98	9.28
H -190	JGM - 282 x JGM - 216	10.5	13.5	27.3	5.0	6.8	26.5	54.0	6.45	10.35
H -191	JGM - 282 x JGM - 216	11.5	8.5	19.8	4.0	8.2	29.3	47.0	5.86	8.96
H -192	JGM - 282 x JGM - 216	11.3	10.0	28.3	6.3	5.3	34.7	72.0	6.57	10.07
H -193	JGM - 282 x JGM - 216	15.3	17.3	29.0	6.0	6.7	30.0	33.5	4.50	9.30
H -194	JGM - 282 x JGM - 216	14.8	9.0	27.8	6.3	5.7	23.5	35.0	6.88	8.08
H -195	JGM - 282 x JGM - 216	14.3	10.5	16.5	3.8	5.0	33.4	31.0	3.42	8.92
H -196	JGM - 282 x JGM - 216	15.8	14.0	39.3	8.0	4.3	23.1	26.0	11.30	14.20
H -197	JGM - 282 x JGM - 216	13.3	8.3	12.3	4.0	6.6	30.3	27.0	0.99	4.29
H -198	JGM - 282 x JGM - 216	18.3	14.8	26.8	6.3	5.0	26.7	36.0	5.17	7.37
H -199	JGM - 282 x JGM - 216	16.5	7.5	23.8	4.5	5.9	32.2	53.5	0.00	1.20
H -200	JGM - 282 x JGM - 216	11.8	10.5	24.3	4.5	6.0	33.3	31.0	5.70	6.80
H -201	JGM - 282 x JGM - 216	6.0	8.0	34.0	5.8	6.7	34.8	35.0	2.30	4.60

H- 191 (4.8m) was the tallest plant recorded among the F1 hybrids planted in 2018 and the shortest plants were h- 184, H- 197 and H- 200 having a height of 3m at the age of 4 years. The girth range was between 32 – 55cm. The E-W spread was between 2.8 – 6.1m and N-S spread was between 2.9 – 6.3m. Therefore, maximum canopy area was recorded in H- 192 (45.61m<sup>2</sup>) followed by H – 195 (41041m<sup>2</sup>) and H- 199 (40.69m<sup>2</sup>) and minimum canopy area was in H- 197 (13.84m<sup>2</sup>).

Therefore, it was observed that H- 189, H- 191, H- 193, H- 183 hybrids are promising. Flowering density was highest in H- 198 (18.3 panicles/m<sup>2</sup>) followed by H- 183 (17.0 panicles/m<sup>2</sup>) and H- 199 (16.5 panicles/m<sup>2</sup>). Nut bearing was highest in H- 196(39.3 nuts/m<sup>2</sup>) followed by H- 201 (34 nuts/m<sup>2</sup>) and H- 189, H- 187 (31 nuts/m<sup>2</sup>). H- 186 and H- 196 were found cluster bearers. More than 6 nuts were recorded in H- 185, H- 187, H- 192,

H- 194 H- 198. Bold nuts were recorded in H- 191 (8.2g), H- 182 (7.7g), H- 186 (7.0g) and H- 189 (7.0g). Shelling percentage ranged between 23.1-35% and highest was recorded in H- 183 and H- 181. The bold nut type hybrids H- 186 and H- 189 both had more than 30% shelling recovery. At the 4<sup>th</sup> year of harvest, the highest yielder was H- 196 (11.30kg/tree). Other good yielders were H- 194, H- 192 and H- 190, yielding more than 6kg/tree. The bold nut type hybrids H- 191 and H-189 also produced more than 5 kg/tree. Cumulative yield was maximum in H- 196 (14.20 kg/tree) followed by H- 190 (10.30kg/tree) and H- 192 (10.07 kg/tree)

## VRIDHACHALAM

### Progress/achievements:

Hybridisation was carried out using VRI2, VRI.3 and HC6. A total of 178 numbers of hermaphrodite flowers were pollinated in two different cross combinations and 10 nuts were harvested. HC.6 which is a semi dwarf F<sub>1</sub> was selfed.

**Table Details of hybridization programme during 2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	VRI.3 X VI.2	96	12	12.50	8	66	
2	VRI.2 VS.3	82	4	15	2	50	
3	HC.6 selfed	24(selfed)	3	9.2	1	33	
	<b>Total</b>	<b>178</b>	<b>19</b>		<b>11</b>		



## GOA

### a. Crossing and raising of crossed seedling progeny :

During the flowering season (December 2021 to March 2022), 1661 crosses involving different parental combinations were effected. Percent nut set of the crosses varied from 5.81 (HB-31/05 X Tiswadi-3) to 25.36 (T11 X Valpoi-2) and, a total of 304 crosses resulted in the development and maturity of crossed seed nuts which were collected and hybrid seedlings were raised.

**Table 1. Different parental combinations for crossing and percent fruit set**

Parental combination	Number of crosses (nos)	Crossed seed nuts obtained (Nos)	% Set
Tiswadi-3 × Vengurla-4	31	4	12.9
HB-31/05 × Tiswadi-3	86	5	5.81
Tis-3 X Valpoi-7	35	5	14.28
Valpoi - 7 × Tiswadi-3	293	33	11.26
Valpoi-1 × Bhars-1	280	61	21.78
T-11 × Valpoi-2	205	52	25.36
Valpoi-2 × T-11	21	5	23.8
Balli-1 × Tiswadi-3	208	49	23.55
Tiswadi-3 × Balli-1	92	8	8.69
GB-2 × Valpoi-2	40	10	25.00
GB-2 × Tiswadi -3	60	4	6.66
T-11× Tudal	27	6	22.22
Tudal × T-11	80	18	22.5
KN-2 × Valpoi-2	145	36	24.82
	1661	304	18.30

### b. Evaluation of crossed progeny

Among 1<sup>st</sup> set of 12 genotypes of crossed seedling progeny, cumulative raw nut yield for 8 harvests varied from 28.62 kg/tree (H-5/05) to 112.91 kg/tree (H-31/05) with mean nut weight of 9.14g and shelling percentage of 31.84 in the former, and 6.06g and 31.42 in the later respectively. Two crossed seedlings viz. H 21/05 and H-27/05 continued to record promising performance with nut yield of 9.35kg/tree and 12.54 kg/tree respectively during 2022 season with pooled mean nut weight of 8.46g and 7.85g, and per cent shelling of 31.18 and 28.12 respectively, while the cumulative nut yield for 8 harvests was 82.27kg/tree with average nut yield of 10.28kg/tree in H-21/05 with the corresponding values of 81.22 kg/tree and 10.15kg/tree in H-27/05. Pooled mean apple size was observed to be more than 74 g with higher TSS of 10.8 – 11.2 °B in both the crossed seedlings. Although, the highest cumulative nut yield ( 110.91kg/tree) was recorded in H-31/05, the mean nut size was abysmally small (6.06g) coupled with smaller sized apple (48.6g), however with the conspicuous cluster bearing tendency. Therefore, this was also used as potential parent in crossing programme. Considering their consistent promising performance with respect to nut yield and nut and apple quality during the last 8 harvesting seasons, H-21/05 and H-27/05, are shortlisted for submitting the variety release proposals for the state of Goa.

Table 2. Nut yield performance of crossed seedling progeny of first set

S. No	Crossed seedling progeny	Nut yield (kg/tree)								Cum. yield (kg/tree) (8 harvests)	Av. nut yield (Kg/tree) (8 harvests)
		2015	2016	2017	2018	2019	2020	2021	2022		
1	H- 5/05	1.65	1.45	3.12	1.87	3.24	5.58	4.86	6.85	28.62	3.57
2	H- 14/05	1.81	3.28	4.24	3.22	5.32	8.87	4.55	5.55	33.38	4.17
3	H- 11/05	4.41	4.90	6.42	6.77	7.11	8.36	5.34	6.35	49.66	6.20
4	H- 12/05	5.85	8.25	8.42	5.97	7.32	8.48*	4.58*	3.88	52.75	6.59
5	H- 13/05	0.89	1.85	3.25	5.3	5.98*	2.86*	2.11**	-	-	-
6	H- 21/05	6.7	8.55	9.27	10.32	14.24	13.28	10.5	9.35	82.27	10.28
7	H- 22/05	2.87	5.68	6.25	5.17	7.68	8.78*	3.1*	5.88	45.41	5.67
8	H- 23/05	2.02	4.05	5.87	4.35	5.55	6.58	4.95	6.86	40.23	5.02
9	H- 27/05	3.35	5.35	6.84	12.6	12.88	10.64	17.02	12.54	81.22	10.15
10	H- 29/05	1.55	2.85	3.33	5.66*	-	-	-	-	-	-
11	H- 30/05	1.01	2.35	3.52*	2.92*	5.78	4.55	5.75	5.22	31.11	3.88
12	H- 31/05	8.56	12.45	8.86	18.22	21.45*	19.33*	13.6*	8.44	110.91	13.86

\* Affected by CSRB ; \*\* Died due to CSRB

**Table 3. Performance of Nut and apple characteristics of 1<sup>st</sup> set of crossed seedling progeny ( Pooled means for 8 harvests)**

Sr. No	Crossed seedling progeny	Av. Nut Wt. (g)	Shelling (%)	Apple wt (g)	TSS (° B)

1	H- 5/05	9.14	31.84	69.3	10.6
2	H- 14/05	7.98	29.69	77.5	9.2
3	H- 11/05	7.02	31.46	82.2	8.8
4	H- 12/05	8.1 2	28.73	80.4	11.4
5	H- 13/05 <sup>#</sup>	7.49	28.00	76.6	10.4
6	H- 21/05	8.46	31.18	78.8	10.8
7	H- 22/05	9.86	32.64	84.2	11.2
8	H- 23/05	7.78	34.19	72.4	10.8
9	H- 27/05	7.85	28.12	74.3	11.2
10	H- 29/05 <sup>*</sup>	7.70	-	60.4	8.6
11	H- 30/05	7.59	28.02	82.6	9.8
12	H- 31/05	6.06	31.42	48.6	12.4

# Pooled mean for 7 harvests; \* Pooled mean for 4 harvests

In second Evaluation block comprising of 234 crossed seedling genotypes, established during July, 2019, 35 genotypes started flowering, of which fruits were obtained from 8 crossed genotypes indicating their precocious nature ( Table ).

Table 4 . Nut and Apple characteristics of precocious crossed genotypes ( 2022 season)

Sl.No.	Parental combination	No. fruits obtained	Nut wt (g)	Apple wt (g)	TSS (°B)
1	39Ax Valpoi 7 (HB18/178)	3	12.2	146	11
			12.8	142	13
			10.4	131	11
		<b>Mean</b>	<b>11.8</b>	<b>139.6</b>	<b>11.6</b>
2	Veng -4 x Tis-3 (HB18/346)	2	12	158	11
			11	156	11
		<b>Mean</b>	<b>11.5</b>	<b>157</b>	<b>11</b>
3	Tis-3x Veng-4 HB-18/384	3	10	84	9.4
			11	80	9.3
			9	88	9.1
		<b>Mean</b>	<b>10.0</b>	<b>84</b>	<b>9.2</b>
4	Valpoi -7x 39-A HB-18/248	3	9	97	9
			8	92	9.4
			9	90	9
		<b>Mean</b>	<b>8.6</b>	<b>93</b>	<b>9.1</b>
5	Tis-3 x 10-A HB-18/108	2	12	98	10.9
			13	82	12.4

		Mean	12.5	90	11.6
6	Tis-3 x Veng-4 HB-18/376	2	10	110	11.4
			11	102	11.4
		Mean	10.5	106	11.4
7	39 A x Valpoi -7 HB-18/179	5	9	85	11
			7	84	11.6
			8	70	11.2
			8	58	11.2
			9	56	11.3
		Mean	8.2	70.6	11.2
8	Valpoi -7 x39-A HB-18/201	2	9	62	12.5
			8	54	13
		Mean	8.5	58	12.7

Among the crossed genotypes which started flowering and fruiting, the nut weight was in between 8.2g (HB-18/179) and 12.5g (HB-18/108). Five genotypes produced bigger sized nuts of more than 10g. While the remaining three genotypes had the nut weight of 8.2-8.6g. Similarly, mean apple size varied from 58 g (HB-18/201) to 157g (HB18/346) with apples having higher TSS (>11 °B) in most of the genotypes.

## MADAKKATHARA

### Progress/achievements :

During the year, hybridization was done with an objective to develop hybrids with bold nut and high shelling percentage. Kanaka, Dhana, Amrutha and Poornima were used as female parents and crossed with Priyanka, the bold nut type. A total of 891 numbers of hermaphrodite flowers were pollinated in four different cross combinations and 40 nuts were harvested.

**Table : Details of hybridization programme during 2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	Dhana x Priyanka	135	8	5.92	8	100	8
2	Kanaka x Priyanka	387	18	4.65	15	83.33	13
3	Amrutha x Priyanka	147	8	5.44	5	62.5	5
4	Poornima x Priyanka	222	6	2.70	6	100	2
	<b>Total</b>	<b>891</b>	<b>40</b>	<b>4.48</b>	<b>34</b>	<b>85</b>	<b>28</b>



## PILICODE

Hybridization was carried out by selecting promising germplasm like Priyanka (High yielding, high nut size, more adapted), Nihara (dwarf type) and PLD 83 (Promising local germplasm). A total of 650 crosses were done and the average fruit set percentage was 8.98%. Many fruits did not survive due high TMB occurrence and damage by unseasonal and heavy rainfall.

**Table : Details of hybridization programme during 2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	Priyanka x Nihara	126	2	9.5	2	100	2
2	Nihara x Priyanka	131	2	15.2	1	50	1
3	Priyanka x PLD 83	120	1	5	0	0	
4	PLD 83 x Priyanka	107	0	6.5	0	0	
5	Nihara x PLD 83	82	0	9.7	0	0	
6	PLD 83 x Nihara	84	0	13	0	0	
	<b>Total</b>	<b>650</b>	<b>5</b>	<b>8.98</b>	<b>3</b>	<b>25</b>	<b>3</b>



## VENGURLA

### **Progress:**

During the year 2021-22, hybridization programme was started with an objective to combine the desirable traits such as high yield, bold nut, cluster bearing habit, short flowering period, late synchronized flowering and high shelling percentage in single genotype. Total 751 numbers of hermaphrodite flowers were pollinated in four different cross combinations. Total 185 F<sub>1</sub> hybrid nuts were harvested from 4 cross combinations. The nuts were sown in polybags and after germination 152 Nos. of F<sub>1</sub> cashew progenies were obtained and these progenies are planted in the field for further evaluation.



**Table : Details of hybridization programme during 2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	V-2 X RFRS-172	166	35	39.16	28	80.00	25
2	V-3 X RFRS-195	192	55	41.14	41	74.55	38
3	RFRS-195 X V-3	183	45	43.72	37	82.22	30
4	V-5 X RFRS-172	210	60	43.81	46	76.66	40
	<b>Total</b>	<b>751</b>	<b>185</b>	-	<b>152</b>	-	<b>133</b>

#### **Evaluation of hybrids:**

On the basis of standard criteria *viz.*, compact canopy, cluster bearing habit, nut weight (more than 8 g), shelling percentage (more than 28%) and high yield, 12 F<sub>1</sub> cashew progeny were screened as promising hybrids during the year 2021-22. It is seen from Table that among the promising hybrids, H-3765 recorded the maximum height (8.60 m) and minimum height found in H-3942 (3.60 m). The highest stem girth (126.0 cm) was observed in H-3765 while, EW canopy spread (10 m), NS canopy spread (10.60 m) noted maximum in H-3765. The data from the table revealed that the maximum flowering duration (98.0 days) recorded in H-3719 and H-3746. With regards to yield attributes of promising hybrids, the maximum nut weight recorded by H-3746 (14.7g) and followed by H-3948 (13.5g). The highest apple weight of 98.0 g was recorded in H-3873. The highest annual nut yield was recorded in H-3765 (5.42 kg/tree). Cumulative yield for the last 9 harvests was noted highest in H-3719 (42.05 kg/tree).



**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Cross combination	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
						E-W	N-S
1	H-3719	Hy. 2/16 X V-4	2004	7.30	91.00	9.10	10.20
2	H-3740	V-7 X Kankadi	2004	8.50	87.00	8.50	9.30
3	H-3746	V-5 X Kankadi	2004	8.00	95.00	5.80	7.60
4	H-3765	V-3 X Hy.2/16	2005	8.60	126.0	10.00	10.60
5	H-3775	V-4 X Hy.2/15	2005	8.50	93.00	8.30	9.70
6	H-3873	V-2 X B.T.1	2009	4.80	50.00	2.70	3.20
7	H-3882	V-2 X B.T.22	2009	4.40	43.00	3.50	3.30
8	H-3889	V-2 X B.T.65	2009	4.70	42.00	4.20	3.50
9	H-3942	V-5 X B.T.22	2010	3.60	40.00	3.00	4.30
10	H-3947	V-5 X B.T.22	2010	3.80	39.00	3.40	2.90
11	H-3948	V-5 X B.T.22	2010	5.10	38.00	3.40	3.60
12	H-3991	V-4 X M-44/3	2013	5.30	50.00	4.80	4.40
	Mean						
	SEm $\pm$						
	CD @5%						
	CV (%)						



H-1039



H-1039



H-883



H-991

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight(g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	3719	2004		98	8.90	85.0		4.72	42.05*	High yield with cluster bearing
2	3740	2004		97	8.90	55.0		2.37	17.67*	Bold nut
3	3746	2004		98	14.7	80.0		2.21	13.73*	Bold nut
4	3765	2005		96	7.10	80.0		5.42	34.71***	High yield
5	3775	2005		91	8.80	75.0		3.28	22.97***	Bold nut
6	3873	2009		90	7.00	98.0		2.01	16.65*	
7	3882	2009		96	8.50	52.0		2.10	20.26*	Bold nut
8	3889	2009		95	6.20	80.0		1.58	16.44*	
9	3942	2010		96	9.00	41.0		1.02	10.10**	Bold nut

10	3947	2010		89	7.80	65.0		1.05	10.54**	
11	3948	2010		96	13.5	44.0		1.02	13.54**	Bold nut
12	3991	2013		97	5.60	48.0		3.37	16.20***	
	Mean									
	SEm ±									
	CD @5%									
	CV (%)									

\*Cum. yield for 9 harvests, \*\* Cum. yield for 8 harvests and \*\*\* Cum. yield for 6 harvests

### Performance of new set of promising hybrids under Konkan conditions

The 2757 F1 cashew progenies planted at 5m x 5m during 1999 to 2004 were evaluated during 2015. Out of these F1 progenies, the best performing 56 hybrids were evaluated as promising hybrids. Among these 56 F1 hybrids, replicated trial of the top performing 18 hybrids initiated at AICRP-Cashew Vengurla centre during July, 2016 under Gen.4.

#### Progress:

Data revealed that there was significant difference among the different hybrids with respect to all yield attributes. Significantly the highest apple weight of 88.33 g recorded in H-1306 and it was at par with treatments H-883 (85.00 g), H-735 (81.67 g), V-9 (81.67 g), H-992 (73.33 g). The maximum nut weight of 11.37 g recorded in H-1675 and it was found at par with treatments H-883 (10.73 g) and H-735 (10.40 g). So far as yield is concerned, significantly the highest yield of the new set of promising hybrids was recorded in H-1039 (6.39 kg/tree & 1.31t/ha) and superior over the rest of treatments.

**Table: Growth parameters during the year 2022**

Sl. No.	Hybrid No.	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
				E-W	N-S
1	H-735	2.10	20.77	1.43	1.74
2	H-778	3.17	41.90	3.31	3.21
3	H-801	2.57	27.43	1.79	1.72
4	H-883	2.88	32.60	2.34	2.26
5	H-939	2.36	29.60	2.59	2.08
6	H-991	2.74	32.57	2.57	2.30
7	H-969	2.82	33.90	2.41	2.46
8	H-958	2.72	34.93	2.51	2.69
9	H-992	2.66	32.00	2.95	2.08
10	H-1016	2.43	30.90	2.23	2.29
11	H-1039	3.20	41.42	3.76	3.79
12	H-1155	2.54	38.80	2.21	2.39
13	H-1174	2.91	36.40	2.49	2.71
14	H-2005	2.72	36.67	3.13	2.77
15	H-1675	2.12	23.23	2.25	1.61

16	H-1187	3.06	34.40	2.97	2.78
17	H-1306	2.75	33.87	2.50	2.66
18	V-9 (Check)	2.60	32.33	2.59	2.53
	Mean				
	SEm $\pm$	0.31	5.87	0.44	0.46
	CD @5%	N.S.	N.S.	N.S.	N.S.
	CV (%)	20.15	30.81	29.65	32.83

**Table Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	H-735			96.07	10.40	81.67	25.00	1.62	1.98	Bold nut
2	H-778			97.07	5.73	55.67	28.80	4.47	7.65	High yield
3	H-801			97.50	4.83	50.00	31.27	2.95	4.15	High shelling%
4	H-883			97.17	10.73	85.00	29.57	2.70	4.33	Bold nut
5	H-939			96.00	7.93	51.67	32.10	3.83	4.65	High shelling%
6	H-991			97.00	7.70	60.00	32.10	4.85	7.93	High yield and High shelling%
7	H-969			97.83	9.83	64.33	30.67	1.75	3.64	Bold nut and high shelling%
8	H-958			96.20	9.37	44.00	27.57	2.99	3.58	Bold nut
9	H-992			97.33	7.87	73.33	31.33	1.64	2.51	High shelling %
10	H-1016			96.40	9.13	63.00	28.43	2.55	3.89	Bold nut
11	H-1039			95.10	7.27	60.00	30.47	6.39	11.08	Cluster bearing and High yield
12	H-1155			96.20	7.03	63.00	29.20	1.25	2.2	
13	H-1174			95.60	8.97	65.00	30.80	2.90	4.19	Cluster bearing
14	H-2005			95.17	8.83	71.67	30.67	0.41	0.93	High shelling %
15	H-1675			96.60	11.37	53.33	26.27	0.88	1.4	Bold nut
16	H-1187			97.00	8.50	63.33	32.60	1.85	4.59	High shelling%
17	H-1306			95.10	8.07	88.33	29.80	3.60	4.78	
18	V-9 (Check)			96.40	8.83	81.67	28.77	3.52	4.51	
	Mean									
	SEm $\pm$			0.65	0.35	5.24	0.87	0.30	-	
	CD @5%			NS	1.01	15.13	2.51	0.88	-	
	CV (%)			1.16	7.15	14.11	5.06	18.84	-	

**Progress :**

Due to non availability of sufficient and viable pollen, we could not undertake the hybridization work this year, more over weather parameters during the season have severely hampered the hybridization work.

**Evaluation Details**

Design	:	RCBD
Replication/ Blocks (if augmented design is followed)	:	
Spacing	:	6m x6m
Number of entries	:	6
Details of entries	:	H-01, H-81, H-151, H-188, H-191, H-216.

**Progress:**

Observations of growth parameters of Cashew hybrids evaluated during 2022 revealed that, their tree height ranged from 3.0 m to 4.1 m, stem girth ranged from 41.4 cm to 54.4 cm and canopy spread ranged from 2.8 m to 4.5 m. Highest plant height and stem girth was noticed in H-151 (4.1 m and 54.4 cm) and maximum canopy spread was recorded in H-81 (4.5 m). Reproductive parameters revealed that flowering was between February (late) and March (late) and the duration extended up to 68 days in case of H-216, highest nut weight recorded was 8.8 g in H-81 hybrid and apple weighed was up to 113.8 g in case of H-216. The nut yield per tree was higher in H-191 hybrid with an yield of 4.7 kg/tree during third harvest and cumulative nut yield of 9.66 kg/tree for first three harvests. The shelling percentage was highest in H-191 and was 30.2%.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	H-01	2016 (Dec)	3.4	43.5	3.8	3.1
2	H-81	2016 (Dec)	3.7	50.7	4.5	4.2
3	H-151	2016 (Dec)	4.1	54.4	4.3	3.3
4	H-188	2016 (Dec)	3.0	43.1	4.0	3.6
5	H-191	2016 (Dec)	3.1	41.4	3.4	2.8
6	H-216	2016 (Dec)	3.6	47.3	3.6	3.7
	Mean	-	3.5	46.7	3.9	3.5
	SEm $\pm$	-	0.18	2.17	0.36	0.23
	CD @5%	-	0.53	6.53	1.08	0.70
	CV (%)	-	8.82	8.03	15.85	11.67

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	H-01	2016 (Dec)	March (Late)	67	7.1	84.9	28.5	3.72	8.98	-
2	H-81	2016 (Dec)	March (Late)	54	8.8	102.3	26.0	3.95	8.94	-
3	H-151	2016 (Dec)	March (Late)	62	7.5	97.4	28.3	3.19	8.33	-
4	H-188	2016 (Dec)	March (Late)	54	7.6	83.8	26.2	3.52	8.75	-
5	H-191	2016 (Dec)	February (Late)	65	7.7	94.0	30.2	4.15	9.669.66	-
6	H-216	2016 (Dec)	March (Late)	68	8.2	113.8	28.0	2.52	7.47	-
	Mean	-	March (Late)	62	7.8	96.1	27.8	3.51	8.69	-
	SEm ±	-	-	7.51	0.25	5.47	1.75	0.18	-	-
	CD @5%	-	-	22.63	0.77	16.49	5.27	0.54	-	-
	CV (%)	-	-	4.05	5.63	9.87	10.50	8.80	-	-



## JAGDALPUR

During the year 2022, hybridization was initiated with the objective of developing bold nut (above 9 g), cluster bearing, compact canopy and high yielding F<sub>1</sub> progenies suitable for

Bastar Plateau agro-climatic zone of Chhattisgarh. Two promising parents CARS-8 (bold nut >12 g) and V-9 (cluster bearing) were selected for direct and reciprocal crosses. Total 68 nuts were harvested in both the cross combinations, out of which 15 nuts were obtained in cross combination Vengurle-9 x CARS-8 and 53 nuts were obtained in cross combination CARS-8 x Vengurle-9. All nuts were sown and maintained in protected condition for next season planting.

**Table: Details of hybridization programme during 2022**

Sl. No.	Cross combination	# of flowers pollinated	# of nuts harvested	% fruit set	No. of seeds germinated	% germination	# of plants in the main field
1	Vengurle-9 x CARS-8	252	19	23.43	15	78.94	-
2	CARS-8 x Vengurle-9	532	70	34.23	53	75.71	-
	<b>Total</b>	<b>784</b>	<b>89</b>		<b>68</b>		

### Evaluation of F<sub>1</sub> progenies (Year of planting 2021)

#### Evaluation Details

Design	:	Augmented Design
Replication/ Blocks (if augmented design is followed)	:	
Spacing	:	6m x6m
Number of entries	:	29
Details of entries	:	

Among the twenty-nine F<sub>1</sub> progenies which were planted in the year 2021 initial biometric observation were recorded, maximum tree height was recorded in JH-20-12 (1.81 m), stem girth in JH-20-30 (13 cm), canopy spread in East West direction in JH-20-5 (1.03 m) and canopy spread in North-South direction in JH-20-12 (1.20 m). Out of 29 F<sub>1</sub> progenies 12 progenies recorded precocity.

**Table: Growth parameters of F<sub>1</sub> progenies of crosses of 2020 during the year 2022**

Sl. No.	Accession	Cross	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
						E-W	N-S

1	JH-20-1	VRI-1 X V-4	2021	1.38	10	0.95	1.10
2	JH-20-3	VRI-1 X V-4	2021	1.55	10	0.63	0.74
3	JH-20-5	VTH 711/4 X H-303	2021	1.24	12	1.03	0.80
4	JH-20-6	VRI-1 X V-4	2021	1.60	12	0.90	1.04
5	JH-20-7	H-303 X CARS-8	2021	0.92	10	0.55	0.98
6	JH-20-8	CARS-8 X H-303	2021	1.04	9	0.42	0.50
7	JH-20-9	CARS-8 X H-303	2021	0.84	10	0.65	0.45
8	JH-20-10	CARS-8 X H-303	2021	1.25	10	0.53	0.29
9	JH-20-11	V-4 X H-303	2021	0.91	10	0.65	0.57
10	JH-20-12	V-4 X H-303	2021	1.81	14	0.98	1.20
11	JH-20-13	V-4 X H-303	2021	0.70	10	0.75	0.60
12	JH-20-14	H-303 X CARS-8	2021	0.86	10	0.40	0.65
13	JH-20-15	NRCC Sel-2 X V-4	2021	1.35	11	0.97	1.08
14	JH-20-16	CARS-7 x VTH 711/4	2021	0.93	9	0.60	0.65
15	JH-20-17	CARS-7 x VTH 711/4	2021	1.49	12	0.83	0.90
16	JH-20-18	H-303 X VTH 711/4	2021	1.06	10	0.80	0.91
17	JH-20-19	H-303 X VTH 711/4	2021	1.51	10	0.70	0.80
18	JH-20-20	H-303 X VTH 711/4	2021	0.85	10	0.84	0.58
19	JH-20-21	H-303 X VTH 711/4	2021	1.12	11	0.63	0.90
20	JH-20-22	H-303 X VTH 711/4	2021	1.14	10	0.70	0.76
21	JH-20-23	H-303 X VTH 711/4	2021	1.16	10	0.80	0.91
22	JH-20-25	H-303 X VTH 711/4	2021	0.81	9	0.65	0.73
23	JH-20-26	H-303 X VTH 711/4	2021	1.45	10	0.60	0.57
24	JH-20-27	H-303 X VTH 711/4	2021	0.70	8	0.35	0.49
25	JH-20-29	H-303 X VTH 711/4	2021	1.03	10	0.38	0.53

26	JH-20-30	H-303 X VTH 711/4	2021	1.34	13	0.72	1.05
27	JH-20-31	CARS-10 x V-4	2021	0.65	7	0.35	0.34
28	JH-20-32	VRI-3 x V-4	2021	0.75	6	0.35	0.32
29	JH-20-34	CARS-7 x VTH 711/4	2021	0.49	6	0.22	0.25





#### Gen.4: Rapid polyclonal hybrid evaluation trial

**Centres: East Coast :**

Bapatla, Bhubaneshwar and Vridhachalam

**West Coast :**

Madakkathara and Vengurla

**Plains / others:**

Hogalagere

The objective of this experiment is to utilize accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP centres as parents, to combine the desirable traits such as high yield, bold nut, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering and high shelling percentage in single genotype.

**Accession details:**

Sr. No	Accession No.	Original source of collection
1	C2-6	CRS, Bhubaneshwar
2	H-12/05	ICAR Research Complex for Goa
3	H-2917	RFRS, Vengurla
4	VRI (cw) H1	CRS, Vridhachalam
5	H-504	CRS, Bapatla
	Spacing	3 m x 2 m
	Number of seeds/ accession	30

**BAPATLA**

The genotypes are planted in 3 m x 2 m spacing covered with insect proof cover during the flowering season and collected the seeds and sown in the polythene bags. F<sub>1</sub> seedlings were raised and are planted in the field.

Promising Hybrids/Genotype	No. of Seed collected from each genotype	no of seeds sown	no of seeds germinated	% seed germinated
H-504	36	33	31	93.94
C2-6	39	34	30	88.23
H-12/05	45	43	38	88.37
H-2917	33	29	26	89.65
VRI (cw)H1	54	49	45	91.84



## BHUBANESHWAR

### Evaluation details :

During the fruiting season 2021-22, total 75 numbers of seed nuts were harvested (15 from each genotype) and sown in poly bag on 18<sup>th</sup> May, 2022 for raising seedlings. Only 66 seed nuts were germinated and these seedlings were planted in the main field on 30.08.2022 at a spacing 6m x 6m following Augmented design for further evaluation.

No of polycross entries	:	128
Blocks	:	03
Statistical design	:	Augmented
Spacing	:	6m x 6m
Year of planting	:	2021

Now the plants are at vegetative stage. However, a lot of variations have been observed with respect to morphological characters.

## VRIDHACHALAM

During the year 10 nuts were collected from VRI (CW)H1 and 5 nuts from C2-6 and raised in poly bags .

## MADAKKATHARA

### Evaluation details:

During the year, 10 nuts each were collected from the genotypes, C2-6, H-12/05, VRI (cw) H1 and seedlings were raised in polybags. The scion sticks of H 2917 were collected from RFRS, Vengurla and the grafts were produced. Precocious flowering was observed in two polyclonal hybrid seedlings planted in June 2021.

## VENGURLA

### Evaluation details:

The grafts of all high yielding hybrids are planted in 3m x 2m spacing @ 5 grafts/hybrids in July, 2018. All grafts were covered with insect proof cover in cashew season 2021-22 and introduced pollinators for pollination. 30 Nos. of cashew polyclonal F<sub>1</sub> progenies obtained from H-2917 in the last two years and planted in the field in December, 2021 for further evaluation. 70 nuts were harvested from VRI(cw) H1. Among 70 nuts sown 33 nuts were germinated. Precocity of flowering observed early in cashew accession C2-6 (15<sup>th</sup> November, 2021).



## HOGALAGERE

We have collected planting material from Bapatla and Vridhachalam AICRP centers and have planted them in the experimental lay out on 21-10-2022 and planting after care measures are being taken up

### Gen. 5. Characterization of germplasm for cashew apple

**Centres: East Coast :**

**West Coast :**

Bapatla

Pilicode

**Objective:** To identify germplasm having preferred apple characters suitable for value addition.

## BAPATLA

Accessions : Priyanka, T.No 2/14, TNo. 17/5, TNo: 5/1, BLA 139-1, BLA39-4, TNo3/4, TNo 8/7, TNo 18/3. Hy 95 T4, TNo 12/1, TNo 228 and BPP-8.  
Design : CRD  
Replication : 3

Among the 13 genotypes evaluated during the year 2021-22, the maximum mean annual nut yield per tree was recorded in BPP-8 (9.30 kg) followed by Priyanka (8.30 kg). The maximum nut weight was recorded in Priyanka (9.67 g) followed by BPP-8 (8.10 g). The maximum apple weight was recorded in Priyanka (97.4 g) followed by BPP-8 (61.40 g). The apple nut ratio was highest in T.No.8/7 (13.07) followed by T.No. 2/14 (11.83). The juice recovery percentage was found maximum in T.No.228 (70.30 %) followed by BLA-39/4 (69.00%). Among the 13 genotypes the total soluble solids was ranged from 9.40<sup>o</sup> Brix to 11.86<sup>o</sup> Brix. However, the highest TSS was recorded in Priyanka (11.86). The maximum vitamin C content was recorded in T.No. 8/7 (168.11 mg/100gm) followed by T.No.3/4 (167.28 mg/100 gm). With regard to the tannin content the lowest was recorded in Priyanka (3.05 mg/100 g) followed by BPP-8 (3.06 mg/100 gm). The acidity content was lowest in Priyanka (0.43%) followed by T.No.2/14 (0.48%).

**Table : Physical parameters of cashew germplasm for cashew apple.**

S.No	Germplasm	Nut wt (g)	Apple wt (g)	Yield /tree (kg)	Apple nut ratio	Juice recovery (%)	Colour of the apple colour
1	Priyanka	9.67	97.40	8.30	10.09	68.70	Red yellow
2	TNo 2/14	4.42	52.30	4.46	11.83	55.30	Yellow
3	TNo 17/5	4.13	37.30	4.84	9.03	56.20	Yellow
4	TNo 5/1	4.96	39.40	3.67	7.94	61.00	Yellow
5	BLA139-1	4.84	36.46	4.30	7.53	59.40	Yellow
6	BLA 39-4	4.18	36.33	7.56	8.69	69.00	Yellow
7	TNo 3/4	4.47	42.40	4.96	9.48	60.40	Yellow
8	TNo 8/7	3.91	51.20	4.25	13.09	54.12	Yellow
9	TNo 18/3	4.79	48.44	4.00	10.11	56.10	Yellow
10	Hy 95-T4	5.69	49.30	5.96	8.66	61.20	Yellow
11	TNo 12/1	4.43	45.60	3.90	10.29	58.40	Yellow
12	TNo 228	4.45	38.20	5.20	8.58	69.30	Red Yellow
13	BPP-8	8.10	61.20	9.30	7.55	66.30	Yellow
	Mean						
	SEm ±	0.22	2.93	0.41	0.49	1.92	
	CD @5%	0.64	8.61	1.22	1.45	5.64	

	CV (%)	7.18	10.39	13.27	9.11		
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**Table : Chemical parameters of cashew germplasm for cashew apple**

S.No.	Accession	TSS (°Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1	Priyanka	11.86	131.86	3.05	0.43
2	TNo 2/14	10.40	136.20	3.18	0.48
3	TNo 17/5	11.10	149.10	3.14	0.51
4	TNo 5/1	9.40	136.10	3.6	0.97
5	BLA139-1	10.11	135.23	3.35	1.07
6	BLA 39-4	9.47	150.10	3.24	0.79
7	TNo 3/4	11.10	167.28	3.18	0.81
8	TNo 8/7	10.96	168.11	3.22	0.51
9	TNo 18/3	11.20	163.45	3.19	0.55
10	Hy 95-T4	10.40	162.18	3.18	0.56
11	TNo 12/1	10.30	126.24	3.30	0.68
12	TNo 228	10.26	131.20	3.22	0.71
13	BPP-8	10.36	138.16	3.06	0.54
	Mean				
	SEm ±	0.25	4.80	0.08	0.037
	CD @5%	0.75	14.09	NS	0.11
	CV (%)	4.20	5.70	4.48	9.64



## PILICODE

accessions: 5

Design: CRD

Replication: 4

Apple weight was highest for PLD 84 (127.68g), PLD 87 (125.15g) and PLD 86 (120.6g). Regarding nut weight germplasm were on par. Highest ascorbic acid content was observed with PLD 86 (217.7 mg/100g) followed by PLD 85 (209.06 mg/100g). TTannin content, Acidity and TSS were statistically on par for the varieties Sugar Acid ratio was highest for PLD 85 (12.31) followed by PLD 84 (17.05). SAR was lowest for PLD 87(12.84). Highest yield was recorded in PLD 86. Lowest was in PLD 87. Apple to nut ratio was statistically similar in all the germplasm tested

**Table : Physical parameters of cashew germplasm for cashew apple.**

S.No	Germplasm	Nut wt (g)	Apple wt (g)	Yield /tree (kg)	Apple nut ratio	Juice recovery (%)	Colour of the apple
	PLD 83	10.11	106.45	0.26	10.58		
	PLD 84	11.43	127.68	0.26	11.38		
	PLD 85	9.57	116.4	0.26	12.18		
	PLD 86	10.74	120.60	0.35	11.30		

	PLD 87	11.03	125.15	0.12	11.38		
	Mean	10.69	122.46	0.24	11.36		
	SEm ±	<b>0.57</b>	<b>4.14</b>	<b>0.01</b>	<b>0.63</b>		
	CD @5%	<b>NS</b>	<b>12.49</b>	<b>0.04</b>	<b>NS</b>		
	CV (%)	<b>10.77</b>	<b>6.95</b>	<b>10.93</b>	<b>11.01</b>		

**Table : Chemical parameters of cashew germplasm for cashew apple**

S.No.	Accession	TSS (°Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1	PLD 83	9.38	205.14	0.14 (0.80)	0.61 (1.06)
2	PLD 84	9.67	190.94	0.11 (0.78)	0.57 (1.03)
3	PLD 85	10.07	209.06	0.13 (0.79)	0.72 (1.10)
4	PLD 86	9.92	217.70	0.14 (0.80)	0.70 (1.10)
5	PLD 87	8.53	207.14	0.12 (0.79)	0.67 (1.08)
	Mean	9.51	206.00	0.13	0.65
	SEm ±	<b>0.47</b>	<b>2.80</b>	<b>0.01</b>	<b>0.02</b>
	CD @5%	<b>NS</b>	<b>8.43</b>	<b>NS</b>	<b>NS</b>
	CV (%)	<b>9.83</b>	<b>2.72</b>	<b>1.83</b>	<b>3.43</b>

### Gen. 6. Evaluation of promising bold nut, bigger size apple types and high yielding cashew genotypes

**Centres: East Coast :** Bapatla, Bhubaneswar, Jhargram and Vridhachalam  
**West Coast :** Goa, Madakkathara, Pilicode and Vengurle  
**Plains / others:** Hogalagere, Jagdalpur and Kanabargi

**Objective:** To evaluate the performance of promising bold nut bigger size apple and high yielding cashew genotypes at different AICRP Centres

#### Experimental details:

Total Number of genotypes : 16  
 Design : RCBD  
 No. of replications : 2  
 No. of plants per genotype : 4  
 Spacing : 6m x 6m  
 Year of planting :

#### Material:

Sl. No.	Sponsoring centre	Cashew genotypes
1	CRS, Bapatla	H-218

2	CARS, Jagdalpur	CARS-8, CARS-10
3	CCARI, Goa	Tiswadi-3, Tudal-1, HB22/05
4	RFRS, Vengurle	H-3043, H-2873
5	CRS, Bhubaneswar	C-136, D-21, E-22
6	DCR, Puttur	H-126, H-130, NRC-301, NRC-493 and V-7

**Treatment  
Details**

Treatments	Code No.
T <sub>1</sub>	A
T <sub>2</sub>	B
T <sub>3</sub>	C
T <sub>4</sub>	D
T <sub>5</sub>	E
T <sub>6</sub>	F
T <sub>7</sub>	G
T <sub>8</sub>	H
T <sub>9</sub>	I
T <sub>10</sub>	J
T <sub>11</sub>	K
T <sub>12</sub>	L
T <sub>13</sub>	M
T <sub>14</sub>	N
T <sub>15</sub>	O
T <sub>16</sub>	P

## BAPATLA

The trial was started in the year 2019. 16 coded genotypes of different centers of India were evaluated, there was no significant difference observed with respect to mean plant height, stem girth and canopy spread (EW and NS).

## BHUBANESHWAR

Evaluation of 17 coded genotypes of cashew revealed that the plant height (3.79m) and trunk girth (31.73cm) recorded maximum in 'K' code while canopy spread in East-West (4.05m) and North-South (4.57m) recorded maximum in 'B' code.

Among the coded genotypes, 'E' code was found to be quite an early flowering type (flowering commence from last week of September) while 'A' code and 'C' code exhibited earliness in flowering (Nov.-Dec.). Genotypes of other codes noted medium ('B' code, 'G' code 'I' code, 'J' code 'K' code, 'N' code, 'O' code and 'Q' code) to late ('C' code, 'CARS-8, 'F' code, 'H' code 'L' code, 'M' code) flowering season. Duration of flowering was recorded maximum in code 'E' (73.5 days) while the least duration of flowering was recorded in code D(55.5days).

Mean nut weight and apple weight were recorded maximum in code 'P'(12.5g) and 'M'(201.75g) code, respectively. Code 'O' recorded maximum shelling (31.93%) among the

evaluated genotypes. Mean annual nut yield was recorded significantly maximum in code 'Q'(1.79 kg plant<sup>-1</sup>).

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	A	2019	3.28	29.95	3.33	3.58
2	B	2019	2.98	29.42	4.05	4.575
3	C	2019	2.815	27.385	3.29	3.425
4	D	2019	1.905	9.385	1.485	1.65
5	E	2019	2.735	26.01	2.96	2.985
6	F	2019	2.97	25.475	3.37	3.75
7	G	2019	2.775	24.725	3.75	3.125
8	H	2019	2.965	28.375	3.5	3.665
9	I	2019	2.755	23.885	2.99	3.17
10	J	2019	2.63	25.87	3.54	3.64
11	K	2019	3.79	31.735	3.82	3.93
12	L	2019	3.065	26.5	3.495	3.71
13	M	2019	2.71	26.885	3.29	3.04
14	N	2019	3.295	25.735	3.62	3.79
15	O	2019	3.395	26.47	3.62	3.87
16	P	2019	2.625	23.41	3.32	3.485
17	Q	2019	3.16	29.2	3.455	3.615
	<b>Mean</b>		<b>2.93</b>	<b>25.90</b>	<b>3.34</b>	<b>3.47</b>
	<b>SEm ±</b>		<b>0.23</b>	<b>2.76</b>	<b>0.36</b>	<b>0.38</b>
	<b>CD @5%</b>		<b>0.71</b>	<b>8.35</b>	<b>1.09</b>	<b>1.15</b>
	<b>CV (%)</b>		<b>11.32</b>	<b>15.07</b>	<b>15.24</b>	<b>15.59</b>

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	A	2019	Early(Nov.-Dec.)	59	9.66	95.25	27.37	0.84		
2	B	2019	Medium(Dec.-Jan)	60	11.15	93.89	29.50	0.96		
3	C	2019	Early(Nov.-Dec.)	67	8.51	88.33	31.67	0.16		
4	D	2019	Late(Jan.-Feb.)	55.5	11.85	81.23	28.65	0.11		
5	E	2019	Extra Early(Sept.-Oct.)	73.5	8.2	35.15	30.05	0.90		
6	F	2019	Late(Jan.-Feb.)	63	11.74	87.5	28.74	0.32		
7	G	2019	Medium(Dec.-Jan.)	63.5	8.12	64.9	30.91	0.40		

8	H	2019	Late(Jan.-Feb.)	63.5	9.5	85.66	29.47	0.45		
9	I	2019	Medium(Dec.-Jan.)	59.5	9.66	85.8	29.09	0.88		
10	J	2019	Medium(Dec.-Jan.)	61	10.765	84.5	26.52	0.83		
11	K	2019	Medium(Dec.-Jan.)	67.5	9.38	65.725	27.61	0.58		
12	L	2019	Late(Jan.-Feb.)	65.5	11.07	89.5	25.20	0.38		
13	M	2019	Late(Jan.-Feb.)	67.5	11.545	201.75	29.84	0.89		
14	N	2019	Medium(Dec.-Jan.)	64.5	11.73	107.9	27.17	1.35		
15	O	2019	Medium(Dec.-Jan.)	65	8.915	72.25	31.93	0.94		
16	P	2019	Late(Jan.-Feb.)	65	12.5	113.75	26.80	0.83		
17	Q	2019	Medium(Dec.-Jan.)	68.5	8.87	51.05	28.54	1.79		
	Mean			<b>64.05</b>	<b>10.18</b>	<b>88.47</b>	<b>28.76</b>	<b>0.74</b>		
	SEm ±			<b>3.40</b>	<b>0.29</b>	<b>3.35</b>	<b>0.50</b>	<b>0.07</b>		
	CD @5%			<b>10.29</b>	<b>0.88</b>	<b>10.14</b>	<b>1.51</b>	<b>0.21</b>		
	CV (%)			<b>7.50</b>	<b>4.04</b>	<b>5.35</b>	<b>2.46</b>	<b>13.7</b>		

## JHARGRAM

The plants under bold nut trial were planted in September 2019. In bold nut trial, no plants survived in E code. In all the plants though there was good amount of flowering but nut bearing was negligible. Most of the plants produced only 5-6 nuts. The plants were on par in respect of plant height, girth, spread and canopy area. But there was significant difference in flowering. Highest panicle density was in K & L code followed by F, H, O and Q. Very meager flowering was noticed in Q code.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	D	2019	1.90	14.00	1.55	1.35
2	F	2019	1.97	21.00	1.57	2.28
3	G	2019	1.30	13.67	0.98	0.95
4	J	2019	2.07	22.33	1.48	1.47
5	K	2019	2.28	24.33	2.77	2.90
6	L	2019	1.93	19.67	1.77	1.65
7	M	2019	1.32	19.67	1.32	1.47
8	N	2019	1.30	15.67	1.55	0.95
9	O	2019	2.13	23.33	2.38	2.47
10	P	2019	2.03	17.67	1.87	1.95
11	Q	2019	1.78	18.67	2.10	1.72
12	HB 22/05	2019	1.30	14.00	0.80	0.77
13	H- 2873	2019	1.55	15.00	1.10	1.70

14	E-22	2019	1.62	18.00	1.73	1.63
15	C-136	2019	1.80	19.00	2.07	1.83
16	D-21	2019	1.92	17.00	1.93	2.00
	Mean					
	SEm $\pm$		0.21	1.57	0.18	0.15
	CD @5%		0.61	4.55	0.52	0.42
	CV (%)		20.81	14.89	18.67	14.88

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Flowwering/sq.m
1	D	2019	February (Mid)	60	26.33
2	F	2019	March (Late)	54	80.67
3	G	2019	March (Late)	50	7.67
4	J	2019	March (Late)	45	24.00
5	K	2019	March (Late)	48	96.67
6	L	2019	January Early	68	83.67
7	M	2019	February (Mid)	60	17.00
8	N	2019	February (Mid)	59	18.67
9	O	2019	January Early	67	54.67
10	P	2019	January Early	70	27.67
11	Q	2019	February (Mid)	61	33.33
12	HB 22/05	2019	March (Late)	52	70.67
13	H- 2873	2019	March (Late)	53	7.00
14	E-22	2019	January Early	66	28.67
15	C-136	2019	January Early	65	28.67
16	D-21	2019	January Early	70	22.00
	Mean				
	SEm $\pm$				1.59
	CD @5%				4.59
	CV (%)				7.03

## VRIDHACHALAM

The experiment was initiated with 13 genotypes collected from DCR, Puttur during 2019. It was planted during 20.11.2019. The trees are under vegetative stage. Evaluation of 13 coded genotypes of cashew revealed that the tree height was maximum in F code (2.88 m) while the canopy spread in East-West (3.78 m) and North-South (4.18 m) was recorded maximum in J code

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	D	2019	2.25	26.65	2.68	2.70
2	E	2019	2.77	31.59	3.29	3.56
3	F	2019	2.88	30.52	3.21	3.81
4	G	2019	2.52	31.12	3.27	3.90
5	I	2019	2.21	27.27	2.67	3.12
6	J	2019	2.74	31.48	3.78	4.18
7	K	2019	2.50	32.17	3.20	3.43
8	L	2019	2.74	32.63	3.05	2.91
9	M	2019	2.40	29.89	2.64	2.77
10	N	2019	1.28	7.51	1.75	2.05
11	O	2019	1.56	19.62	2.32	2.55
12	P	2019	2.20	22.34	2.64	2.98
13	Q	2019	2.33	30.84	2.80	2.97
	Mean		2.34	27.20	2.87	3.14
	SEm $\pm$		0.21	2.39	0.24	0.28
	CD @5%		0.60	6.89	0.71	0.81
	CV (%)		18.04	17.50	16.92	18.31



## GOA

Under this programme, grafts of 16 coded bold nut genotypes sourced from different AICRP Centers were planted in the field following Randomized Bloch Design with three replications for further evaluation.

## MADAKKATHARA

The experiment has been initiated with the planting materials of 13 genotypes collected from DCR, Puttur during 2019. During the year 2022, fruiting was observed in 11 genotypes C, D, E, G, J, K, L, M, N, O and Q. The genotypes exhibited significant differences with respect to canopy spread and the highest value was observed in the genotype P.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	C	2019	2.76	34.13	2.55	2.83
2	D	2019	2.80	33.96	2.06	2.17
3	E	2019	2.74	29.38	3.16	2.89
4	F	2019	2.80	37.63	3.30	3.39
5	G	2019	2.65	35.50	2.88	2.98
6	J	2019	2.96	35.13	3.36	3.21
7	K	2019	2.92	34.50	3.19	3.44
8	L	2019	2.74	34.84	2.47	2.64
9	M	2019	2.69	37.17	3.26	3.20
10	N	2019	2.88	37.00	3.21	3.18
11	O	2019	2.70	37.38	3.17	3.21

12	P	2019	2.99	38.00	3.69	3.78
13	Q	2019	2.89	33.00	2.01	2.04
	Mean		2.81	35.20	2.95	3.01
	SEm $\pm$		0.39	4.71	0.25	0.26
	CD @ 5%		NS	NS	0.76	0.79
	CV (%)		19.77	18.91	11.81	12.16



**Polyclonal block at CRS, Madakkathara**

**Table: Reproductive parameters during the year 2022**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1	C	2019	Dec (Mid)	97	8.22	43.41	31.87	0.176	0.176	
2	D	2019	Dec (Mid)	79	13.65	95.91	21.68	0.072	0.072	
3	E	2019	Oct (Early)	83	9.63	15.86	32.09	0.039	0.039	Low apple weight
4	F	2019	Dec (Mid)	89	12.5	63.10	27.12	0.025	0.025	
5	G	2019	Dec (Mid)	96	9.84	51.71	28.56	0.092	0.092	
6	K	2019	Dec (Mid)	108	10.29	38.29	29.06	0.132	0.132	
7	L	2019	Dec (Mid)	93	10.66	59.11	21.29	0.032	0.032	
8	M	2019	Dec (Mid)	112	12.87	115.02	27.58	0.105	0.105	High apple weight

9	N	2019	Dec (Mid)	78	14.16	74.94	27.19	0.596	0.596	
10	O	2019	Dec (Mid)	89	12.77	64.32	19.97	0.013	0.013	
11	Q	2019	Oct (Early)	118	9.13	53.57	29.24	0.198	0.198	Early flowering
	Mean			94.72	11.24	61.38	26.87	0.13	0.13	
	SEm ±									
	CD @5%									
	CV (%)									

## PILICODE

Grafts of all the varieties included in the trial have been collected from DCR Puttur and planted in the field. Data recorded for the third year is furnished here.

Regarding plant height, the accessions did not differ significantly. Highest girth was observed in O (7.33 cm) which was statistically on par with K (6.9 cm), M (6.68 cm) and P (6.62 cm). Least was observed with germplasm J (5.65cm), G (5.67 cm), I (5.82 cm) H (5.74 cm) F (6.19 cm) and A (6.35 cm).

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	A	2019	128.20	6.35	40.10	38.00
2	B		112.25	6.46	32.15	39.30
3	C		121.80	6.53	46.50	47.60
4	D		124.50	6.56	38.40	41.70
5	E		116.40	6.45	40.40	41.70
6	F		95.90	6.19	40.50	48.20
7	G		109.10	5.67	35.00	36.60
8	H		97.20	5.74	27.20	28.20
9	I		109.06	5.82	30.44	38.16
10	J		108.00	5.65	39.00	40.50
11	K		106.30	6.90	41.30	40.10
12	L		114.58	6.49	36.96	41.18
13	M		120.10	6.68	39.50	45.30
14	N		115.80	6.36	40.70	48.20
15	O		121.20	7.33	37.10	40.20
16	P		120.20	6.62	44.30	43.00
17	Q		108.68	6.51	43.35	41.53
	Mean		<b>NS</b>	<b>**</b>	<b>**</b>	<b>**</b>
	SEm ±		<b>6.23</b>	<b>0.24</b>	<b>2.51</b>	<b>2.82</b>
	CD @5%		-	<b>0.72</b>	<b>7.53</b>	<b>8.46</b>
	CV (%)		<b>7.75</b>	<b>5.30</b>	<b>9.24</b>	<b>9.70</b>

## VENGURLA

The trial was laid out in June, 2020. The growth of all experimental grafts were satisfactory. The first year growth observations of the trial are recorded and presented in Table. Data revealed that there was a significant difference with respect to all vegetative growth parameters except NS spread.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Mean spread (m)
					E-W	N-S	
1	A	2020	0.46	3.63	0.12	0.22	0.17
2	B	2020	0.62	3.64	0.26	0.35	0.31
3	C	2020	0.55	3.10	0.23	0.30	0.26
4	D	2020	1.59	11.05	0.74	0.79	0.77
5	E	2020	1.42	11.50	1.05	0.98	1.01
6	F	2020	1.11	12.00	1.33	1.18	1.25
7	G	2020	1.29	10.50	1.54	1.17	1.35
8	H	2020	1.18	11.13	1.07	1.28	1.17
9	I	2020	1.02	9.95	0.85	0.67	0.76
10	J	2020	1.10	11.38	1.02	1.17	1.09
11	K	2020	1.59	12.56	1.49	1.46	1.47
12	L	2020	1.41	12.75	1.16	1.21	1.18
13	M	2020	1.50	16.54	1.38	1.35	1.36
14	N	2020	1.13	8.52	0.85	0.79	0.82
15	O	2020	0.89	11.13	0.68	0.68	0.68
16	P	2020	1.32	11.95	1.35	0.80	1.08
17	Q	2020	1.36	12.75	1.14	1.01	1.07
	Mean		1.15	10.24	0.96	0.91	0.93
	SEm $\pm$		0.16	2.03	0.20	0.25	0.21
	CD @5%		0.48	6.13	0.60	N.S.	0.62
	CV (%)		19.46	27.98	29.18	39.20	31.12



view of Experiment plot



VRI (cw) H1

## HOGALAGERE

We have collected planting material from Bapatla and Vridhachalam AICRP centers and have planted them in the experimental lay out on 21-10-2022 and planting after care measures are being taken up.



## JAGDALPUR

The data on biometric and yield characters collected from the experimental plants are presented in Table.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1.	A	2019	2.26	24.51	2.46	2.65
2.	B	2019	2.58	23.63	2.67	2.63
3.	C	2019	2.17	23.51	2.02	2.42
4.	D	2019	2.21	20.90	1.99	1.81
5.	E	2019	2.07	22.50	1.89	2.08
6.	F	2019	2.15	26.51	2.50	2.78
7.	G	2019	2.40	24.45	2.67	2.40
8.	H	2019	2.16	24.07	2.34	1.93
9.	I	2019	2.27	22.40	2.96	2.62

10.	J	2019	2.40	22.76	3.10	2.58
11.	K	2019	2.89	21.54	2.98	3.02
12.	L	2019	2.67	19.52	2.50	2.49
13.	M	2019	2.59	25.32	2.74	2.39
14.	N	2019	1.82	21.05	2.06	1.76
15.	O	2019	2.45	26.54	2.73	2.93
16.	P	2019	2.28	26.20	2.40	3.14
17.	Q	2019	2.27	24.51	1.94	1.85
	Mean		2.33	23.33	2.47	2.44
	SEm $\pm$		0.10	1.14	0.17	0.17
	CD @5%		0.28	3.23	0.51	0.52
	CV (%)		8.85	10.21	9.75	9.90

**Table. Flowering and yield parameters during the experiment period**

Sl. No.	Accession	Year of planting	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Special Features
1.	A	2019	Mid	105.50	10.48	91.72	27.85	0.31		
2.	B	2019	Late	95.00	11.18	84.21	29.22	0.47		
3.	C	2019	Late	107.00	8.23	62.51	31.05	0.11		
4.	D	2019	Mid	105.00	12.11	86.72	28.44	0.27		Jumbo Nut
5.	E	2019	Mid	104.50	8.05	39.22	29.87	0.60		
6.	F	2019	Late	113.50	10.34	61.55	29.03	0.18		
7.	G	2019	Early	100.50	8.73	109.32	29.52	0.38		Off season flowering
8.	H	2019	Late	102.00	9.49	71.67	29.39	0.29		
9.	I	2019	Mid	96.50	8.97	66.23	29.60	0.48		
10.	J	2019	Late	109.00	13.34	157.50	26.64	0.56		Jumbo Nut
11.	K	2019	Mid	115.00	11.44	154.00	28.34	0.44		
12.	L	2019	Mid	88.00	10.17	102.00	25.70	0.09		
13.	M	2019	Mid	108.00	11.32	177.12	28.82	0.39		Large apple
14.	N	2019	Early	106.00	12.56	72.72	27.18	0.98		Jumbo Nut
15.	O	2019	Late	93.00	9.57	82.06	30.53	0.78		
16.	P	2019	Late	93.00	13.55	91.85	27.54	0.90		Jumbo Nut
17.	Q	2019	Mid	112.00	9.74	69.96	28.83	1.01		
	Mean			103.15	10.54	92.96	28.68	0.48		
	SEm $\pm$			4.97	0.17	6.23	0.67	0.06		
	CD @5%			15.03	0.52	18.84	2.03	0.17		
	CV (%)			6.81	5.31	9.48	3.91	16.42		

## KANABARGI

A total of thirteen accessions were collected from DCR Puttur and planted during the year 2019-20. All the accessions were established well and are at vegetative stage. Few accessions showed flowering during the second year; later these flowers were removed to have better growth of plants. Among the different accessions Accession Code -D had better height followed by Code -J, Q, L and P.

**Table: Growth parameters during the year 2022**

Sl. No.	Accession	Year of planting	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)	
					E-W	N-S
1	D	2019	2.70	24.67	1.88	1.77
2	E		1.70	23.00	1.71	1.60
3	F		1.89	34.67	1.86	1.77
4	G		1.65	26.50	1.70	1.86
5	I		1.64	22.67	1.68	1.65
6	J		2.25	27.00	1.83	1.87
7	K		1.96	21.50	1.44	1.33
8	L		2.13	28.83	2.17	2.13
9	M		1.73	24.00	1.28	1.37
10	N		2.00	29.75	1.91	2.08
11	O		1.78	24.33	1.77	1.68
12	P		2.09	25.00	1.94	1.73
13	Q		2.17	25.00	1.73	1.73
	Mean		1.98	25.92	1.76	1.74
	SEm $\pm$		0.14	2.52	0.19	0.19
	CD @5%		0.41	7.35	0.55	0.57
	CV (%)		12.39	16.83	18.69	19.44

## Gen. 7. Trial on Dwarf genotypes in cashew

<b>Centres: East Coast :</b>	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara, Pilicode and Vengurle
<b>Plains / others:</b>	Hogalagere, Jagdalpur, Kanabargi

**Objective :** To assess dwarf and semi-dwarf accessions for their yield potential and seedling selection from these accessions for yield and yield attributing characters

### EXPERIMENTAL DETAILS:

<b>Genotypes</b>	: <b>16 Accessions</b> NRC 214, NRC 314, NRC 315, NRC 312, NRC 313, NRC 306, NRC 415, BDB 58, DB 626, TR8, Taliparamba, NRC 492, HC-6, H-3831, JGM-282 and local check (VRI-3)
<b>Spacing</b>	: 3m x 3m, 4m x 4m and 5m x 5m
<b>Replications</b>	: Three
<b>Parameters to be recorded</b>	: Tree height, Tree spread, Girth, Canopy coverage (% of the allotted area), Number of flowering laterals, Nut weight, Yield (kg/tree) and Cumulative yield (kg/tree).
<b>Pruning</b>	: Need based
<b>Centres (11)</b>	: Vengurla, Kanabargi, Hogalagere, Puttur, Madakkathara, Vridhachalam, Bapatla, Jagadalpur, Bhubaneswar, Jhargram, Pilicode
<b>Plants unit/ accession</b>	: Four
<b>Design</b>	: Split Plot (Spacing as main plot and varieties as sub plots)
<b>Year of planting</b>	:
<b>Important</b>	High yielding varieties of the respective centers to be planted in the periphery of the experiment to aid in introgression

The experiment is yet to start at Bapatla, Bhubaneswar, Jhargram, Vridhachalam, Pilicode, Hogalagere and Jagadalpur

## MADAKKATHARA

The grafts of dwarf genotypes were collected from DCR, Puttur and planted during September 2022.



**Planting of dwarf genotypes at CRS, Madakkathara**



**Inauguration of planting of dwarf genotypes by Hon'ble Vice chancellor, Kerala Agricultural University**

## KANABARGI

A total of nine varieties grafted plants (VRI-3, DB-626, NRC-214, NRC-312, NRC-415, H-3831, HC-6, and Taliparamba) and scions of three varieties (Netra Vaman, NRC-315 and NRC-314) were supplied from DCR- Puttur during the month of September-2022. Among the scions supplied, the success percentage was very low and these scions will be collected during the next year. The other grafted plants will be planted at HREC, Hidkal Dam during the month of Dec-2022

## PILICODE

Planting of genotypes collected from ICAR-DCR, Puttur has been completed by November first week.





## VENGURLA

Planting materials required for the experiment were collected from DCR, Puttur during August 2022 and planted in the experimental plot. The trial is in initial stage and growth of all the experimental grafts is satisfactory.





**view of experiment plot of evaluation of dwarf and semi dwarf accession for high density planting system at AICRP-Cashew, Vengurla centre**

# CROP MANAGEMENT

## II. CROP MANAGEMENT

### Hort. 1a : Nutrient management for yield maximization in cashew

<b>Centres: East Coast :</b>	Bhubaneswar
<b>West Coast :</b>	Paria
<b>Plains / others:</b>	Hogalagere

**Objective:** To investigate the effect of nutrient management approaches on growth, yield and soil properties

**Treatments:**

- T<sub>1</sub>: 100% Recommended Dose of N, P and K Fertilizer (RDF)\*
- T<sub>2</sub>: 100% RDF+10kg FYM / plant / year
- T<sub>3</sub>: 100% RDF+10kg FYM / plant / year + foliar spray of major nutrients (3% Urea+0.5% H<sub>3</sub>PO<sub>4</sub>+1% K<sub>2</sub>SO<sub>4</sub>)

- T<sub>4</sub>: 100% RDF+10kg FYM / plant / year + foliar spray of secondary and micronutrients (0.5% Zn SO<sub>4</sub>+0.1% Solubor\*\*+0.5% MgSO<sub>4</sub>)
- T<sub>5</sub>: 100% RDF+10kg FYM / plant / year + foliar spray of major nutrients (3% Urea+0.5% H<sub>3</sub>PO<sub>4</sub>+1% K<sub>2</sub>SO<sub>4</sub>) + foliar spray of secondary and micronutrients (0.5% Zn SO<sub>4</sub>+0.1% Solubor+0.5% MgSO<sub>4</sub>)
- T<sub>6</sub>: Control
- \*100% RDF = The dose of N, P and K fertilizer as per the centre's recommendation
- \*\*Solubor = Source of fertilizer for Boron

## BHUBANESHWAR

Variety : Balabhadra  
 Spacing : 7 m x 7m  
 Year of planting : 2014

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy(m)
			E-W	N-S	
T1	3.92	51.74	5.37	5.41	5.39
T2	4.01	52.14	5.38	5.46	5.42
T3	4.11	53.50	5.55	5.64	5.59
T4	4.04	56.57	5.52	5.81	5.66
T5	4.21	57.33	5.85	5.92	5.88
T6	3.57	48.60	4.77	4.70	4.72
Mean	3.98	53.31	5.40	5.49	5.44
SEm ±	0.18	2.11	0.31	0.31	0.24
CD @5%	0.55	6.37	0.94	0.95	0.72
CV (%)	9.17	7.93	11.51	11.46	8.73

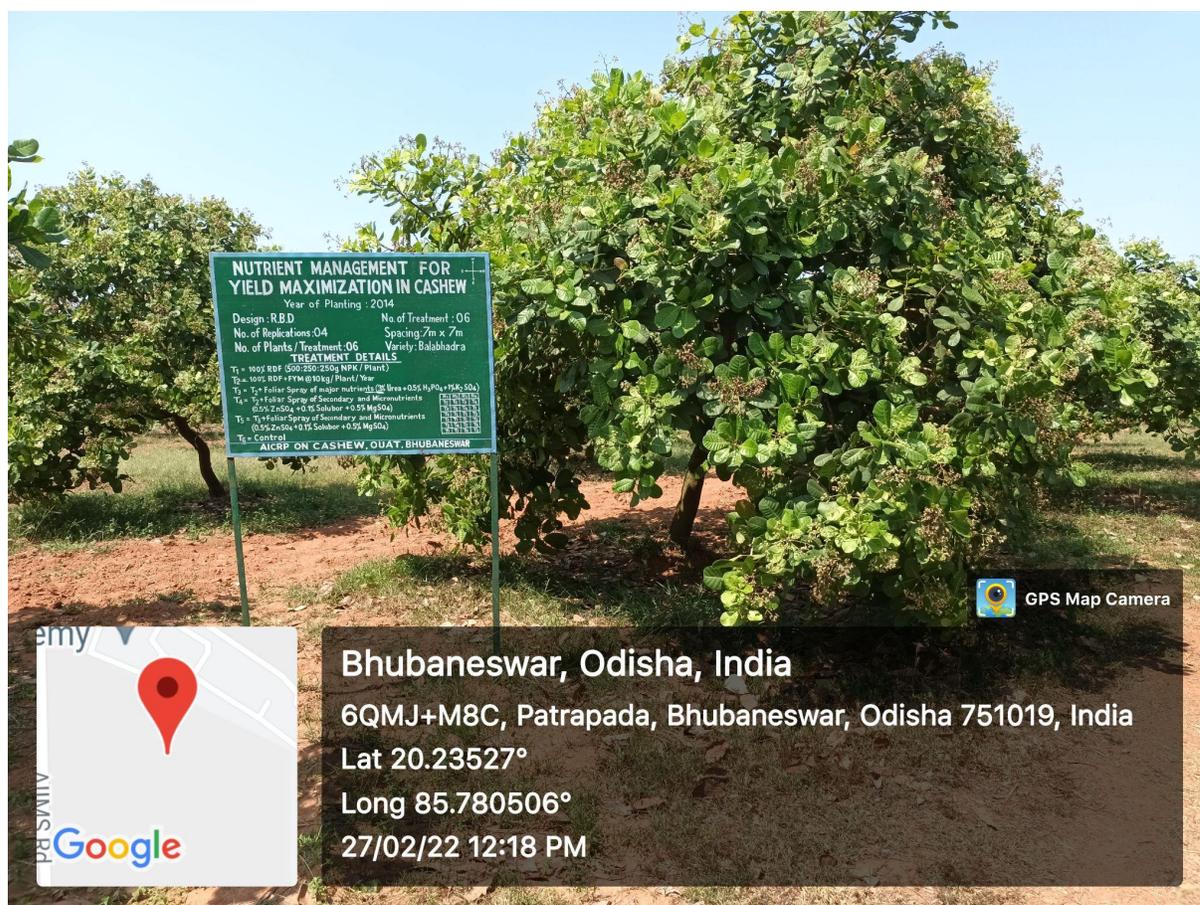
**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
T1			7.06	46.40	29.33	2.66	13.62
T2			7.15	49.73	29.71	2.92	14.96
T3			7.42	49.50	29.73	3.07	15.91
T4			7.50	51.35	29.73	3.10	16.01
T5			7.66	54.95	30.19	4.29	18.71
T6			6.85	43.50	29.25	2.77	12.62
Mean			7.27	49.24	29.66	3.13	
SEm ±			0.22	2.34	1.10	0.26	

CD @5%			0.67	7.07	3.30	0.78	
CV (%)			6.14	9.52	7.38	16.61	

### Conclusion/ Inference:

Treatment T5 i.e. cashew trees applied with 100% RDF +10 kg FYM alongwith foliar spray of major nutrients (3% Urea + 0.5% MAP + 1% K<sub>2</sub> SO<sub>4</sub>),secondary and micro-nutrients(0.5% ZnSO<sub>4</sub> + 0.1% solubor as boron source + 0.5% MgSO<sub>4</sub>) was recorded significantly superior with relevant to vegetative parameters like plant height(4.21m),stem girth(57.33cm) , average canopy spread (5.88m) and nut yield (4.29kg).The treatment T5 was recorded numerically higher values in all the growth and yield attributing characters over remaining treatments and the lowest values were recorded in T6 i.e. control treatment which was performed only based on the available nutrients in the soil.





**PARIA**

Variety : Vengurla-7  
Spacing : 7X7 m  
Year of planting : 2022

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub>	0.56	3.33			
T <sub>2</sub>	0.57	3.10			
T <sub>3</sub>	0.57	3.07			
T <sub>4</sub>	0.57	2.97			
T <sub>5</sub>	0.57	3.10			
T <sub>6</sub>	0.58	3.00			
Mean					
SEm ±	0.02	0.10			
CD @5%	NS	NS			
CV (%)	5.44	5.59			

**HOGALAGERE**

Variety : Chintamani - 1  
 Spacing : 8m x 8m

Year of planting : 2012

Overall yield of all the treatments of different experiments conducted at HREC, hogalagere was low during 2021-22 due to unseasonal rains during summer season.

