

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

वार्षिक प्रतिवेदन  
ANNUAL REPORT  
2016-17



भा.कृ.अनु.प. - काजू अनुसंधान निदेशालय  
पुत्तूर - 574 202, दक्षिण कन्नड, कर्नाटक



ICAR - DIRECTORATE OF CASHEW RESEARCH  
PUTTUR - 574 202, DAKSHINA KANNADA, KARNATAKA

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परियोजना समन्वयकर्ता  
डा. एम.जी. नायक

PROJECT COORDINATOR  
Dr. M.G. NAYAK



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## प्राक्कथन

यह, अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 33 वीं वार्षिक प्रतिवेदन है। यह प्रतिवेदन में अप्रैल - 2016 से मार्च - 2017 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, माडकत्तरा (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।

[एम.जी. नायक]

प्रभारी निदेशक एवं परियोजना समन्वयकर्ता

स्थान : पुत्तूर

दिनांक : 31.07.2017



## ABOUT THIS REPORT

This is the thirty third 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 April 2016 to March 2017.

There are total fourteen centres ie., four in the East Coast of India, namely, Bapatla (Andhra Pradesh); Bhubaneshwar (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.

[ M.G. NAYAK ]

ACTING DIRECTOR & PROJECT COORDINATOR

Place : Puttur

Dated : 31.07.2017





# CHAPTER 1 : TECHNICAL







## परियोजना समन्वयकर्ता की रिपोर्ट

वर्तमान में काजू के अखिल भारतीय समन्वयीन अनुसंधान परियोजना के चोदह केंद्र हैं, जो देश के बारह काजू उगानेवाले विभिन्न राज्यों में स्थित हैं। इन सभी केंद्रों पर विभिन्न राज्य कृषि विश्वविद्यालयों और आयसीएआर के संस्थानों का प्रशासनीक नियंत्रण होता है। परियोजना का वर्ष 2016-17 का मूल बजट आबंटन ₹.265.19 लाख (भा.कृ.अ.प. का शेयर) था और कुल व्यय ₹.358.78 लाख (भा.कृ.अ.प. का शेयर) था।

निम्नलिखित विधियों से काजू की उत्पाद और उत्पादन क्षमता बढ़ाना इस परियोजना का लक्ष्य है:

1. उच्च उत्पादन के साथ रोग एवं कीट सहन/निरोधी, अच्छे गिरी गुणवत्ता वाले और जैविक और अजैविक तनाव को सहने वाले किस्मों का विकास।
2. विभिन्न कृषि - मौसमी परिस्थितियों में काजू फसल के लिए कृषि प्रौद्योगिकी का मानकीकरण।
3. लागत प्रभावी, दक्ष पीडक एवं रोग प्रबंधन विधियों का विकास।

इन लक्ष्यों को पूरा करने के लिए प्रारंभित विविध परियोजनाओं से प्रतिवेदन अवधि में प्राप्त मुख्य परिणामों को विविध विभागों में प्रस्तुत है।

### फसल सुधार

जननद्रव्य संपन्मूल को अगर देखते हैं, तो 165 एक्सेशनों को अलग अलग केन्द्रों में संग्रह किया गया और रोपित किया गया है। कुल संग्रह किए गए एक्सेशनों की संख्या 1655 हुई। भुवनेश्वर केन्द्र द्वारा 57 एक्सेशनों का चारित्रवर्णन किया गया और एक केटलॉग प्रकाशित किया गया। गोवा केन्द्र द्वारा 14 एक्सेशनों का चारित्रवर्णन किया गया है और उत्तम उपज, बड़ा

फल और बड़ा नट देनेवाले तीन एक्सेशनों को संग्रह किया है। वेंगुर्ला केन्द्र द्वारा एक CNSL मुक्त एक्सेशन RFRS-195 पहचाना गया है और इसका मूल्यांकन जारी है। अलग अलग केन्द्रों में जर्मप्लाज्म एक्सेशनों में फल का गुण, टी.एस.एस., विटामिन-सी, टैनिन और एसिडिटी जैसे गुणों के लिए अध्ययन किया गया और इन गुणोंवाली आशादायक एक्सेशनों को पहचाना गया है। अधिक उपज देने वाली नये किस्मों को ढुंढने के उद्देश्य से जगदलपुर में जारी बड़ुस्थरीय परीक्षण-II में कुछ आशाजनक एक्सेशनों को पहचाना गया है। आशाजनक संकरों को पहचानने के उद्देश्य से विभिन्न वायुगुणों के प्रदेशों में बापट्ला, भुवनेश्वर, वृधाचलम, मडक्कतरा और वेंगुर्ला केन्द्रों में बहुस्थानीय परीक्षण-II आयोजन किया गया। बापट्ला केन्द्र में, पिछले चार साल से मूल्यांकन किए गए 11 जिनोटाइप में BPP-8 सबसे अच्छा वेजिटेटिव और रिप्रोडक्टिव गुणों को दर्ज किया। अधिक बीज उत्पादन के दृष्टि से इस वर्ष भुवनेश्वर में BH-6, मडक्कतरा में H-1593, वेंगुर्ला में H-662 और वृधाचलम में H-14 बेहतर प्रदर्शन दिखाया। विमोचित किस्मों के प्रदर्शन को देखा गया तो (बहु स्थानीय परीक्षण-V) भुवनेश्वर और झारग्राम में V-7, पिलिकोड में प्रियांका, वृधाचलम में VRI-3 और मडक्कतरा में अमृता बेहतरीन प्रदर्शन दिखाया। भुवनेश्वर में 5, झारग्राम में 17, पिलिकोड में 6, वेंगुर्ला में 58, वृधाचलम में 14 और गोवा में 12 संकरों को मूल्यांकन किया गया और इसमें से कुछ अत्युत्तम संकरों को पहचाना गया। गोवा केन्द्र में 9 क्रसिंग प्रयोग से 194 संकर बीजों को उत्पाद किया गया है। वेंगुर्ला केन्द्र में 58 में से 18 उत्तम संकरों को परीक्षण के लिए रिप्लिकेटेड ट्राइल में लगाया गया है। आर.टी.एस. और जाम बनाने के लिए उत्तम किस्मों को ढुंढने का



अध्ययन में बापट्ला केन्द्र में BPP-8, होगलगेरे केन्द्र में चिंतामणी-1, जगदलपुर केन्द्र में CARS-6, झारग्राम में Ullal-4, कनबर्गी में V-4, V-7, मडकतरा में प्रियांका, पिलिकोड में PLD-75 और PLD-40 और वेंगुर्ला में वेंगुर्ला-4, अन्य किस्मों से बेहतर प्रदर्शन दिखाया।

### फसल प्रबंधन

होगलगेरे केन्द्र पर काजू की अधिकतम उपज लेने के लिए पोषण प्रबंधन पर परीक्षण के तहत उर्वरको की 100% सिफारिश और 10 किलोग्राम गोबर की खाद के साथ मुख्य, गौण और सूक्ष्म पोषक तत्वों को पत्ति छिड़काव के तहत सर्वश्रेष्ठ पाया गया है। उच्च घनत्व काजू बागानों में उर्वरक आवेदन के संबंध में 225:75:75 किलो/हैक्टर उर्वरक स्तर को 10x5 मीटर की दूरी वाले रोपण में अधिकतम काजू उपज के लिए बापट्ला केन्द्र पर बेहतर पाया गया है। हालांकी, भुवनेश्वर केन्द्र में उर्वरक के स्तर के साथ 10x5 मीटर दूरी वाले बागानों में 150:50:50 किलो/हैक्टर उर्वरक सिफारिश को बेहतर पाया गया। झारग्राम केन्द्र में 10x5 मीटर अंतराल और 75:25:25 एन.पी.के. किलो/हैक्टर के लाभ अनुपात लागत से अधिक था। उर्वरको कि अलग-अलग मात्रा को लोवर घनत्व रोपण प्रणाली में अपेक्षाकृत कम किफायती माना जाता है। लेकिन उर्वरक की उच्च मात्रा ने खेती की लागत में बढ़ोतरी की जिससे मडकतरा केन्द्र पर रिटर्न कम मिला। पिलिकोड केन्द्र पर 75:25:25 एन.पी.के. किलो/हैक्टर उर्वरक स्तर 6x4 अंतराल पर लागत के बजाय लाभकारी पाया गया। बुंद - बुंद सिंचाई परीक्षण में 80% संचयी पैन वाष्पीकरण पर सिंचाई प्रयोग होगलगेरे, वेंगुर्ला और वृद्धाचलम केन्द्र पर उच्चतम पाया गया।

उच्च घनत्व रोपण अवलोकन संबंधी परीक्षणों में यह पाया गया है कि लाभ का अनुपात

4x4m की दूरी वाले बागानों का प्रती ईकाई क्षेत्र उपज 8x8m की दूरी वाले बागानों से अधिक था। अंतर फसल प्रयोग में, बापट्ला केन्द्र में गैदे के साथ काजू की खेती से अधिक लाभ हुआ है। जबकी झारग्राम और पारिया में भिंडी, कानबर्गी में लोबिया, मडकतरा में प्लंपगो जियलनिका और वेंगुर्ला कड़ाई याम लाभदायक पाया गया था।

विभिन्न केन्द्रों में आयोजित कार्बनिक प्रबंधन परीक्षण से पता चला है की उर्वरको के साथ 10 किलो गोबर की खाद को भुवनेश्वर, वृद्धाचलम और वेंगुर्ला केन्द्रों पर अधिकतम उपज के साथ प्रभावी पाया गया। हालांकी झारग्राम केन्द्र में 100% नाईट्रोजन गोबर की खाद के रूप में, कानबर्गी में जैव-उर्वरक 200 किलो/पेड़/वर्ष के साथ गोबर की खाद से 100% नाईट्रोजन, मडकतरा जैव उर्वरक के साथ गोबर की खाद के रूप में 50% नाईट्रोजन को प्रभावी पाया गया। अंतरण उर्वरक परीक्षण में 10x10 मीटर दूरी वाले बागानों में 117:29:29 एन.पी.के. किलो/पेड़/वर्ष को कानबर्गी में उच्चतम उपज के साथ प्रभावी पाया गया।

### फसल सुरक्षा :

इस वर्ष के दौरान भुवनेश्वर में कोई टीएमबी की घटना नहीं थी। टीएमबी और अन्य कीटों के नियंत्रण के लिए कीटनाशकों के मुल्यांकन परीक्षण में, बापट्ला, झारग्राम और भुवनेश्वर में लैम्डा साइहालोथ्रिन (0.6 मीली/ली) ने पत्ता और फुल छिद्रक, शूट टिप कैटरपिलर और सेब तथा नट छिद्रक का बेहतर नियंत्रण प्रदान किया। होगलगेरे, मडकतरा और जगदलपुर में थिमोथोक्सम 25WG (0.2 ग्रा/ली) से टीएमबी पर अच्छा नियंत्रण पाया गया। पारिया और वेंगुर्ला में ब्यूप्रोफेजिन (2 मीली/ली) को शूट और पनिकल्स के टीएमबी पर अच्छा नियंत्रण करते हुए पाया गया। बापट्ला, मडकतरा, वेंगुर्ला, जगदलपुर और होगलगेरे में



काजू तना और जड़ छिद्रक के नियंत्रण में फिप्रोनील (2 मीली/ली) की पट्टी लगाने से छिद्रक कीड़े की पुनर्संरचना के बीना पेड़ों को सुरक्षित पाया गया। हालांकी, भुवनेश्वर, वृद्धाचलम और झारग्राम में क्लोरोपेरीफोस की स्वैबींग से पेड़ों की अधिकतम संख्या पाई गई। अधिकतम तना परिधि और पेड़ की उम्र के रूझान में अधिकतम सीएसआरबी के उपद्रव को देखा गया।

बापट्ला में काजू के कीट उपद्रव की घटनाओं पर जैविक और अजैविक कारकों के प्रभाव के संबंध में, यह पाया गया कि पत्ती और फुल छिद्रक उपद्रव पर न्यूनतम तापमान का नकारात्मक सहसंबंध था और सापेक्ष आद्रता से सकारात्मक सहसंबंध पाया गया। जहाँ तक पत्ती खान का संबंध है, बापट्ला में न्यूनतम तापमान के साथ नकारात्मक सहसंबंध देखा गया, लेकिन जगदलपुर में सकारात्मक सहसंबंध देखा गया। हालांकी, इसकी घटना का सकारात्मक संबंध भुवनेश्वर और बापट्ला में उच्च तापमान के साथ रहा जबकी जगदलपुर, भुवनेश्वर और झारग्राम में सापेक्ष आद्रता से पाया गया। पत्ता मोड़ने वाले किड़ों की घटना बापट्ला और जगदलपुर में तापमान से नकारात्मक सहसंबंध में पाई गई। जहाँ तक शूट टिप कैटरपिलर का संबंध है, इसकी घटनाएं बापट्ला और भुवनेश्वर में न्यूनतम तापमान से सकारात्मक रूप से सहसंबंधित पाया गया। बापट्ला, होगलगेरे और मडकतारा में सेब और नट छिद्रक की घटनाओं के लिए उच्च तापमान के साथ सकारात्मक सहसंबंध में देखा गया, लेकिन झारग्राम में यह संबंध नकारात्मक था। पुष्प कीटों के उपद्रव को भुवनेश्वर, होगलगेरे और जगदलपुर में उच्च तापमान के साथ सकारात्मक संबंध और वेंगुर्ला में नकारात्मक सहसंबंध देखा गया।

जगदलपुर, झारग्राम और वेंगुर्ले में सापेक्ष आद्रता के साथ नकारात्मक संबंध देखा गया। होगलगेरे, झारग्राम, वेंगुर्ले और पारिया में न्यूनतम और अधिकतम तापमान के साथ टीएमबी का नकारात्मक प्रभाव देखा गया। इसकी घटना सापेक्ष आद्रता से होगलगीरे, पारिया, मडकतारा, वृद्धाचलम और वेंगुर्ला में सकारात्मक सहसंबंध में थी।

### प्रौद्योगिकी का स्थानांतरण:

विभिन्न केंद्रों द्वारा काजू के 4,44,993 कलमों का उत्पादन और वितरण इस वर्ष में किया गया। विभिन्न एआईसीआरपी केंद्रों द्वारा पुरुषों और महिलाओं के स्वयं सहायता समूहों को काजू उत्पादन तकनिक, छटाई और काजू सेब के उपयोगों के संबंध में 25 प्रशिक्षणों का आयोजन भी किया गया। जनजातीय उपयोजना के अंतर्गत आदिवासी किसानों को काजू उत्पादन में सशक्त बनाने के संबंध में 10 से अधिक जागरूकता और प्रशिक्षण कार्यक्रमों का आयोजन किया गया। इसके अलावा बापट्ला, भुवनेश्वर, जगदलपुर, झारग्राम, मडकतारा, पिलिकोड और वेंगुर्ले के वैज्ञानिकों ने विभिन्न कार्यक्रमों में संसाधन व्यक्ती के रूप में भाग लिया।

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## PROJECT CO-ORDINATOR'S REPORT

The AICRP on Cashew has presently fourteen centres, which are located in 12 cashew-growing states of the country and are under the administrative control of different State Agricultural Universities/ ICAR Institutes. The original budget allocation of the project for the year 2016-17 was Rs. 265.19 lakhs (ICAR Share) and the expenditure was Rs. 358.78 lakhs (ICAR Share).

The mandate of the project is to increase production and productivity of cashew 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 and

3. Evolving cost effective and efficient pest and disease management practices.

The salient findings during the period under report, in different projects are presented here.

### CROP IMPROVEMENT

As far as genetic resources are concerned, 165 germplasm accessions have been collected and planted by various centres. The total number of germplasm accessions conserved is 1655. A catalogue of 57 germplasm accessions with characterisation data has been published by Bhubaneswar centre. The Goa centre has collected three accessions having bold nut, bigger apple and higher nut yield types in addition to characterisation of 14 accessions. Vengurle center could identify a CNSL free type RFRS-195 and is under evaluation at the centre. The germplasm accessions at different centres

were also characterised for cashew apple traits such as juice recovery, TSS, Vitamin-C, Tannins and Acidity and promising types have been identified for each of these traits.

The multilocation trial-II aiming at evaluation of new high yielding varieties in different agro-climatic conditions was conducted at Jagdalpur and has led to identification of some promising types. The multilocation trial-III aiming at evaluation of promising hybrids in different agroecological conditions was conducted at Bapatla, Bhubaneswar, Vridhachalam, Madakkathara and Vengurle centres. At Bapatla centre, out of 11 genotypes evaluated in the last four years, BPP-8 recorded very good vegetative and reproductive growth compared to other genotypes. Genotype BH-6 at Bhubaneswar, H-1593 at Madakkathara, H-662 at Vengurle and H-14 at Vridhachalam performed well with respect to nut yield during the year. With respect to performance of released varieties (Multilocation trial-V), Vengurle-7 at Bhubaneswar and Jhargram, Amrutha at Madakkathara, Priyanka at Pilicode and VRI-3 at Vridhachalam performed well for nut yield during the year. Under hybridisation and selection, as many as 116 hybrid progenies were evaluated and some promising progenies are identified. Evaluation of five hybrid progenies at Bhubaneswar, 17 at Jhargram, 6 at Pilicode, 58 at Vengurle, 14 at Vridhachalam, 12 at Goa has led to identification of some promising types. At Goa center, 194 hybrid nuts have been produced with 9 crosses. Eighteen best performing hybrids out of 58 have been put under replicated trial at Vengurle center.





Under the trial on varietal screening of cashew apple for preparation of RTS and Jam, the overall acceptability of RTS and Jam was found better in BPP-8 at Bapatla center, Chintamani-1 at Hogalagere center, CARS-6 at Jagadapur centre, Ullal-4 at Jhargram, Vengurle-4 and Vengurle-7 at Kanabargi, Priyanka at Madakkathara, PLD 75 and PLD-40 at Pilicode, Vengurle-4 at Vengurle were found better compared to other varieties.

### CROP MANAGEMENT

In the trial on nutrient management for yield maximisation in cashew, application of 100% recommended dose of fertilizers and 10 kg farm yard manure along with foliar spray of major, secondary and micronutrients was found to be significantly superior at Hogalagere center. With regard to fertilizer application in high density cashew plantations, the spacing of 10 m x 5 m with the fertilizer levels of 225:75:75 kg/ha was found to be better in terms of nut yield in Bapatla center. However, the spacing of 10 m x 5 m with fertilizer levels 150:50:50 kg/ha was found better in Bhubaneswar center. At Jhargram center, the benefit to cost ratio was highest with 10 m x 5m spacing and 75:25:25 kg NPK/ha. Lower density planting with different doses of fertilizers is found to be comparatively less economical but highest dose of fertilizer increased the cost of cultivation and reduced the returns at Madakkathara center. It was found that the spacing of 6m x 4m with fertilizer level of 75:25:25 NPK kg/ha yielded the highest benefit to cost ratio at Pilicode center.

In the drip irrigation trial, the irrigation treatment at 80% cumulative pan evaporation was found to be superior at Hogalagere,

Vengurle and Vridhachalam centers. In high density planting- observational trials, it was revealed that benefit to cost ratio increased up to 5<sup>th</sup> harvest in 4m x 4m spacing but then onwards it started decreasing. In Jhargram center, yield per unit area was more in 4m x 4m spacing compared to 8m x 8m spacing. As far as intercropping trials are concerned, it was found that marigold was found profitable in Bapatla center. However, Okra at Jhargram and Paria, cowpea at Kanabargi, *Plumbago zeylanica* at Madakkathara and Greater yam at Vengurle were found profitable.

Organic management trial was conducted at different centres revealed that recommended dose of fertilizers with 10 kg of farm yard manure gave the highest cumulative nut yield in Bhubaneswar, Vridhachalam and Vengurle centers. However, at Jhargram center, 100% nitrogen as Farm Yard Manure, at Kanabargi, 100% nitrogen from FYM along with biofertilizer consortium (200kg/tree/year), at Madakkathara, 50 % Nitrogen as FYM with biofertilizer consortium were found superior. In the spacing cum fertilizer trial, spacing of 10 m x 10 m with 117:29:29 gram NPK/plant/year gave highest yield in Kanabargi.

### CROP PROTECTION

There was no TMB incidence in Bhubaneswar during the year. In the trial on evaluation of insecticides for control of TMB and other pests, Lambda cyhalothrin (0.6ml/litre) offered better control of leaf and blossom webber, shoot tip caterpillar and apple and nut borer at Bapatla, Jhargram and Bhubaneswar. At Hogalagere, Madakkathara and Jagdalpur, Thiamethoxam 25WG (0.2 g/l) gave good control



for TMB. However at Paria and Vengurle, Buprofezin (2ml/l) was found to be superior for controlling TMB on shoots and panicles. For control of cashew stem and root borer, at Bapatla, Madakkathara, Vengurle, Jagadapur and Hogalagere, swabbing of Fipronil @ 2ml/l offered protection to the tune of 80.95% without reinfestation. However, maximum recovery of trees was observed in case of chlorpyrifos swabbing (10ml/l) in Bhubaneswar, Vridhachalam and Jhargram. The trend of higher the stem girth and age of the tree, higher was the infestation by CSRB was observed in most of the centers.

With respect to influence of biotic and abiotic factors on the incidence of pest complex of cashew, it was observed that leaf and blossom webber incidence was negatively correlated with minimum temperature and positively correlated with relative humidity at Bapatla. As far as leaf miner is concerned, negative correlation was observed with minimum temperature at Bapatla but positive correlation was observed at Jagadapur. However, its incidence was positively correlated with a) maximum temperature at Bapatla and Bhubaneswar b) relative humidity at Jagdalpur, Bhubaneswar and Jhargram. Leaf folder's incidence was negatively correlated with maximum temperature at Bapatla and Jagdalpur. As for as shoot tip caterpillar is concerned, its incidence was positively correlated with minimum temperature at Bapatla and Bhubaneswar. There was positive correlation observed with maximum temperature for the incidence of Apple and Nut Borer at Bapatla, Hogalagere and Madakkathara but negative correlation at Jhargram. For inflorescence thrips,

positive correlation with maximum temperature was observed at Bhubaneswar, Hogalagere and Jagadapur and negative correlation at Vengurle. Negative correlation with relative humidity was observed at Jagdalpur, Jhargram and Vengurle. The TMB incidence was negatively correlated with both minimum and maximum temperature at Hogalagere, Jhargram, Vengurle and Paria. Its incidence was positively correlated with relative humidity at Hogalagere, Paria, Madakkathara, Vridhachalam and Vengurle.

#### **TRANSFER OF TECHNOLOGY :**

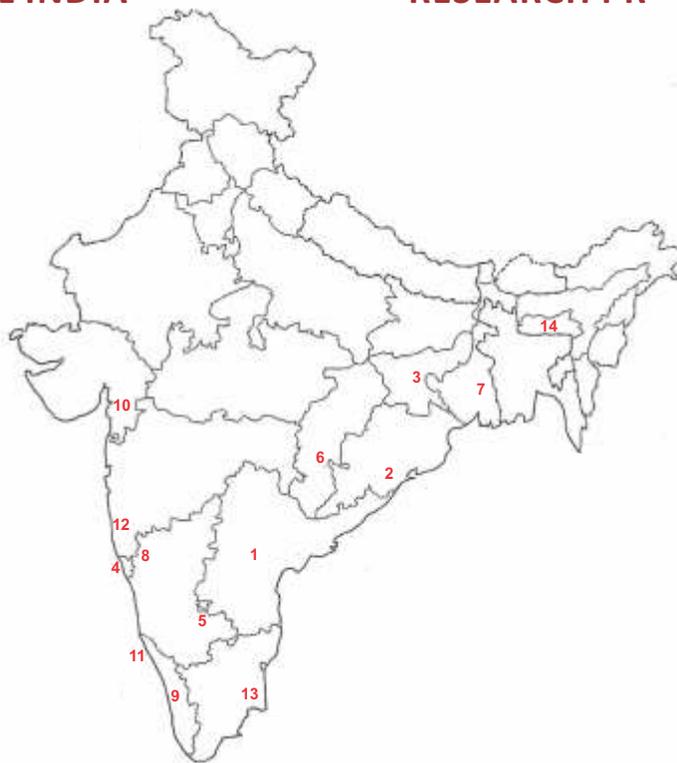
Cashew grafts to the tune of 4,44,993 have been produced by different centres and distributed during the year. As many as 25 trainings on production technology, pruning, cashew apple utilization of cashew for both men and women self help groups have been conducted by various AICRP-C centres. Under Tribal Sub Plan, more than 10 awareness and training programs related to empowering of tribal farmers about cashew production have been conducted. Besides these, scientists of Bapatla, Bhubaneswar, Jagadapur, Jhargram, Madakkathara, Pilicode, Vengurle have participated in various programs as resource persons.

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## 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

- During the year, 165 germplasm accessions have been collected and planted by various centres. The total number of germplasm accessions conserved in regional cashew field gene banks of AICRP centers is 1655.
- In multilocation trial-III, at Bapatla centre, BPP-8 recorded very good vegetative and reproductive characters compared to other genotypes. Genotype BH-6 at Bhubaneswar, H-1593 at Madakkathara, H-662 at Vengurle and H 14 at Vridhachalam performed well with respect to nut yield during the year.
- With respect to performance of released varieties, Vengurle-7 at Bhubaneswar and Jhargram, Amrutha at Madakkathara, Priyanka at Pilicode and VRI-3 at Vridhachalam performed well for nut yield during the year. Under hybridisation and selection, as many as 116 hybrid progenies were evaluated and some promising progenies are identified.
- The overall acceptability of RTS and Jam was found better in BPP-8 at Bapatla center, Chintamani-1 at Hogalagere center, CARS-6 at Jagadapur centre, Ullal-4 at Jhargram, Vengurle-4 and Vengurle-7 at Kanabargi, Priyanka at Madakkathara, PLD 75 and PLD-40 at Pilicode, Vengurle-4 at Vengurle
- Lower density planting with different doses of fertilizers is found to be comparatively less economical but highest dose of fertilizer increased the cost of cultivation and reduced the returns at Madakkathara center.
- The irrigation treatment at 80% cumulative pan evaporation was found to be superior at Hogalagere, Vengurle and Vridhachalam centers.
- Marigold as an intercrop in cashew was found profitable in Bapatla center. However, Okra at Jhargram and Paria, cowpea at Kanabargi, *Plumbago zeylanica* at Madakkathara and Greater yam at Vengurle were found profitable.
- Organic management trial was conducted at different centres revealed that recommended dose of fertilizers with 10 kg of farm yard manure gave the highest cumulative nut yield in Bhubaneswar, Vridhachalam and Vengurle centers.
- Lamda cyhalothrin (0.6ml/litre) offered better control of TMB, leaf and blossom webber, shoot tip caterpillar and, apple and nut borer at Bapatla, Jhargram and Bhubaneswar. At Hogalagere, Madakkathara and Jagadapur, Thiamethoxam 25WG (0.2 g/l) gave good control for TMB.
- For control of cashew stem and root borer, at Bapatla, Madakkathara, Vengurle, Jagadapur and Hogalagere, swabbing of Fipronil @ 2ml/l offered protection to the tune of 80.95% without reinfestation. However, maximum recovery of trees was observed in case of chloropyrifos swabbing (10ml/l) in Bhubaneswar, Vridhachalam and Jhargram.
- The TMB incidence was negatively correlated with both minimum and maximum temperature at Hogalagere, Jhargram, vengurle and Paria. Its incidence was positively correlated with relative humidity at Hogalagere, Paria, Madakkathara, Vridhachalam and Vengurle

### Planting Material Produced :

A total of 444993 grafts were produced during 2016-17 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
Bapatla	24000
Bhubaneswar	25000
Jagdapur	135000
Jhargram	6000
Madakkathara	97162
Pilicode	3500
Vengurle	128700
Vridhachalam	25631
<b>TOTAL</b>	<b>444993</b>



## REPORT OF THE ANNUAL GROUP MEETING OF SCIENTISTS OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW-2016

The Annual Group Meeting of Scientists of All India Coordinated Research Project on Cashew-2016 was held during 27<sup>th</sup> – 29<sup>th</sup> December 2016 at Regional Research Station (TNAU), Vridhachalam, Tamil Nadu.



### Inaugural Session of Annual Group Meeting of AICRP-Cashew 2016 at RRS, Vridhachalam, TN

At the outset, Dr. D. Saraladevi, Dean, HC & RI (W), Tiruchirappalli welcomed the delegates. The AGM was inaugurated by Dr. W.S. Dhillon, ADG (Hort. Sci.), ICAR, New Delhi by lighting the traditional lamp. On this occasion, Dr. M. Maheswaran, Director of Research, TNAU, Dr. N. Kumar, Former Dean (Horticulture), TNAU, Coimbatore and Dr. H. Hameed Khan, Former Project Coordinator (Palms) and Former Head (Crop Production), CPCRI, Kasaragod were also present as Guests of Honour. Dr. W.S. Dhillon in his Inaugural address, informed that in India less than 2% of land is under Horticultural crops. Earlier, the Agriculture sector contributed 2% of GDP. Recently the horticulture has surpassed Agriculture with the production of 262 million tones and now by 282 million tones and next year the projection is for about 291 million tones. The agricultural crops contribute 12.7% of GDP whereas in case of Horticultural sector it is about 4-5%. He informed that the percapita availability of horticultural produce is 100g but the requirement is about 230g. He further mentioned that the world's horticultural productivity is almost 17 tonnes/ha whereas in India it is only 13 tonnes/ha for which we have to strive hard to achieve the gap of 4 tonnes to reach the world average. He put forth the efforts made by the ICAR Institutes and State Agricultural Universities to increase the productivity of Horticultural Crops. Under cashew research, he felt that programmes should be made on short term, midterm and long term to achieve results. Efforts should be made to produce and give quality planting material for increasing productivity. He also mentioned that research should be oriented towards development of high yielding varieties having favourable characteristics like high shelling, tolerant to pest and diseases and adaptability of varieties to changing climatic situations. The possibilities of dwarf rootstocks giving high yield should be exploited.