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)*	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub>	4.00	20.02	6.53	6.63	6.58
T <sub>2</sub>	4.03	20.30	6.85	6.73	6.79
T <sub>3</sub>	4.06	20.34	6.93	6.88	6.90
T <sub>4</sub>	4.11	20.58	7.03	7.08	7.05
T <sub>5</sub>	4.23	21.69	7.43	7.35	7.39
T <sub>6</sub>	3.76	19.04	6.35	6.38	6.36
Mean	4.03	20.33	6.85	6.84	6.84
SEm ±	0.12	0.63	0.21	0.21	0.20
CD @5%	NS	NS	0.64	NS	0.59
CV (%)	6.08	6.19	6.17	6.03	5.72

\* Even though stem diameter was recorded it was presented as stem girth

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
T <sub>1</sub>	March (late)	90.50	7.04	35.27	29.51	5.98	51.11
T <sub>2</sub>	March (late)	94.00	7.11	35.87	29.68	6.15	53.78
T <sub>3</sub>	March (late)	95.25	7.19	37.47	29.80	6.75	57.26
T <sub>4</sub>	March (late)	98.75	7.25	37.95	30.10	6.88	58.48
T <sub>5</sub>	March (late)	102.25	7.31	38.22	30.16	7.12	63.94
T <sub>6</sub>	March (late)	88.00	6.98	35.04	29.37	5.17	42.45
Mean		94.79	7.15	36.63	29.77	6.34	54.50
SEm ±		2.79	0.123	1.83	0.48	0.29	1.24
CD @5%		8.42	NS	NS	NS	0.88	3.74
CV (%)		5.89	3.23	9.96	3.24	9.21	4.55



### Inference

The treatments studied in the current experiment influenced canopy spread, duration of flowering days, nut yield per tree of current season and cumulative nut yield per tree. The treatment T5 ie. 100% RDF+10kg FYM / plant / year + foliar spray of major nutrients (3% Urea+0.5% MAP +1% K<sub>2</sub>SO<sub>4</sub>) + foliar spray of secondary and micronutrients (0.5% Zn SO<sub>4</sub>+0.1% Solubor+0.5% MgSO<sub>4</sub>) recorded wider canopy spread (7.39m), higher nut yield per tree (7.12 kg/tree) and cumulative nut yield (63.94 kg/tree) along with longer flowering duration (102.25 days)

### Hort.2: Fertilizer application in high density cashew plantations

**Centres: Plains / others:** Hogalagere

This trial envisages identification of optimum population density for cashew and suitable fertilizer doses at different high density plantings for specific regional variety.

### HOGALAGERE

**Treatment Details :**

**Main plot - Plant density :3 levels ;**

**S1- 200 Plants/ha (10×5 m)**

**S2- 400Plants/ha (6×4 m)**

Sub plot- Fertilizer (kgs of n, P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O per ha) : 3 levels ;

M1-75:25: 25  
M2- 150 :50 :50  
M3- 225:75:75

FERTILIZER APPLICATION : 1<sup>ST</sup> YEAR : 1/5<sup>TH</sup>

2 YEAR : 2/5<sup>th</sup>

3 year : 3/5<sup>th</sup>

4 year :4/5<sup>th</sup>

5 year : full dose

Variety : Ullal 1

Year of planting : 2015

**Table: Growth parameters during the year 2022**

	Plant height (m)				Stem girth (cm)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	3.53	3.40	3.23	3.39	19.42	18.93	18.56	18.97
M2	3.63	3.43	3.37	3.48	19.84	19.10	18.68	19.20
M3	3.77	3.47	3.42	3.55	20.12	19.22	18.97	19.44
Mean	3.64	3.43	3.34	3.47	19.79	19.08	18.74	19.20
	SEm	CD	CV %		SEm	CD	CV %	
Main plot (Population)	0.06	0.22	4.82		0.37	1.47	5.84	
Sub plot (Fertilizer)	0.07	0.22	6.31		0.20	0.61	3.07	
SP means @ same level of MP	0.13	0.39			0.34	1.05		
MP means @ same or diff. levels of SP	0.12	0.38			0.47	1.69		

	Canopy spread (E-W) (m)				Canopy spread (N-S) (m)				Average canopy spread (m)			
	S1	S2	S3	Mean	S1	S2	S3	Mean	S1	S2	S3	Mean
M1	4.13	3.77	3.47	3.79	4.10	3.73	3.40	3.74	4.12	3.75	3.43	3.77
M2	4.20	3.83	3.50	3.84	4.20	3.80	3.57	3.86	4.20	3.82	3.53	3.85
M3	4.27	3.87	3.57	3.90	4.23	3.90	3.53	3.89	4.25	3.88	3.55	3.89
Mean	4.20	3.82	3.51	3.84	4.18	3.81	3.50	3.83	4.19	3.82	3.51	3.84
	SEm	CD	CV %		SEm	CD	CV %		SEm	CD	CV %	

Main plot (Population)	0.07	0.29	5.69		0.06	0.24	4.71		0.06	0.24	4.74	
Sub plot (Fertilizer)	0.04	0.13	3.26		0.06	0.19	4.74		0.03	0.09	2.39	
SP means @ same level of MP	0.07	0.22			0.10	0.32			0.05	0.16		
MP means @ same or diff. levels of SP	0.09	0.34			0.10	0.35			0.07	0.27		

**Table: Reproductive parameters during the year 2022**

	Flowering time (month followed by early/mid/late)				Flowering duration days			
	S1	S2	S3	Mean	S1	S2	S3	Mean
<b>M1</b>	March (late)	March (late)	March (late)	-	101.67	97.67	97.00	98.78
<b>M2</b>	March (late)	March (late)	March (late)	-	99.33	99.67	100.33	99.78
<b>M3</b>	March (late)	March (late)	March (late)	-	103.67	102.33	101.00	102.33
<b>Mean</b>	-	-	-		101.56	99.89	99.44	100.30
	SEm	CD	CV %		SEm	CD	CV %	
<b>Main plot (Population)</b>	-	-	-		1.20	4.70	3.58	
<b>Sub plot (Fertilizer)</b>	-	-	-		1.52	4.69	4.56	
<b>SP means @ same level of MP</b>	-	-	-		2.64	8.13		
<b>MP means @ same or diff. levels of SP</b>	-	-	-		2.46	8.08		

	Nut weight				Apple weight				Shelling (%)			
	S1	S2	S3	Mean	S1	S2	S3	Mean	S1	S2	S3	Mean
<b>M1</b>	7.10	7.05	7.05	7.07	34.59	34.56	34.15	34.43	30.01	29.84	29.59	29.81
<b>M2</b>	7.21	7.07	7.09	7.12	34.87	34.15	34.76	34.60	30.15	29.98	29.48	29.87
<b>M3</b>	7.25	7.13	7.11	7.16	35.26	34.45	34.94	34.88	30.34	30.02	29.90	30.09
<b>Mean</b>	7.19	7.08	7.08	7.12	34.91	34.39	34.62	34.64	30.17	29.95	29.65	29.92

	SEm	CD	CV %		SEm	CD	CV %		SEm	CD	CV %	
Main plot (MP)	0.05	0.19	2.04		0.22	0.87	1.92		0.26	1.01	2.58	
Sub plot (SP)	0.06	0.20	2.72		0.60	1.85	5.20		0.20	0.63	2.03	
SP means @ same level of MP	0.11	0.34			1.04	3.21			0.35	1.08		
MP means @ same or diff. levels of SP	0.10	0.34			0.88	2.75			0.39	1.33		

	Nut yield (kg/plant)				Cumulative yield (kg/plant)			
	S1	S2	S3	Mean	S1	S2	S3	Mean
<b>M1</b>	3.54	3.41	3.38	3.44	16.96	15.70	14.80	15.82
<b>M2</b>	3.68	3.60	3.52	3.60	17.58	16.25	15.49	16.44
<b>M3</b>	4.41	3.67	3.65	3.91	18.86	16.58	15.80	17.08
<b>Mean</b>	3.88	3.56	3.52	3.65	17.80	16.18	15.36	16.45
	SEm	CD	CV %		SEm	CD	CV %	
<b>Main plot (MP)</b>	0.15	0.60	12.62		0.21	0.81	3.79	
<b>Sub plot (SP)</b>	0.23	0.71	18.96		0.22	0.69	4.07	
<b>SP means @ same level of MP</b>	0.40	1.23			0.39	1.19		
<b>MP means @ same or diff. levels of SP</b>	0.36	1.17			0.38	1.26		

#### Conclusion/ Inference:

Among the different population densities studied, 10 x 5m (S1) registered better growth and yield with 3.64 m height, 19.79 cm stem dia, 4.19m canopy spread, 7.19g nut weight, 34.91g apple weight, 3.88 kg nut yield per plant and 17.80 kg cumulative nut yield /plant with out any influence on shelling percentage. Among the different fertilizer levels tried, M3 (225kg N:75 kg P2O5:75kg K2O per ha) recorded higher values for plant height (3.55m), stem dia (19.44cm), canopy spread (3.89m), nut weight (7.16g), apple weight (34.88g), nut yield (3.91 kg/tree) and cumulative nut yield (17.08kg/tree).

The interaction of wider spacing (S1- 10mx5m) and higher dose of fertilizer (M3 - 225kg N:75 kg P2O5:75kg K2O per ha) recorded better growth and yield (4.41 kg/tree in current year and 18.86 kg/ tree cumulative yield)

### Hort.3: Drip irrigation trial

**Centres: East Coast**

Bhubaneswar

**Plains / others:**

Jagdapur and Hogalagere

The trial aims at studying the response of cashew to supplementary irrigation during flushing and flowering phases and to work out the critical stages of irrigation.

#### BHUBANESHWAR

##### Experimental details:

Design : Randomized Block Design

Replication : Four

Treatment details : T<sub>1</sub> - No irrigation

T<sub>2</sub> -Irrigation 20% of Cumulative Pan Evaporation(CPE)

T<sub>3</sub>- Irrigation 40% of Cumulative Pan Evaporation (CPE)

T<sub>4</sub>- Irrigation 60% of Cumulative Pan Evaporation (CPE)

T<sub>5</sub>- Irrigation 80% of Cumulative Pan Evaporation (CPE)

Variety : BPP-8

Spacing : 7 m x 7 m

**Table : Weather parameters during 2022**

Month	Rainfall (mm)	No. of Rainy days	Temperature (°C)		Relative Humidity (%)		Wind speed (km/hr)
			Max. (Average)	Min. (average)	Max. (average)	Min. (average)	Max. (average)
February	41.1	1	30.0	17.2	95	71	
March	0.0	0	35.4	22.5	94	70	
April	0.0	0	36.9	26.5	94	76	

#### Conclusion/ Inference:

The experiment has been initiated with variety BPP-8 during 2021. All the five treatments were replicated four times. Each treatment will be imposed in four plants per replication. The drip irrigation system has been established in the experimental plot. The treatment will be imposed from the year 2024 as the grafts are now one year old. Evapotranspiration data of 30 years has been collected and mean values will be used for imposing the irrigation levels.



## JAGDALPUR

### Experimental details:

Design : Randomized Block Design

Replication : Four

Treatment details : T<sub>1</sub> - No irrigation  
 T<sub>2</sub> -Irrigation 20% of Cumulative Pan Evaporation(CPE)  
 T<sub>3</sub>- Irrigation 40% of Cumulative Pan Evaporation (CPE)  
 T<sub>4</sub>- Irrigation 60% of Cumulative Pan Evaporation (CPE)  
 T<sub>5</sub>- Irrigation 80% of Cumulative Pan Evaporation (CPE)

Variety : Vengurla-4

Spacing : 7 x 7 m

**Table : Mean values of cumulative pan evaporation and quantity of water applied to plants based on CPE values for different treatments during 2022**

Month	Evaporation rate (mm)	20% CPE (litres/plant/day)	40% CPE (litres/plant/day)	60% CPE (litres/plant / day)	80% CPE (litres/plant / day)
February	3.80	0.76	1.52	2.28	3.04
March	5.40	1.08	2.16	3.24	4.32
April	6.00	1.20	2.40	3.60	4.80

Mean	5.07	1.01	2.03	3.04	4.05
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**Table : Weather parameters during 2022**

Month	Rainfall (mm)	No. of Rainy days	Temperature (°C)		Relative Humidity (%)		Wind speed (km/hr)
			Max. (Average)	Min. (average)	Max. (average)	Min. (average)	Max. (average)
February	0.50	0	29.5	11.90	89.40	30.60	2.1
March	1.60	0	35.0	17.20	81.40	23.90	2.3
April	12.60	2	36.9	21.70	78.10	37.80	4.1

During the first year of imposing treatment the growth attributing characters were found to be non-significant, however the yield and yield attributing characters were significantly different within the treatments. The flowering duration was recorded significantly highest in irrigation at 80% of CPE (106.32 days). Maximum nut weight was recorded in irrigation at 80% of CPE (7.73 g) which was at par with irrigation at 60% of CPE (7.53 g). Similarly, apple weight was also recorded highest in 80% of CPE (50.60 g). Significantly maximum nut yield was observed in 80% of CPE (1.61 kg/tree).

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub>	2.57	27.50	2.81	2.54	2.82
T <sub>2</sub>	2.50	27.00	3.05	2.81	2.98
T <sub>3</sub>	2.77	28.75	3.14	2.83	3.01
T <sub>4</sub>	2.81	27.00	3.25	2.54	2.90
T <sub>5</sub>	2.90	29.25	3.20	3.16	3.18
Mean	2.71	27.90	3.09	2.78	2.98
SEm ±	0.13	1.25	0.16	0.29	0.20
CD @5%	NS	NS	NS	NS	NS
CV (%)	9.85	8.99	10.48	20.38	13.48

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant) 1 <sup>st</sup> harvest
T <sub>1</sub>	February (Mid)	80.43	6.65	39.13	29.56	0.97	0.97
T <sub>2</sub>	February	83.26	6.96	42.88	29.58	1.16	1.16

	(Mid)						
T <sub>3</sub>	February (Mid)	88.77	7.14	44.55	29.75	1.25	1.25
T <sub>4</sub>	February (Mid)	96.00	7.53	50.38	29.65	1.39	1.39
T <sub>5</sub>	February (Mid)	106.32	7.73	50.60	29.62	1.61	1.61
Mean		90.96	7.20	45.51	29.63	1.28	1.28
SEm ±		1.45	0.19	2.60	0.19	0.07	0.07
CD @5%		4.52	0.59	8.11	NS	0.22	0.22
CV (%)		4.19	5.28	11.44	2.12	10.94	10.94

### Conclusion/ Inference:

Thus, irrigation at 80% of CPE significantly increased nut yield and nut weight of cashew in four-year-old plantation under Bastar region of Chhattisgarh.



## HOGALAGERE

### Experimental details:

Design : Randomized Block Design

Replication : Four

Treatment details : T<sub>1</sub> - No irrigation

T<sub>2</sub> -Irrigation 20% of Cumulative Pan Evaporation(CPE)

T<sub>3</sub>- Irrigation 40% of Cumulative Pan Evaporation (CPE)

T<sub>4</sub>- Irrigation 60% of Cumulative Pan Evaporation (CPE)

T<sub>5</sub>- Irrigation 80% of Cumulative Pan Evaporation (CPE)

Variety : Chintamani - 1

Spacing : 8m x 8m

### Hort.4: Expt.2 High density planting – Observational trials

<b>Centres: East Coast:</b>	Bapatla and Vridhachalam
<b>Plains / others:</b>	Jagdalpur

The trial aims to identify the optimum population density for cashew to maximize the returns per unit area.

## JAGDALPUR

### Experimental details

<b>Year of planting</b>	:	<b>2020</b>
<b>Variety</b>	:	<b>NRCC Selection 2</b>
<b>Spacing</b>	:	<b>4 x 4 m and 8 x 8 m</b>

Maximum tree height, stem girth, canopy spread and canopy surface area were recorded in 8m x 8m spacing with NRCC Selection 2 variety which was planted during 2019. However, significantly higher ground area coverage by canopy was recorded 17.01 per cent in 4 x 4 m spacing. It was noticed that duration of flowering, nut weight, apple weight and shelling per cent were statistically similar in both the spacing in the 1<sup>st</sup> harvest (3<sup>rd</sup> year after planting). Nut yield was significantly higher in 8 x 8 m spacing. Yield per ha was recorded higher in 4 x 4 spacing with 256.37 kg nut yield. Net returns and benefit cost ratio were negative in the first harvest during the experiment period.

**Table : Growth parameters during 2022**

Spacing	Tree height (m)	Stem Girth (cm)	canopy spread (m)		Canopy surface area (m <sup>2</sup> )	Ground area coverage by canopy (%)
			E-W	N-S		
<b>4m x 4m</b>	1.70	20.69	1.79	1.71	5.99	17.01
<b>8m x 8m</b>	1.78	24.07	1.80	1.73	6.21	4.22
<b>t value</b>	-0.75	-0.85	-0.01	-0.13	-0.24	-5.75
<b>P value</b>	0.23 <sup>NS</sup>	0.20 <sup>NS</sup>	0.49 <sup>NS</sup>	0.44 <sup>NS</sup>	0.40 <sup>NS</sup>	<0.00001**

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
<b>4m x 4m</b>	February (Mid)	100.12	8.23	46.31	29.27	0.41	0.41
<b>8m x 8m</b>	February (Mid)	103.29	8.15	44.93	29.16	0.53	0.53
<b>t value</b>	-	-1.27	0.56	0.59	0.36	-2.35	-2.35
<b>P value</b>	-	0.11 <sup>NS</sup>	0.29 <sup>NS</sup>	0.28 <sup>NS</sup>	0.36 <sup>NS</sup>	0.03*	0.03*

**Table: Yield and B: C ratio in high density trials**

Harvest	Yield (kg/ha.)		Net returns (Rs/ha.)		B.C. ratio	
	(4m x 4m)	(8m x 8m)	(4m x 4m)	(8m x 8m)	(4m x 4m)	(8m x 8m)
1 <sup>st</sup>	256.37	35.84	-29,885	-19,378	-0.54	-0.85

\*The cost of establishment is included for calculating the B:C ratio for the first harvest

\*\*Selling price of cashew (var. NRCC Sel. 2) for the year 2021-22 was 100 and 90 per kg for shiny and dull nuts respectively.



### Hort.6: Intercropping in Cashew

<b>Centres: East Coast :</b>	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara, Paria and Vengurla
<b>Plains / others:</b>	Darisai, Jagdalpur and Kanabargi

The objectives of this trial are to identify compatible intercrops with cashew in the initial stages of orchard development, to study the economic benefits of inter-cropping system and to work out a soil fertility management strategy for the intercropping system.

### BAPATLA

#### Experimental Details:

Year of Planting (Main plot) :	2002
Variety :	BPP-6
Design :	RBD
Spacing (Cashew) :	8x8
Replication :	4
Intercrops :	5, (Cashew+china aster, Cashew + Marigold, Cashew +Chrysanthemum, Cashew + crossandra and cashew alone)

Among the different intercrops studied during the initial years of cashew the treatment T2 (Cashew +Marigold) recorded maximum yield of 3875 Kg/ha and was superior over rest of the treatments

followed by T1 (Cashew + China aster) of 1109 kg/ha and T4 (Cashew +Crossandra) recorded the lowest yield ( 234 Kg/ha).

Further the economics of growing intercrops, it is seen from the data presented in table: 2.5 that growing Marigold as inter crop in cashew orchard give the higher net profit of Rs.131820/- with C.B ratio of 2.27 followed by crossandra Rs.114904/- and C.B ratio of 1.85 and the lowest net profit was obtained in Chrysanthemum Rs. 65536/- with B.C. ratio of 0.96.

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T1 Cashew + China Aster	7.10	11.09	7.90	12.32	86.45	30000	32000	62000	110916	44360	155276	93276	1.50
T2 Cashew + Marigold	24.80	38.75	8.00	12.48	48.06	30000	28000	58000	112320	77500	189820	131820	2.27
T3 Cashew + Chrysanthemum	2.50	3.90	8.40	13.10	46.24	30000	38000	68000	117936	15600	133536	65536	0.96
T4 Cashew + Crossandra	1.50	2.34	7.60	11.86	82.12	30000	32000	62000	106704	70200	176904	114904	1.85
T5 Cashew Alone	-	-	6.90	10.76	68.69	30000	---	30000	96876	---	96876	66876	2.22
Mean			7.76	12.10	66.39	30000							
SEm ±	1.15	0.60	0.17	0.37	1.77								
CD @5%	3.69	1.95	0.54	1.16	5.52								
CV (%)	25.49	8.55	4.49	6.18	5.34								

#### Sale Price (Rs/Kg)

Raw Cashew Nuts	:	Rs. 90 /- per Kg
Intercrops	:	Marigold - Rs. 20/- per Kg
Chrysanthemum	:	Rs. 40 /- per Kg
China aster	:	Rs. 40/- per Kg
Crossandra	:	Rs. 300/- per Kg

LER (Land Equivalent Ratio) and REE (Relative Economic Efficiency), Production Efficiency(kg/ha/day) and Cashew equivalent yield(kg/ha), Land use efficiency (%) at the end of the experiment period to be given

#### Conclusion/ Inference:

**Marigold as inter crop in cashew orchard give the higher net profit of Rs.131820/- with B:C ratio of 2.27 followed by crossandra Rs.114904/- and B:C ratio of 1.85**



## BHUBANESHWAR

### Experimental Details:

Year of Planting (Main plot) :	2021
Variety :	Jagannath(BH-6)
Design :	Randomized Block Design
Spacing (Cashew) :	7m X 7m
Replication :	Four
Intercrops :	Four different intercrops
Treatment details :	<ul style="list-style-type: none"> <li>T1 -Cashew + Okra</li> <li>T2- Cashew + Dolichos Bean</li> <li>T3- Cashew + Cowpea</li> <li>T4- Cashew + Marigold</li> <li>T5- Control (Cashew alone)</li> </ul>

### Conclusion/ Inference:

The experiment was laid out by planting four intercrops in the newly planted cashew plantation(2021) spaced at 7 mx 7m apart during last week of July,2022.Harvesting of cowpea,okra and marigold is going on.The dolichos bean is in flowering stage.



## JHARGRAM

### Experimental Details:

Year of Planting (Main plot) : 2017  
 Variety : BPP- 8  
 Design : RBD  
 Spacing (Cashew) : 4m X4m  
 Replication : 6  
 Intercrops : Cow pea, Cluster bean, Black gram, Ground nut and Turmeric

The plot size for intercropping under 4mX4m spacing was 8sq.m and for sole crop 16 sq.m. Five intercrops viz. cowpea, cluster bean, black gram, turmeric and ground nut were grown under cashew plantation. It was observed that Black gram both as sole crop as well as intercrop with cashew supported maximum B:C ratio followed by cashew + Cluster bean. Highest land equivalent ratio was with cashew + cluster bean (2.22) , thus total land saving was 122.4%. It was observed from the LER value that intercropping in cashew was profitable in terms of saving of land. Crop equivalent yield was highest with cashew + Turmeric.

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
Cashew + Cowpea	3.7	22.9	1.57	9.8	46.10	24000	40000	64000	98799	45833	64000	80633	1.26
Cashew + Cluster bean	3.2	19.9	1.71	10.7	44.07		28000	52000	107760	79667	52000	135427	2.60
Cashew + Black gram	2.6	16.3	1.67	10.5	41.73		30265	54265	105639	97500	54265	148874	2.74
Cashew + Turmeric	22.3	139.5	1.19	7.4	39.51		175000	199000	748420	278958	199000	154800	0.78
Cashew + Ground nut	1.6	10.1	1.38	8.6	30.30		50000	74000	86890	90938	74000	103827	1.40
Cashew alone	--	--	1.30	8.1	46.10		--	24000	82063	--	24000	58063	2.42
Sole crop of Cow pea	4.5	28.13					40000	40000		56250	40000	16250	0.41
Sole crop of Cluster bean	3.5	21.88					35200	28000		65625	28000	37625	1.34
Sole crop of Black gram	3.2	20.0					30265	30265		120000	30265	89735	2.97
Sole crop of	26.0	162.5					175000	175000		325000	175000	150000	0.86

Turmeric													
Sole crop of Ground nut	2.1	13.3					50000	50000		45833	50000	69250	1.39
Mean													1.73
SEm ±													0.23
CD @5%					NS								0.68
CV (%)													20.39

Sale Price (Rs/Kg)

Raw Cashew Nuts : Rs101/kg

Intercrops: Cow pea : Rs. 20/kg, Cluster bean : Rs 40/kg, Black Gram : Rs60/kg, Turmeric : Rs. 20/kg,

Ground nut: Rs. 90/kg

## VRIDHACHALAM

### Experimental Details:

Year of Planting (Main plot) : 2007

Variety : VRI-3

Design : RBD

Spacing (Cashew) : 7X7 M

Replication : 4

Intercrops : Cashew + Gomphrena, Cashew+Cockscomb, Cashew + Tuberose, Cashew +Chrysanthemum, Cashew+African Marigold, Cashew+Golden rod and Cashew alone

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio	
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net		
Cashew + Gomphrena	5000	50	420	4.29	42.10	25000	75000	100000	54600	250000	304600	204600	3.3	
Cashew+ Cockscomb	4000	40	420	4.29	39.2	25000	65000	90000	54600	160000	214600	124600	2.4	
Cashew + + Tuberose	4000	40	420	4.29	43.5	25000	90000	115000	54600	320000	374600	259600	3.5	
Cashew +Chrysanthemum	7500	75	420	4.29	40.4	25000	55000	80000	54600	112500	167100	87100	2.0	
Cashew+ African Marigold	15000	150	420	4.29	44.0	25000	65000	90000	54600	240000	294600	204600	3.6	
Cashew+ Golden rod	5000	50	420	4.29	41.6	25000	59000	84000	54600	150000	204600	120600	2.5	
Cashew alone	-	-	420	4.29	45.2	-	-	-	-	-	-	-	-	2.18
Mean	-	-	-	-	-	-	-	-	-	-	-	-	-	2.78
SEm ±	-	-	-	-	-	-	-	-	-	-	-	-	-	0.307
CD @5%	-	-	-	-	-	-	-	-	-	-	-	-	-	0.651
CV (%)	-	-	-	-	-	-	-	-	-	-	-	-	-	15.53

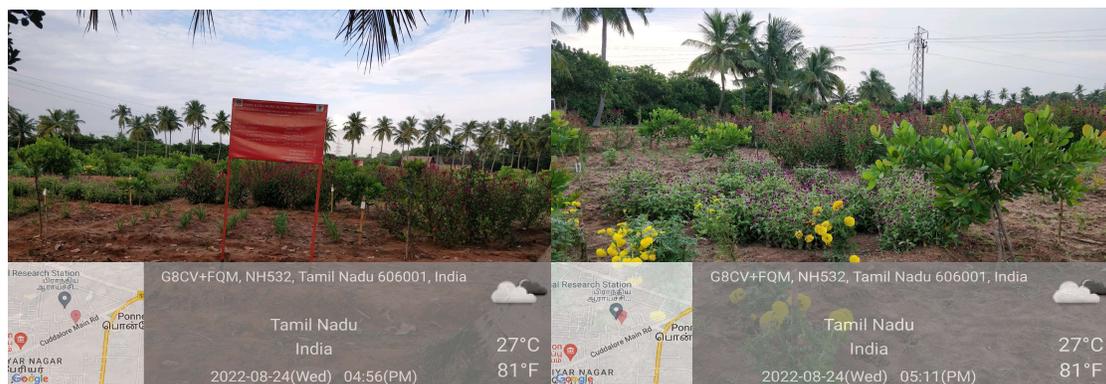
Sale Price (Rs/Kg)

Raw Cashew Nuts : Rs. 130/kg

Intercrops : Gomphrena- Rs.50/kg, Cockscomb- Rs.40/kg, Tuberose- Rs.80/kg, Chrysanthemum- Rs.15/kg, African Marigold- Rs.16/kg, Golden rod- Rs.10/kg.

**Conclusion/ Inference:**

Among the different intercrops studied African marigold recorded the maximum yield of 150 Quintol/ha with a net returns of 2.04 lakhs and a cost benefit ratio of 3.6. It was followed by tuberose.



**MADAKKATHARA**

**Experimental Details:**

Year of Planting (Main plot) : 2019  
 Variety : Priyanka  
 Design : RBD  
 Spacing (Cashew) : 5m x 5m  
 Replication : 3  
 Intercrops : 6

**Treatments**

- T1 Cashew + Ginger (*Zingiber officinale*)
- T2 Cashew + East Indian Arrowroot (*Curcuma angustifolia*)
- T3 Cashew + Black Turmeric (*Curcuma caesia*)
- T4 Cashew + Aromatic Turmeric (*Curcuma aromatica*)
- T5 Cashew + Mango Ginger (*Curcuma amada*)
- T6 Cashew + Turmeric (*Curcuma longa*)
- T7 Control (Cashew alone)

Intercropping in cashew was done with a set of six popular aromatic spice crops. The intercrops were planted in a newly established plantation with cashew planted at a spacing of 5m x 5 m and managed under rainfed condition.

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop	Yield of cashew	% Ground coverage by	Cost of cultivation (Rs./ha)	Returns (Rs./ha)	B:C ratio
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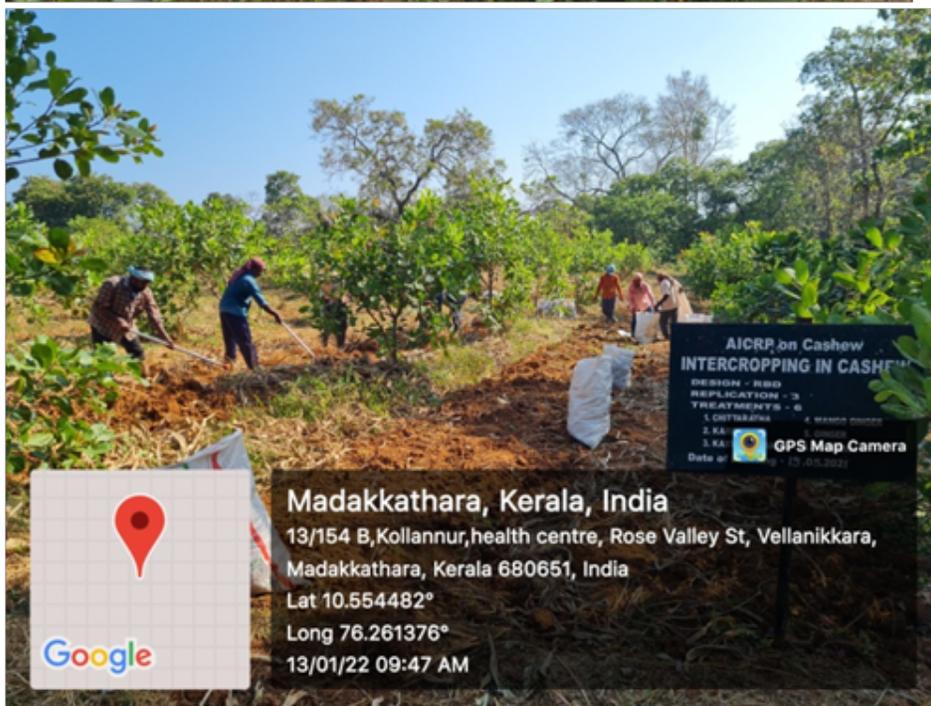
					cashew canopy								
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T1	22.74d	151.44d	0.738	2.21	46.02	22000	561600	583600	19890	1514400	1534290	950690	1.62
T2	46.47a	312.18a	0.685	2.05	41.02	22000	528000	550000	18450	1873080	1891530	1341530	2.43
T3	27.82cd	185.31cd	0.822	2.46	41.02	22000	818400	840400	22140	2779650	2801790	1961390	2.3
T4	32.93bc	219.35bc	0.618	1.85	48.88	22000	600000	622000	16650	2632200	2648850	2026850	3.25
T5	35.88b	238.99b	0.687	2.06	47.88	22000	486000	508000	18540	1194950	1213490	705490	1.38
T6	36.62b	243.88b	0.722	2.16	45.32	22000	525600	547600	19440	1463280	1482720	935120	1.70
T7			0.707	2.12	36.31	22000		22000	19080		19080	-2920	0.13
Mean	33.74	225.19	0.711	2.13	43.77								
SEm ±	2.35	15.69	0.088	0.265	9.11								
CD @5%	7.42	49.45	NS	NS	NS								
CV (%)	12.07	12.07	21.48	21.48	30.06								

#### Sale Price (Rs/Kg)

Raw Cashew Nuts : Rs. 90/kg  
 Intercrops : Ginger @ Rs. 100/kg, East Indian Arrowroot @ Rs. 60/kg, Black Turmeric @ Rs. 150/kg, Aromatic turmeric @ Rs. 120/kg, Mango Ginger @ Rs. 50/kg, Turmeric @ Rs. 60/kg

#### Conclusion/ Inference:

Among the intercrops, the highest yield of 312.18Q/ha was recorded in East Indian Arrowroot followed by turmeric (243.8 Q/ha). The economic analysis revealed that the highest B:C ratio of 3.25 was in treatment T<sub>4</sub>, i.e, with aromatic turmeric as intercrop. Cashew intercropped with East Indian arrowroot and Black turmeric had B:C ratio above 2.0.



## PARIA

### Experimental Details:

Year of Planting (Main plot)	:	2010
Variety	:	Vengurla-4
Design	:	Randomized Block Design
Spacing (Cashew)	:	8 X 8 m
Replication	:	3

Intercrops : Coriander, Fenugreek, Spinach, Amaranthus

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T <sub>1</sub> : C + Coriander	0.42	42.00	2.47	3.85		12000	23000	35000	42385	92400	134785	99785	2.85
T <sub>2</sub> : C + Fenugreek	0.32	32.00	2.37	3.70		12000	23000	35000	40669	70400	111069	76069	2.17
T <sub>3</sub> : C + Spinach	0.44	43.50	1.54	2.40		12000	23000	35000	26392	95700	122092	87092	2.49
T <sub>4</sub> : C+ Amaranthus	0.09	8.50	1.46	2.27		12000	23000	35000	25002	21250	46252	11252	0.32
T <sub>5</sub> : Cashew alone	0.00	0.00	1.30	2.03		12000	00	12000	22308	00	22308	10308	0.86
Mean													
SEm ±	0.01	0.94	0.16	0.25									
CD @5%	0.03	3.07	0.55	0.82									
CV (%)	6.48	6.48	15.21	15.21									

Sale Price (Rs/Kg)

Raw Cashew Nuts : 110 Rs/Kg

Intercrops : Coriander 22 Rs/Kg, Fenugreek 22 Rs/Kg, Spinach 22 Rs/Kg, Amaranthus 25 Rs/Kg

### Conclusion/ Inference:

Among the different intercrops in cashew studied the treatment cashew + spinach (T<sub>3</sub>) got higher intercrop yield (43.50q/ha) while under treatment cashew + coriander (T<sub>1</sub>) got higher cashew nut yield (3.85q/ha). Further, in the economics of growing intercrops, it is seen that higher BC ratio of 2.85 under treatment cashew + coriander (T<sub>1</sub>) followed by BC ratio of 2.49 under treatment cashew + spinach (T<sub>3</sub>).

## VENGURLA

### Experimental Details:

Year of Planting (Main plot) : December, 2016

Variety : Vengurle-9

Design : R.B.D.

Spacing (Cashew) : 7m x 7m

Replication : Five

Intercrops : Five

1. Cashew + Yardlong bean (*Wali*) (*Vigna unguiculata sp. sesquipedalis*)

2. Cashew + Dolichos bean (*Wal*) (*Dolichos lablab*)
3. Cashew + Cowpea (*Vigna unguiculata*)
4. Cashew + Chilli (*Capsicum annum*)
5. Cashew + Brinjal (*Solanum melongena*)

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T1: Y.L. bean	13.75	54.98	4.66	9.50		72640	34168	106808	123500	274900	398400	291592	2.73
T2: D. bean	7.55	30.20	3.97	8.10		72640	24679	97319	105300	151000	256300	158981	1.63
T3: Cow pea	6.39	25.54	4.03	8.23		72640	28305	100945	106990	127700	234690	133745	1.32
T4: Chilli	5.53	22.10	3.90	7.95		72640	36480	109120	103350	110500	213850	104730	0.96
T5: Brinjal	11.11	44.42	3.85	7.86		72640	40520	113120	102180	222100	324280	211160	1.87
Mean													
SEm ±	0.35	1.40	0.15	0.30									
CD @5%	1.07	4.30	0.44	0.91									
CV (%)	8.90	8.90	8.07	8.06									
T6: Control Cashew sole			4.01	8.18		72640	0	72640	106340	0	106340	33700	0.46

Sale Price (Rs/Kg)

Raw Cashew Nuts : Rs.130/- per kg (University rate for the year 2021-22)

Intercrops :

1. Yardlong bean : Rs. 50/kg
2. Dolichos bean : Rs. 50/kg
3. Cowpea : Rs. 50/kg
4. Chilli : Rs. 50/kg
5. Brinjal : Rs. 50/kg

UHDP Canopy development





**Yardlong bean (Wali)**

**Conclusion/ Inference:**

Intercropping in cashew trial with new sets of regionally important intercrops was conducted during *rabi*-2021-22 at AICRP-Cashew, Vengurla. Yield data of cashew (main crop) and inter-crops were recorded and economics also worked out. From the data presented in Table, it was observed that the treatment T<sub>1</sub>(yardlong bean as an intercrop) recorded significantly higher yield (54.98 q/ha) and superior over the rest of the treatments. The maximum cashew nut yield (main crop) 9.50 q/ha was recorded in treatment T<sub>1</sub> (yard long bean as an intercrop).

The highest net returns of Rs. 2,91,592/- was obtained from cashew + Yardlong bean(T<sub>1</sub>) intercropping system with B:C ratio of 2.73.

## DARISAI

**Experimental Details:**

Year of Planting (Main plot)	:	(Cashew 2012)
Variety	:	Tomato (Var. Swarn Samridhi) Frenchbean (Var. Arka Komal) Turmeric (Var. Rajendra Sonia) Arrowroot (Var. Local) Cashew (Var.V4)
Design	:	RBD
Spacing (Cashew)	:	8m x 5m
Replication	:	03
Intercrops	:	

Result: Cashew + Turmeric recorded the highest B/C ratio 3.08 followed by cashew + arrowroot @ 2.87.

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
T1		93.03		5.53		58000	61000	119000	58065	241878	9943	30943	2.52
T2		42.92		5.82		58000	51500	109500	61110	145928	7038	17538	1.89
T3		104.47		5.36		58000	45000	103000	56280	261175	7455	14455	3.08
T4		116.78		5.12		58000	42000	100000	53760	233560	7320	37320	2.87
T5		-		7.08		58000	-	58000	74340	-	4340	16340	1.28
Mean													
SEm ±													
CD @5%													
CV (%)													

**Treatment Details:-**

T1- Cashew (Var.V4) + Tomato (Var. Swarn Samridhi)

- T2- Cashew (Var.V4) + Frenchbean (Var. Arka Komal)
- T3- Cashew (Var.V4) + Turmeric (Var. Rajendra Sonia)
- T4- Cashew (Var.V4) + Arrowroot (Var. Local)
- T5- Cashew (Var.V4)

Sale Price (Rs/Kg)

Raw Cashew Nuts :

Intercrops :

Cashew Rs.105 /kg, Tomato Rs.26/kg, French bean Rs.34/kg, Turmeric Rs. 25/Kg, Arrowroot Rs. 20/Kg



## JAGDALPUR

### Experimental Details:

Year of Planting (Main plot)	:	2020
Variety	:	Indira Kaju-1
Design	:	RBD
Spacing (Cashew)	:	6 x 6 m
Replication	:	4
Intercrops	:	6

From the data presented in Table, it is observed that treatment Keukand [*Costus speciosus* (J.Koenig) Sm.] recorded significantly the highest yield of 164.25 q/ha and superior over the rest of the treatments. The maximum cashew yield was recorded without intercropping treatment. The highest net returns of Rs. 2,00,194/- was obtained from cashew + Elephant foot yam intercropping system, however B:C ratio was recorded highest in cashew + colocasia intercropping system (1.45).

### Insert one or two photos

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
Cashew + Sweet Potato	27.24	147.12	0.13	0.36	3.82	35,460	96,726	1,32,186	3240.9	294240	297480.9	1,65,295	1.25
Cashew + Colocasia	18.40	99.37	0.16	0.44	4.43	35,460	87,632	1,23,092	3988.8	298110	302098.8	1,79,007	1.45
Cashew + Keukand	30.42	164.25	0.15	0.42	4.09	35,460	45,632	81,092	3739.5	82125	85864.5	4,773	0.06
Cashew + Bunda	22.51	121.56	0.17	0.47	4.38	35,460	59,632	95,092	4238.1	182340	186578.1	91,486	0.96

Cashew + Elephant foot yam	19.58	105.75	0.14	0.39	3.97	35,460	1,37,961	1,73,421	3490.2	370125	373615.2	2,00,194	1.15
Cashew + Tapioca	22.43	121.12	0.09	0.25	2.83	35,460	47,135	82,595	2243.7	90840	93083.7	10,489	0.13
Cashew alone	0	0	0.17	0.47	5.67	35,460	0	35,460	4238.1	0	4238.1	-31,222	-0.88
Mean	20.08	108.45	0.14	0.36	4.17	35460	67816	103276	3597	188254	191851	88574	0.59
SEm ±	0.89	7.11	0.01	0.03									
CD @5%	2.71	21.3	NS	0.09									
CV (%)	12.32	14.87	6.98	8.76									

Sale Price (Rs/Kg)

Raw Cashew Nuts : 90 Rs/kg  
 Intercrop : Sweet Potato - Rs. 20/kg , Colocasia - Rs. 30/kg , Keukand - Rs. 5/kg , Bunda – Rs. 15/kg , Elephant foot yam – Rs. 35/kg , Tapioca - Rs. 7.50/kg

### Conclusion/ Inference:

During the first year experiment the highest B:C ratio was recorded in cashew + colocasia intercropping system.





## KANABARGI

### Experimental Details:

Year of Planting (Main plot)	:	2011 (pruned plants)
Variety	:	V-4
Design	:	RBD
Spacing (Cashew)	:	6m x 6m
Replications	:	Three
Intercrops	:	Cabbage, Cauliflower, Knol Khol, Gaillardia, China Aster and Chrysanthemum

Among the different intercrops tried under cashew flower crops performed better than the vegetables for yield of the intercrops Among the flowers Gaillardia recorded more yield followed by China Aster and Chrysanthemum where as in vegetable crop Knol Khol performed much better for yield over cabbage and cauliflower

**Table : Yield and economics of cashew and inter crops during 2022**

Treatment details	Yield of intercrop		Yield of cashew		% Ground coverage by cashew canopy	Cost of cultivation (Rs./ha)			Returns (Rs./ha)				B:C ratio
	Kg/plot	Q/ha	Kg/tree	Q/ha		Cashew	Inter crop	Total	Cashew	Inter crop	Total	Net	
cashew + Cabbage	12.23	1986.00	7.89	2185.53		79430.56	26166.67	105597.22	292861.02	17377.50	310238.52	204641.30	1.94
Cashew +Cauliflower	5.70	925.00	7.85	2174.45		79430.56	16666.67	96097.22	291376.30	7631.25	299007.55	202910.33	2.11
Cashew + Knol Khol	21.57	3503.00	7.81	2163.37		79430.56	31866.67	111297.22	289891.58	40284.50	330176.08	218878.86	1.97

Cashew + Gaillardia	22.73	3691.00	8.32	2304.64		79430.56	82000.00	161430.56	308821.76	110730.00	419551.76	258121.20	1.60
Cashew + China Aster	15.18	2465.00	7.77	2152.29		79430.56	41788.89	121219.44	288406.86	78880.00	367286.86	246067.42	2.03
Cashew + Chrysanthemum	15.16	2461.00	7.65	2119.05		79430.56	58044.44	137475.00	283952.70	86135.00	370087.70	232612.70	1.69
Cashew Alone			7.99	2202.15		79430.56		79430.56	295088.10		295088.10	215657.54	2.72
Mean													
SEm ±													
CD @5%													
CV (%)													

Sale Price (Rs/Kg) : Cabbage @ Rs. 8.75/kg, Cauliflower @ Rs.8.25/kg, Knol Khol @ 11.50/kg, Gaillardia @Rs. 30/kg, China Aster @ 32/kg, Chrysanthemum @ Rs. 35/kg

Raw Cashew Nuts : 134/Kg

Intercrops :



### Hort.7: Organic Management of Cashew

<b>Centres: East Coast :</b>	Bapatla and Vridhachalam
<b>Plains / others:</b>	Darisai and Hogalagere

The objective of this trial is to evaluate and standardize an organic management schedule for cashew cultivation to optimize the returns and to work out economic feasibility of organic farming systems over conventional farming.

### BAPATLA

### Experimental Details

Design	:	RBD
Variety	:	BPP-8
Spacing	:	7 m X 7 m
Year of planting	:	2014
Number of Treatments	:	8
Number of Replications	:	3
Number plants/treatment	:	6

### Treatments details:

- T1 - 100 % N as FYM
- T2 - 100 % N as FYM +Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g
- T3 - 50 % N as FYM + Bio-fertilizers (200g) + Rock phosphate
- T4 - 100 % N as Vermicompost + Bio-fertilizers (200g)
- T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)
- T6 - In situ green manuring / green leaf manuring to meet 100 % N
- T7 - 25 % N as FYM + Recycling of organic residue + in situ green manuring green leaf manuring + Bio-fertilizers (200 g)
- T8 - Recommended doses of fertilizer +10 kg FYM (Control)

Among the treatments, the mean plant height was recorded highest in T4 (3.85m) followed by T4 (3.42m) and T2 (3.36m). Highest mean canopy height was noticed in T4 (3.37 m) followed by T2 (2.96 m).The mean trunk girth was recorded highest in T4 (62.22 cm) followed by T2 (60.46 cm). The canopy spread (E-W) was recorded maximum in T4 (6.90 m) followed by T3(6.35 m). The canopy spread (N-S) was recorded maximum in T4 (6.75 m) followed by T2 (6.48 m).The mean canopy spread was recorded maximum in T4 (6.82 m) followed by T2 (6.41 m) and canopy surface area was recorded maximum in T4 (51.28 m<sup>2</sup>) followed by T2 (43.37m<sup>2</sup>).The shortest flowering duration was recorded in T<sub>8</sub> (77.0 days) and followed by T<sub>1</sub> (81.0 days). With respect to Mean nut weight was found to be non-significant and mean annual nut yield per tree and mean apple weight were found to be significant. Among the treatments, the mean nut weight was found maximum in T<sub>4</sub> (8.23 g) followed by T<sub>2</sub> (8.04 g) and T<sub>1</sub> (8.01 g). With regard to the mean apple weight, the highest was recorded in T<sub>4</sub> (67.30g) followed by T<sub>6</sub>(61.70g). The shelling percentage was recorded highest in T<sub>2</sub> (29.16) followed by T<sub>4</sub> (28.80). The maximum mean annual nut yield per tree during the year was recorded in T<sub>4</sub> (7.43 kg) followed by T2 (6.90 kg) The cumulative nut yield was recorded highest in T<sub>4</sub> (25.53 kg/tree) followed by T<sub>2</sub> (23.55 Kg/tree) for five annual harvests.

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy (Mt)
			E-W	N-S	
T1	2.96	58.16	6.00	6.27	6.13
T2	3.36	60.46	6.35	6.47	6.41
T3	3.25	58.4	6.26	6.48	6.37
T4	<b>3.85</b>	<b>62.22</b>	<b>6.90</b>	<b>6.75</b>	<b>6.82</b>

T5	3.42	58.93	5.39	5.92	5.65
T6	3.24	54.06	5.15	5.48	5.31
T7	3.27	55.93	5.83	5.77	5.80
T8	2.96	55.26	5.91	5.96	5.93
Mean					
SEm $\pm$	0.27	5.00	0.13	0.12	0,06
CD @5%	NS	NS	0.38	0.36	0.19
CV (%)	14.23	14.96	3.65	3.30	1.82

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
T1	February (Mid)	81	8.01	59.3	27.32	6.70	23.22
T2	February (Mid)	90	8.04	60.9	29.10	6.90	23.55
T3	February (Mid)	86	7.89	58.7	28.60	6.42	21.37
T4	February (Mid)	88	8.23	67.3	28.88	7.43	25.53
T5	February (Mid)	98	7.99	55.9	27.30	5.30	18.60
T6	February (Mid)	85	7.79	61.7	26.10	5.60	19.00
T7	February (Mid)	96	7.66	55.0	28.33	5.20	19.13
T8	February (Mid)	77	7.80	45.4	28.67	6.00	21.06
Mean							
SEm $\pm$			0.12	1.39	1.03	0.28	
CD @5%			N.S.	4.26	NS	0.86	
CV (%)			2.55	4.16	6.37	7.89	

#### Conclusion/ Inference:

The maximum mean annual nut yield per tree during the year was recorded in T<sub>4</sub> (7.43 kg) followed by T<sub>2</sub> (6.90 kg) The cumulative nut yield was recorded highest in T<sub>4</sub> (25.53 kg/tree) followed by T<sub>2</sub>(23.55 Kg/tree) for five annual harvests. The treatment T<sub>4</sub> ie 100% N as Vermicompost with 200 g Biofertilizer has recorded the highest nut yield.

#### DARISAI

##### Experimental Details

Design	:	RBD
Variety	:	Balbhadra
Spacing	:	5m x 5m
Year of planting	:	2012
Number of Treatments	:	08
Number of Replications	:	03

Number plants/treatment : 06

#### Treatments details:

T1 - 100 % N as FYM

T2 - 100 % N as FYM +Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g

T3 - 50 % N as FYM + Bio-fertilizers (200g) + Rock phosphate

T4 - 100 % N as Vermicompost + Bio-fertilizers (200g)

T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)

T6 - In situ green manuring / green leaf manuring to meet 100 % N

T7 - 25 % N as FYM + Recycling of organic residue + in situ green manuring green leaf manuring + Bio-fertilizers (200 g)

T8 - Recommended doses of fertilizer +10 kg FYM (Check)

Results: Recommended dose of fertilizer (N 500 gm, P<sub>2</sub>O<sub>5</sub> 250 gm & K<sub>2</sub>O 250 gm ) + 10 Kg FYM (Check) recorded the maximum nut yield / plant (3.81 Kg) which was statistically on par with T<sub>2</sub> (3.51 Kg) where 100 % N + Bio-fertilizer 200gm/plant was applied and T<sub>7</sub> (3.32 Kg/plant) where, 25 % N as FYM + recycling of organic residue + in C<sub>2</sub> green manuring + Bio-fertilizer (200 gm/plant) was applied . On the basis of cumulative yield (Six harvests) T<sub>8</sub> (Control) was found significantly superior to all other organic treatments.

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T1	4.90	72.42	7.69	6.93	7.31
T2	3.67	74.92	7.73	7.39	7.56
T3	3.99	57.62	5.26	4.52	4.89
T4	4.41	61.54	5.82	5.44	5.63
T5	4.62	52.36	4.68	4.36	4.52
T6	5.18	48.89	7.41	6.89	7.15
T7	4.15	77.02	7.75	7.35	7.55
T8	4.22	80.95	7.86	7.42	7.64
Mean					
SEm ±	0.46	5.56	0.57	0.49	0.54
CD @5%	1.27	14.82	1.68	1.42	1.49
CV (%)	14.19	15.53	13.78	14.62	14.46

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Treatment	Flowering time (month followed by early/mid/late)
T1	Dec., Mid	78.90	6.09	57.94	25.30	3.08	22.94	T1	Dec., Mid
T2	Nov., Early	85.33	6.31	53.22	27.75	3.51	25.39	T2	Nov., Early
T3	Jan, Late	69.91	5.98	66.14	24.16	2.19	17.75	T3	Jan, Late
T4	Dec., Mid	81.59	6.26	57.07	26.78	3.12	23.53	T4	Dec., Mid

T5	Jan, Late	62.93	5.89	61.28	23.49	1.83	15.51	T5	Jan, Late
T6	Dec., Mid	73.06	6.06	64.09	25.70	2.94	21.97	T6	Dec., Mid
T7	Nov., Early	87.43	6.51	68.86	27.53	3.32	25.35	T7	Nov., Early
T8	Nov., Early	89.02	6.71	74.31	28.07	3.81	28.09	T8	Nov., Early
SEm ±		0.62	-	2.49	0.31	0.22	0.28	SEm ±	
CD @5%		1.14	NS	7.32	0.84	0.58	0.74	CD @5%	
CV (%)		14.38	-	14.48	14.64	14.57	15.13	CV (%)	

## HOGALAGERE

### Experimental Details

Design	:	RCBD
Variety	:	Ullal - 1
Spacing	:	7m X 7m
Year of planting	:	2014
Number of Treatments	:	8
Number of Replications	:	3
Number plants/treatment	:	6

### Treatments details:

- T1 - 100 % N as FYM
- T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g
- T3 - 50 % N as FYM + Bio-fertilizers (200g) + Rock phosphate
- T4 - 100 % N as Vermicompost + Bio-fertilizers (200g)
- T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)
- T6 - In situ green manuring / green leaf manuring to meet 100 % N
- T7 - 25 % N as FYM + Recycling of organic residue + in situ green manuring green leaf manuring + Bio-fertilizers (200 g)
- T8 - Recommended doses of fertilizer +10 kg FYM (Control)

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)*	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T1	3.48	19.51	3.82	3.58	3.70
T2	3.67	20.46	3.68	3.65	3.67
T3	3.50	19.63	3.90	3.73	3.82
T4	3.70	20.84	3.97	3.85	3.91
T5	3.43	19.23	3.63	3.57	3.60
T6	3.40	19.09	3.55	3.52	3.53
T7	3.82	21.75	4.07	4.03	4.05
T8	3.87	21.81	4.13	4.17	4.15
Mean	3.61	20.29	3.84	3.76	3.80
SEm ±	0.10	0.44	0.15	0.15	0.12

CD @5%	0.31	1.32	0.46	0.44	0.37
CV (%)	4.97	3.721	6.80	6.68	5.61

\* stem diamtr was recorded and presented as girth

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
T1	March(late)	98.00	7.14	33.98	29.30	3.28	21.54
T2	March(late)	97.67	7.20	34.25	29.72	3.64	24.36
T3	March(late)	96.33	7.17	33.76	29.45	3.41	22.12
T4	March(late)	101.67	7.28	35.32	30.04	4.22	25.04
T5	March(late)	100.00	7.11	34.16	29.20	3.12	19.32
T6	March(late)	98.00	7.09	33.85	29.13	3.06	18.13
T7		103.67	7.34	35.56	30.14	4.45	27.36
T8		106.67	7.31	35.48	30.10	4.52	27.65
Mean	-	100.25	7.20	34.55	29.64	3.71	23.19
SEm ±	-	2.45	0.13	1.65	0.36	0.18	0.29
CD @5%	-	7.42	0.38	5.00	1.09	0.56	0.89
CV (%)	-	4.23	3.05	8.27	2.10	8.61	2.20

### Conclusion/ Inference:

Applying the cashew with recommended dose of fertilizer (T8) was superior among all the treatments studied. However, among the organic treatments T7 i.e. 25 % N as FYM + Recycling of organic residue + in situ green manuring green leaf manuring + Bio-fertilizers (200 g) was superior and found on par with the T8. This organic treatment recorded 3.63m plant height, 19.13 cm stem dia 2.35m canopy height, 3.49m canopy dia 25.71sq m canopy surface area 36.22g apple weight, 7.21g nut weight and produced 8.05kg nut yield per tree in the current year producing 16.42 q / ha nut. the cumulative yield of the trees with this treatment was 22.91kg/tree i.e. 46.73q/ha considering 5 harvests taken.



### Hort.8 : Spacing cum fertilizer trial

<b>Centres: Plains / others:</b>	Darisai and Paria
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The objective of this trial is to arrive at an appropriate spacing and fertilizer dose for maximizing returns from cashew.

#### DARISAI

##### Treatment Details

Variety : BPP8  
 Spacing : 10m x5m, S2:6mx4m S3:5mx4m  
 Fertilizer application levels : 75kN, 25kgP2O5 25kg k2O:M2: 150kgN 50kgP2O5 50kgK2O  
 M3:225kg N 75kgP2O5 75kgK2O

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
S1M1	3.83	59.65	9.34	8.79	9.07
S1M2	5.34	74.02	10.62	9.83	10.23

S1M3	4.54	65.12	10.21	9.59	9.90
S2M1	4.80	50.24	7.26	6.56	6.91
S2M2	4.33	59.74	6.79	6.27	6.53
S2M3	5.25	56.41	6.58	5.93	6.26
S3M1	4.19	52.00	5.19	4.68	4.94
S3M2	3.80	58.41	5.48	5.12	5.30
S3M3	4.92	52.23	5.69	5.47	5.58
SEm ±	0.22	3.14	0.56	0.49	0.51
CD @5%	0.58	8.86	1.53	1.18	1.37
CV(%)	14.78	14.63	15.56	15.19	15.32

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant) after 7th harvest	Remarks
S1M1	Dec, Mid	81.07	6.71	72.41	27.02	4.09	31.18	
S1M2	Nov.Early	92.03	7.56	80.24	26.71	4.57	36.56	
S1M3	Dec, Mid	80.62	6.48	72.69	26.14	3.81	28.03	
S2M1	Dec, Mid	85.61	6.83	75.89	25.77	3.62	25.29	
S2M2	Dec, Mid	76.91	7.31	76.52	25.50	3.38	24.79	
S2M3	Dec, Mid	75.68	7.12	72.63	24.74	2.46	18.52	
S3M1	Dec, Mid	72.56	6.94	70.26	24.35	2.18	16.45	
S3M2	Dec, Mid	73.59	6.73	67.42	25.06	2.72	19.67	
S3M3	Jan. Late	65.46	6.53	62.78	23.67	1.58	13.82	
SEm ±		3.62	0.24	2.42	0.27	0.24	0.41	
CD @5%		10.24	0.65	7.17	0.62	0.61	1.13	
CV(%)		15.39	14.17	14.48	14.68	14.73	15.13	

S1 M2 is significantly superior in current year yield and also in cumulative yield on the basis of seven harvest among all other interactions tested.

## Hort.9: Evaluation of production potential of newly developed variety Bidhan Jhargram - 2 at different spacings

<b>Centres: East Coast :</b>	Jhargram
<b>Plains / others:</b>	Darisai

The objective of this trial is to evaluate the new variety at different location for production potential under different spacing.

### JHARGRAM

#### Experimental Details :

Treatments	:	Spacing (T1: 10m X10m, T2: 8m X8m, T3: 7m X5m, T4 : 4m X4m)
Replications	:	6 (six)
Design	:	RBD
Variety	:	Bidhan Jhargram- 2

Year of planting : 2014

**Conclusion/ Inference:**

Significant variation was noticed between the wider spacings and 4m X4m spacing with respect to plant height, trunk girth, north – south spread, canopy area and nuts/m<sup>2</sup>. While the growth characters of Bidhan Jhargram- 2 plants under 10m X10m, 8m x8m and 7m X5m were on par. Yield per tree was significantly different in all the spacings. Therefore, yield per unit area was also significantly different among the different spacings. Highest yield per ha was noticed in T<sub>1</sub> treatment (10m X10m) followed by T<sub>2</sub> (8m X8m). It depicted that Bidhan Jhargram - 2 variety was not suitable for high density planting.



**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub> – 10m x 10m	5.1	63.0	7.2	7.3	7.3
T <sub>2</sub> - 8m x 8m	5.2	67.7	7.0	6.7	6.9
T <sub>3</sub> - 7m x 5m	5.0	65.0	5.9	6.3	6.1
T <sub>4</sub> - 4m x 4m	4.2	50.3	4.3	4.1	4.2
Mean	4.9	61.5	6.1	6.1	6.1
SEm ±	0.1	2.2	0.3	0.4	0.2
CD @5%	0.4	6.4	0.8	1.0	0.7
CV (%)	6.6	8.7	10.4	14.1	9.1

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant) for 5 harvests	Remarks
T <sub>1</sub> – 10m x 10m			8.2			2.8	11.8	Bidhan Jhargram was not performing well in high density planting.
T <sub>2</sub> - 8m x 8m			8.2			2.3	11.2	
T <sub>3</sub> - 7m x 5m			8.3			1.9	9.9	
T <sub>4</sub> - 4m x 4m			8.2			0.5	4.8	
Mean			8.2			1.9	9.4	
SEm ±						0.1		
CD @5%			NS			0.3		
CV (%)						15.4		

## DARISAI (No data)

### Hort. 11: Ultra high-density planting in cashew

<i>Centres: East Coast :</i>	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
<i>West Coast :</i>	Madakkathara, Pilicode and Vengurla
<i>Plains</i>	Hogalagere, Jagdalpur and Kanabargi

The objective of this trial is to identify the suitable variety for ultra high density (UHDP) and to study the economic feasibility of ultra high-density vs normal planting density planting in cashew.

## BAPATLA

**Experimental details: field preparation completed after removal of old cashew plantation. planting will be done during the third week of November,2022**

Year of planting : November , 2022

Design	:	Split Plot
Replication	:	3
Treatments	:	Main plot and sub plot details
Main Plot Spacings	:	3
1.		7.5 m x 7.5 m
2.		5.0 m x 5.0 m
3.		2.5 m x 2.5 m
Sub plot Varieties	:	3
1.		VRI-3
2.		NRCC Selection -2
3.		BPP-11
Each plot size	:	225m <sup>2</sup>
Number of plants/treatment	:	

## BHUBANESHAR

### Experimental details:

Year of planting	:	2020
Design	:	Split plot
Replication	:	Three
Treatments details	:	
Main Plot (Spacing)	:	3
1- 2.5m x 2.5m		
2- 3m x 3m		
3- 7.5m x 7.5m		
Sub plot (Varieties)	:	
1- VRI-3		
2-NRCC Sel-2		
3- Balabhadra		
Number of plants/treatment	:	06 plants/treatment for UHDP 03 plants/treatment for normal planting

**Table : Growth parameters during 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
S1	1.82	14.14	2.27	2.29	2.28
S2	1.80	14.07	2.29	2.34	2.31
S3	1.69	13.92	1.87	2.24	2.21
<b>Mean</b>					
<b>SEm ±</b>	0.09	0.41	0.10	0.14	0.11
<b>CD @5%</b>	0.35	1.60	0.37	0.54	0.43
<b>CV (%)</b>	<b>15.05</b>	<b>8.71</b>	<b>12.69</b>	<b>17.99</b>	<b>14.64</b>
V1	1.99	14.67	2.40	2.45	2.42
V2	1.55	13.31	2.14	2.26	2.20

V3	1.77	14.15	2.22	2.15	2.19
<b>Mean</b>					
<b>SEm ±</b>	<b>0.44</b>	0.22	0.12	0.07	0.09
<b>CD @5%</b>	<b>0.12</b>	0.67	0.66	0.23	0.29
<b>CV (%)</b>	<b>6.49</b>	4.61	16.56	9.65	12.51
S1V1	2.06	14.86	2.42	2.56	2.49
S1V2	1.55	13.04	2.10	2.12	2.11
S1V3	1.84	14.51	2.30	2.19	2.24
S2V1	1.96	14.48	2.36	2.38	2.36
S2V2	1.57	13.51	2.35	2.39	2.37
S2V3	1.88	14.22	2.17	2.25	2.21
S3V1	1.94	14.67	2.42	2.41	2.41
S3V2	1.30	13.37	1.97	2.28	2.12
S3V3	1.59	13.71	2.20	2.02	2.11
<b>Mean</b>	<b>1.77</b>	14.04	<b>2.25</b>	<b>2.29</b>	<b>2.27</b>
<b>SEm ±</b>	0.07	0.37	0.22	0.13	0.16
<b>CD @5%</b>	0.20	1.15	0.66	0.39	0.50
<b>CV (%)</b>	8.22	4.11	10.26	10.08	8.10

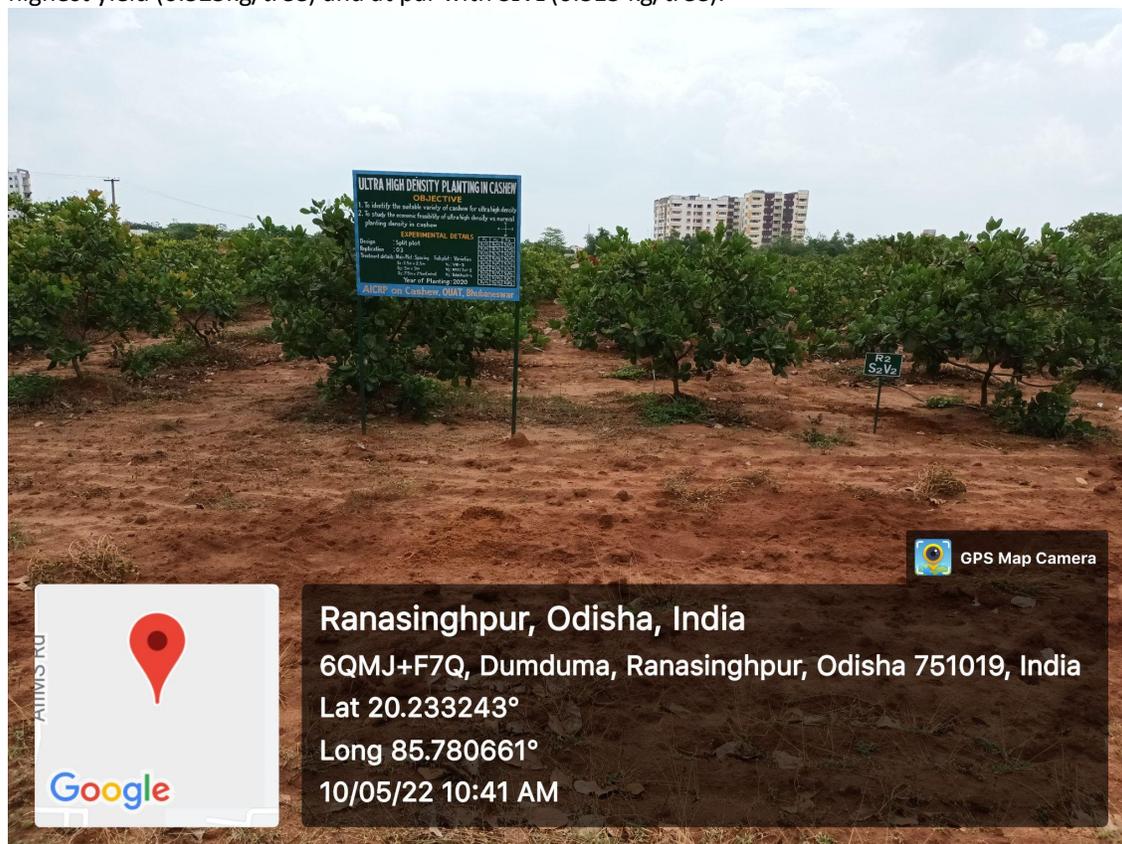
**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (Month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)
S1			7.74	53.92	30.55	0.288
S2			7.66	53.20	31.30	0.298
S3			7.74	54.34	30.46	0.290
<b>Mean</b>						
<b>SEm ±</b>			0.05	0.29	0.46	19.46
<b>CD @5%</b>			0.20	1.14	1.82	76.38
<b>CV (%)</b>			<b>1.94</b>	<b>1.62</b>	<b>4.52</b>	<b>19.96</b>
V1			7.74	46.75	31.34	0.281
V2			8.17	62.09	31.09	0.302
V3			7.23	52.63	29.89	0.294
<b>Mean</b>						
<b>SEm ±</b>			0.07	0.65	0.41	13.51
<b>CD @5%</b>			0.20	2.00	1.25	41.62
<b>CV (%)</b>			2.59	3.62	3.97	13.86
S1V1			7.84	48.26	31.67	0.288
S1V2			8.12	62.18	30.36	0.325
S1V3			7.25	1.32	29.62	0.260
S2V1			7.72	45.84	32.10	0.265

S2V2			8.15	61.53	31.65	0.315
S2V3			7.12	52.24	30.16	0.305
S3V1			7.65	46.15	30.24	0.291
S3V2			8.25	62.56	31.26	0.282
S3V3			7.31	54.32	29.88	0.296
<b>Mean</b>			<b>7.71</b>	<b>53.82</b>	<b>30.77</b>	<b>0.292</b>
<b>SEm ±</b>			0.12	1.12	0.71	23.40
<b>CD @5%</b>			0.35	3.46	2.17	72.08
<b>CV (%)</b>			2.14	4.18	3.59	16.13

### Conclusion/ Inference:

From the first year results, it has revealed that the effect of spacing, variety and their interaction showed non-significant difference for the vegetative growth parameters. The growth parameters i.e. plant height and stem girth were found to be high in S<sub>1</sub>(2.5m x 2.5m) where as canopy spread was high in S<sub>2</sub>(3m x 3m). Variety(V<sub>1</sub>) showed the highest value for all the growth parameters. Maximum value was observed in variety V<sub>1</sub> at spacing S<sub>1</sub> for all the growth attributes studied. The highest yield (0.298 kg/tree) was recorded in S<sub>1</sub> spacing. Variety NRCC Sel-2(V<sub>2</sub>) recorded the highest yield (0.302 kg/tree). The interaction effect between spacing and varieties showed that S<sub>1</sub>V<sub>2</sub> recorded the highest yield (0.325kg/tree) and at par with S<sub>2</sub>V<sub>2</sub> (0.315 kg/tree).



### JHARGRAM

Experimental details:

Year of planting	:	2018
Design	:	Split Plot design (Main Plot : Spacing, Sub Plot: Variety)
Replication	:	3
Treatments	:	
Main plot	:	Spacing
		S1: 8m X 8m
		S2 : 5m X 5m
		S3 : 3m X 3m
Sub plot	:	Variety details
		V1 : VRI - 3
		V2 : NRCC-2
		V3 : K- 22-1
Number of plants/treatment	:	4 plants /treatment

The effect of spacing and variety was clearly noticed in plant height which significantly different due to spacing and variety. While no variation was noticed in trunk girth and E-W spread of varieties under different spacing. North – south spread was significantly different in different varieties. Amount of biomass removal was significantly different for different spacing and varieties. Maximum biomass was removed for 3m X 3m while it was on par for 8m X 8m and 5m X 5m spacings. With respect to varieties maximum biomass was removed in NRCC- 2 followed by K- 22-1 and minimum for VRI - 3. Percent ground coverage by canopy was significantly different for different spacing and variety. Maximum given area was covered in 3m X 3m spacing followed by 5m X 5m and least in 8m X 8m. NRCC- 2 and K- 22-1 covered about 41 % ground area by canopy and VRI – 3 covered 28.8 % ground area. No significant variation was noticed among the treatments with respect to flowering. Nuts/m<sup>2</sup> was on par for S<sub>1</sub> (8m X 8m) and S<sub>3</sub> (3m X 3m) spacing, while it was least in S<sub>2</sub> (5m X 5m) spacing. Comparing among varieties V<sub>1</sub> (VRI – 3) produced highest no of nuts/m<sup>2</sup>. Nut weight was only significantly different for varieties. NRCC- 2 had bold nuts (7.7g) while VRI – 3 and K- 22- 1 had medium sized nuts. Heaviest apples were recorded in K- 22 – 1 followed by NRCC- 2 . Yield/plant was not significantly different with spacing but varietal difference was significant. Highest yield was recorded in NRCC- 2 7.89 Kg/Plant followed by K- 22 – 1 and minimum in VRI – 3. Interaction effect showed that S<sub>1</sub>V<sub>1</sub>, S<sub>2</sub>V<sub>2</sub> and S<sub>3</sub>V<sub>2</sub> were on par with respect to yield /plant. With respect to yield /ha varietal variation was significant and highest yield /ha was in NRCC- 2 and it was the best in all the three spacings. Cumulative yield was highest in NRCC- 2 (8.6 kg/tree) for 4 harvests.

**Table : Growth parameters during 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
S1	2.8	30.1	3.0	3.1	3.1
S2	2.8	29.3	3.3	3.2	3.3
S3	2.4	30.2	2.7	2.8	2.7
<b>Mean</b>	2.7	29.9	3.0	3.0	3.0
<b>SEm ±</b>					
<b>CD @5%</b>	0.2	NS	NS	NS	NS
<b>CV (%)</b>	<b>10.66</b>	<b>12.72</b>	<b>18.89</b>	<b>12.57</b>	<b>12.10</b>
V1	2.4	26.4	2.6	2.6	2.6
V2	3.0	31.1	3.3	3.4	3.3
V3	2.6	32.1	3.1	3.1	3.1

<b>Mean</b>	<b>2.67</b>	29.89	3.00	3.04	3.02
<b>SEm ±</b>					
<b>CD @5%</b>	<b>0.12</b>	NS	NS	0.3	0.2
<b>CV (%)</b>	<b>7.55</b>	11.10	18.29	19.76	17.81
S1V1	2.7	29.0	2.7	2.8	2.7
S1V2	3.1	32.3	3.5	3.7	3.6
S1V3	2.5	29.0	2.8	2.9	2.9
S2V1	2.2	22.3	2.5	2.5	2.5
S2V2	3.3	30.3	3.7	3.8	3.7
S2V3	3.0	35.3	3.9	3.5	3.7
S3V1	2.2	28.0	2.5	2.6	2.5
S3V2	2.7	30.7	2.8	2.7	2.7
S3V3	2.4	32.0	2.8	3.0	2.9
<b>Mean</b>	<b>2.7</b>	29.9	<b>3.0</b>	<b>3.0</b>	<b>3.0</b>
<b>SEm ±</b>					
<b>CD @5%</b>	0.37	NS	NS	0.8	0.7
<b>CV (%)</b>					

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (Month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight(g)	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
S1			6.1	41.6	6.38	7.0
S2			6.2	42.4	6.44	7.2
S3			6.2	41.6	6.38	7.1
<b>Mean</b>			6.2	41.9	6.4	7.1
<b>SEm ±</b>						
<b>CD @5%</b>			NS	NS	NS	
<b>CV (%)</b>			<b>3.56</b>	<b>3.68</b>	<b>3.70</b>	
V1			5.3	30.1	5.49	6.2
V2			7.7	45.7	7.89	8.6
V3			5.6	49.8	5.81	6.5
<b>Mean</b>			6.19	41.85	6.40	7.09
<b>SEm ±</b>						
<b>CD @5%</b>			0.11	0.75	0.12	
<b>CV (%)</b>			3.21	3.25	3.35	
S1V1			5.2	30.3	5.41	6.0
S1V2			7.7	46.0	8.05	8.7
S1V3			5.5	48.3	5.66	6.1
S2V1			5.3	29.0	5.35	6.1
S2V2			7.8	46.3	7.99	8.8

S2V3			5.7	52.0	5.97	6.7
S3V1			5.4	31.0	5.71	6.4
S3V2			7.5	44.7	7.64	8.4
S3V3			5.7	49.0	5.79	6.5
<b>Mean</b>			<b>6.2</b>	<b>41.9</b>	<b>6.4</b>	<b>7.1</b>
<b>SEm ±</b>						
<b>CD @5%</b>			NS	2.2	0.35	
<b>CV (%)</b>						

**Conclusion/ Inference:** NRCC - 2 was found to be the best variety for high density and ultra high density plantation in the fifth year.



**VENGURLA****Experimental details:**

Year of planting	:	July 2018
Design	:	Split Plot
Replication	:	3
Treatments	:	
Main plot	:	Spacing
		2.5m x 2.5m
		3.0m x 3.0m
		8.0m x 8.0m
Sub plot	:	Variety details
		VRI-3
		Ullal-1
		Vengurle-9
Number of plants/treatment	:	4 plants /treatment

**Table : Growth parameters during 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
S1	1.44	16.29	1.14	1.12	1.13
S2	1.50	17.81	1.26	1.23	1.24
S3	1.85	20.42	1.60	1.59	1.59
Mean					
SEm ±	0.11	0.64	0.07	0.06	0.10
CD @5%	NS	2.58	0.27	0.26	NS
CV (%)	21.44	10.56	15.18	14.70	23.21
V1	1.71	18.92	1.51	1.41	1.46
V2	1.49	17.43	1.33	1.34	1.38
V3	1.60	18.17	1.15	1.18	1.17
Mean					
SEm ±	0.06	0.68	0.07	0.06	0.05
CD @5%	NS	NS	0.21	0.17	0.15
CV (%)	11.96	11.30	15.53	12.80	10.94
S1V1	1.42	16.08	1.28	1.13	1.21
S1V2	1.46	17.80	1.32	1.30	1.31
S1V3	1.44	14.97	0.82	0.92	0.87
S2V1	1.51	16.83	1.15	1.05	1.10
S2V2	1.37	16.25	1.24	1.33	1.28
S2V3	1.63	20.33	1.38	1.32	1.35
S3V1	2.20	23.83	2.10	2.06	2.07

S3V2	1.64	18.25	1.44	1.40	1.42
S3V3	1.72	19.19	1.25	1.31	1.28
Mean					
SEm ±	0.15	1.16	0.12	0.10	0.12
CD @5%	NS	3.94	0.40	0.35	0.45
CV (%)	11.96	11.31	15.53	12.80	10.94

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (Month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shelling %	Nut yield (Kg/ tree)	Cumulative yield (Kg/ plant)	Remark
S1	Nov. (Early)	96.22	7.80	58.11	31.54	1.66	1.20	
S2	Nov. (Early)	95.43	7.87	48.11	31.91	2.41	1.54	
S3	Nov. (Early)	96.34	7.72	61.00	31.16	2.67	1.70	
<b>Mean</b>								
<b>SEm ±</b>		<b>0.34</b>	<b>0.29</b>	<b>2.93</b>	<b>0.57</b>	<b>0.06</b>		
<b>CD@5%</b>		<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.25</b>		
<b>CV(%)</b>		<b>1.07</b>	<b>11.24</b>	<b>15.79</b>	<b>5.41</b>	<b>8.18</b>		
V1	Nov. (Early)	96.41	7.08	44.11	31.41	2.13	1.45	
V2	Nov. (Early)	96.01	7.42	59.44	32.30	1.90	1.29	
V3	Nov. (Early)	95.58	8.89	63.67	30.90	2.71	1.71	
<b>Mean</b>								
<b>SEm ±</b>		<b>0.39</b>	<b>0.27</b>	<b>1.61</b>	<b>0.44</b>	<b>0.13</b>		
<b>CD@5%</b>		<b>NS</b>	<b>0.86</b>	<b>5.01</b>	<b>NS</b>	<b>0.41</b>		
<b>CV (%)</b>		<b>1.22</b>	<b>10.57</b>	<b>8.65</b>	<b>4.20</b>	<b>17.63</b>		
S1V1	Nov. (Early)	96.67	6.97	42.33	31.67	1.68	1.22	
S1V2	Nov. (Early)	96.43	7.73	64.33	31.37	1.56	1.15	
S1V3	Nov. (Early)	95.57	8.70	67.67	31.60	1.73	1.23	
S2V1	Nov. (Early)	95.57	7.43	44.33	30.73	2.08	1.42	
S2V2	Nov. (Early)	95.67	7.17	50.67	32.87	1.99	1.32	
S2V3	Nov. (Early)	95.07	9.00	49.33	32.13	3.15	1.89	
S3V1	Nov. (Early)	97.00	6.83	45.67	31.83	2.63	1.70	
S3V2	Nov. (Early)	95.93	7.37	63.33	32.67	2.14	1.39	
S3V3	Nov. (Early)	96.10	8.97	74.00	28.97	3.23	2.00	
<b>Mean</b>								
<b>SEm ±</b>		<b>0.65</b>	<b>0.49</b>	<b>2.78</b>	<b>0.84</b>	<b>0.20</b>		
<b>CD5%</b>		<b>NS</b>	<b>NS</b>	<b>8.58</b>	<b>NS</b>	<b>NS</b>		
<b>CV (%)</b>		<b>1.22</b>	<b>10.87</b>	<b>8.65</b>	<b>4.20</b>	<b>17.63</b>		



View of experimental plot after pruning



2.5 m X 2.5 m

3.0 m X 3.0 m

8.0 m X 8.0 m



VRI-3



Ullal-1



V-9

**Conclusion/ Inference:**

The UHDP trial was initiated in July, 2018 at AICRP-Cashew, RFRS, Vengurla and 2021-22 was the second year of experimentation. The data regarding vegetative growth, flowering, nut yield and yield contributing characters were recorded and presented in Table. The spacing, variety and their interaction effects showed non-significant results for plant height while it was significant for plant girth(cm), plant spread (EW, NS and mean spread).

The precocity of flowering was observed in varieties V<sub>1</sub> (VRI-3), V<sub>2</sub> (Ullal-1) and V<sub>3</sub> (V-9). All the three varieties started flowering early in the 2<sup>nd</sup> week of November, 2021.

The flowering parameters were recorded and presented in Table. Data revealed that the spacing, variety and their interactions showed non-significant effects on flowering duration days), number of laterals per m<sup>2</sup> and flowering panicles per m<sup>2</sup>. S<sub>3</sub> spacing (8m x 8m) recorded the maximum plant spread (EW-1.60m, NS-1.59m and mean spread 1.46m) and it was significantly superior over the rest of the spacings. The variety V<sub>1</sub> recorded maximum plant spread (EW -1.51m, NS-1.41m and mean spread 1.27m).

The data regarding apple weight(g) revealed that there was a significantly higher apple weight in spacing of 8.0m x 8.0m and variety V<sub>3</sub>(V-9-63.67g). The nut weight was significantly higher in variety V<sub>3</sub>(V-9-8.89g) while spacing and interaction effects were non-significant.

The data regarding yield (kg/tree and q/ha) showed that the spacings, varieties and their interactions significantly affect the yield (kg/tree & t/ha) except interaction effect for yield (kg/tree). The highest yield (kg/tree) was recorded in S<sub>3</sub> spacing (2.67 kg/tree) and at par with S<sub>2</sub> spacing (2.41 kg/tree) while the yield (t/ha) was concerned, the spacing S<sub>2</sub> recorded significantly higher yield (2.68 t/ha) and it was at par with S<sub>1</sub> (2.65 t/ha). The variety V-9 (V<sub>3</sub>) recorded the highest yield (2.71 kg/tree) and superior over Ullal-1 (V<sub>2</sub>) and VRI-3 (V<sub>1</sub>) varieties. The interaction effect between different spacings and varieties showed that S<sub>3</sub>V<sub>3</sub> (3.23 kg/tree) and S<sub>2</sub>V<sub>3</sub> recorded the higher yield (3.50 t/ha).

There were non-significant differences among the spacing, varieties and their interactions with respect to shelling percentage.

## KANABARGI

### Experimental details:

Year of planting : 2022-23  
 Design : Split Plot  
 Replication : Three  
 Treatments : Main plot (Spacing) and sub plot details( Varieties)  
 Number of plants/treatment : Five

The Ultra High Density trail was initiated during the month August -2022. Under this trail Three Spacing (8m x 8m, 3m x 3m, 2.5m x 2.5m ) and three varieties (VRI-3, NRCC Sel-2, V-9 Check) has been followed.

## MADAKKATHARA

### Experimental details:

Year of planting : 2017  
 Design : Split Plot  
 Replication : 3  
 Treatments : Main plot and subplot - spacing  
     2.5m x 2.5m  
     3.0m x 3.0m  
     8.0m x 8.0m

Sub plot : Variety details  
     VRI-3  
     NRCC Sel-2  
     Poornima

Number of plants/treatment : 16

The experiment was initiated during 2017. Three varieties (VRI-3, NRCC Selection-2 and Poornima) were planted at three spacings (2.5m, 3.0m and 8.0m) in split plot design with three replications. The trees were regularly pruned in the month of June to maintain a height of 1.5 m.

**Table : Growth parameters during 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
S1	2.43	35.27 <sup>b</sup>	2.26 <sup>b</sup>	2.35 <sup>b</sup>	2.31 <sup>b</sup>
S2	2.67	41.36 <sup>ab</sup>	2.68 <sup>b</sup>	2.70 <sup>b</sup>	2.69 <sup>b</sup>
S3	3.14	49.06 <sup>a</sup>	4.06 <sup>a</sup>	4.33 <sup>a</sup>	4.19 <sup>a</sup>
<b>Mean</b>	<b>2.74</b>	<b>41.89</b>	<b>3.00</b>	<b>3.12</b>	<b>3.06</b>
<b>SEm ±</b>	<b>0.297</b>	<b>2.08</b>	<b>0.282</b>	<b>0.257</b>	<b>0.270</b>
<b>CD @5%</b>	<b>NS</b>	<b>8.18</b>	<b>1.11</b>	<b>1.01</b>	<b>1.06</b>
<b>CV (%)</b>	<b>32.41</b>	<b>14.93</b>	<b>28.23</b>	<b>24.65</b>	<b>26.39</b>
V1	2.880	43.66	3.12	3.31	3.21
V2	2.744	43.98	2.94	2.91	2.92
V3	2.627	38.05	2.95	3.17	3.06
<b>Mean</b>	<b>2.74</b>	<b>41.89</b>	<b>3.00</b>	<b>3.13</b>	<b>3.06</b>
<b>SEm ±</b>	<b>0.144</b>	<b>2.34</b>	<b>0.12</b>	<b>0.153</b>	<b>0.129</b>
<b>CD @5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>CV (%)</b>	<b>15.73</b>	<b>16.80</b>	<b>12.0</b>	<b>14.67</b>	<b>12.65</b>
S1V1	2.42	34.27	2.22	2.29	2.25
S1V2	2.36	36.19	2.25	2.31	2.28
S1V3	2.50	35.36	2.33	2.46	2.40
S2V1	2.92	43.21	2.94	2.77	2.86
S2V2	2.55	41.72	2.44	2.61	2.52
S2V3	2.54	39.13	2.68	2.72	2.70
S3V1	3.28	53.50	4.19	4.86	4.53
S3V2	3.31	54.02	4.13	3.80	3.97
S3V3	2.83	39.66	3.85	4.33	4.09
<b>Mean</b>	<b>2.74</b>	<b>3.91</b>	<b>3.00</b>	<b>3.12</b>	<b>3.06</b>
<b>*Factor A at the same levels of factor B (<math>\alpha =0.05</math>)</b>					
<b>SEm ±</b>	<b>0.360</b>	<b>3.91</b>	<b>0.330</b>	<b>0.336</b>	<b>0.32</b>
<b>CD @5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>*Factor B at same levels of factor A (<math>\alpha =0.05</math>)</b>					
<b>SE(m)</b>	<b>0.249</b>	<b>4.06</b>	<b>0.282</b>	<b>0.265</b>	<b>0.224</b>
<b>CD @5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

\* Factor A- spacing, factor B - varieties

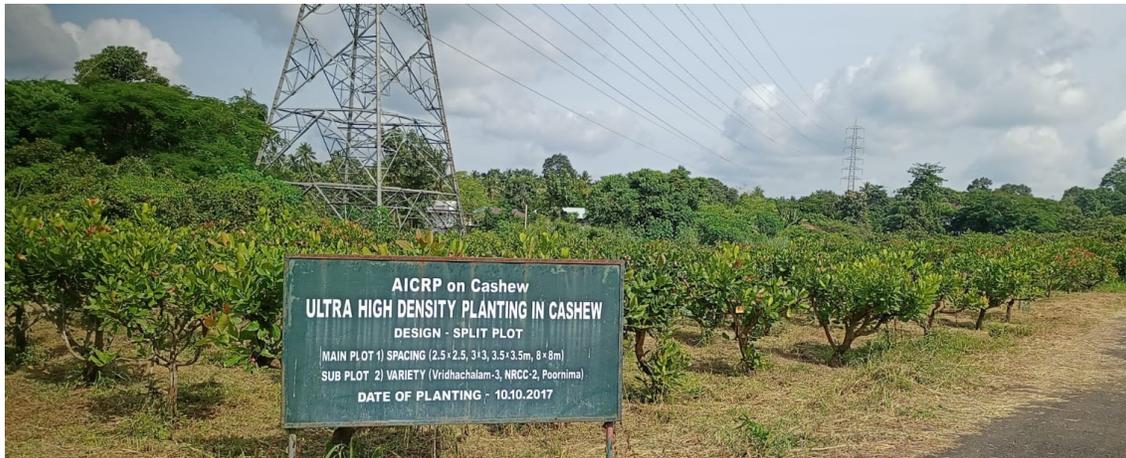
**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (Month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Remarks
S1	Oct (Early)		9.47	62.73	33.56	0.34 <sup>b</sup>	0.59	
S2	Oct (Early)		9.42	62.42	34.04	0.42 <sup>b</sup>	0.63	
S3	Oct (Early)		9.40	61.30	32.71	1.40 <sup>a</sup>	1.87	
<b>Mean</b>			<b>9.43</b>	<b>62.15</b>	<b>33.43</b>	<b>0.72</b>	<b>1.03</b>	
<b>SEm ±</b>			<b>0.308</b>	<b>1.08</b>	<b>1.34</b>	<b>0.062</b>		
<b>CD @5%</b>			<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.243</b>		
<b>CV (%)</b>			<b>9.80</b>	<b>5.23</b>	<b>12.08</b>	<b>25.57</b>		
V1	Oct (Early)		7.79 <sup>b</sup>	32.22 <sup>c</sup>	35.47	0.64	0.93	
V2	Oct (Early)		11.94 <sup>a</sup>	91.16 <sup>a</sup>	30.56	0.84	1.11	
V3	Oct (Early)		8.56 <sup>b</sup>	63.08 <sup>b</sup>	34.28	0.69	1.07	
<b>Mean</b>			<b>9.43</b>	<b>62.15</b>	<b>33.43</b>	<b>0.72</b>	<b>1.03</b>	
<b>SEm ±</b>			<b>0.293</b>	<b>1.53</b>	<b>1.55</b>	<b>0.075</b>		
<b>CD @5%</b>			<b>0.902</b>	<b>4.73</b>	<b>NS</b>	<b>NS</b>		
<b>CV (%)</b>			<b>9.31</b>	<b>7.42</b>	<b>13.90</b>	<b>31.18</b>		
S1V1			8.08	32.33	37.47	0.39	0.71	
S1V2			12.20	91.21	30.36	0.35	0.54	
S1V3			8.14	64.66	32.84	0.29	0.53	
S2V1			7.90	32.00	34.30	0.32	0.54	
S2V2			11.66	91.26	31.63	0.51	0.69	
S2V3			8.70	64.00	36.21	0.45	0.68	
S3V1			7.38	32.33	34.67	1.20	1.47	
S3V2			11.96	91.00	29.69	1.66	2.1	
S3V3			8.85	60.59	33.78	1.34	2.04	
<b>Mean</b>			<b>9.43</b>	<b>62.15</b>	<b>33.43</b>	<b>0.72</b>	<b>1.03</b>	
<b>Factor A at the same levels of factor B (<math>\alpha</math> =0.05)</b>								
<b>SEm ±</b>			<b>0.516</b>	<b>2.43</b>	<b>2.57</b>	<b>0.10</b>		
<b>CD @5%</b>			<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>		
<b>Factor B at same levels of factor A (<math>\alpha</math>=0.05)</b>								
<b>SEm ±</b>			<b>0.507</b>	<b>2.66</b>	<b>2.68</b>	<b>0.13</b>		
<b>CD @5%</b>			<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>		
Treatment	Flowering time (Month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Remarks

\*Replicated observations on duration of flowering was not recorded

#### Conclusion/ Inference:

Spacing had a significant effect on stem girth, canopy spread (EW, NS) and average spread of canopy with highest value in main plot treatment S<sub>3</sub> (8.0 X 8.0m). The growth parameters were not significantly different between varieties. Nut yield per tree was significantly high in main plot S<sub>3</sub> (1.4 kg/ tree). Highest nut and apple weight was observed in the NRCC Sel- 2 i.e, 11.94 g and 91.16 g respectively. Interaction effect was not significant.



## Hort.12 : Pruning response of different cashew varieties

<b>Centres: East Coast :</b>	Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara and Vengurla
<b>Plains / others:</b>	Hogalagere

The project aims at assessing pruning response of different varieties released by AICRP Centres

### Treatment details:

Spacing	: 7m x 7m
Design	: RBD
Replications	: 5
Treatment details	: T <sub>1</sub> · Control T <sub>2</sub> · 25% leader in June T <sub>3</sub> · 25% lateral in June T <sub>4</sub> · 50% lateral in June T <sub>5</sub> · 25% leader in August T <sub>6</sub> · 25% lateral in August T <sub>7</sub> · 50% lateral in August T <sub>8</sub> · 25% leader in September T <sub>9</sub> · 25% lateral in September T <sub>10</sub> · 50% lateral in September

Note: All the leader and laterals should be cut at 25 % and 50 % of their total length.

No. of plants/Rep.	: 2
No. of trees req./ treat/rep.	: 10
Total number of plants	: 100 (30 trees x 3 months= 90 for treatment imposition for 3 months + 10 trees for control)
Package of practices	: Uniform POP should be followed i.e. application of RDF and plant protection schedule.

## JHARGRAM

### Year of Starting : June 2022

The plants selected for pruning trial were not significantly different with respect to the growth characteristics. But significant difference was noticed in flowering /m<sup>2</sup>, vegetative laterals /m<sup>2</sup>, nuts/m<sup>2</sup> and the treatments were on par with respect to yield /tree.

Highest amount of fresh biomass was removed in T2 treatment (25 % of leader shoot in June)while T4 (50% lateral shoot removed in June)and T5 (25% leader shoot removed in July) were on par but significant difference was recorded from rest of the treatments. The treatments were on par after pruning in different months with respect to plant height, E-W spread, Canopy area. Significant

variation was noticed in emergence of new shoots per pruned branches. T5 (15.6) T6, T7 and T10 were on par with respect to new shoot arrival after pruning and significant difference was recorded with those and rest of the treatments to produce new shoots. It was clear from the experiment that maximum number of new shoots emerged when pruning was done in July irrespective of pruning method, while in September 25% lateral shoot removal had supported maximum number of new shoot emergence.

Before Pruning

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub>	4.8	59.2	5.3	5.2	5.2
T <sub>2</sub>	5.8	79.3	7.7	8.2	7.9
T <sub>3</sub>	6.2	91.3	9.4	9.2	9.3
T <sub>4</sub>	5.4	80.7	7.8	8.2	8.0
T <sub>5</sub>	5.7	91.8	8.6	8.8	8.7
T <sub>6</sub>	6.1	100.3	9.2	8.7	8.9
T <sub>7</sub>	5.8	100.0	9.0	8.8	8.9
T <sub>8</sub>	5.6	84.0	8.4	7.9	8.1
T <sub>9</sub>	6.0	84.8	8.1	7.5	7.8
T <sub>10</sub>	5.8	82.0	8.9	8.1	8.5
Mean					
SEm ±					
CD @5%	NS	NS	NS	NS	NS
CV (%)	13.3	19.2	17.7	20.8	18.3

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub>	4.7		4.7	5.9	5.3
T <sub>2</sub>	5.5		6.9	7.1	7.0
T <sub>3</sub>	6.1		7.1	7.2	7.1
T <sub>4</sub>	5.9		7.2	6.7	7.0
T <sub>5</sub>	5.5		6.8	7.0	6.9
T <sub>6</sub>	5.5		7.2	7.0	7.1
T <sub>7</sub>	5.9		7.1	6.8	6.9
T <sub>8</sub>	4.4		4.9	5.0	5.0
T <sub>9</sub>	5.6		5.5	5.6	5.5
T <sub>10</sub>	5.1		5.7	5.5	5.6
Mean					
SEm ±	0.3		0.5		
CD @5%	0.9		1.7	NS	NS
CV (%)	11.8		19.0	18.6	17.3

**Table: Reproductive parameters during the year 2022**  
Before pruning

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)
T <sub>1</sub>			7.6	60.0		5.7
T <sub>2</sub>			7.8	65.3		6.7
T <sub>3</sub>			8.0	63.5		6.5
T <sub>4</sub>			7.6	57.9		6.1
T <sub>5</sub>			7.6	61.4		6.1
T <sub>6</sub>			7.7	57.0		6.1
T <sub>7</sub>			8.0	72.8		5.9
T <sub>8</sub>			7.8	59.9		6.6
T <sub>9</sub>			7.5	59.5		6.4
T <sub>10</sub>			7.7	59.3		6.7
Mean						
SEm ±						0.1
CD @5%			NS	NS		0.4
CV (%)			3.4	18.1		4.5

**Table: Reproductive parameters during the year 2022**  
After pruning

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	New branch /shoot
T <sub>1</sub>								3.0
T <sub>2</sub>								4.9
T <sub>3</sub>								5.6
T <sub>4</sub>								5.6
T <sub>5</sub>								15.6
T <sub>6</sub>								15.9
T <sub>7</sub>								15.7
T <sub>8</sub>								5.7
T <sub>9</sub>								7.5
T <sub>10</sub>								14.1
Mean								
SEm ±								0.8
CD @5%								2.6
CV (%)								19.1

Treatment	Number of flowering laterals/sq. meter area of canopy	Number of non-flowering laterals / sq. meter area of canopy
Mean		
SEm $\pm$		
CD @5%		
CV (%)		

### Conclusion/ Inference:

Pruning exerted a positive effect on new shoot development. Irrespective of pruning method maximum effect was noticed in July pruning. New shoots emerged after September pruning were affected by leaf miner.





## VRIDHACHALAM

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T1: Control	3.5	76.5	5.0-6.8	5.2-6.6	5.1-6.7
T2: 25% leader in June	3.8	80.4	5.6-7.2	5.6-6.9	5.6-7.0
T3: 25% lateral in June	3.6	78.0	5.5-7.0	5.5-6.8	5.5-6.9
T4: 50% lateral in June	3.6	77.8	5.2-6.9	5.3-6.7	5.2-6.8
T5: 25% leader in August	4.3	87.6	6.0-7.8	5.8-7.2	5.9-7.5
T6: 25% lateral in August	4.2	85.3	6.0-7.7	5.9-7.1	5.9-7.4

T7: 50% lateral in August	3.9	82.5	5.8-7.5	5.7-7.0	5.7-7.2
T8: 25% leader in September	4.4	89	6.3-7.9	5.8-7.3	6.0-7.6
T9: 25% lateral in September	4.5	94.2	6.6-8.1	6.2-7.7	6.4-7.9
T10: 50% lateral in September	4.4	90.0	6.4-8.0	6.0-7.5	6.2-8.0
Mean	4.02	84.13	-	-	-
SEm $\pm$	0.110	1.372	-	-	-
CD @5%	0.317	3.951	-	-	-
CV (%)	6.259	3.722	-	-	-

Among the different levels of pruning the treatment T9( 25% lateral in September ) recorded the highest tree height of 4.5 metre and girth of 94.2 cm. It was followed by T10( 50% lateral in September) and T8( 25% leader in September).Similarly the T9( 25% lateral in September ) also recorded the maximum average canopy spread.

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)
T1: Control	Dec(Early)	90	6.6	69	30.0	12.0
T2: 25% leader in June	Dec(Early)	95	6.8	71	30.4	12.8
T3: 25% lateral in June	Dec(Early)	94	6.7	70	30.3	12.5
T4: 50% lateral in June	Dec(Early)	93	6.7	69	30.2	12.0
T5: 25% leader in August	Dec(Early)	98	7.0	68	30.4	13.1
T6: 25% lateral in August	Dec(Early)	97	6.9	70	30.5	13.0
T7: 50% lateral in August	Dec(Early)	95	6.9	71	30.0	12.9

T8: 25% leader in September	Dec(Early)	100	7.1	72	30.3	13.2
T9: 25% lateral in September	Dec(Early)	104	7.2	73	30.6	13.3
T10: 50% lateral in September	Dec(Early)	102	7.1	72	30.0	13.2
Mean	-	99.5	6.9	70.5	30.2	12.8
SEm $\pm$	-	0.720	0.082	0.690	0.704	0.746
CD @5%	-	2.07	0.237	1.987	NS	NS
CV (%)	-	1.60	2.681	2.199	5.173	12.84

The treatment T9( 25% lateral in September ) recorded longer duration of flowering 104 days , higher nut weight (7.2 g), apple weight (73 g), higher shelling percentage (30.6 %),and nut yield per tree(13.3kg/tree). It was followed by T10( 50% lateral in September).

Treatment	Number of flowering laterals/sq. meter area of canopy	Number of non-flowering laterals / sq. meter area of canopy
T1: Control	6.9	12.0
T2: 25% leader in June	8.0	13
T3: 25% lateral in June	7.5	12.5
T4: 50% lateral in June	7.0	12.9
T5: 25% leader in August	9.0	15.5
T6: 25% lateral in August	8.5	14.2
T7: 50% lateral in August	8.8	13.5
T8: 25% leader in September	9.8	15.9
T9: 25% lateral in September	10	16.5
T10: 50% lateral in September	9.5	16.0
Mean	8.5	14.2
SEm $\pm$	0.757	0.825
CD @5%	NS	NS
CV (%)	20.30	13.12

It was observed that higher number of flowering laterals and non flowering laterals /sq. meter area of canopy was recorded by T9( 25% lateral in September ) and it was followed by T10( 50% lateral in September).

#### Conclusion/ Inference:

Among the several pruning treatments, the september pruning at 25% lateral shoots recorded higher morphological and reproductive characters.



## MADAKKATHARA

The experiment was initiated in August 2021 with the variety Dhana planted at a spacing of 5m x 5m. Pruning was done in the months of June, August and September 2022 as per the experimental design.

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T1	4.37 <sup>a</sup>	88.5	5.93 <sup>abcd</sup>	6.72	6.32 <sup>abc</sup>
T2	4.53 <sup>a</sup>	99.8	6.99 <sup>a</sup>	6.32	6.66 <sup>a</sup>
T3	4.45 <sup>a</sup>	87.0	5.69 <sup>bcd</sup>	6.48	6.09 <sup>abcd</sup>
T4	4.45 <sup>a</sup>	77.97	5.54 <sup>cd</sup>	5.47	5.51 <sup>cd</sup>
T5	4.39 <sup>a</sup>	106.4	6.78 <sup>ab</sup>	6.28	6.53 <sup>ab</sup>
T6	4.33 <sup>a</sup>	87.0	5.07 <sup>d</sup>	5.31	5.19 <sup>d</sup>
T7	4.51 <sup>a</sup>	80.6	5.02 <sup>d</sup>	5.59	5.30 <sup>d</sup>
T8	3.87 <sup>b</sup>	87.2	6.56 <sup>abc</sup>	6.49	6.52 <sup>ab</sup>
T9	4.10 <sup>ab</sup>	90.3	5.72 <sup>bcd</sup>	5.79	5.75 <sup>abcd</sup>
T10	3.89 <sup>b</sup>	88.4	5.44 <sup>cd</sup>	5.83	5.64 <sup>abcd</sup>
<b>Mean</b>	<b>4.28</b>	<b>89.23</b>	<b>5.87</b>	<b>6.02</b>	<b>5.95</b>
<b>SEM<sub>±</sub></b>	<b>0.15</b>	<b>8.3</b>	<b>0.39</b>	<b>0.34</b>	<b>0.31</b>
<b>CD@ 5%</b>	<b>0.43</b>	<b>NS</b>	<b>1.14</b>	<b>NS</b>	<b>0.91</b>
<b>CV</b>	<b>7.86</b>	<b>20.78</b>	<b>15.41</b>	<b>12.89</b>	<b>11.91</b>

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight (g)	Shellin g %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)
T1	Nov (early)	99	8.71	71.0	28.60	3.33 <sup>a</sup>	3.33
T5	Nov (early)	98	8.63	70.2	27.73	3.69 <sup>a</sup>	3.69

T6	Nov (early)	97	8.91	69.6	28.91	2.80 <sup>ab</sup>	2.80
T7	Nov (early)	101.2	8.83	72.2	28.10	2.13 <sup>b</sup>	2.13
T8	Nov (early)	95	8.61	68.8	27.73	2.77 <sup>ab</sup>	2.77
T9	Nov (early)	105	8.53	71.0	29.07	2.74 <sup>ab</sup>	2.74
T10	Nov (early)	96	9.05	69.4	27.69	2.13 <sup>b</sup>	2.13
Mean		98.74	8.75	70.31	28.26	2.79	2.79
SE (m) $\pm$		3.27	0.599	2.26	1.37	0.34	
CD @ 5%		NS	NS	NS	NS	1.01	
CV (%)		7.42	10.81	5.08	7.69	27.63	

\*Treatments T2, T3 and T4 were not done during 2021

Treatment	Number of flowering laterals/sq. meter area of canopy	Number of non-flowering laterals / sq. meter area of canopy
T1	10.06	12.76
T5	9.17	12.45
T6	9.80	12.23
T7	7.35	16.13
T8	9.28	13.86
T9	8.34	13.83
T10	6.95	16.85
<b>Mean</b>	<b>7.13</b>	<b>14.01</b>
<b>SE (m)</b>	<b>1.15</b>	<b>1.86</b>
<b>CD @ 5%</b>	<b>NS</b>	<b>NS</b>
<b>CV (%)</b>	<b>29.54</b>	<b>29.66</b>

\*Treatments T2, T3 and T4 were not done during 2021

### Conclusion/ Inference:

Pruning exerted a significant effect on tree height, E-W canopy spread and average spread of canopy. Significantly lower tree height was observed in treatments T8 (3.87m) and T10 (3.89m) and treatment T9 (4.10m) was found on par. The average canopy spread was significantly high in treatment, T<sub>2</sub> (6.66m) and T5 (6.53m), T8(6.52m), T1 (6.32m), T3 (6.09m) and T9 (5.75m) were found on par.

Among the reproductive parameters, nut yield per tree was the highest in treatment T5 (3.69kg) and T1 (3.33kg). Significantly lower yield was observed in treatments T7 and T10 (2.13 kg). During the year 2022, pruning had no significant effect on the number of flowering and non flowering laterals. All other reproductive parameters were not significantly affected by treatments.



## VENGURLA

**Table: Growth parameters during the year 2022**

Treatment	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy (m)
			E-W	N-S	
T1: Control	6.33	62.2	6.40	7.17	6.79

T2: 25% leader in June	6.19	68.1	7.48	6.63	7.06
T3: 25% lateral in June	6.19	80.5	7.56	6.90	7.23
T4: 50% lateral in June	6.18	75.7	5.96	6.10	6.03
T5: 25% leader in August	6.16	68.4	6.08	6.67	6.38
T6: 25% lateral in August	6.15	67.1	6.17	6.34	6.26
T7: 50% lateral in August	6.22	75.3	6.51	5.81	6.16
T8: 25% leader in September	6.13	77.4	7.40	6.75	7.08
T9: 25% lateral in September	6.15	83.7	8.61	7.46	8.04
T10: 50% lateral in September	6.18	67.0	6.26	6.62	6.44
Mean					
SEm $\pm$	<b>0.03</b>	<b>4.11</b>	<b>0.37</b>	<b>0.35</b>	<b>0.31</b>
CD @5%	<b>0.05</b>	<b>5.81</b>	<b>1.07</b>	<b>NS</b>	<b>0.90</b>
CV (%)	<b>1.21</b>	<b>12.66</b>	<b>12.18</b>	<b>11.64</b>	<b>10.42</b>

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Remarks
T1: Control	Nov. (Early)	96.50	8.20	45.20	30.88	8.90		
T2: 25% leader in June	Nov. (Early)	95.40	8.36	45.50	30.18	9.59		
T3: 25% lateral in June	Nov. (Early)	96.20	7.86	50.40	29.50	9.17		
T4: 50% lateral in June	Nov. (Early)	95.00	8.32	56.10	31.30	10.39		
T5: 25% leader in August	Nov. (Early)	95.20	8.24	58.20	30.40	12.50		
T6: 25% lateral in August	Nov. (Early)	95.40	8.30	54.40	31.00	11.33		
T7: 50% lateral in August	Nov. (Early)	95.10	8.18	51.20	29.30	9.18		
T8: 25% leader in September	Nov. (Early)	94.80	8.54	50.70	30.50	9.44		
T9: 25% lateral in September	Nov. (Early)	95.40	8.30	46.20	31.50	10.86		
T10: 50% lateral in September	Nov. (Early)	94.60	8.58	45.50	31.00	10.08		
Mean								
SEm $\pm$		0.66	0.19	1.70	0.81	0.32		
CD @5%		NS	NS	4.91	NS	0.91		
CV (%)		-	-	7.42	-	6.95		

Treatment	Number of flowering laterals/sq. meter area of canopy	Number of non-flowering laterals / sq. meter area of canopy
T1: Control	11.57	17.93
T2: 25% leader in June	10.47	16.23
T3: 25% lateral in June	10.08	15.62

T4: 50% lateral in June	10.23	15.87
T5: 25% leader in August	10.82	16.78
T6: 25% lateral in August	9.96	15.44
T7: 50% lateral in August	10.20	15.80
T8: 25% leader in September	10.16	15.74
T9: 25% lateral in September	10.04	15.56
T10: 50% lateral in September	10.00	15.50
Mean		
SEm $\pm$	0.29	0.45
CD @5%	0.84	1.30
CV (%)	6.30	7.10



**Conclusion/ Inference:**

The trial of pruning response of cashew variety V-4 was initiated in the year June, 2021. All the pruning treatments were imposed in the 2<sup>nd</sup> fortnight of June, August and September, 2021. The data regarding growth, flowering, fruiting and yield were recorded and presented in table.

Among the treatments, the results for flowering duration were non-significant. The number of laterals per m<sup>2</sup> (27.6) were significantly higher in the treatment T<sub>5</sub>(25% leader in August) and it was at par with all the pruning treatments except control. The results regarding nut weight (g) were non-significant for all the treatments while the apple weight (58.20g) was significantly superior in treatment T<sub>5</sub> (25% leader in August), it was at par with pruning treatment T<sub>4</sub>(50% lateral in June-56.10g) and T<sub>6</sub> (25%) lateral in August-54.40g). The yield data recorded showed that the treatment T<sub>5</sub> (25% leader in August) was significantly superior over the rest of the treatments. There were non-significant results for shelling %.



## HOGALAGERE

**Table: Growth parameters during the year 2022**

Treatment*	Tree Height (m)	Stem Girth (cm)	Canopy Spread (m)		Average Spread of the canopy
			E-W	N-S	
T <sub>1</sub> -Control	3.27	68.40	6.98	6.83	6.91
T <sub>2</sub> -25% Leader in August	3.27	68.30	6.99	6.97	6.98

<b>T<sub>3</sub>-25% Lateral in August</b>	3.29	75.20	6.56	6.48	6.52
<b>T<sub>4</sub> -50% Lateral in August</b>	3.34	71.00	6.52	6.31	6.42
<b>T<sub>5</sub>-25% Leader in September</b>	3.36	69.40	6.43	6.45	6.44
<b>T<sub>6</sub>- 25% Lateral in September</b>	3.74	80.00	7.53	7.41	7.47
<b>T<sub>7</sub> -50% Lateral in September</b>	3.59	78.00	8.07	7.67	7.87
<b>T<sub>8</sub> -25% Leader in October</b>	3.51	74.80	7.51	7.41	7.46
<b>T<sub>9</sub> -25% Lateral in October</b>	3.46	76.40	7.25	7.48	7.37
<b>T<sub>10</sub> -50% Lateral in October</b>	3.42	72.60	6.94	7.26	7.10
Mean	3.43	73.41	7.06	7.01	7.03
SEm ±	0.088	3.56	0.33	0.34	0.32
CD @5%	0.23	10.20	0.94	0.99	0.92
CV (%)	5.27	10.84	10.31	10.93	10.11

\* since delayed flowering and haresting are observed in center, pruning treatments are set accordingly

**Table: Reproductive parameters during the year 2022**

Treatment	Flowering time (month followed by early/mid/late)	Duration of flowering (days)	Nut weight (g)	Apple weight. (g)	Shelling %	Nut Yield (kg/tree)	Cumulative Yield (Kg/plant)	Remarks
<b>T<sub>1</sub> -Control</b>	March(late)	87.40	7.03	34.16	29.62	2.75		
<b>T<sub>2</sub> -25% Leader in August</b>	March(late)	94.10	7.13	35.42	29.78	3.64		
<b>T<sub>3</sub>-25% Lateral in August</b>	March(late)	90.70	7.12	34.21	29.66	3.87		
<b>T<sub>4</sub> -50% Lateral in August</b>	March(late)	90.90	7.12	36.04	29.69	3.57		
<b>T<sub>5</sub>-25% Leader in September</b>	March(late)	92.00	7.19	36.70	29.98	3.51		
<b>T<sub>6</sub>- 25% Lateral in September</b>	March(late)	94.90	7.21	37.56	30.05	4.00		
<b>T<sub>7</sub> -50% Lateral in September</b>	March(late)	92.30	7.22	36.39	29.99	3.96		
<b>T<sub>8</sub> -25% Leader in October</b>	March(late)	89.30	7.10	34.37	29.72	3.65		
<b>T<sub>9</sub> -25% Lateral in October</b>	March(late)	88.10	7.11	34.08	29.85	3.81		
<b>T<sub>10</sub> -50% Lateral in October</b>	March(late)	88.80	7.18	34.74	29.80	3.58		
Mean	-	90.85	7.14	35.37	29.81	3.63		
SEm ±	-	1.92	0.04	1.02	0.24	0.17		
CD @5%	-	5.50	0.11	2.91	0.68	0.49		
CV (%)	-	4.72	1.22	6.42	1.78	10.59		

Treatment	Number of flowering laterals/sq. meter area of canopy	Number of non-flowering laterals / sq. meter area of canopy
<b>T<sub>1</sub> -Control</b>	15.20	7.00

T <sub>2</sub> -25% Leader in August	21.30	4.50
T <sub>3</sub> -25% Lateral in August	24.70	2.90
T <sub>4</sub> -50% Lateral in August	20.60	4.30
T <sub>5</sub> -25% Leader in September	18.80	5.30
T <sub>6</sub> - 25% Lateral in September	22.80	3.30
T <sub>7</sub> -50% Lateral in September	20.70	4.80
T <sub>8</sub> -25% Leader in October	19.70	4.70
T <sub>9</sub> -25% Lateral in October	20.20	3.00
T <sub>10</sub> -50% Lateral in October	18.00	4.50
Mean	20.20	4.43
SEm ±	0.83	0.37
CD @5%	2.38	1.06
CV (%)	9.17	18.71

**Conclusion/ Inference:**

Among the different pruning treatments studied, 25% lateral pruning in september recorded extended flowering (94.90days) with high nut yield (4 kg/tree). The yield was on par with all other pruning treatments and were superior over unpruned control.

## **II. CROP PROTECTION**

### III. CROP PROTECTION

#### Ent. 1: Chemical Control of pest complex in cashew Expt. 3. Evaluation of insecticides for control of TMB and other insect pests

<b>Centres: East Coast :</b>	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara, Paria and Vengurla
<b>Plains / others:</b>	Jagdapur and Kanabargi

The project aims at identifying the effective insecticide amongst the newer synthetic insecticides in comparison with recommended spray schedule, which are safer as well as economically feasible for managing the insect pests of cashew.

#### BAPATLA

No. of replications	:	4
No. of trees per replication	:	2
Design	:	RCBD
Variety	:	BPP-5
Age of the tree	:	20 Years

Treatment details:

T <sub>1</sub>	:	Thiamethoxam 25 WG	:	0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG	:	0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC	:	2 ml/l
T <sub>4</sub>	:	Buprofezin 25 SC	:	2 ml/l
T <sub>5</sub>	:	<i>Beauveria bassiana</i> WP	:	1 g/l
T <sub>6</sub>	:	<i>Beauveria bassiana</i> WP	:	5 g/l
T <sub>7</sub>	:	λ – Cyhalothrin 5 EC	:	0.6 ml/l
T <sub>8</sub>	:	POP of the University		
T <sub>9</sub>	:	Untreated check		

T8 POP should be given (**treatment details**)

#### Spray interval:

Number of shoots selected :

(First spray to start at 5-10 % damage (0.5 damage grade).

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

During the year 2021-22, the activity of different important foliage, flower and nut feeding pests of cashew was medium to low during the season. During this season the incidence of Tea mosquitobug

infestation was not observed and the incidence of leaf and blossom webber was very low (almost zero) in all treatments.

With regard to Shoot tip caterpillar, treatment T<sub>7</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) was found to be more effective in managing the pest and which is on par with the treatment T<sub>8</sub> (Monocrotophos 36 SL (1.6 ml/l) at flushing, Chlorpyriphos 20 EC (2.0 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage) compared to rest of the treatments.

With regard to leaf folder damage, treatment T<sub>8</sub> (Monocrotophos 36 SL (1.6 ml/l) at flushing, Chlorpyriphos 20 EC (2.0 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage) was found to be more effective in managing the pest followed by treatment T<sub>7</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) compared to rest of the treatments.

The treatment T<sub>7</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) offered better control against Apple and nut borer damage and on par with treatment T<sub>8</sub> (Monocrotophos 36 SL (1.6 ml/l) at flushing, Chlorpyriphos 20 EC (2.0 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage). The similar trend was observed in managing the leaf miner damage.

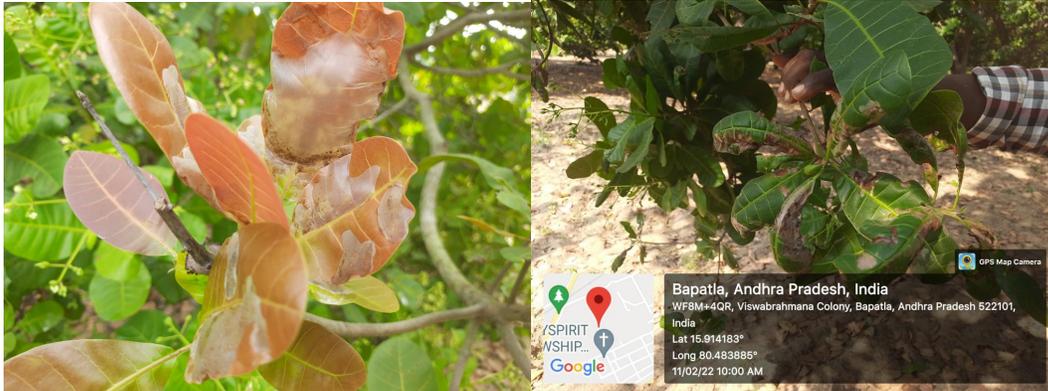
**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray										ANB (Pre /Post) % damage	Spiders Mean no. of Spiders per 24 inflorescence (?)
	TMB		Thrips		Shoot tip caterpillar		Leaf miner		Leaf folder			
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage		
T1	Not observed during the experimental period				2.73 (1.62)	4.85 <sup>d</sup> (2.19)	6.35 (2.37)	8.35 <sup>bc</sup> (2.88)	1.62 (1.06)	5.07 <sup>cd</sup> (2.24)	13.71 <sup>abc</sup> (3.69)	3.93 (1.98) <sup>c</sup>
T2					2.38 (1.52)	4.92 <sup>d</sup> (2.21)	8.26 (2.72)	5.74 <sup>c</sup> (2.38)	2.55 (1.10)	4.02 <sup>de</sup> (2.00)	12.27 <sup>bc</sup> (3.50)	4.70 (2.16) <sup>bc</sup>
T3					3.16 (1.25)	3.25 <sup>e</sup> (1.76)	2.52 (1.09)	6.81 <sup>bc</sup> (2.58)	2.75 (1.63)	5.67 <sup>bc</sup> (2.38)	10.07 <sup>c</sup> (3.15)	5.41 (2.32) <sup>bc</sup>
T4					3.88 (1.90)	6.64 <sup>cd</sup> (2.57)	3.18 (1.78)	8.98 <sup>b</sup> (2.97)	1.42 (1.02)	6.19 <sup>bc</sup> (2.48)	15.73 <sup>ab</sup> (3.96)	4.81 (2.18) <sup>bc</sup>
T5					3.68 (1.87)	9.28 <sup>ab</sup> (3.04)	5.61 (2.28)	14.62 <sup>a</sup> (3.82)	3.71 (1.92)	9.37 <sup>a</sup> (3.06)	14.18 <sup>abc</sup> (3.75)	7.92 (2.79) <sup>a</sup>
T6					2.03 (1.40)	8.05 <sup>bc</sup> (2.83)	5.22 (2.18)	12.64 <sup>a</sup> (3.55)	0.64 (0.56)	6.52 <sup>b</sup> (2.54)	13.67 <sup>abc</sup> (3.66)	6.41 (2.50) <sup>ab</sup>
T7					3.10 (1.72)	1.53 <sup>f</sup> (1.23)	2.29 (1.23)	1.58 <sup>d</sup> (1.26)	0.99 (0.69)	3.52 <sup>e</sup> (1.87)	3.49 <sup>d</sup> (1.85)	1.75 (1.32) <sup>c</sup>
T8					2.81 (1.62)	1.94 <sup>ef</sup> (1.38)	2.20 (1.25)	2.91 <sup>d</sup> (1.67)	1.08 (0.90)	2.18 <sup>f</sup> (1.47)	4.51 <sup>d</sup> (2.11)	1.57 (1.25) <sup>c</sup>
T9					4.06 (1.96)	11.06 <sup>a</sup> (3.32)	6.82 (2.23)	14.45 <sup>a</sup> (3.78)	2.39 (1.50)	11.22 <sup>a</sup> (3.35)	17.48 <sup>a</sup> (4.12)	8.31 (2.88) <sup>a</sup>
Mean												
CD (p=0.05)					NS	0.39	NS	0.51	NS	0.30	0.62	0.38
SE(m) ±					0.33	0.13	0.47	0.17	0.30	0.10	0.21	0.13
CV (%)					40.05	11.51	49.15	12.44	52.70	8.52	12.68	11.98

\*Values in the parentheses of damage score are square root transformation values

### Influence of insecticides on natural enemies

Population of spiders was maximum in untreated check and treatment T<sub>5</sub>. However, among rest of the treated plots the, T<sub>6</sub> and the treatment T<sub>3</sub> recorded maximum population of spiders and treatments T<sub>8</sub> (Monocrotophos 36 SL (1.6 ml/l) at flushing, Chlorpyriphos 20 EC (2.0 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage) and T<sub>7</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) were recorded less number of spiders compared to other treatment at 30 days after 3<sup>rd</sup> spray.



leaf miner damage



Shoot tip caterpillar damage



Apple and nut borer damage

## BHUBANESHWAR

Treatment details:

T <sub>1</sub>	:	Thiamethoxam 25 WG	:	0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG	:	0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC	:	2 ml/l
T <sub>4</sub>	:	Buprofezin 25 SC	:	2 ml/l
T <sub>5</sub>	:	<i>Beauveria bassiana</i> WP	:	1 g/l
T <sub>6</sub>	:	<i>Beauveria bassiana</i> WP	:	5 g/l
T <sub>7</sub>	:	$\lambda$ – Cyhalothrin 5 EC	:	0.6 ml/l
T <sub>8</sub>	:	POP of the University		
T <sub>9</sub>	:	Untreated check		

Insect pests namely shoot tip caterpillar (STC), red banded thrips and leaf miner incidence were noticed with variable intensity during the cropping season in 2022. The STC incidence varied from 1.86 to 4.26 per cent damaged shoot before spraying and was significant. Significantly least STC incidence was recorded from the treatment  $\lambda$  cyhalothrin (T7) followed by T8 and T2 with infestation varying from 3.12 to 15.09 % damaged shoot as against 16.23 % damaged shoot in untreated control. The red banded thrips incidence varied from 47.75 to 89.83 per leaf (seems very high, is it mean population?). before spraying. Significantly minimum population (5.40-8.64/ leaf) of the pest was observed in T1, T2 and T6 at 15 days after spraying as against 92.15 RBT per leaf was recorded in the untreated control. The per cent damaged by leaf miner varied from 1.41 to 3.37 before insecticidal treatment and significantly less leaf miner damage was recorded in T8 followed by T7 and T1, and the maximum damage percent was noticed in untreated check 15.18.

The spider population varied from 1.27 to 3.56 per lateral among treatments. The spider population was higher in T1, T4, and T5 i.e., *Beauveria* microbial insecticides. As such no significant difference in yield was found among the treated plants.

**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Thrips (unit?)		Shoot tip caterpillar		Leaf miner	
	Pre treatment D S (0-4)	Post treatment D S (0-4) ?	Pre treatment (% damage)	Post treatment (% damage)	Pre treatment (% damage)	Post treatment (% damage)
T1: Thiamethoxam 25 WG (0.1g/l)	57.35 (7.64)	5.40 (2.53)	1.86 (1.69)	7.48 (2.91)	1.41 (1.55)	5.30 (2.51)
T2:Thiamethoxamm 25 WG (0.2g/l)	52.97 (7.35)	6.16 (2.68)	2.29 (0.02)	10.05 (3.32)	2.28 (1.81)	7.21 (2.87)
T3: Carbosulfan 25 EC (2 ml/l)	47.75 (6.98)	25.26 (5.12)	3.16 (2.03)	9.81 (3.29)	3.16 (2.04)	8.23 (3.04)
T4: Buprofezin 25 SC (2 ml/l)	56.48 (7.58)	43.01 (6.63)	2.15 (1.77)	11.50 (3.54)	3.04 (2.01)	7.90 (2.98)
T5: <i>Beauveria bassiana</i> WP (1g/l)	54.23 (7.43)	38.96 (6.32)	2.54 (1.88)	15.09 (4.01)	2.13 (1.77)	7.65 (2.94)
T6: <i>Beauveria bassiana</i> WP (5g/l)	54.08 (7.42)	8.64 (3.11)	2.74 (1.93)	14.19 (3.90)	2.00 (1.73)	9.17 (3.19)
T7 λ- Cyhalothrin 5 EC (0.6ml/l)	59.00 (7.74)	58.35 (7.70)	3.23 (2.05)	3.12 (2.03)	2.87 (1.97)	4.16 (2.27)
T8-POP of the University λ- Cyhalothrin 5 EC (0.8ml/l)	61.11 (7.88)	64.25 (8.08)	4.12 (2.26)	4.34 (2.31)	1.83 (1.68)	3.14 (2.04)
T9- Untreated Check	89.83 (9.53)	92.15 (9.65)	4.26 (2.97)	16.23 (4.15)	3.37 (2.09)	15.18 (4.02)
<b>CD (p=0.05)</b>	<b>0.16</b>	<b>0.158</b>	<b>0.032</b>	<b>0.066</b>	<b>0.025</b>	<b>0.029</b>
<b>SE(m) ±</b>	<b>0.053</b>	<b>0.052</b>	<b>0.010</b>	<b>0.022</b>	<b>0.008</b>	<b>0.01</b>
<b>CV (%)</b>	<b>1.184</b>	<b>1.567</b>	<b>0.923</b>	<b>1.152</b>	<b>0.787</b>	<b>0.583</b>

\*Values in the parentheses of damage score are square root transformation values

### JHARGRAM (No data was given)

### VRIDHACHALAM

No. of replications : Four  
 No. of trees per replication : Two  
 Design : RBD  
 Variety : VRI-3  
 Age of the tree : Twenty  
 Spray interval: 30 Days  
 Number of shoots selected : 24 Leader Shoots

Treatment details:

T<sub>1</sub> : Thiamethoxam 25 WG : 0.1 g/l all the three sprays

T <sub>2</sub>	:	Carbosulfan 25 EC	:	2 ml/l all the three sprays
T <sub>3</sub>	:	Buprofezin 25 SC	:	2 ml/l all the three sprays
T <sub>4</sub>	:	λ – Cyhalothrin 5 EC	:	0.6 ml/l all the three sprays
T <sub>5</sub>	:	Thiamethoxam 25 WG	:	0.2 g/l all the three sprays
T <sub>6</sub>	:	Imidachloprid 18.6 SL	:	0.6 ml/l all the three sprays
T <sub>7</sub>	:	Untreated check		

As per the technical Programme, three round spray schedule of chemical insecticides was followed at flushing, flowering and fruit formation stages @ 10 lit./tree

The data on the pest incidence for each treatment was recorded from randomly selected fresh 24 leader shoots of each tree at four sides (East, West, North, South) on 7, 15 and 30 days after each spray on pest infestations were taken. Observations were recorded on the infestation of TMB (damage in 0-4 scale) (0 – No lesions/streaks; 1 – 1 to 3 necrotic lesions /streaks; 2 – 4 to 6 coalescing or non-coalescing lesions/streaks; 3 – Above six coalescing or non-coalescing lesions/streaks; 4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles) on flushes, TMB population (adults and nymphs), leaf miner(% infestation), leaf folder(% infestation), Leaf and blossom webber (% infestation), Leaf thrips population Numbers and Thrips damage on nut surface (Damage grade in 0-4 scale) (0=Healthy; 1= less than 25% corky growth on nuts; 2= 26-50% corky growth on nuts; 3= 51-75% corky growth on nuts; 4= more than 76% corky growth on nuts), apple and nut borer damage(% infestation). Natural enemies population viz., Spiders, ants, coccinellids and cotesia were also recorded.

#### **Field evaluation of insecticides for residual toxicity against Tea Mosquito Bug and its damage: (residual toxicity is done by all centres**

Residual toxicity studies of different insecticides on survival of Tea Mosquito bug after spray and damage grade on different insecticides in the cashew field was carried out. As per the technical Programme, spraying of chemical insecticides was followed at flushing stage with maximum spray suspension used per tree was 10 lit./each spray. The insecticides were sprayed on cashew plants with tender leaves. Mosquito net sleeve cages of size 35 x 25 cm were prepared for caging purpose. Field collected adults were caged on individual stout shoot on same day, Third day and seventh day after spraying @ 6 adult tea mosquito bugs / cage / replication. The survival of adults was recorded 24h after caging and cage was removed. For this, ten new leader stout shoots of each tree at four sides (East, West, North, and South) were selected randomly with four replications. Observations were recorded on the infestation of TMB (damage in 0-4 scale) (Grade 0-No damage, 1= 1-3 necrotic lesion, 2= 2-6 coalescing lesions, 3=more than 6 coalescing lesions and 4= complete drying) 48 h after caging on flushes were also recorded.

#### **Insecticidal effect on Pollinators**

Studies on insecticidal effect on pollinators were made to find out the activities of bees on cashew flowers. Spray schedule of chemical insecticides as per the technical programme was followed at flowering stage with maximum spray suspension used per tree was 10 lit./each spray *i.e.*, during Flowering stage. Observation on the activity of bees on cashew flowers on 1,3,7 and 15 days after spray was recorded. Randomly 10 flowering panicles were selected for each replication and observed for 10 minutes at 10.30 a.m, 11.30 a.m, 12.30 p.m,1.30p.m. Different bee species were also recorded.

## Results

The population trend of TMB and other foliar feeding insects was recorded (Table. 3). Thirty days after 3<sup>rd</sup> spray, all the insecticides were effective in controlling TMB populations to zero as against 16.790 bugs/ 24 leader shoots observed in untreated control. Furthermore, the per cent damage of leaf miner, leaf folder, leaf and blossom webber and nut borer was very low in all insecticides treated trees as compared to untreated trees.

The population trends of various natural enemies in respect of all the insecticides treatment gradually decimated the population of spiders, coccinellids, ants and braconid wasp after each round of insecticidal spray. In unprotected trees, the activity of weaver ants and *Cotesia* wasps were predominant among different forms of natural enemies. (Table).

Results of residual toxicity studies of different insecticides on survival of Tea Mosquito bug after spray and damage grade on different insecticides in the cashew field revealed that cent per cent mortality of adults of TMB was observed in all the insecticides treated on same day, but on the third and seventh day adults were survived in all the treatments. The damage score ranged from 1.250 to 1.175 as against untreated check which recorded 2.263 (Table).

Studies on insecticidal effect on pollinators on cashew flowers and the activity of pollinators viz., Indian bee, *Apis cerana indica* F., Little bee, *Apis florea* L., Stingless bee, *Tetragonula* sp. was observed. The results revealed that pollinators population was reduced in the insecticides treated when compared to the untreated control. The pre-treatment pollinators population was observed more during the 12.30 p.m. and was non-significant in all treatments including the untreated control. Reduction of pollinators population was observed one day after insecticides spray which ranged from 0.001 to 0.3 during 10.30 a.m on first day after spraying (Table).

**Table .Effect of insecticides on the incidence of TMB at Vridhachalam  
(Mean of four replications)**

Treatments		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)			Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)			Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		
			I Spray				II Spray				III Spray		
			7 DAS	15 DAS	30 DAS		7 DAS	15 DAS	30 DAS		7 DAS	15 DAS	30 DAS
T1	Thiamethoxam 25 WG @ 0.1 g/lit.	3.125 (2.031)	1.250 (1.500)	0.730 (1.315)	1.331 (1.526)	3.275 (2.068)	0.910 (1.382)	0.560 (1.249)	0.465 (1.21)	3.425 (2.103)	0.520 (1.233)	0.1938 (1.092)	0.1325 (1.064)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	3.100 (2.025)	2.350 (1.83)	1.430 (1.559)	1.761 (1.662)	3.313 (2.077)	1.856 (1.69)	0.814 (1.347)	0.725 (1.313)	3.549 (2.133)	1.276 (1.508)	0.7225 (1.312)	0.5538 (1.246)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	3.150 (2.037)	2.400 (1.844)	1.775 (1.666)	2.219 (1.794)	3.225 (2.055)	2.154 (1.776)	1.306 (1.518)	0.996 (1.413)	3.394 (2.096)	1.589 (1.609)	0.8813 (1.371)	0.6825 (1.297)
T4	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	3.225 (2.055)	0.725 (1.313)	0.463 (1.209)	0.778 (1.333)	3.181 (2.045)	0.483 (1.217)	0.281 (1.132)	0.175 (1.083)	3.332 (2.081)	0.298 (1.139)	0.0875 (1.043)	0.0225 (1.011)
T5	Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	3.200 (2.049)	1.225 (1.492)	0.665 (1.29)	1.273 (1.507)	3.300 (2.074)	0.901 (1.379)	0.510 (1.229)	0.415 (1.189)	3.463 (2.112)	0.448 (1.203)	0.1663 (1.08)	0.1738 (1.083)
T6	Imidachloprid 18.6 SL @0.6 ml/lit. all the three sprays	3.150 (2.037)	1.900 (1.703)	1.054 (1.433)	1.478 (1.574)	3.306 (2.075)	1.370 (1.539)	0.785 (1.336)	0.775 (1.332)	3.558 (2.135)	0.848 (1.359)	0.3900 (1.179)	0.2513 (1.119)
T7	Untreated control	3.250 (2.062)	3.288 (2.071)	3.313 (2.077)	3.400 (2.098)	3.425 (2.104)	3.469 (2.114)	3.475 (2.115)	3.531 (2.129)	3.539 (2.13)	3.580 (2.14)	3.6188 (2.149)	3.7125 (2.171)
C.D.		NS	0.024	0.04	0.033	NS	0.027	0.052	0.038	NS	0.036	0.034	0.021
SE(m)		0.008	0.008	0.013	0.011	0.006	0.009	0.017	0.013	0.014	0.012	0.011	0.007
SE(D)		0.011	0.011	0.019	0.016	0.008	0.013	0.024	0.018	0.02	0.017	0.016	0.01
CV		0.767	0.95	1.756	1.359	0.561	1.137	2.434	1.818	1.358	1.634	1.699	1.114

DAS – Days After Spraying; Values in the parentheses are transformed values

Table. Efficacy of insecticides on TMB Population /24 Leader Shoots at (Mean of four replications)

Treatments	Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)			Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)			Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		
		I Spray				II Spray				III Spray		
		7 DAS	15 DAS	30 DAS		7 DAS	15 DAS	30 DAS		7 DAS	15 DAS	30 DAS
Thiamethoxam 25 WG @ 0.1 g/lit. all the three sprays	9.338 (3.215)	2.793 (1.947)	1.893 (1.701)	0.858 (1.363)	10.506 (3.392)	1.685 (1.638)	1.655 (1.628)	0.765 (1.328)	14.950 (3.994)	0.682 (1.297)	0.360 (1.166)	0.088 (1.043)
Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	9.315 (3.212)	4.188 (2.277)	2.375 (1.837)	1.615 (1.617)	10.696 (3.42)	3.298 (2.073)	2.683 (1.919)	2.248 (1.802)	15.075 (4.009)	2.709 (1.925)	0.750 (1.323)	0.425 (1.193)
Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	9.303 (3.210)	4.960 (2.441)	3.300 (2.073)	1.848 (1.687)	10.683 (3.418)	3.735 (2.176)	2.848 (1.961)	2.709 (1.926)	15.050 (4.006)	3.125 (2.031)	1.063 (1.435)	0.931 (1.39)
Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	9.303 (3.210)	1.680 (1.635)	0.980 (1.407)	0.523 (1.234)	10.626 (3.41)	0.635 (1.278)	0.575 (1.253)	0.245 (1.116)	15.050 (4.006)	0.300 (1.14)	0.069 (1.034)	0.008 (1.004)
Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	9.313 (3.211)	2.654 (1.911)	1.793 (1.670)	0.813 (1.346)	10.813 (3.437)	1.530 (1.588)	1.523 (1.588)	0.764 (1.327)	14.975 (3.997)	0.621 (1.273)	0.215 (1.102)	0.078 (1.038)
Imidachloprid 18.6 SL @0.6 ml/lit. all the three sprays	9.300 (3.209)	3.684 (2.163)	1.928 (1.711)	1.635 (1.622)	10.662 (3.415)	2.905 (1.976)	2.395 (1.841)	1.633 (1.621)	14.950 (3.993)	1.413 (1.552)	0.528 (1.236)	0.367 (1.168)
Untreated control	9.243 (3.200)	9.575 (3.252)	9.685 (3.269)	9.825 (3.290)	10.701 (3.421)	11.203 (3.493)	12.875 (3.725)	3.756 (3.841)	15.100 (4.012)	15.675 (4.083)	15.851 (4.105)	16.790 (4.218)
C.D.	NS	0.08	0.063	0.07	NS	0.077	0.094	0.078	NS	0.051	0.052	0.038
SE(m)	0.005	0.027	0.021	0.023	0.011	0.026	0.031	0.026	0.03	0.017	0.017	0.013

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SE(D)	0.007	0.038	0.03	0.033	0.015	0.036	0.044	0.037	0.042	0.024	0.025	0.018
CV	0.321	2.389	2.139	2.687	0.638	2.52	3.162	2.803	1.484	1.782	1.136	1.597

PTC – Pre Treatment Count; DAS – Days After Spraying

Values in the parentheses are transformed values (??)

**Table Efficacy of insecticides on Per cent reduction of TMB population / 24 leader shoots and at Vridhachalam****(Mean of four replications)**

Tr.	Treatments	I Spray			II Spray			III Spray		
		% reduction over control			% reduction over control			% reduction over control		
		7 DAS	15 DAS	30 DAS	7 DAS	15 DAS	30 DAS	7 DAS	15 DAS	30 DAS
T1	Thiamethoxam 25 WG @ 0.1 g/lit. all the three sprays	70.84	80.46	91.27	60.54	87.15	94.44	95.65	97.73	99.48
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	56.27	75.48	83.56	48.09	79.17	83.66	82.72	95.27	97.47
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	48.20	65.92	81.20	41.20	77.88	80.31	80.06	93.30	94.45
T4	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	82.45	89.88	94.68	70.48	95.53	98.22	98.09	99.57	99.95
T5	Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	72.28	81.49	91.73	61.78	88.17	94.45	96.04	98.64	99.54
T6	Imidacloprid 18.6 SL @0.6 ml/lit. all the three sprays	61.53	80.10	83.36	52.59	81.40	88.13	90.99	96.67	97.82
T7	Untreated control	-	-	-	-	-	-	-	-	-

Table. Efficacy of insecticides against foliar pests at Vridhachalam

(Mean of four observations)

Treatments		Mean damage after 3 <sup>rd</sup> spray												Yield
		TMB Damage (% damage)		Leaf Miner (% damage)		Leaf and Blossom Webber (% damage)		Leaf Thrips Population (Nos.)		Thrips Damage grade (0-4 Score)		Apple and Nut Borer (% damage)		
		PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	
T1	Thiamethoxam 25 WG @ 0.1 g/lit. all the three sprays	5.296 (13.299)	0.545 (4.221)	7.534 (15.923)	3.800 (11.236)	10.459 (18.860)	1.956 (8.037)	12.676 (20.848)	2.375 (1.837)	1.278 (1.509)	0.558 (1.248)	2.218 (8.559)	0.566 (4.304)	6.575 (2.752)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	5.358 (13.378)	0.710 (4.799)	7.407 (15.785)	4.688 (12.499)	10.636 (19.025)	2.444 (8.989)	12.601 (20.783)	2.813 (1.952)	1.205 (1.485)	0.838 (1.355)	2.175 (8.477)	0.683 (4.723)	6.705 (2.776)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	5.503 (13.561)	0.858 (5.304)	7.327 (15.699)	4.788 (12.633)	10.751 (19.132)	2.569 (9.215)	12.683 (20.854)	2.940 (1.985)	1.250 (1.500)	0.980 (1.407)	2.168 (8.463)	0.833 (5.230)	6.775 (2.788)
T4	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	5.652 (13.746)	0.197 (2.53)	7.368 (15.743)	3.505 (10.785)	10.630 (19.02)	1.504 (7.04)	12.535 (20.726)	1.563 (1.600)	1.295 (1.513)	0.309 (1.144)	2.160 (8.447)	0.335 (3.302)	6.325 (2.706)
T5	Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	5.363 (13.385)	0.495 (3.984)	7.332 (15.704)	3.800 (11.236)	10.463 (18.864)	1.884 (7.884)	12.725 (20.89)	2.225 (1.796)	1.235 (1.494)	0.498 (1.223)	2.245 (8.614)	0.460 (3.884)	6.625 (2.761)
T6	Imidacloprid 18.6 SL @0.6 ml/lit. all the three sprays	5.390 (13.419)	0.478 (3.948)	7.510 (15.898)	4.675 (12.481)	10.486 (18.886)	1.911 (7.943)	12.576 (20.762)	2.563 (1.887)	1.315 (1.521)	0.693 (1.300)	2.218 (8.559)	0.665 (4.648)	6.850 (2.802)
T7	Untreated control	5.741 (13.856)	6.911 (15.236)	7.645 (16.044)	7.940 (16.360)	10.761 (19.140)	16.803 (24.189)	12.673 (20.846)	12.675 (3.698)	1.380 (1.541)	1.855 (1.690)	2.183 (8.492)	3.350 (10.539)	5.343 (2.518)
C.D.		NS	0.716	NS	0.18	NS	0.261	NS	0.041	NS	0.045	NS	0.497	0.03
SE(m)		0.086	0.239	0.076	0.06	0.112	0.087	0.09	0.014	0.019	0.015	0.067	0.166	0.01
SE(d)		0.122	0.338	0.108	0.085	0.158	0.123	0.128	0.019	0.027	0.021	0.094	0.235	0.014
C.V.		1.279	8.366	0.962	0.964	1.174	1.663	0.866	1.298	2.577	2.243	1.565	6.346	0.744

PTC- Pre Treatment Count;

DAS: Days After Spraying

Values in the parentheses are arc sine transformed values for per cent damage and transformed values for population numbers.