In the presidential address, Dr. M. Maheswaran, Director of Research, TNAU congratulated the scientists of AICRP-Cashew, DCR, Puttur and RRS, Vridhachalam for their dedicated efforts in improving the cashew crop. He stressed the need for understanding the pollination mechanism & development of hybrids. He also mentioned about the technologies required for increasing the productivity of cashew, development of value addition chain in cashew products and entrepreneurship development with strong linkages. He further informed that there is a problem of varietal notification if a variety is released from State, but it is not a problem while released at the centre. Hence a common procedure for notification has to be developed.

Dr. M.G. Nayak, Director (Acting) and PC-AICRP Cashew, Directorate of Cashew Research Puttur presented the Project Coordinators Report and detailed about the importance and achievements of AICRP cashew. He said that technologies developed by the Centres have been well accepted by the farmers and played a major role in augmenting their income. He opined that the efforts of the AICRP Cashew centres in producing elite planting material upto 4.00 lakhs and also transfer of technology has led to a wider awareness about scientific cashew technology among farmers. He mentioned about the implementation of NEH and TSP programmes which has helped in creating awareness about cashew cultivation and dissemination of improved technologies in the regions.

The technical session was started with the Action Taken Report on the recommendations of the previous year by Dr. Mohana, G.S., PC Cell In-charge. The research progress and results obtained in various experiments at different AICRP-Cashew centers viz., Bapatla, Bhubaneswar, Chintamani, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Pilicode, Vengurle and Vridhachalam as well as, the co-operating centres viz., Arabhavi, Goa and Tura were presented by the scientists of the respective disciplines from each centre. The presentations were made in three main sessions viz., Crop Improvement, chaired by Dr.N.Kumar, Former Dean (Horticulture), TNAU, Coimbatore; Crop Management chaired by Dr.H.Hameed Khan, Former Project Coordinator (Palms) and Former Head (Crop Production), CPCRI, Kasaragod and Crop Protection chaired by Dr.K.Samiayyan, Dean, AC&RI, Eachankottai, Thanjavur.

The Plenary session was chaired by Dr. K. Ramasamy, Vice Chancellor, TNAU wherein he unfolded the developments made by the countries like Taiwan, Vietnam, Israel with lesser land, rainfall or working force. He informed that in India target should be fixed for achieving the agricultural productivity. He said that scientists should be the part for the development of the country. It is because of farmers, scientists are existing. They should play a role in tripling the income of a farmer. He mentioned that everything is possible when you identify the deficiencies and take action to rectify them.

A session of Interaction of development departments and research centres was also held which was chaired by Mr. S Kannan, Executive Director & Secretary, The Cashew Export Promotion Council of India, Kollam, Kerala. Mr. S. Kannan, elaborated the cashew market, current situation of India and need of the hour for cashew industry to improve the status of India among the leading countries. He also requested the scientific community that each and every technology has to be uploaded in the website for the industrial development. Farmers inquired about various issues such as CSRB attack in established cashew orchard and cultivation practices for cashew in changing climate scenario. Two progressive farmers of cashew viz., Mr.Ramalingam (Ariyalur district), Mr. Narayanasamy (Cuddalore District) illustrated their achievements and expressed their problems in cashew cultivation and also suggested to develop insurance for cashew which will help farmers during natural vagaries.



# EXPERIMENTAL RESULTS







# I. CROP IMPROVEMENT







## I. CROP IMPROVEMENT

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

**Centres:** **East Coast** : Bhubaneswar, Jhargram and Vridhachalam  
**West Coast** : Goa, Paria, Pilicode and Vengurla  
**Plains / others** : Darisai, Hogalagere, Kanabargi, Jagdalpur and Tura

The objectives of the project 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

During the current year, 165 germplasm accessions have been collected by different centres of AICRP on Cashew and have been planted in the respective Regional Cashew Field Gene Banks (RCFGBs). The total number of accessions conserved so far is 1710 (Table. 1.1)

**Table 1.1 : Cashew germplasm holding in different centres**

Centre	No. of accessions		Existing
	Earlier existing	Collected during 2016-17	
<b>East Coast</b>			
Bapatla	91	6	97
Bhubaneswar	106	2	108
Jhargram	283	1	284
Vridhachalam	208		208
<b>West Coast</b>			
Goa	94	3	97
Madakkathara	142	0	142
Paria	0	0	0
Pilicode	87	0	87
Vengurla	306	59	365
<b>Plains tract/others</b>			
Barapani	45	14	59
Darisai	17	5	22
Hogalagere	51	59	110
Kanabargi	0	0	0
Jagdalpur	70	2	72
Tura	45	14	59
<b>Total</b>	<b>1545</b>	<b>165</b>	<b>1710</b>

### BHUBANESWAR

During the fruiting season, scion materials of two cashew germplasm viz. RP-11 (local collection) and Jhargram-2 (from Jhargram Centre, West Bengal) were collected and clonal planting materials were raised by soft wood grafting. Grafted plants of collected germplasm were planted in the germplasm conservation block for future evaluation. Till date a total 108 numbers of cashew germplasm accessions are maintained in the Regional Field Gene Bank of CRS, Bhubaneswar. During the year, characterization of 57 numbers of germplasm accessions have been completed and a catalogue has been published by the centre (Table 1.2 and 1.3).



**Table 1.2 : Vegetative parameters of promising cashew germplasm at Bhubaneswar Centre \***

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )	No. of laterals / m <sup>2</sup>
				N-S	E-W		
OC 55	2003	5.2	70.0	7.1	8.0	44.75	23.00
OC 56		4.5	63	5.5	6.7	29.21	21.00
OC 60		6.8	100	8.8	8.5	58.74	23.00
OC 77		6.5	104	9.0	9.8	69.36	31.00
OC 78		5.4	66.5	7.1	8.2	45.94	19.50
OC 109		7.3	92	5.1	5.5	22.05	22.25
OC 110		5.8	99	7.1	7.3	40.69	19.75
OC145		6.6	87.4	6.5	7.6	39.02	19.00

*\*Observational strip*

**Table 1.3 :Yield parameters of promising cashew germplasm at Bhubaneswar Centre \***

Accession No.	Flowering duration (days)		No. of panicles / m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
	Range	Mean				
OC 55	3 <sup>rd</sup> week of Dec. to 1 <sup>st</sup> week of March	65	17.04	0.08	23.50	6.3
OC 56	1 <sup>st</sup> week of Nov. to 1 <sup>st</sup> week of Feb.	89	14.44	0.30	28.75	7.0
OC 60	2 <sup>nd</sup> week of Nov. to 3 <sup>rd</sup> week of Feb.	92	11.56	0.20	18.50	5.5
OC 77	2 <sup>nd</sup> week of Jan. to 4 <sup>th</sup> week of March	77	16.83	0.01	19.32	5.0
OC 78	2 <sup>nd</sup> week of Jan. to 3 <sup>rd</sup> week of March	67	13.23	0.02	34.25	7.8
OC 109	2 <sup>nd</sup> week of Dec. to 4 <sup>th</sup> week of Feb.	76	13.63	0.02	14.63	5.3
OC 110	2 <sup>nd</sup> week of Dec. to 1 <sup>st</sup> week of Mar.	65	14.43	0.12	24.00	6.0
OC145	2 <sup>nd</sup> week of Dec. to 1 <sup>st</sup> week of Mar.	86	18.50	0.10	26.5	5.4

*\*Observational strip*

Accession OC 145 recorded maximum nut weight (7.4g) as well as annual nut yield (17.0 kg plant<sup>-1</sup>) at 10<sup>th</sup> harvest. Shelling was recorded maximum in accession OC 110 (33.3%) while apple weight was recorded maximum in accession OC 60 (70.0g). Accession OC 60 also recorded the maximum cumulative nut yield (31.84kg tree<sup>-1</sup>) followed by OC 55 (30.8kg tree<sup>-1</sup>) and OC 145 (29.68 kg tree<sup>-1</sup>) for 10 harvest (Table 1.4).



Table 1.4 :Yield parameters of promising cashew germplasm at Bhubaneswar Centre \*

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. nut yield (kg/tree) (for 10 Harvests)
OC 55	6.5	52.0	27.7	11.0	30.8
OC 56	4.9	30.0	28.6	11.7	24.16
OC 60	7.0	70.0	28.2	8.7	31.84
OC 77	5.6	58.0	28.5	8.3	23.63
OC 78	4.4	32.0	27.3	10.4	22.21
OC 109	6.4	33.0	29.7	8.8	20.07
OC 110	6.0	57.0	33.3	8.1	20.9
OC145	7.4	27.0	28.1	17.0	29.68

*\*Observational strip*

## GOA

Two new accessions (Batim-1/17 and Batim-6/17) from Batim village in Goa Velha and one accession (Arjun -1/17) from Casarvane village of Pernem zone in North Goa, having bold nut, bigger apple and higher nut yield, were identified for adding to Germplasm collection. The characteristic features of mother trees of these accessions are presented in the Table(1.5).

Table 1.5 : Cashew accessions newly collected during the year

Sl. No.	Accession name	Approx. age (yrs)	Av. Nut wt. (g)	Shelling (%)	Apple wt. (g)	Apple Colour	TSS (°B)
1	Batim-1/17	About 15	10.27	28.88	102.33	Yellow	9.82
2	Batim-6/17	About 26	11.59	28.68	132.25	Yellow	10.6
3	Arjun-1/17	About 35	11.57	28.22	95.80	Red	10.6



Batim-1/17 having bold nuts and bigger apples



Batim-6/17 having bold nuts and juicy apples



Arjun-1/17: Developing nuts in cluster and matured apples on the tree canopy

With addition of these three new accessions to the earlier Germplasm of 94 accessions, a total of 97 germplasm accessions of cashew representing the following different groups is being maintained at Goa Centre.

- Jumbo nut types : 14 + 3 = 17 accessions
- Bold „ „ : 40 accessions
- Medium nut and high yielders : = 13 „
- Remaining 23: high yielders/ cluster bearers irrespective of nut size
- Dwarf canopy types : 3 accessions
- Very compact canopy type: 1 accession





### Characterization of selected local bold nut cashew genotypes:

The results on characterization of 14 genotypes (Valpoi-1, Valpoi-2, Valpoi-3, Bardez-3, Bardez-9, Tiswadi-7, Tudal-1, Tudal-3, Mayem-1, BKL-1, BKL-2, FMGDI-1, Tiswadi-3 and Goa-1Check) revealed that the accession Valpoi-2 showed vigorous growth with maximum tree height of 4.64m with collar girth of 59.47cm followed by Valpoi-3 with corresponding values of 4.58m and 57.6 cm respectively, both of which started flowering from 2012 along with other accessions namely, Valpoi-1 and Tiswadi-3 with medium vigorous growth habit . Bardez-8/98 recorded the highest nut yield of 4.22 kg/tree with medium bold nut of 7.63g and mean apple weight of 63.49g, followed by Bardez-9 with 3.94 kg/tree as compared to 3.03kg/tree of raw nut yield in check. Valpoi-2, Bardez-9 and Tiswadi-3 continued to record higher nut weight in the range of 10.88g – 11.51g. Valpoi-3, Bardez 8/98, Mayem-1 and BKL-2 recorded the mean nut weight of less than 8g but were on par with check (7.78g). All other accessions recorded the mean nut weight in between 8.13 (Valpoi-1) and 9.27g (FMGDI-1). Shelling percentage significantly varied from 27.61 (Bardez-9) to 31.43 as compared of 30.36% shelling in Check variety. Among the accessions, apple weight varied from 61.6g in Mayem-1 to 93.68 in Tiswadi-3 (Table 1.6).

**Table 1.6 : Per se Performance of bold-nut genotypes of cashew during 2016 season**

Sl. No.	Genotype	Height (m)	Girth (cm)	Flowering Year	Nut yield (kg/tree)	Mean nut Wt. (g)	Mean apple Wt. (g)	TSS (°B)	Shelling (%)
1	Valpoi-1	3.43	41.90	2012	2.40	8.13	73.13	11.29	29.04
2	Valpoi-2	4.64	59.47	2012	1.44	11.51	90.68	10.31	28.31
3	Valpoi-3	4.58	57.60	2012	2.09	7.62	88.58	11.27	28.01
4	Bardez-8/98	4.41	48.13	2011	4.22	7.63	63.49	11.76	29.92
5	Bardez-9	3.36	46.33	2011	3.94	10.88	86.57	11.64	27.61
6	Tiswadi-3 (Goa-2)	4.11	47.67	2012	1.84	11.41	93.68	10.17	29.18
7	Tiswadi-7	4.07	40.77	2011	1.50	8.16	71.32	10.16	30.46
8	Tudal-1	4.43	38.77	2011	1.84	8.70	81.42	11.59	28.73
9	Tudal-3	4.16	39.97	2011	1.48	9.03	79.04	10.36	28.42
10	Mayem-1	4.27	42.83	2011	2.82	7.97	61.60	11.19	31.43
11	BKL-1	3.38	45.70	2011	1.47	8.42	73.96	11.24	28.19
12	BKL-2	3.85	42.90	2011	1.46	7.99	73.43	11.96	28.64
13	FMGDI-1	3.35	47.60	2011	1.75	9.27	84.68	11.66	28.89
14	Goa-1 (Check)	4.26	46.80	2011	3.03	7.78	70.79	12.01	30.36
	<b>Mean</b>	<b>4.02</b>	<b>46.17</b>		<b>2.23</b>	<b>8.89</b>	<b>78.00</b>	<b>11.19</b>	<b>29.09</b>
	<b>CD (5%)</b>	<b>0.472</b>							
	<b>C.V</b>	<b>7.33</b>							



## HOGALAGERE

As the plants are less than two years old, the flowering and yield parameters have not been recorded (Table 1.7).

**Table 1.7 : Vegetative parameters of promising cashew germplasm at HREC, Hogalagere Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )	No. of laterals / m <sup>2</sup>
				N-S	E-W		
Tr. No. 40	2014	2.5	21.5	1.5	0.5	3.14	18
2/97-Kottarakara	2014	2.2	19.0	1.9	0.3	3.80	16
9/8 EPM	2014	2.0	16.3	2.1	1.4	9.62	15
Tr. No. 274	2014	1.9	15.7	2.3	0.9	8.04	14
9/88	2014	1.8	14.8	1.3	0.8	3.46	16
6/86	2014	1.7	18.0	2.3	0.4	5.72	11
13/5 Kodur	2014	1.7	15.7	2.1	0.8	6.60	10
<b>Mean</b>		<b>1.97</b>	<b>17.29</b>	<b>1.93</b>	<b>0.73</b>	<b>5.77</b>	<b>14.29</b>

### Constraints :

Protection of young plants from high speed winds, higher temperatures, and wild animals from adjacent forest area is a major constraint. In addition, the possibilities of irrigating plants is also limited due to deeper borewells and very low power supply hours.

## JAGDALPUR

Ten accessions collected from DCR, Puttur were planted during the year 1996-97. It is evident from the data presented in table that the mean annual nut yield/tree was highest for NRC- 138 (10.40 Kg), followed by NRC-137 (9.70 Kg) (Table 1.8). The cumulative Nut yield was highest in NRC- 137 (98.65 Kg) with 17 harvests. Mean nut weight was found highest for NRC-138 (8.60 g) followed by NRC-140 and NRC-137. Shelling per cent was found highest in NRC- 131 (30.10%) (Table 1.9).





**Table 1.8 : Vegetative parameters of promising cashew germplasm at Jagdalpur Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Flowering duration (days)	No. of flowering laterals / m <sup>2</sup>	Mean no. of nuts/panicle
				E-W	N-S			
NRC- 130	1996-97	5.50	93.50	7.90	6.40	98	13.75	3.80
NRC- 131	1996-97	7.30	96.20	8.40	8.40	78	11.50	4.10
NRC- 136	1996-97	6.80	100.50	8.70	7.50	85	12.25	4.50
NRC- 137	1996-97	7.90	120.20	9.40	8.70	66	15.25	5.80
NRC- 138	1996-97	<b>8.30</b>	122.50	<b>10.30</b>	<b>9.80</b>	94	17.50	5.20
NRC- 140	1996-97	5.60	106.80	8.10	7.60	85	11.75	3.20
NRC- 190	1996-97	6.80	109.20	9.10	8.10	74	12.50	3.80
NRC- 191	1996-97	6.60	114.30	7.80	7.30	60	14.25	4.60
NRC- 192	1996-97	7.60	118.50	9.90	9.20	83	10.75	3.00
NRC-193	1996-97	6.40	113.60	9.00	7.50	96	14.50	5.10

**Table 1.9 :Yield parameters of promising cashew germplasm at Jagdalpur centre**

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (For 17 Harvests)
NRC- 130	7.50	68.40	26.80	7.50	55.38
NRC- 131	7.80	51.50	<b>30.10</b>	6.30	49.23
NRC- 136	6.50	58.30	28.40	6.10	46.75
NRC- 137	8.00	49.50	28.50	9.70	<b>98.65</b>
NRC- 138	<b>8.60</b>	64.30	29.30	<b>10.40</b>	90.68
NRC- 140	8.40	<b>100.20</b>	28.20	6.80	53.85
NRC- 190	7.30	58.50	25.70	5.90	41.35
NRC- 191	7.80	53.80	29.50	8.30	73.86
NRC- 192	7.50	61.80	27.60	6.20	46.20
NRC-193	7.10	58.60	28.30	7.80	74.87

### JHARGRAM

The germplasm had more than 7 g nut weight were JGM – 288, JGM – 251, JGM – 302, JGM – 287, JGM – 290, JGM – 291, JGM – 231 and JGM - 289. The shelling percentage varied between 17.4% to 38.4% (Table 1.10). The highest yielder was in JGM – 302 followed by JGM – 313, JGM – 219, JGM – 310, JGM – 282 and JGM – 251 (Table 1.11). Cumulative yield record showed that JGM – 251 was the highest yielder (63.3kg/tree for 7 harvests) followed by JGM – 282 (60.1kg/tree for 7 harvests) (Table 1.12).



**Table 1.10 : Vegetative parameters of promising cashew germplasm at Jhargram Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )	No. of laterals / m <sup>2</sup>
				N-S	E-W		
JGM-217	2004	5.3	73.0	7.4	7.9	68.7	24.5
JGM-219	"	7.4	93.5	8.3	6.6	84.0	19.8
JGM-220	"	7.5	82.5	7.3	8.3	77.4	10.0
JGM-221	"	7.2	88.5	7.4	7.2	67.9	4.0
JGM-223	"	5.8	55.0	4.6	7.7	46.4	4.3
JGM-226	"	7.1	95.5	6.0	8.5	73.7	17.3
JGM-231	"	7.1	98.0	9.3	7.5	83.6	9.3
JGM-236	"	6.7	80.0	7.1	6.3	62.9	20.5
JGM-242	"	6.3	61.0	7.2	6.9	88.4	15.5
JGM-251	"	6.7	87.5	9.0	8.8	89.5	12.3
JGM-252	"	6.1	79.5	8.2	8.6	77.7	17.5
JGM-280	2005	5.6	76.5	7.1	7.4	61.1	20.3
JGM-282	"	5.9	67.5	7.4	7.4	51.9	20.0
JGM-287	"	6.3	76.5	6.8	8.5	49.8	18.5
JGM-288	"	6.0	60.0	6.1	6.9	74.5	16.8
JGM-289	"	6.4	69.0	7.9	7.8	53.1	13.8
JGM-290	"	6.3	80.5	6.8	6.1	65.5	15.3
JGM-291	"	5.7	73.0	7.1	7.8	77.4	14.5
JGM-292	"	5.9	74.0	8.0	8.5	77.1	19.0
JGM-296	"	6.9	71.5	8.3	7.9	80.2	13.8
JGM-299	"	5.9	68.0	7.9	7.7	70.5	18.5
JGM-302	"	6.8	86.0	8.4	8.8	89.7	17.3
JGM-310	"	6.5	73.5	8.6	6.9	73.7	11.5
JGM-313	"	5.7	76.5	7.3	6.3	53.6	14.0
JGM-314	"	4.7	52.5	6.4	5.4	40.0	16.0
JGM-320	2006	6.0	80.0	5.7	7.2	57.4	13.8

**Table 1.11 :Yield parameters of promising cashew germplasm at Jhargram Centre**

Accession No.	Mean Flowering duration (days)	No. of panicles / m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
JGM-217	78	17.5	0.19	32.0	6.8
JGM-219	84	16.5	0.21	42.8	8.8





JGM-220	70	7.0	0.09	19.8	5.8
JGM-221	50	4.0	0.08	16.8	5.5
JGM-223	67	4.3	0.11	20.0	6.3
JGM-226	86	14.5	0.15	16.8	5.3
JGM-231	76	8.3	0.07	9.5	3.5
JGM-236	83	16.0	0.04	18.8	5.5
JGM-242	90	10.8	0.16	32.3	5.5
JGM-251	65	5.0	0.24	24.3	8.3
JGM-252	65	16.3	0.08	15.0	3.0
JGM-280	90	12.5	0.29	38.5	16.3
JGM-282	77	19.3	0.21	67.8	11.5
JGM-287	76	16.8	0.17	28.8	5.8
JGM-288	74	14.8	0.13	15.5	4.0
JGM-289	70	12.0	0.09	11.5	3.0
JGM-290	56	13.0	0.19	31.5	6.5
JGM-291	54	13.0	0.06	12.5	2.5
JGM-292	68	17.0	0.20	23.0	5.0
JGM-296	75	13.8	0.17	27.0	6.0
JGM-299	87	15.0	0.25	30.3	6.8
JGM-302	66	14.8	0.20	29.3	8.3
JGM-310	66	6.3	0.22	35.5	6.0
JGM-313	69	10.0	0.34	65.8	18.3
JGM-314	65	11.5	0.22	29.3	11.8
JGM-320	78	10.0	0.18	35.5	5.0

Table 1.12 : Yield parameters of promising cashew germplasm at Jhargram Centre

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 10 Harvests)
JGM-217	5.0	51.0	38.4	7.4	32.6
JGM-219	5.2	36.0	21.1	12.7	41.1
JGM-220	5.0	24.0	32.4	6.1	34.1
JGM-221	6.0	20.0	31.9	6.8	28.9
JGM-223	5.7	45.0	31.8	5.3	24.7
JGM-226	6.6	25.0	18.1	6.6	19.5
JGM-231	7.1	36.0	32.4	5.7	52.7
JGM-236	5.5	27.5	30.5	6.4	42.2
JGM-242	5.4	27.5	29.6	10.5	51.3
JGM-251	7.6	40.0	27.7	11.2	63.3



JGM-252	6.1	35.0	29.1	5.7	15.9
JGM-280	5.0	40.0	23.8	8.0	24.9
JGM-282	5.0	41.0	30.0	12.0	60.1
JGM-287	7.5	20.0	32.9	7.3	20.5
JGM-288	8.2	20.0	17.4	7.5	14.4
JGM-289	7.0	46.5	24.5	4.3	17.3
JGM-290	7.3	42.5	32.9	10.2	38.6
JGM-291	7.3	37.5	32.9	5.6	26.2
JGM-292	5.7	29.0	20.6	6.8	19.7
JGM-296	5.0	33.0	31.8	7.4	24.8
JGM-299	5.2	45.0	32.5	7.6	24.1
JGM-302	7.5	40.5	30.3	13.3	28.9
JGM-310	6.9	40.0	24.6	12.2	42.8
JGM-313	5.5	32.5	34.7	13.1	20.8
JGM-314	5.4	12.5	22.4	6.3	12.2
JGM-320	5.5	39.0	25.5	7.6	14.3

### PILICODE

Highest mean nut weight of 12.85g was recorded in PLD 20 while the lowest of 3.09g was recorded in PLD 57. Highest shelling percentage of 32.65% was recorded in PLD 1, whereas the lowest shelling percentage of 20.31% was recorded in PLD 20 with highest nut weight indicating the inverse relationship of nut weight and shelling percentage. Mean annual nut yield and cumulative yield were highest in PLD 4 similar to previous years (Table 1.13, 1.14, 1.15 and 1.16).

**Table 1.13 : Vegetative parameters of promising cashew germplasm at Pilicode Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				N-S	E-W	
PLD1	1998	8.38	0.80	8.20	8.18	63.35
PLD 3		9.57	1.04	7.54	7.51	63.28
PLD 4		9.42	1.09	7.51	7.38	67.58
PLD 12		<b>10.45</b>	1.33	7.82	6.33	68.65
PLD 15		7.18	0.78	5.68	6.04	40.11
PLD 16		9.51	0.94	5.62	6.24	49.42
PLD 17		<b>10.14</b>	<b>1.45</b>	<b>9.61</b>	<b>9.10</b>	<b>91.49</b>
PLD 18		9.18	1.04	5.40	8.49	50.60
PLD 19		9.50	<b>1.43</b>	<b>9.10</b>	6.75	68.00
PLD 20		9.18	1.25	6.25	7.88	61.74
PLD 57		1.88	0.28	2.95	2.87	5.38
Mean		<b>8.58</b>	<b>1.04</b>	<b>6.88</b>	<b>6.98</b>	<b>57.24</b>
CV%		<b>3.02</b>	<b>6.86</b>	<b>8.70</b>	<b>6.72</b>	<b>9.80</b>



**Table 1.14 : Yield parameters of promising cashew germplasm at Pilicode Centre**

Accession No.	Nut wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 12 Harvests)
PLD1	7.70	<b>32.65</b>	6.41	52.56
PLD 3	8.54	29.31	5.89	39.57
PLD 4	6.85	31.96	<b>7.79</b>	<b>62.39</b>
PLD 12	9.57	26.08	6.72	54.42
PLD 15	8.05	27.88	4.19	24.61
PLD 16	8.29	25.94	5.20	40.22
PLD 17	8.68	27.25	3.83	22.86
PLD 18	9.14	29.50	4.66	23.16
PLD 19	8.60	28.56	3.19	20.99
PLD 20	<b>12.85</b>	<b>20.31</b>	3.04	22.59
PLD 57	3.09	29.74	2.08	8.44
<b>Mean</b>	<b>8.31</b>	<b>28.11</b>	<b>4.82</b>	<b>33.80</b>
<b>CV%</b>	<b>1.43</b>	<b>2.00</b>	<b>3.33</b>	-

**Table 1.15 : Vegetative parameters of promising cashew germplasm at Pilicode Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )	No. of laterals / m <sup>2</sup> (Not flowered)
				N-S	E-W		
PLD 75	2003	4.41	0.16	3.97	3.60	15.55	<b>10.25</b>
PLD 54		3.77	0.43	3.75	3.94	11.93	12.75
PLD 44		5.05	0.38	4.38	2.84	15.50	11.75
PLD 64		5.33	0.47	4.68	4.18	16.04	11.55
PLD 62		5.76	<b>0.85</b>	6.03	<b>7.99</b>	35.14	<b>17.33</b>
PLD 40		<b>8.55</b>	0.84	<b>7.28</b>	6.98	<b>55.20</b>	10.75
PLD 48		6.52	0.83	6.47	<b>7.69</b>	40.75	16.33
PLD 67		5.28	0.69	6.32	5.67	27.50	14.79
PLD 66		5.95	0.71	6.10	6.65	35.47	14.13
PLD 45		7.75	0.63	5.15	4.58	31.94	14.79
PLD 82		4.71	0.59	3.87	5.08	17.30	10.38



**Table 1.16 : Yield parameters of promising cashew germplasm at Pilicode Centre**

Accession No.	No. of panicles / m <sup>2</sup>	Ratio of bisexual: male flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
PLD 75	<b>8.75</b>	0.14	2.33	2.25
PLD 54	5.13	0.14	2.13	3.23
PLD 44	3.00	0.11	2.20	2.20
PLD 64	3.42	0.15	2.87	2.33
PLD 62	4.38	0.13	<b>5.83</b>	2.98
PLD 40	5.04	0.13	3.50	2.00
PLD 48	4.25	<b>0.16</b>	4.77	<b>3.63</b>
PLD 67	5.50	0.09	1.25	0.75
PLD 66	5.27	0.14	2.03	1.17
PLD 45	5.50	0.13	1.25	0.75
PLD 82	5.51	0.13	1.42	1.04

**Constraints :**

Lack of area for planting new germplasm, difficulty in recording observations as the trees are planted at 4 x 4 spacing and have grown tall.

**VENGURLE**

At present there are 311 cashew germplasm in the gene bank and 18 types were collected from other centres. Since 2004, total 1360 F<sub>1</sub> cashew progenies developed and planted in the plots for further evaluation. During the year 2015-16, total 58 hybrid nuts were harvested from 2 cross combinations. The nuts were sown for germination. Growth observations of 14 types during the year 2015-16 were recorded and presented in Table (1.17). Among the 14 types, RFRS 188 recorded the highest height (7.10 m) while, RFRS 189 had the maximum stem girth of 73.50 cm. Maximum canopy area (40.69 m<sup>2</sup>) was observed in RFRS 188. Whereas, the maximum number of laterals/m<sup>2</sup> (30.20/m<sup>2</sup>) was recorded in RFRS 195.

**Table 1.17 : Vegetative parameters of promising cashew germplasm at Vengurle centre**

Accession No.	Year of planting	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )	No. of laterals/ m <sup>2</sup>
				N-S	E-W		
RFRS 185	2005	6.60	67.00	6.00	6.15	29.02	23.00
RFRS 186	2005	6.07	47.70	5.37	5.70	24.09	22.70
RFRS 187	2005	7.00	62.70	6.07	6.97	33.37	18.30
RFRS 188	2005	<b>7.10</b>	65.00	7.50	6.90	<b>40.69</b>	21.00
RFRS 189	2005	6.50	<b>73.50</b>	6.00	6.70	31.55	23.00





RFRS 190	2005	6.00	68.00	5.40	7.90	34.61	29.00
RFRS 191	2005	4.40	52.00	5.60	4.70	20.74	22.00
RFRS 192	2005	5.20	48.00	6.20	4.70	23.23	25.00
RFRS 193	2005	5.95	45.00	3.35	4.35	11.58	22.00
RFRS 194	2005	6.00	50.00	4.80	4.40	16.61	18.00
RFRS 195	2005	4.36	48.10	5.05	4.81	19.00	<b>30.20</b>
RFRS 196	2008	2.85	27.00	2.35	2.60	4.75	23.50
RFRS 197	2012	1.95	19.00	1.35	1.25	1.33	-
RFRS 198	2012	1.40	15.00	1.00	0.50	0.43	-

The minimum flowering duration was observed in RFRS 192 (87days). The highest sex ratio of 0.25 was observed in RFRS 195. The maximum number of nuts per sq. m. (26.0/m<sup>2</sup>) was noted in RFRS 188 while, the maximum number of nuts per panicle (4.60) was recorded in RFRS 194 (Table 1.18).

**Table 1.18 : Yield parameters of promising cashew germplasm at Vengurle centre**

Accession No.	Flowering duration (days)		Ratio of male : bisexual flowers	No. of nuts/m <sup>2</sup>	No. of nuts/panicle
	Range	Mean			
RFRS 185	90-94	92	0.12	18.00	2.10
RFRS 186	95-102	98	0.12	15.00	2.10
RFRS 187	94-112	102	0.11	13.00	2.50
RFRS 188	94-100	100	0.12	<b>26.00</b>	4.30
RFRS 189	88-98	93	0.14	20.50	2.80
RFRS 190	87-95	91	0.13	24.50	2.80
RFRS 191	92-101	92	0.11	10.00	1.30
RFRS 192	87-96	<b>87</b>	0.13	19.00	2.50
RFRS 193	88-97	93	0.12	17.50	2.30
RFRS 194	91-94	93	0.24	24.50	<b>4.60</b>
RFRS 195	95-106	101	<b>0.25</b>	25.30	4.20
RFRS 196	89-91	90	0.16	9.00	1.30
RFRS 197*	-	-	-	-	-
RFRS 198*	-	-	-	-	-

\* are in prebearing stage



Yield attributing data of cashew germplasm (Table 1.19) showed that RFRS 188 had the maximum nut weight of 9.50 g. The highest apple weight (60.0 g), shelling percentage (30.50%) and annual nut yield (2.31 kg/tree) for the year 2015-16 was found in RFRS 195. Higher cumulative nut yield at 3<sup>rd</sup> harvests (5.27 kg/tree) was observed in RFRS 195.

**Table 1.19 : Yield parameters of promising cashew germplasm at Vengurle centre**

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree)	Cum. yield (kg/tree)
RFRS 185	6.10	40.00	30.00	0.380	2.02*
RFRS 186	7.20	38.00	27.00	0.510	3.24*
RFRS 187	7.80	55.00	28.00	0.100	2.53*
RFRS 188	<b>9.50</b>	50.00	27.00	0.120	2.06*
RFRS 189	8.00	53.00	27.50	0.680	3.18*
RFRS 190	8.20	53.00	30.00	0.320	3.25*
RFRS 191	5.40	48.00	30.00	0.375	1.90*
RFRS 192	6.50	32.00	29.00	1.010	4.01*
RFRS 193	6.20	35.50	28.00	0.440	2.52*
RFRS 194	6.60	47.00	27.00	0.200	1.43*
RFRS 195	5.80	<b>60.00</b>	<b>30.50</b>	<b>2.31</b>	<b>5.27**</b>
RFRS 196	6.30	58.00	30.00	0.180	***

\*Cum. yield for 6<sup>th</sup> harvests, \*\* Cum. yield for 3<sup>rd</sup> harvests and \*\*\* pre-bearing stage.



## Gen.3. Varietal Evaluation Trials 1. Multi Location Trial – II

**Centres : Plains / others : Jagdalpur**

The objective of this experiment is to evaluate the growth and yield performance of new high yielding varieties obtained from different centres in different agro climatic localities.

### Experimental Details:

No. of entries	:	13
Bapatla	:	3/28, 3/33, 10/19, 30/1
Vengurla	:	H 68, H 255, H 303, H 320, H 367
Vridhachalam	:	M 15/4, M 44/3
DCR, Puttur	:	VTH 107/3, VTH 40/1
Design	:	RBD
Replications	:	Three
Year of Planting	:	1992 (1993 at Bapatla, 2003 at Jhargram, 1994 at Vridhachalam)

### JAGDALPUR

The multilocation trial was laid out in RBD with three replications during 2000 consisting of 14 genotypes. The data on morphological and yield characters were recorded. Nut yield (Kg/tree) was highest for H-68 (8.27kg) followed by V-4 & H-367 (Table 1.20). The maximum nut weight (10.37g) was recorded in H-255 followed by H-367. Whereas the maximum apple weight (80.17g) was recorded in H-367 followed by H-255. The shelling percent was recorded maximum for V-4 (30.77 %) followed by H-303 & NRCC Sel-1 (Table 1.21).

**Table 1.20 : Vegetative parameters of cashew genotypes in MLT-II at Jagdalpur Centre**

Accession	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Flowering duration (days)	Mean no. of flowering laterals / m <sup>2</sup>	Mean no. of nuts/panicle
			E-W	N-S			
T.No. 30/1	5.33	93.83	6.73	6.67	88	14.83	3.60
T.No. 3/33	6.00	101.12	6.87	6.77	81	15.17	3.07
T.No. 10/19	5.90	101.05	7.03	6.63	66	12.92	4.00
T.No. 3/28	5.73	96.43	6.43	7.20	68	13.50	4.47
H- 68	6.90	<b>109.13</b>	7.23	7.87	73	17.75	5.40
H- 255	6.40	103.47	7.20	7.30	71	15.58	4.07
H- 303	6.47	101.70	7.20	7.07	61	19.25	6.87
H- 320	5.87	101.02	7.17	7.57	59	16.25	5.33
H- 367	6.13	99.15	6.53	<b>8.13</b>	90	16.75	3.93



M- 15/4	5.40	94.97	6.57	6.80	79	12.17	4.07
M- 44/3	5.43	82.43	6.27	6.17	75	14.25	5.03
NRCC-Sel-1	6.17	106.13	7.70	7.47	56	13.42	4.20
NRCC-Sel-2	5.90	89.80	6.87	6.43	65	14.83	5.20
V-4	<b>7.07</b>	108.07	<b>7.97</b>	7.78	61	18.25	6.47
<b>SEm ±</b>	<b>0.31</b>	<b>3.54</b>	<b>0.26</b>	<b>0.24</b>	-	<b>0.36</b>	<b>0.21</b>
<b>CD at 5%</b>	<b>0.90</b>	<b>10.32</b>	<b>0.76</b>	<b>0.70</b>	-	<b>1.07</b>	<b>0.61</b>
<b>CV%</b>	<b>8.89</b>	<b>6.20</b>	<b>6.56</b>	<b>5.88</b>	-	<b>4.16</b>	<b>7.85</b>

Table 1.21 : Yield parameters of cashew genotypes in MLT-II at Jagdalpur centre

Accession No.	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 13 Harvests)
T.No. 30/1	6.57	50.47	26.73	5.23	29.30
T.No. 3/33	7.00	56.20	28.77	4.73	27.64
T.No. 10/19	6.03	58.90	28.30	4.57	29.53
T.No. 3/28	7.47	52.83	29.67	4.38	25.70
H- 68	9.00	70.13	29.80	<b>8.27</b>	<b>51.97</b>
H- 255	<b>10.37</b>	73.27	29.47	6.87	36.53
H- 303	7.97	61.57	30.23	7.17	45.23
H- 320	8.63	67.17	29.50	6.53	38.09
H- 367	10.13	<b>80.17</b>	29.23	7.30	42.41
M- 15/4	6.70	52.63	28.17	3.87	21.62
M- 44/3	6.03	49.87	27.73	4.53	27.54
NRCC-Sel-1	8.03	58.10	30.10	5.35	25.95
NRCC-Sel-2	8.97	67.13	28.17	5.82	35.75
V-4	8.30	68.17	<b>30.77</b>	8.07	<b>49.15</b>
<b>SEm ±</b>	<b>0.18</b>	<b>0.71</b>	<b>0.43</b>	<b>0.30</b>	-
<b>CD at 5%</b>	<b>0.54</b>	<b>2.08</b>	<b>1.27</b>	<b>0.89</b>	
<b>CV%</b>	<b>4.05</b>	<b>2.00</b>	<b>2.61</b>	<b>9.01</b>	





## 2. Multi Location Trial – III

**Centres:**  
**East Coast** : Bapatla, Bhubaneswar and Vridhachalam  
**West Coast** : Madakkathara and Vengurla  
**Plains / others** : Hogalagere

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

### Experimental Details :

Starting year: 2003, No. of entries: 10 + 1(Local check)

Sponsoring centre	Promising hybrids	TMB tolerant type
CRS, Bhubaneswar	BH 6, BH 85	--
CRS, Madakkathara	H 1597	K 22-1
RFRS, Vengurla	H 662, H 675	--
RRS, Vridhachalam	--	H 11 & H 14
DCR, Puttur	H 32/4	Goa 11/6
<b>Total</b>	<b>6</b>	<b>4</b>

**Replications – Three**

**Spacing 7.5 x 7.5 m**

**Plot size -4 plants per plot**

### BAPATLA

Table 1.22 : Growth parameters of cashew genotypes in MLT-III at Bapatla Centre

Sl. No.	Variety/ Genotype	Mean Plant height (m)	Canopy height(m)	Trunk girth (cm)	Mean Canopy spread (m)	Canopy surface area (m <sup>2</sup> )
1.	Goa 11/6	4.6	3.9	98.00	7.8	67.5
2.	H.662	3.0	2.7	81.03	5.0	29.4
3.	<b>H.32/4</b>	<b>5.1</b>	<b>4.7</b>	<b>103.17</b>	<b>8.0</b>	<b>75.3</b>
4.	K.22/1	4.8	4.3	94.60	6.7	57.2
5.	H.11	4.6	4.1	83.50	7.0	60.5
6.	H.675	4.5	4.2	84.56	6.9	59.8
7.	H.14	4.4	4.2	84.56	6.9	50.3
8.	<b>BPP-8</b>	<b>4.8</b>	<b>4.6</b>	<b>108.33</b>	<b>8.4</b>	<b>83.1</b>
9.	H.1597	4.6	4.2	89.50	6.5	55.1
10.	B.H.6	4.6	4.3	85.02	7.4	66.0
11.	B.H.85	4.7	4.4	78.08	7.6	71.9
	<b>CD@5%</b>	<b>0.8</b>	<b>0.8</b>	<b>16.24</b>	<b>NS</b>	<b>NS</b>
	<b>SEM ±</b>	<b>0.3</b>	<b>0.3</b>	<b>5.47</b>	<b>0.7</b>	<b>9.6</b>



**Table 1.23 : Yield parameters of cashew genotypes in MLT-III at Bapatla Centre**

Sl. No.	Variety/ Genotype	Date of first Flowering	Date of last Flowering	Duration of Flowering (days)	Flowering Intensity/ Sq. mt.	Sex ratio	No. of nuts/m <sup>2</sup>	No. of nuts/ panicle
1.	Goa 11/6	10.2.16	12.5.16	93.0	22.25	0.23	27.48	4.18
2.	H.662	28.1.16	17.5.16	111.0	18.29	0.17	17.70	3.13
3.	<b>H.32/4</b>	6.2.16	23.5.16	108.0	<b>25.00</b>	0.19	34.29	<b>4.66</b>
4.	K.22/1	25.2.16	20.5.16	<b>86.0</b>	20.59	0.14	31.96	3.62
5.	<b>H.11</b>	21.2.16	15.5.16	<b>85.0</b>	23.32	<b>0.06</b>	32.38	3.49
6.	<b>H.675</b>	10.2.16	20.5.16	101.0	18.44	<b>0.34</b>	35.14	3.94
7.	<b>H.14</b>	20.1.16	10.5.16	112.0	16.27	0.28	<b>36.28</b>	4.05
8.	<b>BPP-8</b>	20.1.16	28.4.16	100.0	<b>27.67</b>	0.16	<b>39.69</b>	<b>4.84</b>
9.	H.1597	17.1.16	19.4.16	94.0	18.69	0.12	21.73	3.50
10.	B.H.6	20.1.16	10.5.16	112.0	21.87	0.16	29.60	2.55
11.	B.H.85	1.2.16	5.5.16	95.0	20.52	0.13	34.73	2.54
	<b>CD@5%</b>				<b>5.52</b>	<b>0.09</b>	<b>NS</b>	<b>1.41</b>
	<b>SEM±</b>				<b>1.86</b>	<b>0.03</b>	<b>5.71</b>	<b>0.47</b>

**Table 1.24 : Yield parameters of cashew genotypes in MLT-III at Bapatla Centre**

Sl. No.	Variety/ Genotype	Nut weight [g]	Apple weight (g)	Shelling (%)	Nut yield /tree (Harvest No.9) (kg)	CNY/ tree (2008-2016) (kg)
1.	Goa 11/6	5.31	48.55	28.94	8.38	46.03
2.	H.662	7.08	43.83	30.08	2.87	21.37
3.	<b>H.32/4</b>	<b>7.68</b>	66.28	<b>31.88</b>	<b>10.12</b>	<b>54.15</b>
4.	K.22/1	5.35	51.38	<b>35.68</b>	3.24	27.06
5.	H.11	4.48	30.97	30.17	9.79	33.07
6.	H.675	4.12	32.22	30.92	5.90	27.83
7.	H.14	5.43	29.18	30.82	8.33	41.25
8.	<b>BPP-8</b>	7.64	63.05	28.71	<b>11.14</b>	<b>65.46</b>
9.	<b>H.1597</b>	5.67	<b>79.38</b>	28.20	4.73	39.66
10.	<b>B.H.6</b>	<b>8.01</b>	60.77	31.86	7.96	40.15
11.	<b>B.H.85</b>	6.50	<b>70.00</b>	28.82	8.30	37.04
	<b>CD@5%</b>	<b>1.10</b>	<b>19.34</b>	<b>NS</b>	<b>4.27</b>	<b>12.37</b>
	<b>SEM±</b>	<b>0.37</b>	<b>6.51</b>	<b>2.24</b>	<b>1.44</b>	<b>4.17</b>





The maximum mean annual nut yield per tree during the year was recorded in BPP-8 (11.14kg) followed by H.32/4 (10.12kg) and cumulative nut yield per tree was also recorded in BPP-8 (65.46 kg/tree) followed by H-32/4 (54.15kg/tree) in 9 annual harvests. With regard to the mean apple weight was recorded maximum in H1597 (79.38g) followed by BH-85 (70.00g) (Table 2.22, 2.23 and 2.24).

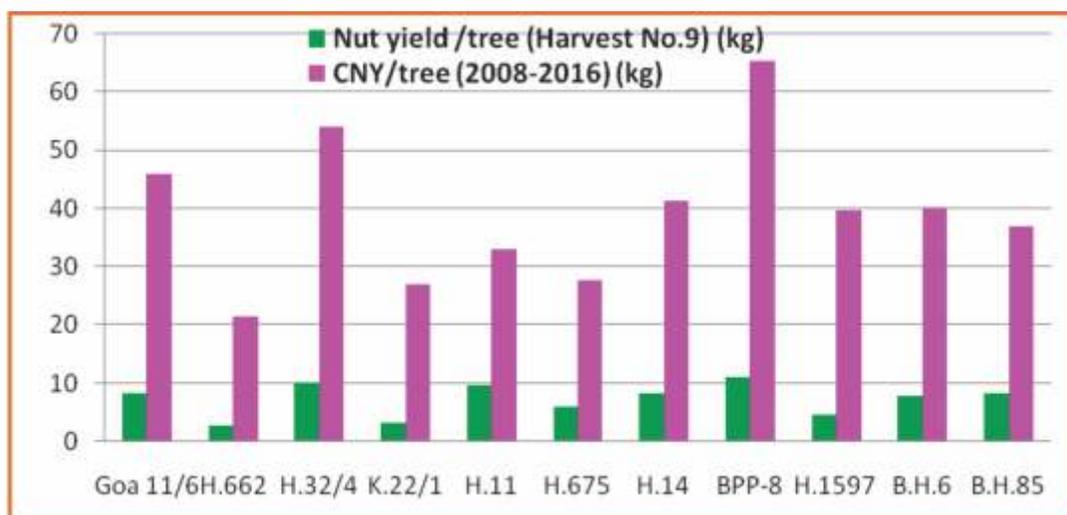


Fig. Yield parameters of cashew genotypes in MLT-III at Bapatla Centre

#### Compilation of four years data

Among the 11 genotypes evaluated BPP-8 has recorded highest vegetative growth parameters, maximum canopy height, canopy spread, and canopy surface area in the four consecutive years during 2012-13, 2013-14, 2014-15 and 2015-16. With regard to annual nut yield (11.14kg/tree) and cumulative nut yield (65.46 kg/tree) also performing well in consistently BPP – 8 in all the four years for 9 annual harvests.

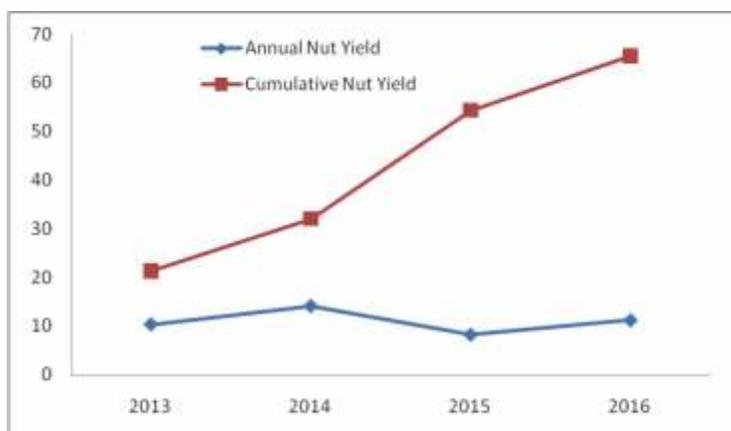


Fig. Cumulative nut yield and annual nut yield of BPP-8 during 2012-13, 2013-14, 2014-15 & 2015-16 under MLT-III





**BHUBANESWAR**

**Table 1.25 : Vegetative parameters of cashew genotypes in MLT-III at Bhubaneswar Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				E-W	N-S	
BH 6	2003	5.47	84.80	8.50	8.60	57.40
BH 85		5.40	93.07	8.90	9.10	63.59
H 1597		5.37	94.43	8.70	8.60	58.75
K 22-1		4.03	44.73	5.33	5.87	24.62
H 662		4.97	56.67	6.23	6.43	31.51
H 675		4.40	60.20	5.53	5.10	22.20
H 11		5.40	83.90	8.23	8.83	57.16
H 14		5.30	74.70	8.13	8.43	53.90
H 32/4		6.07	92.67	8.57	8.83	59.44
Goa 11/6		5.67	84.63	8.47	8.70	57.83
BPP-8 (Local Check)		5.83	89.87	9.10	9.40	67.17
<b>Mean</b>			<b>5.26</b>	<b>78.15</b>	<b>7.79</b>	<b>7.99</b>
<b>SEm ±</b>		<b>0.15</b>	<b>0.87</b>	<b>0.14</b>	<b>0.15</b>	<b>1.10</b>
<b>CD at 5%</b>		<b>0.45</b>	<b>2.58</b>	<b>0.41</b>	<b>0.45</b>	<b>3.24</b>
<b>CV%</b>		<b>4.98</b>	<b>1.93</b>	<b>3.07</b>	<b>3.32</b>	<b>3.77</b>

**Table 1.26 : Yield parameters of cashew genotypes in MLT-III at Bhubaneswar Centre**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
	Range	Mean				
BH 6	1 <sup>st</sup> week of Jan to 1 <sup>st</sup> week of Apr.	92.33	22.87	0.19	25.00	4.00
BH 85	1 <sup>st</sup> week of Dec. to 2 <sup>nd</sup> week of Apr.	117.00	25.40	0.27	32.33	6.00
H 1597	1 <sup>st</sup> week of Jan to 2 <sup>nd</sup> week of Apr.	85.00	24.50	0.32	29.60	5.00
K 22-1	3 <sup>rd</sup> week of Dec. to 1 <sup>st</sup> week of Apr.	113.67	21.87	0.21	22.67	5.33
H 662	2 <sup>nd</sup> week of Jan. to 1 <sup>st</sup> week of Apr.	75.67	16.90	0.14	23.33	3.33
H 675	2 <sup>nd</sup> week of Dec. to 1 <sup>st</sup> week of Apr.	118.00	20.79	0.58	33.13	8.67



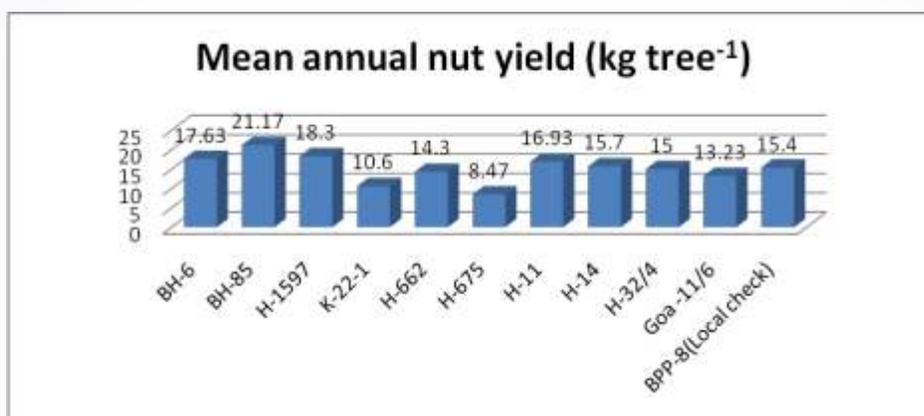


H 11	4 <sup>th</sup> week of Dec to 3 <sup>rd</sup> week of Mar.	118.33	24.73	0.22	26.87	7.00
H 14	2 <sup>nd</sup> week of Nov. to 4 <sup>th</sup> week of Mar.	129.67	21.50	0.24	34.87	6.00
H 32/4	4 <sup>th</sup> week of Dec to 4 <sup>th</sup> week of Mar.	106.00	20.57	0.21	26.37	6.33
Goa 11/6	2 <sup>nd</sup> week of Jan to 3 <sup>rd</sup> week of Apr.	85.33	20.52	0.18	27.23	6.00
BPP-8 (Local Check)	2 <sup>nd</sup> week of Dec. to 1 <sup>st</sup> week of Apr.	121.00	19.07	0.14	27.73	4.33
<b>Mean</b>		<b>105.64</b>	<b>21.70</b>	<b>0.25</b>	<b>28.10</b>	<b>5.64</b>
<b>SEm ±</b>		<b>2.03</b>	<b>0.70</b>	<b>0.02</b>	<b>0.84</b>	<b>0.28</b>
<b>CD at 5%</b>		<b>5.98</b>	<b>2.06</b>	<b>0.05</b>	<b>2.48</b>	<b>0.82</b>
<b>CV%</b>		<b>3.32</b>	<b>5.53</b>	<b>12.04</b>	<b>5.17</b>	<b>8.51</b>

Nut weight was recorded maximum for the genotype BH-6 (8.73g) while the minimum was recorded for the genotype H-675 (4.73g). Genotype BH-85 had maximum apple weight (72.67g) among the tested genotypes. Maximum shelling was recorded in genotype H-675 (33.35%) followed by BH-6 (32.97%) and H-662 (32.23%). The annual nut yield (kg tree<sup>-1</sup>) ranged from minimum 8.47 (H-675) to maximum 21.17 (BH-85) during the fruiting season. The cumulative nut yield (kg tree<sup>-1</sup>) for 10 harvests was recorded maximum for the genotype BH-85 (75.34) followed by BH-6 (65.44) and H-1597 (55.39) (Table 1.25, 1.26 and 1.27).

**Table 1.27 : Yield parameters of cashew genotypes in MLT-III at Bhubaneswar Centre**

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 10 Harvests)
BH 6	8.73	66.33	32.97	17.63	65.44
BH 85	7.37	72.67	30.28	21.17	75.34
H 1597	7.40	60.33	31.19	18.30	55.39
K 22-1	6.27	46.00	30.53	10.60	28.03
H 662	7.77	63.67	32.23	14.30	33.14
H 675	4.73	33.33	33.35	8.47	23.95
H 11	5.53	35.67	30.53	16.93	52.99
H 14	5.43	32.00	29.47	15.70	42.39
H 32/4	6.53	67.67	27.82	15.00	46.07
Goa 11/6	7.27	58.00	30.28	13.23	51.02
Local Check	7.63	50.67	29.05	15.40	52.27
<b>Mean</b>	<b>6.79</b>	<b>53.30</b>	<b>30.70</b>	<b>15.16</b>	<b>47.82</b>
<b>SEm ±</b>	<b>0.13</b>	<b>1.59</b>	<b>0.51</b>	<b>0.90</b>	-
<b>CD at 5%</b>	<b>0.39</b>	<b>4.70</b>	<b>1.51</b>	<b>2.65</b>	-
<b>CV%</b>	<b>3.38</b>	<b>4.76</b>	<b>2.88</b>	<b>10.27</b>	



### MADAKKATHARA

Significant difference could not be noticed with regard to annual nut yield among genotypes. However, the highest nut yield was recorded by H-1593 (5.766kg/tree) followed by H-11. The cumulative yield was highest for H-1593, the same result was obtained for the year 2014-15 also (Table 1.28, 1.29 and 1.30).

**Table 1.28 : Vegetative parameters of cashew genotypes in MLT-III at Madakkathra Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				E-W	N-S	
BH 6	2003	6.18	82.19	7.48	8.21	7.84
BH 85	2003	7.05	87.86	7.12	7.85	7.48
H 1593	2003	5.29	81.58	7.93	7.45	7.69
K 22-1	2003	6.14	87.11	8.03	7.65	7.84
H 662	2003	7.57	96.88	8.55	8.95	8.75
H 675	2003	7.16	87.05	7.97	8.16	8.06
H 11	2003	6.09	87.83	9.20	8.95	9.07
H 14	2003	6.16	91.91	8.85	8.43	8.64
H 32/4	2003	6.63	83.00	7.55	8.90	8.22
Goa 11/6	2003	6.63	84.88	8.79	8.50	8.64
Dhana (Local Check)	2003	5.96	93.83	8.63	8.46	8.54
<b>Mean</b>		<b>0.218</b>	<b>4.238</b>	<b>0.536</b>		<b>8.25</b>
<b>SEm ±</b>		<b>0.64</b>	<b>12.47</b>	<b>1.58</b>	<b>NS</b>	
<b>CD at 5%</b>		<b>5.88</b>	<b>8.37</b>	<b>11.33</b>		
<b>CV%</b>	<b>2003</b>	<b>6.18</b>	<b>82.19</b>	<b>7.48</b>	<b>8.21</b>	<b>7.84</b>





**Table 1.29 : Yield parameters of cashew genotypes in MLT-III at Madakkathara Centre**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/panicle
	Range	Mean			
BH 6	59-110	84	8.50	0.239	6
BH 85	83-114	98	6.75	0.250	12
H 1593	38-135	86	10.29	0.214	9
K 22-1	79-120	99	7.37	0.199	11
H 662	78-113	95	7.16	0.077	8
H 675	59-124	91	5.05	0.098	8
H 11	62-126	94	10.22	0.261	9
H 14	58-123	90	9.05	0.113	8
H 32/4	83-144	113	7.09	0.223	8
Goa 11/6	81-120	100	6.96	0.291	8
Dhana (Local Check)	75-118	96	7.75	0.495	8
<b>Mean</b>		<b>5.934</b>	<b>1.085</b>	<b>0.044</b>	<b>8.63</b>
<b>SEm ±</b>		<b>17.46</b>	<b>3.19</b>	<b>0.13</b>	
<b>CD at 5%</b>		<b>10.53</b>	<b>23.99</b>	<b>34.06</b>	
<b>CV%</b>	<b>59-110</b>	<b>84</b>	<b>8.50</b>	<b>0.239</b>	

**Table 1.30 : Yield parameters of cashew genotypes in MLT-III at Madakkathara Centre**

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 9 Harvests)
BH 6	8.01	72.85	4.200	34.6
BH 85	6.93	68.37	3.398	33.39
H 1593	7.37	69.63	5.766	46.39
K 22-1	6.66	63.43	3.732	34.42
H 662	7.62	50.19	4.313	42.17
H 675	6.83	58.25	4.865	35.35
H 11	5.36	62.84	5.643	37.03
H 14	6.46	74.33	5.056	38.11
H 32/4	7.55	73.06	4.706	37.32
Goa 11/6	7.46	71.41	4.651	41.40
Dhana (Local Check)	8.90	63.20	5.612	41.66
<b>SEm ±</b>	<b>0.81</b>	<b>17.77</b>	<b>--</b>	
<b>CD at 5%</b>	<b>6.65</b>	<b>15.83</b>	<b>NS</b>	
<b>CV%</b>	<b>8.01</b>	<b>72.85</b>	<b>--</b>	



## VENGURLE

Table 1.31 : Vegetative parameters of cashew genotypes in MLT-III at Vengurle centre

Accession No.	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				E-W	N-S	
BH.6	2008	3.16	42.89	5.42	5.43	23.22
BH.85	2008	3.43	39.89	4.25	4.53	15.18
H.1593	2008	3.32	43.89	4.53	4.69	16.83
K- 22-1	2008	3.68	43.78	4.90	4.97	19.07
H. 662	2008	<b>3.72</b>	43.11	4.86	4.66	18.05
H. 675	2008	3.62	40.00	<b>5.59</b>	<b>5.72</b>	<b>25.12</b>
H. 11	2008	3.25	45.33	5.32	5.58	23.51
H. 14	2008	3.37	38.67	4.99	4.59	13.40
H. 32/4	2008	3.27	44.55	4.80	4.84	18.35
Bhaskara	2008	3.59	<b>48.33</b>	4.55	4.44	16.81
V-7	2008	3.69	46.88	4.37	4.56	15.90
<b>Mean</b>		<b>3.46</b>	<b>43.39</b>	<b>4.87</b>	<b>4.91</b>	<b>18.68</b>
<b>SEm ±</b>		<b>0.15</b>	<b>2.83</b>	<b>0.43</b>	<b>0.35</b>	<b>2.06</b>
<b>CD at 5%</b>		<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>CV %</b>		<b>7.19</b>	<b>11.30</b>	<b>15.29</b>	<b>12.65</b>	<b>26.58</b>

Table 1.32 : Yield parameters of cashew genotypes in MLT-III at Vengurle Centre

Accession No.	Flowering duration (days)		No. of laterals/ m <sup>2</sup>	No. of panicles /m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
	Range	Mean					
BH.6	81-99	<b>89.66</b>	28.33	<b>18.10</b>	0.13	16.80	<b>4.23</b>
BH.85	84-103	91.00	24.46	15.10	<b>0.17</b>	18.23	3.26
H-1593	84-99	91.66	<b>29.70</b>	<b>18.10</b>	0.15	19.00	2.90
K- 22-1	86-98	92.66	25.33	15.53	0.15	<b>19.90</b>	3.53
H-662	84-98	92.00	24.90	13.66	<b>0.19</b>	19.10	3.50
H-675	90-103	<b>97.33</b>	27.43	<b>16.66</b>	0.15	<b>20.13</b>	<b>4.33</b>
H-11	86-100	92.00	<b>29.63</b>	<b>18.56</b>	0.12	11.83	2.53
H-14	85-97	92.66	25.00	<b>16.00</b>	0.14	<b>22.36</b>	3.23
H-32/4	86-108	92.33	27.86	<b>16.76</b>	0.15	17.80	2.53
Bhaskara	85-98	92.33	25.63	15.26	0.14	<b>20.40</b>	2.83
V-7	84-100	97.00	24.73	15.33	0.14	<b>22.33</b>	2.83
<b>Mean</b>	-	<b>92.79</b>	<b>26.63</b>	<b>16.28</b>	<b>0.15</b>	<b>18.90</b>	<b>3.24</b>
<b>SEm ±</b>	-	<b>0.98</b>	<b>1.08</b>	<b>0.88</b>	<b>0.009</b>	<b>1.10</b>	<b>0.23</b>
<b>CD at 5%</b>	-	<b>2.89</b>	<b>3.18</b>	<b>2.59</b>	<b>0.026</b>	<b>3.25</b>	<b>0.70</b>
<b>CV %</b>	-	<b>1.85</b>	<b>7.03</b>	<b>9.36</b>	<b>10.10</b>	<b>10.11</b>	<b>12.75</b>



It is seen from the data presented (Table 1.33) that H-662 recorded significantly the maximum mean nut weight (10.06 g) and at par with V-7 (9.36 g) while, significantly the maximum apple weight of 81.16 g was noted in BH-6 and at par with H-1593 (75.00g). Whereas, significantly the maximum annual nut yield (5.84 kg/tree) and cum. yield for last 4 harvests (19.37 kg/tree) was recorded in H-662.