Table. Effect of insecticide sprays on natural enemies at Vridhachalam

(Mean of four observations)

Treatments		Spiders			Ants			Coccinellids			Cotesia sp.						
		PTC	Post-treatment count (Mean population/24 leader shoots)			PTC	Post-treatment count (Mean population/24 leader shoots)			PTC	Post-treatment count (Mean population/24 leader shoots)			PTC	Post-treatment count (Mean population/24 leader shoots)		
			I Spray 30 DAS	II Spray 30 DAS	III Spray 30 DAS		I Spray 30 DAS	II Spray 30 DAS	III Spray 30 DAS		I Spray 30 DAS	II Spray 30 DAS	III Spray 30 DAS		I Spray 30 DAS	II Spray 30 DAS	III Spray 30 DAS
T1	Thiamethoxam 25 WG @ 0.1 the three sprays	17.576 (4.31)	8.756 (3.123)	6.733 (2.78)	11.690 (3.562)	13.258 (3.776)	8.388 (3.064)	12.500 (3.674)	13.380 (3.792)	6.293 (2.7)	2.465 (1.861)	3.405 (2.099)	4.375 (2.318)	8.300 (3.05)	4.053 (2.248)	4.553 (2.356)	4.558 (2.357)
T2	Carbosulfan 25 EC @ 2 ml/lit three sprays	17.438 (4.294)	9.458 (3.234)	6.768 (2.787)	10.580 (3.403)	13.195 (3.768)	8.075 (3.012)	12.600 (3.688)	14.325 (3.915)	6.405 (2.721)	2.408 (1.844)	3.275 (2.067)	4.498 (2.345)	8.315 (3.052)	3.703 (2.168)	4.453 (2.335)	4.563 (2.358)
T3	Buprofezin 25 % SC @ 2 ml/lit three sprays	17.530 (4.305)	9.623 (3.259)	7.198 (2.863)	10.123 (3.335)	13.373 (3.791)	8.150 (3.025)	12.450 (3.667)	14.210 (3.9)	6.453 (2.73)	2.605 (1.898)	3.405 (2.098)	4.338 (2.31)	8.350 (3.058)	3.675 (2.162)	4.443 (2.333)	4.513 (2.347)
T4	Lambda-Cyhalothrin 5 EC @ the three sprays	17.542 (4.306)	7.488 (2.913)	6.400 (2.72)	11.414 (3.523)	13.368 (3.79)	8.463 (3.076)	12.700 (3.701)	13.315 (3.783)	6.385 (2.717)	2.373 (1.836)	3.450 (2.109)	4.610 (2.368)	8.438 (3.072)	4.198 (2.28)	4.615 (2.369)	4.683 (2.383)
T5	Thiamethoxam 25 WG @ 0.2 the three sprays	17.390 (4.288)	8.933 (3.152)	6.791 (2.791)	11.580 (3.547)	13.395 (3.794)	8.353 (3.058)	12.530 (3.678)	13.400 (3.795)	6.578 (2.752)	2.460 (1.86)	3.375 (2.092)	4.450 (2.334)	8.268 (3.044)	4.120 (2.263)	4.575 (2.361)	4.553 (2.356)
T6	Imidachloprid 18.6 SL @ 0.6 ml/lit the three sprays	17.461 (4.297)	9.293 (3.208)	6.627 (2.762)	11.180 (3.49)	13.250 (3.77)	8.278 (3.046)	12.475 (3.671)	13.725 (3.837)	6.313 (2.704)	2.450 (1.857)	3.373 (2.091)	4.433 (2.331)	8.308 (3.051)	3.665 (2.16)	4.663 (2.38)	4.575 (2.361)
T7	Untreated control	17.384 (4.288)	18.740 (4.443)	19.436 (4.521)	20.380 (4.624)	13.403 (3.795)	15.628 (4.078)	17.500 (4.301)	20.600 (4.648)	6.300 (2.702)	6.823 (2.797)	9.553 (3.248)	10.250 (3.354)	8.383 (3.063)	9.348 (3.217)	10.288 (3.36)	11.500 (3.535)
C.D.		N/A	0.033	0.03	0.033	N/A	0.031	0.029	0.037	N/A	0.066	0.055	0.027	N/A	0.032	0.038	0.04
SE(m)		0.01	0.011	0.01	0.011	0.012	0.01	0.01	0.012	0.014	0.022	0.019	0.009	0.007	0.011	0.013	0.013
SE(d)		0.014	0.015	0.014	0.015	0.017	0.014	0.013	0.017	0.02	0.031	0.026	0.013	0.01	0.015	0.018	0.019
C.V.		0.447	0.655	0.659	0.6	0.622	0.641	0.506	0.622	1.048	2.198	1.64	0.726	0.443	0.908	1.019	1.055

PTC- Pre Treatment Count; DAS: Days After Spraying; Values in the parentheses are transformed values ?? for population numbers.

**Table. Field evaluation of insecticides for residual toxicity against Tea Mosquito Bug and its damage at Vridhachalam**  
(Mean of four replications)

Treatments		No. of adults survived after 24 hours after caging on			Damage grade (0-4 scale) 48 h after caging		
		Same day	Third day	Seventh day	Same day	Third day	Seventh day
T1	Thiamethoxam 25 WG @ 0.1 g/lit. all the three sprays	0.00	1.23	4.15	1.300 (1.748)	2.650 (1.913)	3.214 (1.917)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	0.00	2.60	3.35	1.333 (1.837)	2.770 (1.751)	3.441 (1.793)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	0.00	3.13	3.50	1.453 (1.894)	2.747 (1.728)	3.355 (1.83)
T4	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	0.00	1.75	3.48	1.211 (1.734)	2.210 (1.801)	3.258 (1.917)
T5	Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	0.00	1.23	4.33	1.287 (1.842)	2.685 (1.908)	3.316 (2.059)
T6	Imidachloprid 18.6 SL @0.6 ml/lit. all the three sprays	0.00	2.23	4.63	1.566 (1.920)	2.453 (1.770)	3.331 (2.118)
T7	Untreated control	6.00	6.00	5.50	2.843 (1.722)	3.630 (1.864)	3.848 (2.136)
				C.D.	0.012	0.032	0.13
				SE(m)	0.142	0.116	0.101
				SE(D)	0.201	0.164	0.143
				CV	5.641	2.529	3.269

DAS – Days After Spraying

Values in the parentheses are transformed values

Table.. Effect of insecticide sprays on Pollinators at Vridhachalam –Flowering Stage (During second spray)

(Mean of four observations)

Treatment		Pre Treatment count (Mean population/ 10 panicles for 10 minutes)				Post-treatment count (Mean population/10 panicles for 10 minutes)											
						1 DAS				7 DAS				15 DAS			
		10.30 a.m	11.30 a.m	12.30 a.m	1.30 a.m	10.30 a.m	11.30 a.m	12.30 a.m	1.30 a.m	10.30 a.m	11.30 a.m	12.30 a.m	1.30 a.m	10.30 a.m	11.30 a.m	12.30 a.m	1.30 a.m
T 1	Thiamethoxam 25 WG @ 0.1 g/lit. all the three sprays	3.360 (2.408)	4.478 (2.336)	5.433 (2.355)	5.438 (2.416)	0.228 (1.108)	0.328 (1.152)	0.400 (1.183)	0.453 (1.205)	1.800 (1.942)	2.278 (2.042)	3.925 (1.869)	3.400 (1.993)	3.450 (2.438)	4.653 (2.454)	5.850 (2.397)	2.404 (2.449)
T 2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	3.398 (2.404)	4.476 (2.398)	5.425 (2.339)	5.443 (2.361)	0.875 (1.369)	0.868 (1.366)	0.913 (1.383)	0.913 (1.383)	2.025 (1.946)	2.455 (2.062)	4.413 (1.904)	3.575 (1.988)	4.310 (2.405)	4.500 (2.476)	5.720 (2.428)	2.362 (2.412)
T 3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	3.400 (2.362)	4.488 (2.402)	5.275 (2.398)	5.463 (2.343)	0.978 (1.406)	1.083 (1.443)	1.028 (1.424)	0.993 (1.411)	2.113 (1.956)	2.505 (2.069)	4.825 (1.96)	3.825 (2.011)	4.290 (2.384)	4.450 (2.424)	5.780 (2.482)	2.327 (2.452)
T 4	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	3.528 (2.327)	4.502 (2.364)	5.248 (2.408)	5.418 (2.413)	0.002 (1.001)	0.002 (1.001)	0.002 (1.001)	0.002 (1.001)	1.475 (1.956)	1.825 (2.05)	3.708 (1.974)	3.380 (2.478)	3.375 (2.406)	4.530 (2.444)	5.828 (2.411)	2.395 (2.543)
T 5	Thiamethoxam 25 WG @ 0.2 g/lit. all the three sprays	3.475 (2.395)	4.513 (2.322)	5.283 (2.368)	5.398 (2.39)	0.225 (1.107)	0.320 (1.149)	0.400 (1.182)	0.553 (1.246)	1.840 (2)	2.400 (2.066)	3.925 (1.944)	3.450 (2.482)	4.450 (2.467)	4.503 (2.478)	5.758 (2.482)	2.395 (2.547)
T 6	Imidachloprid 18.6 SL @0.6 ml/lit. all the three sprays	3.470 (2.395)	4.475 (2.396)	5.450 (2.324)	5.443 (2.377)	0.350 (1.161)	0.400 (1.183)	0.875 (1.369)	0.850 (1.359)	1.725 (2.013)	2.450 (1.856)	4.303 (1.978)	3.723 (2.488)	3.900 (2.418)	4.500 (2.434)	5.920 (2.495)	2.383 (2.557)
T 7	Untreated control	3.483 (2.383)	4.500 (2.415)	5.518 (2.409)	5.315 (2.346)	3.753 (2.18)	4.473 (2.339)	5.800 (2.608)	5.575 (2.564)	3.925 (2.007)	4.843 (1.884)	6.275 (1.992)	5.753 (2.483)	4.425 (2.436)	4.938 (2.379)	6.733 (2.452)	2.408 (2.562)
C.D.		NS	NS	NS	NS	0.036	0.031	0.039	0.038	0.055	0.088	0.08	0.077	0.015	0.012	0.033	0.041
SE(m)		0.012	0.019	0.015	0.022	0.012	0.01	0.013	0.013	0.018	0.029	0.027	0.026	0.032	0.035	0.034	0.014
SE(d)		0.018	0.028	0.021	0.03	0.017	0.014	0.019	0.018	0.026	0.041	0.038	0.037	0.045	0.049	0.048	0.019

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C.V.	1.048	1.638	1.26	1.813	1.804	1.481	1.806	1.734	1.853	2.922	2.743	2.273	2.616	2.852	2.751	1.09
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PTC- Pre Treatment Count; DAS: Days After Spraying; Values in the parentheses are transformed values for population numbers.

## MADAKKATHARA

No. of replications	:	3
No. of trees per replication	:	2
Design	:	RCBD
Variety	:	Madakkathara 1
Age of the tree	:	20
Treatment details:		
T <sub>1</sub>	:	Thiamethoxam 25 WG : 0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG : 0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC : 2 ml/l
T <sub>4</sub>	:	Thiacloprid 25 SC : 1.5 ml/l
T <sub>5</sub>	:	<i>Beauveria bassiana</i> WP : 10 g/l
T <sub>6</sub>	:	λ – Cyhalothrin 5 EC : 0.6 ml/l
T <sub>7</sub>	:	POP, KAU (L-cyhalothrin-quinalphos-thiamethoxam)
T <sub>8</sub>	:	Untreated check

Spray interval : Three sprays were given at an interval of 21 days during flowering and nut set stage

Number of shoots selected : 24

(First spray to start at 5-10 % damage (0.5 damage grade).

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

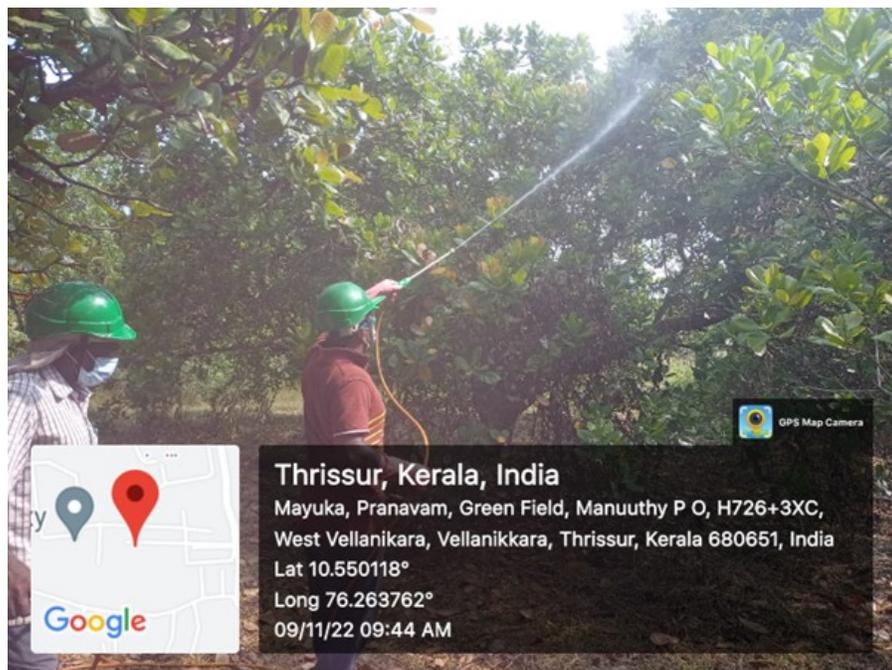
All the treatments were found superior to control and significantly lower TMB damage was recorded in treatment, T4 (Thiacloprid 25 SC @ 1.5 ml/l).

The per cent damage reduction over control varied among the insecticides from 1<sup>st</sup> spray to 3<sup>rd</sup> spray. Highest percent damage of TMB over control was observed in T6 (λ – Cyhalothrin 5 EC @ 0.6 ml/l) followed by T4 (Thiacloprid 25 SC @ 1.5 ml/l) when overall average value was compared. Treatment T4 recorded the highest B:C ratio of 2.89.

The residual toxicity of insecticides against TMB was evaluated under caged conditions. The number of adults survived 24 hrs after caging on the same day, 3<sup>rd</sup> day and 7<sup>th</sup> day after application of treatment was found to be significantly higher in T8 (control), but adults did not survived in treatments T2 and T3. Even after the release of adults on the seventh day of treatment application, no damage was observed in T2 (Thiamethoxam @ 0.2g/l) and T3 (Carbosulfan @ 2ml/l) indicating the high residual effect.

### Conclusion

Significantly lower TMB damage was recorded in T4 (Thiacloprid 25 SC @ 1.5 ml/l) with a high BC ratio of 2.89.



**Thrissur, Kerala, India**  
Mayuka, Pranavam, Green Field, Manuuthy P O, H726+3XC,  
West Vellanikara, Vellanikkara, Thrissur, Kerala 680651, India  
Lat 10.550118°  
Long 76.263762°  
09/11/22 09:44 AM

**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray									
	TMB		Thrips		Shoot tip caterpillar		Leaf miner		Leaf folder	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage
T <sub>1</sub> :Thiamethoxam 25 WG (0.1 g/l)	0.31 (0.901)	0.159 (0.793) <sup>bc</sup>	0.00 (0.707)	0.042 (0.735)	0.00 (0.707)	0.00 (0.707)	1.91 (1.303)	0.955 (5.567) <sup>b</sup> c		
T <sub>2</sub> :Thiamethoxam 25 WG (0.2 g/l)	0.28 (0.88)	0.159 (0.807) <sup>bc</sup>	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.564 (4.022) <sup>c</sup>		
T <sub>3</sub> :Carbosulfan 25 EC (2 ml/l)	0.32 (0.903)	0.180 (0.817) <sup>bc</sup>	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.955 (5.596) <sup>b</sup> c		
T <sub>4</sub> :Thiacloprid 25 SC (1.5 ml/l)	0.65 (1.07)	0.058 (0.745) <sup>c</sup>	0.00 (0.707)	0.007 (0.712)	0.00 (0.707)	0.00 (0.707)	10.06 (2.96)	2.17 (8.297) <sup>a</sup> b		
T <sub>5</sub> : <i>B. bassiana</i> WP (10 g/l)	0.36 (0.928)	0.262 (0.854) <sup>b</sup>	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	2.78 (1.426)	0.774 (4.682) <sup>c</sup>		
T <sub>6</sub> :λ-Cyhalothrin 5 EC (0.6 ml/l)	0.51 (1.003)	0.124 (0.785) <sup>bc</sup>	0.00 (0.707)	0.042 (0.736)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	2.648 (9.33) <sup>a</sup>		
T <sub>7</sub> :POP, KAU (L-cyhalothrin-quinalphos-thiamethoxam)	0.48 (0.928)	0.146 (0.798) <sup>bc</sup>	0.00 (0.707)	0.1875 (0.819)	0.00 (0.707)	0.00 (0.707)	0.00 (0.707)	1.91 (7.824) <sup>a</sup> b		

<b>T<sub>8</sub> : Untreated check</b>	0.65 (1.074 )	0.435 (0.956) <sup>a</sup>	0.00 (0.707)	0.00 (0.707 )	0.00 (0.707)	0.334 (0.880)	0.00 (0.707)	2.778 (9.336) <sup>a</sup>		
<b>Mean</b>	0.5	0.190	0.00	0.0695	0.00	0.334	1.84	1.594		
<b>CD (<math>p=0.05</math>)</b>	NS	0.033	NS	NS	NS	NS	NS	3.11		
<b>SE(m) <math>\pm</math></b>	0.077	0.024	0.00	0.033	0.00	0.061	0.649	0.223		
<b>CV (%)</b>	13.13	9.93	0.00	7.78	0.00	14.51	80.66	25.98		

\*Values in the parentheses of damage score are square root transformation values

**Source of *B. bassiana*** : : AICRP on BCCP, Kerala Agricultural University, Vellanikkara

**Table: Efficacy of different insecticides on insect pests of cashew pooled over years (2015-16 to 2018)**

Treatment	Mean damage of pests (four years data)		
	TMB	Thrips	Leaf miner
	*Post treatment mean D S (0-4)	Post treatment mean D S (0-4)	Post treatment mean % damage
T1: Thiamethoxam (0.1g/l)	0.032 (0.181) <sup>bcde</sup>	0.032 (0.729)	2.475 (5.156)
T2: Thiamethoxam (0.2g/l)	0.012 (0.103) <sup>e</sup>	0.067 (0.750)	1.741 (4.468)
T3: Carbosulfan (2ml/l)	0.071 (0.252) <sup>bc</sup>	0.027 (0.726)	0.803 (3.122)
T4: Buprofezin (2ml/l)	0.081 (0.262) <sup>b</sup>	0.024 (0.724)	2.649 (5.403)
T5: <i>Beauveria bassiana</i> WP (1g/l)	0.063 (0.215) <sup>bcd</sup>	0.062 (0.749)	2.233 (5.053)
T6: <i>Beauveria bassiana</i> WP (5g/l)	0.042 (0.718) <sup>cde</sup>	0.046 (0.738)	1.853 (4.542)
T7: L-cyhalothrin (0.6 ml/l)	0.027 (0.155) <sup>de</sup>	0.057 (0.745)	1.904 (4.608)
T8: POP, Kerala	0.017 (0.120) <sup>e</sup>	0.042 (0.736)	0.023 (0.645)
T9: Untreated check	0.0164 (0.392) <sup>a</sup>	0.068 (0.753)	4.076 (6.421)
Mean	0.057	0.042	1.973
CD @5%	0.084	NS	NS
SE(m) ±	0.021	0.001	0.228
CV (%)	27.842	3.493	38.77

\*Values in the parentheses of damage score are square root transformation values

\*\*Pests may be different for different centers

The efficacy of different insecticides on insect pests of cashew viz., TMB, thrips and leaf miner were pooled over 4 years from 2015 to 2019. Significantly lower TMB damage was observed in the treatments sprayed with thiamethoxam (0.2g/l) and POP recommendations of KAU.

**Table : Reduction in TMB damage over control in various insecticidal sprays in cashew during the year 2022**

Treatments	Per cent damage reduction of TMB at different days after spray (DAS)					
	First spray		Second spray		Third spray	
	Laterals	Panicles	Laterals	Panicles	Laterals	Panicles
T <sub>1</sub>	10.89	14.76	30.27	29.41	41.62	33.94
T <sub>2</sub>	13.52	12.22	26.97	32.56	26.73	35.84
T <sub>3</sub>	10.01	13.79	29.45	32.03	37.19	33.51

T <sub>4</sub>	27.34	35.23	12.88	25.9	36.41	29.79
T <sub>5</sub>	12.26	5.37	29.72	4.10	30.25	17.20
T <sub>6</sub>	33.6	19.82	14.94	29.89	36.29	34.13
T <sub>7</sub>	26.28	9.96	19.83	23.57	36.35	27.38
T <sub>8</sub>	-	-	-	-	-	-

**Table : Yield and economics of cashew in chemical control trial during 2022**

Treatments	Yield of Cashew (t/ ha)	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T <sub>1</sub>	2.317	73995	254870	180875	2.44
T <sub>2</sub>	2.055	75990	226050	150060	1.97
T <sub>3</sub>	1.883	82800	207130	124330	1.50
T <sub>4</sub>	2.975	84000	327250	243250	2.89
T <sub>5</sub>	1.083	75740	119130	43390	0.57
T <sub>6</sub>	2.018	74100	221980	147880	1.99
T <sub>7</sub>	2.055	74730	226050	151320	2.02
T <sub>8</sub>	0.965	72000	106150	34150	0.47

Selling price of cashew @Rs. 110/kg of raw cashewnuts

#### **Influence of insecticides on insect pests other than tea mosquito bug**

Infestation of leaf miners, shoot caterpillars and thrips were recorded. However, a significant difference was only observed in the case of leaf miners. The lowest damage per cent of leaf miner was observed in treatments, T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) and T<sub>5</sub> (*Beauveria bassiana* WP @ 10 g/l).

#### **Influence of insecticides on natural enemies**

The population of natural enemies was observed and recorded before and after 7 and 15 days of each spray. However, no significant difference was observed between the treatments.

#### **Influence of insecticides on pollinators**

Observations on the activity of bees during the active flowering period of cashew at 1, 7 and 15 days after spray was recorded. Bee activity was found in all the treatments. However the population of pollinators was found high in untreated control compared to other treatments.

**Table : Field evaluation of insecticides for residual toxicity against Tea Mosquito Bug and its damage**  
(Mean of 3 replications)

Treatments	No. of adults survived after 24 hours after caging on			Damage grade (0-4 scale) 48 h after caging		
	Same day	Third day	Seventh day	Same day	Third day	Seventh day
T <sub>1</sub> :Thiamethoxam 25 WG (0.1 g/l)	0.00	2.00	3.00	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	1.00 (1.225) <sup>b</sup>

T <sub>2</sub> :Thiamethoxam 25 WG (0.2 g/l)	0.00	0.00	0.00	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>
T <sub>3</sub> :Carbosulfan 25 EC (2 ml/l)	0.00	0.00	0.00	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>
T <sub>4</sub> :Thiacloprid 25 SC (1.5 ml/l)	0.00	2.00	0.67	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	0.67 (1.052) <sup>b</sup>
T <sub>5</sub> : <i>B. bassiana</i> WP (10 g/l)	4.34	3.34	2.67	1.34 (1.25) <sup>b</sup>	1.34 (1.25) <sup>b</sup>	1.00 (1.225) <sup>b</sup>
T <sub>6</sub> : λ-Cyhalothrin 5 EC (0.6 ml/l)	0.34	0.34	1.34	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	1.00 (1.225) <sup>b</sup>
T <sub>7</sub> :Quinalphos	0.00	0.00	0.67	0.00 (0.707) <sup>c</sup>	0.00 (0.707) <sup>c</sup>	1.00 (1.225) <sup>b</sup>
T <sub>8</sub> : Untreated check	4.34	4.00	4.67	2.67 (1.77) <sup>a</sup>	2.67 (1.77) <sup>a</sup>	3.00 (1.871) <sup>a</sup>
			Mean	0.5	0.5	0.958
			SE(m) ±	0.009	0.009	0.011
			CD @ 5%	0.162	0.162	0.183
			CV %	10.19	10.19	9.152

Values in the parentheses are  $\sqrt{x+0.5}$  transformed values

## PARIA

Design	:	RCBD
Variety	:	
Age of the tree	:	
Treatment details:		
T <sub>1</sub>	:	Thiamethoxam 25 WG : 0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG : 0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC : 2 ml/l
T <sub>4</sub>	:	Buprofezin 25 SC : 2 ml/l
T <sub>5</sub>	:	<i>Beauveria bassiana</i> WP : 1 g/l
T <sub>6</sub>	:	<i>Beauveria bassiana</i> WP : 5 g/l
T <sub>7</sub>	:	λ – Cyhalothrin 5 EC : 0.6 ml/l
T <sub>8</sub>	:	Untreated check

:

### Spray interval:

Number of shoots selected :

(First spray to start at 5-10 % damage (0.5 damage grade).

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

Three sprays were imposed at 30 days interval during flushing, flowering and fruit and nut development stages. The data on damage score of Tea Mosquito Bug (TMB) on shoots and panicles recorded before and 7 and 15 days after spray (DAS). All the treatments showed non-significant results for combating TMB population suggesting even distribution of pest in experimental plot before imposition of treatments.

After first spray, the results revealed significantly lowest (0.20 damage score) shoot damage by TMB when crop was treated with buprofezin and found statistically at par with carbosulfan with 0.26 damage score. The next effective treatment was L- cyhalothrin with 0.39 damage score. After second spray, the treatment buprofezin was found superior to all other treatments for managing TMB with significantly lowest (0.21 damage score) shoot damage and which was at par with carbosulfan and L- cyhalothrin with 0.24 and 0.37 damage score, respectively. More or less similar trend was observed after third spray. Highest shoot damage score was observed in control after all the spray. Overall, results of pooled over periods and spray revealed significantly maximum (1.39 damage score) shoot damage was observed in control. Whereas, significantly lowest (0.20 damage score) shoot damage was recorded in buprofezin and found statistically at par with carbosulfan (0.25 damage score). The order of effectiveness of various treatments against TMB was found to be buprofezin 0.05%  $\geq$  carbosulfan 0.05% > L- cyhalothrin 0.003% > thiamethoxam 0.005%  $\geq$  thiamethoxam 0.0025% > *Beauveria bassiana* 1 x 10<sup>8</sup> cfu/ml @ 50 gm/10 lit water > *Beauveria bassiana* 1 x 10<sup>8</sup> cfu/ml @ 10 gm/10 lit water > control.

In case of panicle damage by TMB, buprofezin recorded lowest (0.31 damage score) panicle damage after second spray and found statistically at par with carbosulfan and L- cyhalothrin with 0.34 and 0.43 damage score, respectively. Similar trend was observed after third spray in which significantly lowest (0.21 damage score) panicle damage was observed in buprofezin. Overall, results of pooled over periods and spray revealed the treatment buprofezin was found significantly superior against TMB with 0.26 damage score and at par with carbosulfan with 0.29 damage score. The maximum (1.39 damage score) panicle damage was observed in control. The order of effectiveness of various treatments against TMB was found to be buprofezin 0.05%  $\geq$  carbosulfan 0.05% > L- cyhalothrin 0.003% > thiamethoxam 0.005%  $\geq$  thiamethoxam 0.0025% > *Beauveria bassiana* 1 x 10<sup>8</sup> cfu/ml @ 50 gm/10 lit water > *Beauveria bassiana* 1 x 10<sup>8</sup> cfu/ml @ 10 gm/10 lit water > control.

Per cent damage reduction over control of various insecticides against TMB incidence on laterals and panicles at 15 days after spray was calculated. Among all the treatments the buprofezin 25% SC 20 ml/10 lit was found most effective with 94.37 per cent damage reduction over control on laterals at 15 days after first spray. After second and third spray buprofezin 25% SC 20 ml/10 lit was found effective treatment with 91.37 and 89.51 per cent damage reduction over control on laterals. In case of panicles, buprofezin 25% SC 20 ml/10 lit was found superior to all other treatments for managing TMB with 83.57 and 87.50 per cent damage reduction over control after second and third spray.

### **Yield and economics**

Result revealed that during 2021-22 maximum yield was obtained in buprofezin 25% SC 20 ml/10 lit while lowest yield was noted in control. Considering the economics of the treatments, highest net realization (87214.00) was observed in L-Cyhalothrin 5% EC 6 ml /10 lit. While in case of ICBR, it was highest with T7 (L-Cyhalothrin 5% EC 6 ml /10 lit) (1:17.64).

**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray	
	TMB	
	Pre treatment D S (0-4)	Post treatment D S (0-4)
1	1.35(1.33)	1.11(0.73)
2	1.35(1.32)	1.03(0.57)
3	1.36(1.36)	0.86(0.25)
4	1.36(1.35)	0.83(0.20)
5	1.36(1.34)	1.26(1.08)
6	1.35(1.33)	1.17(0.87)
7	1.36(1.35)	0.94(0.38)
8	1.36(1.36)	1.37(1.39)
Mean		
CD ( $p=0.05$ )	NS	0.07
SE(m) $\pm$	0.04	0.02
CV (%)	7.73	9.68

\*Values in the parentheses of damage score are square root transformation values

**Source of *B. bassiana* :**

**Table :** Reduction in TMB damage over control in various insecticidal sprays in cashew during the year 2022

Treatments	Per cent damage reduction over control of various insecticides against TMB incidence on laterals and panicles at different days after spray (DAS)					
	First spray		Second spray		Third spray	
	Laterals	Panicles	Laterals	Panicles	Laterals	Panicles
Thiamethoxam 25% WG 1g/10 lit	62.68		52.52	55.00	48.95	45.59
Thiamethoxam 25% WG 2g/10 lit	67.61		64.75	59.29	65.03	50.74
Carbosulfan 25% EC 20ml/10 lit	90.14		89.93	81.43	86.71	85.29
Buprofezin 25% SC 20 ml/10 lit	94.37		91.37	83.57	89.51	87.50
<i>Beauveria bassiana</i> 10 g/10 lit	28.17		28.06	21.43	27.27	16.18
<i>Beauveria bassiana</i> 50 gm/10 lit	50.00		46.76	42.86	38.46	29.41
L-Cyhalothrin 5% EC 6 ml /10 lit	80.99		77.70	71.43	77.62	75.00
Untreated control	62.68		52.52	55.00	48.95	45.59

**Table :** Yield and economics of cashew in chemical control trial during 2022

Treatments	Yield of Cashew (t/ ha)	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T <sub>1</sub>	476	4259	42078	37820	9.88
T <sub>2</sub>	667	6646	68796	62150	10.35
T <sub>3</sub>	863	19071	96242	77171	5.05
T <sub>4</sub>	882	15912	98935	83023	6.22
T <sub>5</sub>	370	5382	27227	21845	5.06
T <sub>6</sub>	642	19422	65374	45952	3.37
T <sub>7</sub>	836	5242	92456	87214	17.64
T <sub>8</sub>	175	0.00	<b>0.00</b>	<b>0.00</b>	<b>0.00</b>

Selling price of cashew @Rs. 140/kg nut

## VENGURLA

No. of replications	:	Four
No. of trees per replication	:	Two
Design	:	RBD
Variety	:	Vengurla-7
Age of the tree	:	16 years
Treatment details:		

T <sub>1</sub>	:	Thiamethoxam 25 WG	:	0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG	:	0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC	:	2 ml/l
T <sub>4</sub>	:	Buprofezin 25 SC	:	2 ml/l
T <sub>5</sub>	:	λ – Cyhalothrin 5 EC	:	0.6 ml/l
T <sub>6</sub>	:	Untreated check		

### Number of sprays :

Three (First at vegetative flush, Second at panicle initiation and third at fruiting)

Spray interval: One month

Number of shoots selected : 24/tree

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

### Tea Mosquito Bug;

The data on cumulative mean incidence of TMB at seven days after spraying revealed that the treatment T5 (λ cyhalothrin 5 EC @ 0.6 ml/lit) was found to be significantly superior over rest of the treatments with the least incidence of 0.25 and it was at par with T2 (Thiamethoxam 25WG @ 0.2 g/lit) which recorded 0.32 scale.

The data on cumulative incidence of TMB at fifteen days after spraying revealed that the treatment T5 (λ cyhalothrin 5 EC @ 0.6 ml/lit) was found to be significantly superior over the rest of the treatments by recording 0.29 scale incidence of TMB. The next best treatment was T2 (Thiamethoxam 25WG @ 0.2 g/lit) which recorded 0.39 scale and it was at par with the treatments T3 (Carbosulfan 25 EC @ 2 ml/lit), T1 (Thiamethoxam 25 WG @0.1 g/lit) and T3 (Buprofezin 25 SC @ 2 ml/lit) with 0.42, 0.43 and 0.46 mean incidence of TMB.



### **Thrips**

At seven and fifteen days after 3<sup>rd</sup> spray the treatment T2 (Thiamethoxam 25WG @ 0.2 g/lit) was observed to be most effective with least incidence of thrips (0.18 and 0.22) and was significantly superior over all other treatments.

### **Conclusion**

The treatment  $\lambda$  cyhalothrin 5 EC @ 0.6 ml/lit and Thiamethoxam 25 WG @ 0.2 g/lit were found superior for the management of tea mosquito bug of cashewnut.

Thiamethoxam 25 WG @ 0.2 g/lit was observed to be most effective for the management of thrips.

**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray					
	TMB			Thrips		
	Pre treatment DBS (0-4)	Post treatment Cumulative mean incidence 7 DAS (0-4)	Post treatment Cumulative mean incidence 15 DAS (0-4)	Pre treatment DBS (0-4)	Post treatment 7 day after 3rd spray (0-4)	Post treatment 15 days after 3rd spray (0-4)
Thiamethoxam 25 WG @ 0.1 g/lit	0.53	0.37	0.43	0.58	0.26	0.35
Thiamethoxam 25 WG @ 0.2 g/lit	0.50	0.32	0.39	0.57	0.18	0.22
Carbosulfan 25 EC @ 2 ml/lit	0.50	0.36	0.42	0.59	0.26	0.33
Buprofezin 25 SC @ 2 ml/lit	0.52	0.39	0.46	0.57	0.25	0.31
$\lambda$ cyhalothrin 5 EC @ 0.6 ml/lit	0.52	0.25	0.29	0.59	0.25	0.30
Untreated check	0.51	0.56	0.68	0.58	0.33	0.48
CD ( $p=0.05$ )	NS	0.10	0.09	NS	0.03	0.03
SE(m) $\pm$	0.01	0.03	0.03	0.01	0.01	0.01
CV (%)		6.89	6.41		6.42	6.58

DBS Day before spray

DAS Days after spraying

### Natural enemies (Spiders)

The data on cumulative mean spider population at seven and fifteen days after spraying revealed that the spider population was maximum (0.29) and (0.39) in treatment T6 (Untreated control) and was found significantly superior over rest of the treatments.

**Table :** Reduction in TMB damage over control in various insecticidal sprays in cashew during the year 2022

Treatments	Per cent damage reduction over control of various insecticides against TMB incidence at different days after spray (DAS)					
	First spray		Second spray		Third spray	
	7 DAS	15 DAS	7 DAS	15 DAS	7 DAS	15 DAS
Thiamethoxam 25 WG @ 0.1 g/lit	20.69	44.83	36.21	35.71	39.02	40.66
Thiamethoxam 25 WG @ 0.2 g/lit	31.03	40.91	44.83	45.71	46.34	46.15
Carbosulfan 25 EC @ 2 ml/lit	27.58	34.10	39.65	38.57	40.24	39.56
Buprofezin 25 SC @ 2 ml/lit	20.65	27.27	31.03	32.86	34.15	35.16
λ cyhalothrin 5 EC @ 0.6 ml/lit	41.38	52.27	56.90	58.57	58.54	58.24

DAS Days after spray

**Table :** Yield and economics of cashew in chemical control trial during 2022

Treatments	Yield of Cashew (t/ ha)	Cost of insecticide Rs/ha	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
				Total	Net	
Thiamethoxam 25 WG @ 0.1 g/lit	1.69	737	109387	236600	127213	2.16
Thiamethoxam 25 WG @ 0.2 g/lit	1.84	1474	110124	257600	146876	2.34
Carbosulfan 25 EC @ 2 ml/lit	1.68	3400	112050	235200	123150	2.10
Buprofezin 25 SC @ 2 ml/lit	1.68	3592	112242	235200	122958	2.10
λ cyhalothrin 5 EC @ 0.6 ml/lit	2.05	912	109562	287000	177438	2.62
untreated check	0.51	-	108650	74400	-	0.68

Selling price of cashew @Rs.140/kg nut

## JAGADALPUR

No. of replications	:	03
No. of trees per replication	:	03/treatment
Design	:	RCBD
Variety	:	vengurla
Age of the tree	:	19
Treatment details:		
T <sub>1</sub>	:	Thiamethoxam 25 WG : 0.1 g/l
T <sub>2</sub>	:	Thiamethoxam 25 WG : 0.2 g/l
T <sub>3</sub>	:	Carbosulfan 25 EC : 2 ml/l
T <sub>4</sub>	:	Buprofezin 25 SC : 2 ml/l
T <sub>5</sub>	:	<i>Beauveria bassiana</i> WP : 1 g/l
T <sub>6</sub>	:	<i>Beauveria bassiana</i> WP : 5 g/l
T <sub>7</sub>	:	λ – Cyhalothrin 5 EC : 0.6 ml/l
T <sub>9</sub>	:	Untreated check

### Spray interval:

Number of shoots selected :

(First spray to start at 5-10 % damage (0.5 damage grade).

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

### Results:

The results of the insecticides against TMB revealed that, after, first, second and third spray, the efficacy of different insecticides were statistically superior over untreated control (Table 1). The pre treatment damage score of TMB was non-significant in all treatments including untreated control with 1.03 damage score (DS). The results were observed in third spray after 15 days, T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) showed least (0.07) damage score followed by T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 0.37 DS and T<sub>1</sub> (Thiamethoxam 25 WG @ 0.1 g/l) with 0.61 DS.

The efficacy of different insecticide against thrips revealed that before spray of insecticide the mean damage score of thrips was statistically non significant including untreated control (1.13 DS). After 15 days of third spray, the damage score was lowest (0.10) in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) which was on par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 0.28 damage score. The pre treatment observation of shoot tip caterpillar was non -significant including untreated control. The data recorded on 15 days after third spray of insecticides showed that the per cent leaf damage was low (1.17 %) in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) followed by T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 1.73 per cent and T<sub>3</sub> (Carbosulfan 25 EC @ 2 ml/l) with 2.83 per cent.

The lowest per cent incidence (0.96 %) of leaf miner was observed in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) which was not at par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 1.78 per cent and T<sub>1</sub>

(Thiamethoxam 25 WG @ 0.1 g/l) with 2.83 per cent. Similarly, leaf folder damage per cent was minimum (1.40 %) in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) which was at par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 2.20 per cent. All the treatments were statistically superior over untreated control (T<sub>8</sub>) with 8.48 per cent incidence (table 1).

#### **Conclusion of trial based on 7 years data (2015-16 to 2021-22)**

From the data (table 2) presented revealed that the lowest TMB mean damage score (0.22) was observed in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) which was at par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 0.35 DS/leader shoot. However lowest thrips mean damage score was found in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) with 0.36 DS which was at par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with 0.37 DS /leader shoot. The lowest percent infestation of chewing insect like shoot tip caterpillar, leaf folder and leaf miner were observe in T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) followed by and at par with T<sub>2</sub> (Thiamethoxam 25 WG @ 0.2 g/l) with varied level of infestation.

Therefore L-cyhalothrin 5 EC @ 0.6ml/l and Thiamethoxam 25 WG @ 0.2 g/l can be used for management of TMB and foliage insect-pests of cashew under Bastar Plateau region of Chhattisgarh. Based on a 7 years experiment, it has been concluded.

**Table :1 Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray									
	TMB		Thrips		Shoot tip caterpillar		Leaf miner		Leaf folder	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage
T <sub>1</sub> Thiamethoxam 25 WG (0.1 g/l)	0.93 (1.39)	0.61 (1.27) <sup>c</sup>	1.07 (1.43)	0.71 (1.31) <sup>d</sup>	5.33 (2.51)	3.33 (2.06) <sup>cd</sup>	7.40 (2.88)	3.82 (2.19) <sup>c</sup>	8.15 (3.02)	6.67 (2.76) <sup>d</sup>
T <sub>2</sub> Thiamethoxam 25 WG (0.2 g/l)	1.00 (1.41)	0.37 (1.17) <sup>b</sup>	1.12 (1.45)	0.28 (1.13) <sup>b</sup>	4.40 (2.32)	1.73 (1.65) <sup>ab</sup>	5.27 (2.47)	1.78 (1.66) <sup>b</sup>	10.61 (3.41)	2.20 (1.78) <sup>b</sup>
T <sub>3</sub> Carbosulfan 25 EC (2 ml/l)	0.95 (1.40)	0.67 (1.29) <sup>cde</sup>	1.28 (1.51)	0.46 (1.21) <sup>c</sup>	6.17 (2.64)	2.83 (1.90) <sup>c</sup>	8.10 (3.01)	5.01 (2.45) <sup>d</sup>	9.61 (3.20)	5.90 (2.61) <sup>c</sup>
T <sub>4</sub> Buprofezin 25 SC (2ml/l)	0.88 (1.37)	0.62 (1.27) <sup>cd</sup>	1.04 (1.43)	0.81 (1.34) <sup>de</sup>	5.15 (2.44)	3.65 (2.13) <sup>def</sup>	7.80 (2.95)	6.67 (2.76) <sup>e</sup>	9.15 (3.18)	7.60 (2.88) <sup>de</sup>
T <sub>5</sub> <i>Beauveria bassiana</i> (1g/l)	1.10 (1.43)	0.89 (1.37) <sup>ef</sup>	1.60 (1.61)	1.17 (1.47) <sup>def</sup>	5.17 (2.46)	3.50 (2.09) <sup>de</sup>	9.26 (3.19)	7.76 (2.92) <sup>e</sup>	13.08 (3.75)	9.00 (3.16) <sup>fg</sup>
T <sub>6</sub> <i>Beauveria bassiana</i> (5g/l)	1.33 (1.52)	0.98 (1.40) <sup>fg</sup>	1.03 (1.42)	0.84 (1.35) <sup>defg</sup>	6.33 (2.69)	4.33 (2.28) <sup>fg</sup>	7.20 (2.86)	6.83 (2.77) <sup>f</sup>	13.31 (3.78)	8.68 (3.10) <sup>f</sup>
T <sub>7</sub> L-cyhalothrin 5EC (0.6ml/l)	1.00 (1.41)	0.07 (1.03) <sup>a</sup>	1.05 (1.43)	0.10 (1.05) <sup>a</sup>	6.57 (2.71)	1.17 (1.47) <sup>a</sup>	8.70 (3.10)	0.96 (1.40) <sup>a</sup>	10.79 (3.42)	1.40 (1.55) <sup>a</sup>
T <sub>8</sub> Untreated check	1.03 (1.43)	1.40 (1.54) <sup>h</sup>	1.13 (1.46)	1.60 (1.61) <sup>h</sup>	4.33 (2.29)	5.23 (2.49) <sup>h</sup>	7.56 (2.92)	9.17 (3.18) <sup>h</sup>	8.48 (3.08)	11.06 (3.47) <sup>h</sup>
Mean	1.03	0.70	1.16	0.74	5.43	3.22	7.66	5.25	10.40	6.56
CD ( $p=0.05$ )	NS	0.23	NS	0.16	NS	0.59	NS	0.56	NS	0.50
SE(m) $\pm$	0.09	0.07	0.07	0.05	0.19	0.19	0.17	0.18	0.22	0.16
CV (%)	10.38	9.97	8.25	7.01	13.02	16.59	10.06	13.06	11.26	10.52

\*Values in the parentheses of damage score are square root transformation values

Source of *B. bassiana* : State bio-control laboratory Bilaspur (CG) from 2018-19

**Table: 2 Efficacy of different insecticides on insect pests of cashew pooled over 7 years (2015-16 to 2021-22)**

Treatment	Mean damage of pests (four years data)				
	TMB	Thrips	Shoot tip caterpillar	Leaf miner	Leaf folder
	*Post treatment mean D S (0-4)	Post treatment mean D S (0-4)	Post treatment mean % damage	Post treatment mean % damage	Post treatment mean % damage
T <sub>1</sub> Thiamethoxam 25 WG (0.1 g/l)	0.50 (1.21) <sup>c</sup>	0.62 (1.93) <sup>cd</sup>	8.15 (12.96) <sup>de</sup>	4.85 (8.81) <sup>c</sup>	7.79 (11.74) <sup>cd</sup>
T <sub>2</sub> Thiamethoxam 25 WG (0.2 g/l)	0.35 (1.16) <sup>b</sup>	0.37 (1.72) <sup>ab</sup>	6.25 (11.51) <sup>b</sup>	3.33 (7.58) <sup>a</sup>	5.99 (10.93) <sup>ab</sup>
T <sub>3</sub> Carbosulfan 25 EC (2 ml/l)	0.82 (1.33) <sup>ef</sup>	0.64 (2.00) <sup>cde</sup>	7.60 (12.29) <sup>cd</sup>	5.56 (9.29) <sup>cde</sup>	7.56 (11.60) <sup>c</sup>
T <sub>4</sub> Buprofezin 25 SC (2ml/l)	0.59 (1.25) <sup>cd</sup>	0.58 (1.81) <sup>c</sup>	7.60 (12.43) <sup>cd</sup>	5.33 (8.66) <sup>cd</sup>	7.90 (11.83) <sup>cde</sup>
T <sub>5</sub> <i>Beauveria bassiana</i> (1g/l)	0.84 (1.34) <sup>efg</sup>	0.94 (2.12) <sup>fg</sup>	9.11 (13.46) <sup>ef</sup>	7.54 (10.56) <sup>fg</sup>	10.17 (12.95) <sup>g</sup>
T <sub>6</sub> <i>Beauveria bassiana</i> (5g/l)	0.75 (1.31) <sup>e</sup>	0.81 (2.05) <sup>f</sup>	6.97 (11.01) <sup>bc</sup>	6.72 (9.95) <sup>f</sup>	8.06 (11.44) <sup>def</sup>
T <sub>7</sub> L-cyhalothrin 5EC (0.6ml/l)	0.22 (1.10) <sup>a</sup>	0.36 (1.82) <sup>a</sup>	4.68 (9.79) <sup>a</sup>	3.81 (8.04) <sup>ab</sup>	5.49 (10.21) <sup>a</sup>
T <sub>8</sub> Untreated check	1.43 (1.54) <sup>h</sup>	1.62 (2.49) <sup>h</sup>	16.21 (18.97) <sup>g</sup>	9.82 (13.14) <sup>h</sup>	15.07 (17.15) <sup>h</sup>
Mean	<b>0.69</b>	0.74	8.32	5.87	8.50
CD ( $p=0.05$ )	0.13	0.13	1.17	0.92	1.11
SE(m) $\pm$	0.05	0.05	0.38	0.31	0.40
CV (%)	7.04	5.01	8.80	8.11	8.29

\*Values in the parentheses of damage score are square root transformation values

**Table : Yield and economics of cashew in chemical control trial during 2022**

Treatments	Yield of Cashew (kg/ ha)	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T1 Thiamethoxam 25 WG (0.1 g/l)	796	28251	63648	35397	1:2.25
T2 Thiamethoxam 25 WG (0.2 g/l)	898	28762	71808	43046	1:2.50
T3 Carbosulfan 25 EC (2 ml/l)	734	31902	62016	30114	1:1.94
T4 Buprofezin 25 SC (2ml/l)	796	32567	63648	31081	1:1.95
T5 <i>Beauveria bassiana</i> (1g/l)	632	27985	50592	22607	1:1.81
T6 <i>Beauveria bassiana</i> ( 5g/l)	796	28964	60384	31420	1:2.08
T7 L-cyhalothrin 5EC (0.6ml/l)	1016	29488	81274	51786	1:2.76
T8 Untreated check	475	26600	38026	11426	1:1.43

Selling price of cashew @Rs. 80\_/kg nut

## KANABARGI

No. of replications : 04  
 No. of trees per replication : 02  
 Design : RCBD  
 Variety : V-4  
 Age of the tree : 13 years

### Treatment details:

T<sub>1</sub> : Thiamethoxam 25 WG : 0.1 g/l  
 T<sub>2</sub> : Thiamethoxam 25 WG : 0.2 g/l  
 T<sub>3</sub> : Carbosulfan 25 EC : 2 ml/l  
 T<sub>4</sub> : Buprofezin 25 SC : 2 ml/l  
 T<sub>5</sub> : *Beauveria bassiana* WP : 1 g/l  
 T<sub>6</sub> : *Beauveria bassiana* WP : 5 g/l  
 T<sub>7</sub> : λ – Cyhalothrin 5 EC : 0.6 ml/l  
 T<sub>8</sub> : POP of the University  
 T<sub>9</sub> : Untreated check

Spray interval : 30 days

Number of shoots selected: leader shoots of each tree from all the four sides

(First spray to start at 5-10 % damage (0.5 damage grade).

The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

0 – No lesions/streaks.

1 – 1 to 3 necrotic lesions /streaks.

2 – 4 to 6 coalescing or non-coalescing lesions/streaks.

3 – Above six coalescing or non-coalescing lesions/ streaks.

4 – Lesions/streaks confluent or wilting or drying of affected Shoots / panicles.

Three sprays were imposed at 30 days interval at flushing, flowering and at fruit & nut developmental stage.

**Methodology:** The data on pest incidence from 4 trees per each treatment was recorded from 24 leader shoots of each tree from all the four sides at one day before spray and 30 days after each spray. In case of apple and nut borer total nuts in 24 panicles and the nuts damaged by the borer were counted at 30 days after 3rd spray. Thrips and aphids damage on nut surface was graded on 100 nuts per tree following 0 to 4 scale. Counts of spiders were recorded at 30 days after 3rd spray by tapping 24 panicles per tree on 1 sq. foot card board. During the year 2021-22, the activity of different important foliage, flower and nut feeding pests incidence was very low in all treatments. Hence treatments were not imposed during this season.

**Table : Efficacy of different insecticides on insect pests of cashew during 2022**

Treatment	Mean damage after third spray							
	TMB		Thrips (No./shoot or panicle)**		Aphids (No. affected shoots/plant)**		Apple & Nut Borer (% damage)*	
	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment D S (0-4)	Post treatment D S (0-4)	Pre treatment % damage	Post treatment % damage	Pre treatment % damage	Post treatment % damage
T1- Thiamethoxam 25 WG (0.1 g/l)	2.67 (1.78)	1.00 (1.22)	5.34 (2.42)	1.65 (1.47)	3.59 (2.02)	1.57 (1.44)	2.57 (1.75)	0.70 (1.09)
T2- Thiamethoxam 25 WG (0.2 g/l)	2.11 (1.62)	0.66 (1.08)	4.66 (2.27)	1.13 (1.27)	2.90 (1.84)	0.41 (0.95)	1.92 (1.55)	0.18 (0.82)
T3-Carbosulfan 25 EC (2 ml/l)	3.33 (1.96)	1.87 (1.54)	4.32 (2.20)	1.81 (1.52)	4.31 (2.19)	1.40 (1.38)	2.77 (1.81)	1.09 (1.26)
T4-Buprofezin 25 SC (2ml/l)	2.61 (1.76)	1.05 (1.24)	5.75 (2.50)	2.86 (1.83)	3.84 (2.08)	1.62 (1.46)	2.62 (1.77)	1.89 (1.52)
T5-Beauveria bassiana (1g/l)	2.79 (1.81)	1.82 (1.52)	5.70 (2.49)	3.98 (2.12)	4.62 (2.26)	2.54 (1.74)	3.16 (1.91)	2.20 (1.64)
T6-Beauveria bassiana ( 5g/l)	3.00 (1.87)	1.30 (1.34)	6.82 (2.71)	3.65 (2.04)	4.00 (2.12)	2.34 (1.69)	2.98 (1.86)	1.89 (1.55)
T7-L-cyhalothrin 5EC (0.6ml/l)	1.71 (1.49)	0.38 (0.94)	4.32 (2.20)	0.91 (1.19)	2.74 (1.80)	0.18 (0.83)	2.46 (1.72)	0.07 (0.75)
T8-Untreated check	2.19 (1.64)	2.40 (1.70)	4.85 (2.31)	<sup>6.79</sup> (2.70)	3.28 (1.95)	2.75 (1.80)	2.62 (1.77)	2.31 (1.68)
Mean	<b>2.55</b>	<b>1.31</b>	<b>5.22</b>	<b>2.85</b>	<b>3.66</b>	<b>1.60</b>	<b>2.64</b>	<b>1.28</b>
CD ( $p=0.05$ )	NS	0.12	NS	0.21	NS	0.48	NS	0.21
SE(m) $\pm$	0.16	0.04	0.23	0.07	0.18	0.16	0.15	0.07

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CV (%)	13.54	10.47	13.70	12.72	9.37	7.55	12.33	10.39
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\*Values in the parentheses of damage score are square root transformation values      \*\* Arc sine transformation

**Source of *B. bassiana*** : Institute of Organic Farming, Biocontrol Laboratory, University of Agricultural Sciences, Dharwad-580005

**Table: Efficacy of different insecticides on insect pests of cashew (First year data)**

Treatment	Mean damage of pests (four years data)				
	TMB	Thrips	Aphids (No. affected shoots/plant)	Apple & Nut Borer(% damage)*	Yield of Cashew (t/ ha)
	*Post treatment mean D S (0-4)	Post treatment mean D S (0-4)	Post treatment mean D S (0-4)	Post treatment mean % damage	
T1- Thiamethoxam 25 WG (0.1 g/l)	0.55 (1.02)	0.50 (1.00)	0.89 (1.14)	4.22 (11.85)	1.483
T2- Thiamethoxam 25 WG (0.2 g/l)	0.40 (0.95)	0.23 (0.91)	0.13 (0.84)	2.96 (9.99)	2.189
T3- Carbosulfan 25 EC (2 ml/l)	0.97 (1.21)	0.55 (1.03)	1.39 (1.32)	4.75 (12.59)	1.821
T4- Buprofezin 25 SC (2ml/l)	0.67 (1.08)	0.45 (0.98)	2.41 (1.60)	4.28 (11.95)	1.604
T5-Beauveria bassiana (1g/l)	0.96 (1.21)	0.76 (1.12)	2.81 (1.73)	6.32 (14.56)	1.109
T6-Beauveria bassiana ( 5g/l)	0.81 (1.14)	0.68 (1.09)	2.41 (1.63)	5.63 (13.72)	1.451
T7-L-cyhalothrin 5EC (0.6ml/l)	0.27 (0.88)	0.34 (0.92)	0.09 (0.76)	3.60 (10.94)	1.650
T8-Untreated check	1.64 (1.46)	1.36 (1.36)	2.95 (1.77)	8.34 (16.79)	0.926
Mean	<b>0.78</b>	<b>0.62</b>	<b>1.65</b>	<b>5.02</b>	
CD @5%	0.06	0.07	0.27	1.55	0.63
SE(m) ±	0.02	0.023	0.09	0.52	0.21
CV (%)	7.47	5.32	9.24	8.30	10.54

\*Values in the parentheses of damage score are square root transformation values

The results of the insecticides against TMB revealed that, after three sprays, the efficacy of different insecticides were statistically superior over untreated control. The pre treatment damage score of TMB was non-significant in all treatments including untreated control with 2.19 damage score (DS). Fifteen days after third spray showed least (0.40) damage score followed by T2 with 0.70 and T1 with 1.05.

#### **Influence of insecticides on insect pests other than tea mosquito bug**

The efficacy of different insecticide against thrips and aphids revealed that before spray of insecticide the mean damage score of thrips was statistically non significant including untreated control (1.30 DS). After 15 days of third spray, the damage score was lowest (0.33) in T7 (L-cyhalothrin 5 EC @ 0.6ml/l) which was on par with T2 with 0.66 damage score. The pre treatment observation of Apple and nut borer was non-significant including untreated control. The data recorded on 15 days after third spray of insecticides showed that the per cent nut damage was low (0.07 %) in T7) followed by T2) with 0.18 per cent and T3 with 1.09 per cent.

## Conclusion

The lowest TMB mean damage score (0.24) was observed in T7) which was at par with T2 () with 0.66 DS/leader shoot. However lowest thrips and aphid mean damage score was found in T2 (Thiamethoxam 25 WG @ 0.2 g/l) with 1.13 AND 0.41 DS respectively which was at par with T7 (L-cyhalothrin 5 EC @ 0.6ml/l) with 0.91 and 0.18 DS/leader shoot, respectively. The lowest percent infestation of apple and nut borer were observed in T7 (L) followed by and at par with T2 with varied level of infestation. Therefore L-cyhalothrin 5 EC @ 0.6ml/l and Thiamethoxam 25 WG @ 0.2 g/l can be used for management of TMB and sucking pests of cashew.

**Table :** Reduction in TMB damage over control in various insecticidal sprays in cashew during the year 2022

Treatments	Per cent damage reduction over control of various insecticides against TMB incidence on laterals and panicles at different days after spray (DAS)					
	First spray		Second spray		Third spray	
	Laterals	Panicles	Laterals	Panicles	Laterals	Panicles
T1- Thiamethoxam 25 WG (0.1 g/l)	31.35	32.93	41.23	27.20	47.99	51.37
T2-Thiamethoxam 25 WG (0.2 g/l)	38.92	39.93	59.33	48.15	69.40	72.53
T3-Carbosulfan 25 EC (2 ml/l)	36.74	37.94	45.61	35.12	63.99	72.13
T4-Buprofezin 25 SC (2ml/l)	32.51	35.66	38.88	26.41	62.20	65.53
T5-Beauveria bassiana (1g/l)	5.96	4.13	7.71	10.20	18.20	18.54
T6-Beauveria bassiana (5g/l)	17.64	22.33	27.38	28.86	39.90	42.45
T7-L-cyhalothrin 5EC (0.6ml/l)	31.50	39.98	30.55	25.53	45.89	51.67
T8-Untreated check	-	-	-	-	-	-

Percent damage reduction over control in various insecticidal sprays assessed according to the equation of Henderson and Tilton (1955) is presented in Table. Percentage damage reduction over control varied among the insecticides from 1st spray to 3rd spray. All the treatments showed an increased percentage control of TMB damage in laterals over the control except T5 and T6 from 1st spray to 3rd spray. Lowest percentage damage of TMB over control was observed in T2-Thiamethoxam 25 WG (0.2 g/l) and T3-Carbosulfan 25 EC (2 ml/l) throughout the experiment.

### Benefit to cost ratio analysis

The highest benefit : cost ratio was recorded in T2-Thiamethoxam 25 WG (0.2 g/l) followed by T3-Carbosulfan 25 EC (2 ml/l) and T7-L-cyhalothrin 5EC (0.6ml/l).

**Table : Yield and economics of cashew in chemical control trial during 2022**

Treatments	Yield of Cashew (t/ ha)	Cost of Cultivation (Rs. /ha)	Returns (Rs. /ha)		B: C
			Total	Net	
T1- Thiamethoxam 25 WG (0.1 g/l)	1.483	57919	140885	82966	2.432
T2-Thiamethoxam 25 WG (0.2 g/l)	2.189	58238	197010	138772	3.383
T3-Carbosulfan 25 EC (2 ml/l)	1.821	59520	163890	104370	2.754
T4-Buprofezin 25 SC (2ml/l)	1.604	62352	144360	82008	2.315
T5-Beauveria bassiana (1g/l)	1.109	61987	99810	37823	1.610
T6-Beauveria bassiana (5g/l)	1.451	60080	130590	70510	2.174
T7-L-cyhalothrin 5EC (0.6ml/l)	1.650	58048	148500	90452	2.558
T8-Untreated check	0.926	54000	83340	29340	1.543

Selling price of cashew @Rs. 95 /kg nut

### Influence of insecticides on natural enemies

Population of natural enemies was observed and recorded before and after 7 and 15 days of each spray. However, the population of natural enemies was found to be negligible even

### Influence of insecticides on pollinators

Influence of insecticides on the pollinators of cashew was observed and recorded before and after 7 and 15 days after each spray. Bee activity was found in all treatments after first spray except T4 (Thicloprid), But after second and third spray, bee activity was noticed only in treatment T8.

### Expt.4 : Evaluation of Botanicals for the control of Tea Mosquito Bug and other insect pests

<b>Centres: East Coast :</b>	Bapatla and Vridhachalam
<b>West Coast :</b>	Paria, Pilicode, Madakkathara and Vengurla

<b>Plains / others:</b>	Hogalagere, Jagdalpur and Kanabargi
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**Objective :** Evaluation of botanicals for the control of foliage and floral pests of Cashew.

### BAPATLA

#### Experimental details:

No of treatments	: 7
Treatment details	:
	T <sub>1</sub> : Custard leaf extract @ 7.5%
	T <sub>2</sub> : Chilli Garlic Extract @ 2%
	T <sub>3</sub> : Pongamia seed extract @ 4%
	T <sub>4</sub> : Azadirachtin 10000 ppm@ 1 ml/l
	T <sub>5</sub> : Ajith paul botanical formulation (AAVYA Botanical pesticide )
	T <sub>6</sub> : Lambda Cyhalothrin 5EC @ 0.6 ml/l
	T <sub>7</sub> : Water spray
No. of replications	: 3
No. of trees per replication	: 2
Age of the tree	: 5 years
Design	: RBD

During the year 2020-21, the activity of different important foliage, flower and nut feeding pests of cashew was medium during the season. Among the botanical treatments all treatments were superior over the control for managing the leaf and blossom webber and all were on par with each other.

With regard to Shoot tip caterpillar, among the botanical treatments treatment T<sub>4</sub> (Azadirachtin 10000 PPM @ 1.0 ml per lit) was found effective in managing the shoot tip caterpillar followed by treatment T<sub>1</sub> (Custard apple leaf extract @ 7.5%) which were on par with each other. Among the botanical treatments the treatment T<sub>4</sub> (Azadirachtin 10000 PPM @ 1.0 ml per lit) offered better control against Apple and nut borer damage followed compared to rest of the treatments. Similar trend was observed in leaf miner incidence. Among the all treatment chemical check i.e. treatment T<sub>6</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) was observed effective in managing the foliage and floral pests.

Population of spiders were maximum in all botanical treatments less number of spider population was observed in treatment T<sub>6</sub> ( $\lambda$ -Cyhalothrin 0.6 ml/l) chemical check. However they were observed non-significant among the treatments.

**Table : Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2022**

Treatments	TMB damage on shoots / inflorescences (0-4 scale) at DAS			Mean
	On shoots		On Inflorescence	
	15 DAS	Before	15 DAS	

	Before Spry		Spray		
Custard leaf extract @ 7.5%	Tea mosquito bug infestation was not observed during the experimental period				
Chilli Garlic Extract @ 2%					
Pongamia seed extract @ 4%					
Azadirachtin 10000 ppm@ 1 ml/l					
AAVYA Botanical pesticide					
Lamda Cyahalothrin 5EC @ 0.6 ml/l					
Water spray					
Mean					
SE(m) ±					
CD @ 5%					
CV					

\*Values in the parentheses of damage score are square root transformation values

**Table: Efficacy of different botanicals against pest complex during 2022**

Treatment	Incidence of different pests on shoots or inflorescence at DAS							
	LBW damaged shoots (%)		Shoot tip caterpillar damaged shoots (%)		Leaf miner Damage (%)		Apple & Nut Borer (% damage) *	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15
Custard leaf extract @ 7.5%	5.49 (2.31)	5.90 <sup>b</sup> (2.4)	5.6 (2.3)	4.6 <sup>c</sup> (2.1)	11.0 (3.3)	12.2 <sup>bc</sup> (3.5)	Not recorded?	10.5 <sup>b</sup> (3.2)
Chilli Garlic Extract @ 2%	6.67 (2.47)	6.92 <sup>b</sup> (2.6)	3.8 (1.9)	5.9 <sup>b</sup> (2.4)	13.3 (3.6)	13.1 <sup>b</sup> (3.6)		10.5 <sup>b</sup> (3.3)
Pongamia seed extract @ 4%	5.43 (2.19)	6.15 <sup>b</sup> (2.5)	4.4 (2.1)	4.8 <sup>bc</sup> (2.2)	15.1 (3.9)	15.0 <sup>ab</sup> (3.9)		11.9 <sup>ab</sup> (3.4)
Azadirachtin 10000 ppm@ 1 ml/l	5.83 (2.37)	4.79 <sup>b</sup> (2.2)	5.3 (2.3)	4.3 <sup>c</sup> (2.1)	12.2 (3.5)	10.0 <sup>c</sup> (3.2)		6.3 <sup>c</sup> (2.5)
AAVYA Botanical pesticide	7.64 (2.74)	6.89 <sup>b</sup> (2.6)	5.3 (2.3)	6.1 <sup>b</sup> (2.4)	12.6 (3.5)	14.4 <sup>ab</sup> (3.8)		10.7 <sup>b</sup> (3.3)
Lamda Cyahalothrin 5EC @ 0.6 ml/l	6.59 (2.41)	2.45 <sup>c</sup> (1.5)	4.2 (2.0)	2.0 (1.4) <sup>d</sup>	11.8 (3.4)	6.7 <sup>d</sup> (2.6)		2.8 <sup>d</sup> (1.6)
Water spray	7.25 (2.59)	10.78 <sup>a</sup> (3.3)	5.2 (2.1)	8.5 (2.9) <sup>a</sup>	11.6 (3.4)	18.1 <sup>a</sup> (4.3)		16.0 <sup>a</sup> (4.0)
Mean								
CD @ 5%	NS	0.59	NS	0.27	NS	0.44		0.62
SE(m) ±	0.19	0.19	0.35	0.09	0.12	0.14		0.20
CV (%)	13.37	13.45	28.39	6.90	5.99	6.92		11.51

#### Evaluation of phytotoxicity of botanicals on cashew

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

**Table : Evaluation of botanicals safety to natural enemies during 2022**

Treatment	No. of predators on shoots or inflorescence at DAS**							
	<i>Spiders</i>		<i>Menochilussexmaculatus</i>		<i>Chrysoperl asp</i>		Syrphid	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15 DAS
Custard leaf extract @ 7.5%		7.9 (5.0)						
Chilli Garlic Extract @ 2%		6.4 (4.0)						
Pongamia seed extract @ 4%		5.8 (3.5)						
Azadirachtin 10000 ppm@ 1 ml/l		7.1 (4.2)						
AAVYA Botanical pesticide		6.2 (3.4)						
Lamda Cyahalothrin 5EC @ 0.6 ml/l		1.9 (1.4)						
Water spray		7.4 (4.5)						
Mean								
SE(m) ±		NS						
CD @ 5%		0.82						
CV (%)		38.43						

**IMPORTANT : Henderson- Tilton formula for control correction need to be deployed ?? results are not seen**

## VRIDHACHALAM

### Experimental details:

No of treatments	:	Nine
No. of replications	:	Four
No. of trees per replication	:	Two
Year of Planting	:	2005
Design	:	RBD

Treatment details:

T-1	:	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 2 days. Soaked in Mud pot with 10 litres of water.
T-2	:	NSKE 5%
T-3	:	Deshi Cow urine 100 ml/litre of water.
T-4	:	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - Methanol Extract
T-5	:	Rhizomes of Acorus 5% soaked overnight.
T-6	:	Pongam oil 5 %
T-7	:	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract
T-8	:	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water )
T-9	:	Untreated check

As per the technical Programme, botanicals were sprayed during flushing, flowering and fruit formation stage at the fortnight intervals before reaching ETL. Totally five round of sprays were imposed with maximum spray suspension used per tree was 10 lit./each sp

### Botanicals preparation methodology

T1- Leaves of each of 500 grams of Adathoda, Datura, Vitex, Calotropis and Neem was grinded and leaf extracts of Adathoda, Datura, Vitex, Calotropis, Neem was soaked in 10 litres of water and fermented for 2 days, and the supernatant was used for spraying; T2- Neem Seed Kernal Extract 5% was prepared and used; T3- Deshi Cow urine 100 ml/litre of water; T4- Leaves of each of 500 grams of Adathoda, Datura, Vitex, Calotropis and Neem was grinded and leaf extracts of Adathoda, Datura, Vitex, Calotropis, Neem was soaked in Methanol and the supernatant extract was used for spraying;-; T5- Rhizomes of Acorus 5% soaked overnight and supernatant was used for spraying; T6-Pongam oil 5 %; T7- Leaves of each of 500 grams of Adathoda, Datura, Vitex, Calotropis and Neem was grinded and leaf extracts of Adathoda, Datura, Vitex, Calotropis, Neem was soaked in n - hexane, and the supernatant extract was used for spraying;-; T8- Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water );T9-Untreated check. For all the treatments khadhi soap@ 1g/litre of water was added for spraying.

### Observations recorded

The data on the pest incidence for each treatment was recorded from randomly selected fresh 24 leader shoots of each tree at four sides (East, West, North, South) on 7, and 15 days after each spray on pest infestations were taken. Observations were recorded on the infestation of TMB (damage in 0-4 scale) on flushes, TMB population (adults and nymphs), leaf miner(% infestation), leaf folder(% infestation), Leaf and blossom webber (% infestation), apple and nut borer damage(% infestation). Natural enemies population viz., Spiders, ants, coccinellids and cotesia were also recorded.

### Evaluation of phytotoxicity of botanicals on cashew

As per the technical Programme, in Botanicals field experiments, symptoms like leaf injury, wilting, vein clearing, necrosis, epinasty and hyponasty were observed in each trees at 1,3,5,7,10 and 14 days after spraying as per the protocol of Central Insecticide Board and Registration Committee (C.I.B and R.C).

### Method of assessment

#### Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

### Results:

The results of evaluation of Botanical pesticides against TMB revealed that 15 days after third, fourth and fifth spraying, the efficacy of botanicals was low when compared to the standard insecticides treated check. All the botanical pesticides were sprayed in the field before reaching ETL. During the flushing period, the first and second spray was carried out prior to the TMB incidence. TMB incidence was not observed in botanical pesticides sprayed when compared to the Untreated check (the damage score observed was 2.045). The pre-treatment damage score of TMB was non-significant in all the treatments. Reduction of fresh infestation was observed 7 days after each round of spray. Standard insecticide check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6ml/lit.of water) is effective in controlling the TMB incidence. Among all the botanical pesticides sprayed, spraying of combined Leaf extracts of Adathoda, Datura, Vitex, Calotropis and neem was very effective in controlling the TMB incidence (0.395 and 0.347 scale), followed by Pongam oil 5% was very effective in controlling the TMB incidence (0.406 and 0.306 scale), followed by NSKE 5% (1.153 and 0.785 scale). The same was observed in 7 DAS and 15 DAS of fourth and fifth spraying also. After the fourth spray, the damage score ranged between 0.007 and 0.608 in different treatments as against an increased damage score of 3.469 in untreated control. Fifteen days after fifth spray, the damage score decreased and ranges between 0.0049 and 0.6099 in various treatments as against an increased score of 3.825 in control (Table.1 and 2).

The overall efficacy ranked in the order against the incidence of TMB and its population at Vridhachalam are as follows: T9 -Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water ) > T1-spraying of combined Leaf extracts of Adathoda, Datura, Vitex, Calotropis and neem > T6- Pongam oil 5 % > T2-NSKE 5% >T3 Deshi Cow urine 100 ml/litre of water > T5-Rhizomes of Acorus 5% >T4-Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem -Methanol Extract > T7-Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract.

The population trend of TMB and other foliar feeding insects was recorded (Table.2). fifteen days after 5<sup>th</sup> spray, all the botanical pesticides effective in controlling TMB populations to 0.174 as against 4.750 bugs/ 24 leader shoots observed in untreated control. Furthermore, the per cent damage of leaf miner(ranged from 2.636 to 3.300), leaf and blossom webber(ranged from 2.210 to 3.758) and nut borer (ranged from 0.066 to 1.151) was low in all botanicals treated trees as compared to untreated trees(Table 3).

### Phytotoxic effect of botanicals on cashew

The results on the investigations of the phytotoxic effect of botanicals sprayed at fortnight intervals during flushing, flowering and fruit formation stage on cashew variety VRI-3 are furnished in the Table 4. The observations showed that none of the botanical treatments caused any phytotoxic symptoms such as injury to leaf tip and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty. Hence, it was concluded that these botanical treatments did not inflict any phytotoxic effect on cashew.

The population trends of various natural enemies in respect of all the botanical treatments gradually decimated the population of spiders, coccinellids, ants and braconid wasp after each round of insecticidal spray. In unprotected trees, the activity of weaver ants and *Cotesia* wasps were predominant among different forms of natural enemies. (Table.5).