**Table 1.33 : Yield parameters of cashew genotypes in MLT-III at Vengurle centre**

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (For 4 <sup>th</sup> harvests)
BH 6	9.00	<b>81.16</b>	<b>32.83</b>	3.52	12.85
BH 85	7.56	51.33	30.16	4.01	9.88
H 1593	8.86	<b>75.00</b>	<b>31.50</b>	3.87	12.12
K-22-1	6.53	71.16	30.00	3.41	10.49
H. 662	<b>10.06</b>	65.66	29.16	<b>5.84</b>	<b>19.37</b>
H. 675	6.30	48.66	<b>31.66</b>	4.62	11.96
H. 11	6.26	34.16	<b>31.33</b>	3.54	9.23
H. 14	6.96	41.56	<b>30.83</b>	3.85	13.96
H. 32/4	8.33	64.50	26.66	3.02	11.76
Bhaskara	8.20	57.00	<b>31.80</b>	3.05	10.68
V-7	<b>9.36</b>	63.66	29.66	3.10	12.70
<b>Mean</b>	<b>7.95</b>	<b>59.45</b>	<b>30.51</b>	3.80	12.27
<b>SEm±</b>	<b>0.33</b>	<b>2.72</b>	<b>0.81</b>	<b>0.31</b>	-
<b>CD @ 5%</b>	<b>1.00</b>	<b>8.04</b>	<b>2.41</b>	<b>0.92</b>	-
<b>CV %</b>	<b>7.38</b>	<b>7.95</b>	<b>4.64</b>	<b>14.25</b>	-

### VRIDHACHALAM

**Table 1.34 : Growth parameters of cashew genotypes in MLT-III at Vridhachalam centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Mean canopy spread (m)		Mean canopy area (m <sup>2</sup> )
				E-W	N-S	
BH 6	2008	<b>4.64</b>	<b>45.2</b>	<b>5.08</b>	<b>4.92</b>	35.41
BH 85		3.88	48.4	4.72	4.64	31.03
H 1597		<b>3.24</b>	52.1	4.52	4.80	<b>30.76</b>
K 22-1		3.72	49.2	4.61	4.82	31.49
H 662		4.44	48.4	4.84	<b>5.40</b>	<b>37.13</b>
H 675		3.72	<b>52.4</b>	4.60	4.77	31.09
H 11		4.00	48.2	4.72	4.89	32.70
H 14		3.48	48.0	4.54	4.75	30.56
H 32/4		4.32	49.4	5.02	5.20	36.99
Goa 11/6		3.88	48.4	4.82	4.72	32.23
VRI 3 (Check)		3.82	47.6	4.71	4.76	31.76
<b>Sem(±)</b>		<b>0.16</b>	<b>0.44</b>	<b>0.08</b>	<b>0.22</b>	<b>1.14</b>
<b>CD @ 5%</b>		<b>0.26</b>	<b>1.16</b>	<b>0.16</b>	<b>0.46</b>	<b>2.28</b>



**Table 1.35 : Yield parameters of cashew genotypes in MLT-III at Vridhachalam Centre**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
	Range	Mean			
BH 6	72-76	74	<b>11.2</b>	18	3.2
BH 85	72-80	75	13.4	24	<b>3.0</b>
H 1597	70-74	<b>72</b>	15.2	20	4.8
K 22-1	75-81	78	14.2	22	5.8
H 662	80-84	82	12.00	28	6.0
H 675	83-85	84	13.2	25	5.2
H 11	72-80	76	14.7	<b>17.2</b>	4.8
<b>H 14</b>	76-80	78	<b>19.2</b>	<b>32</b>	<b>6.4</b>
H 32/4	78-82	80	16.2	28.4	4.8
Goa 11/6	75-81	78	12.4	27.6	4.0
VRI 3(Local Check)	85-87	<b>86</b>	19.2	30.4	6.0
<b>SEm ±</b>			<b>0.54</b>	<b>0.66</b>	<b>0.26</b>
<b>CD at 5%</b>			<b>1.13</b>	<b>1.14</b>	<b>0.66</b>

The accessions, H 1597, H 22-1, H11, H 14, H32/4, Goa 11/6 and VRI 3 recorded nut weight more than 7.0 g. Significant variation was observed for mean annual nut yield. The accession H14 of Vridhachalam centre recorded highest nut yield and cumulative yield (Table 1.34, 1.35 and 1.36).

**Table 1.36 : Yield parameters of cashew genotypes in MLT-III at Vridhachalam Centre**

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 3 Harvests)
BH 6	6.8	55.2	30.0	2.60	10.01
BH 85	6.7	<b>45.4</b>	29.6	3.02	12.60
H 1597	7.0	50.2	29.2	3.10	11.94
K 22-1	7.0	50.6	<b>28.0</b>	<b>2.20</b>	<b>8.71</b>
H 662	6.4	55.2	30.0	3.20	12.19
H 675	6.9	50.2	<b>30.2</b>	3.80	13.79
H 11	7.0	52.4	29.2	3.70	13.93
H 14	7.0	54.2	29.8	<b>4.80</b>	<b>16.69</b>
H 32/4	7.0	50.2	29.0	3.80	13.08
Goa 11/6	<b>7.2</b>	<b>60.5</b>	29.6	3.00	13.01
VRI3 (Local Check)	7.0	50.2	29.0	3.60	13.16
<b>SEm ±</b>	<b>NS</b>	<b>1.4</b>	<b>NS</b>	<b>0.11</b>	<b>--</b>
<b>CD at 5%</b>	<b>--</b>	<b>3.6</b>	<b>--</b>	<b>0.50</b>	<b>--</b>



### 3. Performance of Released Varieties (Multi Location Trial – V)

**Centres:** **East Coast** : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara, Paria, Pilicode and Vengurla  
**Plains / others** : 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.

#### Treatments :

Year of Initiation : 2006  
No. of varieties : 25

Sl. No.	Varieties	Sl. No.	Varieties	Sl. No.	Varieties
1	BPP-4	10	Dhana	19	NRCC Set2
2	BPP-6	11	Kanaka	20	Ullal-1
3	BPP-8	12	Priyanka	21	Ullal-3
4	Bhubaneswar-1	13	Amrutha	22	Ullal-4
5	Chintamani-1	14	Vengurla-1	23	UN-50
6	Jhargram-1	15	Vengurla-4	24	Goa-1
7	Madakkathara-1	16	Vengurla-6	25	Bhaskara
8	Madakkathara-2	17	Vengurla-7		
9	K-22-1	18	VRI-3		

#### BAPATLA

The trial is taken up during the year September 2014 with the following released varieties of different centres.

Date of Planting : 30.09.2014  
Design : RBD  
No of Replications : 3  
No of Plants per replication : 4



State	No.	Released varieties
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	1	NRCC set-2
Tamilnadu	1	VRI-3
GOA	2	Goa-1, Bhaskara
<b>Total</b>	<b>25</b>	

Plants are under vegetative phase, growth of the plants is in good condition and vegetative parameters will be recorded during the year 2017-18.

### BHUBANESWAR

**Table 1.37 : Vegetative parameters of cashew genotypes in MLT-V at Bhubaneswar centre (Year of Planting 2008)**

Accession	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
			E-W	N-S	
BPP-4	4.25	54.55	5.70	5.70	25.52
BPP-6	4.45	57.75	6.85	6.35	34.19
BPP-8	5.00	69.75	7.85	7.00	43.34
Bhubaneswar-1	3.95	57.30	5.75	5.90	26.64
Chintamani-1	4.65	64.40	6.30	7.05	34.99
Jhargram-1	4.70	68.05	7.65	7.15	43.04
Madakkathara-1	4.55	60.60	5.90	5.90	27.34
Madakkathara-2	4.15	50.50	4.65	4.90	17.90
K-22-1	3.85	54.95	5.20	5.40	22.06
Dhana	4.60	63.90	6.85	7.05	37.94
Kanaka	4.75	63.25	5.85	5.80	26.64
Priyanka	4.75	59.25	7.05	7.10	39.29
Amrutha	3.90	46.75	4.60	4.70	16.98
Vengurla-1	4.35	57.00	6.60	6.40	33.22
Vengurla 4	4.55	56.00	5.95	5.95	27.79





Vengurla-6	4.70	55.25	6.15	6.25	30.18
Vengurla-7	5.25	76.30	8.50	8.90	59.42
VRI-3	3.45	47.90	5.45	5.15	22.06
NRCC Set-2	4.35	59.10	6.05	5.85	27.79
Ullal-1	4.60	65.75	6.50	6.60	33.68
Ullal-3	4.50	50.90	5.90	5.90	27.45
Ullal-4	4.45	55.85	5.35	5.85	24.64
UN-50	4.55	57.70	5.65	5.15	22.90
Goa-1	4.30	57.00	5.50	5.85	25.28
Bhaskara	4.45	64.20	5.95	6.30	29.45
<b>Mean</b>	<b>4.44</b>	<b>58.96</b>	<b>6.15</b>	<b>6.17</b>	<b>30.39</b>
<b>SEm ±</b>	<b>0.16</b>	<b>2.71</b>	<b>0.21</b>	<b>0.18</b>	<b>1.47</b>
<b>CD at 5%</b>	<b>0.48</b>	<b>7.92</b>	<b>0.63</b>	<b>0.51</b>	<b>4.27</b>
<b>CV%</b>	<b>5.19</b>	<b>6.50</b>	<b>4.93</b>	<b>4.02</b>	<b>6.81</b>

**Table 1.38 : Yield parameters of cashew genotypes in MLT-V at Bhubaneswar centre (Year of Planting 2008)**

Accession No.	Flowering duration (days)		No. of panicles/m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/m <sup>2</sup>	No. of nuts/panicle
	Range	Mean				
BPP-4	2 <sup>nd</sup> week Dec to 3 <sup>rd</sup> week Apr.	123	16.13	0.59	35.85	6.5
BPP-6	1 <sup>st</sup> week Dec to 4 <sup>th</sup> week Apr.	145	16.88	0.22	18.72	8.0
BPP-8	2 <sup>nd</sup> week Dec to 1 <sup>st</sup> week Apr.	105	17.25	0.12	34.70	4.0
Bhubaneswar-1	3 <sup>rd</sup> week Dec. to 2 <sup>nd</sup> week Apr.	112.5	16.40	0.34	24.75	7.5
Chintamani-1	1 <sup>st</sup> week Jan to 4 <sup>th</sup> week Apr.	123	20.25	0.12	11.70	4.5
Jhargram-1	1 <sup>st</sup> week of Dec. to 1 <sup>st</sup> week May	150.5	20.25	0.04	4.97	1.0
Madakkathara-1	1 <sup>st</sup> week Jan to 3 <sup>rd</sup> week Apr.	100.5	17.38	0.26	26.33	5.0
Madakkathara-2	1 <sup>st</sup> week Jan to 4 <sup>th</sup> week Apr.	102.5	15.99	0.24	17.75	3.5
K-22-1	3 <sup>rd</sup> week of Dec to 2 <sup>nd</sup> week of Apr.	113.5	16.33	0.09	13.40	5.0



Dhana	2 week of Jan to 3 <sup>rd</sup> week of Apr.	89.5	23.50	0.35	15.75	3.0
Kanaka	3 <sup>rd</sup> week of Jan to 4 <sup>th</sup> week of April.	105	20.50	0.90	10.10	2.5
Priyanka	3 <sup>rd</sup> week of Jan to 4 <sup>th</sup> week of Apr.	98	19.13	0.08	5.35	1.0
Amrutha	3 <sup>rd</sup> week of Dec. to 2 <sup>nd</sup> week of May	103.5	20.13	0.06	11.85	5.5
Vengurla-1	3 <sup>rd</sup> week of Jan. to 2 <sup>nd</sup> week of May	110.5	22.50	0.03	8.80	2.0
Vengurla-4	3 <sup>rd</sup> week of Dec. to 2 <sup>nd</sup> week of Apr.	113.5	20.48	0.55	33.40	5.0
Vengurla-6	1 <sup>st</sup> week of Dec. to 3 <sup>rd</sup> week of Apr.	127.5	18.50	0.13	28.65	6.5
Vengurla-7	4 <sup>th</sup> week of Dec. to 3 <sup>rd</sup> week Apr.	111.5	19.88	0.22	36.85	3.0
VRI-3	1 <sup>st</sup> week of Nov. to 3 <sup>rd</sup> week of Apr.	136.5	22.25	0.30	19.30	7.0
NRCC Sel-2	3 <sup>rd</sup> week of Dec to 3 <sup>rd</sup> week of Apr.	115	17.25	0.16	15.85	3.0
Ullal-1	2 <sup>nd</sup> week of Jan to 3 <sup>rd</sup> week of May	128.5	18.00	0.02	7.75	2.0
Ullal-3	1 <sup>st</sup> week of Jan to 4 <sup>th</sup> week of Apr.	109	16.63	0.19	23.72	3.0
Ullal-4	3 <sup>rd</sup> week of Jan. to 2 <sup>nd</sup> week of May	102.5	21.75	0.04	13.50	4.0
UN-50	1 <sup>st</sup> week of Jan to 4 <sup>th</sup> week of Apr.	116	17.63	0.06	8.25	1.0





Goa-1	2 <sup>nd</sup> week of Jan to 3 <sup>rd</sup> week of May	125.5	22.38	0.10	11.55	5.0
Bhaskara	4 <sup>th</sup> week of Dec to 2 <sup>nd</sup> week of Apr.	98	17.63	0.25	35.20	4.5
<b>Mean</b>		<b>114.62</b>	<b>19.00</b>	<b>0.22</b>	<b>19.00</b>	<b>4.12</b>
<b>SEm ±</b>		<b>2.83</b>	<b>1.04</b>	<b>0.04</b>	<b>0.99</b>	<b>0.30</b>
<b>CD at 5%</b>		<b>8.26</b>	<b>3.03</b>	<b>0.12</b>	<b>2.88</b>	<b>0.88</b>
<b>CV%</b>		<b>3.49</b>	<b>7.72</b>	<b>24.20</b>	<b>7.35</b>	<b>10.76</b>

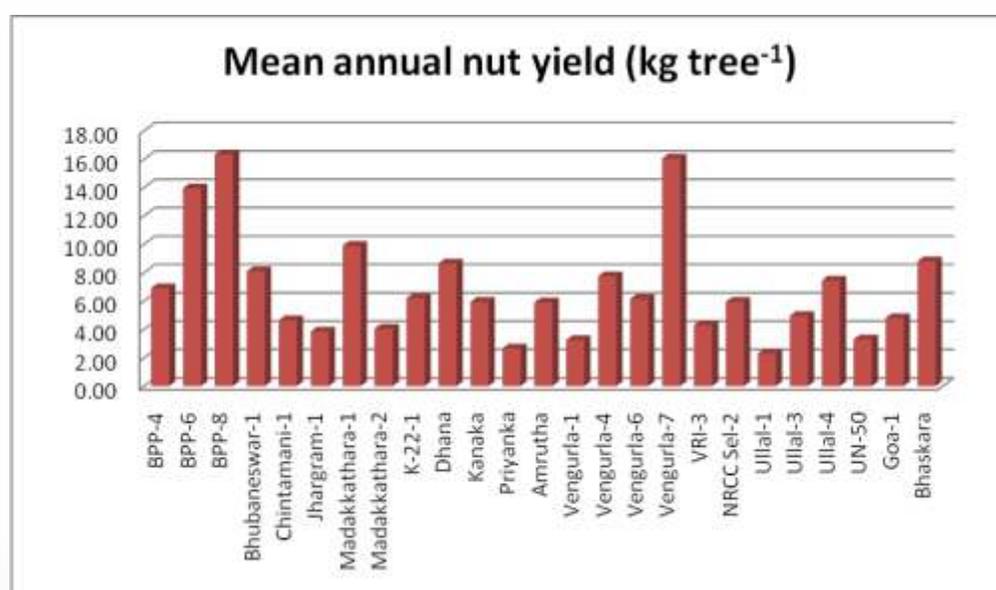
The table revealed that significantly highest nut weight was recorded in cashew varieties Vengurla-7 and Priyanka (10.10g each) while significantly lowest nut weight was recorded in variety Jhargram-1 (5.35g). Variety Priyanka also recorded significantly maximum apple weight (130.00g) among the tested cashew varieties. Minimum apple weight was recorded for the variety Madakkathara-1 and BPP-6 (35.0g each). Shelling % was recorded maximum for cashew variety VRI-3 (34.65%) followed by variety Bhubaneswar-1 (34.05%) and Madakkathara-2 (33.33%). The annual nut yield ranged from minimum 2.30 kg tree<sup>-1</sup> (Ulla-1) to maximum 16.35 kg tree<sup>-1</sup> (BPP-8) at 6<sup>th</sup> harvest. However, cumulative nut yield was recorded maximum for the variety BPP-8 (35.92 kg tree<sup>-1</sup>) followed by V-7 (34.16kg tree<sup>-1</sup>) and Bhaskara (25.28kg plant<sup>-1</sup>) while the lowest was recorded in variety Jhargram-1 (8.35 kg tree<sup>-1</sup>) for 6 harvest (Table 1.37, 1.38 and 1.39).

**Table 1.39 : Yield parameters of cashew genotypes in MLT-V at Bhubaneswar Centre (Year of Planting 2008)**

<b>Accession No.</b>	<b>Nut wt (g)</b>	<b>Apple wt. (g)</b>	<b>Shelling %</b>	<b>Annual nut yield (kg/tree)</b>	<b>Cum. yield (kg/tree) (for 6 Harvests)</b>
BPP-4	5.60	51.4	30.19	6.90	17.44
BPP-6	6.10	35.0	30.36	13.95	21.73
BPP-8	7.65	65.5	29.07	16.35	35.92
Bhubaneswar-1	6.40	46.0	34.05	8.10	21.22
Chintamani-1	6.25	39.0	30.28	4.65	14.49
Jhargram-1	5.35	41.0	30.15	3.85	8.35
Madakkathara-1	6.45	35.0	32.57	9.90	21.98
Madakkathara-2	7.25	51.0	33.33	4.05	11.48
K-22-1	6.55	54.5	30.23	6.20	13.32
Dhana	7.90	52.5	28.67	8.65	22.36



Kanaka	6.45	62.5	32.14	5.95	18.61
Priyanka	10.10	130.0	30.26	2.65	10.45
Amrutha	7.15	64.5	29.48	5.90	11.82
Vengurla-1	7.55	40.5	29.15	3.25	13.01
Vengurla-4	7.10	45.0	32.15	7.75	20.89
Vengurla-6	8.35	51.0	32.63	6.15	17.97
Vengurla-7	10.10	58.0	32.14	16.05	34.16
VRI-3	6.25	36.5	34.65	4.30	16.35
NRCC Sel-2	8.10	69.5	31.94	5.95	20.08
Ullal-1	7.45	43.8	29.65	2.30	11.52
Ullal-3	8.40	51.5	31.06	4.95	16.09
Ullal-4	8.10	54.5	28.92	7.45	14.18
UN-50	7.85	70.5	31.60	3.30	9.83
Goa-1	8.10	68.5	32.69	4.80	15.58
Bhaskara	6.45	49.5	28.58	8.80	25.28
<b>Mean</b>	<b>7.30</b>	<b>54.70</b>	<b>31.00</b>	<b>7.00</b>	<b>17.8</b>
<b>SEm ±</b>	<b>0.13</b>	<b>1.98</b>	<b>0.27</b>	<b>0.20</b>	<b>-</b>
<b>CD at 5%</b>	<b>0.38</b>	<b>5.79</b>	<b>0.78</b>	<b>0.59</b>	<b>-</b>
<b>CV%</b>	<b>2.54</b>	<b>5.13</b>	<b>1.21</b>	<b>4.15</b>	





**HOGALAGERE**

**Table 1.40 : Vegetative parameters of cashew genotypes in MLT-V at Hogalagere centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				E-W	N-S	
BPP-4	2015	1.35	12	1.6	1.5	7.54
BPP-6	2015	1.14	11.29	1.11	1.32	4.64
BPP-8	2015	Gap filled plants (<1 year old)				
Bhubaneswar-1	2015					
Chintamani-1	2015	0.83	6	0.57	0.61	1.09
Jhargram-1	2015	1.32	13	1.3	1.49	6.11
Madakkathara-1	2015	0.75	6.25	0.47	0.47	0.69
Madakkathara-2	2015	0.76	7	0.79	0.83	2.06
K-22-1	2015	1.1	10	1.12	1.03	3.63
Dhana	2015	Gap filled plants (<1 year old)				
Kanaka	2015	1.15	10.33	1.12	1.05	3.70
Priyanka	2015	Gap filled plants (<1 year old)				
Amrutha	2015	1.32	13	1.65	1.37	7.16
Vengurla-1	2015	1.07	9.86	0.94	0.93	2.75
Vengurla-4	2015	1.12	11	1.37	1.24	5.35
Vengurla-6	2015	0.8	7.8	0.68	0.62	1.33
Vengurla-7	2015	1	10.5	0.93	1.05	3.08
VRI-3	2015	1.7	12.5	1.47	1.2	5.60
NRCC Set-2	2015	1.39	12.8	1.46	1.29	5.94
Ullal-1	2015	Gap filled plants (<1 year old)				
Ullal-3	2015	0.87	6.67	0.68	0.8	1.72
Ullal-4	2015	1.28	10.56	1.22	1.06	4.08
UN-50	2015	1.59	14	1.88	1.56	9.29
Goa-1	2015	0.93	9	0.96	3.55	15.97
Bhaskara	2015	1.22	10	1.3	4.09	22.81
	<b>Mean</b>	<b>1.13</b>	<b>10.18</b>	<b>1.13</b>	<b>1.35</b>	<b>5.73</b>

**Note:** The experimental plot is adjacent to the forest land and the plants are damaged by High speed wind and wild animals (Deer and wild boar during night times). Gap filling is being taken up as and when the plants are getting affected.



## JHARGRAM

Table 1.41 : Vegetative parameters of cashew genotypes in MLT-V at Jhargram centre (Year of Planting: 2010)

Accession	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
			E-W	N-S	
BPP-4	4.3	46.3	5.6	5.3	37.2
BPP-6	4.4	50.0	5.9	5.6	38.1
BPP-8	4.0	45.7	4.9	5.4	31.3
Bhubaneswar-1	3.7	40.0	5.0	4.7	25.4
Chintamani-1	4.4	44.3	5.4	5.5	35.1
Jhargram-1	3.5	40.7	4.8	4.8	29.6
Madakkathara-1	4.1	44.0	3.9	4.7	25.8
Madakkathara-2	3.8	44.0	4.1	5.1	24.4
K-22-1	4.4	56.0	6.0	5.5	37.5
Dhana	4.3	56.7	5.3	5.0	32.1
Kanaka	4.3	45.3	4.6	5.0	30.0
Priyanka	4.4	49.7	6.0	6.0	44.4
Amrutha	3.6	44.0	4.4	4.0	21.1
Vengurla-1	4.0	46.7	4.8	4.3	24.7
Vengurla-4	3.9	48.3	4.4	4.5	23.0
Vengurla-6	3.9	43.3	5.2	5.7	46.3
Vengurla-7	4.7	52.3	6.1	5.9	40.0
VRI-3	3.4	41.3	4.3	4.8	27.5
NRCC Sel-2	4.2	49.3	4.9	4.9	30.6
Ullal-3	5.1	51.7	6.3	6.1	46.9
Ullal-4	3.9	51.0	4.9	5.3	29.7
UN-50	4.5	50.0	5.4	6.0	37.3
Goa-1	4.6	48.0	5.5	5.6	38.3
Bhaskara	4.4	49.3	5.1	4.9	32.4
<b>Mean</b>	<b>4.2</b>	<b>47.4</b>	<b>5.1</b>	<b>5.2</b>	<b>32.9</b>
<b>SEm ±</b>	<b>0.06</b>	<b>0.60</b>	<b>0.09</b>	<b>0.09</b>	<b>1.00</b>
<b>CD at 5%</b>	<b>0.12</b>	<b>1.22</b>	<b>0.19</b>	<b>0.17</b>	<b>2.03</b>
<b>CV%</b>	<b>11.6</b>	<b>10.8</b>	<b>13.9</b>	<b>25.8</b>	<b>25.0</b>





**Table 1.42 : Yield parameters of cashew genotypes in MLT-V at Jhargram centre (Year of Planting: 2010)**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>	No. of nuts/panicle
	Range	Mean				
BPP-4	-	93.3	13.9	0.4	42.4	10.9
BPP-6	-	88.0	8.8	0.1	19.2	8.6
BPP-8	-	73.7	12.8	0.1	31.0	7.1
Bhubaneswar-1	-	72.0	15.9	0.4	70.4	19.7
Chintamani-1	-	85.0	14.6	0.2	32.5	14.3
Jhargram-1	-	63.0	18.0	0.2	38.7	7.5
Madakkathara-1	-	98.7	14.1	0.2	31.2	8.8
Madakkathara-2	-	90.0	13.8	0.1	23.4	8.3
K-22-1	-	74.0	14.7	0.2	33.5	10.7
Dhana	-	78.0	9.6	0.2	23.8	8.3
Kanaka	-	87.7	16.5	0.3	33.9	6.1
Priyanka	-	81.3	13.4	0.3	13.8	3.7
Amrutha	-	76.0	14.8	0.2	30.0	9.6
Vengurla-1	-	69.0	11.6	0.3	61.3	19.5
Vengurla-4	-	75.7	13.2	0.2	46.3	9.3
Vengurla-6	-	71.0	15.6	0.2	36.3	7.5
Vengurla-7	-	92.7	12.4	0.1	22.3	7.8
VRI-3	-	85.0	17.6	0.2	35.1	8.8
NRCC Set2	-	71.0	17.8	0.3	39.6	8.0
Ullal-1	-	--	--	--	--	--
Ullal-3	-	88.0	11.4	0.2	30.0	10.3
Ullal-4	-	81.3	15.6	0.1	31.3	6.3
UN-50	-	71.3	11.7	0.1	21.5	6.7
Goa-1	-	94.3	9.6	0.2	28.4	12.9
Bhaskara	-	60.3	10.8	0.3	42.6	12.8
<b>Mean</b>	-	<b>80.0</b>	<b>13.7</b>	<b>0.2</b>	<b>34.1</b>	<b>9.7</b>
<b>SEm ±</b>	-	<b>1.24</b>	<b>0.40</b>	<b>0.01</b>	<b>1.61</b>	<b>0.50</b>
<b>CD at 5%</b>	-	<b>2.52</b>	<b>0.82</b>	<b>0.02</b>	<b>3.27</b>	<b>1.02</b>
<b>CV%</b>	-	<b>5.31</b>	<b>4.01</b>	<b>4.38</b>	<b>4.07</b>	<b>3.84</b>



**Table 1.43 : Yield parameters of cashew genotypes in MLT-V at Jhargram centre (Year of Planting: 2010)**

Accession No.	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 4 Harvests)
BPP-4	4.2	45.0	18.8	5.5	11.0
BPP-6	4.5	36.7	24.5	3.8	10.7
BPP-8	7.0	50.5	32.3	6.3	17.0
Bhubaneswar-1	4.5	29.5	34.2	5.5	18.5
Chintamani-1	4.9	26.7	32.2	4.0	11.2
Jhargram-1	4.8	31.7	28.7	3.7	13.2
Madakkathara-1	4.9	26.2	33.5	4.0	7.8
Madakkathara-2	6.0	50.6	32.4	3.1	10.5
K-22-1	5.4	31.4	27.8	6.2	15.0
Dhana	5.9	48.0	31.1	4.2	11.3
Kanaka	5.1	52.2	32.9	4.3	12.8
Priyanka	6.4	90.2	28.1	4.1	9.6
Amrutha	6.1	56.0	31.1	3.6	16.4
Vengurla-1	4.2	37.8	32.8	3.9	11.4
Vengurla-4	5.8	36.2	31.3	4.1	17.0
Vengurla-6	5.4	40.1	31.6	3.0	11.6
Vengurla-7	7.4	47.2	28.0	3.4	20.8
VRI-3	6.0	31.6	25.8	4.7	15.1
NRCC Set-2	4.8	56.4	32.5	5.0	14.4
Ullal-1	6.4	39.6	24.6	5.6	15.7
Ullal-3	6.4	46.8	32.1	5.4	17.1
Ullal-4	7.1	82.8	28.1	3.8	13.9
UN-50	6.1	44.3	24.7	2.9	12.5
Goa-1	6.0	43.8	25.1	10.5	20.1
Bhaskara	4.2	45.0	18.8	5.5	11.0
<b>Mean</b>	<b>5.6</b>	<b>45.1</b>	<b>29.3</b>	<b>4.6</b>	<b>13.9</b>
<b>SEm±</b>	<b>0.11</b>	<b>2.16</b>	<b>0.81</b>	<b>0.21</b>	<b>0.48</b>
<b>CD at 5%</b>	<b>0.23</b>	<b>4.38</b>	<b>1.65</b>	<b>0.42</b>	<b>0.98</b>
<b>CV%</b>	<b>16.8</b>	<b>2.95</b>	<b>13.2</b>	<b>4.07</b>	<b>22.7</b>

Ullal – 1 variety could not be evaluated due to initial death of all the plants.



### MADAKKATHARA

The maximum nut yield was recorded by Amrutha (1.289kg/tree) followed by Sulabha (1.162kg/tree). The highest cumulative yield was recorded by Dhana (9.074kg/tree) followed by Kanaka (9.056kg/tree) the same was recorded in the previous year also (Table 1.46).

**Table 1.44 : Vegetative parameters of cashew genotypes in MLT-V at Madakkathra Centre**

Accession	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
				E-W	N-S	
BPP-4	2006	5.72	55.00	6.08	5.87	5.97
Chinthamani-1	2006	5.57	53.00	6.97	7.01	6.99
Jhargram-1	2006	5.25	58.50	6.84	7.13	6.98
Madakkathara-1	2006	5.08	60.00	4.99	5.04	5.01
Madakkathara-2	2006	5.67	57.00	6.56	6.32	6.44
K-22-1	2006	5.43	62.96	5.70	5.06	5.38
Dhana	2006	5.06	56.40	7.32	6.93	7.12
Kanaka	2006	5.11	54.40	5.30	5.57	5.43
Priyanka	2006	5.09	53.20	6.41	5.72	6.06
Amrutha	2006	5.21	53.30	7.03	6.60	6.81
Vengurla-1	2006	5.31	52.80	7.04	6.62	6.83
Vengurla-4	2006	5.47	54.20	5.36	5.92	5.65
Vengurla-6	2006	5.26	51.80	6.31	6.49	6.40
VRI-3	2006	5.15	60.40	5.69	5.72	5.70
Ullal-1	2006	5.58	44.40	7.88	7.73	7.80
Ullal-3	2006	5.13	45.50	6.92	6.47	6.69
Ullal-4	2006	5.46	56.20	6.92	6.96	6.94
UN-50	2006	5.81	46.75	6.71	5.81	6.26
Bhaskara	2006	5.46	48.66	6.23	6.10	6.16
Dharasree	2006	5.40	51.75	5.21	5.72	5.46
Anakkayam	2006	5.02	54.75	4.90	5.35	5.12
Akshaya	2006	4.93	48.60	5.06	5.16	5.11
Anagha	2006	4.73	49.20	5.02	4.93	4.97
Raghav	2006	5.01	49.29	4.51	4.50	4.50
NRCC Set-1	2006	4.98	45.33	5.20	5.86	5.53
Sulabha	2006	4.94	51.60	5.52	5.60	5.56
Damodar	2006	4.90	44.50	4.07	4.10	4.08
<b>Mean</b>		<b>5.25</b>	<b>52.57</b>	<b>5.99</b>	<b>5.94</b>	<b>5.96</b>
<b>SEm ±</b>		<b>0.61</b>	<b>9.54</b>	<b>1.60</b>	<b>1.26</b>	--
<b>CD at 5%</b>		<b>7.07</b>	<b>11.24</b>	<b>16.45</b>	<b>13.28</b>	--
<b>CV%</b>		<b>0.214</b>	<b>3.371</b>	<b>0.566</b>	<b>0.446</b>	--



**Table 1.45 : Vegetative parameters of cashew genotypes in MLT-V at Madakkathara centre**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/panicle
	Range	Mean			
BPP-4	114-122	118	6.98	0.24	5
Chinthamani-1	108-128	118	9.06	0.19	2
Jhargram-1	92-121	106	9.20	0.23	5
Madakkathara-1	99-111	105	5.35	0.23	6
Madakkathara-2	110-119	114	4.71	0.21	12
K-22-1	103-142	122	9.36	0.27	8
Dhana	93-112	102	10.09	0.19	5
Kanaka	98-136	117	6.96	0.23	8
Priyanka	97-135	116	9.81	0.20	8
Amrutha	110-127	118	8.38	0.24	11
Vengurla-1	111-121	116	8.10	0.20	8
Vengurla-4	108-133	120	7.57	0.16	11
Vengurla-6	106-133	119	8.89	0.22	9
VRI-3	73-128	100	9.18	0.21	13
Ullal-1	111-124	117	7.05	0.20	9
Ullal-3	96-115	105	8.81	0.19	10
Ullal-4	99-123	111	7.25	0.24	10
UN-50	102-122	112	7.16	0.21	5
Bhaskara	101-120	110	8.11	0.20	8
Dharasree	98-120	109	8.93	0.24	9
Anakkayam	107-126	116	6.75	0.23	12
Akshaya	126-116	121	6.48	0.19	7
Anagha	96-127	111	7.61	0.23	10
Raghav	122-126	124	10.15	0.23	9
NRCC Sel-1	97-103	100	9.16	0.18	9
Sulabha	107-122	114	10.38	0.26	14
Damodar	97-140	118	9.18	0.23	11
<b>Mean</b>		<b>113.29</b>	<b>8.17</b>	<b>0.22</b>	<b>8.66</b>
<b>SEm ±</b>		<b>6.435</b>	<b>0.822</b>	<b>0.031</b>	
<b>CD at 5%</b>		<b>18.20</b>	<b>2.33</b>	<b>0.09</b>	
<b>CV%</b>		<b>9.75</b>	<b>17.24</b>	<b>23.20</b>	





Table 1.46 : Vegetative parameters of cashew genotypes in MLT-V at Madakkathara centre

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 9 Harvests)
BPP-4	6.17	52.74	0.424	6.514
Chinthamani-1	6.95	45.34	0.562	6.952
Jhargram-1	5.12	48.53	0.592	8.532
Madakkathara-1	6.30	40.20	0.418	8.018
Madakkathara-2	6.82	50.36	0.593	7.273
K-22-1	5.93	48.08	1.060	7.240
Dhana	8.01	42.90	0.744	9.074
Kanaka	5.82	45.94	0.736	9.056
Priyanka	10.16	65.35	0.858	8.448
Amrutha	7.17	50.25	1.289	8.499
Vengurla-1	6.24	42.73	0.377	7.287
Vengurla-4	6.33	46.18	0.459	6.389
Vengurla-6	6.20	47.43	0.288	7.368
VRI-3	7.02	47.24	1.098	8.218
NRCC Set-1	7.36	34.81	0.383	7.123
Ullal-1	6.59	42.90	0.423	5.623
Ullal-3	7.15	47.38	1.073	6.803
Ullal-4	6.94	40.32	0.586	7.336
UN-50	9.30	41.01	0.327	7.147
Bhaskara	7.03	45.40	0.400	7.350
Dharasree	9.20	46.72	0.399	5.739
Anakkayam	6.93	38.72	0.528	5.728
Akshaya	9.84	33.80	0.512	7.632
Anagha	9.85	58.70	0.478	7.038
Raghav	8.41	49.04	0.888	7.808
NRCC Set-1	7.36	34.81	0.383	7.123
Sulabha	9.68	43.64	1.162	9.012
Damodar	8.30	48.46	0.484	6.944
<b>SEm ±</b>	<b>0.355</b>	<b>2.852</b>	<b>0.258</b>	
<b>CD at 5%</b>	<b>1.01</b>	<b>8.07</b>	<b>0.73</b>	
<b>CV%</b>	<b>8.23</b>	<b>10.77</b>	<b>68.14</b>	

**PARIA**

Out of 25, many entries have been collected and collection of remaining entries will be completed during the year 2017-18.



## PILICODE

The experiment was laid out during 2007-08. Twenty five varieties have been allotted for the experiment and 20 released varieties with 10 plants each were planted during June 2008. The biometric observations were recorded and presented (Table 1.47, 1.48 and 1.49). The varieties differed among themselves for all the biometric characters studied .

**Table 1.47 : Vegetative parameters of cashew genotypes in MLT-V at Pilicode centre (2008 Planted)**

Accession	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
			E-W	N-S	
BPP-4	-	-	-	-	-
BPP-6	3.00	0.30	3.00	3.45	8.08
BPP-8	2.53	0.23	2.53	2.13	4.88
Bhubaneswar-1	<b>5.10</b>	0.41	3.95	4.10	18.4
Chintamani-1	-	-	-	-	-
Jhargram-1	-	-	-	-	-
Madakkathara-1	3.47	0.34	3.12	3.45	10.50
Madakkathara-2	4.28	0.48	4.02	4.17	16.41
K-22-1	<b>5.10</b>	0.46	4.80	4.88	<b>23.01</b>
Dhana	2.73	0.33	2.33	2.35	5.44
Kanaka	4.22	0.49	4.03	3.91	16.88
Priyanka	3.51	0.38	3.71	3.69	12.07
Amrutha	4.77	0.39	4.80	4.42	19.28
Vengurla-1	-	-	-	-	-
Vengurla-4	2.94	0.23	2.90	2.64	7.63
Vengurla-6	-	-	-	-	-
Vengurla-7	<b>5.50</b>	0.47	<b>5.30</b>	<b>5.43</b>	<b>27.84</b>
VRI-3	<b>5.00</b>	0.30	3.20	3.10	13.70
NRCC Set-2	3.13	0.35	4.02	4.15	11.40
Ullal-1	<b>5.11</b>	0.44	4.91	4.58	<b>21.72</b>
Ullal-3	4.25	0.31	4.20	4.50	16.07
Ullal-4	-	-	-	-	-
UN-50	4.93	0.47	3.88	4.15	19.27
Goa-1	3.01	<b>0.51</b>	3.06	3.19	8.56
Bhaskara	4.21	0.34	3.69	3.53	14.98
<b>Mean</b>	<b>4.04</b>	<b>0.38</b>	<b>3.76</b>	<b>3.78</b>	<b>14.53</b>
<b>SEm ±</b>	-	-	-	-	-
<b>CD at 5%</b>	<b>1.44</b>	<b>0.15</b>	<b>1.08</b>	<b>1.12</b>	<b>7.46</b>
<b>CV%</b>	<b>17.00</b>	<b>18.80</b>	<b>13.69</b>	<b>14.16</b>	<b>24.45</b>



**Table 1.48 : Yield parameters of cashew genotypes in MLT-V at Pilicode centre (2008 Planted)**

Accession No.	Flowering duration (days)		No. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	No. of nuts/ m <sup>2</sup>
	Range	Mean			
BPP-4	-	-	-	-	-
BPP-6	95- 105	100	<b>7.14</b>	0.10	1.34
BPP-8	53-60	57	3.50	0.01	1.83
Bhubaneswar-1	50-65	54	5.50	0.10	2.00
Chintamani-1	-	-	-	-	-
Jhargram-1	-	-	-	-	-
Madakkathara-1	90-108	96	5.90	0.11	<b>3.90</b>
Madakkathara-2	60-68	64	4.75	0.10	0.44
K-22-1	80-88	84	5.19	0.09	1.94
Dhana	90-100	96	4.25	<b>0.30</b>	0.63
Kanaka	105-115	110	5.91	0.08	1.29
Priyanka	118-130	122	4.98	0.09	2.66
Amrutha	90-107	98	5.97	0.12	2.17
Vengurla-1	-	-	-	-	-
Vengurla-4	60-78	69	4.69	0.09	0.98
Vengurla-6	-	-	-	-	-
Vengurla-7	30-40	34	5.69	0.10	1.25
VRI-3	40-54	47	4.25	0.10	0.63
NRCC Set-2	80-86	83	4.24	0.17	1.21
Ullal-1	40-48	44	2.75	0.08	0.50
Ullal-3	20-35	27	4.88	0.12	0.25
Ullal-4	-	-	-	-	-
UN-50	60-78	69	<b>6.88</b>	0.10	1.25
Goa-1	20-30	24	5.44	0.13	0.69
Bhaskara	90-100	95	4.37	0.11	1.72
<b>CD at 5%</b>	-	-	<b>1.74</b>	<b>0.06</b>	<b>0.92</b>
<b>CV%</b>	-	-	<b>16.33</b>	<b>26.83</b>	<b>31.31</b>

**Table 1.49 : Yield parameters of cashew genotypes in MLT-V at Pilicode centre (2008 Planted)**

Accession No.	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 3 Harvests)
BPP-4	-	-	-	-
BPP-6	5.80	101.00	0.95	1.76



BPP-8	10.35	92.50	10.50	10.83
Bhubaneswar-1	5.25	73.50	10.24	11.00
Chintamani-1	-	-	-	-
Jhargram-1	-	-	-	-
Madakkathara-1	7.32	47.50	2.75	6.75
Madakkathara-2	7.15	63.50	6.41	10.86
K-22-1	7.80	52.00	8.87	10.94
Dhana	8.00	61.50	2.46	3.67
Kanaka	9.90	60.00	6.79	10.51
Priyanka	11.20	62.25	15.78	<b>26.68</b>
Amrutha	11.35	63.00	11.50	<b>15.49</b>
Vengurla-1	-	-	-	-
Vengurla-4	7.43	53.00	1.38	2.17
Vengurla-6	-	-	-	-
Vengurla-7	9.00	48.75	3.29	4.77
VRI-3	6.13	52.00	1.43	2.70
NRCC Set2	11.00	85.50	0.88	2.87
Ullal-1	7.10	50.00	1.90	3.48
Ullal-3	7.33	53.00	3.71	5.92
Ullal-4	-	-	-	-
UN-50	10.28	62.50	2.70	4.13
Goa-1	6.75	57.50	2.09	2.69
Bhaskara	7.65	54.00	0.98	4.95
<b>SEm ±</b>	-	-	-	-
<b>CD at 5%</b>	<b>0.31</b>	<b>6.23</b>	<b>1.16</b>	<b>1.28</b>
<b>CV%</b>	<b>1.81</b>	<b>4.72</b>	<b>11.10</b>	<b>8.15</b>

## VRIDHACHALAM

Table 1.50 : Vegetative parameters of cashew genotypes in MLT-V at Vridhachalam centre (Year of Planting- 2008)

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean canopy area (m <sup>2</sup> )
			E-W	N-S	
BPP-4	3.76	41.6	4.74	5.10	34.29
BPP-6	3.72	44.2	4.56	5.16	33.46
BPP-8	<b>3.15</b>	46.8	4.42	5.94	38.01
Bhubaneswar-1	3.70	45.4	4.46	5.65	36.20
Chintamani-1	3.82	46.4	4.44	5.48	34.85



Jhargram-1	3.75	49.2	4.56	<b>6.10</b>	40.24
Madakkathara-1	3.80	50.6	4.64	5.45	36.05
Madakkathara-2	3.50	52.4	4.92	5.35	37.35
K-22-1	3.56	48.6	4.40	5.10	31.96
Dhana	3.32	48.4	4.72	5.44	36.56
Kanaka	3.64	47.6	4.76	5.81	39.57
Priyanka	3.61	46.4	4.52	5.80	37.72
Amrutha	3.72	46.4	4.68	5.52	36.84
Vengurla-1	3.85	47.2	5.12	5.91	<b>43.08</b>
Vengurla-4	3.64	49.4	4.36	5.20	32.37
Vengurla-6	3.66	51.2	<b>3.81</b>	5.48	30.56
Vengurla-7	3.48	48.1	4.45	5.61	35.84
VRI-3	3.64	46.6	4.84	5.59	38.52
NRCC Sel-2	3.92	50.2	4.68	<b>4.98</b>	33.05
Ullal-1	3.98	48.2	5.02	5.24	37.28
Ullal-3	3.74	48.6	4.71	5.55	37.28
Ullal-4	<b>4.25</b>	46.6	<b>5.54</b>	5.60	<b>43.95</b>
UN-50	3.96	45.1	5.32	5.68	42.85
Goa-1	3.99	47.1	4.74	5.72	38.75
Bhaskara	4.10	45.3	4.60	5.59	36.77
<b>SEm ±</b>	<b>0.22</b>	<b>0.42</b>	<b>0.36</b>	<b>0.26</b>	<b>0.16</b>
<b>CD at 5%</b>	<b>0.48</b>	<b>0.84</b>	<b>0.74</b>	<b>0.62</b>	<b>0.40</b>

Table 1.51 :Yield parameters of cashew genotypes in MLT-V at Vridhachalam centre

Accession No.	Flowering duration (days)		Mean no. of panicles/ m <sup>2</sup>	Ratio of male : bisexual flowers	Mean no. of nuts/ m <sup>2</sup>	Mean no. of nuts/ panicle
	Range	Mean				
BPP-4	68-80	74	14.8	0.21	19.4	<b>3.2</b>
BPP-6	70-82	76	16.8	0.24	20.4	3.2
BPP-8	65-75	70	18.2	0.25	20.2	4.8
Bhubaneswar-1	65-71	68	12.6	0.19	15.4	4.9
Chintamani-1	60-64	<b>62</b>	14.8	0.23	20.4	4.6
Jhargram-1	68-72	70	13.4	0.12	12.4	4.2
Madakkathara-1	69-75	72	16.8	0.22	20.4	4.8
Madakkathara-2	72-80	76	19.2	0.19	18.2	5.2
K-22-1	73-77	75	14.8	<b>0.12</b>	<b>11.6</b>	6.2
Dhana	71-81	76	12.8	0.23	22.4	6.8
Kanaka	66-72	68	14.2	0.15	14.2	5.8



Priyanka	62-66	64	14.2	0.24	22.4	5.8
Amrutha	72-84	78	11.8	0.26	24.6	6.4
Vengurla-1	80-86	83	<b>10.2</b>	0.12	11.8	4.8
Vengurla-4	70-82	76	11.6	0.28	24.6	6.0
Vengurla-6	70-74	72	15.4	0.26	22.8	5.6
Vengurla-7	72-76	74	16.2	0.27	24.6	5.6
VRI-3	81-87	84	<b>20.4</b>	<b>0.30</b>	<b>29.4</b>	3.4
NRCC Set2	68-72	70	19.8	0.26	24.8	5.0
Ullal-1	70-74	72	14.2	0.16	14.6	5.0
Ullal-3	70-82	76	13.8	0.20	18.2	4.8
Ullal-4	72-76	74	14.8	0.17	24.2	<b>12.0</b>
UN-50	79-85	82	15.2	0.14	12.4	4.6
Goa-1	80-92	<b>86</b>	14.8	0.21	20.2	4.6
Bhaskara	72-84	78	18.4	0.24	22.4	10.0
<b>SEm ±</b>		<b>2.4</b>	<b>1.16</b>		<b>2.80</b>	<b>0.14</b>
<b>CD at 5%</b>		<b>4.6</b>	<b>3.62</b>		<b>6.12</b>	<b>0.24</b>

The average nut weight, nuts/ panicle<sup>1</sup> and nuts/ m<sup>2</sup> showed significant variations among the cashew varieties. The average nut weight varies from 5.8 g to 7.8 g. Maximum nut weight of 7.8 g was recorded by Priyanka. The varieties BPP4, BPP-8, Madakkathara-2, Amrutha, Vengurla-4, Vengurla-7, VRI 3 and Ullal-4 recorded nut weight of 7.2g (Table 1.50 and 1.51).

Apple weight varies from minimum of 51.2 g in BPP 6 to maximum of 70.0 in Priyanka. Shelling ranged from 26.2 % (BPP-4) to 30.2 % (Vengurla-4). Nut yield/ tree recorded significant differences among the varieties. The mean annual nut yield plant<sup>-1</sup>(kg) varies from 3.62 kg (Bhubaneswar 1) to 7.30 kg (VRI-3) with cumulative nut yield of 10.35 kg (Bhubaneswar 1) to 17.87 kg (VRI 3) at fifth harvest (Table 1.52).

**Table 1.52 : Yield parameters of cashew genotypes in MLT-V at Vridhachalam centre (Year of Planting- 2008)**

Accession No.	Mean Nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 5 Harvests)
BPP-4	7.2	63.3	<b>26.2</b>	5.00	14.38
BPP-6	5.0	<b>51.2</b>	27.4	5.62	15.36
BPP-8	7.2	66.2	28.0	5.10	15.30
Bhubaneswar-1	6.6	56.7	26.8	<b>3.62</b>	<b>10.35</b>
Chintamani-1	6.0	66.6	27.0	3.85	11.34
Jhargram-1	<b>5.8</b>	53.3	28.2	3.62	10.99
Madakkathara-1	6.2	52.7	28.0	4.75	14.27
Madakkathara-2	7.2	60.4	29.2	4.70	13.42



K-22-1	6.6	59.4	30.0	5.02	14.24
Dhana	7.0	59.5	28.6	5.00	13.68
Kanaka	6.6	56.7	27.8	5.25	14.91
Priyanka	<b>7.8</b>	68.1	29.4	5.10	14.46
Amrutha	7.2	61.2	29.8	5.10	14.04
Vengurla-1	6.6	60.7	29.0	6.20	15.98
Vengurla-4	7.2	<b>70.0</b>	<b>30.2</b>	6.30	16.44
Vengurla-6	6.8	58.4	28.4	4.50	12.64
Vengurla-7	7.2	67.6	29.2	4.70	14.26
VRI-3	7.2	59.0	27.4	<b>7.30</b>	<b>17.87</b>
NRCC Set-2	7.0	60.2	28.6	4.20	12.24
Ullal-1	6.8	53.0	29.2	3.80	12.14
Ullal-3	7.0	51.8	28.2	4.20	12.50
Ullal-4	7.2	59.0	28.0	5.20	14.07
UN-50	7.0	56.2	29.2	4.80	13.42
Goa-1	7.0	61.6	30.0	4.75	13.25
Bhaskara	6.8	62.5	28.6	6.20	15.34
<b>SEm ±</b>	<b>0.08</b>	<b>1.38</b>	<b>0.18</b>	<b>0.08</b>	
<b>CD at 5%</b>	<b>0.24</b>	<b>2.94</b>	<b>0.42</b>	<b>0.24</b>	



### Gen.3. Multilocation Trial – VI (Special MLT)

**Centres:** **West Coast** : Paria  
**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).

#### Experimental details:

Two rows each, of the cashew varieties (listed below) comprising of six plants per row.

#### Varieties :

NRCC Sel-2                      Bhaskara                      BPP-8                      Dhana                      VRI-3  
VRI (CW) H-1                      H 303                      Vengurla-4 (Common check)                      Local Check \*

#### \* Local Check for New Centres :

BAU Centre : BPP-8  
Paria, Arabhavi & Tura : V-4

#### TURA

Table 1.53 : Performance of Cashew Varieties under Special Multi Location trial

No.	Variety	Year of plantation	Plant Ht. (m)	Trunk Girth (cm)	Mean canopy spread (m)		Remarks
					E-W	N-S	
1	Dhanna	2010	3.7	47	4.60	3.20	Average fruiting 1kg kg/plant
2	VRI(CW)H1	2011	2.4	20	2.40	2.50	Average 350 grm./p
3	V-4	2010	3.3	30	4.60	3.10	750 g/plant
4	H-303	2010	3.5	32	3.50	2.70	-do-
5	Bhaskara	2014-15	1.80	15	1.2	0.90	No fruiting was seen
6	BPP-8	2014-15	1.40	15	1.30	1.20	-do-
7	Vengurla-4	2014-15	1.80	14	1.55	1.45	-do-
8	VRI-3	2014-15	1.80	17	1.60	1.50	-do-
9	NRCC Sel.2	2014-15	1.4	17	1.60	1.55	-do-



## Gen.4. Hybridization and Selection

**Centres:** **East Coast** : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam  
**West Coast** : Goa, Pilicode and Vengurla  
**Plains / others** : Hogalagere

The objective is to utilize the 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.

### BAPATLA

As a result of continuous crossing programme and systematic evaluation the BPP-1, BPP-2, BPP-8 and BPP-9 were released as hybrid varieties and T.No.10/19 and T.No. 30/1 is proposed for release as BPP-10 and BPP-11.

Existing F1 progenies have been evaluated for the vegetative characters, duration of flowering, yield, nut weights etc., and the data is presented in the (Table 1.54 and 1.55).

**Table 1.54 : Growth parameters of different cashew hybrids at Bapatla Centre planted during 1997**

Hybrid No.	Cross Combination	Plant height (m)	Canopy height (m)	Stem girth (cm)	Canopy spread(m)	Canopy surface area (m <sup>2</sup> )
H-9	T 273 x T 72	7.1	6.1	125.00	9.9	122.94
H-14	T 228 x T2/22	6.6	6.3	135.00	8.4	99.83
H-19	T 228 x T2/22	6.7	6.3	125.00	8.7	105.37
<b>H-36</b>	<b>F.No 3 x T 30/1</b>	7.5	6.5	110.00	<b>13.8</b>	<b>205.39</b>
H-38	BPP 6 T2/22	6.3	6.0	140.00	10.4	129.64
<b>H-49</b>	<b>BPP-8 x T2/22</b>	<b>8.0</b>	<b>7.55</b>	140.00	<b>12.3</b>	<b>189.05</b>
H-61	T 71 x T 273	5.6	5.4	105.00	12.1	153.05
H-64	T 71 x T 273	6.7	6.5	140.00	8.2	100.25
<b>H-65</b>	<b>T 71 x T 273</b>	<b>8.1</b>	<b>7.9</b>	<b>155.00</b>	10.1	147.69
H-67	T 71 x T 273	7.8	7.4	140.00	11.8	176.37
H-76	T 71 x T 273	7.9	7.5	135.00	11.1	162.59



**Table 1.55 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 1997**

Hybrid No.	Cross combination	Date of first Flowering	Date of last Flowering	Duration of Flowering (days)	No. of flowering laterals/m <sup>2</sup>	Sex ratio	Nuts / m <sup>2</sup>	No. of nuts/ panicle
H-9	T 273 x T 72	15.2.16	4.5.16	80.0	22.0	0.08	27.0	2.75
<b>H-14</b>	<b>T 228 x T2/22</b>	20.2.16	01.5.16	72.0	<b>35.0</b>	<b>0.23</b>	56.0	<b>4.25</b>
H-19	T 228 x T2/22	15.3.16	20.5.16	67.0	20.0	0.11	21.0	1.50
<b>H-36</b>	<b>F.No 3 x T 30/1</b>	25.2.16	25.4.16	<b>61.0</b>	20.0	0.18	30.0	3.50
<b>H-38</b>	<b>BPP 6 x T2/22</b>	28.2.16	30.4.16	<b>63.0</b>	24.0	0.12	<b>66.0</b>	4.00
<b>H-49</b>	<b>BPP-8 x T 2/22</b>	15.2.16	3.5.16	81.0	20.0	<b>0.21</b>	25.0	2.20
H-61	T 71 x T 273	20.2.16	26.4.16	65.0	<b>26.0</b>	0.08	56.3	<b>5.00</b>
H-64	T 71 x T 273	20.2.16	26.5.16	97.0	22.0	0.08	20.0	1.50
H-65	T 71 x T 273	1.2.16	7.5.16	69.0	24.0	0.16	21.0	1.50
<b>H-67</b>	<b>T 71 x T 273</b>	2.2.16	20.4.16	79.0	24.0	0.17	<b>61.3</b>	3.50
H-76	T 71 x T 273	18.2.16	26.4.16	69.0	20.0	0.15	38.0	2.75

**Table 1.56 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 1997**

Hybrid No.	Cross combination	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield@14 <sup>th</sup> harvest(2016) (kg/tree)	Cum.yield (kg/tree (for 14 Harvests)
H-9	T 273 x T 72	4.25	40.0	30.14	2.80	94.28
<b>H-14</b>	<b>T 228 x T2/22</b>	<b>7.61</b>	35.0	27.34	<b>24.20</b>	142.14
H-19	T 228 x T2/22	5.73	45.0	29.68	0.350	90.06
<b>H-36</b>	<b>F.No 3 x T30/1</b>	<b>8.33</b>	<b>60.0</b>	28.80	14.35	<b>171.80</b>
<b>H-38</b>	<b>BPP 6 x T2/22</b>	5.03	30.0	30.42	<b>15.50</b>	129.93
H-49	BPP-8 x T2/22	7.04	50.0	23.48	11.60	118.28
<b>H-61</b>	<b>T 71 x T 273</b>	3.62	35.0	<b>34.50</b>	13.00	101.05
H-64	T 71 x T 273	3.49	30.0	27.30	1.75	102.13
<b>H-65</b>	<b>T 71 x T 273</b>	3.87	30.0	<b>33.10</b>	5.10	94.27
<b>H-67</b>	<b>T 71 x T 273</b>	6.14	30.0	30.12	9.70	<b>170.55</b>
H-76	T 71 x T 273	5.62	32.50	29.30	1.80	129.73

Among the different hybrids of 1997 evaluated the mean nut weight was found highest in H-36 (8.33g) followed by H-14 (7.61g). The maximum apple weight was recorded in H-36 (60.0g). The shelling percentage was found highest in H-61 (34.50) followed by H-65 (33.10). The annual nut yield per tree was recorded maximum in H-14 (24.20kg) followed by H-38 (15.50kg). The cumulative nut yield was found maximum in H-36 (171.80kg per tree) followed by H-67 (170.55kg per tree) for 14 annual harvests (Table 1.56).