**Table 1. Effect of Botanicals on the incidence of TMB at Vridhachalam**

(Mean of four replications)

Treatment		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)		Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)	
			III Spray			IV Spray			V Spray	
			7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 15-20 days. Soaked in Mud pot with 10 litres of water.	2.033 (1.493)	0.395 (1.492)	0.347 (1.867)	3.146 (1.605)	0.112 (1.255)	0.311 (2.115)	3.600 (1.636)	0.100 (1.268)	0.0830 (2.118)
T2	NSKE 5%	2.038 (1.364)	0.568 (1.296)	0.558 (1.260)	3.115 (1.422)	0.372 (1.473)	0.343 (1.424)	3.529 (1.463)	0.393 (1.488)	0.3671 (1.466)
T3	Deshi Cow urine 100 ml/litre of water.	2.041 (1.379)	0.569 (1.446)	0.450 (1.449)	3.106 (1.455)	0.519 (1.53)	0.488 (1.464)	3.506 (1.457)	0.488 (1.474)	0.4163 (1.429)
T4	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - Methanol Extract	2.034 (1.443)	0.825 (1.419)	0.690 (1.479)	3.152 (1.586)	0.785 (1.536)	0.727 (1.523)	3.284 (1.620)	0.739 (1.557)	0.6099 (1.542)
T5	Rhizomes of Acorus 5% soaked overnight.	2.039 (1.309)	0.583 (1.505)	0.527 (1.521)	3.095 (1.384)	0.499 (1.683)	0.496 (1.685)	3.171 (1.439)	0.475 (1.692)	0.4370 (1.678)
T6	Pongam oil 5 %	2.043 (1.319)	0.406 (1.441)	0.306 (1.429)	3.128 (1.388)	0.175 (1.303)	0.158 (1.388)	3.226 (1.417)	0.175 (1.319)	0.1490 (1.305)
T7	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract	2.035 (1.463)	0.820 (1.486)	0.714 (1.799)	3.120 (1.620)	0.633 (1.521)	0.608 (2.085)	3.281 (1.648)	0.608 (1.527)	0.5330 (2.111)
T8	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water )	2.045 (1.362)	0.280 (1.272)	0.241 (1.332)	3.165 (1.437)	0.009 (1.343)	0.007 (1.317)	3.259 (1.443)	0.007 (1.321)	0.0049 (1.306)
T9	Untreated check	2.040 (1.375)	2.550 (1.245)	2.850 (1.919)	3.200 (1.421)	3.525 (1.262)	3.675 (2.138)	3.328 (1.441)	3.469 (1.267)	3.8250 (2.162)
C.D.		NS	0.125	0.371	NS	0.152	0.586	NS	0.121	0.622

SE(m)	0.151	0.152	0.126	0.233	0.254	0.2	0.266	0.263	0.212
SE(d)	0.213	0.214	0.179	0.329	0.359	0.282	0.376	0.372	0.299
C.V.	1.667	1.645	6.174	3.436	5.377	23.74	3.272	3.675	2.216

DAS – Days After Spraying; Values in the parentheses are transformed values

**Table. 2 Efficacy of Botanicals on TMB population / 24 leader shoots at Vridhachalam (Mean of four replications)**

Treatment		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)		Pre-Treatment Count /24 leader shoots	Post-treatment count (Mean TMB population/24 leader shoots)	
			III Spray			IV Spray			V Spray	
			7 DAS	15 DAS		7 DAS	15 DAS		7 DAS	15 DAS
T1	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 15-20 days. Soaked in Mud pot with 10 litres of water.	2.800 (1.602)	0.505 (1.313)	0.396 (1.424)	3.350 (1.754)	0.380 (1.392)	0.355 (2.157)	4.753 (1.862)	0.330 (1.415)	0.174 (1.747)
T2	NSKE 5%	2.703 (1.479)	0.729 (1.484)	0.579 (1.459)	3.298 (1.596)	0.883 (1.651)	0.858 (1.781)	4.695 (1.614)	0.833 (1.686)	0.421 (1.474)
T3	Desi Cow urine 100 ml/litre of water.	2.725 (1.471)	0.807 (1.487)	0.632 (1.505)	3.275 (1.606)	1.326 (1.682)	1.301 (1.771)	4.632 (1.576)	1.276 (1.655)	0.927 (1.554)
T4	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - Methanol Extract	2.750 (1.524)	0.818 (1.51)	0.640 (1.537)	3.310 (1.724)	1.355 (1.715)	1.305 (1.633)	4.529 (1.838)	1.280 (1.813)	0.946 (1.751)
T5	Rhizomes of Acorus 5% soaked overnight.	2.653 (1.473)	0.772 (1.593)	0.622 (1.603)	3.450 (1.54)	1.073 (1.795)	1.048 (1.828)	4.660 (1.568)	1.023 (1.915)	0.518 (1.818)
T6	Pongam oil 5%	2.680 (1.491)	0.571 (1.407)	0.455 (1.995)	3.473 (1.544)	0.787 (1.546)	0.762 (1.405)	4.712 (1.525)	0.737 (1.556)	0.403 (1.435)
T7	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract	2.675 (1.585)	0.928 (1.488)	0.656 (1.984)	3.368 (1.786)	1.721 (1.606)	1.696 (2.158)	4.693 (1.889)	1.646 (1.739)	0.809 (2.054)
T8	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water)	2.725 (1.478)	0.187 (1.424)	0.162 (1.398)	3.333 (1.663)	0.260 (1.512)	0.235 (1.382)	4.790 (1.698)	0.210 (1.511)	0.123 (1.423)
T9	Untreated check	2.800 (1.487)	2.950 (1.282)	2.984 (1.953)	3.575 (1.66)	3.670 (1.349)	3.891 (2.197)	4.600 (1.682)	4.691 (1.396)	4.750 (2.07)
C.D.		NS	0.152	0.454	NS	0.154	0.485	NS	0.125	0.138
SE(m)		0.185	0.207	0.154	0.179	0.224	0.165	0.294	0.315	0.35
SE(d)		0.261	0.293	0.218	0.253	0.317	0.234	0.416	0.446	0.495
C.V.		4.479	8.735	8.712	1.687	8.302	8.231	4.67	8.634	1.096

DAS – Days After Spraying; Values in the parentheses are transformed values

**Table.3 Efficacy of Botanicals against foliar pests at Vridhachalam (Mean of four replications)**

Treatment		Mean damage after 5 <sup>th</sup> spray										Yield (Kg per tree)
		TMB Damage % % damage or grade?		Leaf Miner %		Leaf and Blossom Webber %		Apple and Nut Borer %		Leaf Thrips Population (Nos.) no per leaf?		
		PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	
T1	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 15-20 days. Soaked in Mud pot with 10 litres of water.	3.688 (12.366)	0.203 (7.272)	5.460 (12.04)	2.636 (7.280)	4.370 (9.561)	2.210 (5.398)	1.540 (9.662)	0.066 (11.972)	10.210 (2.969)	3.278 (2.068)	6.340 (3.044)
T2	NSKE 5%	3.715 (12.195)	0.666 (7.459)	5.190 (12.305)	2.758 (7.966)	4.420 (9.622)	2.504 (5.805)	1.563 (9.535)	0.530 (5.252)	10.203 (2.972)	3.530 (2.128)	5.725 (2.953)

T3	Deshi Cow urine 100 ml/litre of water.	3.513 (12.285)	0.753 (7.362)	5.200 (11.999)	2.688 (7.588)	4.340 (9.759)	3.343 (6.741)	1.587 (9.495)	0.755 (5.161)	10.260 (2.977)	3.878 (2.208)	5.748 (2.977)
T4	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem -Methanol Extract	3.683 (11.982)	0.840 (7.445)	5.203 (12.182)	3.138 (7.812)	4.297 (9.546)	3.406 (5.723)	1.665 (9.640)	0.932 (5.076)	10.173 (2.987)	3.778 (2.186)	5.450 (2.919)
T5	Rhizomes of Acorus 5% soaked overnight.	3.613 (11.822)	0.728 (7.117)	5.220 (12.188)	3.156 (6.618)	4.313 (9.594)	3.240 (5.471)	1.582 (9.719)	0.655 (8.75)	10.260 (2.977)	3.753 (2.18)	5.573 (2.932)
T6	Pongam oil 5 %	3.685 (12.142)	0.653 (7.031)	5.252 (12.265)	2.678 (7.861)	4.258 (9.648)	3.338 (6.409)	1.542 (9.737)	0.430 (5.086)	10.150 (2.976)	3.315 (2.077)	5.848 (3.07)
T7	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract	3.673 (12.119)	1.215 (7.252)	5.318 (12.074)	3.300 (7.976)	4.414 (9.614)	3.758 (8.428)	1.591 (9.954)	1.151 (11.676)	10.173 (2.934)	3.853 (2.203)	5.295 (3.062)
T8	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water )	3.655 (12.119)	0.453 (6.974)	5.315 (12.279)	2.541 (7.560)	4.377 (9.749)	0.775 (8.478)	1.761 (9.852)	0.046 (11.659)	10.155 (2.948)	2.888 (1.972)	6.650 (2.600)
T9	Untreated check	3.835 (12.112)	4.268 (7.301)	5.340 (12.363)	6.229 (6.565)	4.283 (9.536)	4.653 (8.440)	1.783 (9.751)	2.105 (11.843)	10.153 (2.966)	12.346 (3.653)	2.663 (2.653)
C.D.		NS	0.227	NS	0.591	NS	1.39	NS	1.581	NS	0.04	0.29
SE(m)		0.163	0.138	0.077	0.201	0.144	0.474	0.117	0.538	0.014	0.014	0.099
SE(d)		0.23	0.194	0.109	0.285	0.204	0.67	0.165	0.761	0.019	0.019	0.14
C.V.		2.681	3.796	1.267	5.388	2.992	13.998	2.408	12.673	0.917	1.192	6.793

PTC- Pre Treatment Count; DAS: Days After Spraying ; Values in the parentheses are arc sine transformed values for per cent damage and transformed values for population numbers.

**Table 4 Phytotoxic effect of Botanicals on cashew (Table not required as no toxicity)  
(Mean of four observations)**

T. No.	Treatments	Phytotoxicity rating*				
		Injury to leaf tip and leaf surface	Wilting	Vein clearing	Necrosis	Epinasty and Hyponasty
T <sub>1</sub>	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 15-20 days. Soaked in Mud pot with 10 litres of water.	0	0	0	0	0
T <sub>2</sub>	NSKE 5%	0	0	0	0	0
T <sub>3</sub>	Deshi Cow urine 100 ml/litre of water.	0	0	0	0	0
T <sub>4</sub>	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem -Methanol Extract	0	0	0	0	0
T <sub>5</sub>	Rhizomes of Acorus 5% soaked overnight.	0	0	0	0	0
T <sub>6</sub>	Pongam oil 5 %	0	0	0	0	0
T <sub>7</sub>	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract	0	0	0	0	0

T <sub>8</sub>	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water )	0	0	0	0	0
T <sub>9</sub>	Untreated check	0	0	0	0	0

\*Observed on 1, 3, 5, 7, 10 and 15 days after first, second, third, fourth and fifth spraying.

**Table .5 Effect of Botanical sprays on natural enemies at Vridhachalam**

(Mean of four observations)

T. No.	Treatments	Mean number of natural enemies in 24 inflorescence 15 days after 5 <sup>th</sup> spray							
		Spiders		Ants		Coccinellids		Cotesia	
		PTC	15 DAS	PTC	15 DAS	PTC	15 DAS	PTC	15 DAS
T1	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem fermented for 15-20 days. Soaked in Mud pot with 10 litres of water.	12.589 (3.043)	7.436 (2.573)	15.344 (3.099)	6.139 (3.039)	4.430 (3.095)	4.974 (2.551)	3.413 (3.091)	5.328 (2.866)
T2	NSKE 5%	12.603 (3.051)	7.292 (2.716)	15.581 (3.098)	6.293 (2.892)	4.588 (3.107)	6.260 (2.729)	3.740 (3.100)	5.458 (2.504)
T3	Deshi Cow urine 100 ml/litre of water.	12.423 (3.021)	9.781 (2.524)	15.581 (3.092)	12.134 (3.057)	4.686 (3.071)	5.050 (2.399)	3.978 (2.955)	5.350 (2.672)
T4	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - Methanol Extract	12.583 (3.044)	7.955 (2.717)	15.654 (3.023)	8.733 (2.702)	4.530 (3.092)	5.050 (2.649)	3.875 (3.033)	5.403 (2.469)
T5	Rhizomes of Acorus 5% soaked overnight.	12.728 (3.023)	7.178 (2.598)	15.499 (3.094)	6.708 (2.818)	4.567 (3.095)	5.430 (2.436)	3.728 (3.113)	4.250 (2.653)
T6	Pongam oil 5 %	12.556 (3.067)	6.171 (2.794)	15.348 (3.095)	6.209 (2.672)	4.677 (3.118)	5.303 (2.632)	4.150 (3.077)	4.075 (3.237)
T7	Leaf extracts of each of 500 grams of Adathoda, Datura, Vitex, Calotropis, Neem - n-hexane Extract	12.551 (3.093)	8.260 (2.617)	15.574 (3.111)	9.256 (2.903)	4.503 (3.04)	5.125 (2.725)	3.513 (3.093)	5.365 (3.206)
T8	Standard treated check (Spraying of Lambda Cyhalothrin 5% EC @ 0.6 ml/lit of water )	12.605 (3.112)	6.348 (2.799)	15.527 (3.021)	6.413 (2.471)	4.626 (3.041)	5.313 (2.932)	3.363 (3.043)	4.575 (3.226)
T9	Untreated check	12.424 (3.061)	13.602 (2.893)	15.424 (3.074)	16.556 (2.702)	4.648 (3.048)	5.250 (2.713)	3.948 (3.102)	4.600 (3.207)
	C.D.	NS	0.135	NS	0.242	NS	0.181	NS	0.573
	SE(m)	0.033	0.089	0.033	0.082	0.031	0.062	0.051	0.195
	SE(d)	0.046	0.125	0.047	0.116	0.044	0.087	0.072	0.276
	C.V.	2.136	6.587	2.154	5.863	2.042	4.673	3.318	3.485

Values in the parentheses are transformed values

**Table : Evaluation of botanicals safety to natural enemies during 2022 (Data?)**

Treatment	No. of predators on shoots or inflorescence at DAS**							
	<i>Oxyessweta</i>		<i>Menochilussexmaculatus</i>		<i>Chrysoperl asp</i>		Syrphid	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15 DAS

Mean																
SE(m) ±																
CD @ 5%																
CV (%)																

**IMPORTANT : Henderson- Tilton formula for control correction need to be deployed**

**PARIA**

**Experimental details:**

No of treatments : 9

- Treatment details :
- T<sub>1</sub> Custard apple 10%
  - T<sub>2</sub> NAU Product 10%
  - T<sub>3</sub> Akdo 1%
  
  - T<sub>4</sub> Tulsi 10%
  - T<sub>5</sub> Nirgudi 5%
  - T<sub>6</sub> Kalmagh 10%
  - T<sub>7</sub> Cow urine 10%
  - T<sub>8</sub> L- cyhalothrin 6ml/10 lit
  - T<sub>9</sub> Untreated control

No. of replications : 3

No. of trees per replication : 2

Age of the tree :

Design : RBD

**Table: 1 Efficacy of different botanicals against tea mosquito bug incidence in cashew at Paria centre during the year 2021-22**

Treat. No.	On shoots (Damage score 0-4)															
	First spray				Second spray				Third spray				Pooled			
	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Pooled
T <sub>1</sub>	1.31	1.28	1.28	1.28	1.35	1.31	1.36	1.34	1.34	1.32	1.34	1.33	1.33	1.31	1.33	1.32
	(1.22)	(1.15)	(1.14)	(1.15)	(1.32)	(1.22)	(1.35)	(1.29)	(1.30)	(1.24)	(1.28)	(1.26)	(1.28)	(1.20)	(1.26)	(1.23)
T <sub>2</sub>	1.30	1.07	1.01	1.04	1.36	1.12	0.98	1.05	1.36	1.17	1.06	1.12	1.34	1.12	1.02	1.07
	(1.19)	(0.65)	(0.53)	(0.59)	(1.35)	(0.76)	(0.46)	(0.61)	(1.34)	(0.87)	(0.62)	(0.75)	(1.29)	(0.76)	(0.54)	(0.65)
T <sub>3</sub>	1.27	1.27	1.29	1.28	1.33	1.31	1.37	1.34	1.35	1.35	1.37	1.36	1.32	1.31	1.34	1.33
	(1.12)	(1.10)	(1.18)	(1.14)	(1.27)	(1.20)	(1.37)	(1.29)	(1.31)	(1.33)	(1.36)	(1.35)	(1.23)	(1.21)	(1.30)	(1.26)
T <sub>4</sub>	1.33	1.29	1.25	1.27	1.32	1.25	1.30	1.28	1.38	1.28	1.33	1.31	1.35	1.28	1.30	1.29
	(1.28)	(1.17)	(1.07)	(1.12)	(1.25)	(1.07)	(1.19)	(1.13)	(1.41)	(1.15)	(1.28)	(1.21)	(1.31)	(1.13)	(1.18)	(1.16)
T <sub>5</sub>	1.26	1.27	1.27	1.27	1.37	1.28	1.33	1.30	1.35	1.29	1.34	1.32	1.33	1.28	1.31	1.30
	(1.09)	(1.12)	(1.10)	(1.11)	(1.38)	(1.13)	(1.27)	(1.20)	(1.32)	(1.17)	(1.30)	(1.23)	(1.26)	(1.14)	(1.22)	(1.18)
T <sub>6</sub>	1.27	1.20	1.16	1.18	1.33	1.21	1.26	1.23	1.37	1.24	1.31	1.28	1.32	1.22	1.25	1.23

	(1.11)	(0.93)	(0.86)	(0.90)	(1.26)	(0.96)	(1.08)	(1.02)	(1.38)	(1.04)	(1.23)	(1.13)	(1.25)	(0.98)	(1.05)	(1.02)
T <sub>7</sub>	1.30	1.26	1.27	1.27	1.31	1.29	1.35	1.32	1.35	1.32	1.34	1.33	1.32	1.29	1.32	1.31
	(1.20)	(1.09)	(1.12)	(1.11)	(1.22)	(1.17)	(1.33)	(1.25)	(1.33)	(1.25)	(1.29)	(1.27)	(1.25)	(1.17)	(1.25)	(1.21)
T <sub>8</sub>	1.28	0.96	0.84	0.90	1.34	1.00	0.86	0.94	1.38	0.95	0.83	0.89	1.34	0.97	0.84	0.91
	(1.14)	(0.43)	(0.21)	(0.32)	(1.31)	(0.51)	(0.25)	(0.38)	(1.40)	(0.39)	(0.18)	(0.29)	(1.28)	(0.44)	(0.21)	(0.33)
T <sub>9</sub>	1.31	1.35	1.39	1.37	1.34	1.39	1.42	1.40	1.37	1.38	1.41	1.40	1.34	1.37	1.41	1.39
	(1.23)	(1.32)	(1.44)	(1.38)	(1.29)	(1.43)	(1.51)	(1.47)	(1.37)	(1.42)	(1.49)	(1.46)	(1.29)	(1.39)	(1.48)	(1.43)
S <sub>Em</sub> ± T	0.05	0.05	0.06	0.05	0.06	0.06	0.06	0.05	0.04	0.05	0.04	0.04	0.04	0.04	0.04	0.04
S													0.01	0.01	0.01	0.01
P				0.01				0.01					0.01			0.03
T x S													0.04	0.04	0.04	0.02
T x P				0.03				0.04					0.04			0.01
S x P																0.01
T x S x P																0.04
CD at 5% T	NS	0.17	0.18	0.15	NS	0.18	0.18	0.15	NS	0.15	0.13	0.11	NS	0.13	0.12	0.11
S													0.04	NS	0.04	0.03
P				NS												
T x S													NS	NS	NS	NS
T x P				NS				NS				NS				0.06
S x P																NS
T x S x P																NS
C. V. %	7.05	7.68	8.40	10.34	8.30	8.01	8.32	9.99	6.24	6.72	5.91	7.18	9.28	10.28	9.34	12.57

Figures are transformed values and those in parentheses are original values.

**Table: 2 Efficacy of different botanicals against tea mosquito bug incidence in cashew at Paria centre during the year 2021-22**

Treat. No.	On panicles (Damage score 0-4)											
	Second spray				Third spray				Pooled			
	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Mean	BS	7 DAS	15 DAS	Pooled
T <sub>1</sub>	1.33	1.26	1.28	1.27	1.34	1.28	1.27	1.27	1.34	1.27	1.27	1.27
	(1.27)	(1.09)	(1.13)	(1.11)	(1.31)	(1.14)	(1.10)	(1.12)	(1.29)	(1.12)	(1.12)	(1.12)
T <sub>2</sub>	1.32	1.16	1.11	1.14	1.33	1.12	1.15	1.14	1.32	1.14	1.13	1.14
	(1.23)	(0.86)	(0.72)	(0.79)	(1.28)	(0.76)	(0.82)	(0.79)	(1.25)	(0.81)	(0.77)	(0.79)
T <sub>3</sub>	1.34	1.27	1.28	1.28	1.32	1.27	1.27	1.27	1.33	1.27	1.28	1.27
	(1.30)	(1.12)	(1.15)	(1.13)	(1.24)	(1.12)	(1.11)	(1.11)	(1.27)	(1.12)	(1.13)	(1.12)
T <sub>4</sub>	1.34	1.24	1.23	1.24	1.34	1.27	1.26	1.28	1.34	1.26	1.25	1.25
	(1.29)	(1.05)	(1.01)	(1.03)	(1.31)	(1.11)	(1.10)	(1.11)	(1.30)	(1.08)	(1.06)	(1.07)
T <sub>5</sub>	1.32	1.26	1.25	1.25	1.32	1.28	1.28	1.28	1.32	1.27	1.27	1.27
	(1.24)	(1.08)	(1.06)	(1.07)	(1.25)	(1.13)	(1.15)	(1.14)	(1.25)	(1.10)	(1.10)	(1.10)
T <sub>6</sub>	1.34	1.23	1.20	1.22	1.34	1.24	1.25	1.24	1.34	1.23	1.22	1.23
	(1.31)	(1.01)	(0.94)	(0.98)	(1.30)	(1.04)	(1.06)	(1.05)	(1.30)	(1.03)	(1.00)	(1.01)
T <sub>7</sub>	1.35	1.27	1.28	1.28	1.34	1.26	1.27	1.27	1.35	1.27	1.28	1.27
	(1.33)	(1.11)	(1.14)	(1.13)	(1.30)	(1.09)	(1.12)	(1.11)	(1.32)	(1.10)	(1.13)	(1.12)
T <sub>8</sub>	1.33	0.99	0.92	0.95	1.34	1.02	0.89	0.96	1.33	1.01	0.90	0.96
	(1.26)	(0.49)	(0.34)	(0.41)	(1.28)	(0.54)	(0.29)	(0.42)	(1.27)	(0.51)	(0.32)	(0.42)
T <sub>9</sub>	1.33	1.36	1.35	1.35	1.33	1.34	1.37	1.36	1.33	1.35	1.36	1.35
	(1.28)	(1.34)	(1.32)	(1.33)	(1.27)	(1.30)	(1.38)	(1.34)	(1.28)	(1.32)	(1.35)	(1.34)
S. Em. ± T	0.05	0.04	0.05	0.03	0.05	0.04	0.05	0.04	0.05	0.03	0.04	0.03
T									0.01	0.01	0.01	0.01
S												
P				0.01				0.02				0.01
T x S									0.03	0.04	0.04	0.02
T x P				0.04				0.05				0.03
S x P												0.02
T x S x P												0.05
C. D. at 5% T	NS	0.11	0.15	0.10	NS	0.14	0.16	0.11	NS	0.09	0.13	0.09
S									NS	NS	NS	NS
P				NS				NS				NS
T x S									NS	NS	NS	NS
T x P				NS				NS				NS
S x P												NS
T x S x P												NS
C. V. %	6.57	5.24	7.08	6.67	6.94	6.25	7.39	7.35	8.64	6.16	8.62	8.97

Figures are transformed values and those in parentheses are original values.

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
--------	-------------------

0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

**Table : Evaluation of botanicals safety to natural enemies during 2022**

Treatment	No. of predators on shoots or inflorescence at DAS**			
	ANTS		SPIDER	
	BS	15 DAS	BS	15 DAS
1	3.11	3.99	0.35	0.39
2	3.64	3.47	0.39	0.43
3	3.43	3.24	0.36	0.40
4	3.33	3.69	0.36	0.38
5	3.15	3.61	0.28	0.39
6	3.21	3.92	0.33	0.42
7	3.88	3.63	0.32	0.36
8	3.08	3.42	0.28	0.15
9	3.81	3.29	0.33	0.36
Mean				
SE(m) ±	0.45	0.37	0.04	0.04
CD @ 5%	NS	NS	NS	0.13
CV (%)	22.85	17.97	22.96	20.43

Data on damage score of Tea Mosquito Bug (TMB) on shoots and panicles recorded before and 7 and 15 days after spray (DAS). Before imposition of treatments, all the treatments showed non-significant results for combating TMB population suggesting even distribution of pest in experimental plot.

The results revealed significantly lowest (0.32 damage score) shoot damage by TMB when crop was treated with L- cyhalothrin after first spray. The next effective treatment was NAU Product (10%) and found statistically at par with kalmagh (10%) with 0.90 damage score. After second spray, the treatment L- cyhalothrin was found superior to all other treatments for managing TMB with significantly lowest (0.38 damage score) shoot damage and which was at par with NAU Product (10%) with 0.61 damage score. More or less similar trend was observed after third spray in which the treatment L- cyhalothrin was found superior to all other treatments for managing TMB with significantly lowest (0.29 damage score) shoot damage.

Overall, results of pooled over periods and spray revealed significantly maximum (1.43 damage score) shoot damage was observed in control. Whereas, significantly lowest (0.33 damage score) shoot damage was recorded in L- cyhalothrin. The next effective treatment was NAU Product (10%) with 0.65 damage score. The order of effectiveness of various treatments against TMB was found to be L- cyhalothrin > NAU Product 10% > Kalmagh 10% ≥ Tulsi 10% ≥ Nirgudi 5% ≥ Cow urine 10% ≥ Custard apple 10% ≥ Akdo 1% ≥ control.

In case of panicle damage by TMB, treatment T<sub>8</sub> (L- cyhalothrin) recorded lowest (0.41 damage score) panicle damage after first spray. Significantly lowest (0.79 damage score) panicle damage was observed in

NAU Product (10%) which was found at par with Kalmagh (10%) and Tulsi (10%) with 0.98 and 1.03 damage score, respectively.

Overall, results of pooled over periods and spray revealed treatment T<sub>2</sub> (NAU Product 10%) was found significantly superior (0.79 damage score) but inferior to standard check wherein significantly lower (0.42 damage score) panicle damage was observed. The maximum (1.34 damage score) panicle damage was observed in control. The order of effectiveness of various treatments against TMB was found to be Lambda cyhalothrin > NAU Product 10% ≥ Kalmagh 10% ≥ Tulsi 10% ≥ Nirgudi 5% ≥ Cow urine 10% ≥ Custard apple 10% ≥ Akdo 1% ≥ control.

Population of natural enemies was recorded at 15 days after each spray. Among the different treatments, ants population was maximum in akdo 1% after first spray while the lowest population of ants was recorded in the chemical treatment after first and second spray. In case of spider, the lowest population was observed in chemical treatment.

**IMPORTANT : Henderson- Tilton formula for control correction need to be deployed**

## PILICODE

### Experimental details:

- No of treatments : 8  
 Treatment details :
1. Neem seed kernel extract 5 ml/litre (5% solution - 50 gram kernels/litre and dilute to 5% and spray)
  2. Kasaragod dwarf cow urine – 100ml/litre (10%)
  3. Vitex *negundo* extract – 7.5 ml/litre
  4. Bougainvillea leaf extract - 5ml/litre (5 % solution has been prepared)
  5. *Hyptis suaveolens* extract – 5ml/litre (5 % solution has been prepared)
  6. Standard check – Lambda cyhalothrin – 0.6 ml/litre as per POP recommendation
  7. Untreated control
  8. 'Aavya' by Ajith Paul

No. of replications	: 4
No. of trees per replication	: 6
Age of the tree	: 24 years
Design	: RBD

**Time of spray** : at Flushing, flowering and nut setting stage. As per the last AGM recommendation an additional spray was given during October

**Observations** : Damage scoring was done as per directions of AICRP on Cashew experiment on TMB control using chemicals, by counting the damage score from 0 to 4 from 52 leader shoots from a plant.

Aqueous extract of leaves was prepared by taking 10g of leaves and grinding using mortar and pestle. Before spraying of treatments, all the trees had statistically similar damage score and population of insects. Spraying was undertaken at three stages: flushing, flowering and nut setting and an additional spraying was given as per the recommendation of 2020 AGM before the flushing stage. After this spraying, lowest damage score was reported from Lambda Cyhalothrin treated trees, followed by Neem seed kernel extract treatment.

Before flushing, the lowest damage score was observed with Lambda cyhalothrin (1.75) followed Neem seed kernel extract treatments (2.50) and Kasaragod dwarf cow urine treatment (2.75). At flushing stage, lowest damage score was observed with Lambda cyhalothrin (1.00) followed Neem seed kernel extract treatments

(2.50) and Kasaragod dwarf cow urine treatment (2.75). During the flowering stage, the lowest damage score was reported from Lamda Cyhalothrin treated trees, followed by Neem seed kernel extract treatment. During the flowering stage, Lambda cyhalothrin treatment (1.75) had the lowest damage score followed by Neem seed kernel extract treatment (2.25).

Before the flushing stage, the average population of Nymph + Adult was lowest in Lamda cyhalothrin (20.45) followed by Neem seed kernel extract treatment (23.87) at 15 DAS. By 30 DAS lower population was noticed in Neem seed Kernel extract treatment (20.60) followed by Lamda Cyhalothrin (21.45). During the flushing stage, average population was lowest in Kasaragod dwarf cow urine treatment (18.40), Neem seed kernel extract treatment (21.00) 15 DAS. At 30 DAS population was lowest in Bougainvillea extract treatment (20.10). During the flowering stage, average population was lowest in Kasaragod dwarf cow urine treatment (20.00) followed by Neem seed Kernel extract treatment (21.00) at 15 DAS. At 30 DAS, the trend was similar. At the nut setting stage, population was lowest in Neem seed kernel extract treatment (16.40) followed by Bougainvillea leaf extract treatment (17.60) at 15 DAS. At 30 DAS, Both Neem seed kernel tract treatment and Kasaragod dwarf cow urine treatment had the lowest average population of nymphs and adults.

After applying Henderson Tilton formula for control correction, it could be noticed that, Lambda cyhalothrin was most effective in bringing down the population, but its efficacy decreased in the progressive stages. Similar was the trend for the botanicals. Also it could be inferred that initial if sprays are undertaken in earlier stages sprays can be skipped in critical stages like nut setting and flowering. Hence from this experiment, it could be concluded that Neem seed kernel extract @5% could effectively manage TMB and could be a possible organic alternative to chemical control.

**Table 1: Effect of botanicals on the incidence of TMB at Pilicode (2021-22)**

Treatment	Before spray		Before Flushing			Flushing			Flowering		
	Pre treatment mean damage score (0-4)*	Average Population (Nymph + Adult)#**	Post treatment mean damage score (0-4)*	Average Population (Nymph + Adult)#** 15 DAS	Average Population (Nymph + Adult) 30 DAS#**	Post treatment mean damage score (0-4)*	Average Population (Nymph + Adult)15 DAS#**	Average Population (Nymph + Adult)30 DAS#**	Post treatment mean damage score (0-4)*	Average Population (Nymph + Adult)15 DAS#**	Average Population (Nymph + Adult)30DAS#**
Neem seed kernel extract	2.64 (1.64)	26.80 (5.18)	2.50 (1.72)	23.87 (4.89)	20.60 (4.54)	2.50 (1.72)	20.00 (4.47)	23.00 (4.80)	2.25 (1.65)	21.00 (4.58)	18.00 (4.24)
Kasaragod dwarf cow urine	2.68 (1.65)	25.90 (5.09)	3.25 (1.93)	24.90 (4.99)	22.90 (4.79)	2.75 (1.79)	18.40 (4.29)	23.40 (4.84)	3.50 (2.00)	20.00 (4.47)	19.10 (4.37)
<i>Vitex negundo</i>	2.66 (1.65)	25.90 (5.09)	3.00 (1.86)	25.30 (5.03)	25.30 (5.03)	4.00 (2.12)	26.30 (5.13)	25.00 (5.00)	4.00 (2.12)	23.00 (4.80)	22.00 (4.69)
Bougainvillea leaf extract	2.68 (1.65)	26.10 (5.11)	3.00 (1.87)	25.70 (5.07)	24.20 (4.92)	2.75 (1.79)	21.50 (4.64)	20.10 (4.48)	3.00 (1.86)	23.00 (4.80)	18.60 (4.31)
<i>Hyptis suaveolens</i>	2.70 (1.669)	25.40 (5.049)	2.75 (1.80)	28.32 (5.32)	26.98 (5.19)	3.00 (1.84)	24.20 (4.92)	22.40 (4.73)	2.50 (1.73)	22.60 (4.754)	22.60 (4.75)
Lamda xyhalothrin	2.75 (1.67)	26.05 (5.10)	1.75 (1.49)	20.45 (4.52)	21.45 (4.63)	1.00 (1.23)	25.00 (5.00)	21.30 (4.62)	1.75 (1.48)	23.20 (4.82)	23.20 (4.82)
'Aavya' by Ajith Paul	2.56 (1.62)	26.30 (5.13)	3.25 (1.93)	27.10 (5.21)	28.74 (5.36)	3.75 (2.06)	28.00 (5.29)	27.00 (5.20)	3.50 (1.99)	25.00 (5.00)	23.00 (4.80)
Untreated control	2.68 (1.65)	26.20 (5.12)	3.75 (2.06)	26.89 (5.19)	29.89 (5.47)	3.25 (1.92)	29.00 (5.39)	28.00 (5.29)	3.50 (1.99)	26.90 (5.19)	24.00 (4.90)
F Test	NS	NS	**	**	**	**	**	**	**	**	**
SEm	0.01	0.03	0.0001	inf	inf	0.12	0.02	0.02	0.11	0.03	0.02
CD	-	-	0.20	0.07	0.08	0.36	0.05	0.04	0.33	0.07	0.06
CV %	1.59	1.19	7.42	0.996	1.10	13.35	0.65	0.60	12.20	1.02	0.89

**Table 1 contd ;Effect of botanicals on the incidence of TMB at Pilicode (2021-22)**

Treatment	Nut setting		
	Post treatment mean damage score (0-4)*	Average Population (Nymph + Adult)15 DAS#**	Average Population (Nymph + Adult)30DAS#**
Neem seed kernel extract	1.25 (2.50)	16.40 (4.05)	14.30 (3.78)
Kasaragod dwarf cow urine	3.50 (2.91)	18.10 (4.25)	14.60 (3.82)
<i>Vitex negundo</i>	3.25 (2.87)	21.60 (4.65)	15.20 (3.90)
Bougainvillea leaf extract	2.50 (2.73)	17.60 (4.20)	16.00 (4.00)
<i>Hyptis suaveolens</i>	2.25 (2.69)	20.00 (4.47)	14.80 (3.85)
Lamda xyhalothrin	2.00 (2.64)	19.20 (4.38)	15.30 (3.91)
'Aavya' by Ajith Paul	3.25 (2.87)	21.00 (4.58)	17.00 (4.12)
Untreated control	3.50 (2.91)	22.00 (4.69)	17.80 (4.22)
<b>F Test</b>	<b>**</b>	<b>**</b>	<b>**</b>
<b>SEm</b>	<b>0.08</b>	<b>0.02</b>	<b>0.02</b>
<b>CD</b>	<b>0.24</b>	<b>0.07</b>	<b>0.05</b>
<b>CV %</b>	<b>5.86</b>	<b>1.00</b>	<b>0.92</b>

\*Figures in parentheses are square root transformed values

# Figures in parentheses are square root+ 0.5 transformed values

**Table 2: Effect of botanicals on the average population of TMB after applying Henderson- Tilton formula for control correction at Pilicode (2021-22)**

Treatment	Average Population (Nymph + Adult)#**						Nut setting	
	Before flushing		Flushing		Flowering			
Neem seed kernel extract	14.77	20.883	-0.064	-19.163	4.938	3.855	0.529	-7.838
Kasaragod dwarf cow urine	7.98	15.702	17.180	-31.727	11.027	-7.202	-3.378	0.215
<i>Vitex negundo</i>	6.50	8.315	-7.153	1.543	4.211	-7.295	-7.155	13.046
Bougainvillea leaf extract	5.79	13.661	8.435	3.127	-19.131	9.318	-3.323	-12.360
<i>Hyptis suaveolens</i>	-6.82	12.725	7.528	4.086	-5.040	-12.182	3.432	8.507
Lamda xyhalothrin	24.894	3.845	-20.211	11.758	-13.393	-12.134	9.627	1.481
'Aavya' by	1.395	2.844	-0.466	0.119	3.607	-3.182	0.359	-0.113

Ajith Paul								
Untreated control	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
F Test	**	**	**	**	**	**	**	**
SEm	1.21	1.20	1.01	1.03	1.08	1.41	1.39	1.50
CD	3.55	3.54	2.97	3.03	3.17	4.12	4.10	4.41
CV %	35.40	24.68	308.01	54.41	125.26	77.79		

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

#### Inference of the experiment:

Hence from this experiment, it could be concluded that Neem seed kernel extract @5% could effectively manage TMB and could be a possible organic alternative to chemical control.



Bougainvillea Leaf extract, *Hyptis suaveolens* extract and *Vitex negundo* extract

Neem seed Kernel extract



**Kasaragod dwarf cow urine**



## MADAKKATHARA

### Experimental details:

No of treatments	:	12
Treatment details	:	
T1- Neem Seed Kernel Extract 5%		
T2- Desi cow urine 10%		
T3- Pongamia oil 5%		
T4- Cinnamon leaf extract 2%		
T5- Cinnamon leaf extract 5%		
T6- <i>Acorus calamus</i> rhizome powder extract 2%		
T7- <i>Acorus calamus</i> rhizome powder extract 5%		
T8- <i>Andrographis paniculata</i> leaf extract 2%		
T9- <i>Andrographis paniculata</i> leaf extract 5%		
T10- 'Aavya' botanical formulation 4g/l		
T11- POP, KAU		
T12- Untreated check		
No. of replications	:	3
No. of trees per replication	:	2
Age of the tree	:	17
Design	:	RBD

Before spraying of botanicals, the average TMB damage score on the shoot was 0.11 and on inflorescence was 0.09. there was no significant difference among the treatments in TMB damage score on shoot and inflorescence. Incidences of thrips was only observed in the experimental plot and no significant difference was observed among the treatments.

#### **Botanicals preparation methodology**

Aqueous extract of power of dried neem seed kernels, cinnamon leaves, rhizomes of *Acorus calamus*, and leaves of *Andrographis* was prepared as per treatment concentration and sprayed at fortnight intervals from the flushing stage onwards.

**Table : Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2022 (TMB damage scores are very less to assess the efficacy)**

Treatments	TMB damage on shoots/inflorescences (0-4 scale) at DAS				Mean
	On shoots		On Inflorescence		
	Before Spray	15 DAS	Before Spray	15 DAS	
T1	0.073 (0.756)	0.035 (0.730)	0.082 (0.761)	0.000 (0.707)	0.018
T2	0.153 (0.804)	0.020 (0.721)	0.076 (0.758)	0.000 (0.707)	0.01
T3	0.179 (0.823)	0.011 (0.715)	0.092 (0.769)	0.000 (0.707)	0.006
T4	0.034 (0.730)	0.063 (0.750)	0.059 (0.747)	0.028 (0.726)	0.046
T5	0.227 (0.844)	0.010 (0.714)	0.088 (0.766)	0.003 (0.709)	0.007
T6	0.066 (0.751)	0.016 (0.718)	0.132 (0.792)	0.008 (0.713)	0.012
T7	0.020 (0.721)	0.038 (0.733)	0.074 (0.755)	0.041 (0.735)	0.039
T8	0.094 (0.769)	0.000 (0.707)	0.075 (0.757)	0.053 (0.743)	0.027
T9	0.099 (0.772)	0.000 (0.707)	0.074 (0.757)	0.014 (0.716)	0.007
T10	0.093 (0.767)	0.000 (0.707)	0.112 (0.78)	0.003 (0.709)	0.002
T11	0.110 (0.778)	0.005 (0.710)	0.131 (0.789)	0.026 (0.725)	0.016
T12	0.227 (0.844)	0.068 (0.752)	0.021 (0.722)	0.030 (0.728)	0.049
Mean	0.11	0.023	0.09	0.017	-
SE(m) ±	0.034	0.013	0.021	0.01	-
CD @ 5%	NS	NS	NS	NS	-
CV	7.673	3.18	6.48	2.59	-

\*Values in the parentheses of damage score are square root transformation values

**Table: Efficacy of different botanicals against pest complex during 2022**

Treatment	Incidence of different pests on shoots or inflorescence at DAS							
	Apple & Nut Borer (% damage)*		Thrips (No./shoot or panicle) **		Aphids(No. affected shoots/plant)**		Mealy bugs (No. shoots affected/plant)	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15
T1	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T2	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-

T3	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T4	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T5	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T6	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T7	-	-	0.00 (0.707)	0.000 (0.707)	-	-	-	-
T8	-	-	0.00 (0.707)	0.013 (0.726)	-	-	-	-
T9	-	-	0.00 (0.707)	0.00 (0.707)	-	-	-	-
T10	-	-	0.00 (0.707)	0.00 (0.707)	-	-	-	-
T11	-	-	0.00 (0.707)	0.00 (0.707)	-	-	-	-
T12	-	-	0.00 (0.707)	0.00 (0.707)	-	-	-	-
Mean	-	-	0.00	0.006	-	-	-	-
SE(m) ±	-	-	0.00	0.002	-	-	-	-
CD @ 5%	-	-	NS	NS	-	-	-	-
CV (%)	-	-	0.00	5.883	-	-	-	-

### Evaluation of phytotoxicity of botanicals on cashew

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

No phytotoxicity was observed among the botanicals evaluated.

**Table : Evaluation of botanicals safety to natural enemies during 2022**

Treatment	No. of predators on shoots or inflorescence at DAS**	
	<i>Oxypossiweta</i>	
	BS	15 DAS
T1	0.00 (0.707)	0.00 (0.707)
T2	0.00 (0.707)	0.00 (0.707)
T3	0.00 (0.707)	0.00 (0.707)
T4	0.00 (0.707)	0.007 (0.712)
T5	0.007 (0.712)	0.00 (0.707)
T6	0.00 (0.707)	0.00 (0.707)
T7	0.00 (0.707)	0.00 (0.707)
T8	0.00 (0.707)	0.00 (0.707)
T9	0.00 (0.707)	0.00 (0.707)
T10	0.00 (0.707)	0.00 (0.707)
T11	0.00 (0.707)	0.00 (0.707)
T12	0.00 (0.707)	0.00 (0.707)
Mean	0.0006	0.0006
SE(m) ±	0.00	0.00
CD @ 5%	NS	NS
CV (%)	0.33	0.33

### Inference of the experiment:

No significant difference was observed among the botanicals evaluated with respect to the damage of TMB and other insect pests of cashew. The highest per cent damage reduction over control was observed in the treatment, T6 (*Acorus calamus*, 2 %).

**IMPORTANT : Henderson- Tilton formula for control correction need to be deployed**

## VENGURLA

### Experimental details:

No of treatments : Eleven

Treatment details :

T <sub>1</sub> :	Nirgudi ( <i>Vitex negundo</i> ) plant extract @ 5%
T <sub>2</sub> :	Kalmagh ( <i>Andrographis paniculata</i> ) plant extract @ 5%
T <sub>3</sub> :	Tiriphall ( <i>Zanthoxylum piperitum</i> ) seed extract 5%
T <sub>4</sub> :	Dhatra ( <i>Datura stramonium</i> ) seed extract @ 5 %
T <sub>5</sub> :	Custard apple leaves + Bael leaves + Ruhi leaves + Tulsi leaves + Drumstick leaves + Hibiscus leaves + Bitter gourd juice @ 5 % extract (on the basis of farmers feedback)
T <sub>6</sub> :	Satvin ( <i>Alstonia scholaris</i> ) bark extract @ 5%
T <sub>7</sub> :	Neem seed ( <i>Azadirachta indica</i> ) kernel extract @ 5 %

<b>T<sub>8</sub>:</b>	Deshi cow urine @10%
<b>T<sub>9</sub>:</b>	Standard check ( $\lambda$ cyhalothrin5EC @ 0.6ml/lit)
<b>T<sub>10</sub>:</b>	Botanical formulation "AAVYA" @ 4 g/l of water (Ajit Paul)
<b>T<sub>11</sub>:</b>	Untreated control

No. of replications	: Three
No. of trees per replication	: Two
Age of the tree	: 15 years
Design	: RBD

### Botanicals preparation methodology

For preparation of a standard solution of treatment, 1kg of plant/seed material was taken in 10 liter water, boiled for 30 minutes, allowed to cool and kept as such for 24 hours. Next day again, boiled for 30 minutes and allowed to cool. This solution was used as a standard/stock solution. The 5 % extract was taken from this standard/stock solution.

### Methodology

Twenty four shoots were selected randomly from four sides (E, W, N, and S) on the trees under observation and labeled individually. The total numbers of laterals in the selected leader shoots were recorded. The incidence of tea mosquito bug was recorded on selected shoots/inflorescences in 0 to 4 scales as given below.

- 0 – No lesions/streaks.
- 1 – 1 to 3 necrotic lesions /streaks.
- 2 – 4 to 6 coalescing or non-coalescing lesions/streaks.
- 3 – Above six coalescing or non-coalescing lesions/ streaks.
- 4 – Lesions/streaks confluent or wilting or drying of affected Shoots/ panicles.

The treatment T10 (Botanical formulation "AAVYA" @ 4 g/l of water) was found to be the most effective (0.36) for management of TMB, but it was at par with all other treatments except T11 (Untreated control). At fifteen days after spraying, treatment T9 (standard check) noticed (0.27) TMB incidence and found to be significantly superior over the rest of the treatments. Among the different botanical treatments, the treatment T10 (Botanical formulation "AAVYA" @ 4 g/l of water) was found to be the most effective (0.36) for management of TMB, but it was at par with all other treatments except T11 (Untreated control).

Regarding spider population, there was no significant difference among all treatments that indicated that there was no adverse effect of all botanicals under study on spider population.

No phytotoxicity was observed on plants after botanical spray.

The maximum yield (11.57 kg/tree) was recorded in treatment T9 (Standard check) which was significantly superior to all other treatments. Among the different botanicals, treatment T10 (Botanical formulation "AAVYA" @ 4 g/l of water) recorded maximum yield (6.91 kg/tree) but was at par with all other treatments except T3 (Tiriphal seed extract 5%).

### Table : Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2022

Treatments	TMB damage			Yield Kg/tree
	Before spray 0-4 scale	Cumulative mean of 7 DAS 0-4 scale ??	Cumulative mean of 15 DAS 0-4 scale	
Nirgudi ( <i>Vitex negundo</i> ) plant extract 5%	0.57	0.38	0.45	6.83
Kalmagh ( <i>Andrographis paniculata</i> ) plant extract 5%	0.57	0.37	0.44	6.83
Tiriphal ( <i>Zanthoxylum piperitum</i> ) seed extract 5%	0.57	0.40	0.47	5.77
Dhatura ( <i>Datura stramonium</i> ) seed extract 5 %	0.57	0.39	0.46	6.90
Custard apple leaves + Bael leaves + Ruhi leaves + Tulsi leaves + Drumstick leaves+ Hibiscus leaves + Bitter gourd juice - 5 % extract (on the basis of farmers feedback)	0.57	0.38	0.45	6.83
Satvin ( <i>Alstonia scholaris</i> ) bark extract 5%	0.57	0.37	0.44	6.90
Neem seed ( <i>Azadirachta indica</i> ) kernel extract 5 %	0.57	0.37	0.45	6.80
Deshi cow urine 10%	0.55	0.41	0.48	6.70
Standard check <i>Lambda cyhalothrin</i> / Recommended spray	0.59	0.23	0.27	11.57
Botanical formulation "AAVYA" @ 4 g/l of water (Ajit Paul)	0.57	0.36	0.44	6.91
Untreated control	0.50	0.65	0.79	3.60
SE(m) ±	0.02	0.03	0.02	0.17
CD @ 5%	NS	0.08	0.06	0.51
CV %	-	10.46	8.62	9.78

DAS- Days after spraying

#### Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50

6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$



## HOGALAGERE

### Experimental details:

No of treatments	:	7
Treatment details	:	
1. NSKE 5%		
2. Azadirachtin 1% @ 1ml/l		
3. <i>Pongamia</i> seed extract 4%		
4. Chilli-Garlic Extract 7.5%		
5. *Ajith Paul (AAVYA) @4g/l		
6. L - Cyhalothrin <a href="#">5EC@0.6ml/l</a>		
7. Untreated control		
No. of replications	:	3
No. of trees per replication	:	3
Age of the tree	:	7
Design	:	RCBD

### Methodology for preparation of 4% *Pongamia* seed extract:

Take 4 kg of fresh and well dried *Pongamia* seeds (4 kg). Remove the outer seed coat and use only the kernel. Pound or grind the kernels gently to powder it and tie the crushed material in the muslin cloth and soak overnight (12 h) in a plastic bucket containing 10 liter of water. Stir the contents with wooden plank in the morning and filter through a double layer of muslin cloth by squeezing the cloth containing soaked material. Add remaining 90 liters of water (reasonably good quality) to make up the volume to 100 liter, to get 4% seed extract. Add 10 ml/liter of liquid soap or detergent (make a paste of the detergent and then mix it in the spray solution) to spray solution prior to spray to help the extract stick well to the leaf surface. Stir the contents with wooden plank till the solution becomes milky white. Mix the spray solution well with

wooden plank till the solution becomes milky white and use it for application during cooler hours of the day by using a high volume sprayer.

#### Methodology for preparation of 7.5% Chilli-Garlic extract:

Grind 7 kg of green chilli to get semi liquid paste and soak overnight in 10 liters of water. Grind 1 kg garlic bulbs with 2 liters of water and soak overnight in 250 ml of kerosene separately. Filter both green chilli as well as garlic paste separately by squeezing the muslin cloth. Mix the two liquids in a single container and make up the spray solution volume to 100 liters by adding good quality water. Add 10 ml/liter of liquid soap or detergent (make a paste of the detergent and then mix it in the spray solution) to spray solution prior to spray to help the extract stick well to the leaf surface. Mix the spray solution well with wooden plank and use it for application during cooler hours of the day by using a high volume sprayer.

#### Treatment imposition

The results on efficacy of different botanical treatments against tea mosquito bug (TMB) on cashew revealed that, the damage of TMB on shoots and inflorescence (0-4 score) ranged between 1.88 to 2.62 and 2.07 to 3.09, respectively at a day before application of the treatments. The TMB damage on young shoots was ranged from 0.87 to 2.44 and on inflorescence it ranged from 0.86 to 3.23 at 15 days after spray (Table 1). In both cases, the damage on shoots and inflorescence was significantly reduced in treatment Lambda-cyhalothrin 5 EC (0.87 & 0.86) at 15 days after each spray in all the sprays. The azadirachtin 1% (0.95 & 1.03), NSKE 5% (1.38 & 1.60) and Ajith Paul (AAVYA) (1.64 & 2.02) were found to be next best treatments in reducing the TMB damage both on young shoots and inflorescence in all the sprays. However, the *Pongamia* seed extract 4% (2.75 & 2.15) and chilli-garlic extract 7.5% (2.46 & 2.99) treatments were found to be least effective in reducing the TMB damage on cashew (Table 1). The minimum mean TMB damage on cashew was recorded in the treatment Lambdacyhalothrin 5EC (0.87), followed by Azadirachtin 1% (0.99), NSKE 5% (1.49), Ajith Paul (AAVYA) (1.83), whereas maximum mean TMB damage was observed in treatments *Pongamia* seed extract 4% (2.45), chilli-garlic extract 7.5% (2.73) and untreated control (2.84) (Table 1).

As per the Henderson - Tilton formula, the treatments Lambda-cyhalothrin 5EC (0.6 ml/l) and Azadirachtin 1% (1ml/l) reduced the TMB damage significantly with 63.22 and 54.26 per cent reduction over control on young shoots, which was followed by NSKE 5% treatment with 39.02 per cent. The Ajith Paul (AAVYA) (4g/l), chilli-garlic extract 7.5% and *Pongamia* seed extract 4% treatments were found to be inferior in reduction of TMB damage on shoots. Similar trend was observed with respect to the TMB damage on inflorescence on cashew (Table 1).

Treatments	TMB damage on shoots / inflorescences (0-4 scale) at DAS				Mean	Nut yield (kgs/plant)	% damage reduction over control (H-T formula)	
	On shoots		On Inflorescence				Shoots	Panicle
	Before Spry	15 DAS	Before Spray	15 DAS				
NSKE 5%	2.43 (1.71)	1.38 (1.37)	2.73 (1.80)	1.60 (1.45)	1.49	5.39	39.02	43.93
Azadirachtin 1% @ 1ml/l	2.23 (1.65)	0.95 (1.20)	2.00 (1.58)	1.03 (1.24)	0.99	6.21	54.26	50.73
<i>Pongamia</i> seed extract 4%	2.58 (1.75)	2.75 (1.80)	2.07 (1.60)	2.15 (1.63)	2.45	5.38	14.45	0.64
Chilli-Garlic Extract	2.50	2.46	2.55	2.99	2.73	3.99	5.66	12.17

7.5%	(1.73)	(1.72)	(1.75)	(1.87)				
*Ajith Paul (AAVYA) @4g/l	1.88 (1.54)	1.64 (1.46)	2.50 (1.73)	2.02 (1.59)	1.83	5.22	6.33	22.70
L - Cyhalothrin 5EC@0.6ml/l	2.54 (1.74)	0.87 (1.17)	2.67 (1.78)	0.86 (1.17)	0.87	6.34	63.22	69.19
Untreated control	2.62 (1.76)	2.44 (1.71)	3.09 (1.89)	3.23 (1.93)	2.84	3.99	0.00	0.00
Mean	2.40	1.78	2.52	1.98	1.89	0.04	-	-
SE(m) ±	0.07	0.05	0.05	0.04	-	0.13	-	-
CD @ 5%	0.21	0.14	0.15	0.13	-	3.57	-	-
CV	7.46	5.42	5.08	5.02	-	13.82	-	-

The results on efficacy of different botanical treatments against apple and nut borer (ANB), thrips, aphids and mealybugs on cashew indicated that, the per cent damage of ANB on cashew apples ranged from 2.53 to 3.04 per cent and 0.50 to 3.40 per cent, respectively at a day before and 15 days after application of the treatments. The treatment Lambda-cyhalothrin @ 5 EC (0.6 ml/l) was found to be significantly superior with least per cent damage of 0.50 per cent over remaining treatments in all the sprays. Whereas, the NSKE 5% (0.62%), azadirachtin 1% (0.76%) and Ajith Paul (AAVYA®) (1.89%) were found to be next best treatments in reducing the ANB damage across sprays. However, the *Pongamia* seed extract 4% (2.26%) and chilli-garlic extract 7.5% (2.59%) treatments were found to be least effective in reducing the ANB damage on cashew apples (Table 2).

Similarly, the number of thrips (both nymphs & adults) per shoot or inflorescence significantly reduced with application of different treatments and it ranged from 3.52 to 5.33 and 1.40 to 4.96, respectively at a day before and 15 days after spray application. The treatment Lambda-cyhalothrin @ 5 EC was found to be significantly superior with 1.40 no. of thrips per shoot or inflorescence, compared to remaining treatments. Whereas, the treatments NSKE 5% (2.25 no. per shoot or inflorescence), azadirachtin 1% (2.26) and *Pongamia* seed extract 4% (3.55) were found to be next best treatments in reducing the thrips damage. However, Ajith Paul (AAVYA®) (3.69) and chilli-garlic extract 7.5% (4.20) treatments were found to be least effective in reducing the thrips damage on cashew (Table 2)

The aphid population (number of affected shoots per plant) was also ranged from 2.89 to 4.53 and 1.89 to 4.35 at a day before and 15 days after spray. The lower number of aphid infested shoots per plant was observed in azadirachtin 1% (2.26), Lambda-cyhalothrin @ 5 EC (2.39), NSKE 5% (2.51) treatments compared to other treatments. The higher aphid infestation was recorded in Ajith Paul (AAVYA®) (2.98), chilli-garlic extract 7.5% (2.97) and *Pongamia* seed extract 4% (2.94) treatments (Table 2).

The mealybug population (number of affected shoots per plant) was ranged from 2.41 to 2.92 and 1.25 to 3.30 at a day before and 15 days after spray. The lower number of mealybug infested shoots per plant was observed in azadirachtin 1% (1.25), NSKE 5% (1.95) and Ajith Paul (AAVYA®) (2.10) treatments compared to other treatments. The higher mealybug infestation was recorded in treatments untreated control (3.30), Lambda-cyhalothrin @ 5 EC (3.23), *Pongamia* seed extract 4% (2.88) and chilli-garlic extract 7.5% (2.60) (Table 2).

As per the Henderson-Tilton formula, the treatments Lambda-cyhalothrin 5 EC (0.6 ml/l) and NSKE 5% reduced the per cent ANB damage significantly with 85.59 and 79.16 per cent reduction over control, which was followed by Azadirachtin 1% (1 ml/l) treatment with 78.24 per cent. The Ajith Paul (AAVYA®) (44.41%), *Pongamia* seed extract 4% (22.23%), and chilli-garlic extract 7.5% (13.28%) treatments were found to be inferior in reduction of ANB damage. Similar trend was observed with respect to the thrips damage on cashew (Table 2). Nevertheless, Azadirachtin 1% (58.77 & 61.66), NSKE 5% (52.62 & 49.61) and Lambda-

cyhalothrin 5 EC (41.60 & 40.43), respectively were found to be effective in reduction of aphid and mealy bug affected shoots per plant (Table 2).

**Table: Efficacy of different botanicals against pest complex during 2022**

Treatment	Incidence of different pests on shoots or inflorescence at DAS							
	Apple & Nut Borer (% damage) *		Thrips (No./shoot or panicle) **		Aphids(No. affected shoots/plant) **		Mealy bugs (No. shoots affected/plant)	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15
NSKE 5%	2.59 (1.76)	0.62 (1.06)	5.33 (2.41)	2.25 (1.66)	4.53 (2.24)	2.51 (1.73)	2.92 (1.85)	1.95 (1.56)
Azadirachtin 1% @ 1ml/l	3.04 (1.87)	0.76 (1.12)	4.83 (2.30)	2.26 (1.66)	3.92 (2.10)	1.89 (1.54)	2.46 (1.72)	1.25 (1.32)
<i>Pongamia</i> seed extract 4%	2.53 (1.74)	2.26 (1.66)	4.04 (2.13)	3.55 (2.01)	3.35 (1.96)	2.94 (1.85)	2.41 (1.70)	2.88 (1.84)
Chilli-Garlic Extract 7.5%	2.6 (1.76)	2.59 (1.76)	3.52 (2.00)	4.2 (2.17)	2.89 (1.84)	2.97 (1.86)	2.43 (1.70)	2.60 (1.76)
*Ajith Paul (AAVYA) @4g/l	2.96 (1.86)	1.89 (1.54)	5.14 (2.37)	3.69 (2.05)	3.8 (2.07)	2.98 (1.86)	2.66 (1.78)	2.10 (1.61)
L - Cyhalothrin 5EC@0.6ml/l	3.02 (1.87)	0.5 (1.00)	4.93 (2.33)	1.4 (1.38)	3.5 (2.00)	2.39 (1.69)	2.42 (1.70)	3.23 (1.93)
Untreated control	2.96 (1.86)	3.4 (1.97)	3.9 (2.09)	4.96 (2.33)	3.72 (2.05)	4.35 (2.20)	2.49 (1.73)	3.30 (1.95)
Mean	2.81	1.72	4.53	3.19	3.67	2.86	2.54	2.47
SE(m) ±	0.06	0.06	0.08	0.06	0.08	0.06	0.07	0.06
CD @ 5%	0.18	0.16	0.24	0.16	0.22	0.19	0.20	0.17
CV (%)	6.00	6.70	6.47	5.10	6.49	6.07	6.88	6.06

### Evaluation of phytotoxicity of botanicals on cashew

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

### Phytotoxicity of botanicals on cashew:

On cashew the phytotoxicity of botanicals was monitored at each application of botanical treatments. The data indicated that none of the botanical treatments at dosage used as foliar spray produces phytotoxicity on cashew during 2021-22 (Table 3).

### Evaluation of botanicals for safety to natural enemies in cashew

The number of spiders per plant at 15 days after spray was significantly higher in all the botanical treatments such as NSKE 5% (4.02), azadirachtin 1% (3.93), chilli-garlic extract 7.5% (3.73), Ajith Paul (AAVYA®) (3.53) and untreated control (3.57). Whereas lower number of spiders (1.87) has been recorded in treatment Lambda-cyhalothrin @ 5EC. However, similar trend was noticed for other natural enemies such as ladybird beetles, green lace wing and syrphid population in all the treatments, but population was reduced in Lambda-cyhalothrin 5EC treated plants indicating toxicity of the chemical to natural enemies (Table 4). Therefore, the application of this chemical should be avoided during flowering and fruiting to conserve the native natural enemies.

**Table : Evaluation of botanicals safety to natural enemies during 2022**

Treatment	No. of predators on shoots or inflorescence at DAS**							
	<i>Oxyopes sweta</i>		<i>Menochilus sexmaculatus</i>		<i>Chrysoperl asp</i>		Syrphid	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15 DAS
NSKE 5%	2.38 (1.70)	4.02 (2.12)	2.29 (1.67)	4.1 (2.14)	2.19 (1.64)	3.97 (2.11)	2.48 (1.72)	3.78 (2.07)
Azadirachtin 1% @ 1ml/l	2.43 (1.71)	3.93 (2.10)	2.06 (1.60)	3.61 (2.03)	2.14 (1.62)	3.47 (1.99)	1.89 (1.54)	4.43 (2.22)
<i>Pongamia</i> seed extract 4%	2.3 (1.67)	3.38 (1.97)	2.87 (1.83)	3.11 (1.90)	2.46 (1.72)	3.33 (1.96)	2.37 (1.69)	3.39 (1.97)
Chilli-Garlic Extract 7.5%	2.55 (1.74)	3.73 (2.05)	2.58 (1.75)	3.58 (2.02)	2.66 (1.78)	3.7 (2.05)	2.33 (1.68)	3.11 (1.90)
*Ajith Paul (AAVYA) @4g/l	1.82 (1.52)	3.53 (2.01)	2.57 (1.75)	2.76 (1.81)	2.4 (1.70)	3.97 (2.11)	2.1 (1.61)	3.28 (1.94)
L - Cyhalothrin 5EC@0.6ml/l	2.69 (1.78)	1.87 (1.54)	2.19 (1.64)	1.6 (1.45)	2.58 (1.75)	1.22 (1.31)	2.06 (1.60)	1.91 (1.55)
Untreated control	2.08 (1.61)	3.57 (2.02)	2.29 (1.67)	4.81 (2.30)	3.1 (1.90)	4.7 (2.27)	2.22 (1.65)	4.73 (2.29)
Mean	2.32	3.43	2.41	3.37	2.50	3.48	2.21	3.52
SE(m) ±	0.08	0.10	0.07	0.08	0.07	0.09	0.08	0.09
CD @ 5%	0.23	0.29	0.20	0.23	0.22	0.27	0.22	0.27
CV (%)	8.21	8.72	7.10	7.12	7.50	8.02	8.07	8.12





Preparation of botanical extracts



## JAGADALPUR

### Experimental details: Expt. 4 Evaluation of botanicals for control of TMB and other insect pests

No of treatments	:	09
Treatment details	:	
No. of replications	:	03
No. of trees per replication	:	03
Age of the tree	:	19
: CRBD		

#### Table Details of plant material

S. No.	Plant	Plant part use	Method
1	<i>Andrographis paniculata</i>	Tender shoots +Leaves+ Flower (1kg)	Decoction
2	<i>Datura metel</i>	Leaves+fruits (1kg)	Decoction
3.	<i>Calotropis procera</i>	Leaves +flower(1kg)	Decoction
4	<i>Cleistanthus collinus</i>	Leaves (1kg)	Decoction

5	Mixed plant + cow urine	<i>Andrographis</i> (tender shoots +leaves+ flower) + <i>Calotropis</i> (leaves+flower) + <i>Cascabela</i> (leaves+fruits) + <i>Datura</i> (leaves+fruits) + <i>Cleistanthus</i> (leaves)+ <i>Pongamia</i> (leaves+ seed) + <i>Lantana</i> (leaves +fruit) + <i>Vitex negundo</i> (leaves) + <i>Annona squamosa</i> (leaves)+ <i>Azadirachta indica</i> (leaves+ seed) (Each 100gm to prepare 1kg plant part)	Putrefaction
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**Methodology:-**

In decoction method 1 kg fresh plant part were grinded and mixed in 2 liter of water in earthen pot and boiled for 20 minute. After 20 minutes of boiling, it is kept overnight and next day the material is again boiled for 20 minute and kept for cooling. After cooling plant extract collect in clean container after sieving and used as standard solution. In the case of putrefaction 1 kg mixed plant part mentioned above is soaked in 8 liter *desi* cow urine and 2 liter water in earthen pot for 20 days closed mouth. After that putrefied material was sieved and used as standard solution.

**Spray:** Flushing, flowering and fruiting stage of crop

**Observation:** Pre and post observation at 15 day after spray

**Results:**

It is evident from the data (table 5) evaluation of botanicals against TMB revealed, after first, second and third spraying, the efficacy of different botanicals was statistically superior over untreated control. The results revealed that T<sub>7</sub> (L-cyhalothrin 5 EC @ 0.6ml/l) showed least (0.18) damage score (DS) followed by T<sub>4</sub> (*Datura metel* decoction @ 5 %) with 0.42 DS which was at par with T<sub>2</sub> (*Andrographis paniculata* decoction @5 %) with 0.47 damage score per leader shoot. The least efficient botanical was T<sub>7</sub>(Cow urine+ mixed plant putrefaction 3 %) with 0.96 damage score per leader shoot. The pre treatment damage score of tea mosquito bug was non -significant including untreated control (T<sub>9</sub>) with 0.84 per cent incidence.

**Table 5 Efficacy of different botanicals against incidence of TMB at Jagdalpur during 2021-22**

Treatments		Mean damage score after third spray at 15 DAS		Yield (Kg/plant)
		Pre treatment damage score (0-4 scale)	Post treatment damage score (0-4 scale)	
T <sub>1</sub>	<i>Andrographis paniculata</i> decoction 3 %	0.78 (1.33)	0.89 (1.37) <sup>ef</sup>	3.73 (2.14) <sup>d</sup>
T <sub>2</sub>	<i>Andrographis paniculata</i> decoction 5 %	0.88 (1.37)	0.47 (1.21) <sup>bc</sup>	4.67 (2.23) <sup>c</sup>
T <sub>3</sub>	<i>Datura metel</i> decoction 3 %	1.32 (1.52)	0.70 (1.30) <sup>d</sup>	3.50 (2.02) <sup>fgh</sup>
T <sub>4</sub>	<i>Datura metel</i> decoction 5 %	1.00	0.42	4.10

		(1.41)	(1.19) <sup>b</sup>	(2.29) <sup>b</sup>
T <sub>5</sub>	<i>Calotropis gigantea</i> decoction 3 %	0.80 (1.34)	0.84 (1.36) <sup>de</sup>	3.20 (2.02) <sup>fg</sup>
T <sub>6</sub>	<i>Cleistanthus collinus</i> 3 %	1.22 (1.49)	0.93 (1.39) <sup>efgh</sup>	3.27 (2.04) <sup>ef</sup>
T <sub>7</sub>	Cow urine+ mixed plant putrefaction 3 %	0.90 (1.38)	0.96 (1.40) <sup>efg</sup>	3.47 (2.09) <sup>e</sup>
T <sub>8</sub>	L-cyhalothrin 5EC (0.6ml/l)	0.70 (1.30)	0.18 (1.08) <sup>a</sup>	5.25 (2.44) <sup>a</sup>
T <sub>9</sub>	Untreated check	0.84 (1.35)	1.48 (1.57) <sup>i</sup>	2.43 (1.75) <sup>i</sup>
	Mean	0.94	0.76	3.74
	CD ( $p=0.05$ )	NS	0.18	0.33
	SE(m) $\pm$	0.08	0.06	0.11
	CV (%)	9.03	7.82	8.79

\*Values in the parentheses of damage score are square root transformation values

### Evaluation of phytotoxicity of botanicals on cashew

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

## KANABARGI

### Experimental details:

No of treatments : 07

Treatment details :

#### Sl.No.Treatments

- T<sub>1</sub> NSKE 5%  
 T<sub>2</sub> Azadiracthin 1% @ 1ml/l  
 T<sub>3</sub> *Pongamia* seed extract 4%

T <sub>4</sub>	Chilli-Garlic Extract 7.5%		
T <sub>5</sub>	*Ajith Paul (AAVYA) @4g/l		
T <sub>6</sub>	L - Cyhalothrin 5EC @ 0.6 ml/l		
T <sub>7</sub>	Untreated control		
No. of replications	:	03	
No. of trees per replication	:	04	
Age of the tree	:	13	
Design	:	RBD	

### Botanicals preparation methodology

**NSKE 5%:** Preparation of five per cent Neem seed kernel extract is done by soaking 5.0 Kg of neem powder in 100 litre of water overnight and squeezed with the help of muslin cloth. Before spraying 0.5 ml soap solution is added for better mixing and spreading of the solution.

**Pongamia seed extract 4%:** Preparation of five per cent Neem seed kernel extract is done by soaking 4.0 Kg of pongamia powder in 100 litre of water overnight and squeezing with the help of muslin cloth. Before spraying 0.5 ml soap solution is added for better mixing and spreading of the solution.

**Table : Efficacy of botanicals against Tea Mosquito Bug (TMB) during 2022**

Treatments	TMB damage on shoots / inflorescences (0-4 scale) at DAS				Mean	Nut yield (Kg/tree)
	On shoots		On Inflorescence			
	Before Spray	15 DAS	Before Spray	15 DAS		
T1-NSKE 5%	2.19 (1.64)	1.07 (1.25)	2.34 (1.68)	1.27 (1.33)	<b>1.72</b>	2.53
T2-Azadiracthin 1% @ 1ml/l	2.10 (1.61)	0.66 (1.08)	2.10 (1.61)	0.72 (1.10)	<b>1.39</b>	2.75
T3-Pongamia seed extract 4%	2.22 (1.65)	1.72 (1.49)	2.15 (1.63)	1.61 (1.45)	<b>1.93</b>	1.89
T4-Chilli-Garlic Extract 7.5%	2.12 (1.62)	2.07 (1.60)	2.22 (1.65)	2.05 (1.60)	<b>2.12</b>	1.82
T5-*Ajith Paul (AAVYA) @4g/l	2.18 (1.64)	1.12 (1.27)	2.09 (1.61)	1.21 (1.31)	<b>1.65</b>	2.20
T6-L - Cyhalothrin 5EC @ 0.6 ml/l	2.15 (1.63)	0.61 (1.05)	2.21 (1.65)	0.51 (1.01)	<b>1.37</b>	3.10
T7-Untreated control	2.30 (1.67)	2.01 (1.59)	2.50 (1.73)	2.06 (1.60)	<b>2.22</b>	1.78
Mean	<b>2.18</b>	<b>1.32</b>	<b>2.23</b>	<b>1.35</b>		
SE(m) ±	0.05	0.07	0.14	0.10	0.18	0.10
CD @ 5%	0.15	0.23	0.42	0.28	0.27	0.31
CV %	11.41	6.59	10.96	8.10	9.27	7.75

\*Values in the parentheses of damage score are square root transformation values

**Table: Efficacy of different botanicals against pest complex during 2022**

Treatment	Incidence of different pests on shoots or inflorescence at DAS							
	Apple & Nut Borer (% damage) *		Thrips (No./shoot or panicle) **		Aphids(No. affected shoots/plant) **		Mealy bugs (No. shoots affected/plant)	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15
T1-NSKE 5%	1.66 (7.41)	0.35 (3.38)	4.17 (2.16)	1.31 (1.35)	3.53 (2.01)	1.72 (1.49)	-----	-
T2-Azadiracthin 1% @ 1ml/l	1.79 (7.69)	0.32 (3.23)	4.16 (2.16)	1.27 (1.33)	3.73 (2.06)	1.21 (1.31)	-	--
T3-Pongamia seed extract 4%	1.52 (7.07)	0.89 (5.41)	4.02 (2.13)	2.15 (1.63)	3.31 (1.95)	1.92 (1.55)	-	-
T4-Chilli-Garlic Extract 7.5%	1.52 (7.07)	1.16 (6.19)	4.14 (2.15)	2.56 (1.75)	3.32 (1.95)	1.90 (1.55)	-	-
T5-*Ajith Paul (AAVYA) @4g/l	1.71 (7.51)	0.85 (5.29)	4.23 (2.17)	2.09 (1.61)	3.60 (2.03)	1.76 (1.50)		
T6-L - Cyhalothrin 5EC @ 0.6 ml/l	1.77 (7.64)	0.23 (2.75)	4.12 (2.15)	1.13 (1.28)	3.69 (2.05)	1.44 (1.39)		
T7-Untreated control	1.64 (7.36)	1.31 (6.57)	4.18 (2.16)	3.15 (1.91)	3.50 (2.00)	2.99 (1.87)		
Mean	<b>1.66</b>	<b>0.73</b>	<b>4.15</b>	<b>1.95</b>	<b>3.53</b>	<b>1.85</b>		
SE(m) ±	0.10	0.20	0.25	0.18	0.18	0.13		
CD @ 5%	NS	0.60	0.73	0.53	0.51	0.40		

\*Values in the parentheses of damage score are Arc sine transformation values

\*\*Values in the parentheses of damage score are square root transformation values

### Evaluation of phytotoxicity of botanicals on cashew

As per the technical Programme, in Botanicals field experiments, symptoms like leaf injury, wilting, vein clearing, necrosis, epinasty and hyponasty were observed in each tree at 1,3,5,7,10 and 14 days after spraying as per the protocol of Central Insecticide Board and Registration Committee (C.I.B and R.C).

### Method of assessment

Leaf injury was assessed by visual rating in a 0-10 scale

Rating	Phytotoxicity (%)
0	No phytotoxicity
1	0-10
2	11-20
3	21-30
4	31-40
5	41-50
6	51-60
7	61-70
8	71-80
9	81-90
10	91-100

The per cent leaf injury was calculated using the formula,

$$\text{Per cent leaf injury} = \frac{\text{Total grade points}}{\text{Maximum grade} \times \text{Number of leaves observed}} \times 100$$

#### Phytotoxic effect of botanicals on cashew:

The observations showed that none of the botanical treatments caused any phytotoxic symptoms such as injury to leaf tip and leaf surface, wilting, vein clearing, necrosis, epinasty and hyponasty. Hence, it was concluded that these botanical treatments did not inflict any phytotoxic effect on cashew.

**Table : Evaluation of botanicals safety to natural enemies during 2022**

Treatment	No. of predators on shoots or inflorescence at DAS**							
	<i>Oxyopes sweta</i>		<i>Menochilus sexmaculatus</i>		<i>Chrysoperla asp</i>		Syrphid	
	BS	15 DAS	BS	15 DAS	BS	15 DAS	BS	15 DAS
T1-NSKE 5%	1.90 (1.55)	0.85 (1.16)	2.01 (1.58)	1.02 (1.23)	2.03 (1.59)	1.01 (1.23)	2.01 (1.58)	0.90 (1.18)
T2-Azadiracthin 1% @ 1ml/l	1.72 (1.49)	0.95 (1.20)	1.82 (1.52)	1.07 (1.25)	1.93 (1.56)	1.10 (1.27)	1.84 (1.53)	0.99 (1.22)
T3-Pongamia seed extract 4%	1.97 (1.57)	1.18 (1.29)	2.07 (1.60)	1.30 (1.34)	2.20 (1.64)	1.33 (1.35)	2.09 (1.61)	1.50 (1.41)
T4-Chilli-Garlic Extract 7.5%	1.84 (1.53)	1.25 (1.32)	1.94 (1.56)	1.37 (1.37)	2.05 (1.60)	1.41 (1.38)	1.94 (1.56)	1.63 (1.46)
T5-*Ajith Paul (AAVYA) @4g/l	1.86 (1.54)	1.27 (1.33)	1.96 (1.57)	1.38 (1.37)	2.07 (1.60)	1.42 (1.39)	1.97 (1.57)	1.59 (1.45)
T6-L - Cyhalothrin 5EC @ 0.6 ml/l	1.87 (1.54)	0.21 (0.84)	1.97 (1.57)	0.17 (0.82)	2.10 (1.61)	0.29 (0.89)	1.98 (1.58)	0.40 (0.95)
T7-Untreated control	1.90 (1.55)	2.18 (1.64)	2.01 (1.58)	2.37 (1.69)	2.13 (1.62)	2.44 (1.72)	2.02 (1.59)	2.58 (1.75)
Mean	<b>1.87</b>	<b>1.13</b>	<b>1.97</b>	<b>1.24</b>	<b>2.07</b>	<b>1.29</b>	<b>1.98</b>	<b>1.37</b>
SE(m) ±	0.13	0.06	0.14	0.08	0.13	0.07	0.13	0.09
CD @ 5%	0.38	0.19	0.40	0.24	0.35	0.20	0.38	0.27
CV (%)	10.20	9.51	10.12	10.66	8.70	9.06	9.77	11.58

**Inference of the experiment:****Ent1. Evaluation of insecticides for the control of TMB and other pests :**

The results of the table 1 indicated that among the botanicals, azadiracthin 1% @ 1ml/l recorded significantly low tea mosquito bug damage on shoots (0.66) and on panicles (0.72) on 0 to 4 scale basis at 15 days after spray which is superior to other botanicals such as \*Ajith Paul (AAVYA) @4g/l, *Pongamia* seed extract 4% and Chilli-Garlic Extract 7.5%. Further, azadiracthin 1% @ 1ml/l was on par with standard check, lambda - Cyhalothrin 5EC @ 0.6 ml/l which registered 0.61 and 0.51 tea mosquito bug damage on 0 to 4 scale basis on shoots and panicles, respectively, at 15 days after spray indicating azadiracthin 1% @ 1ml/l is effective and easily adoptable by the farming community.

Further, percent incidence of apple and nut Borer on cashew was less in both NSKE 5% (0.35%) and azadiracthin 1% @ 1ml/l (0.32%) at 15 days after spray which was on par with lambda - Cyhalothrin 5EC @ 0.6 ml/l indicating the effectiveness of neem based insecticides. Similarly, thrips and aphids damage on cashew was recorded which revealed that again neem based insecticides excelled in recording less population of thrips and aphids as compared to other botanicals and on par with standard insecticide check, lambda - Cyhalothrin 5EC @ 0.6 ml/l confirming the efficacy of neem based insecticides.

During the experimentation, the natural enemy population especially predators such as *Oxyopes sweta*, *Menochilus sexmaculatus*, *Chrysoperla* sp and Syrphida were also recorded to know the safety of the different treatments in cashew ecosystem. Among the various treatments, almost all the botanical insecticides have recorded statistically higher predator population as compared to standard insecticide check, lambda - Cyhalothrin 5EC @ 0.6 ml/l indicating that botanicals are relatively safer than insecticides.

Ultimately the effectiveness of treatments measured by the cashew nut yield per tree where both NSKE 5% (2.53 kg nuts/tree) and azadiracthin 1% @ 1ml/l (2.75 kg nuts/tree) recorded higher nut yield per tree as compared to other botanicals such as \*Ajith Paul (AAVYA) @4g/l, *Pongamia* seed extract 4% and Chilli-Garlic Extract 7.5%. On the contrary, azadiracthin 1% @ 1ml/l and other botanicals were inferior to standard check, lambda - Cyhalothrin 5EC @ 0.6 ml/l which registered higher nut yield (3.10 kg nuts/tree) indicating the superiority of standard check. However, from the safety and residue point of view, use neem based insecticides is advisable as compared to insecticides.

**Ent. 2: Control of cashew stem and root borer****Expt. 2. Curative control trial**

<b>Centres: East Coast :</b>	Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara and Vengurla
<b>Plains / others:</b>	Hogalagere and Jagdalpur

The objective of this trial is to evaluate different pesticides and neem products for their efficacy in curative control of the cashew stem and root borer incidence after extraction of pest stages.

**BAPATLA**

During 2021-22, among the insecticides evaluated as post extraction prophylaxis, Imidacloprid (Swabbing and drenching) @ 2.0 ml/l have offered protection to the tune of 65.00 % trees without re-infestation followed by Fipronil Swabbing 2 ml/l with 60.00 % trees without re-infestation. The other treatments Chlorpyrifos 10 ml/l (Treated Check) and neem oil 5% (Swabbing) have offered 55.00 and 50.00 percent protection without re-infestation and are superior over the control treatment which recorded 40.00 % trees

without re-infestation. Preferential zone of attack is collar + root in 37.00 percent of trees (37/100) followed by stem+ collar + root and stem in 20.00 and 16.00 percent of trees.

### Cashew Stem and Root Borer damage symptoms

**Table : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2022**

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
Fipronil Swabbing (2 ml/ lit)	20		8	40.0	60.0	
Neem oil swabbing (5%)	20		10	50.0	50.0	
imidacloprid (2 ml/l) (swabbing and drenching)	20		7	35.0	65.0	
Chlorpyrifos (10 ml/l) (Treated check)	20		9	45.0	55.0	
Untreated check (only removal of CSRB grubs)	20		12	60.0	40.0	

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Stem girth	< 60 cm	1	0	0.00	1	100.00
	60-80cm	10	3	30.00	7	70.00
	80-100 cm	54	22	40.74	32	59.26
	>100 cm	35	21	60.00	14	40.00
<b>Total</b>		<b>100</b>	<b>46</b>	<b>46.00</b>	<b>54</b>	<b>54.00</b>
Age of the tree	< 10 years	0	0	0.00	0	0.00
	10-15 years	6	2	33.33	4	66.67
	>15years	94	44	46.81	50	53.19
<b>Total</b>		<b>100</b>	<b>46</b>	<b>46.00</b>	<b>54</b>	<b>54.00</b>
Zone of attack	C + R	37	15	40.54	22	59.46
	C + S	12	7	58.33	5	41.67
	R	5	3	60.00	2	40.00
	S	16	5	31.25	11	68.75
	C	10	1	10.00	9	90.00
	C + S + R	20	15	75.00	5	25.00
<b>Total</b>		<b>100</b>	<b>46</b>	<b>46.00</b>	<b>54</b>	<b>54.00</b>
Yellowing of canopy	Canopy yellowing	19	19	100.00	0	0.00

	Canopy not yellowing	81	27	33.33	54	66.67
<b>Total</b>		<b>100</b>	<b>46</b>	<b>46.00</b>	<b>54</b>	<b>54.00</b>
<b>% of bark circumference damaged</b>	<25	40	0	0.00	40	100.00
	26-50	31	19	61.29	12	38.71
	51-75	16	14	87.50	2	12.50
	>75	13	13	100.00	0	0.00
<b>Total:</b>		<b>100</b>	<b>46</b>	<b>46.00</b>	<b>54</b>	<b>54.00</b>

**Table: Two way table (Stem girth Vs Age of the tree)**

<b>Stem Girth</b>	<b>&lt;60 cm</b>	<b>60-80 cm</b>	<b>80-100 cm</b>	<b>&gt;100 cm</b>	<b>Total</b>
<b>Age of the tree</b>					
<10 years	0	0	0	0	0
10-15 Years	1	0	5	0	6
>15 Years	0	10	49	35	94
<b>Total</b>	<b>1</b>	<b>10</b>	<b>54</b>	<b>35</b>	<b>100</b>

**Table: Results of chi-square ( $\chi^2$ ) test showing associations between physical parameters of tree and effect of POP treatments (?)**

Parameters	Chi square value ( $\chi^2$ )	df	P value
% of bark circumference			
Canopy			
Zone of attack			
Age of tree			
Stem diameter			

\*  $p < 0.05$

**Table : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB)**

**(Percent of trees without reinfestation)**

Treatment	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Overall mean
Fipronil Swabbing [2 ml/l]	80.95	70.00	73.9	65.0	60.0	65.0	68.5
Neem oil Swabbing [5%]	66.67	61.90	60.9	45.0	45.0	40.0	52.3
Imidacloprid [2 ml/l] (Swabbing and Drenching)	80.95	87.50	82.6	70.0	75.0	75.0	78.1
Chlorpyrifos [10 ml/l] (Treated Check)	78.26	83.78	69.6	55.0	55.0	55.0	65.6
Un treated check (only removal of CSRB grubs)	33.33	37.50	39.1	30.0	35.0	30.0	33.1

**Table : Per cent of trees reinfested after PEP (post extraction prophylaxis)**

Physical parameters		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	Overall mean
Stem diameter	< 60 cm	0	20.00	0.00	0.00	0.00	0.00	3.33
	60-80 cm	25.81	16.67	37.50	0.00	27.80	38.10	24.31
	80-100 cm	25	29.41	35.10	58.30	44.90	48.10	40.14
	> 100 cm	42.5	45.45	40.00	55.30	65.50	54.20	50.49
Age of the tree	<10 years	0	0.00	10.00	0.00	16.70	27.30	9.00
	10-15 years	33.33	18.18	16.00	43.30	46.20	61.90	36.49
	>15 years	25.76	34.15	43.80	55.70	53.10	45.60	43.02
Zone of attack	C	27.03	25.00	21.40	100.00	44.40	71.40	48.21
	S	18.18	19.23	15.80	23.10	11.80	35.30	20.57
	R	0	33.33	0.00	0.00	28.60	50.00	18.66

	C+S	14.29	30.00	45.00	40.00	37.50	50.00	36.13
	C+R	34.21	21.67	26.90	61.10	50.00	48.30	40.36
	R+S							
	C+S+R	71.43	81.82	51.40	66.70	78.30	42.10	65.29
Yellowing of canopy	Canopy yellowing	66.67	66.67	87.50	96.10	90.50	92.30	83.29
	Canopy not yellowing	25.49	23.01	30.80	29.70	34.20	31.10	29.05
% of bark circumference damaged	< 25	17.39	4.62	13.30	11.20	5.00	2.80	9.05
	26-50	45.83	24.00	35.10	48.70	44.40	45.80	40.64
	51-75	50	57.89	57.10	88.20	94.10	83.30	71.77
	>75	50	84.21	75.00	100.00	100.00	93.80	83.84



## BHUBANESHWAR

### Experimental Details

Number of trees: 102

Number of treatments: 6

**Table : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2022**

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
T1:Fipronil Swabbing (2 ml/ lit)	18		7	39.0	61.0	
T2:Neem oil swabbing (5%)	17		9	53.0	47.0	

T3: Imidacloprid (2 ml/l) (swabbing and drenching)	18		6	33.0	67.0	
T4: Chlorpyrifos 20 EC (10 ml/l) (Treated check)	20		8	40.0	60.0	
T5: Mechanical extraction of grub ( treated check)	15		8	53.0	47.0	
T6: Untreated check (only removal of CSRB grubs) (T5 and T6- no difference in treatment?)	14		10	71.0	29.0	
<b>Total</b>	<b>102</b>		<b>48</b>	<b>47.05</b>	<b>52.95</b>	

The Post Extraction Prophylaxis (PEP) treatment against Cashew stem and root borer (CSRB) carried out during 2022 is presented. The total number of infested plants by CSRB was 102 out of which 54 plants (52.95%) showed without reinfestation over the PEP treatments. Maximum recovery was achieved in treatment T3 followed by T1 and T4).

The physical parameters on infestation of CSRB revealed that the infestation increased with increase in stem girth upto 80-100 cm. Highest infestation (45.55%) was recorded in 60-80 cm. Highest infestation of CSRB was found in age group of 10-15 years but highest recovery (60.71%) was recorded in plants of age group more than 15 years. The stem and collar region zone of attack recorded highest incidence of Stem borer i.e. 32 out of 102 plants (50.00%). However, highest recovery (100 %) was detected in case of root zone attack. About 58.06% of bored borers had consumed 51-75% of bark circumference. 17 out 102 plants ( 16.66 %) showed yellowing of canopy while the remaining cashew plants were non yellow.

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Stem girth	< 60 cm	5	0	64.28	5	100
	60-80cm	28	18	42.55	10	35.71
	80-100 cm	46	20	45.55	27	54.74
	>100 cm	23	10	38.07	12	55.54
<b>Total</b>		<b>102</b>	<b>48</b>	<b>47.05</b>	<b>54</b>	<b>52.00</b>
Age of the tree	< 10 years	18	8	44.44	8	44.44
	10-15 years	56	29	51.78	29	51.78
	>15years	28	11	39.28	17	60.71
<b>Total</b>		<b>102</b>	<b>48</b>	<b>47.05</b>	<b>54</b>	<b>52.95</b>
Zone of attack	C + R	10	5	50.00	5	50.00
	C + S	32	16	50.00	16	50.00
	R	7	0	0.00	7	100.00
	S	23	12	52.17	11	47.82
	C	13	7	53.84	6	46.15
	C + S + R	17	8	47.05	9	52.29
<b>Total</b>		<b>102</b>	<b>48</b>	<b>47.05</b>	<b>54</b>	<b>52.95</b>
Yellowing of canopy	Canopy yellowing	17	10	58.82	7	41.17
	Canopy not yellowing	85	38	47.70	47	55.29
<b>Total</b>		<b>102</b>	<b>48</b>	<b>47.05</b>	<b>54</b>	<b>52.95</b>
% of bark circumference damaged	<25	18	6	33.33	12	66.33
	26-50	28	15	54.10	13	46.42
	51-75	31	18	58.06	13	41.93
	>75	25	9	36.00	16	64.00
<b>Total:</b>		<b>102</b>	<b>48</b>	<b>47.05</b>	<b>54</b>	<b>52.95</b>

Some centres adopted stem diameter and some followed stem girth or circumference...uniformity is needed.

### JHARGRAM (data was not given)

### VRIDHACHALAM

#### Experimental Details

Design : CRD  
 Number of treatments : Five  
 Variety : VRI-3, VRI-2  
 Replication : Four

## Treatment Details

T <sub>1</sub>	:	Fipronil 5% SC Swabbing 2ml/lit.
T <sub>2</sub>	:	Neem Oil suspension 5%.
T <sub>3</sub>	:	Imidachloprid 17.8 SL Swabbing and Drenching 2ml/lit.
T <sub>4</sub>	:	Chlorpyriphos 20 EC 10ml/lit.
T <sub>5</sub>	:	Treated check (only removal of CSRB grubs followed).

As per the technical programme, the treatments were applied sequentially as and when infested trees are available. The treatments were swabbed on the trunk, stem and exposed roots and drenching of the insecticides in the root region after the removal of grubs (Post Extraction prophylaxis) and cocoons from the infested trees to the extent possible and observation on re-infestation and persistent infestation were recorded at monthly intervals.

**Results**

Maximum recovery of 73.91% was observed in chlorpyriphos 20 EC @10 ml/lit. of water as swabbing and drenching of CSRB infested trees as against mere recovery of 13.33 in treated check (only removal of CSRB grubs). Treatments with Fipronil 5% SC swabbing @ 2ml/lit. and Imidachloprid 17.8 SL Swabbing and Drenching @ 2ml/lit. lead to 63.64 and 50.00% recovery respectively as against nil recovery in untreated check. The overall results indicate that chlorpyriphos recorded maximum recovery, followed by Fipronil and Imidachloprid which are at par in reducing the CSRB infestation, with an average cost of protection of Rs.100/-, Rs.112/- and Rs. 121/- respectively (Table.)

**Table : Efficacy of insecticides as curative control - Post extraction prophylaxis (PEP) against cashew stem and root borer during 2022 at Vrindhachalam**

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees without reinfested	No. of trees with Reinfestation	Mean % recovery trees without Reinfestation	Cost of treatment per tree
T1-Fipronil 5% SC Swabbing@ 2ml/lit.	22	3	14	8	63.64b	112.00
T2- Neem Oil suspension 5% Swabbing and Drenching	15	3	5	10	33.33d	92.00
T3- Imidachloprid 17.8 SL Swabbing and Drenching @ 2ml/lit.	16	3	8	8	50.00c	121.00
T4-Chlorpyriphos 20 EC @ 10ml / lit. Swabbing and Drenching	23	3	17	6	73.91a	100.00
T5- Treated check (only removal of CSRB grubs followed).	15	3	02	13	13.33e	70.00
<b>Total</b>	<b>91</b>		<b>46</b>	<b>45</b>		

Observations recorded in the physical parameters of treated cashew trees under Post Extraction Prophylaxis (PEP) curative trial revealed that the cashew trees having 80-100 cm of stem girth (70.59 %) were more prone to the attack of CSRB infestation (Table. ). Comparing the age of the cashew infested trees, more than 15- year- old cashew trees (56.41%) were more susceptible to attack of CSRB. Preferential zone of attack of re-infestations by CSRB in the trees were Collar + Stem +Root zone followed by Collar + Root and Collar + Stem with 73.08, 60.87 and 38.89 per cent re- infested trees respectively. Yellowing of canopy showed 82.50 per cent re-infestation. Trees with less than 25 per cent bark circumference damage had maximum re-infestation with 62.50 per cent followed by 51-75 per cent bark circumference damage (40.00% re-infestation). This implies that early detection of borer infestation and simultaneous prophylaxis treatment on a community basis is very important to mitigate persistent attack of cashew stem and root borer.

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) curative trial observed at Vrindhachalam**

Physical parameters		Total no. of trees treated	No. of trees infested after PEP	% of infested trees	No. of trees not reinfested after PEP	% of not reinfested trees
<b>Stem girth</b>	< 60 cm	10	3	30.00	7	70.00
	60-80cm	41	24	58.54	17	41.46
	80-100 cm	17	12	70.59	5	29.41
	>100 cm	23	6	26.09	17	73.91
<b>Total</b>		<b>91</b>	<b>45</b>		<b>46</b>	
<b>Age of the tree</b>	< 10 years	4	2	50.00	2	50.00
	10-15 years	48	21	43.75	27	56.25
	>15years	39	22	56.41	17	43.59
<b>Total</b>		<b>91</b>	<b>45</b>		<b>46</b>	
<b>Zone of attack</b>	C + R	23	14	60.87	9	39.13
	C + S	18	7	38.89	11	61.11
	R	7	0	0	7	100.00
	S	6	2	33.33	4	66.67
	C	8	3	37.50	5	62.50
	S + R	3	0	0	3	100.00
	C+S+R	26	19	73.08	7	26.92
<b>Total</b>		<b>91</b>	<b>45</b>		<b>46</b>	
<b>Yellowing of canopy</b>	Canopy yellowing	40	33	82.50	7	17.50
	Canopy not yellowing	51	12	23.53	39	76.47
<b>Total</b>		<b>91</b>	<b>45</b>		<b>46</b>	
<b>% of bark circumference damaged</b>	<25	48	30	62.50	18	37.50
	26-50	33	11	33.33	22	66.67
	51-75	10	4	40.00	6	60.00
	>75	0	0	0	0	0
<b>Total:</b>		<b>91</b>	<b>45</b>		<b>46</b>	

**Table: Results of chi-square ( $X^2$ ) test showing associations between physical parameters of tree and effect of POP treatments**

Parameters	Chi square value ( $X^2$ )	df	P value
% of bark circumference	0.017	3	11.39
Canopy	0.021	1	6.67
Zone of attack	0.024	6	6.25
Age of tree	0.014	2	15.26
Stem diameter	0.016	3	11.86

\*  $p < 0.05$

## MADAKKATHARA

### Experimental Details

Age of the trees	:	>20 Years
Number of trees	:	110
Number of treatments	:	5
Design	:	CRD

Among the insecticides evaluated as PEP, swabbing with fipronil @2ml/l ( $T_1$ ) has offered the highest recovery with 95.45 per cent followed by the drenching of chlorpyrifos @ 10m/l ( $T_4$ ) (90.90). the cost of treatment in fipronil (Rs. 122/ tree/year) was comparatively low to other treatments.

The maximum infestation was observed in trees with stem girth of more than 100 cm (83 trees) and age more than 15 years. In most of the trees, infestation was noticed on collar and root zone. The recovery of trees after PEP was closely associated with per cent bark circumference damaged, zone of attack and stem diameter.

**Table : Efficacy of insecticides as Post extraction prophylaxis (PEP) against cashew stem and root borer during 2022**

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
Fipronil (swabbing) 2 ml/l	22	1	1	4.55	95.45	122/-
Neem oil (swabbing) 50 ml/l	22	1	7	31.81	68.18	124.5/-
Imidacloprid (swabbing and drenching) 2ml/l	22	1	9	40.90	59.09	153/-
Chlorpyrifos (treated check) 10	22	1	2	9.09	90.9	142.5/-

ml/l						
Untreated check (only removal of CSRB grubs)	22	1	10	45.45	45.45	100/-

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
<b>Stem girth</b>	< 60 cm	3	1	33.333	2	66.667
	60-80cm	5	2	40	3	60
	80-100 cm	19	3	15.789	16	84.21
	>100 cm	83	22	26.506	61	73.49
<b>Total</b>		<b>110</b>	<b>28</b>	<b>25.45</b>	<b>82</b>	<b>74.54</b>
<b>Age of the tree</b>	< 10 years	0	0	0	0	0
	10-15 years	0	0	0	0	0
	>15years	110	28	25.45	82	74.54
<b>Total</b>		<b>110</b>	<b>28</b>	<b>25.45</b>	<b>82</b>	<b>74.54</b>
<b>Zone of attack</b>	C + R	42	7	16.66	35	83.33
	C + S	1	0	0	1	100
	R	24	1	4.166	23	95.83
	S	0	0	0	0	0
	C	10	0	0	10	100
	C + S + R	33	20	66.66	13	39.39
<b>Total</b>		<b>110</b>	<b>28</b>	<b>25.45</b>	<b>82</b>	<b>74.54</b>
<b>Yellowing of canopy</b>	Canopy yellowing	31	20	64.52	11	35.48
	Canopy not yellowing	79	8	10.12	71	89.87
<b>Total</b>		<b>110</b>	<b>28</b>	<b>25.45</b>	<b>82</b>	<b>74.54</b>
<b>% of bark circumference damaged</b>	<25	50	0	0	50	100
	26-50	29	10	34.48	19	65.517
	51-75	22	10	45.45	12	54.545
	>75	9	8	88.88	1	11.11
<b>Total:</b>		<b>110</b>	<b>28</b>	<b>25.45</b>	<b>82</b>	<b>74.54</b>

**Table: Two way table (Stem girth Vs Age of the tree)**

Stem Girth \ Age of the tree	<60 cm	60-80 cm	80-100 cm	>100 cm	Total
<10 years	-	-	-	-	-
10-15 Years	-	-	-	-	-
>15 Years	3	5	17	85	110
Total	3	5	17	85	110

**Table: Results of chi-square ( $\chi^2$ ) test showing associations between physical parameters of tree and effect of POP treatments**

Parameters	Chi square value ( $\chi^2$ )	df	P value
% of bark circumference	7.5*	3	0.06
Canopy	5.99	1	0.01
Zone of attack	5.38*	4	0.25
Age of tree	-	-	-
Stem diameter	0.28*	2	0.87

\* p&lt; 0.05

### Conclusion

Swabbing with fipronil @2ml/l (T<sub>1</sub>) has offered the highest recovery and lowest cost of treatment per tree.

**Table : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB)**

Treatment	2015-16	2016-17	2017-18	2018-19	2019-20	Overall mean
T1	100.00	75.00	80.00	75.00	80.00	82.00
T2	65.00	90.00	65.00	85.00	75.00	76.00
T3	90.00	75.00	75.00	80.00	85.00	81.00
T4	80.00	85.00	90.00	85.00	75.00	83.00
T5	42.11	40.00	50.00	45.00	55.00	46.4

**Table : Percentage of trees reinfested after PEP (post extraction prophylaxis)**

Physical parameters		2015-16	2016-17	2017-18	2018-19	2019-20	Overall mean
Stem diameter	< 19 cm	-	-	-	-	-	-
	19-32 cm	18.91	-	35.71	23.08	57.3	27.00
	> 32 cm	29.5	30.55	29.80	30.00	30.8	30.13
Age of the tree	<10 years	-	-	-	-	-	-

	10-15 years	-	-	12.5	6.67	-	3.83
	>15 years	34.24	26.90	32.69	33.33	28.6	31.15
Zone of attack	C	35.71	16.66	9.52	12.50	11.00	17.07
	S	-	-	-	-	-	-
	R	-	8.33	27.27	8.82	-	8.88
	C+S	13.33	100.0	55.55	-	13.3	16.03
	C+R	14.89	30.00	18.36	21.43	10.00	18.93
	R+S	-	-	-	-	-	-
	C+S+R	50.00	-	62.96	81.25	42.00	47.24
Yellowing of canopy	Canopy yellowing	66.66	50.00	25.00	75.00	-	43.33
	Canopy not yellowing	24.21	23.68	31.89	21.74	28.6	26.02
% of bark circumference damaged	< 25	42.85	40.00	10.41	16.67	0	21.98
	26-50	13.51	33.33	13.88	18.60	15.4	18.94
	51-75	15.62	20.00	36.36	40.00	25.00	27.39
	>75	75.00	16.66	88.00	-	59.8	47.89

### Inference

Swabbing and drenching with chlorpyriphos (10ml/l) resulted in high mean recovery of 83 per cent followed by fipronil (2ml/l) (82 %).



## VENGURLA

### Experimental Details

Age of the trees : 7 to 25 years

Number of trees : 20

Number of treatments:

T<sub>1</sub> - Fipronil 5 EC swabbing @ 2 ml/lit

T<sub>2</sub> - Neem oil swabbing @ 5%

T<sub>3</sub> - Imidacloprid 17.8 SL swabbing and drenching @ 2 ml/lit

T<sub>4</sub> - Chlorpyriphos 20 EC @ 0.2 % (10ml/lit)

T<sub>5</sub> - Treated check (only removal of grub)

T<sub>6</sub> - Untreated check

Design : CRD

The treatment T1 (Fipronil 5 EC swabbing @ 2ml/lit) was found most effective with 85 per cent trees without reinfestation followed by T4 (Chlorpyriphos 20 EC @ 0.2 %) with 80 per cent trees without reinfestation and T3 (Imidacloprid 17.8 SL swabbing and drenching @ 2ml/lit) with 80 per cent trees without reinfestation.

During the year 2021-22, total 120 trees were treated with different treatments for curative management of CSRB. Out of which 50 trees were found reinfested and 70 trees were found without reinfestation after application of different treatments.

The infested trees having the stem girth more than 100 cm were more prone to CSRB reinfestation (25%). The infested trees having the age more than 15 years were more prone to CSRB reinfestation (29.16%), whereas, the trees having less than 10 years age were found to be the least damaged by CSRB (0.83%).

The collar + stem zone was found to be more preferred by CSRB for reinfestation. The maximum trees (16.67%) are having more than 75 per cent bark damage and the minimum (6.66%) are having <25 per cent bark damage.

Yellowing of canopy was observed only in 7.50% reinfested trees.

**Table : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2022**

Treatment	Total No. of trees treated	No. of trees without re-infestation	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
T1 Fipronil 5 EC swabbing @ 2 ml/lit	20	17	3	15	85	
T2 Neem oil swabbing @ 5%	20	11	9	45	55	
T3 Imidacloprid 17.8 SL swabbing and drenching @ 2	20	16	4	20	80	

ml/lit						
T4 Chlorpyriphos 20 EC @ 0.2 % (10ml/lit)	20	16	4	20	80	
T5 Treated check (only removal of grub)	20	8	12	60	40	
T6 Untreated check	20	2	18	90	10	

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
<b>Stem girth</b>	< 60 cm		2	1.67	5	4.17
	60-100cm		19	15.83	44	36.66
	>100 cm		30	25.00	20	16.66
<b>Total</b>			<b>51</b>	<b>42.50</b>	<b>69</b>	<b>57.50</b>
<b>Age of the tree</b>	< 10 years		1	0.83	4	3.34
	10-15 years		15	12.50	21	17.50
	>15years		35	29.16	44	36.66
<b>Total</b>			<b>51</b>	<b>42.50</b>	<b>69</b>	<b>57.50</b>
<b>Zone of attack</b>	C + R		12	10.00	25	20.84
	C + S		29	24.16	23	19.16
	C + S + R		10	8.33	21	17.50
<b>Total</b>			<b>51</b>	<b>42.50</b>	<b>69</b>	<b>57.50</b>
<b>Yellowing of canopy</b>	Canopy yellowing		9	7.50	0	0.00
	Canopy not yellowing		42	35.00	69	57.50
<b>Total</b>			<b>51</b>	<b>42.50</b>	<b>69</b>	<b>57.50</b>
<b>% of bark circumference damaged</b>	<25		8	6.66	41	34.17
	26-50		11	9.16	21	17.50
	51-75		12	10.00	7	5.83
	>75		20	16.67	0	0.00
<b>Total:</b>			<b>51</b>	<b>42.50</b>	<b>69</b>	<b>57.50</b>

**Table: Results of chi-square ( $X^2$ ) test showing associations between physical parameters of tree and effect of POP treatments**

Parameters	Calculated Chi square value ( $X^2$ )	Critical ( $X^2$ )	P value
% of bark circumference	27.06	7.81	0.00000
Yellowing of Canopy	13.16	3.84	0.00000
Zone of attack	6.61	5.99	0.03666
Age of tree	1.15	5.99	0.56236
Stem diameter	10.75	5.99	0.00464

\*  $p < 0.05$

## HOGALAGERE

### Experimental Details

Age of the trees	:	9 - 21 yrs
Number of trees	:	48
Number of treatments	:	6
Design	:	Sequential application of treatments

### Efficacy of insecticides as Post extraction prophylaxis (PEP) against CSRB during 2022

The results on infestation and re-infestation of the CSRB in different treatments applied during Oct.-Nov., Jan - Feb and April - May months revealed that Fipronil (2ml/l) and Chlorpyrifos (0.2%) treatments were found most effective against grubs of CSRB with 73.33% and 66.66% trees without reinfestation, respectively (Table 5). In a treated check, where only grubs extraction was adopted, indicated 20% of treated trees could recover from reinfestation. However, the other treatments also maintained their superiority in suppressing the population over control (Table ).

**Table : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer during 2022**

Treatment	Total No. of trees treated	Frequency of treatment	No. of trees reinfested	% trees with Reinfestation	% trees without Reinfestation	Cost of treatment per tree
Fipronil @ 2ml /lt swabbing (during Oct.- Nov., Jan.- Feb. and April - May)	15	3	4	26.66	73.33	102
Neem oil 5% swabbing	15	3	10	66.66	33.33	12
Imidacloprid 17.8 SL @ 2ml/l as swabbing and drenching	15	3	7	46.66	53.33	201
Chlorpyrifos 20 EC(0.2%) @ 10ml/l	15	3	5	33.33	66.66	18
Treated check - only removal of CSRB grubs	15	3	12	80.00	20.00	0
Untreated control	15	0	12	80.00	20.00	0

### Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial:

The incidence of cashew stem and root borer was monitored randomly at fortnightly intervals in old and neglected cashew gardens. Trees with 60-80cm and 81-100cm stem girth showed maximum damage (75% and 83% preference for infestation) and with respect to age of trees, 10-15 years and more than 15 years old trees were highly prone to CSRB damage (55% & 69% respectively) might be due to maximum availability of dead wood, cracks & crevices and loose bark which favours CSRB oviposition. The zone of CSRB attack was noticed maximum at the collar region (65%) and collar + stem (54%) and 64 per cent of infested trees showed yellowing canopy indicating complete destruction of vascular bundles for uptake of nutrients and

water. The plants with 51-75% bark circumference damage recorded 80% re-infestation compared to other plants, might be due to severely damaged plants larval frass and plant volatiles becoming stimulus to beetles for oviposition (Table ).

**Table : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Stem girth	< 60 cm	5	2	40	3	60
	60-80cm	8	6	75	2	25
	80-100 cm	11	8	83	3	17
	>100 cm	6	3	50	3	50
<b>Total</b>		<b>N=30</b>	<b>N=19</b>	-	<b>N=11</b>	-
Age of the tree	< 10 years	6	0	0	6	100
	10-15 years	11	6	55	5	45
	>15years	13	9	69	4	31
<b>Total</b>		<b>N=30</b>	<b>N=15</b>	-	<b>N=15</b>	-
Zone of attack	C + R	21	12	57	9	43
	C + S	26	14	54	12	46
	R	4	1	25	3	75
	S	9	3	33	6	67
	C	17	11	65	6	35
	C + S + R	30	15	50	15	50
<b>Total</b>		<b>N=107</b>	<b>N=56</b>	-	<b>N=51</b>	-
Yellowing of canopy	Canopy yellowing	11	7	64	4	36
	Canopy not yellowing	19	14	74	5	26
<b>Total</b>		<b>N=30</b>	<b>N=21</b>	-	<b>N=9</b>	-
% of bark circumference damaged	<25	12	5	42	7	58
	26-50	9	6	67	3	33
	51-75	5	4	80	1	20
	>75	4	1	25	3	75
<b>Total:</b>		<b>N=30</b>	<b>N=19</b>	-	<b>N=21</b>	-

**Table: Two way table (Stem girth Vs Age of the tree)**

Stem Girth \ Age of the tree	<60 cm	60-80 cm	80-100 cm	>100 cm	Total
<10 years	1	2	3	0	<b>6</b>
10-15 Years	1	3	4	3	<b>11</b>
>15 Years	3	3	4	3	<b>13</b>
<b>Total</b>	<b>5</b>	<b>8</b>	<b>11</b>	<b>6</b>	<b>30</b>

### Results of chi-square ( $X^2$ ) test showing associations between physical parameters of tree and effect of POP treatments

The chi-square analysis of physical parameters of cashew plant for infestation of CSRB showed non significant results with respect to per cent bark circumference damaged ( $x^2=0.741$ ), canopy type ( $x^2=0.806$ ), zone of attack of the stem ( $x^2=0.934$ ), age of the tree ( $x^2=0.165$ ), and stem diameter ( $x^2=0.895$ ) (Table ).

**Table: Results of chi-square ( $X^2$ ) test showing associations between physical parameters of tree and effect of POP treatments**

Parameters	Chi square value ( $X^2$ )	df	P value
% of bark circumference	0.741NS	3	7.815
Canopy	0.806NS	1	3.841
Zone of attack	09.34NS	5	11.070
Age of tree	0.165NS	2	5.991
Stem diameter	0.895NS	3	7.815

### Conclusion

#### Efficacy of the different treatments as post extraction prophylaxis (PEP) against CSRB across the years:

The results on infestation and re-infestation of the CSRB in different treatments applied during Oct.-Nov., Jan - Feb and April - May months across five years revealed that Fipronil (2ml/l) and Chlorpyrifos (0.2%) treatments were found most effective against grubs of CSRB with overall mean recovery (trees without reinfestation) of 82% and 74%, respectively (Table ). whereas Imidacloprid 17.8 SL treatment found to be next best treatment (62% overall mean recovery) against CSRB. In treated check, where only grubs extraction was adopted indicated 38% of treated trees could recover from reinfestation. However, the other treatments also maintained their superiority in suppressing the population over control (Table ).

**Table : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB)**

Treatment	Year 1	Year 2	Year 3	Year 4	Year 5	Overall mean
Fipronil swabbing @ 2ml/l (during Oct.-Nov., Jan.- Feb. and April - May)	83	85	87	80	73	82
Neem oil swabbing 5% suspension	46	47	40	26	33	38
Imidacloprid 17.8 SL @ 2ml/l as swabbing and drenching	71	71	53	60	53	62
Chlorpyrifos 20 EC @ 10ml/l	77	80	80	67	67	74
Treated check - only removal of CSRB grubs	38	37	47	47	20	38

Untreated control	30	31	27	33	20	28
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### Per cent of trees reinfested after PEP (post extraction prophylaxis)

The data on physical parameters of trees reinfested after PEP (Post Extraction Prophylaxis) across five years showed that the incidence of cashew stem and root borer was monitored randomly at fortnightly interval in old and neglected cashew gardens. Trees with 60-80 cm and 81-100 cm stem girth showed maximum damage (83% and 55% of overall mean preference for infestation) and with respect to age of trees, more than 15 years and 10-15 years old trees were highly prone to CSRB damage (72% & 17% of overall mean preference for infestation, respectively) might be due to maximum availability of dead wood, cracks & crevices and loose bark which favours CSRB oviposition. The zone of CSRB attack was noticed maximum at collar region (65%) and collar + stem (67%) and 67 per cent of infested trees showed yellowing canopy indicating complete destruction of vascular bundles for uptake of nutrients and water. The plants with 51-75% and more than 75% bark circumference damage recorded 68% and 93% re-infestation compared to other plants, might be due to larval frass and plant volatiles on severely damaged plants become stimulus to beetles for oviposition (Table 10).

**Table : Per cent of trees reinfested after PEP (post extraction prophylaxis)**

Physical parameters		Year 1	Year 2	Year 3	Year 4	Year 5	Overall mean
Stem diameter	< 19 cm	33	30	50	63	40	43
	19-32 cm	96	70	88	83	79	83
	> 32 cm	42	40	67	75	50	55
Age of the tree	<10 years	0	20	0	0	0	4
	10-15 years	0	30	0	0	55	17
	>15 years	86	80	60	63	69	72
Zone of attack	C	-	-	-	-	65	65
	S	-	-	-	-	33	33
	R	-	-	-	-	25	25
	C+S	73	70	80	60	54	67
	C+R	15	20	20	20	57	26
	R+S	-	-	-	-	31	31
	C+S+R	48	50	60	20	50	46
Yellowing of canopy	Canopy yellowing	60	83	67	61	64	67
	Canopy not yellowing	20	50	50	43	74	47
% of bark circumference damaged	< 25	60	80	80	75	42	33 (67% - plant recovery)
	26-50	30	60	60	67	67	47 (57% - plant recovery)
	51-75	20	20	20	20	80	68 (32% - plant recovery)
	>75	10	0	0	0	25	93 (7% - plant recovery)

							recovery)
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### Treatment imposition

## JAGADALPUR

### Experimental Details Expt. 2.: Curative control trial

Age of the trees : >15 year  
 Number of trees : 50  
 Number of treatments : 05  
 Design : CRD

The post extraction prophylaxis treatment was carried out in 60 trees of forest plantation in Ghatkawali village of Bastar District during 2021-22. The insecticide treatments were swabbed on the trunk, stem and exposed roots and drenching of the insecticides in the root region after the removal of grubs and cocoons from the infested trees.

**Table Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Jagdalpur centre during the year 2021-22**

Treatment	Total	No. of	No. of	% trees	% of
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	number of trees treated	trees without reinfestation	trees re-infested	without reinfestation (Recovery %)	trees re-infested
T <sub>1</sub> : Fipronil swabbing (2ml/l)	10	8	2	80	20
T <sub>2</sub> : Neem oil swabbing (5%)	10	5	5	50	50
T <sub>3</sub> : Imidacloprid (2 ml/l)	10	7	3	70	30
T <sub>4</sub> : Chlorpyrifos (10 ml/l)	10	9	1	90	10
T <sub>5</sub> : Treated check (only removal of CSRB grubs)	10	5	5	50	50
<b>Total</b>	<b>50</b>	<b>34</b>	<b>16</b>		

Perusal of data presented in table 6 showed that the maximum recovery of 90.00 per cent was observed in T<sub>4</sub> (Chlorpyrifos @ 10 ml/l) of water as swabbing and drenching of CSRB infested tree followed by T<sub>1</sub> (Fipronil @ 2ml/l) swabbing with 80.00 per cent recovery and T<sub>3</sub> (Imidacloprid @ 2 ml/l) swabbing and drenching lead with 70.00 per cent whereas, as minimum recovery 50.00 per cent was observed in T<sub>5</sub> (treated check: only removal of CSRB grubs). The overall results indicate that chlorpyrifos recorded maximum recovery, followed by Fipronil and Imidacloprid which nearly similar in reducing the CSRB infestation.

**Table :7 Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial**

Physical parameters		Total trees treated	No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
<b>Stem girth</b>	< 19 cm	0.00	0.00	0.00	0.00	0.00
	19-32 cm	0.00	0.00	0.00	0.00	0.00
	> 32 cm	50.00	16.00	<b>32.00</b>	34.00	68.00
<b>Total</b>		<b>50.00</b>	<b>16.00</b>	<b>32.00</b>	<b>34.00</b>	<b>68.00</b>
<b>Age of the tree</b>	< 10 years	<10 years	0.00	0.00	0.00	0.00
	10-15 years	10-15 years	0.00	0.00	0.00	0.00
	>15years	>15 years	50.00	16.00	<b>32.00</b>	34.00
<b>Total</b>		<b>50.00</b>	<b>16.00</b>	<b>32.00</b>	<b>34.00</b>	<b>68.00</b>
<b>Zone of attack</b>	C + R	11.00	4.00	36.36	7.00	63.64
	C + S	2.00	1.00	<b>50.00</b>	1.00	50.00
	R	1.00	0.00	0.00	1.00	100.00
	S	17.00	5.00	29.41	12.00	70.59
	C	9.00	2.00	22.22	7.00	77.78
	C + S + R	1.00	0.00	0.00	1.00	100.00
<b>Total</b>		<b>9.00</b>	<b>4.00</b>	<b>44.44</b>	<b>5.00</b>	<b>55.56</b>
<b>Yellowing of canopy</b>	Canopy yellowing	50.00	16.00	182.44	34.00	517.56
	Canopy not yellowing	14.00	4.00	28.57	10.00	71.43
<b>Total</b>		<b>36.00</b>	<b>12.00</b>	<b>33.33</b>	<b>24.00</b>	<b>66.67</b>
<b>% of bark</b>	<25	50.00	16.00	61.90	34.00	138.10

<b>circumference damaged</b>	26-50	19.00	7.00	36.84	11.00	57.89
	51-75	14.00	3.00	21.43	11.00	78.57
	>75	10.00	3.00	30.00	7.00	70.00
<b>Total:</b>		<b>7.00</b>	<b>3.00</b>	<b>42.86</b>	<b>5.00</b>	<b>71.43</b>

Observation recorded in the physical parameters of treated cashew trees under post extraction prophylaxis (PEP) curative trial and details are presented in table 7. The data revealed that the cashew trees having > 32 cm of diameter were more prone to the attack of CSRB (32.00 %). Comparing the age of the cashew infested trees, in respect to re-infested after PEP > 15 years old cashew trees (32.00 %) were more susceptible to the attack of CSRB. Preferential zone of re-infestation by CSRB in the trees were stem zone followed by Root+ Stem zone and Collar with 50.00, 44.44 and 36.36 per cent re-infested trees, respectively. Yellowing of canopy was observed in 28.57 per cent re- infested trees. Trees with more than >75 per cent bark circumference damage had maximum re-infestation of 42.86 per cent followed by less than <25 per cent bark circumference damage 36.84 per cent. The data presented in two way table 8 between age of tree and stem diameter revealed that all the trees having stem diameter below 19 cm and 19 - 32 cm had zero year age plants. In stem diameter more than 32 cm had 50 trees which were more than 15 years old.

**Table 8 Two way table (Stem diameter VS Age of Tree)**

<b>Age of Tree Stem diameter</b>	<b>&lt;10 years</b>	<b>10-15 years</b>	<b>&gt;15 years</b>	<b>Total</b>
< 19 cm	0	0	0	0
19 - 32 cm	0	0	0	0
> 32 cm	0	0	50	50
Total	0	0	50	50

**Table:9 Results of chi-square ( $\chi^2$ ) test showing associations between physical parameters of tree and effect of POP treatments**

<b>Parameters</b>	<b>Chi square value (<math>\chi^2</math>)</b>	<b>df</b>	<b>P value</b>
% of bark circumference	1.67	3	0.64
Canopy	0.105	1	0.74
Zone of attack	2.42	6	0.87
Age of tree	0	2	1
Stem diameter	0	2	1

\* p< 0.05

Chi square analysis of insecticides for various physical parameters showed non- significant relationship and parameters like age of tree and stem diameters chi square value cannot be determined as parameters had zero values (Table 9).

#### **Conclusion of trial based on 7 years data (2015-16 to 2021-2022)**

Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Jagdalpur centre during the year 2015-16 to 2021-2022 concluded that among the tested insecticides the maximum recovery of 77.68 per cent was observed in T<sub>4</sub> (Chlorpyriphos @ 10 ml/l) of water as swabbing and drenching of CSRB infested tree followed by T<sub>1</sub> (Fipronil @ 2ml/l) swabbing lead with 69.05 per cent and T<sub>3</sub> (Imidacloprid @ 2 ml/l) swabbing and drenching with 63.49 per cent recovery whereas, as minimum recovery was observed in T<sub>5</sub> (treated check: only removal of CSRB grubs). The overall results indicate that chlorpyriphos recorded maximum recovery, followed by Fipronil and Imidacloprid which nearly similar in reducing the CSRB infestation (table 10).

Observation recorded year 2015-16 to 2021-2022 concluded that among the physical parameters of treated cashew trees under post extraction prophylaxis (PEP) curative trial (table 11) revealed that the cashew trees having > 32 cm of diameter were more prone to the attack of CSRB (42.41 %). Comparing the age of the cashew infested trees, in respect to re-infested after PEP > 15 years old cashew trees (38.23 %) were more susceptible to the attack of CSRB. Preferential zone of re-infestation by CSRB in the trees were stem zone followed by C+S+R (Collar + Stem +Root) zone with 45.90 and 40.98 per cent re-infested trees, respectively. Yellowing of canopy was observed in 44.29 per cent re- infested trees. Trees with 26-50 per cent bark circumference damage had maximum re-infestation of 47.39 per cent. It has concluded that Chlorpyriphos (10 ml/l) swabbing and drenching and Fipronil swabbing (2ml/l) was best for management of CSRB.

**Table 10 Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Jagdalpur centre during the year 2021-22**

Recovery per cent (without reinfestation trees) Overall mean 2015-16 to 2021-22 (7 year)								
Treatment	2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Overall mean
T <sub>1</sub> : Fipronil swabbing (2ml/l)	77.78	66.67	61.11	44.44	83.33	70.00	80	69.05
T <sub>2</sub> : Neem oil swabbing (5%)	55.56	38.89	33.33	16.67	61.11	60.00	50	45.08
T <sub>3</sub> : Imidacloprid (2 ml/l) swabbing and drenching	66.67	44.44	55.55	50	77.78	80.00	70	63.49
T <sub>4</sub> : Chlorpyriphos (10 ml/l) swabbing and drenching	72.22	72.22	66.67	77.78	88.89	90.00	90	79.68
T <sub>5</sub> : Treated check (only removal of CSRB grubs)	44.45	33.33	27.78	11.11	33.33	30.00	50	32.86
T <sub>5</sub> : Untreated check	33.34	22.22	22.22	-	11.11	60.00	-	29.78
Total plant	108	108	108	108	108	60	50	92.86

**Table 11: Per cent of trees reinfested after PEP (post extraction prophylaxis) under PEP trial at Jagdalpur centre from the year 2015-16 to 2021-22 (7 year)**

Physical parameters		2015-16	2016-17	2017-18	2018-19	2019-20	2020-21	2021-22	Overall mean
Stem diameter	< 19 cm	20.00	28.57	22.22	28.57	0.00	0.00	0.00	14.19
	19-32 cm	30.56	33.33	39.13	53.97	0.00	0.00	0.00	22.43
	> 32 cm	44.00	57.14	61.90	44.74	22.22	34.88	32.00	42.41
Age of the tree	<10 years	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	10-15 years	31.03	47.06	42.10	18.18	0.00	0.00	0.00	19.77
	>15 years	27.69	50.55	51.68	48.45	22.22	35.00	32.00	38.23
Zone of attack	C	20.69	41.30	45.83	56.10	16.13	46.15	36.36	37.51
	S	20.00	65.00	55.55	50.00	30.77	50.00	50.00	45.90
	R	37.50	50.00	46.67	50.00	0.00	0.00	0.00	26.31
	C+S	0.00	33.33	25.00	36.36	18.75	27.27	29.41	24.30
	C+R	15.38	33.33	33.33	56.25	23.53	23.08	22.22	29.59
	R+S	0.00	40.00	40.00	0.00	0.00	66.67	0.00	20.95
	C+S+R	27.78	40.00	33.33	62.50	45.45	33.33	44.44	40.98
Yellowing of canopy	Canopy yellowing	15.00	70.00	40.00	91.67	27.27	37.50	28.57	44.29
	Canopy not yellowing	32.26	45.45	37.63	43.75	21.65	34.09	33.33	35.45
% of bark circumference damaged	< 25	28.00	28.57	28.57	62.26	15.15	21.43	36.84	31.55
	26-50	63.46	63.64	56.90	56.52	35.29	34.48	21.43	47.39
	51-75	40.00	41.17	36.36	37.50	41.67	42.86	30.00	38.51
	>75	20.00	26.67	33.33	66.67	18.18	50.00	42.86	36.82

### Ent.3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew

<b>Centres: East Coast:</b>	Bapatla, Bhubaneswar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara, Paria and Vengurla
<b>Plains / others :</b>	Hogalagere, Kanabargi and Jagdalpur

The objective of the project is to investigate the population dynamics of pests of regional importance and to correlate it to prevalent weather parameters.

## BAPATLA

During the experimental period (1<sup>st</sup> Jan, 2022 to 28<sup>th</sup> Oct, 2022), the relation between the percent pest damage (Y) and weather variables such as Max.Temp (X<sub>1</sub>), Min.Temp.(X<sub>2</sub>), Relative Humidity (m) (X<sub>3</sub>), Relative Humidity (e) (X<sub>4</sub>) and Rainfall (X<sub>5</sub>) was worked out by subjecting the data collected over 43 standard weeks to Multiple Linear Regression Analysis.

Relationship of per cent leaf and blossom webber damaged shoots with selected weather variables was subjected to multiple regression analysis. Results revealed that all weather variables together in question accounted for 25.5 percent variation in per cent shoot damage by leaf and blossom webber ( $R^2= 0.255$ ). However none of the variables was found to influence the damage by LBW independently.

Leaf miner population showed significant negative correlation with minimum temperature (X<sub>2</sub>) and remaining weather variables were found to influence the damage by leaf miner independently and all five independent variables have accounted for 27.9 percent of total variation in percent leaf damage by leaf miner ( $R^2=0.279$ ).

With regard to leaf folder damaged leaves with selected weather variables was subjected to multiple regression analysis? . Results revealed that all weather variables together in question accounted for 29.0 per cent variation in per cent leaf damage by leaf folder ( $R^2= 0.290$ ). However none of the variables was found to influence the damage by leaf folder independently.

Relationship of per cent shoot damage caused by shoot tip caterpillar with selected weather variables was subjected to multiple regression analysis. Results revealed that maximum temperature (X<sub>1</sub>) showed significant negative correlation and remaining weather variables were found to influence the damage by shoot tip caterpillar independently. All independent variables have accounted for 15.2 percent of total variation in percent shoot damage by shoot tip caterpillar ( $R^2=0.152$ ).

With regard to Apple and nut borer all five independent variables have accounted for 10.4% of total variation in percent nut damage by Apple and nut borer (ANB) ( $R^2=0.104$ ). The data indicated that none of the variables were found to influence the damage by apple and nut borer independently.

With regard to natural enemies (Spiders) population all independent variables have accounted for 26.4 % of total variation in per cent in number ( $R^2= 0.264$ ). The data indicated that none of the variables were found to influence the number of spider population.

**Table : Correlation of weather parameters on the activity of pest complex of cashew**

Variable	leaf and blossom webber	leaf miner	leaf folder	shoot tip caterpillar	apple and nut borer
X <sub>1</sub> -Maximum Temp	-0.440	0.112	-0.008	-0.016*	0.363
X <sub>2</sub> -Minimum Temp	0.601	-0.278*	-0.065	0.009	0.075
X <sub>3</sub> -RH (m)	-0.170	-0.004	-0.007	-0.001	-0.029
X <sub>4</sub> -RH (e)	-0.127	0.048	0.009	-0.001	-0.021
X <sub>5</sub> -Rain fall	-0.004	0.005	-0.001	-0.0004	0.028
X <sub>6</sub> — Wind velocity					
X <sub>7</sub> — Evap.					
X <sub>8</sub> — Sun shine hours					
R <sup>2</sup> Value	0.255	0.279	0.290	0.152	0.104

% Variation	25.5	27.9	29.0	15.2	10.4
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\* Significant at 0.05% & \*\* highly significant at 0.01%

**Table : Correlation of weather parameters on the activity of natural enemies**

Variable	Spiders	Insect-2	Insect-3	Insect-4	Insect-5	Insect-6
X <sub>1</sub> -Maximum Temp	-0.136					
X <sub>2</sub> -Minimum Temp	-0.151					
X <sub>3</sub> -RH (m)	-0.073					
X <sub>4</sub> -RH (e)	0.032					
X <sub>5</sub> -Rain fall	-0.010					
X <sub>6</sub> – Wind velocity						
X <sub>7</sub> – Evap.						
X <sub>8</sub> – Sun shine hours						
R <sup>2</sup> Value	0.264					
% Variation	26.4					

\* Significant at 0.05% & \*\* highly significant at 0.01%

**Regression analysis between pests and natural enemies of cashew and weather parameters during 2022**

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1.	LBW	$24.452-0.440(X_1)+0.601(X_2)-0.170(X_3)-0.127(X_4)-0.004(X_5)$	0.255
2.	LM	$0.725+0.112(X_1)-0.278^*(X_2)-0.004(X_3)+0.048(X_4)+0.005(X_5)$	0.279
3.	LF	$1.980-0.008(X_1)-0.065(X_2)-0.007(X_3)+0.009(X_4)-0.001(X_5)$	0.290
4.	STC	$0.526-0.016^*(X_1)+0.009(X_2)-0.001(X_3)-0.001(X_4)-0.0004(X_5)$	0.152
5.	ANB	$-9428+0.363(X_1)+0.075(X_2)-0.029(X_3)-0.021(X_4)+0.028(X_5)$	0.104
6.	Spiders	$13.485-0.136(X_1)-0.151(X_2)-0.073(X_3)+0.032(X_4)-0.010(X_5)$	0.264

**Table : Incidence of different cashew pests during different months during 2022**

Months	Incidence of major cashew pests (% DAMAGE)				
	LBW	LM	LF	STC	ANB
Jan-22	0.02	1.49	0.43	0.08	0.00
Feb-22	0.04	2.15	0.58	0.00	0.00
Mar-22	0.04	0.65	0.04	0.02	0.10
Apr-22	0.03	0.19	0.00	0.03	1.62
May-22	1.16	0.09	0.02	0.00	12.33
Jun-22	10.01	0.12	0.02	0.02	0.00
Jul-22	1.33	0.09	0.00	0.00	0.00
Aug-22	0.95	2.08	0.06	0.00	0.00
Sep-22	0.05	1.58	0.05	0.00	0.00
Oct-22	0.00	2.07	0.69	0.00	0.00

## VRIDHACHALAM

The field experiment was laid out and cashew trees were planted in the year 1995 to study the population dynamics of pests occurring in cashew for correlating pest population with weather parameters. The incidence of cashew pests and natural enemies were recorded at weekly intervals from ten randomly selected cashew trees from 24 leader shoots of each tree from all the four sides at Regional Research Station, Vridhachalam. These cashew trees were grown under unprotected condition.

~~During the year (from June 2021 to October 2022), the relation between weather variables such as minimum temperature ( $^{\circ}\text{C}$ ) (X1), maximum temperature ( $^{\circ}\text{C}$ ) (X2), Relative humidity (Morning%) (X3), relative Humidity (Evening%) (X4), rainfall (X5), rainy days (X6), wind speed(Km/hr.) (X7) and sunshine (hours) (X8), and the TMB Population(Y1), Leaf and blossom webber (% damage) (Y2), Leaf miner (% damage) (Y3), Leaf thrips Population(Y4), Apple and nut borer (% damage) (Y5), Leaf folder (% damage) (Y6), Shoot tip caterpillar (% damage) (Y7), CSRB (% damage) (Y8) and the natural enemies viz., population of spiders(Y9), ants(Y10), coccinellids(Y11), braconids(Y12) and wasp(Y13). The seasonal incidence and correlation coefficient of insect-pests and natural enemies abundance in Cuddalore district are presented in Table 1,2 and 3,4.~~

The incidence of TMB was confined to flushing through fruiting season. Its activity was observed from first week of February 2022 to third week of April 2022. The same observation on TMB activity was recorded during first week of February 2021 to third week of April 2021 also. Maximum TMB damage was observed during the second week of March with mean damage score ranging between 9.8 and 17.0. ~~Nut borer activity during non-bearing periods could not be traced out.~~ Cashew leaf miner incidence is most common in new flushes during July to December reaching the peak during September – October(18.2%) in Cuddalore districts of Tamil Nadu, but incidence can be seen upto January at low level. During peak infestation period, 3 to 8 blisters and nine caterpillars are observed on a single leaf in Cuddalore District of Tamil Nadu. The cashew leaf folder was also observed from July 2021 - November 2021 with 28 % to 2.75 % leaf damage observed in young plantations. Maximum damage was noticed during August 2021 and 2022 and September 2021 and 2022. Whereas, Leaf and blossom webber damage was observed maximum during August 2021 and 2022. Cashew Leaf thrips population (29.0) was noticed in March 2022. However, shoot tip caterpillar was observed during January to February – 2022, but incidence was noticed during January 2022. During 2021 to 2022 CSRB incidence was observed as 42%. The CSRB damage (20%) was prevailing throughout the season but maximum was recorded during August 2022.

**Table.1 Correlation coefficient (r) for abiotic factors and insect pests of cashew at Vridhachalam**

Weather Parameters	TMB Population (Y1)	Leaf and blossom webber (% damage) (Y2)	Leaf miner (% damage) (Y3)	Leaf thrips Population (Y4)	Apple and nut borer (%damage) (Y5)	Leaf folder (%damage) (Y6)	Shoot tip caterpillar (%damage) (Y7)	CSRB (% damage) (Y8)
Minimum temperature ( $^{\circ}\text{C}$ ) (X1)	-0.793**	0.355	0.127	-0.151	-0.101	0.352	-0.367	0.506*
Maximum temperature ( $^{\circ}\text{C}$ ) (X2)	-0.548*	0.195	0.047*	0.133*	0.162	0.258	-0.174	0.407*
Relative Humidity (Morning%) (X3)	0.299	-0.134	0.102	0.088	0.0458	-0.143	0.187	-0.325
Relative Humidity (Evening%) (X4)	0.223	-0.285	0.012	-0.079	-0.015	-0.305	0.178	-0.442
Rainfall (X5)	-0.323	0.0710	0.059	-0.395	-0.280	0.089	-0.096	0.046
Rainy days (X6)	-0.371	0.181	0.128*	-0.403	-0.278	0.139	-0.175	0.072
Wind speed(Km/hr.) (X7)	0.744**	-0.814**	-0.746**	0.453	0.333	-0.755**	0.049	-0.539*
Sunshine (hours) (X8)	0.214*	-0.326	-0.295	0.671**	0.548*	-0.296	-0.056	-0.192

\*significant at 1% level; \*\*significant at 5% level

**Table .2 Correlation coefficient (r) for abiotic factors and population of natural enemies on cashew at Vridhachalam**

Weather Parameters	Spiders (Y9)	Ants (Y10)	Coccinellids (Y11)	Braconids (Y12)	Wasp (Y13)
Minimum temperature (°C) (X1)	0.027	0.090	0.442	0.100	0.745**
Maximum temperature (°C) (X2)	0.298	0.201	0.593*	0.170	0.744**
Relative Humidity (Morning%) (X3)	-0.111	-0.011	-0.020	0.266	-0.286
Relative Humidity (Evening%) (X4)	-0.558*	-0.077	-0.240	0.219	-0.334
Rainfall (X5)	-0.378*	-0.253*	-0.220	-0.003*	-0.279
Rainy days (X6)	-0.223*	-0.197*	-0.134	-0.035*	-0.241
Wind speed(Km/hr.) (X7)	-0.186*	0.093	-0.456	-0.282	-0.447
Sunshine (hours) (X8)	0.377*	0.72*	0.36	0.01	0.25*

\*significant at 1% level; \*\*significant at 5% level.

The results of Correlation studies revealed that TMB population had significant negative correlation ( $r = -0.793$ ) with the minimum temperature and ( $r = -0.548$ ) with maximum temperature. Further, rainfall ( $r = -0.323$ ) and rainy days ( $r = -0.371$ ) had negative correlation with TMB population, but significant positive correlation with wind speed ( $r = 0.744$ ) and sunshine hours ( $r = 0.214$ ).

With regard to the per cent damage of leaf and blossom webber, an insignificant positive correlation was observed with minimum temperature ( $r = 0.355$ ) and maximum temperature ( $r = 0.195$ ) and significant negative correlation was noticed for windspeed ( $r = -0.814$ ).

With regard to per cent leaf miner damage, maximum temperature ( $r = 0.047$ ) and rainydays ( $r = 0.128$ ) displayed a positive correlation and wind speed ( $r = -0.746$ ) showed a significant negative correlation while sunshine hours ( $r = -0.295$ ) showed an insignificant negative correlation.

The results of the leaf thrips population ( $r = 0.671$ ) and apple and nut borer damage ( $r = 0.548$ ) revealed that, it had a significant positive correlation with sunshine hours. Whereas for leaf folder damage, a significant negative correlation with wind speed ( $r = -0.755$ ) was observed.

With regard to shoot tip caterpillar damage, a positive correlation was observed with minimum temperature, morning and evening relative humidity and a negative correlation with maximum temperature, wind speed and sunshine hours but none of them were significant.

The results of the CSRB per cent damage revealed that a positive correlation was observed with minimum ( $r = 0.506$ ) and maximum temperature ( $r = 0.407$ ) and a significant negative correlation with wind speed ( $r = -0.539$ ). (Table 1.)

The results revealed that the spider population had significant negative correlation with relative humidity in the evening ( $r = -0.558$ ), rainfall ( $r = -0.378$ ), rainy days ( $r = -0.223$ ), windspeed ( $r = -0.186$ ), but positive correlation was observed with Sunshine hours ( $r = 0.377$ ). With regard to the population of ants, a positive correlation was observed with sunshine hours ( $r = 0.72$ ) and negative correlation with rainfall ( $r = -0.253$ ) as well as rainy days ( $r = -0.197$ ).

With regard to coccinellid population, significant positive correlation was observed with maximum ( $r = 0.593$ ) temperature. Whereas for the population of braconids, it had significant positive correlation with minimum

( $r = 0.55$ ) temperature and negative correlation with rainfall ( $r = -0.003$ ) and rainy days ( $r = -0.035$ ). The results of the wasp population revealed that, it had significant positive correlation with minimum ( $r = 0.745$ ) and maximum temperature ( $r = 0.744$ ) and sunshine hours ( $r = 0.25$ ).

**Table.3 Regression analysis between pests of cashew and weather parameters during June - 2021 and October - 2022 at Vridhachalam.**

Sl. No.	Biotic factors	Regression equation	R <sup>2</sup>
1.	TMB Population(Y1)	$Y_1 = 66.225 + (-0.903^*)X_1 + (-1.887^*)X_2 + 0.115X_3 + (-0.037)X_4 + (-0.007)X_5 + (-0.107)X_6 + 2.788^*X_7 + 1.597^*X_8$	0.955*
2.	Leaf and blossom webber (% damage) (Y2)	$Y_2 = -7.278^* + (-1.040^*)X_1 + 1.122^*X_2 + 0.870^*X_3 + (-0.580^*)X_4 + (-0.020)X_5 + 0.531^*X_6 + (-6.034^*)X_7 + (-3.118^*)X_8$	0.826*
3.	Leaf miner (% damage) (Y3)	$Y_3 = -12.837^* + (-2.552^*)X_1 + 0.338X_2 + 0.251X_3 + 0.239X_4 + (-0.033)X_5 + 0.797^*X_6 + (-6.310^*)X_7 + (-1.414^*)X_8$	0.694*
4.	Leaf thrips Population(Y4)	$Y_4 = -131.605^* + (-0.368)X_1 + (-0.109)X_2 + 1.204^*X_3 + 0.139X_4 + 0.001X_5 + (-0.007)X_6 + (-1.171^*)X_7 + 4.992^*X_8$	0.680*
5.	Apple and nut borer (% damage) (Y5)	$Y_5 = 1.955^* + (-3.249^*)X_1 + 2.342^*X_2 + (-0.565^*)X_3 + 0.500^*X_4 + (-0.030)X_5 + 1.261^*X_6 + 0.248X_7 + 2.385^*X_8$	0.543*
6.	Leaf folder (% damage) (Y6)	$Y_6 = -71.493^* + (-1.091^*)X_1 + 1.540^*X_2 + 1.720^*X_3 + (-0.942^*)X_4 + 0.0234X_5 + (-0.712^*)X_6 + (-5.730^*)X_7 + (-3.496^*)X_8$	0.790*
7.	Shoot tip caterpillar (% damage) (Y7)	$Y_7 = 15.211^* + (-1.856^*)X_1 + 1.080^*X_2 + (-0.092)X_3 + 0.117X_4 + (-0.002)X_5 + (-0.665^*)X_6 + (-0.347)X_7 + 0.263X_8$	0.263
8.	CSRB (% damage) (Y8)	$Y_8 = -122.677^* + 2.748^*X_1 + 2.316^*X_2 + (-1.511^*)X_3 + 0.064X_4 + (-2.094)X_5 + (-2.065^*)X_6 + (-4.794^*)X_7 + 0.716^*X_8$	0.716*

\*Significant at 1% level; \*\*Significant at 5% level.

**Table.4 Regression analysis between natural enemies of cashew and weather parameters during June - 2021 and October 2022 at Vridhachalam.**

Sl. No.	Biotic factors	Regression equation	R <sup>2</sup>
1.	Spiders(Y9)	$Y_9 = -122.677^* + 2.748^*X_1 + 0.114X_2 + 2.315^*X_3 + (-1.511)X_4 + 0.0641X_5 + (-2.094^*)X_6 + (-2.065^*)X_7 + 4.794^*X_8$	0.716*
2.	Ants(Y10)	$Y_{10} = -8.282^* + (-0.107)X_1 + 0.025X_2 + (-0.128)X_3 + 0.306X_4 + (-0.017)X_5 + 0.603^*X_6 + (-0.716)X_7 + 2.349^*X_8$	0.4578*
3.	Coccinellids(Y11)	$Y_{11} = -125.559^* + (-3.574^*)X_1 + 4.471^*X_2 + 0.558^*X_3 + 0.378X_4 + (-0.044)X_5 + 1.457^*X_6 + (-2.703)X_7 + (-0.199)X_8$	0.850*
4.	Braconids (Y12)	$Y_{12} = -243.169^* + (-1.733^*)X_1 + 4.156^*X_2 + 1.366X_3 + 0.732^*X_4 + (-0.020)X_5 + (-0.023)X_6 + (-2.719^*)X_7 + (-2.349^*)X_8$	0.545*
5.	Wasp(Y13)	$Y_{13} = -155.285^* + 3.057^*X_1 + (-0.021)X_2 + 0.918^*X_3 + 0.191X_4 + 0.003X_5 + (-0.686^*)X_6 + (-1.439^*)X_7 + 0.086X_8$	0.884*

\*Significant at 1% level; \*\*Significant at 5% level.