Table 1.57 : Growth parameters of different cashew hybrids at Bapatla Centre planted during 1999

Hy. No	Cross Combination	Plant height (m)	Canopy height (m)	Stem girth (cm)	Canopy spread (m)	Canopy surface area (m <sup>2</sup> )
H132	T NO 71X TNO 273	5.2	4.7	74.00	4.3	31.8
<b>H136</b>	<b>T NO 71X TNO 273</b>	6.8	6.3	<b>108.00</b>	8.8	106.1
H150	BPP5XBPP9	6.0	5.5	82.00	4.7	44.1
<b>H151</b>	<b>T NO 228X Priyanka</b>	<b>7.2</b>	<b>6.8</b>	<b>106.00</b>	8.6	107.8
<b>H159</b>	<b>T NO 30/1X T NO 228</b>	<b>7.2</b>	<b>7.0</b>	80.00	6.8	82.3
<b>H165</b>	<b>BPP6XBPP9</b>	6.8	6.5	72.00	<b>9.0</b>	<b>111.8</b>
H168	Priyanka X T NO 30/1	6.7	6.4	73.00	5.8	63.4
<b>H169</b>	<b>BPP8XBPP6</b>	<b>7.0</b>	6.5	104.00	<b>9.5</b>	<b>120.1</b>
H170	BPP8XPriyanka	6.5	6.1	65.00	4.8	48.9

Table 1.58 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 1999

Hybrid No.	Cross Combination	Date of first Flowering	Date of last Flowering	Duration of Flowering	No. of flowering laterals/m <sup>2</sup>	Sex Ratio	No. of Nuts / m <sup>2</sup>	No. of nuts/pa nicle
H132	T NO 71x TNO 273	25.1.16	16.4.16	83.0	25.0	0.16	<b>40.0</b>	<b>4.0</b>
H136	T NO 71x TNO 273	20.1.16	21.4.16	93.0	22.0	0.14	33.0	<b>4.0</b>
H150	BPP5x BPP9	1.3.16	25.4.16	<b>56.0</b>	25.0	<b>0.33</b>	10.2	2.0
H151	T NO 228x Priyanka	20.2.16	15.5.16	86.0	<b>32.0</b>	0.15	24.0	3.0
H159	T NO 30/1 x T NO 228	28.2.16	26.4.16	<b>59.0</b>	<b>28.0</b>	0.13	18.4	2.5
H165	BPP6x BPP9	20.1.16	26.4.16	98.0	20.0	0.13	21.2	2.0
H168	Priyanka x T NO 30/1	20.2.16	21.4.16	62.0	26.0	<b>0.17</b>	14.0	2.0
H169	BPP8x BPP6	31.1.16	5.5.16	96.0	23.0	0.14	15.2	2.0
H170	BPP8x Priyanka	2.2.16	7.4.16	66.0	25.0	0.09	15.2	1.2

Among the different hybrids of 1999 evaluated the mean nut weight was recorded maximum in H-165 (6.80g) followed by H-170 (6.70g). The apple weight was also recorded maximum in H-169 (55.0g) followed by H-165 (40.0g). The shelling percentage was recorded maximum in H-151 (33.21) followed by H-159 (32.16). The mean annual nut yield was recorded highest in H-136 (6.9kg/tree) followed by H-151 (6.6kg/tree). The cumulative nut yield per tree was found maximum in H-136 & 151 (56.10kg) followed by H-132 (55.60kg) for 7 annual harvests (Table 1.59).



**Table 1.59 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 1999**

Hybrid No.	Cross combination	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree) 2016	Cum. yield (kg/tree) (for 7 Harvests) 2010-16
H132	T NO 71x TNO 273	4.9	25.0	22.18	5.3	<b>55.6</b>
H136	T NO 71x TNO 273	4.8	35.0	31.20	<b>6.9</b>	<b>56.1</b>
H150	BPP5x BPP9	5.2	35.0	30.10	0.6	27.8
H151	T NO 228x Priyanka	5.1	30.0	<b>33.21</b>	<b>6.6</b>	<b>56.1</b>
H159	T NO 30/1 x T NO 228	3.8	25.0	<b>32.16</b>	0.5	36.7
<b>H165</b>	BPP6x BPP9	<b>6.8</b>	<b>40.0</b>	26.43	2.0	43.6
H168	Priyanka x T NO 30/1	4.1	30.0	30.24	0.6	51.3
H169	BPP8x BPP6	4.7	<b>55.0</b>	32.15	3.3	38.1
<b>H170</b>	BPP8x Priyanka	<b>6.7</b>	35.0	30.01	2.2	44.7

**Table 1.60 : Growth parameters of different cashew hybrids at Bapatla Centre planted during 2000**

Hybrid No.	Cross Combination	Plant height (m)	Canopy height (m)	Stem girth (cm)	Canopy spread (m)	Mean canopy surface area (m <sup>2</sup> )
H179	BPP-6X T NO 2/22	5.5	5.3	85.00	5.6	52.1
<b>H180</b>	<b>BPP-6X T NO 2/22</b>	<b>7.2</b>	<b>6.8</b>	115.00	<b>11.3</b>	<b>155.8</b>
<b>H186</b>	<b>T NO 228X T NO 273</b>	<b>6.2</b>	<b>5.8</b>	125.00	<b>11.1</b>	<b>139.9</b>
H187	T NO 228X T NO 273	5.2	5.0	95.00	7.3	70.9
H190	T NO 228X T NO 273	5.2	3.7	85.00	6.9	54.2
<b>H194</b>	<b>T NO 228 X F NO5</b>	6.1	5.7	125.00	11.0	136.8
H197	T NO 228 X F NO5	5.7	5.4	95.00	10.4	121.6
<b>H200</b>	<b>T NO 228 X BPP8</b>	5.6	5.4	<b>128.00</b>	9.0	99.3
H218	Priyanka X T NO30/1	5.2	4.9	105.00	10.8	122.7

**Table 1.61 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2000**

Hybrid No.	Cross combination	Date of first Flowering	Date of last Flowering	Duration of Flowering	No. of flowering laterals/m <sup>2</sup>	Sex Ratio	Nuts / m <sup>2</sup>	No. of nuts/p anicle
H179	BPP-6 X T NO 2/22	20.2.16	21.4.16	62.0	<b>30.0</b>	<b>0.20</b>	15.0	2.0
H180	BPP-6 X T NO 2/22	20.3.16	27.5.16	69.0	<b>28.0</b>	0.15	9.0	1.0
H186	T NO 228 X T NO 273	31.1.16	7.5.16	98.0	22.0	0.19	<b>45.0</b>	4.0
H187	T NO 228 X T NO 273	28.2.16	16.4.16	<b>49.0</b>	23.0	0.08	37.0	2.2
H190	T NO 228 X T NO 273	12.2.16	11.4.16	60.0	26.0	0.06	<b>49.0</b>	4.0
H194	T NO 228 X F NO5	20.2.16	6.5.16	77.0	20.0	0.17	41.2	<b>4.2</b>
H197	T NO 228 X F NO5	13.3.16	25.5.16	74.0	20.0	0.14	36.0	<b>4.2</b>
H200	T NO 228 X BPP8	21.2.16	7.5.16	77.0	22.0	<b>0.26</b>	18.0	3.0
H218	Priyanka X TNO 30/1	15.1.16	1.5.16	<b>108.0</b>	21.0	0.21	38.2	4.0

**Table 1.62 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2000**

Hybrid No.	Cross combination	Nut wt (g)	Apple wt. (g)	Shelling (%)	Annual nut yield @7 <sup>th</sup> harvest (kg/tree) 2016	Cum.nut yield (kg/tree) (for 7 Harvests) 2010-16
H179	BPP-6X T NO 2/22	5.70	30.00	28.06	1.00	47.42
H180	BPP-6X T NO 2/22	5.68	40.00	28.24	5.30	52.70
H186	T NO 228X T NO 273	5.12	35.00	<b>30.14</b>	11.4	60.15
H187	T NO 228X T NO 273	3.64	30.00	26.76	2.95	45.97
H190	T NO 228X T NO 273	3.80	25.00	26.52	5.10	43.25
<b>H194</b>	<b>T NO 228 X F NO5</b>	<b>6.87</b>	<b>70.00</b>	28.24	13.2	47.25
<b>H197</b>	<b>T NO 228 X F NO5</b>	4.96	40.00	28.96	<b>14.60</b>	<b>65.65</b>
<b>H200</b>	<b>T NO 228 X BPP8</b>	5.04	<b>55.00</b>	<b>30.38</b>	4.45	38.85
<b>H218</b>	<b>PriyankaXT NO 30/1</b>	<b>10.86</b>	40.00	29.98	<b>14.30</b>	<b>72.75</b>

The mean nut weight was registered maximum in H-218 (10.86 g) followed by H-194 (6.87 g). The mean apple weight was recorded highest in H-194 (70.0 g) followed by H-200 (55.0g). The shelling percentage was found highest in H-200 (30.38) followed by H-186 (30.14). The annual nut yield per tree was found highest in H-197 (14.60kg) followed by H-218 (14.30kg). The cumulative nut yield per tree was found highest in H-218 (72.75 kg) which was followed by H-197 (65.55kg) for 7 annual harvests (Table 1.62).



**Table 1.63 : Growth parameters of different cashew hybrids at Bapatla Centre planted during 2001**

Hybrid No.	Cross Combination	Plant height (m)	Canopy height (m)	Stem girth (cm)	Canopy spread (m)	Canopy surface area (m <sup>2</sup> )
<b>H230</b>	<b>T NO 228 x Priyanka</b>	<b>6.0</b>	<b>5.5</b>	<b>105.00</b>	<b>9.0</b>	<b>100.46</b>
H232	T NO 228 x Priyanka	5.2	5.05	100.00	7.5	74.06
H233	T NO 228 x Priyanka	4.5	4.2	93.00	7.8	70.17
H238	BPP5x T NO 2/22	5.2	4.6	90.00	<b>8.8</b>	87.23
<b>H239</b>	<b>BPP5x T NO 2/22</b>	<b>5.7</b>	<b>5.6</b>	<b>105.00</b>	<b>8.8</b>	<b>98.37</b>

**Table 1.64 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2001**

Hybrid No.	Cross combination	Date of first Flowering	Date of last Flowering	Duration of Flowering	No. of flowering laterals/ m <sup>2</sup>	Sex Ratio	Nuts / m <sup>2</sup>	Mean no. of nuts/p anicle
<b>H230</b>	<b>T NO 228 X Priyanka</b>	13.2.16	8.5.16	86.0	<b>25</b>	0.20	<b>45</b>	<b>4.0</b>
H232	T NO 228 X Priyanka	10.2.16	30.4.16	81.0	18	0.16	34	3.0
<b>H233</b>	<b>T NO 228 X Priyanka</b>	12.2.16	10.5.16	89.0	<b>30</b>	0.07	36	3.2
<b>H238</b>	<b>BPP5 X T NO 2/22</b>	10.2.16	10.5.16	91.0	24	<b>0.28</b>	<b>43</b>	3.2
<b>H239</b>	<b>BPP5 X T NO 2/22</b>	20.3.16	16.5.16	<b>58.0</b>	<b>30</b>	<b>0.42</b>	41	<b>4.0</b>

**Table 1.65 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2001**

Hybrid No.	Cross combination	Nut wt. (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree) 2016	Cum.yield (kg/tree) (for 7 Harvests) 2010-2016
H230	T NO 228 X Priyanka	4.89	40	26.14	<b>9.55</b>	<b>73.47</b>
H232	T NO 228 X Priyanka	4.08	35	<b>30.24</b>	9.70	44.90
H233	T NO 228 X Priyanka	4.78	40	<b>30.14</b>	<b>12.85</b>	65.42
H238	BPP5 X T NO 2/22	<b>5.00</b>	45	23.24	4.20	48.20
<b>H239</b>	<b>BPP5 X T NO 2/22</b>	<b>5.99</b>	40	30.12	13.2	<b>80.62</b>

The mean nut weight was found highest in H-239 (5.99 g) followed by H-238 (5.00 g). The shelling percentage was found maximum in H-232 (30.24) followed by H-239 (30.14). The mean annual nut yield per tree was recorded maximum in H-230 (26.55kg) followed by H-233 (12.85 kg). The cumulative nut yield was found maximum in H-239 (80.62kg/tree) followed by H-230 (73.47kg/tree) for 7 annual harvests (Table 1.65).



**Table 1.66 : Growth parameters of different cashew hybrids at Bapatla Centre planted during 2006**

Hybrid No.	Cross Combination	Plant height (m)	Canopy height (m)	Stem girth (cm)	Canopy spread (m)	Canopy surface area (m <sup>2</sup> )
H292	BPP6XULLAL3	6.3	5.9	90.0	8.5	97.02
H293	BPP6XULLAL3	5.8	5.6	100.0	7.55	80.01
H294	BPP6XULLAL3	4.7	4.2	84.0	6.75	56.91
H295	BPP6XULLAL3	4.8	4.6	71.0	6.75	60.51
H298	BPP6XNRCC SEL2	5.3	4.8	70.0	6.45	58.53
H299	BPP6XNRCC SEL2	6.2	5.7	100.0	9.15	81.74
H300	BPP6XNRCC SEL2	5.3	4.4	72.0	6.45	55.29
H301	BPP6XNRCC SEL2	5.8	5.4	90.0	8.50	91.68
H302	BPP6XNRCC SEL2	4.8	4.4	64.0	5.65	46.04
H303	BPP6XNRCC SEL1	5.4	4.8	99.0	9.35	98.35
H304	BPP6XNRCC SEL1	4.5	4.4	77.0	6.20	51.98
H305	BPP6XNRCC SEL1	5.9	5.3	75.0	7.85	80.85
H306	BPP6XULLAL 4	4.0	3.0	76.0	7.5	56.52
H307	BPP6X ULLAL 4	5.0	4.8	74.0	8.5	85.01
H308	BPP6X ULLAL 4	2.5	1.9	35.0	3.10	11.73
H309	BPP6X ULLAL 4	5.5	4.9	90.0	8.55	86.85
H310	BPP6X ULLAL 4	4.3	3.4	59.0	4.85	31.45
H311	BPP6X ULLAL 4	6.1	5.0	90.0	9.10	96.58
H312	BPP6X ULLAL 4	5.6	5.0	68.0	8.25	83.41
H313	BPP8X NRCC Sel 2	4.0	3.1	68.0	6.45	45.27
<b>H314</b>	<b>BPP8X NRCC Sel 2</b>	<b>6.4</b>	6.0	110.0	<b>9.95</b>	<b>121.69</b>
H315	BPP8X NRCC Sel 2	6.1	5.9	85.0	8	89.05
H316	BPP8X NRCC Sel 2	5.3	5.0	74.0	6.85	65.17
<b>H317</b>	<b>BPP8X NRCC Sel 2</b>	<b>7.0</b>	<b>6.8</b>	103.0	9.15	117.65
H318	BPP8X NRCC Sel 2	6.0	5.6	63.0	6.25	62.5
<b>H319</b>	<b>BPP6X NRCC Sel 2</b>	5.3	4.8	<b>112.0</b>	10.30	113.84
H320	BPP6X NRCC Sel 2	5.2	4.6	72.0	5.55	46.44
H321	BPP6X NRCC Sel 2	5.0	4.8	105.0	7.35	69.81
H322	BPP6X NRCC Sel 2	4.9	4.6	65.0	4.95	40.57
H323	BPP6X NRCC Sel 2	4.8	4.4	87.0	6.25	52.99
H324	BPP6X NRCC Sel 2	5.0	4.8	94.0	7.35	69.81
H325	BPP6X NRCC Sel 2	5.8	5.3	80.0	7.85	81.34
H326	BPP6X NRCC Sel 2	5.4	4.4	63.0	5.5	44.82
H327	BPP6X NRCC Sel 2	6.0	5.0	74.0	7.25	70.34
H328	BPP-8X ULLAL-4	3.3	3.10	61.0	9.70	87.72
H329	BPP-8XULLAL-4	4.0	3.9	74.0	5.45	40.39



H330	BPP-8XULLAL4	4.3	4.0	60.0	3.6	24.53
H331	BPP-8XULLAL4	4.0	3.8	65.0	6.25	48.28
H332	BPP-8XULLAL4	3.8	3.1	56.0	5.95	39.79
H333	BPP-8XULLAL4	4.0	3.9	56.0	4.8	34.21
H334	BPP8XBPP4	4.5	4.4	76.0	6.6	56.99
H335	BPP8XBPP4	4.2	4	69.0	7.2	60.82
H336	BPP8XBPP4	4.0	3.7	80.0	6.5	50.21
H337	BPP8XBPP4	4.0	3.7	72.0	5.2	36.90
H338	BPP8XT NO 228	4.9	4.7	85.0	8.5	84.61
H339	BPP8XT NO 228	4.7	4.5	60.0	6.35	54.93
H340	BPP8XT NO 228	5.1	4.9	83.0	8.20	82.26
H341	T NO 228 X BPP8	4.2	4.1	76.0	6.45	52.46
H342	T NO 228 X BPP8	3.1	2.2	58.0	4.45	21.87
H343	T NO 228 X BPP8	4.6	4.2	85.0	7.2	62.51
H344	T NO 228 X BPP8	5.0	4.7	87.0	6.8	61.92
H345	T NO 228 X BPP8	5.4	5.0	86.0	6.8	64.59
H346	T NO 228 X BPP8	5.0	4.5	69.0	5.55	46.09
H347	T NO 228 X BPP8	5.2	4.8	79.0	7	65.28
H348	T NO 228 X BPP8	5.1	4.7	91.0	7.15	66.34
H349	T NO 228 X BPP8	5.0	4.5	76.0	6.10	51.62
H350	T NO 228 X BPP8	5.1	4.4	70.0	7.35	66.12
H351	BPP6XNRC SEL 2	3.4	3.1	67.2	6.45	45.27
H352	BPP8X T NO 10/19	4.7	4.0	77.0	7.15	60.17
H353	BPP8X T NO 10/19	5.4	5.1	81.0	6.45	60.86
H354	BPP8X T NO 10/19	5.7	5.3	91.0	8.20	86.26
<b>H355</b>	<b>BPP8X T NO 10/19</b>	<b>7.0</b>	<b>6.7</b>	<b>100.0</b>	<b>9.9</b>	<b>129.47</b>
H356	BPP8X T NO 10/19	4.9	4.6	90.0	8.05	77.22
H357	BPP8X T NO 10/19	5.5	5.1	76.0	5.95	55.11
H358	BPP8X T NO 10/19	5.4	5.0	85.0	7.05	67.74
H359	BPP8XBPP3	4.0	3.8	60.0	5.55	41.04
H360	BPP8XBPP3	4.0	3.9	61.0	6	45.97
H361	BPP8XBPP3	4.8	4.7	83.0	6.35	56.53
H362	BPP8XBPP3	5.0	4.7	70.0	6.6	59.48
H363	BPP8XBPP3	3.5	3.3	60.0	4.3	26.33
H364	BPP8XBPP3	4.0	3.8	70.0	7	56.82
H365	BPP8XBPP3	5.0	4.8	86.0	7.5	71.24
H366	BPP8XBPP3	4.0	3.2	70.0	6.45	45.97
H368	T NO 228XBPP-8	5.1	4.6	106.0	6.5	57.45
H369	T NO 228XBPP-8	5.9	4.8	93.0	6.75	62.21
H370	T NO 228XBPP-8	5.2	4.8	98.0	7.55	72.42
H371	T NO 228XBPP-8	4.5	3.8	81.0	6.65	52.31
H372	T NO 228XBPP-8	3.1	2.9	52.0	5.5	34.54
H373	T NO 228XBPP-8	6.0	5.8	69.0	6.15	63.44
<b>H374</b>	<b>T NO 228XBPP-8</b>	<b>6.4</b>	<b>6.3</b>	<b>105.0</b>	<b>7.05</b>	<b>79.91</b>
H375	T NO 228XBPP-8	5.6	5.4	94.0	7.05	71.39
H376	T NO 228XBPP-8	5.0	4.6	90.0	6.65	59.30



Table 1.67 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2006

Hybrid No.	Cross combination	Date of first Flowering	Date of last Flowering	Duration of Flowering	No. of flowering laterals/ m <sup>2</sup>	Nuts / m <sup>2</sup>	No. of nuts/panicle
H292	BPP6 X ULLA3	10.3.16	10.5.16	62	16	22	2.2
H293	BPP6 X ULLA3	29.2.16	26.5.16	88	32	25	3
H294	BPP6 X ULLA3	13.3.16	20.5.16	69	13	25	6
H295	BPP6 X ULLA3	25.3.16	01.6.16	69	13	24	3
H297	BPP6XNRCC SEL2	10.3.16	14.5.16	66	29	6	1.2
H298	BPP6XNRCC SEL2	14.3.16	30.5.16	78	25	45	4
H299	BPP6XNRCC SEL2	29.2.16	30.4.16	62	16	22	3
H300	BPP6XNRCC SEL2	14.2.16	16.5.16	93	22	39	4
H301	BPP6XNRCC SEL2	25.2.16	15.5.16	81	18	8	3
H302	BPP6XNRCC SEL2	29.2.16	20.5.16	82	10	19	2
H303	BPP6XNRCC SEL1	21.2.16	26.5.16	96	15	20.2	2
H304	BPP6XNRCC SEL1	07.2.16	05.5.16	89	28	22	3
H305	BPP6XNRCC SEL1	10.3.16	1.6.16	84	12	6.2	1.2
H306	BPP6XULLAL 4	13.3.16	30.5.16	79	31	24.2	2
H307	BPP6X ULLAL 4	10.2.16	30.5.16	111	28	25	2
H308	BPP6X ULLAL 4	29.2.16	01.6.16	94	29	2	1
H309	BPP6X ULLAL 4	20.3.16	30.5.16	72	30	6.2	1.2
H310	BPP6X ULLAL 4	15.1.16	25.4.16	102	28	4.2	1.2
<b>H311</b>	<b>BPP6XULLAL 4</b>	29.2.16	30.5.16	92	<b>34</b>	5	1.2
H312	BPP6X ULLAL 4	29.3.16	28.5.16	61	18	5	1.2
H313	BPP8X NRCC Sel 2	31.3.16	30.5.16	61	19	26	2
H314	BPP8X NRCC Sel 2	15.3.16	31.5.16	78	21	23.2	3
H315	BPP8X NRCC Sel 2	20.3.16	1.6.16	74	19	19	1.2
H316	BPP8X NRCC Sel 2	29.2.16	31.5.16	93	31	31.2	2.2
H317	BPP8X NRCC Sel 2	9.3.16	31.5.16	84	21	24	2
H318	BPP8X NRCC Sel 2	5.2.16	25.5.16	111	15	18.2	2.2
H319	BPP6X NRCC Sel 2	10.3.16	25.5.16	77	30	35	3.2
H320	BPP6X NRCC Sel 2	15.2.16	1.6.16	108	20	26	2.2
H321	BPP6X NRCC Sel 2	13.3.16	26.5.16	75	19	8.2	1
H322	BPP6X NRCC Sel 2	29.2.16	31.5.16	93	31	1.2	1
H323	BPP6X NRCC Sel 2	20.3.16	30.5.16	72	32	28	2.2
H324	BPP6X NRCC Sel 2	29.2.16	25.5.16	87	23	23.2	4
H325	BPP6X NRCC Sel 2	29.2.16	31.5.16	93	28	27.8	3.25
H326	BPP6X NRCC Sel 2	10.3.16	30.5.16	82	22	14.8	1.75



H327	BPP6X NRCC Sel 2	29.2.16	20.5.16	82	28	20	2
H328	BPP-8X ULLAL-4	16.1.16	31.5.16	137	26	35.8	3.5
H329	BPP-8XULLAL-4	20.2.16	29.5.16	100	27	24.8	2.25
H330	BPP-8XULLAL-4	29.2.16	20.5.16	82	26	37	2
H331	BPP-8XULLAL-4	20.1.16	31.5.16	133	16	20.3	2
H332	BPP-8XULLAL-4	13.1.16	31.5.16	140	32	15	2
H333	BPP-8XULLAL-4	10.3.16	25.5.16	77	20	20	2
H334	BPP8XBPP4	20.3.16	31.5.16	73	6	23	3
H335	BPP8XBPP4	29.2.16	26.5.16	88	10	5	1.25
H336	BPP8XBPP4	28.2.16	20.5.16	83	28	45	4
H337	BPP8XBPP4	31.1.16	25.5.16	116	11	21	3
H338	BPP8XT NO 228	21.2.16	20.5.16	90	31	26	
H339	BPP8XT NO 228	25.1.16	30.4.16	97	20	22	2
H340	BPP8XT NO 228	16.2.16	22.5.16	97	24	32	3
H341	T NO 228 X BPP8	12.2.16	25.5.16	104	30	24	2
H342	T NO 228 X BPP8	29.2.16	30.5.16	92	18	28	3
H343	T NO 228 X BPP8	10.2.16	24.5.16	105	21	48	5
<b>H344</b>	<b>T NO 228 X BPP8</b>	20.2.16	15.5.16	86	<b>33</b>	<b>76</b>	<b>6</b>
<b>H345</b>	<b>T NO 228 X BPP8</b>	25.3.16	1.5.16	38	<b>33</b>	52	3
H346	T NO 228 X BPP8	10.3.16	31.5.16	83	27	32	2
H347	T NO 228 X BPP8	29.2.16	10.5.16	72	29	30	2
H348	T NO 228 X BPP8	10.3.16	26.5.16	78	19	19	2
H349	T NO 228 X BPP8	16.3.16	1.6.16	78	32	18	2
<b>H350</b>	<b>T NO 228 X BPP8</b>	21.3.16	31.5.16	72	<b>34</b>	57	4
H351	BPP6XNRC SEL 2	10.3.16	28.5.16	80	19	19	2
H352	BPP8X T NO 10/19	29.2.16	25.5.16	87	26	19	2
H353	BPP8X T NO 10/19	10.3.16	21.5.16	73	27	24	2
H354	BPP8X T NO 10/19	29.2.16	27.5.16	89	27	32	3
H355	BPP8X T NO 10/19	10.1.16	26.4.16	108	22	35	3
H356	BPP8X T NO 10/19	10.3.16	31.5.16	83	28	32	3
H357	BPP8X T NO 10/19	10.3.16	25.5.16	77	22	5	5
H358	BPP8X T NO 10/19	22.2.16	16.5.16	85	27	31	3
H359	BPP8XBPP3	15.3.16	26.5.16	73	15	5	1
H360	BPP8XBPP3	26.1.16	30.5.16	126	22	26	3
H361	BPP8XBPP3	5.2.16	29.4.16	85	23	27	2
H362	BPP8XBPP3	16.2.16	31.5.16	106	21	28	2
H363	BPP8XBPP3	29.2.16	5.5.16	67	23	18	2
<b>H364</b>	<b>BPP8XBPP3</b>	10.3.16	1.5.16	<b>53</b>	25	19	2
H365	BPP8XBPP3	15.1.16	16.5.16	123	24	33	2





H366	BPP8XBPP3	11.2.16	26.5.16	106	31	26	2
<b>H368</b>	<b>T NO 228XBPP8</b>	29.2.16	31.5.16	93	32	<b>74</b>	<b>6</b>
H369	T NO 228XBPP8	21.3.16	30.5.16	71	24	34	3
<b>H370</b>	<b>T NO 228XBPP8</b>	10.3.16	30.5.16	82	30	61	4
H371	T NO 228XBPP8	11.3.16	30.5.16	81	23	49	5
H372	T NO 228XBPP8	29.2.16	26.5.16	88	19	21	4
H373	T NO 228XBPP8	23.3.16	30.5.16	69	32	17	1
H374	T NO 228XBPP8	16.3.16	30.5.16	76	17	6	1
H375	T NO 228XBPP8	10.2.16	10.5.16	91	20	28	4
H376	T NO 228XBPP8	20.3.16	25.5.16	67	26	33	3

**Table 1.68 : Yield parameters of different cashew hybrids at Bapatla Centre planted during 2006**

Hybrid No.	Cross combination	Nut wt. (g)	Apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree) 5 <sup>th</sup> harvest (2016)	Cum nut yield (kg/tree) (for 5 Harvests) 2012-2016
H292	BPP6XULLAŁ3	5.89	40	29.12	2.25	9.40
H293	BPP6XULLAŁ3	5.98	50	26.5	3.8	10.07
H294	BPP6XULLAŁ3	6.09	40	27.14	4.80	10.05
H295	BPP6XULLAŁ3	4.18	60	25.34	2.70	10.76
H297	BPP6XNRCC SEL2	5.33	40	30.8	3.5	12.45
H298	BPP6XNRCC SEL2	5.10	35	31.51	6.5	19.75
<b>H299</b>	<b>BPP6XNRCC SEL2</b>	6.75	<b>65</b>	26.78	8.25	21.20
H300	BPP6XNRCC SEL2	6.34	60	30.10	7.10	18.31
H301	BPP6XNRCC SEL2	5.80	55	28.90	2.8	9.27
H302	BPP6XNRCC SEL2	5.49	60	28.24	2.25	8.6
<b>H303</b>	<b>BPP6XNRCC SEL1</b>	7.65	<b>70</b>	24.22	0.60	7.00
H304	BPP6XNRCC SEL1	6.45	45	29.67	4.90	16.2
H305	BPP6XNRCC SEL1	5.53	60	29.60	1.5	6.7
H306	BPP6XULLAL 4	4.73	45	23.20	9.85	19.6
H307	BPP6X ULLAL 4	5.62	50	25.6	6.60	12
H308	BPP6X ULLAL 4	3.82	45	26.4	0.10	2.9
H309	BPP6X ULLAL 4	5.26	45	27.4	1.45	5.3
H310	BPP6X ULLAL 4	5.26	45	30.10	3.45	11.25
H311	BPP6X ULLAL 4	6.20	50	29.80	3.10	10.70
H312	BPP6X ULLAL 4	5.03	45	26.20	2.35	10.50



H313	BPP8X NRCC Sel 2	6.00	50	27.32	3.45	9.55
H314	BPP8X NRCCSel 2	7.25	45	29.93	6.40	19.10
H315	BPP8X NRCC Sel 2	6.2	45	25.80	1	14.50
H316	BPP8X NRCC Sel 2	6.16	50	20.10	8.50	20
H317	BPP8X NRCC Sel 2	5.32	35	22.17	6.375	28.325
H318	BPP8X NRCC Sel 2	6.07	45	28.95	3.30	14.10
H319	BPP6X NRCC Sel 2	6.38	50	25.64	12.90	34.35
H320	BPP6X NRCC Sel 2	6.10	45	26.74	6.05	12.30
<b>H321</b>	<b>BPP6X NRCC Sel 2</b>	<b>8.72</b>	50	31.33	3.30	15.10
H322	BPP6X NRCC Sel 2	6.65	35	27.80	0.65	3.45
H323	BPP6X NRCC Sel 2	5.35	50	24.5	1.45	11.40
H324	BPP6X NRCC Sel 2	6	40	26.94	4.10	13.10
H325	BPP6X NRCC Sel 2	6.08	45	25.80	3.60	14.40
H326	BPP6X NRCC Sel 2	4.26	40	25.60	1.20	6.95
H327	BPP6X NRCC Sel 2	6.47	45	26.60	5.30	15.40
H328	BPP-8X ULLAL-4	5.78	55	27.20	4.60	10.75
H329	BPP-8XULLAL-4	5.88	50	21.95	6.40	12.65
H330	BPP-8XULLAL-4	7.77	47.5	24.06	1.40	3.85
H331	BPP-8XULLAL-4	5.62	61	24.2	3.7	13.55
H332	BPP-8XULLAL-4	7.35	72.5	31.5	4.2	9.35
H333	BPP-8XULLAL-4	6.96	52.5	30.72	2.50	6.10
H334	BPP8XBPP4	6.17	42.5	26.30	2.00	9.22
H335	BPP8XBPP4	6.94	32.5	28.97	0.60	6.30
H336	BPP8XBPP4	4.33	35	29.84	13.80	26.65
H337	BPP8XBPP4	5.74	52.5	24.23	1.10	10.93
H338	BPP8XT NO 228	8.12	37.5	29.37	7.2	14.75
H339	BPP8XT NO 228	6.9	35	32.46	14.20	20.52
H340	BPP8XT NO 228	7.15	40	32.47	2.40	19.60
H341	T NO 228 X BPP8	6.05	41	22.88	2.65	13.62
H342	T NO 228 X BPP8	6.52	22.5	26.04	4.5	14.15
H343	T NO 228 X BPP8	4.31	25	31.86	6.15	15.60
H344	T NO 228 X BPP8	4.15	20	31.20	11.70	28.60
H345	T NO 228 X BPP8	4.85	25	29.20	6.10	16.75
H346	T NO 228 X BPP8	6.42	22.5	29.84	1.60	7.33
H347	T NO 228 X BPP8	8.03	32.5	28.11	3.2	15.24
H348	T NO 228 X BPP8	6.2	50	30.10	1.8	9.6
H349	T NO 228 X BPP8	4.09	22.5	28.26	3.40	15.15
<b>H350</b>	<b>T NO 228 X BPP8</b>	6.58	32.5	<b>35.36</b>	10.30	24.60



H351	BPP6XNRC SEL 2	7.15	30.0	30.85	9.05	18.40
H352	BPP8X T NO 10/19	6.51	47.5	28.20	4.55	14.02
H353	BPP8X T NO 10/19	6.86	50	20.16	4.10	13.80
H354	BPP8X T NO 10/19	9.04	60	23.20	5.9	11.30
<b>H355</b>	<b>BPP8X T NO 10/19</b>	7.29	32.5	26.09	<b>21.25</b>	<b>54.51</b>
H356	BPP8X T NO 10/19	4.43	25	26.48	2.20	25.90
H357	BPP8X T NO 10/19	4.58	35	27.28	1.05	7.55
H358	BPP8X TNO 10/19	8.48	42.5	28.58	3.90	16.78
<b>H359</b>	<b>BPP8XBPP3</b>	<b>10.28</b>	55	24.95	5.25	9
H360	BPP8XBPP3	6.13	25	31.32	7.80	13.38
H361	BPP8XBPP3	6.19	42.5	26.23	5.25	17.85
H362	BPP8XBPP3	8.22	42.5	27.63	10.90	23.18
H363	BPP8XBPP3	6.97	25	27.88	4.45	10.32
H364	BPP8XBPP3	6.84	50	22.49	2.05	15.46
<b>H365</b>	<b>BPP8XBPP3</b>	6.37	50	22.86	23.6	<b>55.45</b>
H366	BPP8XBPP3	5.43	30	23.42	6.75	18.33
H368	T NO 228XBPP8	4.59	40	22.15	16.60	35.53
H369	T NO 228XBPP8	7.5	45	27.87	2.90	7.48
<b>H370</b>	<b>T NO 228XBPP8</b>	5.8	51	23.80	<b>14.40</b>	30.85
<b>H371</b>	<b>T NO 228XBPP8</b>	7.18	55	<b>32.59</b>	12.75	23.45
H372	T NO 228XBPP8	3.3	20	23.04	1.40	4.61
H373	T NO 228XBPP8	3.55	32.5	26.2	3.7	11.04
H374	T NO 228XBPP8	6.43	41	27.8	1.65	10.03
H375	T NO 228XBPP8	5.48	20	27.24	4.6	10.03
H376	T NO 228XBPP8	6.04	41	31.5	7.3	9.90

The mean nut weight was found highest in H-359 (10.28g) followed by H-321 (8.72g). The shelling percentage was highest in H-371 (32.59) followed by H-350 (35.36). The mean annual nut yield per tree was recorded highest in H-355 (21.25kg/tree) followed by H- 370 (14.40kg/tree). The cumulative nut yield was found highest in H-365 (55.45kg) followed by H- 355 (54.51kg/tree) for 5 annual harvests (Table 1.68).

## BHUBANESWAR

The vegetative characters of promising hybrids are presented in the Table 1.69.



**Table 1.69 : Growth parameters of different cashew hybrids at Bhubaneswar Centre during the year \***

Hybrid No.	Cross combination	Year of Planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
					E-W	N-S	
B6-27	RP-1 x VTH 711/4	2002	5.6	75.4	4.5	5.4	19.23
C6-41	RP 2 x Kankady		3.7	70.4	4.2	4.4	14.56
D6-19	M44/3 x VTH 711/4		4.8	80.2	4.8	5.0	18.84
C2-6	RP 2 x Kankady	2003	6.3	84.5	5.8	6.3	28.73
E7-2	OC 56 x VTH 711/4		5.7	75.7	5.3	5.8	24.17

\*Results of single plant evaluation

**Table 1.70 : Yield parameters of different cashew hybrids at Bhubaneswar Centre**

Hybrid No.	Cross combination	Flowering duration (days)		No. of flowering laterals / m <sup>2</sup>	Ratio of male : bisexual flowers	Nuts/ m <sup>2</sup>	No. of nuts/panicle
		Range	Mean				
B <sub>6-27</sub>	RP-1 x VTH - 711/4	4 <sup>th</sup> week of Jan. to 3 <sup>rd</sup> week of Apr.	83	19.62	0.16	27.32	3
C <sub>6-41</sub>	RP 2 x Kankady	4 <sup>th</sup> week of Jan. to 4 <sup>th</sup> week of Apr.	88	18.43	0.14	25.58	3
D <sub>6-19</sub>	M44/3 x VTH 711/4	3 <sup>rd</sup> week of Jan. to 3 <sup>rd</sup> week of Apr.	84	20.10	0.18	23.88	3
C <sub>2-6</sub>	RP 2 x Kankady	1st week of Jan. to 1st week of Apr.	87	20.53.	0.31	30.24	5
E <sub>7-2</sub>	OC 56 x VTH 711/4	1st week of Feb. to 3rd week of Apr.	77	19.20	0.09	21.62	3
B <sub>6-27</sub>	RP-1 x VTH - 711/4	4 <sup>th</sup> week of Jan. to 3 <sup>rd</sup> week of Apr.	83	19.62	0.16	27.32	3

\*Results of single plant evaluation



The results on yield attributing traits and nut yield revealed that hybrid D6-19 recorded maximum nut weight (9.0g) while apple weight was recorded maximum in hybrid E7-2 (92.0g). Mean annual nut yield (kg tree<sup>-1</sup>) and cumulative nut yield (kg tree<sup>-1</sup>) were recorded maximum in hybrid C2-6 (12.4 & 36.6) followed by D6-19 (9.0 & 28.6) and B6-27 (8.6 & 28.1) respectively. Shelling was recorded maximum for hybrids C2-6 (32.29%) followed by B6-27 (31.61%), C6-41 (30.66%), E7-2 (29.74) and D6-19 (28.16) (Table 1.71).

**Table 1.71 : Yield parameters of different cashew hybrids at Bhubaneswar Centre**

Hybrid No.	Cross combination	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 10 Harvests)
B <sub>6-27</sub>	RP-1 x VTH 711/4	8.2	65.0	31.61	8.6	28.1
C <sub>6-41</sub>	RP2 x Kankady	8.5	69.0	30.66	7.2	25.4
D <sub>6-19</sub>	M44/3 x VTH 711/4	9.0	70.0	28.16	9.0	28.6
						<b>9 Harvest</b>
C <sub>2-6</sub>	RP 2 x Kankady	7.4	35.0	32.29	12.4	36.6
E <sub>7-2</sub>	OC 56 x VTH 711/4	8.3	92.0	29.74	8.3	22.6

**\*Results of single plant evaluation**

## GOA

### a). Performance of 1<sup>st</sup> set of Hybrids (6<sup>th</sup> harvest)

Vigorous growth in Hybrids H-31/05, H-22/05 and H21/05 continued by recording the higher tree height, canopy spread and collar girth (Table). Among the precocious hybrids, H-31/05 was observed to be severely affected by TMB and leaf webber, because of which nut yield was adversely affected (Table 1.72).

**Table 1.72 : Growth performance of cashew hybrids**

Sl. No.	Hybrid	Parental combination	Year of First Flowering	Growth during current season				TMB Incidence and growth
				Height (m)	Collar girth (cm)	Canopy Spread (m)		
Year	N X S	E X W						
1	H- 5/05	Goa – 1 (B2) X Tis –3	2010	4.1	55.2	2.9	3.2	Low TMB
2	H- 14/05	Goa – 1 (B2) X Tis –3	2009	4.3	59.8	2.8	3.1	Low TMB
3	H- 11/05	Goa 1 (B2) X KN 2/98	2008	4.4	68.3	3.9	4.3	High TMB



4	H- 12/05	Valpoi - 7 X V - 4	2009	4.6	64.7	4.1	4.3	Low TMB
5	H- 13/05	GNJ - 2 X Goa - 1 (B2)	2010	4.3	68.2	3.9	4.5	Low TMB
6	H- 21/05	Valpoi - 7 X Tis - 3	2008	5.2	80.2	4.5	4.7	Low TMB, Vigorous & precocious
7	H- 22/05	Goa -1 (B2) X Valpoi- 2	2009	5.4	85.2	3.9	4.2	vigorous
8	H- 23/05	Goa-1 (B2) X Valpoi - 2	2009	4.8	75.5	4.0	4.8	High TMB
9	H- 27/05	V - 4 X Tis - 3	2011	4.4	72.5	4.2	4.6	High TMB
10	H- 29/05	Goa - 1 (B2) X V - 4	2009	4.2	66.3	3.9	4.1	High TMB
11	H- 30/05	Goa - 1 (B2) X V - 4	2010	3.5	55.4	2.5	3.7	Slow growth
12	H- 31/05	Goa - 1 (B2) X V - 4	2008	5.9	92.0	5.9	6.5	High TMB, vigorous

Raw nut yield varied from 3.12kg/tree (H-5/05) to 9.27 kg/tree (H-21/05) with mean nut weight of 7.62g and shelling percentage of 28.35 in the former, and 8.32 g nut weight and 29.02 % of shelling in the latter respectively (Table). Nut yield performance in H-31/05 (8.86kg/tree) was severely affected by the heavy incidence of TMB unlike that (12.45 and 14.56kg/tree) in the previous years. Other hybrids such as H-11/05 (6.42 kg/tree, 7.42g nut weight and 28.22% shelling), H-12/05 (8.12kg/tree, 7.9g nut weight and 28.9 % shelling) and H-22/05 (6.25kg/tree, 9.24g nut weight and 29.78% shelling) recorded consistent performance (Table 1.73).

Higher apple weight was recorded in H-22/05 (94.85g), H-21/05 (80.35g) and H-12/05 (80.05g) with moderate levels of juice contents (68.0, 69.8 and 66.4%) and Total soluble solids (12.6, 12.6 and 11.6 °B) respectively (Table 1.74).

**Table 1.73 :Trend of yield and nut characteristics of first set of hybrids (6<sup>th</sup> harvest) at Goa**

Sl. No.	Hybrid	Nut Wt. (g)				Nut yield (kg/tree)				Shelling (%)			
		2013	2014	2015	2016	2013	2014	2015	2016	2013	2014	2015	2016
1	H- 5/05	7.6	7.8	7.35	<b>7.62</b>	0.88	1.65	1.45	<b>3.12</b>	28.63	28.22	28.00	<b>28.35</b>
2	H- 14/05	8.25	8.12	8.2	<b>8.10</b>	0.65	1.81	3.28	<b>4.24</b>	27.45	28.00	27.55	<b>27.88</b>
3	H- 11/05	<b>7.86</b>	7.80	7.21	<b>7.42</b>	<b>2.10</b>	4.41	4.90	<b>6.42</b>	<b>29.05</b>	<b>28.86</b>	<b>28.35</b>	<b>28.22</b>
4	H- 12/05	<b>7.56</b>	7.82	8.0	<b>7.90</b>	<b>1.85</b>	5.85	8.25	<b>8.12</b>	<b>29.65</b>	<b>29.45</b>	<b>29.80</b>	<b>28.89</b>



5	H-13/05	7.88	7.91	7.55	<b>7.76</b>	0.32	0.89	1.85	<b>3.25</b>	28.33	27.92	27.50	<b>28.00</b>
6	<b>H-21/05</b>	<b>8.26</b>	8.6	8.2	<b>8.32</b>	3.12	6.7	8.55	<b>9.27</b>	<b>29.2</b>	<b>29.15</b>	<b>28.86</b>	<b>29.02</b>
7	<b>H-22/05</b>	<b>8.88</b>	9.02	9.65	<b>9.24</b>	<b>1.95</b>	2.87	5.68	<b>6.25</b>	<b>29.33</b>	<b>29.21</b>	<b>28.76</b>	<b>29.78</b>
8	H-23/05	7.66	7.9	7.85	<b>7.78</b>	0.78	2.02	4.05	<b>5.87</b>	28.80	28.86	28.24	<b>28.08</b>
9	H-27/05	7.35	7.56	7.90	<b>7.85</b>	0.75	3.35	5.35	<b>6.84</b>	28.10	28.55	28.42	<b>27.86</b>
10	H-29/05	7.68	7.60	7.85	<b>7.70</b>	0.90	1.55	2.85	<b>3.33</b>	28.68	28.00	28.22	<b>28.58</b>
11	H-30/05	7.55	7.62	7.85	<b>7.59</b>	0.35	1.01	2.35	<b>3.52</b>	27.80	27.68	27.22	<b>27.66</b>
12	<b>H-31/05</b>	<b>7.11</b>	7.22	6.85	<b>7.32</b>	4.80	14.56	12.45	<b>8.86</b>	<b>28.14</b>	<b>29.02</b>	<b>29.24</b>	<b>28.85</b>

Table 1.74 : Apple characteristics of cashew hybrids at Goa Centre

Sl. No.	Hybrid	Mean Apple Wt. (g)			Juice %			TSS (B°)			Apple colour
		2014	2015	2016	2014	2015	2016	2014	2015	2016	
1	H-5/05	60.55	64.56	62.56	68.5	62.4	65.6	11.2	12.6	11.8	Yellow
2	H-14/05	65.40	62.50	60.32	65.3	69.4	66.7	10.6	11.0	11.4	Orange
3	<b>H-11/05</b>	<b>80.50</b>	<b>72.50</b>	<b>73.12</b>	<b>69.4</b>	<b>70.5</b>	<b>68.44</b>	<b>11.0</b>	<b>10.8</b>	<b>10.6</b>	<b>Red</b>
4	<b>H-12/05</b>	<b>85.50</b>	<b>81.50</b>	<b>80.05</b>	<b>65.6</b>	<b>67.6</b>	<b>66.4</b>	<b>10.8</b>	<b>11.0</b>	<b>11.6</b>	<b>yellow</b>
5	H-13/05	79.55	73.45	72.87	70.0	68.5	67.5	11.2	10.8	11.8	Yellow
6	<b>H-21/05</b>	<b>90.55</b>	<b>82.58</b>	<b>80.35</b>	<b>70.3</b>	<b>72.4</b>	<b>69.8</b>	<b>11.8</b>	<b>12.8</b>	<b>12.6</b>	<b>Yellow</b>
7	<b>H-22/05</b>	<b>100.40</b>	<b>90.35</b>	<b>94.85</b>	<b>69.7</b>	<b>68.5</b>	<b>68.0</b>	<b>12.4</b>	<b>12.8</b>	<b>12.6</b>	<b>yellow</b>
8	H-23/05	75.25	71.35	72.08	63.9	66.8	69.4	11.2	10.8	11.4	Red
9	H-27/05	70.65	68.00	69.32	65.5	69.5	66.2	10.8	11.0	10.6	Yellow
10	H-29/05	68.33	69.45	68.56	66.6	72.5	69.3	10.6	11.6	11.2	Yellow
11	H-30/05	65.68	60.80	61.85	60.2	62.5	61.5	11.2	10.8	11.6	Yellow
12	<b>H-31/05</b>	<b>55.65</b>	<b>45.50</b>	<b>54.65</b>	<b>60.8</b>	<b>59.3</b>	<b>63.7</b>	<b>12.0</b>	<b>12.4</b>	<b>12.6</b>	<b>Yellow</b>



b). Second set of 34, third set of 53, 4<sup>th</sup> set of 81 and 5<sup>th</sup> set of 28 hybrid seedlings planted in the field for evaluation which are in the juvenile stage.

c). **Hybridization work:** Hybridization work was continued during flowering season 2016-17, for producing the 6<sup>th</sup> set of hybrid progeny. A total of 194 hybrid seed nuts of the following parental combinations were produced and the nuts were sown for raising seedlings.

	Parental combinations	Number of seeds obtained
1	KN-2/98 x Valpoi-2	38
2	Valpoi-2 x KN-2/98	17
3	Tis-3 x KN-2/98	29
4	39/A X Valpoi-7	21
5	51/A x Valpoi-2	24
6	T-11 x T-15	14
7	Valpoi-7 x Tis-3	45
8	Valpoi-7 x Valpoi-2	5
9	Valpoi-2 x T-11	1
	<b>Total</b>	<b>194</b>

## JHARGRAM

Nuts/m<sup>2</sup> was highest in case of H-5 (61.3/ m<sup>2</sup>) followed by H- 98 (49.5/ m<sup>2</sup>). Maximum number of nuts/panicle was observed in case of H - 5 (14.3 nuts/panicle), H - 98 (13.8 nuts/panicle) and H - 60 (9.8 nuts/panicle). H - 59, H – 156 and H – 35 produced bold nuts i.e. more than 7g weight. Highest shelling % was in H- 113 (39.7%) followed by H - 179 (37.1%). H- 174 had 6.5g nut weight and also had high shelling % (37.1%). Yield was highest in H- 60 (14.7 kg/tree) followed by H-39 (12.8 kg/tree), H- 98 (12.2 kg/tree) and H- 37 (11.8 kg/tree). Cumulative yield records depicted that H- 37 had maximum cumulative yield for 8 harvests (88.9 Kg/tree) followed by H-98 (75.2 Kg/tree) and H – 39 (70.3Kg/tree) (Table 1.76).





**Table 1.75 : Growth parameters of different cashew hybrids at Jhargram Centre**

Hybrid No.	Cross combination	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
					E-W	N-S	
H-3	JGM- 216 X BLA 39-4	2002	6.8	85.0	7.7	7.8	75.1
H-4	BLA 39-4 X WBDC- V	2002	6.5	67.0	6.7	6.6	63.6
H 5	JGM- 216 X Yellow Hazari	2002	6.0	85.0	5.4	6.3	53.2
H- 35	Local X 2/9 Dicherla	2002	6.1	54.0	5.3	5.4	40.4
H-37	Local X 2/9 Dicherla	2002	6.8	94.0	7.9	8.0	85.2
H-39	Local X 2/9 Dicherla	2002	6.8	95.0	7.6	10.0	92.0
H-49	WBDC- V X Jhargram -1	2002	7.3	79.0	6.9	7.1	68.9
H-51	JGM- 216 X Yellow Hazari	2002	8.9	109.0	8.3	9.2	121.2
H-59	JGM- 216 X Yellow Hazari	2002	6.3	74.0	6.6	5.4	47.1
H-60	BLA 39-4 x DC - 8	2002	5.8	62.0	9.3	6.8	69.5
H-65	WBDC- V X Red Hazari	2002	7.8	83.0	8.1	8.5	103.3
H-69	WBDC- V X Red Hazari	2002	7.7	112.0	8.1	8.7	99.3
H-70	Jhargram -1 X Red Hazari	2002	7.8	113.0	8.4	8.5	92.0
H-98	BPP - 8 X Vengurla - 4	2003	6.6	63.0	7.4	7.3	71.1
H-113	JGM- 216 X Yellow Hazari	2004	6.9	90.0	8.6	7.6	86.3
H-156	JGM- 216 X Yellow Hazari	2005	7.3	58.0	5.5	6.1	53.8
H-174	JGM- 216 X Yellow Hazari	2005	7.2	60.0	4.8	7.1	52.4

**Table 1.76 : Yield parameters of different cashew hybrids at at Jhargram Centre**

Hybrid No.	Cross combination	Flowering duration (days)		No. of flowerin g laterals / m <sup>2</sup>	Ratio of male : bisexual flowers	Nuts / m <sup>2</sup>	No. of nuts/panicle
		Range	Mean				
H-3	JGM- 216 X BLA 39-4		80	12.5	0.22	24.5	6.8
H-4	BLA 39-4 X WBDC- V		67	8.0	0.31	32.5	8.5
H 5	JGM- 216 X Yellow Hazari		70	17.8	0.43	61.3	14.3
H- 35	Local X 2/9 Dicherla		69	11.8	0.03	9.5	1.3
H-37	Local X 2/9 Dicherla		70	12.8	0.28	36.3	7.0
H-39	Local X 2/9 Dicherla		80	10.5	0.34	38.0	9.8
H-49	WBDC- V X Jhargram -1		90	8.5	0.33	37.8	8.3
H-51	JGM- 216 X Yellow Hazari		65	10.5	0.37	20.5	8.0
H-59	JGM- 216 X Yellow Hazari		76	15.0	0.39	24.5	8.8



H-60	BLA 39-4 x DC – 8	77	15.3	0.41	45.3	9.8
H-65	WBDC– V X Red Hazari	75	15.8	0.30	38.8	8.3
H-69	WBDC– V X Red Hazari	65	8.0	0.26	23.5	7.0
H-70	Jhargram -1 X Red Hazari	69	5.5	0.23	23.0	6.3
H-98	BPP - 8 X Vengurla - 4	70	8.8	0.41	49.5	13.8
H-113	JGM– 216 X Yellow Hazari	70	10.0	0.20	26.3	6.5
H-156	JGM– 216 X Yellow Hazari	77	10.3	0.07	25.0	4.0
H-174	JGM– 216 X Yellow Hazari	72	8.3	0.27	30.8	9.8

**Table 1.77 : Yield parameters of different cashew hybrids at at Jhargram Centre**

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 12 Harvests)
H-3	JGM– 216 X BLA 39-4	4.9	36.8	27.4	6.1	34.5
H-4	BLA 39-4 X WBDC– V	6.9	46.6	22.2	9.7	43.0
H 5	JGM– 216 X Yellow Hazari	4.8	50.0	30.8	10.5	47.1
H- 35	Local X 2/9 Dicherla	7.0	40.0	32.7	4.7	59.1
H-37	Local X 2/9 Dicherla	5.6	20.9	33.3	11.8	88.9
H-39	Local X 2/9 Dicherla	5.4	43.5	28.8	12.8	70.3
H-49	WBDC– V X Jhargram -1	3.9	32.2	35.0	6.9	46.4
H-51	JGM– 216 X Yellow Hazari	5.1	50.6	28.6	8.5	56.0
H-59	JGM– 216 X Yellow Hazari	7.2	30.6	27.6	5.6	27.3
H-60	BLA 39-4 x DC – 8	6.9	43.5	31.9	14.7	47.6
H-65	WBDC– V X Red Hazari	4.2	48.5	33.3	11.5	69.1
H-69	WBDC– V X Red Hazari	5.4	30.0	36.5	8.5	57.2
H-70	Jhargram -1 X Red Hazari	6.2	53.0	14.28	8.9	51.6
H-98	BPP - 8 X Vengurla - 4	5.1	46.0	32.5	12.2	75.2
H-113	JGM– 216 X Yellow Hazari	5.6	30.8	39.7	8.6	23.2
H-156	JGM– 216 X Yellow Hazari	7.1	54.5	21.5	6.5	29.5
H-174	JGM– 216 X Yellow Hazari	4.9	36.8	27.4	6.1	34.5



**PILICODE**

The dwarf type PLD-57 was used for hybridization with ANK-1 and MDK-1 with the objective of obtaining hybrid progenies having dwarf stature, higher percentage of bisexual flowers, nut setting and high nut yield.

The mean of the growth characteristics of the hybrids produced during 2001 and 2003 are furnished in the (Table 1.78).

**Table 1.78 : Growth parameters of different cashew hybrids at Pilicode Centre**

Hybrid No.	Cross combination	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
					E-W	N-S	
	PLD 57 graft	2003	1.88	0.28	2.95	3.15	5.35
	PLD 57 (OP)		2.50	0.55	3.75	5.00	9.84
	PLD 57 X ANK1		4.02	1.07	10.00	9.33	32.73
	ANK 1 X PLD 57		4.02	1.07	10.00	9.33	32.73
	MDK 1 X PLD 57		4.80	1.20	9.50	6.80	33.82
	MDK 1		5.50	0.92	7.75	8.50	39.89

**Table 1.79 : Yield parameters of different cashew hybrids at Pilicode Centre**

Cross combination	No. of flowering laterals / m <sup>2</sup>	Ratio of male : bisexual flowers	Nuts/ m <sup>2</sup>	Mean annual nut yield (kg/tree)
PLD 57 graft	<b>16.18</b>	0.13	3.50	0.60
PLD 57 (OP)	7.90	0.14	1.97	0.55
PLD 57 X ANK 1	4.48	0.22	2.25	2.00
ANK 1 X PLD 57	5.13	0.15	6.74	1.60
MDK 1 X PLD 57	3.41	0.17	4.03	6.35
MDK 1	3.33	0.14	2.96	2.90

**VENGURLE**

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, 18 F<sub>1</sub> hybrid seedlings during the year were screened initially as promising hybrids. It is seen from Table that among the promising hybrids, 2876 recorded maximum height (7.20 m). Maximum stem girth (99.00 cm) was recorded in hybrids, 2917. The maximum canopy area (42.29 m<sup>2</sup>) was recorded in H-2084 (Table 1.80 and 1.81).