Minimum temperature (°C) (X1),

Maximum temperature (°C) (X2),

Relative Humidity (Morning %) (X3),

Relative Humidity (Evening %) (X4),  
Rainfall (X5), Rainy days (X6), Wind speed (Km/hr.) (X7) and Sunshine (hours) (X8).

Based on the regression analysis (Table.3,4) by taking pest population, damage per cent and population of natural enemies(Y) as a dependent variable and weather parameters(X) as independent variables following equations were fitted for season June 2021 to October 2022.

Results of multiple linear regression analysis between weather parameters and abundance of TMB population revealed that the maximum temperature ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) had significant contribution towards the TMB population with the  $R^2$  value 0.95. When the minimum temperature ( $T_{min}$ ) decreased by  $1^{\circ}\text{C}$ , number of TMB population decreased by 0.90 percent and  $1^{\circ}\text{C}$  of maximum temperature ( $T_{max}$ ) decreased the population by 1.88 per cent as well and when sunshine hours increases by  $1^{\circ}\text{C}$ , number of TMB population increases by 1.59 per cent.

A similar trend is noticed in leaf and blossom webber damage with the  $R^2$  value of 0.83 and  $1^{\circ}\text{C}$  increase in maximum temperature increased per cent damage by leaf and blossom webber by 1.22 percent and  $1^{\circ}\text{C}$  of minimum temperature ( $T_{min}$ ) decreased the incidence of the pest by 1.04 per cent as well.

With regard to leaf miner damage maximum( $T_{max}$ ) and minimum ( $T_{min}$ ) temperature had significant contribution towards their abundance with the  $R^2$  value 0.69 and a  $1^{\circ}\text{C}$  increase in maximum temperature ( $T_{max}$ ), 0.338 percent increase and with  $1^{\circ}\text{C}$  decrease in minimum temperature ( $T_{min}$ ) 2.552 per cent decrease in leaf miner damage could be predicted.

The same trend is noticed in leaf thrips population also that maximum ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) have contributed to leaf thrips incidence with  $R^2$  value 0.68 and with  $1^{\circ}\text{C}$  increase in minimum temperature ( $T_{min}$ ) 0.368 percent decrease and with  $1^{\circ}\text{C}$  decrease in maximum temperature 0.109 per cent decrease in the leaf thrips population could be predicted.

Maximum temperature ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) had noteworthy contribution towards the abundance of apple and borer damage with the  $R^2$  value 0.54 with  $1^{\circ}\text{C}$  increase in maximum temperature ( $T_{max}$ ), the borer damage increased by 2.342 percent whereas, with  $1^{\circ}\text{C}$  decrease in minimum temperature ( $T_{min}$ ), it decreased by 3.249 per cent respectively.

Results of multiple linear regression analysis between weather parameters and leaf folder per cent damage revealed that the maximum temperature ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) had significant contribution towards the leaf folder damage with the  $R^2$  value 0.79 with  $1^{\circ}\text{C}$  increase in maximum temperature ( $T_{min}$ ), damage increased by 1.54 percent whereas, with  $1^{\circ}\text{C}$  decrease in minimum temperature ( $T_{min}$ ), damage decreased by 1.09 respectively.

A similar trend is noticed in shoot tip caterpillar damage with the  $R^2$  value of 0.26 and  $1^{\circ}\text{C}$  increase in temperature increased per cent damage by 1.08 percent and  $1^{\circ}\text{C}$  of minimum temperature ( $T_{min}$ ) decreased the incidence of the pest by 1.85 per cent as well.

With regard to CSRB per cent damage maximum( $T_{max}$ ) and minimum ( $T_{min}$ ) temperature had significant contribution towards their per cent damage with the  $R^2$  value 0.71 and a  $1^{\circ}\text{C}$  increase in maximum temperature ( $T_{max}$ ), 2.748 percent increase and with  $1^{\circ}\text{C}$  increase in minimum temperature ( $T_{min}$ ), 2.316 per cent increase in CSRB damage could be predicted.

Results of multiple linear regression analysis between weather parameters and abundance of spider population revealed that the maximum temperature ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) had significant contribution towards the spider population with the  $R^2$  value 0.71. When the maximum temperature ( $T_{max}$ ) increased by  $1^{\circ}\text{C}$ , number of spiders population increased by 0.114 per cent and  $1^{\circ}\text{C}$  of minimum

temperature ( $T_{min}$ ) decreased the population by 3.56 per cent as well. A similar trend is noticed in ant damage with the  $R^2$  value of 0.45 and  $1^\circ\text{C}$  increase in maximum temperature increased per cent damage by ant by 0.025 per cent and  $1^\circ\text{C}$  of minimum temperature ( $T_{min}$ ) decreased the incidence of the pest by 0.107 per cent as well.

With regard to cocinellid population maximum ( $T_{max}$ ) and minimum ( $T_{min}$ ) temperature had significant contribution towards their abundance with the  $R^2$  value 0.85 and a  $1^\circ\text{C}$  increase in maximum temperature ( $T_{max}$ ), 4.47 percent increase and with  $1^\circ\text{C}$  decrease in minimum temperature ( $T_{min}$ ) 3.574 per cent decrease in cocinellid population could be predicted. The same trend is noticed in braconid population also that maximum ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) have contributed to braconid population with  $R^2$  value 0.545 and with  $1^\circ\text{C}$  increase in maximum temperature ( $T_{max}$ ) 4.15 percent increase and with  $1^\circ\text{C}$  decrease in minimum temperature 1.73 per cent decrease in the braconid population could be predicted.

Maximum temperature ( $T_{max}$ ) and minimum temperature ( $T_{min}$ ) had noteworthy contribution towards the abundance of wasp population with the  $R^2$  value 0.88 with  $1^\circ\text{C}$  increase in minimum temperature ( $T_{min}$ ), the borer damage increased by 3.057 per cent whereas, with  $1^\circ\text{C}$  decrease in maximum temperature ( $T_{max}$ ), it decreased by 0.021 per cent respectively.

## MADAKKATHARA

The insect pests and natural enemies of cashew were monitored throughout the year. The commonly found insect pests were tea mosquito bugs, leaf miners, and thrips.

The correlation between TMB damage and weather parameters revealed a significant negative correlation with minimum temperature, morning and evening relative humidity and rainfall, but a significant positive correlation with wind velocity and maximum temperature.

A higher magnitude of adjusted  $R^2$  value (0.83) indicated that at least 80 per cent of the TMB damage is explained by the weather parameters under study. The regression coefficient of maximum and minimum temperature, morning and evening relative humidity, rainfall and wind velocity were found significant at a 5 % level of significance, indicating the influence of these weather parameters on TMB damage.

In the case of thrips, a significant negative correlation was established with evening relative humidity. Apple and nut borer damage showed a negative correlation with morning relative humidity.

**Table : Correlation of weather parameters on the activity of pest complex of cashew**

Variable	TMB	Leaf miner	Thrips	Apple and nut borer
X <sub>1</sub> -Maximum Temp	0.711**	0.036	0.242	0.261
X <sub>2</sub> -Minimum Temp	-0.391*	-0.086	-0.258	0.023
X <sub>3</sub> -RH (m)	-0.623**	-0.06	-0.2	-0.387*
X <sub>4</sub> -RH (e)	-0.784**	-0.073	-0.348*	-0.32
X <sub>5</sub> -Rain fall	-0.533**	-0.18	-0.232	-2.07
X <sub>6</sub> – Wind velocity	0.697*	-0.02	0.18	0.156
X <sub>7</sub> – Evap.	0.757	0.064	0.233	0.319
X <sub>8</sub> – Sun shine hours	0.71	0.073	0.325	0.254
$R^2$ Value	0.88	0.11	0.23	0.20
% Variation	12	89	77	80

\* Significant at 0.05% & \*\* highly significant at 0.01%

**Table : Correlation of weather parameters on on the activity of natural enemies**

Variable	Spiders	Red ant (which species)	Black ant (which species)
X <sub>1</sub> -Maximum Temp	0.036	-0.049	-0.188
X <sub>2</sub> -Minimum Temp	0.169	0.19	-0.037
X <sub>3</sub> -RH (m)	0.085	-0.087	0.019
X <sub>4</sub> -RH (e)	-0.01	-0.027	0.114
X <sub>5</sub> -Rain fall	-0.009	-0.129	0.034
X <sub>6</sub> – Wind velocity	0.267	0.267	0.198
X <sub>7</sub> – Evap.	-0.029	-0.033	-0.155
X <sub>8</sub> – Sun shine hours	-0.077	0.002	-0.08
R <sup>2</sup> Value	0.122	0.425	0.230
% Variation	87.80	57.50	77.00

\* Significant at 0.05% & \*\* highly significant at 0.01%

**Regression analysis between pests and natural enemies ??of cashew and weather parameters during 2022**

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1	Tea mosquito bug	$0.97 + (*0.004 X_1) - (*0.037X_2) - (*0.0005X_3) - (*0.001X_4) - (*0.0001X_5) + (*0.032 X_6) + (0.06X_7) + (0.003X_8)$	0.83
2	Thrips	$0.51 - (0.01X_1) - (0.003X_2) + (0.002X_3) - (*0.004X_4) + (0.0001X_5) - (0.005X_6) - (0.003X_7) + (0.0002X_8)$	0.01
3	Apple and nut borer	$0.27 - (0.003X_1) - (0.000X_2) + (*0.002X_3) - (0.0002X_4) + (0.000X_5) - (0.005X_6) - (0.0004X_7) + (0.0001X_8)$	-0.02

**Table : Incidence of natural enemies in cashew ecosystem during 2021**

Predators	Host pest	Peak occurrence (month)	Intensity
<i>Red ant</i>	<i>TMB</i>	November	??

**Table : Incidence of different cashew pests during different months during 2022**

Months	Incidence of major cashew pests				
	TMB (score)	Leaf miner (%)	Thrips (score)	Insect 4	Insect 5
Aug. 2020	0.02	12.03	0	-	-
Sept. 2020	0	0	0	-	-

Oct. 2020	0.018	0.485	0	-	-
Nov. 2020	0.046	0	0	-	-
Dec. 2020	0.01	0	0	-	-
Jan. 2021	0.148	0	0.043	-	-
Feb. 2021	0.342	0	0	-	-
Mar. 2021	0.00	0	0	-	-
Apr. 2021	0	0	0	-	-
May 2021	0	0	0	-	-
Jun. 2021	0	0	0	-	-
Jul. 2021	0	1.563	0		



## PARIA

The incidence of cashew pests and natural enemies were recorded at weekly intervals from randomly selected cashew trees at Agriculture Experimental station, NAU, Paria. These cashew trees were grown under unprotected condition. During the year (from Oct. 2021 to March 2022), the relation between the population of TMB ( $Y_1$ ), spider ( $Y_2$ ), ants ( $Y_3$ ) and lady bird beetle ( $Y_4$ ) and weather parameters such as maximum temperature ( $X_1$ ), minimum temperature ( $X_2$ ), morning relative humidity ( $X_3$ ), evening relative humidity ( $X_4$ ), bright sunshine hours ( $X_5$ ), wind velocity ( $X_6$ ) and evaporation ( $X_7$ ).

Correlation studies revealed that morning relative humidity, bright sunshine hours and wind velocity had a positive correlation with the activity of TMB, but highly significant negative correlation was established with minimum temperature and evaporation. The activities of natural enemies were observed throughout the season. The maximum temperature, minimum temperature, bright sunshine hours, wind velocity and evaporation had negative correlation with the spider population while positive correlation with morning relative humidity and evening relative humidity. In case of ants population, maximum temperature, minimum temperature, bright sunshine hours, wind velocity and evaporation had negative correlation was observed and positive correlation with rest of the weather parameters. The population of lady bird beetle

showed significant positive correlation with morning relative humidity and evening relative humidity and significant negative correlation with maximum temperature and bright sunshine hours.

The multiple regression equations were developed for predicting the pest and natural enemies of cashew by using regression model. By using regression models and the coefficient of determination ( $R^2$ ) indicated that the TMB population ( $Y_1$ ), spider ( $Y_2$ ), ants ( $Y_3$ ) and lady bird beetle ( $Y_4$ ) were predicted to an extent of 78, 31, 58 and 49 per cent respectively.

**Table : Correlation of weather parameters on on the activity of pest complex of cashew**

Variable	TMB
X <sub>1</sub> -Maximum Temp	-0.542*
X <sub>2</sub> -Minimum Temp	-0.768**
X <sub>3</sub> -RH (m)	0.232
X <sub>4</sub> -RH (e)	-0.042
X <sub>5</sub> -Rain fall	
X <sub>6</sub> – Wind velocity	0.321
X <sub>7</sub> – Evap.	-0.737**
X <sub>8</sub> – Sun shine hours	0.296
R <sup>2</sup> Value	0.783
% Variation	78.3

\* Significant at 0.05% & \*\* highly significant at 0.01%

**Table : Correlation of weather parameters on on the activity of natural enemies**

Variable	Spider	Ants	Lady bird beetle
X <sub>1</sub> -Maximum Temp	-0.261	-0.629*	-0.497*
X <sub>2</sub> -Minimum Temp	-0.079	-0.451*	-0.095
X <sub>3</sub> -RH (m)	0.421	0.275	0.507*
X <sub>4</sub> -RH (e)	0.402	0.449*	0.486*
X <sub>5</sub> -Rain fall			
X <sub>6</sub> – Wind velocity	-0.221	-0.200	-0.298
X <sub>7</sub> – Evap.	-0.237	-0.697*	-0.282
X <sub>8</sub> – Sun shine hours	-0.149	-0.137	-0.532*
R <sup>2</sup> Value	0.315	0.584	0.493
% Variation	31.5	58.4	49.3

\* Significant at 0.05% & \*\* highly significant at 0.01%

#### Regression analysis between pests and natural enemies of cashew and weather parameters during 2022

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1	TMB ( $Y_1$ )	$Y_1 = -2.16 + (0.039)X_1 + (-0.019)X_2 + (0.034)X_3 + (-0.003)X_4 + (-0.009)X_5 + (0.413)X_6 + (-0.314)X_7$	0.783
2	Spider ( $Y_2$ )	$Y_2 = -2.17 + (0.038)X_1 + (-0.003)X_2 + (0.015)X_3 + (0.004)X_4 + (-0.010)X_5 + (0.103)X_6 + (-0.083)X_7$	0.315
3	Ants ( $Y_3$ )	$Y_3 = 8.661 + (-0.015)X_1 + (0.015)X_2 + (-0.030)X_3 + (0.007)X_4 + (0.036)X_5 + (-0.364)X_6 + (-0.479)X_7$	0.584

4	Lady bird beetle (Y <sub>4</sub> )	$Y_4 = -0.0399 + (0.012)X_1 + (-0.021)X_2 + (0.007)X_3 + (0.003)X_4 + (-0.062)X_5 + (0.102)X_6 + (0.034)X_7$	0.493
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## VENGURLA

During the year 2021-22 incidence of TMB started in the month of November, 2021 and reached the peak in the month of February, 2022 (0.57) and declined thereafter. The incidence of thrips started from November, 2021 and reached its peak in the month of February, 2022 (0.62) and declined thereafter. The incidence of apple and nut borer was noticed in the month of January with the setting of apples and nuts and it was the maximum in the month of February and March, 2022 (9.00%).

The correlation studies indicated that the Infestation of tea mosquito bug showed significantly negative correlation with minimum temperature ( $r = -0.964$ ), evening RH ( $r = -0.823$ ) and rainfall ( $r = -0.606$ ). The incidence of thrips showed significantly negative correlation with minimum temperature ( $r = -0.949$ ) and evening RH ( $r = -0.778$ ). The incidence of apple and nut borer showed significant negative correlation with minimum temperature ( $r = -0.702$ ) and evening RH ( $r = -0.785$ ).

**Table : Correlation of weather parameters on the activity of pest complex of cashew**

Variable	TMB	Thrips	ANB	Insect 4	Insect 5	Insect 6
X <sub>1</sub> -Maximum Temp	-0.260	-0.334	-0.127			
X <sub>2</sub> -Minimum Temp	-0.964*	-0.949*	-0.702*			
X <sub>3</sub> -RH (m)	-0.065	0.009	-0.337			
X <sub>4</sub> -RH (e)	-0.823*	-0.778*	-0.785*			
X <sub>5</sub> -Rain fall	-0.606*	-0.539	-0.485			
X <sub>6</sub> — Wind velocity						
X <sub>7</sub> — Evap.						
X <sub>8</sub> — Sun shine hours						
R <sup>2</sup> Value	0.576	0.576	0.576			
% Variation						

\* Significant at 0.05% & \*\* highly significant at 0.01%

**Table : Correlation of weather parameters on the activity of natural enemies (No data)**

Variable	Insect 1	Insect 2	Insect 3	Insect 4	Insect 5	Insect 6
X <sub>1</sub> -Maximum Temp						
X <sub>2</sub> -Minimum Temp						
X <sub>3</sub> -RH (m)						
X <sub>4</sub> -RH (e)						
X <sub>5</sub> -Rain fall						
X <sub>6</sub> – Wind velocity						
X <sub>7</sub> – Evap.						
X <sub>8</sub> – Sun shine hours						
R <sup>2</sup> Value						
% Variation						

\* Significant at 0.05% & \*\* highly significant at 0.01%

### Regression analysis between pests and weather parameters during 2022

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1	TMB	$Y_1=1.950+0.008x_1-0.071x_2-0.001x_3-0.006x_4+0.000x_5$	0.940
2	Thrips	$Y_2=2.356-0.013x_1-0.058x_2+0.004x_3-0.002x_4+0.00x_5$	0.873
3	ANB	$Y_3=71.544-0.734x_1-0.439x_2-0.236x_3-0.217x_4+0.002x_5$	0.520

**Table : Incidence of different cashew pests during different months during 2022**

Months	Incidence of major cashew pests				
	TMB (grade?)	Thrips (unit)	ANB (unit)	Insect-4	Insect-5
Aug. 2021	-	-	-		
Sept. 2021	-	-	-		
Oct. 2021	-	-	-		
Nov. 2021	0.17	0.12			
Dec. 2021	0.32	0.29			
Jan. 2022	0.51	0.59	4.00		
Feb. 2022	0.57	0.66	9.00		
Mar. 2021	0.36	0.31	9.00		
Apr. 2022	0.15	0.07	3.00		
May 2022	-	-	-		
Jun. 2022	-	-	-		
Jul. 2022	-	-	-		



## HOGALAGERE

### Influence of abiotic factors on the activity of pest complex of cashew during 2021-22:

Fifteen insect pests species belonging to insect order Hemiptera (4 species), Thysanoptera (2 species), Coleoptera (5 species) and Lepidoptera (4 species) infesting cashew at different crop phenological stages (Table ), and five species of their natural enemies each belonging to order Araneae, Coleoptera, Neuroptera and Diptera were recorded at varied intensity in maidan parts of Karnataka (Table 13). Among them, tea mosquito bug with intensity of 21-36% infestation, cashew stem and root borer with intensity of 2-6% infestation and apple and nut borer with intensity of 15 - 22% infestation were emerging as major pests in the region (Table ).

**Table : Influence of abiotic factors on the activity of pest complex of cashew during 2021-22**

SI No.	Common Name	Scientific Name	Family	Plant part affected	Period of occurrence	Intensity
Order : Hemiptera						
1	Tea mosquito bug	<i>Helopeltis antonii</i> Signoret	Miridae : Hemiptera	Tender shoots, panicles, young apples & nuts	Oct - Mar	Moderate to high (5.11 -26.29%)
2	Aphid	<i>Toxoptera odinae</i>	Aphididae : Hemiptera	Tender shoots, panicles and young apples & nuts	Nov-May	Low to Moderate (5-11%)
3	Mealy bug	<i>Ferrisia virgata</i>	Pseudococcidae Hemiptera	Tender shoots, panicles, young apples & nuts	Feb-May	Low (<5%)
4	Plant bug	<i>Aspongopus janus</i>	Pentatomidae: Hemiptera	Tender shoots, panicles, young apples & nuts	Nov -Jan	Low (<5%)
Order : Thysanoptera						
5	Leaf thrips	<i>Rhipiphorothis cruentatus</i>	Thripidae : Thysanoptera	Leaves	Oct.- Dec	Low to moderate (5-8%)
6	Flower thrips	<i>Scirtothrips dorsalis</i> H.	Thripidae : Thysanoptera	Inflorescence, apple, nuts	Jan- April	Moderate to high (11 -22%)
Order: Coleoptera						
7	Cashew stem and root borer	<i>Plocaederus ferrugineus</i>	Cerambycidae : Coleoptera	stem and root	Throughout the year	Low to moderate (5-15%)
8	Ash weevil	<i>Mylocherus discolor</i>	Curculionidae : Coleoptera	Young leaf, nursery	Throughout the year	Low (<5%)
9	Chafers	<i>Gametes versicolor</i>	Scarabaeidae: Coleoptera	Immature apples	Feb-May	Low (<5%)
10	Blister beetle	<i>Zonabris pustulata</i>	Scarabaeidae: Coleoptera	Immature apples	Feb-May	Low (<5%)
11	Leaf beetles	<i>Monolepta</i> sp.	Chrysomelidae: Coleoptera	Leaves	Jun-Aug.	Low (<5%)
Order: Lepidoptera						
12	Leaf miner	<i>Acrocercops syngamma</i>	Gracillariidae: Lepidoptera	Young leaf	May-Sep	Low (<5%)
13	Apple and nut borer	<i>Citripestis eutrophora (eutraphera?)</i>	Pyralidae: Lepidoptera	Apple and nuts	Feb-Jun	Moderate to high (12-21%)
14	Hairy caterpillar	<i>Euproctis fraterna</i> Moore	Pyralidae: Lepidoptera	Leaves, Inflorescence	Nov. - Mar.	Low (<5%)
15	Leaf webber	<i>Hypotima haligramma</i> M.	Gracillariidae: Lepidoptera	Leaves, Inflorescence	Sept.- Jan.	Moderate (8-12%)

**Table : Incidence of different cashew pests during different months during 2022**

Months	Incidence of major cashew pests				
	TMB	CSRB	ANB	Thrips	Aphids

	(0-4 scale)	(% damage)	(% damage)	(No./shoot or panicle)	(No. affected shoots/ plant)
Aug. 2021	0	0	0	0	0
Sept. 2021	0	0	0	0	0
Oct. 2021	0	2.13	0	0	0
Nov. 2021	0.32	4.86	0	0	0
Dec. 2021	0.39	6.54	0	4.12	7.53
Jan. 2022	0.86	6.12	0	6.43	8.54
Feb. 2022	0.92	4.35	3.82	8.16	11.65
Mar. 2022	1.53	3.16	7.85	10.13	16.73
Apr. 2022	1.84	1.64	11.36	9.61	14.88
May 2022	1.32	0	14.31	8.13	10.76
Jun. 2022	1.26	0	18.22	7.86	6.13
Jul. 2022	1.12	0	12.13	4.52	2.57
<b>Mean</b>	<b>0.80</b>	<b>2.40</b>	<b>5.64</b>	<b>4.91</b>	<b>6.57</b>

**Table : Incidence of natural enemies in cashew ecosystem during 2021-22**

	Predators	Host pest	Month of occurrence	Intensity
1	<i>Oxyopes sweta</i> (Order: Araneae) other spiders?	<i>Helopeltis antonii</i>	Oct - Mar.	Low to moderate (5-10%)
2	<i>Menochilus sexmaculatus</i> (Coccinellidae: Coleoptera)	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Feb.-May	Low to moderate (5-7%)
3	<i>Chrysoperla zastrowi</i> (Chrysopidae: Neuroptera)	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Jan.-May	Low (<5%)
4	<i>Paragens yerburiensis</i> (Syrphidae: Diptera) ( <i>is it Paragus</i> )	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Jan.-May	Low (<5%)
5	<i>Bracon</i> sp. (Braconidae: Hymenoptera)	Caterpillars (undetermined?)	Oct - Mar.	Low (<5%)

Five natural enemies such as spider with mean incidence (indicates?) of 4.98, ladybird beetle (4.28), green lace wing (1.91), syrphid (1.81) and *Bracon* sp a larval parasitoid (2.68) have been recorded on TMB, aphids, mealybug, ANB and other caterpillars in different months of the year.

**Table : Incidence of natural enemies in cashew during different months of 2022**

Months	Incidence of major cashew pests				
	<i>Oxyopes sweta</i>	<i>Menochilus sexmaculatus</i>	<i>Chrysoperla zastrowi</i>	<i>Paragens yerburiensis</i>	<i>Bracon</i> sp.
Aug. 2021	0	0	0	0	0
Sept. 2021	0	0	0	0	0
Oct. 2021	0	0	0	0	1.09
Nov. 2021	3.52	1.62	1.13	1.15	1.06
Dec. 2021	2.82	4.25	2.39	2.49	1.52

Jan. 2022	7.53	5.70	2.88	2.71	1.76
Feb. 2022	6.84	8.68	3.14	3.29	2.41
Mar. 2022	10.39	10.77	4.29	3.50	3.16
Apr. 2022	10.16	9.13	3.69	3.87	4.71
May 2022	6.68	6.59	2.55	2.27	5.26
Jun. 2022	8.74	3.49	1.98	1.72	6.15
Jul. 2022	3.04	1.18	0.81	0.75	5.03
Mean	4.98	4.28	1.91	1.81	2.68

### Correlation of weather parameters on on the activity of pest complex of cashew

The correlation between the pest incidence and weather parameters revealed that minimum temp (+0.63) evening relative humidity (+0.59) and rainfall (+0.78) had highly significant positive correlation with the activity of TMB (Table 15). Whereas negative correlation was established with maximum temperature (-0.52) and morning relative humidity (-0.39). The activity of CSRB was observed throughout the year but its peak activity was noticed during December, April and May. The minimum temperature (+0.81) and rainfall (+0.37) had highly significant positive correlation with the incidence of CSRB and negative correlation was noticed with maximum temperature (-0.49), morning & evening relative humidity (-0.34 & -0.20), respectively (Table 15).

Apple and nut borer (ANB) had significant positive correlation with maximum temperature (+0.52) and highly significant negative correlation with evening RH (-0.19) and significant negative correlation was exhibited with minimum temperature (-0.42) and morning relative humidity (-0.02) and rainfall (-0.14) with activity of ANB. The infestation of thrips showed significant positive correlation with maximum temperature (+0.59) and negative correlation was obtained with rest of the weather parameters. The aphid infestation had significant positive correlation with maximum temperature (+0.60) and significant negative correlation was observed with evening RH (-0.87) and rainfall (-0.75) (Table 15).

**Table : Correlation of weather parameters on on the activity of pest complex of cashew**

Variable	TMB (0-4 scale)	CSRB (% damage)	ANB (% damage)	Thrips (No./shoot or panicle)	Aphids (No. affected shoots/ plant)
X <sub>1</sub> -Maximum Temp	-0.52	-0.49	0.52*	+0.59*	0.60*
X <sub>2</sub> -Minimum Temp	+0.63**	+0.81**	-0.42	-0.30	-0.49
X <sub>3</sub> -RH (m)	-0.39	-0.34	-0.02	-0.57*	-0.73**
X <sub>4</sub> -RH (e)	-0.59*	-0.20	-0.19	-0.78**	-0.87**
X <sub>5</sub> -Rain fall	+0.78**	+0.37**	-0.14	-0.70**	-0.75**
X <sub>6</sub> – Wind velocity	-0.43	0.41	-0.87**	-0.87**	-0.73**
X <sub>7</sub> – Evap.	NA	NA	NA	NA	NA
X <sub>8</sub> – Sun shine hours	NA	NA	NA	NA	NA
R <sup>2</sup> Value	0.22	0.22	0.07	0.37	0.50
% Variation	0.22	0.22	0.07	0.37	0.50

\* Significant at 0.05% & \*\* highly significant at 0.01% NA- weather data not available

### Correlation of weather parameters on on the activity of natural enemies

The correlation between the spider population and weather parameters revealed that minimum temperature (+0.30) evening relative humidity (+0.71) and rainfall (+0.59) had highly significant positive correlation (Table ). Whereas negative correlation was established with maximum temperature (-0.49) and

morning relative humidity (-0.63). The activity of lady bird beetle was observed throughout the year but its peak activity was noticed during December, April and May. The minimum temperature (+0.56) and rainfall (+0.73) had highly significant positive correlation and negative correlation was noticed with maximum temperature (-0.49), morning & evening relative humidity (-0.76 & -0.88), respectively (Table ).

Green lace wing (*Chrysoperla zastrowi*) population had significant positive correlation with maximum temperature (+0.41) and highly significant negative correlation with evening RH (-0.81) and significant negative correlation was exhibited with minimum temperature (-0.58) and morning relative humidity (-0.72) and rainfall (-0.76). The syrphid population showed significant positive correlation with maximum temperature (+0.40) and negative correlation was obtained with rest of the weather parameters. The *Bracon* sp had significant positive correlation with maximum temperature (+0.46) and significant negative correlation was observed with evening RH (-0.21) and rainfall (-0.22) (Table ).

**Table : Correlation of weather parameters on the activity of natural enemies**

Variable	<i>Oxytes sweta</i>	<i>Menochilus sexmaculatus</i>	<i>Chrysoperla zastrowi</i>	<i>Paragens yerburiensis</i>	<i>Bracon</i> sp.
X <sub>1</sub> -Maximum Temp	-0.49	-0.52*	+0.41	+0.40	+0.46
X <sub>2</sub> -Minimum Temp	+0.30	+0.56*	-0.58*	-0.58*	-0.31
X <sub>3</sub> -RH (m)	-0.63*	-0.76**	-0.72**	-0.70**	+0.02
X <sub>4</sub> -RH (e)	+0.71**	-0.88**	-0.81**	-0.79**	-0.21
X <sub>5</sub> -Rain fall	+0.59*	+0.73**	-0.76**	-0.77**	-0.22
X <sub>6</sub> – Wind velocity	-0.53**	-0.71**	-0.70**	-0.74*	-0.05*
X <sub>7</sub> —Evap-	NA	NA	NA	NA	NA
X <sub>8</sub> —Sun shine hours	NA	NA	NA	NA	NA
R <sup>2</sup> Value	0.31	0.50	0.47	0.47	0.06
% Variation	15.28	14.97	2.25	2.01	4.58

\* Significant at 0.05% & \*\* highly significant at 0.01% NA- weather data not available

### Regression analysis between pests and natural enemies of cashew and weather parameters during 2022

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1	TMB	$Y = ((0.0224 * X_1) + (0.0299 * X_2) + (0.0037 * X_3) + (-0.0079 * X_4) + (-0.0028 * X_5) + (0.0297 * X_6) + (-0.0795 * X_7)) + 0.7291$	0.7438
2	CSRB	$Y = ((0.2408 * X_1) + (-1.3953 * X_2) + (-0.6044 * X_3) + (-0.2362 * X_4) + (0.0548 * X_5) + (0.8284 * X_6) + (0.2105 * X_7)) + 60.80$	0.5760
3	ANB	$Y = ((-0.9058 * X_1) + (2.5186 * X_2) + (-0.0668 * X_3) + (-0.3568 * X_4) + (-0.0588 * X_5) + (1.0052 * X_6) + (-0.7799 * X_7)) + 18.5598$	0.9095
4	Thrips	$Y = ((-0.1445 * X_1) + (0.3251 * X_2) + (-0.3534 * X_3) + (-0.1900 * X_4) + (-0.0649 * X_5) + (0.9760 * X_6) + (-0.1968 * X_7)) + 47.4292$	0.9037
5	Aphids	$Y = ((1.0829 * X_1) + (-1.3156 * X_2) + (-0.7489 * X_3) + (0.1122 * X_4) + (-0.0761 * X_5) + (1.0618 * X_6) + (-0.2126 * X_7)) + 63.5980$	0.9289
		<b>Natural enemies</b>	
6	<i>Oxytes sweta</i>	$Y = ((-0.5862 * X_1) + (0.7083 * X_2) + (-0.7213 * X_3) + (-0.0955 * X_4) + (-0.0236 * X_5) + (0.3098 * X_6) + (-0.424 * X_7)) + 85.0920$	0.7197
7	<i>Menochilus sexmaculatus</i>	$Y = ((0.2645 * X_1) + (-0.6087 * X_2) + (-0.3464 * X_3) + (-0.0518 * X_4) + (-0.0279 * X_5) + (0.3957 * X_6) + (-0.1830 * X_7)) + 44.4039$	0.6780
8	<i>Chrysoperla zastrowi</i>	$Y = ((0.1083 * X_1) + (-0.2913 * X_2) + (-0.2594 * X_3) + (0.0436 * X_4) + (-0.0177 * X_5) + (0.2334 * X_6) + (-0.0850 * X_7)) + 26.5823$	0.7154
9	<i>Paragens yerburiensis</i>	$Y = ((0.1127 * X_1) + (-0.2373 * X_2) + (-0.2481 * X_3) + (0.0362 * X_4) + (-0.0203 * X_5) + (0.2647 * X_6) + (-0.0382 * X_7)) + 24.1617$	0.5285

	(is it Paragus)		
10	<i>Bracon sp.</i>	$Y = ((-0.1314 * X1) + (0.4666 * X2) + (-0.0818 * X3) + (-0.0791 * X4) + (-0.0430 * X5) + (0.7127 * X6) + (-0.1636 * X7)) + 10.6614$	0.8853



**MB damage on nuts**



**MB damage on shoots**



**Apple and nut borer damage**



**Aphids infestation on nuts**



**leaf miner damage**

L



**scale insect infestation**

M



**scale insects infestation**

S



**Thrips infestation on apples**

**Incidence of different cashew pests**

**KANABARGI**

**Table : Correlation of weather parameters on the activity of pest complex of cashew**

Weather Parameters	TMB (% damage)	ANB (% damage)	Thrips (No./shoot or panicle)	Aphids (No. affected shoots/plant)
X <sub>1</sub> -Maximum Temp	(-) 0.25	(+) 0.61*	(+) 0.92*	(+) 0.72
X <sub>2</sub> -Minimum Temp	(+) 0.92**	(-) 0.72*	(-) 0.64*	(-) 0.44
X <sub>3</sub> -RH (m)	(-) 0.41	(-) 0.78	(-) 0.23	(-) 0.60
X <sub>4</sub> -RH (e)	(+) 0.59*	(-) 0.94**	(+) 0.34	(-) 0.75*
X <sub>5</sub> -Rain fall	(+) 0.84**	(-) 0.64*	(-) 0.28	(-) 0.77*
X <sub>6</sub> – No. of rainy days	(+) 0.89**	(-) 0.73*	(+) 0.27	(-) 0.80*

\* Significant at 0.05% & \*\* highly significant at 0.01%

#### Regression analysis between pests and natural enemies of cashew and weather parameters during 2022

S.No.	Biotic factor	Regression equation	Adjusted R <sup>2</sup>
1.	TMB	$Y = (-0.0792 X_1) + (-0.1320 X_2) + (-0.0194 X_3) + (-0.0043 X_4) + (0.0016 X_5) + (-0.0219 X_6) + 5.932$	0.84
2.	ANB	$Y = (-0.0018 X_1) + (0.1942 X_2) + (-0.0072 X_3) + (-0.0324 X_4) + (0.0024 X_5) + (-0.0758 X_6) + (-0.6124)$	0.52
3.	Thrips	$Y = (0.0756 X_1) + (0.0134 X_2) + (-0.0754 X_3) + (0.0160 X_4) + (0.0045 X_5) + (-0.1624 X_6) + 4.1369$	0.43
4.	Aphids	$Y = (-0.1213 X_1) + (0.1341 X_2) + (0.0132 X_3) + (-0.0410 X_4) + (0.0021 X_5) + (-0.0849 X_6) + 3.1390$	0.48
Natural enemies			
1	Spider	$Y = (0.0794 X_1) + (0.3232 X_2) + (0.0919 X_3) + (-0.0035 X_4) + (-0.0002 X_5) + (-0.0413 X_6) + (-6.126)$	0.34
2	Lady bird beetle	$Y = (0.1354 X_1) + (-0.2375 X_2) + (-0.0434 X_3) + (0.0416 X_4) + (0.0306 X_5) + (0.0027 X_6) + 8.1498$	0.45
3	Green lace wing	$Y = (0.1256 X_1) + (-0.2134 X_2) + (-0.0013 X_3) + (0.0192 X_4) + (-0.0065 X_5) + (0.0071 X_6) + 2.9471$	0.57
4	Syrphid	$Y = (0.0417 X_1) + (-0.0540 X_2) + (-0.0496 X_3) + (-0.0184 X_4) + (-0.0025 X_5) + (0.0204 X_6) + (-3.4128)$	0.38
Where X <sub>1</sub> - Max. temp; X <sub>2</sub> - Min temp; x <sub>3</sub> - Max. RH; X <sub>4</sub> - Min RH; X <sub>5</sub> - Rainfall & X <sub>6</sub> - Rainy days			

**Table : Incidence of natural enemies in cashew ecosystem during 2021**

Predators	Host pest	Peak occurrence (month)	Intensity
<i>Oxyopes sweta</i> Order: Araneae	<i>Helopeltis antonii</i>	Oct - Mar.	Low to moderate (5-10%)
<i>Menochilus sexmaculatus</i> (Coccinellidae: Coleoptera)	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Feb.-May	Low to moderate (5-10%)
<i>Chrysoperla zastrowi</i> (Chrysopidae: Neuroptera)	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Jan.-May	Low (<5%)
<i>Paragens yerburiensis</i> (Paragus?) (Syrphidae: Diptera)	<i>Toxoptera odinae</i> <i>Ferrisia virgata</i>	Jan.-May	Low (<5%)

Months	Incidence of major cashew pests			
	TMB (% damage)	ANB (% damage)	Thrips (No./shoot or panicle)	Aphids (No. affected shoots/plant)
Aug. 2021	1.69	0.00	0.00	1.17
Sept. 2021	2.74	0.00	0.00	0.00
Oct. 2021	3.51	0.58	0.36	0.37
Nov. 2021	4.55	0.76	1.22	0.22
Dec. 2021	5.57	0.58	2.16	1.04
Jan. 2022	10.55	0.79	0.86	0.00
Feb. 2022	19.19	2.62	2.46	3.38
Mar. 2022	23.35	2.44	2.74	2.18
Apr. 2022	12.45	0.00	0.00	1.25
May 2022	5.20	0.00	0.0	0.20
Jun. 2022	0.00	0.00	4.76	0.00
Jul. 2022	0.00	0.00	2.97	0.00

**Inference of the experiment :****Ent.3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew**

**Pest status :** Totally five insect pests species belonging to insect order Hemiptera (2 spp.), Thysanoptera (1 sp.) and Lepidoptera (2 spp.) infesting cashew at different crop phenological stages, Among them, tea mosquito bug was found to be the major insect pest in the region. The infestation of TMB was commenced from October till March attaining its peak activity from flowering to nut formation stage (10-25%). The pest attached mainly tender shoots, panicles, young apples and nuts. The occurrence of other pests of cashew are apple and nut borer (January to March), thrips (July to February) and aphids (November to May) which are infesting cashew in low to moderate intensity.

**Natural enemies :** A total of four species of their natural enemies each belonging to order Araneae, Coleoptera, Neuroptera and Diptera were recorded at varied intensity in cashew orchards of Karnataka.

Correlation analysis indicated that TMB incidence had highly significant positive correlation with minimum Temp (+0.97), evening relative humidity (+0.68), rainfall (+0.89) and number of rainy days (+0.87) and negative correlation with maximum temperature (-0.18) and morning relative humidity (-0.45).

Apple and nut borer (ANB) had significant positive correlation with maximum temperature (+0.41) and highly significant negative correlation with evening RH (-0.92); and significant negative correlation with minimum temperature (-0.52), morning relative humidity (-0.88), rainfall (-0.56) and number of rainy days (-0.84).

The infestation of thrips showed significant positive correlation with maximum temperature (+0.84) and number of rainy days (+0.23) and negative correlation was obtained with rest of the weather parameters.

The aphid infestation had significant positive correlation with maximum temperature (+0.67), and significant negative correlation was observed with evening RH (-0.76), rainfall (-0.72), and number of rainy days (-0.79).

## JAGDALPUR

### Ent. 3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew

The study was conducted at Shaheed Gundadhoor College of Agriculture and Research Station Kumhrawand, Jagdalpur, Bastar district at weekly intervals from ten randomly selected cashew trees of variety Vengurle-4 from 24 leader shoots of each tree from all the four sides. The ages of the experimental trees were 19 years. The crop observation was taken throughout the year.

The data from Table revealed that TMB damage score had highly significant negative correlation with maximum temperature (-0.610\*\*) and minimum temperature (-0.768\*\*) at 1 per cent level of significance, while significant negative correlation with wind velocity (-0.458\*) at 5 per cent level of significance. The significant positive correlation was found with morning relative humidity (0.444\*) at 5 per cent level of significance. The damage score of thrips showed highly significant and negative correlation maximum temperature (-0.520\*\*) and minimum temperature (-0.579\*\*) at 1 per cent level of significance, whereas significant negative correlation with wind velocity (-0.422\*) at 5 per cent level of significance. This pest also showed significant positive correlation with morning relative humidity (0.465\*) at 5 per cent level of significance.

The per cent damage of shoot tip caterpillar, leaf miner and leaf folder showed negative correlation with maximum temperature, respectively (-0.508\*\*), (-0.462\*\*) and (-0.571\*) while, highly significant positive correlation with morning relative humidity, respectively (0.613\*\*), (0.603\*\*) and (0.724\*\*) at 1 and 5 per cent level of significance.

**Table : Correlation of weather parameters on on the activity of pest complex of cashew**

**Table Influence of weather parameters on the activity of pest complex of cashew at Jagdalpur during the year 2021-22**

Weather Parameters	Y <sub>1</sub> - TMB	Y <sub>2</sub> - Thrips	Y <sub>3</sub> - Shoot tip caterpillar	Y <sub>4</sub> - Leaf miner	Y <sub>5</sub> - Leaf folder
X <sub>1</sub> - Maximum Temp	-0.610**	-0.520**	-0.508*	-0.462*	-0.571**
X <sub>2</sub> - Minimum Temp	-0.768**	-0.579**	-0.003	0.021	0.055
X <sub>3</sub> - Rainfall	-0.203	-0.251	0.277	0.250	0.250
X <sub>4</sub> - RH (m)	0.444*	0.465*	0.613**	0.603**	0.724**
X <sub>5</sub> - RH (e)	-0.219	-0.081	0.518**	0.510*	0.641**

X <sub>6</sub> - Wind velocity	-0.458*	-0.422*	-0.421*	-0.440*	-0.407
X <sub>7</sub> - Evap.	-0.087	-0.247	-0.598**	-0.552**	-0.670**
X <sub>8</sub> - Sun shine hours	0.027	0.050	-0.268	-0.229	-0.383
* Significant at 5 % level (2.007), ** significant at 1% level (2.674)					

**Table : Correlation of weather parameters on on the activity of natural enemies**

**Table Influence of weather parameters on the activity of natural enemies of cashew at Jagdalpur centre during the year 2020-21**

Weather Parameters	Y <sub>6</sub> - Ant	Y <sub>7</sub> - Spiders	Y <sub>8</sub> - Lady bird beetle	Y <sub>9</sub> – Brumus it is also lady bird beetle only..
X <sub>1</sub> - Maximum Temp (°C)	-0.450*	-0.360	-0.545**	-0.508*
X <sub>2</sub> - Minimum Temp (°C)	-0.160	-0.544**	-0.581**	-0.254
X <sub>3</sub> - Rainfall (mm)	-0.175	-0.368	-0.193	-0.017
X <sub>4</sub> - RH (m)	0.547**	0.301	0.434*	0.390
X <sub>5</sub> - RH (e)	-0.259	-0.199	-0.074	0.261
X <sub>6</sub> - Wind velocity (kmph)	-0.341	-0.417*	-0.419*	-0.153
X <sub>7</sub> - Evap.	-0.448*	-0.179	-0.225	-0.521**
X <sub>8</sub> - Sun shine hours	-0.153	0.073	0.017	-0.140
* Significant at 5 % level (2.007), ** significant at 1% level (2.674)				

It is evident from the data (Table 13) the population of black ant and lady bird beetle were positively correlated with morning relative humidity, respectively (0.547\*\*) and (0.434\*) at 1 and 5 per cent level of significance whereas, significant negative correlation with maximum temperature, respectively (-0.450\*) and (-0.545\*\*) at 5 and 1 per cent level of significance respectively. Spider population showed highly significant negative correlation with minimum temperature (-0.544\*\*) whereas, non significant positive correlation with morning relative humidity (r = 0.301) at 1 and 5 per cent level of significance.

#### Regression analysis between pests and natural enemies of cashew and weather parameters during 2022

**Table Regression analysis between pest-natural enemies of cashew and weather parameters during 2020-21**

Dependent factors	Independent factors	
	Multiple regression equation	R <sup>2</sup>
TMB (Y <sub>1</sub> )	$Y_1 = 2.613 - 0.012 (X_1)^* - 0.128 (X_2)^* + 0.000 (X_3) + 0.003(X_4)^* + 0.007(X_5) + 0.017(X_6) + 0.017(X_7) - 0.020(X_8)$	0.645
Thrips (Y <sub>2</sub> )	$Y_2 = -3.859 + 0.123 (X_1) - 0.145 (X_2)^* - 0.005 (X_3) + 0.033 (X_4)^* + 0.024 (X_5) + 0.040(X_6) - 0.063 (X_7) + 0.002 (X_8)$	0.495
Shoot tip caterpillar (Y <sub>3</sub> )	$Y_3 = 1.915 - 0.049(X_1)^* + 0.041 (X_2) - 0.001(X_3) + 0.010 (X_4)^* + 0.005 (X_5) - 0.133 (X_6) - 0.087 (X_7) + 0.028 (X_8)$	0.521
Leaf miner (Y <sub>4</sub> )	$Y_4 = -3.057 + 0.020(X_1)^* + 0.042 (X_2) - 0.006 (X_3) + 0.059 (X_4)^* + 0.037 (X_5) - 0.373 (X_6) - 0.140 (X_7) + 0.091 (X_8)$	0.522
Leaf folder (Y <sub>5</sub> )	$Y_5 = -12.701 - 0.010 (X_1)^* + 0.150 (X_2) - 0.020 (X_3) + 0.177 (X_4)^* + 0.049(X_5) - 0.373 (X_6) - 0.311 (X_7) + 0.052 (X_8)$	0.723

\* Significant at 5 % level

X <sub>1</sub> - Maximum Temperature (°C),	X <sub>2</sub> - Minimum Temperature (°C),
X <sub>3</sub> - Rainfall (mm),	X <sub>4</sub> - Relative Humidity (Morning %),
X <sub>5</sub> - Relative Humidity (Evening %),	X <sub>6</sub> - Wind velocity (Kmph),
X <sub>7</sub> - Evaporation,	X <sub>8</sub> - Sunshine (Hours),

The impact of weather parameters on insect pests and natural enemies were presented in the form of multiple linear regression equation (Table14).

Results (table 14) of multiple linear regression analysis between weather parameters and incidence of TMB damage score( $Y_1$ ) revealed that the minimum temperature ( $X_2$ ), morning relative humidity( $X_4$ ), evening relative humidity ( $X_5$ ) had significant contribution towards the TMB damage with the  $R^2$  value 0.645. When the minimum temperature ( $X_2$ ) increased by  $1^\circ\text{C}$ , damage of TMB decreased by 0.128 per cent, while, 1 per cent increase of morning relative humidity ( $X_4$ ) the TMB incidence increase 0.003 per cent as well. A similar trend is noticed in thrips damage with the  $R^2$  value of 0.495 and minimum temperature ( $X_2$ ) increased by  $1^\circ\text{C}$ , damage of thrips decreased by 0.145 per cent. With regards to the shoot tip caterpillar, leaf miner and leaf folder damage regression equation indicated that an increase in  $1^\circ\text{C}$  of maximum temperatures ( $X_1$ ) reduced the shoot tip caterpillar, leaf miner and leaf folder incidence by 0.049, 0.020 and 0.010 per cent per leader shoot, respectively. Similarly, increase 1 per cent morning relative humidity ( $X_4$ ) increases the shoot tip caterpillar, leaf miner and leaf folder incidence by 0.010, 0.059 and 0.177 per cent.

The multiple regression equations were developed for predicting the pests and natural enemies of cashew by using regression models. By using regression models and coefficient of determination means goodness of fit ( $R^2$ ) indicated that pests observed *viz.*, TMB damage score ( $Y_1$ ), thrips damage score ( $Y_2$ ), shoot tip caterpillar per cent damage ( $Y_3$ ), leaf miner per cent damage ( $Y_4$ ) and leaf folder per cent damage ( $Y_5$ ) were predicted to an extent of 64, 49, 52, 52 and 72 per cent, respectively. From the results of multiple linear regression model the maximum temperature, minimum temperature and relative humidity (morning) are important for determining the development of pests and natural enemies in cashew.

**Table : Incidence of natural enemies in cashew ecosystem during 2021-22**

Predators	Host pest	Peak occurrence (month)	Intensity
<i>Black ants</i>	<i>Caterpillars</i>	November	0.30- 2.30
Spiders	<i>Caterpillars</i>	December	0.14-0.93
Lady bird beetle	Thrips, Mealy Bug, Aphid	December	0.00 – 1.16
<i>Brumus</i>	Thrips, Mealy Bug, Aphid	December	0.00 -0.30

**Table : Incidence of different cashew pests during different months during 2022**

Month	Incidence of major cashew pests (Units are missing)				
	TMB	Thrips	STC	LM	LF
Jun 21	0.00	0.56	1.35	5.11	3.24
July 21	0.00	0.64	1.55	6.59	4.28
August 21	0.00	0.80	2.59	7.75	5.87
September 21	0.00	0.87	2.49	7.79	6.22
October 21	0.16	1.42	2.00	8.46	5.34
November 21	1.57	2.08	1.82	7.12	4.36
December 21	1.80	2.54	2.14	6.89	5.85
January 22	1.55	1.51	1.41	4.38	3.56
February 22	0.53	0.80	1.42	2.85	2.64
March 22	0.13	0.85	1.26	3.24	3.21
April 22	0.01	0.91	1.16	2.76	3.03
May 22	0.00	0.75	1.11	2.17	2.57
Jun 22	0.00	0.42	1.04	1.87	2.51

#### Ent.4 : Screening of germplasm to locate tolerant / resistant types to major pests of the region

<b>Centres: East Coast :</b>	Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
<b>West Coast :</b>	Madakkathara and Vengurla
<b>Plains / others:</b>	Hogalagere and Jagdalpur

The objective of this project is to identify germplasm accessions tolerant / resistant to the major pests of the region.

#### BAPATLA

During the year 2021-22, among the 35 accessions screened to identify the tolerant lines against the pests of cashew, all entries were recorded very less almost negligible incidence of leaf and blossom webber (0.00 – 0.35 percent damage), Leaf folder (0.00 – 0.65 per cent damage) and shoot tip caterpillar (0.00 – 1.85 percent damage). The accession ABT-2 has recorded the highest incidence of leaf miner (3.50%) and ASRPT and T.No. 10/12 have observed no incidence during this season (0.00%). The accession line T.No. 12/8 has recorded with highest incidence of Apple and nut borer (16.67 %) and priyanka, T.No.18/3, T.No. 233, T.No.17/5, Hy.94 T3, Hy- 94-T4 and Hy – 95-T5 were observed no incidence (0.00 %) during this season.

**Table :Screening of cashew germplasm to locate tolerance / resistance to major pests**

Entry	IC NO.	LBW (% damage)	Leaf miner (% damage)	Leaf folder (% damage)	Shoot tip caterpillar (% damage)	Apple and nut borer (% damage)
-------	--------	----------------	-----------------------	------------------------	----------------------------------	--------------------------------

Priyanka	250140	0.35	0.98	0.32	0.00	0.00
T.No.129	249784	0.00	0.62	0.62	0.00	0.29
T.No.275	249982	0.16	0.33	0.65	0.00	9.36
T.No.274	302488	0.00	1.00	0.00	0.00	1.45
T.No.12/1	---	0.00	1.18	0.00	0.16	5.07
T.No.12/8	---	0.16	2.31	0.36	0.32	16.67
T.No.18/3	---	0.34	0.85	0.17	0.33	0.00
ABT-3	302391	0.17	2.81	0.00	0.00	9.17
ABT-2	302390	0.00	3.50	0.61	0.19	2.78
T.No.3/7	--	0.00	0.67	0.00	0.00	1.67
T.No.3/4	---	0.19	0.91	0.18	0.00	5.88
T.No.1/1	---	0.00	0.16	0.00	0.00	0.87
T.No.8/7	302437	0.00	2.96	0.00	0.17	0.00
T.No.4/3	302442	0.18	1.31	0.00	0.18	6.06
T.No.4/5	---	0.00	3.04	0.00	1.75	0.43
T.No.30/1	302368	0.00	0.64	0.00	0.00	2.49
T.No.228	302376	0.00	1.59	0.00	0.63	1.01
T.No.233	302374	0.00	0.34	0.00	0.00	0.00
T.No.244	302379	0.00	0.34	0.00	0.00	0.34
T.No.268	302381	0.00	0.49	0.16	0.00	0.18
T.No. 17/5	---	0.00	0.44	0.00	0.00	0.00
T.No.5/1	250025	0.00	1.11	0.00	0.38	1.80
T.No.10/2	249911	0.00	0.00	0.00	0.00	2.56
T.No.71	302370	0.00	1.00	0.00	0.00	0.84
T.No.277	302384	0.00	0.79	0.00	1.88	1.67
T.No.2/14	302446	0.17	1.04	0.00	0.17	2.86
Ch.gudem	302409	0.32	0.66	0.16	0.80	9.56
ASRPT	---	0.00	0.00	0.33	0.00	1.36
T.No.40/1	---	0.00	0.17	0.16	0.16	2.14
T.No.6/14	302432	0.00	0.99	0.32	0.32	0.98
Hy 94-T3	---	0.00	0.85	0.00	0.00	0.00
T.No.2/5	302387	0.00	1.15	0.00	0.00	0.56
Hy 94-T4	---	0.00	0.96	0.00	0.32	0.00
Hy 95-T4	---	0.32	0.65	0.00	0.00	0.00
Vetapalem	----	0.00	0.32	0.16	0.31	0.27

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions
Leaf and blossom webber	0-5%	T.No.129, T.No.274 , T.No.12/1, T.No.12/8, ABT-3, ABT-2, T.No.3/7, T.No.8/7,T.No.4/3, T.No.4/5, T.No.30/1, T.No.233, T.No.244, T.No.268, T.No.5/1, T.No.7/12, T.No.71, T.No.277, T.No.40/1, Hy 94-T3, T.No.2/5, Hy 95-T4, Priyanka, T.No.275, T.No.18/3, T.No.3/4, T.No.1/1, T.No.228, T.No.2/3, T.No.10/2, T.No.2/14, Ch.gudem, ASRPT, T.No.6/14, Hy 94-T4, Vetapalem	5.1-10%	-

Leaf miner	0-5%	T.No.129, , T.No.12/8, ABT-2, T.No.1/1, T.No.228, T.No.244, M 15/4, T.No.2/3, T.No.7/12, T.No.40/1, Hy 94-T3, Hy 94-T4, Hy 95-T4, Vetapalem, Priyanka, T.No.275, T.No.12/1, T.No.18/3, T.No.3/4, T.No.8/7, T.No.30/1, T.No.233, T.No.268, T.No.17/5, T.No.5/1, T.No.10/2, T.No.71, T.No.277, T.No.2/14, Ch.gudem, ASRPT, T.No.6/14, T.No.274, T.No.2/5, ABT-3, T.No.3/7, T.No.4/3, T.No.4/5	5.1 -10%	
Leaf folder	0-5%	Priyanka, T.No.129, T.No.275, T.No.274, T.No.12/1, T.No.12/8, T.No.18/3, ABT-3, ABT-2, T.No.3/7, T.No.3/4, T.No.1/1, T.No.8/7, T.No.4/3, T.No.4/5, T.No.30/1, T.No.228, T.No.233, T.No.244, T.No.268, M 15/4, T.No.17/5, T.No.5/1, T.No.10/2, T.No.7/12, T.No.71, T.No.277, T.No.2/14, Ch.gudem, ASRPT, T.No.40/1, T.No.6/14, Hy 94-T3, T.No.2/5, Hy 94-T4, Hy 95-T4, Vetapalem, T.No.2/3	5.1-10%	-
Shoot tip caterpillar	0-5%	Priyanka, T.No.129, T.No.12/8, T.No.30/1, T.No.268, M 15/4, T.No.5/1, T.No.2/3, T.No.10/2, T.No.7/12, T.No.71, T.No.2/14, T.No.40/1, Hy 94-T3, T.No.2/5, Hy 95-T4, T.No.275, T.No.274, T.No.12/1, T.No.18/3, ABT-3, ABT-2, T.No.3/7, T.No.3/4, T.No.1/1, T.No.8/7, T.No.4/3, T.No.4/5, T.No.228, T.No.233, T.No.244, T.No.17/5, T.No.277, Ch.gudem, ASRPT, T.No.6/14, Hy 94-T4, Vetapalem	5.1-10%	-
Apple and nut borer	0-5%	T.No.18/3, T.No.30/1, T.No.7/12, Vetapalem, T.No.274, T.No.2/14, T.No.2/3, T.No.277, Hy 94-T4, T.No.3/7, T.No.4/5, T.No.129, T.No.228, T.No.233, T.No.244, T.No.268, Hy 95-T3, T.No.5/1, ASRPT, Priyanka, ABT-2, T.No.71, T.No.2/5, T.No.40/1, T.No.1/1, T.No.10/2, T.No.8/7, Hy 94-T3, T.No.6/14	5.1-10%	T.No.275, T.No.12/1, T.No.12/8, T.No.3/4, ABT-3, T.No.4/3, Ch.gudem

## BHUBANESHWAR

Seasonal incidence of insect pests during 2022 revealed that there was low incidence of shoot tip caterpillar and redbanded thrips while leaf miner, leaf and blossom webber incidence remained negligible. But in first experiment higher level of thrips and STC are seen.. please check.

A positive correlation with weather was observed for the shoot tip caterpillar excepting sunshine hour (-0.165). In case red banded thrips incidence a non- significant correlation was observed with the RH evening ( $r=-0.405$ ). A significant positive correlation was observed with maximum temperature  $P(r=0.860^*)$ ,) and bright sunshine ( $r= 0.656^*$ )

In case of leaf miner a positive correlation with weather was observed excepting sunshine hour (-0.148) and significantly negative correlation with maximum temperature (-0.517\*). A positive correlation was observed with other weather parameters.

**Correlation of pest incidence with weather parameters**

Weather Factor	Thrips	Shoot tip caterpillar	Leaf miner
Maximum temp.(OC)	0.860*	0.258	-0.517*
Min.temp.(OC)	0.408	0.245	0.585
Rain fall (mm)	0.438	0.418	0.227
Rainy days (No.)	0.337	0.291	0.083

R.H (FN)	0.165	0.459	0.321
R.H (AF)	-0.405	0.381	0.387
Evaporation	0.421	0.198	0.215
Wind velocity	0.309	0.024	0.036
BSSH	0.656*	-0.165	-0.148

## VRIDHACHALAM

Screening of the cashew germplasm accessions available at Regional Research Station, Vridhachalam was made to locate the tolerant/ resistant/ susceptible cashew types against TMB and other foliar feeding insects viz., leaf and blossom webber, Leaf miner, Inflorescence caterpillar, Leaf thrips and apple and nut borer pests. Totally 110 Germplasm accessions were available at Regional Research Station, Vridhachalam. The per cent damage of Leaf and blossom webber ranged from 1.0 to 1.1 and the per cent Leaf miner damage was observed as 0.1 per cent in some germplasm accessions.

## MADAKKATHARA

During the year, eight germplasm accessions were screened for TMB tolerance/ resistance and minimum damage score of 0.03 was observed in CRS 192 and CRS 202.

### Conclusion

The results of screening study during 2022 revealed that accessions, CRS 184, CRS 192 and CRS 202 were included in the group of minimum damage.

**Table :Screening of cashew germplasm to locate tolerance / resistance to major pests**

Entry	IC NO.	Tea mosquito bug (% damage) grade?	Insect 2 (% damage)	Insect 2 (% damage)	Insect 2 (% damage)
CRS 184	---	0.08	-	-	-
CRS 191	---	0.43	-	-	-
CRS 192	---	0.03	-	-	-
CRS 199	---	0.39	-	-	-
CRS 200	---	0.31	-	-	-
CRS 201	---	0.25	-	-	-
CRS 202	---	0.03	-	-	-
CRS 203	---	0.33	-	-	-

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions
Tea mosquito bug	0.03 – 0.1	CRS 184, CRS 192, CRS 202	0.15-0.39	CRS 191, CRS 199, CRS 200, CRS 201, CRS 203

## VENGURLA

The lowest TMB incidence (0.46) was noticed in varieties viz., V-1, V-3, V-7, V-8, Hy-778, Hy-993, Hy-1016, Hy-1635, Hy-1187 and Hy-1306 whereas; it was the maximum in V-4 (0.58). (no much difference between lowest and highest)

Regarding thrips the lowest (0.50) thrips infestation was recorded in varieties viz., V-1, V-3, V-7, V-8, Hy-773, Hy- 939, Hy-991, Hy-992, Hy-1039, Hy-1155, Hy-1635 and Hy- 1306 whereas it was the maximum in V-5 (0.62).

**Table :Screening of cashew germplasm to locate tolerance / resistance to major pests**

Entry	IC NO.	TMB incidence (0-4 scale)	Thrips incidence (0-4 scale)	Insect 3 (% damage)	Insect 4 (% damage)
1	V-1	0.46	0.50		
2	V-2	0.50	0.54		
3	V-3	0.46	0.50		
4	V-4	0.58	0.58		
5	V-5	0.50	0.62		
6	V-6	0.54	0.54		
7	V-7	0.46	0.50		
8	V-8	<b>0.46</b>	0.50		
9	V-9	0.50	0.58		
10	Hy- 773	0.50	0.50		
11	Hy- 778	0.46	0.54		
12	Hy- 801	0.50	0.58		
13	Hy- 883	0.46	0.58		
14	Hy- 939	0.50	0.50		
15	Hy- 991	0.50	0.50		
16	Hy- 969	0.54	0.54		
17	Hy- 992	0.50	0.50		
18	Hy- 1016	0.46	0.58		
19	Hy- 1039	0.50	0.50		
20	Hy- 1155	0.54	0.50		
21	Hy- 2005	0.50	0.54		
22	Hy-1635	0.46	0.50		
23	Hy- 1187	0.46	0.58		
24	Hy- 1306	0.46	0.50		

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions

TMB	0.46	V-1, V-3, V-7, V-8, Hy-778, Hy-993, Hy-1016, Hy-1635, Hy-1187, Hy-1306	0.58	V-4
Thrips	0.50	V-1, V-3, V-7, V-8, Hy-773, Hy-939, Hy-991, Hy-992, Hy-1039, Hy-1155, Hy-1635, Hy-1306	0.62	V-5

### HOGALAGERE

The reactions of germplasm accession and MLT-III entries maintained at Horticulture Research and Extension Centre, Hogalagere were observed to identify the susceptibility / resistance or tolerance to infestation of TMB and other major pests if any. The data indicated that none of the yielding germplasm accessions or MLT-III entries have shown resistance or tolerance to TMB infestation (Table ). However the minimum and maximum damage scores were given in Table .

**Table :Screening of cashew germplasm to locate tolerance / resistance to major pests**

Entry	IC NO.	TMB (0-4 scale)	CSRB (% damage)	ANB (% damage)	Thrips (No./shoot or panicle)
1	HREC-06	0.87	3.41	18.47	0.16
2	HREC-10	0.93	4.31	19.93	0.12
3	HREC-12	0.81	3.68	19.34	0.22
4	HREC-21	0.86	4.74	16.44	0.17
5	HREC-24	0.99	5.93	18.56	0.20
6	HREC-26	0.95	5.80	17.79	0.14
7	HREC-27	0.99	5.52	19.47	0.18
8	HREC-28	0.98	3.05	16.42	0.19
9	HREC-29	0.92	4.41	16.34	0.23
10	HREC-31	0.82	3.16	16.35	0.16
11	HREC-42	0.80	3.92	16.42	0.22
12	HREC-44	0.91	5.44	17.45	0.19
13	HREC-45	0.98	4.31	16.10	0.20
14	HREC-49	0.88	4.61	19.76	0.16
15	HREC-75	0.86	3.36	16.32	0.22
16	BH-6	0.99	5.73	18.46	0.21
17	BH-85	0.82	4.31	17.41	0.13
18	H-1597	0.91	4.68	19.98	0.23
19	K-22-1	0.96	4.50	18.17	0.15
20	H-662	0.92	3.17	17.80	0.22
21	H-675	0.81	4.48	16.90	0.18
22	H-11	0.81	3.75	16.19	0.23
23	H-14	0.98	3.46	17.64	0.22
24	H-32/4	0.91	5.35	17.33	0.17
25	Chintamani-1	0.98	5.76	18.52	0.20
26	Chintamani-2	0.93	3.91	16.72	0.12

Table : Cashew germplasm showing minimum and maximum damage of major pests

Infestation by	Min. damage recorded (range)	Germplasm accessions	Max. damage recorded (range)	Germplasm accessions
TMB	(0.80-0.90)	HREC-42, H-11, HREC-12, H-675, BH-85, HREC-31, HREC-21, HREC-75, HREC-06 HREC-49	(0.91-0.99)	HREC-44, H-32/4, H-1597, H-662, HREC-29, HREC-10, Chintamani-2, HREC-26, K-22-1, Chintamani-1, H-14, HREC-28, HREC-45, HREC-27, BH-6, HREC-24
CSRB	(< 5.0)	HREC-42, HREC-24, HREC-27 BH-6, H-14, H-675, HREC-26 HREC-10, HREC-06, HREC-44 HREC-21, H-662, H-11, H-32/4	(> 5.0)	HREC-75, BH-85, H-1597, Chintamani-1, HREC-45, Chintamani-2, K-22-1, HREC-28 HREC-12, HREC-49, HREC-31, HREC-29
ANB	(< 18.0)	HREC-06, HREC-27, HREC-29, BH-6, BH-85, HREC-31, HREC-49, HREC-24, HREC-44 H-675, HREC-28, H-11, H-14 H-662	(>18.0)	HREC-75, K-22-1, HREC-26, H-32/4, Chintamani-1, H-159, Chintamani-2, HREC-12, HREC-42, HREC-21, HREC-45, HREC-10
Thrips	(0.10-0.20)	Chintamani-2, HREC-10, BH-85, HREC-26, K-22-1, HREC-06, HREC-49, HREC-31, HREC-21, H-32/4, HREC-27, H-675, HREC-28, HREC-44	(> 0.21)	Chintamani-1, HREC-24, HREC-45, BH-6, H-14, H-662, HREC-12 HREC-42, HREC-75, H-1597 H-11, HREC-29



Germplasm screening

## JAGDALPUR

### Ent. 4: Screening of germplasm to locate tolerant / resistant types to major pests of the region

Screening of cashew germplasm was conducted to locate tolerant / resistant types to major pests of the region in the gene bank of SG CARS, Jagdalpur. Among twelve promising DCR entries planted during 1997 in SG CARS Jagdalpur, which are 23 years old, all the germplasm recorded low score for thrips and TMB. The experimental data presented in **Table 17** revealed that the lowest score for thrips was recorded in NRC-191 (0.37), whereas, germplasm NRC-130 and NRC-131 had minimum score for TMB 0.00 and 0.00, respectively. The shoot tip caterpillar infestation was ranged from 0.10 to 2.34 per cent and minimum per cent of leaf damage was reported in NRC-191 with 0.10. The lowest damage with respect to leaf miner and leaf folder was recorded in NRC-130 (0.1.80 %) and NRC-190 (2.64 %) respectively.

**Table Screening of promising DCR entries for tolerance/ resistance to the major pests at Jagdalpur during the year 2021-22**

Germplasm	TMB (mean damage score 0-4 scale)	Thrips (mean damage score 0-4 scale)	Shoot tip caterpillar (% of damaged leaves)	Leaf miner (% of mined leaves)	Leaf folder (% of damaged leaves)
NRC-130	0.00	0.81	0.27	1.80	2.88
NRC-131	0.00	0.75	0.73	4.00	2.90
NRC-136	0.01	0.95	2.34	2.00	3.39
NRC-137	0.08	0.90	1.35	8.00	3.98
NRC-138	0.50	0.41	1.12	2.00	4.77
NRC-140	0.16	0.69	1.31	3.00	2.78
NRC-190	0.18	1.22	1.85	4.30	2.64
NRC-191	0.58	0.37	0.10	2.20	4.78
NRC-192	0.24	0.71	1.29	2.40	5.28
NRC-193	0.20	0.90	1.40	2.00	4.76
VTH 711/4	0.17	0.71	1.64	3.12	3.74
Aakhane	0.02	1.29	2.07	4.80	3.88

It is evident from the data (Table 18) revealed that the lowest score of thrips was recorded in germplasm CARS-8 (0.44) whereas maximum in CARS-5 (1.29). The lowest TMB infestation was reported in germplasm CARS-7 (0.08) however, maximum TMB score was reported in CARS-3 (1.00). The minimum damage of leaf caterpillar, leaf miner and leaf folder were found in CARS-7, CARS-8 and CARS-3, respectively.

**Table Screening of local germplasm for tolerance/ resistance to the major pests at Jagdalpur during the year 2021-22**

Germplasm	TMB (mean damage score 0-4 scale)	Thrips (mean damage score 0-4 scale)	Shoot tip caterpillar (% of damaged leaves)	Leaf miner (% of mined leaves)	Leaf folder (% of damaged leaves)
CARS-1	0.88	0.89	1.11	4.09	3.14
CARS-2	0.64	0.93	1.33	2.98	4.40
CARS-3	1.00	0.45	0.11	3.61	1.93
CARS-4	0.90	0.46	1.16	4.58	5.86

CARS-5	0.25	1.29	1.85	5.40	3.19
CARS-6	0.12	0.85	1.16	2.20	1.95
CARS-7	0.08	0.68	0.06	2.00	2.29
CARS-8	0.30	0.44	0.81	1.80	2.19
CARS-9	0.16	0.71	2.71	3.00	3.79
CARS-10	0.45	1.24	1.85	3.10	4.12

The experimental data presented in Table 19 revealed that lowest score of thrips was recorded in germplasm MAD-2 (0.36 DS) whereas maximum in BPP-6 (2.09). The lowest TMB infestation (DS) was reported in germplasm VRI-2 with 0.00 however, maximum TMB score was reported in K-22-1 (1.20). The minimum damage per cent of leaf caterpillar, leaf miner and leaf folder were found in VRI-1, Hy-68 and Ullal-1, respectively with 1.00, 0.22 and 0.56.

**Table Screening of germplasm accession maintained at germplasm block for tolerance/ resistance to the major pests at Jagdalpur during the year 2021-22**

Germplasm	TMB (mean damage score 0-4 scale)	Thrips (mean damage score 0-4 scale)	Shoot tip caterpillar (% of damaged leaves)	Leaf miner (% of mined leaves)	Leaf folder (% of damaged leaves)
NRCC Sel. 1	0.10	0.95	3.14	1.34	3.74
NRCC Sel. 2	0.28	1.12	1.61	1.24	5.23
Tr. No. 3/28	0.20	1.08	3.17	0.98	1.87
Tr. No. 3/33	0.18	0.89	1.36	2.91	2.55
Tr. No. 30/1	0.13	0.62	2.69	7.92	4.17
10/19	0.70	0.99	3.91	2.49	2.42
VRI-1	0.20	0.92	<b>1.00</b>	4.23	4.16
VRI-2	<b>0.00</b>	1.27	2.78	2.37	3.94
VRI-3	0.05	1.27	3.22	1.34	4.29
V-1	0.60	0.84	4.46	6.40	5.42
V-4	1.00	1.50	3.62	4.50	7.16
Ullal-1	0.92	1.51	1.53	1.88	<b>0.56</b>
Ullal-2	0.66	0.79	1.89	1.17	1.20
H-1598	0.16	1.61	1.65	1.23	3.05
H-1608	0.01	1.80	3.36	1.34	4.77
Chintamani-1	0.17	1.07	2.14	1.53	2.05
Bhubnehsvar-1	0.12	1.05	2.35	1.75	2.19
H-1591	0.57	0.48	3.62	3.49	3.39
MAD-2	0.01	<b>0.36</b>	2.77	4.05	4.70
MAD-1	0.14	0.62	2.07	1.87	2.62
K-22-1	<b>1.20</b>	0.80	3.15	4.04	4.81
M-15/4	0.40	1.10	5.95	1.18	3.65
BPP-1	0.30	1.13	2.72	1.25	4.51
BPP-2	0.50	0.94	1.56	1.20	2.01
BPP-4	0.72	0.89	2.07	1.24	2.52
BPP-5	0.06	0.76	2.12	1.44	2.60
BPP-6	0.14	<b>2.09</b>	2.52	3.56	3.07
BPP-8	0.13	0.87	1.55	2.24	2.53
HY-68	0.08	0.71	3.35	<b>0.22</b>	2.20
HY-367	1.00	1.05	3.67	1.79	2.57

JHARGRAM-1	0.18	1.00	2.31	1.96	3.09
Bastar Sel. -1	0.80	1.29	3.25	1.52	4.80

Perusal of the data (Table 20) showed that among the entries screen out during 2021-22 lowest TMB damage score was recorded in NRC-130, AAKHANE, VRI-3, Mad-2, 30/1with (0.00), respectively. Whereas, germplasm CARS-3 had maximum (2.05) damage score of TMB. Similarly thrips damage score was observed throughout the year in which maximum damage score was recorded HY-367 with 2.03 and minimum damage score was recorded MAD-1 with 0.37 DS. The minimum infestation of shoot tip caterpillar, leaf miner and leaf folder was recorded in BPP-2, CARS-2 and CARS-6 with 1.64, 0.00, 0.48 per cent, respectively however maximum per cent of leaf damage was reported in M-15/4, 30/1, MAD-1 with 6.08, 3.98 and 2.56 per cent, respectively.

**Table. Minimum and maximum damage scores recorded in germplasm during 2021-22**

Infestation by	Minimum damage	Germplasm	Maximum damage	Germplasm
Thrips (0-4 scale)	0	-	1.20	Hy-367
TMB (0-4scale)	0	NRC-130, NRC-131, VRI-2,	2.09	K-22-1
Shoot tip caterpillar	0	-	5.95	M15/4
Leaf miner	0	-	8.00	NRC-137
Leaf folder	0	-	7.16	V-4

\* \* \*

## **CHAPTER II : ORGANISATION**

## 1. GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

The ten coordinating centres and one sub centre as well as three co-operating centres are located in the East Coast, West Coast and Plain Regions (plateau region) of the country.

The centres of the East Coast are located at Bapatla, Bhubaneswar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800 mm to 2000 mm annually and is distributed over a period of 7-8 months from June to January. The soil is mainly sandy, red sandy loam, red loam and laterite. Bapatla centre is situated at an elevation of 54.9 m from mean sea level (MSL) with 40° 54' latitude and 80° 28' longitude. At Bapatla the annual average rainfall is 1167 mm and the temperature ranges from 17.3° C to 37.8° C; the soil is sandy soil with low organic matter, medium N, low P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. Average Water Holding Capacity (AWC) of soil is 100 mm and the climate is sub humid (dry). At Bhubaneswar average rainfall is 1550 mm and the temperature ranges from 14.3 to 37.1° C. The soil is red soil, red loamy and laterite. The climate is sub humid (dry), AWC 100 mm. The Jhargram centre is located 87° longitude and 78.8° latitude. At Jhargram average rainfall is 1622 mm and the temperature ranges from 11.3 to 39.4° C. The soil is red, laterite, shallow depth gravels, low in organic matter, N and high in P<sub>2</sub>O<sub>5</sub> and K<sub>2</sub>O. The climate is sub humid (dry), AWC 200 mm. At Vridhachalam average rainfall is 1215 mm and the temperature ranges from 18.7 to 35.7° C, the soil is red laterite, low in organic matter and N, medium in P<sub>2</sub>O<sub>5</sub> and high in K<sub>2</sub>O. The climate is semi arid (dry), AWC 125 mm.

The centres in the West Coast are located at Madakkathara, Pilicode, Vengurla and Paria and a cooperating centre at Goa. This zone receives rainfall ranging from 2800 mm to 3800 mm annually and is distributed over a period of 7-9 months from April/June to December. The soil is typically sandy, sandy loam, sandy clay loam and laterite (oxisol). Madakkathara receives an average rainfall of 3550 mm and the temperature ranges from 22.0° C to 36.2° C, the soil is laterite (oxisol), medium in N, low in P and medium in K contents. The climate is humid and AWC is 150 mm. At Vengurla average rainfall is 2916 mm and the temperature ranges from 17.4° C to 32.9° C. Centre is situated at an elevation of 90m above MSL; the soil is sandy loam to sandy clay loam with high organic matter, N, K and low in P. The climate is humid and AWC is 150 mm. Paria centre is characterized by black loamy soil and receives an average annual rainfall of 2200mm and temperature ranges from 18.5°C to 33.0°C with a mean RH of 70.22 percent.

Maidan tract characterized by even land has Chintamani, Darisai, Jagdalpur centres and co-operating centre at Arabhavi in this region. Chintamani comes under Region III (Southern dry region), Eastern dry zone (zone V) of Karnataka and receives average rainfall of 789 mm and the temperature ranges from 13.9 to 34.5° C. Centre is situated at an elevation of 300m above MSL, the soil is red sandy loam, deficient in N, medium in P<sub>2</sub>O<sub>5</sub> and high in K<sub>2</sub>O. The climate is semi arid (dry), AWC is 150 mm. Darisai Centre has well drained loamy soil and receives about 1200 mm of rain during June to October. Jagdalpur is located at 17° 45' to 20° 34' N and 80° 15'to 82° 15' E longitude with altitude ranging from 550 m to 850 m above MSL with average annual rainfall ranging from 1200-1400 mm. The maximum and minimum temperatures are 41° C and 6° C, respectively. Texturally soils are sandy loam to silty loam, with very poor moisture retaining capacity having shallow depth with poor organic matter (0.05%) and pH value (5.5 - 6.5) about normal. Arabhavi centre is situated in North transitional zone (zone-8) of Karnataka and soils are texturally red sandy loams and having medium to deep soil depth.

The average annual rainfall is 1200 mm. A cooperating centre in Barapani / Tura in Meghalaya region is characterized by hilly terrain and has deep black loamy soils. The average rainfall ranges between 2500 – 4000 mm spread out during the months of June to November. The cooperating centre at Goa is characterized by lateritic soils with shallow to medium depth. The centre is situated at altitude of 25-40m above the MSL. This centre receives rainfall ranging from 2800 mm to 3800 mm spread out during June to December.

## **TRANSFER OF TECHNOLOGY**

### **BAPATLA**

#### **A. Diagnostic visits:**

- Dr. A . Snehalatha Rani, Senior Scientist (Pl. Path), Dr. Ch. Kishore Kumar, Senior Scientist (Pl. Path) HRS, Kovvuru and Dr. B. Nagendra Reddy, Scientist (Ento), CRS, Bapatla visited the cashew plantations at Gopalapuram village of Devarapalli Mandal, West Godavari Dist. on 05.01.2022 and observed gummosis infestation on cashew trees and collected the samples for isolation to identify the casual organism.
- Dr. B. Nagendra Reddy, Scientist (Entomology) visited cashew fields at Sunnadevi, Akkupalli and Boddapadu villages of Palasa Mandal, Srikakulam district and observed infestation of Leaf and Blossom webber and aphids infestation in cashew fields. Further

created awareness to the cashew farmers of Palasa Mandal about different pests of Cashew and their management on 31.01.2022

- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) visited the Kalrayinigudem, Ayyaparajugudem, K. Gokavaram, Annapanenivarigudem villages of Lingapalem Mandal, West Godavari district for inspection of area expansion programme of cashew under SCSP programme sponsored by ICAR-DCR, Puttur on 17.02.2022 along with K. Sneha, M. Deepika, V. Harish VHAs of respected villages and Farmers.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) visited the Kamayyakunta village of Buttayagudem Mandal, West Godavari District on 18.02.2022 along with k. Bhavani, VHA, Kamayyakunta village for inspection of area expansion programme of cashew under TSP programme sponsored by ICAR-DCR, Puttur and advised the farmers on Management practices of Cashew Plants during the summer months.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) identified the germplasm which is early type, cluster bearing, bold nut type accession from the farmer field namely Sri. Bakka Venkata Swamy at Kursakannagudem village of Kamayyakunta Panchayat, Buttayagudem Mandal, West Godavari District on 18.02.2022
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) visited the Venkata cashew nursery for joint inspection along with Deputy Director, Directorate of Cashewnut and Cocoa Development, Cochin and ADH, Jangareddygudem at Buttayagudem West Godavari District on 02.03.2022 under upgradation of cashew nursery scheme sponsored by DCCD, Cochin.
- Dr. B. Nagendra Reddy, Scientist (Entomology) visited cashew fields at Latturu and Boddapadu villages of Palasa Mandal, Srikakulam district and observed the infestation of Tea mosquito bug, Leaf and Blossom webber and Mealy bug in cashew fields. Further created awareness to the cashew farmers of Palasa Mandal about different pests of Cashew and their management on 23.03.2022
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) Dr. B. Nagendra Reddy, Scientist (Ento) visited the cashew fields at Nadimpalem village of Koyyuru Mandal, Visakhapatnam District on 28.03.2022 along with Smt. Sandhya, VHA, Nadimpalem village. Advised the farmers on Management practices of Cashew Plants during the summer months.
- Dr K. Umamaheswara Rao, Senior Scientist (Hort.) & Head (FAC), Dr. B. Nagendra Reddy, Scientist (Ento.) and scientists of Mango Research Station, Nuzvid visited the cashew fields at Annavaram and Siddartha Nagar villages of Nuzvid Mandal on 19.04.2022 and observed

the Nannari as an intercrop in cashew and suggested the control measures for foliage and floral pests' management in cashew. Advised the cashew farmers on cultivation practices

- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.), Dr. B. Nagendra Reddy, Scientist (Ento.) along with Sri. M. Venkateswarlu, Additional Director of Horticulture, Sri. R. Srinivasa Rao, DDH and DHO, Vizianagaram and Sri. K. Satyanarayana Reddy, DHO Parvathipuram Manyam district visited the cashew fields at Parvathipuram, Veeragattam and Seethampeta Mandals of Pravathipuram Manyam district to assess the condition of cashew crop on 30.04.2022 and report submitted to Government of Andhra Pradesh.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) identified the germ plasm lines namely Rajavaram- 1, Rajavaram-2 and Rajavaram-3 from the farmers fields at Rajavaram village of Koyyalagudem Mandal, West Godavari District on 11.05.2022. the collected germplasm lines that are early types, cluster bearing, bold nut type accessions.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) & Head and Dr. B. Nagendra Reddy, Scientist (Ento.) attended Rythu dinotsavam conducted by Agriculture Department, Bapatla District, Govt. of AP on 08.07.2022 at Dr. NTR College of Food Science and technology, ANGRAU, Bapatla.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) & Head visited the Annapanenivarigudem and Kalrayunigudem villages of Lingapalem Mandal West Godavari district for inspecting cashew area expansion programme under SCSP, sponsored by ICAR-DCR, Puttur on 20.09.2022.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) & Head along with Smt. Jennamma, District Horticultural Officer, Bapatla District visited the Kadavakuduru, Pandillapalli, Pullaripalem, Chinaganjam villages of vetapalem mandal of Bapatla District and APFDC plantations of Bapatla division on 13.10.2022 and observed the cashew stem and root borer infestation in cashew plantations of APFDC plantations and advised the control measures and cultural practices to be taken up in cashew plantations.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) & Head identified the dwarf cashew genotype at Pullaripalem village of Vetapalem mandal, Bapatla district which giving high yield of cashew on 13.10.2022
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) & Head and Dr. B. Nagendra Reddy, Scientist (Entomology) organized the training programme on cashew at Gangavaram village of Rajavaram panchayat, Koyyalagudem Mandal, West Godavari district on 28.10.2022 under SCSP sponsored by ICAR- DCR, Puttur. Distributed the Tamarind grafts (Tettu

amalika) and custard apple grafts (Arka sahan) to the beneficiaries of cashew area expansion programme under SCSP sponsored by ICAR, DCR, Puttur for getting additional income. 120 No's of farmers attended the programme. Further collected the scion sticks of cashew germplasm with specific trait from K. kannappagudem, Pandugudem village with earliness in character on 28.10.2022 which was identified during February, 2022.

- Dr. B. Nagendra Reddy, Scientist (Ento) visited the Guddigudem and Karagapadu villages of Gopalapuram mandal of West Godavari District on 18.11.2022 to identify the beneficiaries to implement the cashew area expansion programme under SCSP sponsored by ICAR- DCR, Puttur. Further conducted the field visit and observed the cashew stem and root borer infestation in cashew plantations and advised the control measures and cultural practices to be taken up in cashew plantations.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) & Head visited Alagayapalem village of Ulavapadu Mandal, Nellore Dist and Identified 3 cashew germplasm lines having bold nut type on 21.12.2022.

#### **B. Training Programmes conducted**

- AP Forest Development Corporation, Govt of AP in association with Cashew Research Station, Bapatla organized the workshop on **Advances in Cashew Production Technology** to the officials of APFDC to create the awareness on new techniques in cashew production for development of cashew plantations in APFDC on 07.01.2022. Sri B. Vijaya Kumar, Dy. Conservator of Forests and Director of Eco Tourism, APFDC attended as Chief Guest and Dr. J. Dilip Babu, Principal Scientist (Hort) and Head, CRS, Bapatla and Zonal Research Head, Coastal Zone-II Dr. YSRHU attended as Guest of Honour. Dr. K. Umamaheswara Rao, Senior Scientist (Hort) and Dr. B. Nagendra Reddy Scientist (Ento) delivered the lectures on Establishment of Cashew Production technology and Integrated Pest Management in cashew respectively.
- Organized the District level seminar on Advances in Cashew production technology sponsored by Directorate of Cashewnut and Cocoa Development, Cochin at Conference Hall, MPDO's office, Koyyuru, Visakhapatnam District on 29.03.2022. The programme was attended by Dr J Dilip Babu, Principal Scientist (Hort.) & Head, Cashew Research Station, Bapatla , Dr. T. Janakiram, Hon'ble Vice-chancellor, Dr YSRHU Dr. R.V.S.K. Reddy, Director of Research, Dr YSRHU, Sri G. Prabhakar Rao, Assistant Director of Horticulture, Narsipatnam, Dr K. Umamaheswara Rao, Senior Scientist (Horticulture), Dr. B. Nagendra Reddy, Scientist (Entomology), Ms. Sudarshana Horticultural Officer (Koyyuru), Smt Peeta

Simhachalam, Sarpanch (Rajendrapalem), local representatives, Village Agricultural Assistants and Village Horticultural Assistants around 150 farmers attend the programme.

#### **C. Trainings Programmes Participated:**

- Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) & Head attended the interface meeting on Cashew at Panjim, Goa on 27.08.2022 organized by Directorate of Cashewnut and Cocoa Development, Cochin with Research organizations, development departments and industries and presented the scope of cashew area expansion in Andhra Pradesh.
- Dr. B. Nagendra Reddy, Scientist (Ento) attended Agri Tech- 2022 at Regional Agricultural Research Station, ANGRAU, Lam from 03.12.2022 to 05.12.2022 organized by Acharya NG Ranga Agricultural University, Guntur.

#### **D. HRD Trainings:**

- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) and Dr. B. Nagendra Reddy Scientist (Ento) attended the training programme on Cashew Production and Post Harvest Technologies from 16<sup>th</sup> – 18<sup>th</sup>, February, 2022 organized by ICAR- DCR, Puttur under the sponsorship of MANAGE, Hyderabad.
- Dr. K. Umamaheswara Rao, Senior Scientist (Hort) and Dr. B. Nagendra Reddy Scientist (Ento) attended the Faculty Development Programme on Teaching Competency Enhancement through Innovative Methods from 15<sup>th</sup> – 19<sup>th</sup>, March, 2022 organized by ICAR- NAARM, Hyderabad

#### **E. Group discussions:**

- Dr. J. Dilip Babu, Principal Scientist (Hort.) & Head, Dr K. Umamaheswara Rao, Senior Scientist (Hort.), Dr. B. Nagendra Reddy, Scientist (Ento.) attended the 11<sup>th</sup> REC meeting virtually on 11.02.2022.
- Dr. K. Umamaheswararao, Senior Scientist (Horticulture) attended the Udyana Sandarshana - 2022 at university campus, Venkataramannagudem and exhibited all the cashew samples on 24.02.2022
- Dr. K. Umamaheswara Rao. Senior Scientist (Hort.) and Head (FAC) and Dr. B. Nagendra Reddy, Scientist (Ento.) attended Pre ZREAC meeting at HRS, Lam on 11.04.2022 and presented the research findings for the year 2020-21.
- Dr. J. Dilip Babu, PS (Hort) & Head, Zonal Research Head, CZ-II, Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) and Dr. B. Nagendra Reddy, Scientist (Ento.) attended ZREAC meeting through virtually on 04.05.2022. Dr. J. Dilip Babu, Zonal Research Head, Coastal Zone – II, Principal Scientist (Hort) & Head, presented the action taken report for the

previous year and Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) presented the research highlights of the CRS, Bapatla and clarified the doubts raised by the farmers regarding cashew crop.

- Dr. J. Dilip Babu, Principal Scientist (Hort) & Head, Dr. K. Umamaheswara Rao, Senior Scientist (Hort.) and Dr. B. Nagendra Reddy, Scientist (Ento.) attended 15<sup>th</sup> State Level Technical Programme (SLTP) meetings through virtually on 24.05.2022 to 26.05.2022 and presented the work done report for the year 2020-21 and tentative technical programme for the year 2022-23 with respect to Crop Improvement, Crop Management and Crop Protection for Plan and Non-Plan projects

#### **G. Field Days:**

- Dr. K. Umamaheswara Rao, Senior Scientist (Horticulture) & Dr. B. Nagendra Reddy, Scientist (Entomology) organized the Cashew Field day at Pathapatnam, Srikakulam district on 24.03.2022 sponsored by Directorate of Cashewnut and Cocoa Development, Cochin. Smt. Mangamma, Horticultural Officer, Pathapatnam, Sri. Samba Murthy, Secretary BREDS NGO Pathapatnam, VHAs and VAAs of Pathapatnam, Hiramandalam and Miliyaputti mandals and 150 No's of farmers attended the programme.

#### **OTHER INFORMATION:**

- Dr. J. Dilip Babu, Principal Scientist (Hort) & Head, CRS, Bapatla and Zonal Research Head, CZ-II, Dr. YSRHU retired from his service on 30.06.2022 on attaining superannuation.
- Dr. T. Janakiram, Hon'ble Vice Chancellor, Dr. YSRHU and Dr. L. Naram Naidu, Director of Research, Dr. YSRHU visited the Cashew Research Station, Bapatla on 30.06.2022 and observed the different activities going on at CRS, Bapatla.
- Smt. G. Aruna Reddy, MPP, Ozili Mandal Nellore District and DO, Extension training Centre, Bapatla visited the Dr. YSRHU- Cashew Research Station, Bapatla on 07.07.2022 and they were explained about the different nursery activities carried out at Bapatla.
- Dr. Mohana G.S. Principal Scientist (Genetics and Plant Breeding) and PC Cell In charge, AICRP on Cashew, ICAR- DCR, Puttur visited Dr. YSRHU- CRS, Bapatla on 25.09.2022 and reviewed the progress of research work carried out at Bapatla centre. Further, visited the farmers cashew field at Ramapuram village of Vetapalem Mandal, Bapatla district, where farmer growing cashew in sea coast by using water by digging ponds at a depth of 10 feet.

- WAASAN, NGO working in Srikakulam agency area of Seethampeta, Bahmini, Veeraghattam mandal representatives (13 no's) visited Dr. YSRHU- CRS, Bapatla and underwent training on Cashew Production Technology on 28.11.2022
- Progressive farmer in Oil palm, Sri. U. Chakrapani, Pedavegi, Eluru district visited the Dr. YSRHU- CRS, Bapatla on 30.11.2022 and they were explained about the nursery and research activities going on at Dr. YSRHU- CRS, Bapatla.



Dr. YSRHU- CRS, Bapatla organized the workshop on **Advances in Cashew Production Technology** to the officials of APFDC on 07.01.2022



Dr. YSRHU- CRS, Bapatla , organized the Cashew Field day at Pathapatnam, Srikakulam district on 24.03.2022



Dr. YSRHU- CRS, Bapatla, Organized the District level seminar on Advances in Cashew production technology at Koyyuru, Visakhapatnam District on 29.03.2022



Dr. YSRHU- CRS, Bapatla organized training on Cashew Production Technology to WAASAN, NGO working in Srikakulam agency on 28.11.2022



Dr. YSRHU- CRS, Bapatla, conducted the Grama Sabha at RBK, Vedullapalli Village of Bapatla Mandal and District on 04.06.2022



Identified the germplasm lines from the farmers fields at Rajavaram village of Koyyalagudem Mandal, West Godavari District on 11.05.2022.



Scientists visited the cashew fields at Parvathipuram, Veeragattam and Seethampeta Mandals of Pravathipuram Manyam district to assess the condition of cashew crop



Dr. T. Janakiram, Hon'ble Vice Chancellor, Dr. YSRHU and Dr. L. Naram Naidu, Director of Research, Dr. YSRHU visited the Cashew Research Station, Bapatla on 30.06.2022 and observed the different activities going on at CRS, Bapatla.



Dr. Mohana G.S. Pri. Scientist (Gen. and Plant Breeding) and PC Cell In charge, AICRP on Cashew, ICAR- DCR, Puttur visited Dr. YSRHU- CRS, Bapatla on 25.09.2022



**Diagnostic visits conducted by Scientists**

### **Bhubaneswar**

#### **Extension activities**

- The scientist of the center acted as resource person on the topic “*Commercial cultivation of cashew and wasteland development*” in the training programme on ‘Alternate crop Plan(Beyond Paddy)’ organised by Central Horticultural Experiment Station(IIHR-CHES),Bhubaneswar on 22.06.2022
- The scientist of the centre also participated as resource person in two skill based training for entrepreneurship development on “Orchard management” and “Fruit Crops Nursery Management” organised by Directorate of Horticulture, Government of Odisha under Rashtriya Krishi Vikash Yojana(RKVY) on 18<sup>th</sup> and 24<sup>th</sup>

August,2022 respectively and delivered lectures on management of cashew orchards and care in cashew nursery .

- Scientist of the centre attended as member in the committee to conduct field inspection of replanting programme of cashew implemented by Odisha State Cashew Development Corporation Ltd., Bhubaneswar from 08<sup>th</sup> to 10<sup>th</sup> September,2022
- M.Sc(Ag) students of Fruit Science and Horticulture Technology Department of College of Agriculture(OUAT), Bhubaneswar visited the Cashew Research station on 07.06.2022 for their practical exposure.
- B.Sc(Hons) Agriculture students of M.S.Swaminathan School of Agriculture, Centurian University of Technology and Management(CUTM), Paralakhemundi visited the Cashew Research Station on 31.10.2022 for their practical exposure.
- Dr P.K.Panda participated in discussion programme on the topic "*Chhatta Upare Bagicha*" and "*Kaju Utpadana Brudhi pain Adhunika Gyana Kaushala O Sarakari Protsahana*" in Kisanvani programme of All India Radio, Puri on 01.03.2022 and 12.06.2022 respectively.
- Under SCSP Scheme, 1300 number of cashew grafts along with inputs like FYM, fertilizers, pesticides ,fungicides and weedicides were distributed to eleven scheduled caste farmers of Dhenkanal and Khordha district under area expansion programme on cashew.
- Under TSP Scheme, 1100 number of cashew grafts along with inputs like FYM, fertilizers, pesticides ,fungicides and weedicides were distributed to sixteen tribal farmers of Dhenkanal and Khandhamal district under area expansion programme on cashew.

### Training Programs organized

Sl.No	Title	Date	Place	No.of Participants	Category
1	Cashew Production Technology, Post Harvest Management and Value addition	02.03.2022	Krishi Vigyan Kendra, Sonepur in Sonepur district	50	SCSP Training Programme
2	Scientific Cashew Cultivation	17.03.2022	Krishi Vigyan Kendra, Mayurbhanj-I	50	TSP Training Programme
3	District Level Seminar on Cashew	23.03.2022	Gayaganda village of Jaganathprasad block in Ganjam district	100	DCCD

4	Sustainable Cashew Production Technology	25.03.2022	CDAO conference Hall in Keonjhar district	50	SCSP Training Programme
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Area Expansion on Cashew under TSP at Bahadapal of Dhenkanal District



Farmers' Training under TSP at Mayurbhanj district on 17.03.2022



Farmers' Training under SCSP at Keonjhar district on 25.03.2022



Exposure visit of students



District Level Seminar on Cashew at Gayaganda village of Ganjam district on 23.03.2022



Farmers' Training under SCSP at Sonepur district on 02.03.2022

## DARISAI

### Demonstration of High yielding varieties with bigger size nut

The variety Jagannath, Balbhadra and V4 were demonstrated among the Scheduled Cast farmers.

## JHARGRAM

### SCHEDULED CASTE SUB PLAN

Activities taken up	No. /Area (ha)	Amount (Rs. in lakhs)
a. Area expansion	2 ha	0.625
b. Training	2	0.80
c. Capital - Small Equipments	--	0
<b>TOTAL</b>		1.425

### Work Implemented

Cashew grafts were distributed to 120 farmers of two different districts (60 farmers from Jhargram District and 60 farmers from Purba Medinipur district) under area expansion programme. 4 cashew grafts (Var : BPP- 8, Vengurla- 7, Bidhan Jhargram- 2 and Jhargram- 1) were given to each farmer. Beneficiary selection from Jhargram district was done by Assistant Director of Agriculture (Soil Conservation), Department of Agriculture, Jhargram District, Government of West Bengal. Beneficiary selection from Purba Medinipur district was done by Kasafaltalya Samabay Krishi Unnayan Samity Limited, Vill- Gobindapur, Purba Medinipur, West Bengal- 721453. Apart from high yielding cashew grafts, fungicide, pesticide, neem cake, bone meal and black polythene for mulching were supplied to the farmers. Labour wages for pit digging, planting half circle trench and polythene mulching were also provided to the farmers. The beneficiary details are furnished in the table –1 & 2. The fund utilization details for two different locations are also furnished in table- 3 & 4.

### Location of Area Expansion Programme:

There were two locations of two different districts of West Bengal where area expansion programme was implemented. Kishoripur and Balibandh villages of Jamboni Block, Jhargram District and Gobindapur Village of Purba Medinipur

### Details of Training programme organized:

There were two training programmes organized under Scheduled caste sub plan project during 2022 - 23. The training programmes were organized on 03.03.2022 and 21.03.2023 at Jamboni Block of Jhargram district and Ramnagar – I block, Purba Medinipur, West Bengal respectively. Total number of farmers attended the first training was 60 and the second was 60. The farmers were

trained on various aspects of cashew cultivation such as propagation methods, planting technique, maintenance of cashew orchards, management of pest and diseases of cashew crops, processing of cashew apple. The farmers were given literature on various aspects of cashew cultivation. At the end of every training programme, a questionnaire session was conducted and each expert asked 5 questions to the farmers on cashew cultivation aspect, which the expert had already taught them during the lecture session. The particular farmer who had able to answer the question was awarded with a small gift. The farmers were given travelling allowance also. The state level officers were invited for the training programmes. Dr. Bibekananda Mohanty, Assistant Director of Agriculture (DPAP), Jhargram district , Mr. Tanmay Das ADA, Jamboni block were the dignitaries attended the first training and Dr. Reba Mondal, Assistant Director of Horticulture, State Cashewnut and Horticulture Development Farm, Digha, Purba Medinipur, West Bengal, Sri. Tapas Kanti Dutta, Pradhan, Depal, Smt. Shantilata Panja, Board of members of Kasafaltalya Samabay Krishi Unnayan Samity Limited were the dignitaries in the second training.



Orchard of Bidhan Bonsai Kaju



Training under SCSP

## Hogalagere

### SCSP Training programmes organized

1. Training programme on “Introduction to Cashew crop and its scientific production technologies” was organised by the team of AICRP on Cashew of HREC, Hogalagere under SCSP scheme on 19-03-2022 at Kodadavadi village.
2. Training programme on “Cashew crop introduction and scientific production technologies of Cashew” was organised by the team of AICRP on Cashew of HREC, Hogalagere under SCSP scheme on 22-03-2022 at Doddaganjur village.
3. Training programme on “Introducing Cashew crop and production technologies of Cashew” was organised by the team of AICRP on Cashew of HREC, Hogalagere under SCSP scheme on 25-03-2022 at Dalasanur village.
4. Training programme on “Cashew crop introduction and Scientific production technologies of Cashew” was organised by the team of AICRP on Cashew of HREC, Hogalagere under SCSP scheme on 26-03-2022 at Bagalahalli village.
5. Training programme on “Introduction to Cashew crop and scientific production technologies of Cashew” was organised by the team of AICRP on Cashew of HREC, Hogalagere under SCSP scheme on 27-03-2022 at Bayappalli village.
6. SCSP Training programme on “Scientific Cashew production technologies” was conducted in Mutthakapalli village, Srinivasapura Taluk, Kolar District on 29-11-2022.

Sl. No.	Village	Participants of the Training programme		
		SC	General	Total
1	Kodadavadi,	5	19	24
2	Doddaganjur	10	11	21
3	Dalasanur	10	27	37
4	Bagalahalli	5	31	36
5	Boyappalli	6	28	34
6	Mutthakapalli	14	6	20
Total		50	122	172



SCSP Training programme on scientific production technologies in cashew was conducted in Mutthakapalli village, Srinivasapura Taluk, Kolar District on 29-11-2022

#### **Extension activities/training classes**

1. Research and progress activities as well as technologies developed from HREC, Hogalagere were briefed to batch of 40 students, who visited the station from Chintamani college of Sericulture, Chikkaballapur District on 01-01-2022.
2. Mr. Venkatarama Reddy from Adavichambakur village, Somayajalahalli post, Srinivasapura Taluk, Kolar District visited the Research station for consulting the Scientists on 05-03-2022, with respect to availability of mango and cashew planting material and the technologies of these crops cultivation.
3. Mr. Ravikumar (9611675701), Manjiganahalli, Mulabagal Taluk, Kolar District. Visited HREC, Hogalagere on 06-04-2022 and enquired about Lime plants and cashew planting material.
4. Mr. Lakshmanappa (9480130379), Modiganahalli, Bangarpet Taluk, Kolar District, Visited HREC, Hogalagere on 18-06-2022 and enquired about varieties selection in cashew and crop cultivation aspects.
5. Mr. Venugopal (9886231498), Pichaguntarahalli, Malur Taluk, Kolar District, Visited HREC, Hogalagere on 20-06-2022 and enquired about cashew crop variety selection and crop cultivation aspects.
6. Mr. Pavan Venkatesh (9845079335), Anekal, Kolar District, consulted HREC, Hogalagere scientists on 06-06-2022 and enquired about establishment of new cashew orchard.
7. Mr. Diwakara Reddy (8951159668), Anekal, Kolar District, consulted HREC, Hogalagere scientists on 06-06-2022 and enquired about establishment of new cashew orchard.

8. On 22-11-2022 scientists of HREC Hogalagere visited farmers field SCSP beneficiary at Hogalagere, Srinivasapura Taluk and suggested the good crop management strategies.
9. Exhibited cashew production technologies in Totagarike Mela organised by University of Horticultural Sciences Bagalkot for 3 days between 29<sup>th</sup> to 31<sup>st</sup> December 2022.



Cashew exhibition **Thotagarika Mela 2022** at UHS Bagalkot



Fertilization in experimental plots of Cashew and hands on experience to the diploma students of Horticulture

## Visitors



Dr. Mohana, G.S., Principal Scientist (Genetics and Cytogenetics) and Scientist-in-charge, Project Coordinator's cell, ICAR-DCR, Puttur visited on 08-07-2022



Visit of Dr. S. L. Jagadeesh, ADRE, RHREC, Bangalore to HREC Hogalagere on 12-10-2022



Visit of Dr. H. P. Maheshwarappa, Director of Research, UHSB, Bagalkot on 04-11-2022

## Kanabargi

One day Drone technology demonstration for spraying of agricultural chemicals was organized at Jamboti village Khanpur taluk, Belagavi, District. Scientists from ICAR-DCR, Puttur demonstrated how to configure and operate drone and took up a demonstration chemical spray to control TMB. Around 50 farmers participated in the event.

During Horticultural Mela conducted by UHS, Bagalkot from 29.12.2022 - 31.12.2022 at the head quarters, our center along with HREC Hogalgere had put up a stall. The center exhibited different cashew varieties, good cultivation and management practices and pest control measures. Nearly one lakh farmers from different districts of Northern Karnataka visited the Mela and stall and gathered information.

During the year around 3000 cashew grafts of V-4 variety were sold to the farmers of Northern Karnataka



Demonstration of Drone Technology



Cabbage as intercrop



Exhibition stall of the center at IIHR Bangalore



Experimental Trial

The Scientists of the center have attended activities as below

Sr No.	Date	Name of Speaker	Topic	Event	Place	No. Of farmer		
						Male	Female	Total
1	05/01/22	Dr. S.K. Desai	Organic Farming	Farmer training	FTC, Pardi	60	0	60
2	08/01/22	Dr. S.K. Desai	Scientific cultivation of Cashew	Farmer training	Borpada, Kaparada	62	9	71
3	11/01/22	Dr. S.K. Desai	Scientific cultivation of Cashew	Farmer training	TWTC, KVK, Narmada	13	34	47
4	11/01/22	Prof. S.G. Parmar	Control of pest and disease in fruit crops	Farmer training	TWTC, KVK, Narmada	13	34	47
5	15/01/22	Dr. S.K. Desai	Scientific cultivation of Cashew	Farmer training	Dagadpada, Waghai	33	7	40
6	20/09/22	Dr. S.K. Desai	Agriculture as a business and need of organic farming	NSS Camp	ROFEL, Vapi	60	60	120
7	30/09/22	Dr. S.K. Desai	Post Harvest Management	Farmer training	AES, Pardi	22	3	25

### Other Extension Activities



Cashew cultivation training by Dr S K Desai at Borpada, kaparada, Valsad on 08/01/2022



Cashew protection training by Prof S G Parmar at KVK, Narmada on 11/01/2022

### 1. Cashew Demonstration Plots

Among the 2 cashew demonstration plots maintained in farmer's field, are in sixteenth year of maintenance. 28 demonstration plots established under TSP in under 7<sup>th</sup> year of maintenance. 45 demonstration plots established under TSP in under 6<sup>th</sup> year of maintenance. 20 plots have been established under SCSP during second year of maintenance. 22 plots were established under TSP in are in second year maintenance. 10 demonstrations plots each were established under under scheduled caste sub plan and tribal sub plan in 2022.

## 2. Cashew Nursery

A total of 8500 grafts were produced and distributed to the farmers during this year

## 3. Training Programs /Seminars conducted

Seven trainings and seminars were conducted during the period.

Sr. No.	Date	Venue of training	Category / Sponsored By	No. of participants
1	17/3/2022	Navodaya colony, Periya, Kasaragod	under SCSP	50
2	18/3/2022	RARS Pilicode	under SCSP	50
3	21/3/2022	RARS Pilicode	under SCSP	50
4	15/10/2022	Aralam, Kannur	under SCSP	50
5	5/11/2022	Ariadukkam colony, Mangad, Udma, Kasargod	RARS, Pilicode	50
6	8/11/2022	Parappa Block Panchayat Hall, Kasaragod	DCCD, Kochi	50
7	27/8/2022	Naduvile Meethal Colony, Madavur	Tribal Subplan	50



## Training at RARS Pilicode



Ariadukkam colony, Mangad, Udma, Kasargod

## Seminar/workshops/symposia attended by Dr. A.V. Meera Manjusha, Assistant Professor

Name of Seminar	Venue	Date
National virtual Symposium on Doubling Farmers income by revitalizing Agribusiness ecosystem	online	1.3.2022 to 2.3.2022
Hands on training on statistical tools organized by College of Agriculture, Vellanikkara	Online	28 <sup>th</sup> to 31 <sup>st</sup> March 2022
Training on R software organized Centre for E learning, KAU	Online	23.6.2022 to 27.6.2022

## Trainings attended by Dr. A.V. Meera Manjusha, Assistant Professor as resource person

Particulars	Topic	Venue	Date	No. of farmers
One day training for farmers organized by DCCD Kochi	Scientific Cashew production	Alakode	25.7.2022	100
Technology week, KVK CPCRI Kasaragod	Integrated management of Cashew	Kasaragod	30.11.2022	150

One day district level Cashew Seminar organized by ICAR KVK, Kasaragod	Scientific Cashew Production, varieties and crop management	Cheemeni	26.3.2022	100
Horticultural fair and Cashew Seminar organized by CRS Madakkathara	Cashew Varieties and crop management	Irikkur	10.3.2022	100

### Field visits

Field visits were conducted by the scientists to 25 plots. Problems like TMB, Cashew Stem and root borer attack, other pests and diseases like Colletotrichum Blight Fusarium wilt, poor drainage and management etc. were observed. Farmers were given recommendations as per KAU package of practices.

## Tura

### Planting material production

Some grafts were produced during the year. Local cashew seedlings were raised as rootstock necessary for grafting this year.



### TRAININGS CONDUCTED

- i. **Input distribution cum training programme:** One day Input distribution cum training programme on production technology of cashew for better income of farmers sponsored by AICRP Cashew (NEH Component), ICAR-Directorate of Cashew Research, Puttur was organized at KVK campus on 30<sup>th</sup> June, 2022. Around 55 nos. of cashew farmers from different villages of West Garo Hills district participated in the programme and in the valedictory function; inputs such as micronutrients, knapsack sprayer, foot sprayer and tree pruner with saw were distributed to the farmers.



- ii. **Trainings cum Farmers'-Scientists Interaction programme:** One day Training cum Farmers'-Scientists Interaction programme on "Production and Post-Harvest Management of Cashew" was organized in collaboration with ATMA, West Garo Hills, Meghalaya at Tura during 29<sup>th</sup> November, 2022. Around 37 farmers participated in the programme.



- iii. **Trainings cum Farmers'-Scientists Interaction programme:** One day Training cum Farmers'-Scientists Interaction programme on "Production and Post-Harvest Management of Cashew" was organized at Tura during 28<sup>th</sup> March, 2023. Around 29 farmers participated in the programme.



- iv. **Training:** One day Training programme on “Advance Production Technology of Cashew including usage of Cashew Protect” was organized at Tura during 29<sup>th</sup> March, 2023. Around 20 farmers participated in the programme.



## Vengurla

### Extension activities undertaken

Sr. No.	Date	Title of the training programme	No. of Training	Location	Total no. of farmers/ participants		
					Male	Female	Total
1	2 <sup>nd</sup> March & 5 <sup>th</sup> March, 2022	DCCD sponsored Four training programmes on “Cashew Apple Utilization Training for Unemployed Women”	4	Cashew Farm, RFRS, Tal. Vengurla, Dist. Sindhudurg	-	100	100
2	10 <sup>th</sup> March, 2022	SCSP (Scheduled Caste Sub Plan) Cashew Training Programme: 01	1	Grampanchayat Pulas, Tal. Kudal,	16	34	50

		Area expansion: 2 ha.		Dist. Sindhudurg			
3	21 <sup>st</sup> March, 2022	DCCD sponsored “District Level Seminar on Cashew”	1	Tulsuli, Tal. Kudal, Dist. Sindhudurg	88	62	150
4	15 <sup>th</sup> Sept., 2022	Management of Pest and disease of Cashew	1	Shivram Bhau Hall, Tal. Kudal, Dist. Sindhudurg	91	23	114
5	19 <sup>th</sup> Sept., 2022	Management of Pest and disease of Cashew	1	Shriram Vachan Mandir, Tal. Sawantwadi, Dist. Sindhudurg	89	31	120
6	27 <sup>th</sup> Sept., 2022	Management of Pest and disease of Cashew	1	Grampanchayat Hall, Poip, Tal. Malvan, Dist. Sindhudurg	72	32	104
7	29 <sup>th</sup> Sept., 2022	Management of Pest and disease of Cashew	1	Krushik Chikitsalay Hall, Nandgaon, Tal. Kankvali, Dist. Sindhudurg	110	43	153
8	27 <sup>th</sup> Dec., 2022	Management of Pest and disease of Cashew to the Agril. Department Staff	1	Tal. Vengurla, Dist. Sindhudurg	137	54	191
<b>Total</b>			<b>11</b>		<b>603</b>	<b>379</b>	<b>982</b>

### Demonstrations conducted

Sr. No.	Date	Subject	No. of Demont	Location	Total no. of farmers/ participants		
					Male	Female	Total
1.	29 <sup>th</sup> Nov., 2022	Field demonstration on Management of Cashew Stem and Root Borer	1	Janvali, Tal. Kankvali, Dist. Sindhudurg	12	3	15
2.	23 <sup>rd</sup> Dec., 2022	Farmers Field School on Manangement of Pest and disease of Cashew to the farmers	1	Kunde, Tal. Kudal, Dist. Sindhudurg	20	5	25
<b>Total</b>			<b>2</b>		<b>32</b>	<b>8</b>	<b>40</b>

### Important Visitors/Dignitaries:

- Dr. J. Venkatesha, Chairman of accreditation Committee, Dr. A. R. Desai, Member, Dr. Femina Dy. Director, visited AICRP Cashew RFRS, Vengurla for certification of spices planting material production nurseries.

- b) Hon. Vice-Chancellor and Dr. S. G. Bhawe, Director of Research, Dr. BSKKV, Dapoli visited to RFRS, Vengurla on 21.12.2022.



Demonstration at FFS Kunde



Trainig at RFRS Vengurle



## District Level Seminar



SCSP Programme at Pulas



Cashew Apple Utilization Training

## Vridhachalam

### Trainings conducted

1. Exposure visits on cashew value chain, especially on cashew plantation management, and cashew processing, under the South-South Knowledge Exchange (SSKE) programme funded by the World Bank from Jan. 3-9, 2023



**Inaugural session felicitated by Honorable Vice Chancellor**



**Demonstration of soft wood grafting in cashew**



**Experimental field visit**



**Hands on training – Soft wood grafting in cashew**

	
<p align="center"><b>Pruning techniques in cashew</b></p>	<p align="center"><b>Visit to commercial Nursery</b></p>
	
<p align="center"><b>Visit to Small scale cashew processing industry</b></p>	<p align="center"><b>Interactive session with Tamil Nadu Cashew Exporters Association</b></p>

## **2. Tribal Sub Plan (TSP-AICRP) creating awareness about cashew cultivation and expanding cashew area in Tribal areas**

A training on creating awareness about cashew cultivation and expanding cashew area in Tribal areas was conducted at Thavadanallur, Andimadam block, Ariyalur District on 08.03.2023 under Tribal Sub Plan (TSP-AICRP). The inaugural session of the training was presided over by Dr. N. Thavaprakash, Professor and Head, RRS, Vridhachalam. Dr. M. Palanikumar, Associate Professor (Hort.) welcomed the gatherings and gave lecture on improved production technologies of cashew. Dr. S. Jayaprabavathi, Associate Professor (Ento.) delivered a lecture on IPM on cashew and interacted with farmers. Dr. Paramasivam, Associate Professor (Pl.Pathol.) explained about integrated disease management in cashew and answered the queries of the farmers. During the training the participants were provided with cashew grafts.



**Training was given on cashew production technologies and grafts were distributed**

### **3. Interactive session with Tamil Nadu Cashew Exporters Association Scheduled Caste Sub Plan (SCSP-AICRP) creating awareness about cashew cultivation and expanding cashew area in Scheduled Caste areas.**

A training on creating awareness about cashew cultivation and expanding cashew area in Scheduled Caste areas was conducted at Manakollai village of Kammapuram block, Cuddalore District on 24.03.2023. The inaugural session of the training was presided over by Dr. N. Thavaprakash, Professor and Head, RRS, Vridhachalam. The trainees were provided with technical information on improved production technologies and cashew apple utilization in Tamil. Further he interacted with the SC farmers and clarified the queries raised by the trainees on cashew cultivation. The extension officials of Cuddalore district were also participated in the training. Dr. K. Sundharaiya, Assistant Professor (Horticulture), RRS, Vridhachalam welcomed the gathering and handled the technical session on hi-tech production techniques in cashew. Dr. S. Kannan, Professor (FSN), KVK, Vridhachalam explained different products from cashew and demonstrated preparation of RTS, cashew juice, jam, etc with the support of participant trainees. After preparation, RTS was served to the staff and trainees during the training programme. Dr. S. Jayaprabhavathi, Associate Professor (Agrl. Entomology) explained about integrated pest and disease management in cashew and also interacted with the farmers during the technical sessions. Dr. S. Harisudan, Associate Professor (Agron.) delivered a lecture on importance of drip irrigation and water management, weed management, mulching and intercropping in cashew.



**Training was given on cashew production technology**

#### **4. Scheduled Caste Sub Plan (SCSP-AICRP) creating awareness about cashew cultivation and expanding cashew area in Scheduled Caste areas.**

A training on creating awareness about cashew cultivation and expanding cashew area in Scheduled Caste areas was conducted at Pelanthurai village of Vriddhachahalm block, Cuddalore District on 25.03.2023. The inaugural session of the training was presided over by Dr. N. Thavaprakash, Professor and Head, RRS, Vriddhachalam. The trainees were provided with technical information on improved production technologies and cashew apple utilization in Tamil. Further he interacted with the SC farmers and clarified the queries raised by the trainees on cashew cultivation. The extension officials of Cuddalore district were also participated in the training. Dr. K. Sundharaiya, Assistant Professor (Horticulture), RRS, Vriddhachalam welcomed the gathering and handled the technical session on hi-tech production techniques in cashew. Dr. R. Baskaran, Associate Professor (Agron.), RRS, Vriddhachalam explained about water management and importance of drip irrigation in cashew. Dr. S. Jayaprabhavathi, Associate Professor (Agrl. Entomology) explained about integrated pest and disease management in cashew and also interacted with the farmers during the technical sessions. Dr. K. Natarajan, Associate Professor (SST) delivered a lecture on nursery technologies and propagation methods of cashew to the farmers.



**Distribution of training kits. Dr. N. Thavaprakash, Prof (Agro.) delivered a lecture on scope**

**Details of cashew cashew grafts supplied**

No. of grafts supplied from January, 2022 – December, 2022 are 60, 403 Nos.

Value of 60,403 grafts @ Rs. 24/graft – Rs. 14,49,672/-

SI. No.	No. of grafts sold (Jan, 2022 – Dec, 2022)	Amount Collected(Rs.)
1.	60,403 Nos.	1449672.00

**PUBLICATIONS****Bhubaneswar****Research Publication:**

Sethi, K., Sahoo, S., Dash, M., Kumari, R., Panda, P. K., Mohanna, G.S and Raviprasad, T. N. 2022. Evaluation of cashew (*Anacardium occidentale* L.) germplasm based on morpho-economic traits. *The Pharma Innovation Journal* , **11**(10): 1025-1031.

**Research papers presented at International and National Seminar/Symposia:**

Kumar Amit, Panda, P.K., Nayak, R. N. and Sahoo, N.R. 2022. Effect of organic nutrients on quality of cashew apple cv.BPP-8. In: *National Seminar on Fruit Production in Eastern Tropical Region of India: Challenges and Opportunities*, 24-26 March 2022, Central Horticultural Experiment Station(ICAR-IIHR), Bhubaneswar, Odisha. pp.221

Kumar Amit, Panda, Pramod Kumar., Sahoo, Nihar Ranjan. and Nayak, R. N. 2022. Effect of organic nutrients on quality of cashew (*Anacardium occidentale* L.) value added product cv.BPP-8. In: *National Webinar on Sustainable Interventions towards Resource Conservation and Natural Farming*, 22-23<sup>rd</sup> April, 2022, Academy of Natural Resource Conservation and Management(ANRCM), Lucknow(UP). pp.2.57

Jena, Chinmaya, Panda, Pramod Kumar, Sethi, Kabita and Panda, Rajendra Kumar. 2022. Effect of growth promoting substances on flowering and nut yield of cashew cv.BPP-8 under Odisha region. In: *National Seminar on Horticulture for Sustainable Development, Nutritional and Livelihood Security*. May 26-27, 2022 at Uttar Bang Krishi Vishwavidyalaya, Pundibari, Cooch Behar, West Bengal , pp.150.

**Extension Bulleins/Booklets/Leaflets:**

- Sethi K. and Panda P.K. 2022. *Kaju Kalami Chara Utpadana ra Baisayika Diga*. pp16 (in Odia)
- Panda P.K. and Sethi K..2022. *Saghana Pranalire Kajubadam Chasa* .pp4 (in Odia)

## Jhargram

- Mini Poduval, (2022) Evaluation of the Released Cashew nut Varieties under the Semi Arid Zone of West Bengal. *Environment and Ecology* 40 (2) : 373—380, ISSN 0970-0420 (NAAS rating: 5.25 )
- Poduval, M.(2022). Effects of climatic factors on different cashew (*Anacardium Occidentale* L.) varieties. *Bangladesh Journal of Botany*, 51(3), 527–539. <https://doi.org/10.3329/bjb.v51i3.61999>. (NAAS rating: 6.31 )

## Hogalagere

### Research Paper

Rajendra B.N., Ramachandra, R.K., Aswathanarayana Reddy, N., Honnabyraiah, M.K., Vishnuvardhana, Jagadeesh, S.L., Anjaneya Reddy, B., Ramesh,M. and Subramanyam, B.(2023) Role of different nutrient management on growth and yield attributes of cashew (*Anacardium occidentale* L.) in maidan tracts of Karnataka. *An International Journal of Bioresource and Stress Management*, 14(2):237-242.

### Research Note/ Communication in Journal/ Abstract in Symposium/ Seminar/ Workshop/ Training Manual/ Proceedings of Workshop

Kori Nagaraj, N. Aswathanarayana Reddy, Subramanyam, B. and Ramegowda, G.K. (2022) Report of incidence of mango fruit borer, *Citripestis eutraperha* (Meyrick) (Lepidoptera: Pyralidae) as apple and nut borer in cashew, *Anacardium occidentale* L. (Anacardiaceae in maidan parts of Karnataka, India. *Insect Environment*, 25(1):29-33.

Aswathanarayana Reddy N., Subramanyam, B., Rajendra, B.N. and Ramachandra, R.K. (2022) Screening of cashew varieties to identify tolerant or resistance types against apple and nut borer, *Citripestis eutraperha* (Meyrick) (Lepidoptera: Pyralidae) in maidan parts of Karnataka. *Insect Environment*, 25(1):62-64.

## Madakkathara

### Research paper

- Smitha M.S., Asna A.C.,Jalaja S.Menon., Unnikrishnan T., and Ajithkumar B 2002. Forewarning models of tea mosquito bug; *Helopeltis antonii* (Signoret) in cashew. *Journal of Agrometeorology* 24(3):276-279.

### Book

- *Kanakavila kasumavu* (Malayalam) Dr.Jalaja S.Menon, Dr. Asna A.C, Dr Smitha M.S, Dr.Nasiya Beegum A. N

**Technical Bulletin**

- Cashew news 2021
- Ulppanna Lakhuregha (Malayalam) 2022

**Book Chapter**

- A chapter on cashew apple processing in the training manual of ICAR attracting rural youth in Agricultural programme of KVK, Malappuram authorized by Dr.Asna A .C & Dr. Jalaja S. Menon

**Paper published in the proceedings of National conference on cashew conducted on 30<sup>th</sup>- 31<sup>st</sup> January 2023 at Bhubaneswar**

- Technologies for commercial utilization of cashew apple –Dr.Jalaja S.Menon

**Vengurle****Research paper**

Shedge M. S. , P. M. Haldankar, Ahmed Shabeer TP, C. D. Pawar, M. C. Kasture, V. V. Dalvi,R. G. Khandekar,

and L. S. Khapare. (2022) Jackfruit: Functional component related with human health and its application in food industry. *The Pharma Innovation Journal*, 2277-7695, SP – 11(6): 824-830

Gajbhiye R. C. , S. N. Pawar and B. N. Sawant. Enhancement of cashew yield through foliar feeding of nutrients (2022) *Journal of Eco-friendly Agriculture* 2229-628X, 17(1): 72-75

Gadhve K. T., R. T. Bhingarde, P. C. Mali,N. H. Khobragade and K. V.Malshe.(2022) Response of turmeric (*Curcuma longa* L.) cv. Salem planted by pro tray seedling method to spacing and nutrients. *The Pharma Innovation Journal*,2277-7695, **11**(12):4219-4223

**Books Published**

Gajbhiye R.C., Khapare L.S., Zote V.K., Pawar S.N., Salvi S.P., Sawant B. N., Haldankar P. M. and Raviprasad T. N. (2022). Catalogue-II : Minimum Descriptors of Cashew Germplasm Accessions.

Desai V. S., Golvankar G. M., Munj A. Y., Talha P. M., Zote V. K. and Sawant B. N.(2022) Pocket diary on Management of Pest and Disease of Cashew ( Marathi)

**Marathi article published in newspapers/magazines**

Dr. V. S. Desai, Kara Kaju Palviche Sanrakshan in Bhusanwardhan. November, 2022

Dr. V. S. Desai Pest and Disease Management of Cashew Crop. In Deshonnti Edition, December, 2022

**Participation in Seminar/Webinar/Symposia/Conference**

Khapare L. S., National level training programme on cashew on "Production of quality planting materials and nursery management" organized by DCCD, Kochi held on 6th January 2022 at ICAR-CCARI, Goa.

Desai V. S., Online lecture on Foliage Pest Management in Cashew nut on 30/11/2022 to staff of Agriculture Department of Maharashtra.

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**BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING THE YEAR 2022-23****Allocation****(Rs. in lakhs)**

Centre	Details of sanctioned provision					
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total	ICAR share
Bapatla	67.00	1.20	14.33	0.57	83.10	62.33
Bhubaneswar	61.00	1.20	11.67	0.57	74.44	55.83
Hogalagere	70.40	1.20	17.33	0.00	88.93	66.70
Darisai	28.72	0.40	4.88	1.67	35.67	26.75
Jagdapur	27.00	0.80	11.47	0.00	39.27	29.45
Jhargram	22.00	1.10	10.00	1.67	34.77	26.08
Madakkathara	62.00	1.50	14.00	0.17	77.67	58.25
Paria	42.00	0.80	5.68	0.57	49.05	36.79
Pilicode	17.75	0.40	6.68	0.20	25.03	18.77
Vengurla	58.90	1.20	13.85	0.31	74.26	55.70
Vridhachalam	63.40	1.20	11.55	0.57	76.72	57.54
KRCCH, Kanabargi	0.00	0.40	8.5	0.00	8.90	6.67
ICAR Res. Compl. For Goa, Goa	0.00	0.00	3.55	0.00	3.55	2.66
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.00	0.00	0.00	0.0	0.00
Provision for RC for PC Cell	0.00	0.00	1.79	0.36	2.15	1.61
<b>Total</b>	<b>520.17</b>	<b>11.4</b>	<b>135.28</b>	<b>6.66</b>	<b>673.51</b>	<b>505.13</b>
<b>ICAR Share</b>	<b>390.13</b>	<b>8.55</b>	<b>101.46</b>	<b>4.99</b>	<b>505.13</b>	<b>--</b>
Provision for SCSP						20
Provision for TSP						10
Provision for NEH						76
	<b>GRAND TOTAL</b>					<b>611.13</b>

## Actual Expenditure

(Rs. in lakhs)

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share	SCSP	TSP
Bapatla	59.39	0.91	14.55	0.55	75.40	56.55	3.08	1.43
Bhubaneswar	60.52	0.33	11.67	0.56	73.08	54.81	2.31	2.02
Hogalagere	58.30	0.47	17.08	0.00	75.85	56.89	4.73	--
Darisai	26.02	0.00	5.23	0.00	31.25	23.44	0.63	--
Jagdalpur	20.25	0.60	8.60	00	29.45	22.09	--	2.36
Jhargram	20.55	0.26	5.98	1.25	28.04	21.03	1.38	--
Madakkathara	62.00	00	15.50	0.17	77.67	58.25	1.43	1.42
Paria	41.05	0.18	5.77	0.53	47.53	35.65	--	0.40
Pilicode	17.32	0.40	6.59	0.20	24.51	18.38	1.42	1.03
Vengurla	77.58	0.60	15.76	0.29	94.23	70.67	1.82	--
Vridhachalam	84.37	0.77	11.35	0.57	97.06	72.79	2.36	1.34
KRCCH, Kanabargi	00	0.13	8.50	00	8.63	6.47	--	--
ICAR Res. Compl. For Goa, Goa	00	00	3.53	00	3.53	2.65	--	--
ICAR Res. Compl. For NEH Region, Barapani	00	00	7.37	00	7.37	5.53	--	--
Provision for RC for PC Cell	00	00	1.79	0.36	2.15	1.61	--	--
<b>Total</b>	<b>527.35</b>	<b>4.65</b>	<b>139.27</b>	<b>4.48</b>	<b>675.75</b>	<b>506.81</b>	--	--
<b>ICAR Share</b>	<b>395.51</b>	<b>3.49</b>	<b>104.45</b>	<b>3.36</b>	<b>506.81</b>	--	--	--
Provision for NEH						<b>76.00</b>	--	--
Provision For SCSP						<b>19.16</b>	--	--
Provision for TSP						<b>10.00</b>	--	--
					<b>GRAND TOTAL</b>	<b>611.97</b>	--	--

**WEATHER DATA****Bapatla**

S.No.	Month& Year	Max. temp (°C)	Min. Temp (°C)	RH (%)		Rainfall (mm)	Rainy days (No)
				(m)	(e)		
1.	January 2022	29.5	18.8	85.6	67.6	60.3	3
2.	February 2022	30.9	18.7	85.9	64.7	0	0
3.	March 2022	33.7	22.1	82.8	60.7	0.0	0
4.	April, 2022	34.5	25.9	82.4	73.0	0.0	0
5.	May 2022	36.1	26.6	73.7	65.2	116.1	4
6.	June 2022	37.0	26.4	71.2	59.9	140.0	9
7.	July 2022	32.7	24.3	81.4	69.2	216.6	17
8.	August 2022	34.0	24.8	81.6	68.9	185.1	12
9.	September 2022	33.4	24.6	83.6	76.9	63.4	10
10.	October 2022	31.4	23.0	86.9	79.2	282.6	11
11.	November 2022	30.1	20.5	86.6	76.2	49.5	7
12.	December 2022	30.1	19.9	87.3	78.6	57.1	4

**Bhubhabeshwar**

Months	Temperature(°C)		Relative Humidity(%)		Rainfall (mm)	No. of rainy days	BSH
	Max.	Min.	Max.	Min.			
January,2022	26.5	14.7	94	47	29.1	4	5.9
February,2022	30.0	17.2	95	71	41.1	1	6.5
March,2022	35.4	22.5	94	70	0.0	0	4.7
April,2022	36.9	26.5	94	76	0.0	0	6.2
May,2022	35.9	26.3	93	79	185.9	9	5.6
June,2022	35.4	27.1	93	83	98.2	8	2.8
July,2022	32.3	26.1	95	91	379.3	19	2.2
August,2022	32.2	25.7	94	90	329.4	15	3.2
September,2022	32.8	25.8	95	89	234.1	13	3.9
October,2022	31.8	24.0	93	84	169.1	10	4.5
November,2022	30.7	18.6	83	52	0	0	7.0
December,2022	29.2	16.3	87	44	0	0	6.0
<b>Total</b>					<b>1466.2</b>	<b>79</b>	

## Darisai

Month	Temperature		Humidity %		Rainfall (mm)	Normal Rainfall (mm)	No of Rainy Days
	Max.	Min.	Max.	Min.			
January 22	33.0	7.8	72	31	46.6	127.5	2
February 22	37.8	8.2	73	50	57.4	76.7	4
March 22	39.4	15.4	82	65	0.0	184.8	0
April 22	42.0	19.2	87	78	22.4	370.9	2
May 22	39.6	20.0	89	77	112.4	368.8	11
June 22	39.4	22.4	92	78	188.8	106.8	9
July 22	37.2	23.8	88	63	266.0	80.4	20
August 22	36.4	22.5	89	52	320.0	0.0	16
September 22	35.1	23.5	87	43	186.0	0.0	13
October 22	36.0	19.0	87	52	65.8	15.7	7
November 22	32.1	13.8	83	45	0.0	13.0	0
December 22	30.0	6.8	83	44	0.0	25.0	0
Total					1265.4	1369.6	84

## Hogalagere

Months	Rainfall (mm)	Rainy days (No.s)	Temperature ( <sup>0</sup> c)		Relative Humidity (%)		Wind speed(km/hr)
			Max. (Average)	Min. (average)	Max. (average)	Min. (average)	Max. (average)
January	4.4	1	29.0	17.6	88.7	48.6	14.5
February	0.0	0	30.2	16.2	87.3	36.8	13.7
March	12.5	1	32.9	16.2	84.7	34.5	3.7
April	43.5	3	35.9	20.3	87.5	42.3	7.5
May	147.4	12	32.0	21.2	91.2	55.3	8.4
June	179.6	14	30.7	20.8	89.8	55.0	4.8
July	141.8	13	29.8	21.4	97.5	66.0	9.5
August	304.1	15	29.7	20.9	94.6	65.9	8.2
Septemberr	161.0	10	28.8	19.4	92.1	67.3	20.7
October	154	12	27.4	19.0	95.7	66.4	20.0
November	27.6	6	26.5	17.0	95.0	58.7	21.0
December	97.5	5	26.1	17.1	92.3	60.0	15.8
	1273.4	92	29.92	18.9	91.4	54.7	11.6

## Jharagram

Month	Max. Temp (°C)	Mini. Temp (°C)	Relative Humidity %	Maximum Wind Speed (mph)	Cloud Cover %	Rainfall (mm)	Rainy Days	Average Pressure (mb)	Sun shine hours
January'2022	25	14	50	11.9	24	10.3	4	1014.2	88
February'2022	29	16	45	13.9	11	5.5	1	1011.5	102
March'2022	38	22	39	17.2	4	0.4	0	1006.9	121
April ' 2022	42	26	48	23.1	8	5.8	3	1003.4	109
May'2022	39	28	56	21.2	30	22.8	6	1000.7	89
June'2022	37	28	61	19.6	43	41.64	13	999.9	60
July'2022	33	27	71	17.2	64	58.5	15	1000.7	16
August'2022	32	26	78	16.6	68	109.7	18	1001.1	13
Sept'2022	32	26	81	14.8	61	59.19	18	1003.9	14
October'2022	31	23	75	12.4	39	39.0	11	1009.6	66
November'2022	30	18	45	11.6	5	0	0	1012.6	118
December'2022	29	15	32	12.0	7	0	0	1013.0	119
					Total	352.83	89		

**Kanabargi**

Months	Rainfall (mm)	No. of rainy days	Temperature °C		Relative humidity (%)	
			Max	Min		
Jan-22	-	-	17.80	33.60	74.35	80.22
Feb-22	-	-	21.05	33.70	72.30	79.20
Mar-22	16.00	1	23.35	35.30	72.10	77.90
Apr-22	177.4	10	23.50	35.60	72.50	80.50
May-22	121.0	4	24.20	36.80	74.30	79.60
June-22	90.10	9	21.30	34.30	76.30	82.30
July-22	375.3	21	19.40	26.20	84.60	95.10
Aug-22	313.6	14	20.10	27.80	85.10	94.30
Sept-22	183.0	12	20.8	29.7	70.96	95.56
Oct-22	179.8	11	20.30	26.2	75.38	90.74
Nov-22	6.6	1	22.2	35.1	61.06	79.93
Dec -22	-	-	20.1	30.8	69.2	84.3

## Madakkathara

Month & Year	Average Temperature (°C)		Relative Humidity (%)		Total Rainfall (mm)	Total No. of Rainy days	Mean Sunshine hours (hr)
	Max.	Min.	Max.	Min.			
Jan 22	33.52	22.64	82.6	45.8	0	0	8.918
Feb 22	34.97	23.42	70.25	36.75	0	0	8.54
Mar 22	35.97	24.84	80.5	45.5	1.7	0	6.56
Apr 22	34.12	25.02	90.6	64.4	150.8	11	5.646
May 22	29.35	24.2	95.25	77.5	373.7	20	2.96
June 22	31.07	23.47	96	72.25	424.6	19	4.1
July 22	29	23.42	96.4	81.2	911	29	1.694
Aug 22	30.52	23.67	93.75	71.25	257.6	11	4.77
Sep 22	31.05	23.7	93.75	66.75	140.4	11	5.60
Oct 22	32.16	23.58	91.8	62.4	88.5	10	5.85
Nov 22	32.32	22.9	86.75	57.5	56.5	6	36.95
Dec 22	32.17	22.62	81.5	52	91.1	3	44.97

## Paria

Month	Max. Temp.	Min. Temp.	RH (M)	RH (E)	Wind velocity	Rainfall (mm)	Sunshine hours	Evaporation (mm)
Jan	30.21	10.37	87.19	54.62	1.94	0.00	8.47	2.88
Feb	31.81	10.44	89.66	45.76	2.08	0.00	9.15	3.57
Mar	36.85	17.14	80.76	38.29	2.14	0.00	8.40	4.91
Apr	38.06	21.20	87.16	56.91	2.88	0.00	9.47	6.86
May	36.61	21.08	84.22	59.17	6.55	11.2	9.39	9.66
Jun	33.89	23.90	87.13	72.44	5.21	257.8	7.11	6.49
Jul	29.91	22.74	96.91	94.21	5.26	1782.9	1.42	1.78
Aug	32.27	22.55	93.77	82.73	5.37	578.5	4.02	2.78
Sep	31.84	22.50	93.30	81.62	2.55	678.5	2.99	3.27
Oct	33.65	18.59	89.95	81.25	1.60	41.1	7.40	3.74
Nov	34.97	12.56	84.83	73.11	1.04	0.00	8.90	3.94
Dec	34.23	11.35	87.34	67.19	1.76	0.00	8.93	4.05
Total:						3350.00		

## Pilicode

Month & year	Temperature ( °C)		Relative humidity (%)		Rainfall (Monthly cumu. mm)	No. of rainy days	BSH
	Maximum	Minimum					
January	32.0	19.8	91.7	62.6	0.0	0	9.1
February	32.9	20.5	92.3	69.1	0.0	0	9.0
March	34.7	21.1	90.0	69.6	16.5	1	7.3
April	34.7	22.9	78.4	76.7	66.2	2	6.9
May	32.4	23.7	87.6	76.4	332.8	16	5.6
June	31.2	23.9	88.5	87.9	393.6	27	4.5
July	29.4	23.5	89.3	89.2	1632.4	24	2.0
August	30.6	23.8	88.0	87.5	645.8	19	3.7
September	30.7	23.8	89.1	86.6	328.5	16	5.5
October	32.3	23.7	87.1	81.0	29.7	6	8.6
November	31.8	23.1	92.8	70.5	37.1	9	6.7
December	31.8	21.6	93.9	65.5	31.3	3	7.0

## Tura

Month	Rainfall (mm)	Relative Humidity (%)		Temperature °C	
		Maximum	Minimum	Maximum	Minimum
January	9.4	85	67	24	11
February	60.9	88	57	27	15
March	50.2	88	65	31	18
April	57.3	90	62	32	21
May	533.0	93	69	32	22
June	772.7	93	68	31	22
July	321.3	90	75	32	23
August	188.6	87	70	32	23
September	300.7	89	68	33	22
October	326.6	91	78	31	20
November	0	80	62	29	18
December	0	80	53	26	13

## Vengurle

Month	Temperature ( <sup>0</sup> c)		Humidity (%)		Rain fall (mm)	No. of rainy days
	Maximum	Minimum	Forenoon	Afternoon		
Jan. 2022	31.61	17.44	88.05	61.68	0.00	00
Feb. 2022	32.48	18.10	89.75	57.14	0.00	00
March 2022	32.72	19.21	81.61	60.00	0.00	00
April 2022	34.36	24.43	83.20	61.81	0.00	00
May 2022	34.04	30.67	80.75	65.50	46.50	08
June 2022	31.10	24.26	91.06	84.29	834.20	24
July 2022	30.25	24.35	92.34	84.38	1121.70	30
Aug. 2022	30.51	24.19	92.57	83.43	468.80	27
Sep. 2022	40.53	23.76	93.61	80.29	358.10	22
Oct. 2022	32.31	21.89	89.96	75.17	50.30	10
Nov. 2022	35.12	22.10	84.78	42.34	0.02	01
Dec. 2022	33.02	18.77	80.11	40.32	0.00	00
Total					2879.62	122

## Vridhachalam

Month / Weather factors	Rainfall (mm)	Rainy Days (No.)	Temperature (°C)		Relative Humidity (%)		Sun Shine (Hrs)
			Max.	Min.	Morning	Evening	
January 2022	55.8	2	30.9	21.4	94	71	5.59
February 2022	5.2	1	31.0	21.2	92	70	7.41
March 2022	14.2	2	34.4	22.5	92	66	6.81
April 2022	67.0	5	35.3	25.6	92	68	7.93
May 2022	73.4	5	36.4	26.0	91	68	6.56
June 2022	39.8	3	36.5	25.6	91	63	7.14
July 2022	178.1	7	35.2	24.9	93	69	4.68
August 2022	242.0	10	34.3	24.1	94	73	5.69
September 2022	66.4	3	33.9	23.7	91	72	5.64
October 2022	32.7	32.6	32.7	23.7	93	72	4.02
November 2022	257.2	10	29.7	21.9	94	78	3.55
December 2022	78.4	7	29.8	21.9	94	78	2.74

## Goa

Month	Temp. (°C)Max	Temp. (°C)Min	RH (morning)	RH (Afternoon)	Wind Speed (km/h)	Sunshine (h/day)	Evaporation (mm)	Rainfall (mm)
January	32.2	19.4	83.6	41.6	4.3	9.2	4.2	0.0
February	33.9	19.5	90.1	41.1	4.6	9.6	4.8	0.0
March	35.6	23.6	83.6	49.1	4.6	6.2	5.6	0.3
April	35.2	25.0	86.1	55.4	4.9	6.2	5.8	51.2
May	33.7	25.9	89.0	62.6	4.7	5.7	5.1	99.6
June	31.1	23.9	93.0	78.4	4.9	3.3	4.0	700.6
July	29.5	23.4	94.0	82.7	5.4	1.3	3.6	1098.3
August	29.7	22.9	94.0	79.6	6.6	1.6	2.7	347.6
September	30.2	22.5	94.6	73.7	5.1	4.9	3.6	276.8
October	32.5	21.7	90.0	58.7	3.6	6.9	4.1	71.3
November	34.3	21.2	82.2	46.6	3.5	7.3	4.5	0.0
December	34.6	21.0	86.0	41.6	3.8	7.8	4.7	2.2