**Table 1.80 : Growth parameters of different cashew hybrids at Vengurle centre**

Hybrid No.	Cross combination	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
					E-W	N-S	
2084	J-15 x Kankadi	2004	6.10	75.00	<b>7.30</b>	<b>7.40</b>	<b>42.29</b>
2872	J-15 x Kankadi	2004	5.70	72.00	5.60	5.80	25.50
2873	J-15 x Kankadi	2004	6.80	62.00	6.10	5.40	25.86
2874	J-15 x Kankadi	2004	6.60	88.00	7.10	5.90	33.17
2876	J-15 x Kankadi	2004	<b>7.20</b>	78.00	7.60	6.60	39.57
2886	Taliparamba x B.T22	2004	6.70	89.00	6.10	5.70	27.33
2917	Nanoda x <i>A. microcarpum</i>	2004	5.30	<b>99.00</b>	4.40	5.30	18.39
2926	Nanoda x Kankadi	2004	6.50	81.00	6.00	4.70	22.38
3090	H-320 x B.T.22	2004	4.30	52.00	4.90	5.20	19.14
3043	Jawahar-1 x Kolgaon	2004	7.00	71.00	6.00	5.20	24.62
3059	CYT176 x B.T. 65	2004	5.90	45.00	4.60	4.80	17.34
3084	H-320 x B.T.1	2004	6.70	66.00	5.80	6.70	30.57
3096	H-320 x B.T.65	2004	5.80	62.00	4.90	5.00	19.16
3103	M-26/2 x B.T.1	2004	4.70	73.00	5.60	6.00	26.41
3113	H-1598 x B.T.1	2004	4.60	48.00	4.30	4.20	14.11
3137	<i>A. microcarpum</i> x V-4	2004	4.90	60.00	6.00	5.30	24.97
3139	<i>A. microcarpum</i> x V-7	2004	5.10	63.00	4.40	5.10	17.64
3157	Hy-445 x B.T.10	2004	4.60	54.00	5.60	4.70	20.74

**Table 1.81 : Yield parameters of different cashew hybrids at Vengurle**

Hybrid No.	Cross combination	Flowering duration (days)	No. of flowering laterals/ m <sup>2</sup>	Ratio of male : bisexual flowers	Nuts/ m <sup>2</sup>	No. of nuts/ panicle
		Mean				
2084	J-15 x Kankadi	95	26	0.16	11	1.75
2872	J-15 x Kankadi	97	33	0.15	19	2.75
2873	J-15 x Kankadi	92	20	0.18	13	1.25
2874	J-15 x Kankadi	99	25	0.18	9	1.50
2876	J-15 x Kankadi	98	30	0.12	20	3.00
2886	Taliparamba x B.T22	95	27	0.14	29	5.25





2886	Taliparamba x B.T22	95	27	0.14	29	5.25
2917	Nanoda x <i>A. microcarpum</i>	95	34	0.15	20	2.25
2926	Nanoda x Kankadi	97	26	0.15	<b>39</b>	7.25
3090	H-320 x B.T.22	101	32	0.18	12	2.25
3043	Jawahar-1 x Kolgaon	99	28	0.14	13	2.00
3059	C.Y.T.176 x B.T. 65	<b>91</b>	25	0.16	38	<b>7.50</b>
3084	H-320 x B.T.1	99	26	<b>0.20</b>	33	4.50
3096	H-320 x B.T.65	96	<b>35</b>	0.14	28	3.50
3103	M-26/2 x B.T.1	94	18	0.18	15	2.25
3113	H-1598 x B.T.1	99	27	0.16	32	6.00
3137	Microcarpum x V-4	<b>91</b>	32	0.18	23	3.75
3139	<i>A. microcarpum</i> x V-7	97	25	0.16	23	3.00
3157	Hy-445 x B.T.10	98	24	0.12	18	2.00

With regards to yield attributes of promising hybrids (Table), H-3096 recorded maximum nut weight (16.10 g), while, the highest apple weight recorded by H-3084 (200 g), maximum shelling percentage (33.50%) was observed in H-2874. Maximum annual nut yield and cumulative yield for last 9 harvests was highest in H-2917 i.e. 6.350 kg/tree and 25.29 kg/tree, respectively (Table 1.82).

**Table 1.82 :Yield parameters of different cashew hybrids at Vengurle Centre**

Hybrid No.	Cross combination	Year of planting	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) 9 <sup>th</sup> harvests
2084	J-15 x Kankadi	2004	8.20	80	28.00	0.620	19.38
2872	J-15 x Kankadi	2004	10.7	80	33.00	1.970	16.81
2873	J-15 x Kankadi	2004	7.90	60	30.00	2.300	22.68
2874	J-15 x Kankadi	2004	9.90	60	<b>33.50</b>	3.560	18.47
2876	J-15 x Kankadi	2004	6.80	50	26.00	0.650	9.94
2886	Taliparamba x B.T22	2004	9.70	60	27.50	1.580	9.72
2917	Nanoda x <i>A. microcarpum</i>	2004	10.02	70	31.50	<b>6.350</b>	<b>25.29</b>
2926	Nanoda x Kankadi	2004	8.20	70	26.00	4.580	9.67
3090	H-320 x B.T.22	2004	11.40	70	28.00	2.630	12.30
3043	Jawahar-1 x Kolgaon	2004	13.50	100	26.50	3.840	23.23
3059	CYT176 x B.T. 65	2004	10.20	100	31.00	1.880	14.99



3084	H-320 x B.T.1	2004	14.20	<b>200</b>	25.50	4.880	14.61
3096	H-320 x B.T.65	2004	<b>16.10</b>	140	26.50	2.040	15.33
3103	M-26/2 x B.T.1	2004	8.80	60	33.00	1.840	11.13
3113	H-1598 x B.T.1	2004	10.20	100	28.00	2.140	10.98
3137	Microcarpum x V-4	2004	9.70	80	32.00	1.340	11.10
3139	<i>A. microcarpum</i> x V-7	2004	9.50	100	34.00	1.580	12.48
3157	Hy-445 x B.T.10	2004	11.90	80	80.00	0.340	9.38

Total 4058 number of F<sub>1</sub> cashew progenies planted at cashew farm, RFRS, Vengurle since 1999. The 2756 F<sub>1</sub> cashew progenies planted at 5m x 5m during 1999 to 2004 were evaluated. Out of these progenies, the best performing 58 hybrids were evaluated as promising hybrids as per the guidelines of DCR, Puttur. The grafts of these promising hybrids were prepared at Vengurle centre during 2015.

Out of these 58 F<sub>1</sub> hybrids replicated trial; the best performing 18 hybrids is being initiated at AICRP-Cashew Vengurle centre during July, 2016. The detail of the trial is as follows.

<b>Expt. Gen. 4</b>	:	Performance of new promising hybrids under Konkan conditions
<b>Objectives</b>	:	1) To evaluate the performance of new set of promising hybrids
<b>Location</b>	:	Seed Farm B & C, AICRP-Cashew, RFRS, Vengurle
<b>Spacing</b>	:	7m x 7m
<b>Design</b>	:	RBD
<b>Replication</b>	:	3
<b>Treatment</b>	:	18
<b>Treatment details</b>	:	1) H-735      7) H-969      13) H-1174 2) H-778      8) H-958      14) H-2005 3) H-801      9) H-992      15) H-1675 4) H-883      10) H-1016      16) H-1187 5) H-939      11) H-1039      17) H-1306 6) H-991      12) H-1156      18) V-9 (Local check)
<b>Year of planting</b>	:	July, 2016
<b>Plant unit/replication</b>	:	3
<b>Total No. of plants</b>	:	162



## VRIDHACHALAM

Crossing Programme was formulated to improve the existing released varieties of Tamil Nadu. The varieties VRI 2 and VRI 3 were used as female parents. Promising types from germplasm were selected for specific characteristics and used for crossing programme as male parents. L X T method of hybridization was carried out and the F<sub>1</sub> seeds were planted during 2005, 2006 and 2008. Evaluation of the seedlings was carried out based on the recommendations of the AICRP group meeting. The promising F<sub>1</sub> hybrids to suit the objectives only were selected and carried over for further evaluation.

The hybrids planted during 2005, 2006 and 2008 were evaluated for characteristics viz, high yield, cluster bearing, good fruit set, high % of bisexual flowers, bold nuts, dwarfness and easy peeling testa. Many promising hybrids were identified and data recorded. HC 1 resembled VRI 2 in terms of high yield but had an important advantageous character of easy peeling testa. HC 24 recorded good fruit set, high yield, bold nut (7.6 gms) along with easy peeling testa. HC 10, HC 25, HC 27 and HC 30 were cluster bearing with bold nuts. HC 10 was observed to have the typical characteristic of high yield even under water stress conditions. HC 23 and HC 25 had compact canopy, cluster bearing and bold nuts. HC 17 and HC 23 showed a different type of intensive branching pattern occupying less space of spread (Table 1.83).

**Table 1.83 :Growth parameters of different cashew hybrids at Vridhachalam centre**

Hybrid No.	Cross combination	Year of planting	Tree ht. (m)	Stem girth (cm)	Canopy spread (m)		Canopy area (m <sup>2</sup> )
					E-W	N-S	
HC1	VRI2 X VRI 3	2005	4.25	64.5	4.6	4.4	28.68
HC2	VRI 3 x VSK 2	2005	4.75	45.2	5.6	4.5	36.13
HC3	VRI 3 x TK 1	2005	4.45	64.2	6.8	4.5	45.22
HC 5	VRI 3 x VRI 2	2005	4.80	55.0	5.0	4.7	33.32
HC6	VRI 3 x KGN 1	2005	3.65	55.0	3.8	4.2	22.66
HC8	VRI 3 x PKP 1	2005	4.95	56.0	7.2	5.6	58.02
HC9	VRI 3 x PKP 2	2005	5.60	60.0	7.8	8.8	97.58
HC10	VRI 3 x KK 1	2006	4.65	50.5	5.2	4.6	34.01
HC 17	VRI 3 x AM 1	2006	3.85	45.2	3.8	3.4	18.36
HC 22	VRI 3 X TK 1	2008	4.46	38.2	4.8	5.0	34.01
HC 24	VRI3XM 33/3	2008	3.70	39.5	3.9	3.0	16.86
HC 25	VRI3XVSK 3	2008	3.60	40.1	2.9	5.0	22.10
HC 27	VRI 3 X SL 1	2008	4.25	42.5	5.2	4.6	34.01
HC 30	VRI 3 x PV 1	2008	4.25	48.2	6.2	5.0	44.42



**Table 1.84 : Yield parameters of different cashew hybrids at Vridhachalam Centre**

Hybrid No.	Cross combination	Flowering duration (days)		No. of flowering laterals / m <sup>2</sup>	Ratio of male : bisexual flowers	Nuts/ m <sup>2</sup>	No. of nuts/panicle
		Range	Mean				
HC1	VRI 2 X VRI 3	50-60	61	23	6.4	39.2	11
HC2	VRI 3 x VSK 2	50-62	60	17	13.0	18.6	5
HC3	VRI 3 x TK 1	48-58	59	18	9.0	17.4	4
HC 5	VRI 3 x VR 2	50-53	56	18	7.8	22.2	4
HC6	VRI 3 x KGN 1	58-68	64	17	8.8	16.8	5
HC8	VRI 3 x PKP 1	50-55	57	19	8.5	20.4	4
HC9	VRI 3 x PKP 2	52-55	61	17	6.4	30.4	9
HC10	VRI 3 x KK 1	58-65	54	18	15.8	36.0	15
HC 17	VRI 3 x AM 1	50-52	54	16	8.8	25.0	8
HC 22	VRI 3 X TK 1	50-55	52	17	11.6	20.0	6
HC 24	VRI 3XM 33/3	65-70	72	14	5.8	32.4	7
HC 25	VRI 3XVSK 3	55-60	64	16	15.0	35.4	14
HC 27	VRI 3 X SL 1	65-75	74	18	4.2	30.8	7
HC 30	VRI 3 x PV 1	55-60	58	16	9.0	24.8	10

**Table 1.85 : Yield parameters of different cashew hybrids at Vridhachalam Centre**

Hybrid No.	Cross combination	Nut wt (g)	Apple wt. (g)	Shelling %	Annual nut yield* (kg/tree)	Cum. Yield (kg/tree) (for 5/6/7 Harvests)	Total Number of Harvests
HC1	VRI2 X VRI 3	5.90	25.0	27.5	4.8	33.05	8
HC2	VRI 3 x VSK 2	6.25	31.0	26.5	3.2	25.30	8
HC3	VRI 3 x TK 1	6.50	35.5	24.5	3.0	17.65	8
HC 5	VRI 3 x VRI 2	7.00	40.5	27.5	6.1	30.35	8
HC6	VRI 3 x KGN 1	5.90	51.5	26.0	5.5	21.10	8
HC8	VRI 3 x PKP 1	6.20	48.2	26.0	5.2	21.3	8
HC9	VRI 3 x PKP 2	6.10	30.5	26.4	7.5	22.50	8
HC10	VRI 3 x KK 1	7.40	31.2	28.5	10.5	40.10	7
HC 17	VRI 3 x AM 1	6.00	35.0	27.0	5.0	27.00	7
HC 22	VRI 3 X TK 1	7.20	50.5	28.5	4.8	22.55	6
HC 23	VRI 3 x AM 1	7.20	32.0	27.6	3.0	16.85	6
HC 24	VRI3XM 33/3	7.00	30.8	26.0	6.0	24.40	6
HC 25	VRI3XM 33/3	7.30	52.5	30.0	8.2	30.85	6
HC 27	VRI 3 X SL 1	7.80	50.5	31.5	5.8	28.85	6
HC 30	VRI 3 x PV 1	8.00	52.5	26.8	7.9	32.55	6

\*Drought year, hence low yield recorded



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

**Centres:** **East Coast** : Bapatla, Jhargram and Vridhachalam  
**West Coast** : Goa and Pilicode  
**Plains / others** : Jagdalpur

The objective of the experiment is to identify germplasm having preferred apple characters suitable for value addition.

### BAPATLA

Among the 13 genotypes evaluated during the year 2015-16, the maximum mean annual nut yield per tree recorded in BPP-8 (6.36 kg/tree) followed by BLA 39/4 (6.30 kg/tree). The maximum apple weight was recorded in Priyanka (95.6.0 g) followed by BPP-8 (59.6g). The maximum nut weight was recorded in Priyanka (9.28 g) followed by BPP-8 (7.28 g). The apple nut ratio was highest in T.No.2/14 (12.52) followed by T.No. 8/7 (11.99).The juice recovery percentage was found maximum in BLA-39/4 (71.6%) followed by T.No.228 (70.0%) (Table 1.86).

Table 1.86 : Physical parameters of cashew germplasm for cashew apple at Bapatla

Sl. No.	Germplasm	Nut wt. (g)	Apple wt. (g)	Yield /tree (kg)	Apple nut ratio	Juice recovery (%)	Colour of the apple
1.	Priyanka	<b>9.28</b>	<b>95.6</b>	5.40	10.3	64.9	Red Yellow
2.	T.No: 2/14	4.34	54.37	3.96	<b>12.52</b>	65.6	Yellow
3.	T.No.17/5	4.1	35.0	4.59	8.53	60.2	Yellow
4.	T.No. 5/1	4.86	37.5	3.70	7.71	60.1	Yellow
5.	BLA. 139/1	4.90	35.0	4.30	7.14	56.2	Yellow
6.	BLA. 39/4	3.90	36.25	<b>6.30</b>	9.29	<b>71.6</b>	Yellow
7.	T.No. 3/4	4.30	41.90	3.34	9.74	63.4	Yellow
8.	T.No. 8/7	3.71	44.5	3.60	<b>11.99</b>	54.2	Yellow
9.	T.No. 18/3	4.30	44.5	2.50	10.34	56.0	Yellow
10.	Hy 95-T4	5.0	35.0	5.10	7.00	67.0	Yellow
11.	T.No. 12/1	4.12	42.5	3.40	10.31	60.0	Yellow
12.	T.No. 228	4.33	40.0	4.84	5.47	<b>70.0</b>	Red Yellow
13	BPP-8	<b>7.25</b>	<b>59.6</b>	<b>6.36</b>	8.10	68.0	Yellow
	SEM±	0.37	1.86	0.59	0.93	2.85	
	CD at (5%)	1.10	5.47	0.20	2.72	8.36	

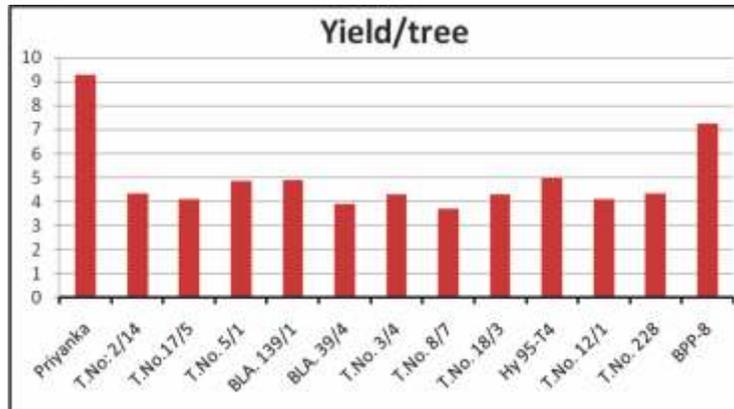
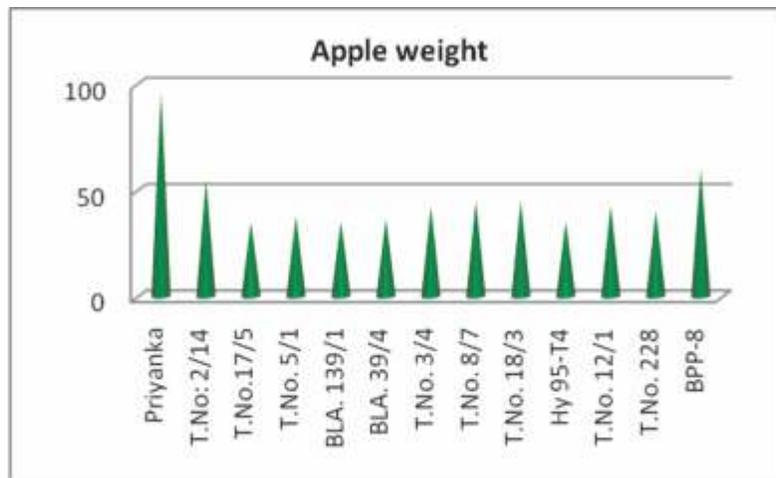
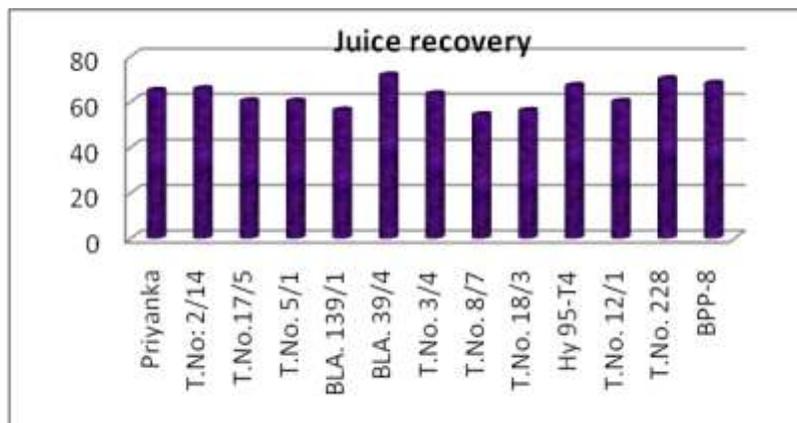


Fig. Yield of cashew germplasm for cashew apple.

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



1: Apple weight of cashew germplasm for cashew apple



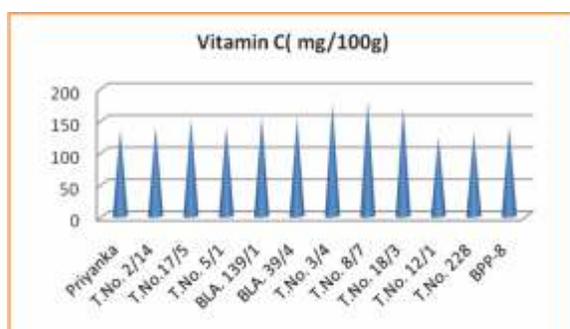


Among the 13 genotypes the Total Soluble Solids was ranged from 9.4<sup>o</sup> Brix to 12.9<sup>o</sup> Brix. However, the highest TSS was recorded in Priyanka (12.9). The lowest vitamin c content was recorded in T.No. 8/7 (180.2mg/100gm) followed by T. No. 3/4 (176.4mg/100gm). With regard to the tannin content the lowest was recorded in T.No. 8/7 (3.12mg/100g) followed by T.No.2/14 (3.20mg/100gm). The acidity content was lowest in T.No.18/3 (0.43%) followed by T.No.8/7 (0.45%) and Priyanka (0.47%) (Table 1.87).

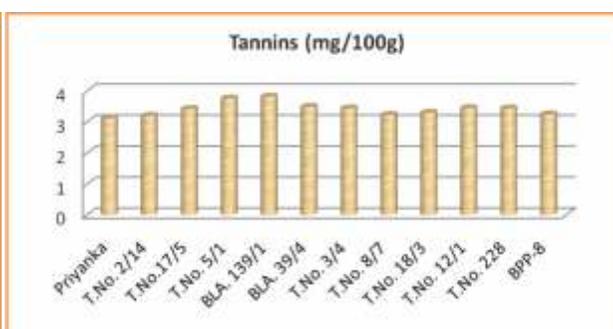
**Table 1.87 : Chemical parameters of cashew germplasm for cashew apple at Bapatla**

S.No.	Germplasm	TSS ( <sup>o</sup> Brix)	Vitamin-C (mg/100 g)	Tannins (mg/100 g)	Acidity (%)
1.	<b>Priyanka</b>	<b>12.9</b>	135.6	<b>3.12</b>	<b>0.47</b>
2.	<b>T.No. 2/14</b>	10.8	140.2	<b>3.20</b>	0.59
3.	T.No.17/5	11.1	151.4	3.42	0.58
4.	T.No. 5/1	9.6	140.1	3.76	1.08
5.	BLA. 139/1	9.4	155.6	3.82	1.20
6.	BLA. 39/4	10.4	153.6	3.49	0.75
7.	<b>T.No. 3/4</b>	10.3	<b>176.4</b>	3.44	0.88
8.	<b>T.No. 8/7</b>	12.1	<b>180.2</b>	3.23	<b>0.45</b>
9.	<b>T.No. 18/3</b>	11.3	170.4	3.30	<b>0.43</b>
10.	Hy 95-T4	11.8	163.0	3.42	0.56
11.	T.No. 12/1	10.9	124.2	3.45	0.68
12.	T.No. 228	10.6	130.4	3.44	0.82
13.	BPP-8	10.9	140.4	3.25	0.48
	<b>SEm±</b>	<b>0.228</b>	<b>3.33</b>	<b>0.063</b>	<b>0.027</b>
	<b>CD at (5%)</b>	<b>0.665</b>	<b>9.73</b>	<b>0.184</b>	<b>0.079</b>

**Fig. Chemical parameters of cashew germplasm for cashew apple**



**Fig 1. Vitamin C of cashew germplasm for cashew apple**



**Fig 2. Tannins of cashew germplasm for cashew apple**

**JAGDALPUR**

Locally collected 10 genotypes were characterized for cashew apple. Apple weight ranged between 45.30g to 105.30g in CARS-4 and CARS-8 respectively. The maximum juice recovery was recorded in CARS-8 (75.20%). The vit C content varied between 210.2 to 263.5 mg/100 ml juice. TSS (<sup>o</sup>Brix) ranged from 10.40 to 16.20 (Table 1.88(a) and 1.88(b)).



**Table 1.88 : (A) Physical observation**

Germplasm	Age of tree (Year)	Yield/ tree (kg) (2015-16)	Apple wt. (g)	Nut wt. (g)	Apple nut ratio	Juice recovery (%)	Colour of apple
CARS-1	32	12.40	58.60	6.40	9.15	58.20	Red
CARS-2	32	10.60	64.40	7.20	8.94	64.50	Yellow
CARS-3	19	7.80	65.80	7.50	8.77	69.20	Red
CARS-4	19	6.70	45.30	6.70	6.76	60.40	Yellow
CARS-5	19	7.80	76.20	7.60	10.02	64.50	Yellow
CARS-6	19	7.30	69.50	7.10	9.78	67.50	Red
CARS-8	19	8.70	105.30	12.80	8.22	75.20	Yellow
CARS-9	19	7.40	74.50	9.40	7.92	68.20	Red
CARS-10	19	10.20	80.20	10.50	7.63	71.40	Yellow
CARS-11	19	8.50	85.60	8.60	9.95	69.5	Red

**Table: (B) Chemical observation**

Germplasm	TSS (0 <sub>Brix</sub> )	Acidity	Vitamin C (mg/100ml)	Total sugar (mg/ml)
CARS-1	12.40	0.36	225.5	12.40
CARS-2	13.80	0.27	251.6	11.50
CARS-3	16.20	0.32	263.5	16.20
CARS-4	14.20	0.45	220.5	9.40
CARS-5	11.80	0.43	226.6	13.30
CARS-6	11.20	0.54	240.5	10.20
CARS-8	12.80	0.40	235.8	13.40
CARS-9	10.40	0.62	210.2	8.70
CARS-10	11.40	0.30	243.4	13.50
CARS-11	13.80	0.43	221.6	10.30

### JHARGRAM

Maximum apple yield was recorded in Adhoor – 26/2 followed by Ullal - 1 and WBDC- V. Juice recovery percentage depicts that it was maximum in Adhoor – 26/2 followed by Ullal- 2 and M- 33/3. Total Sugar percentage was more than 8 in the varieties TN- 5, H- 4-7, WBDC- V, TN- 274 and Ullal- 2. Minimum acidity was noticed in M- 76/1, Ullal- 1, TN – 56. M- 33/3 and Adhoor – 26/2 had also very less acidity (Table 1.89 and 1.90).





**Table 1.89 : Physical parameters of cashew germplasm for cashew apple at Jhargram**

S. No.	Germplasm	Nut Yield /tree (kg)	Apple yield (kg/tree)	Apple wt. (gm)	Nut wt. (gm)	Apple nut ratio	Juice recovery (%)	Colour of the apple
1.	M – 33/3	6.8	68.8	57.7	5.7	10.1	72.3	Pink
2.	Adhoor –26/2	13.4	162.5	58.2	4.8	12.1	83.2	Red
3.	Ullal – 2	6.3	67.0	57.4	5.4	10.6	74.9	Red
4.	T.No. 1/40	2.0	16.8	40.2	4.8	8.4	58.5	Pink
5.	Ullal – 1	13.1	105.3	44.2	5.5	8.0	69.2	Pink
6.	H – 1608	12.2	65.1	36.8	6.9	5.3	69.6	Red
7.	H- 4-7	1.0	6.6	33.1	5.0	6.6	69.5	Red
8.	WBDC– V	8.8	102.0	48.7	4.2	11.6	71.7	Yellow
9.	TN – 56	6.8	75.3	49.8	4.5	11.1	66.7	Yellow
10.	TN – 121	2.0	11.6	27.3	4.7	5.8	61.2	Yellow
11.	TN – 119	6.8	62.5	34.9	3.8	9.2	57.3	Yellow
12.	TN – 274	2.7	28.1	41.6	4.0	10.4	70.0	Red
13	TN – 100	13.3	70.8	39.9	7.5	5.3	68.4	Red
14	Ansoor No. 1	2.0	23.1	46.1	4.0	11.5	67.5	Yellow

**Table 1.90 : Chemical parameters of cashew germplasm for cashew apple at Jhargram**

S.No.	Germplasm	TSS (%)	Total Sugar %	Acidity (%)
1	M – 33/3 (2)	13.2	4.9	0.17
2	Adhoor – 26/2	8.2	5.7	0.19
3	Ullal – 2	16.2	8.0	0.22
4	T.No. 1/40	12.0	7.4	0.61
5	Ullal – 1	18.0	6.9	0.16
6	H – 1608	11.2	5.6	0.48
7	H- 4-7	16.0	8.3	0.22
8	WBDC– V	16.2	8.0	0.21
9	TN – 56	14.2	6.3	0.16
10	TN – 121	14.4	7.1	0.26
11	TN – 119	9.9	5.4	0.30
12	TN – 274	17.2	8.0	0.25
13	TN – 100	11.0	5.6	0.38
14	Ansoor No. 1	11.2	6.9	0.24
15	TN – 5	18.0	8.7	0.22
16	M – 76/1	16.2	7.7	0.11
17	Vetore – 56	12.0	6.3	0.35



### PILICODE

Highest apple weight was recorded in variety BPP8. Apple to nut ratio was highest in the variety BPP8. Highest juice recovery in volume was obtained from BPP 8. Acidity was highest in Priyanka. Tannin Content was lowest in Madakkathara-1. Tannin content was found to be very high in K-22-1 (Table 1.91).

**Table 1.91 : Physical & Chemical parameters of cashew germplasm for cashew apple at Pilicode**

Sl. No.	Germplasm	Apple wt. (gm)	Nut wt. (gm)	Apple nut ratio	Juice recovery (%)	Colour of the apple	Tannins (mg/100 g)	Acidity (%) Citric Acid) g/100ml
1.	NRCC 2	57.84	11.00	5.39	79.54	Reddish yellow	5.3	0.46
2.	Madakkathara1	47.60	7.32	7.10	60.92	Yellow	3.1	0.23
3.	V4	57.61	7.43	7.73	72.91	Red	5.3	0.32
4.	VRI3	27.65	6.13	3.04	68.73	Red	4.4	0.36
5.	Goa-1	43.20	6.75	7.11	71.76	Yellow	5.7	0.48
6.	Dhana	34.32	8.00	3.33	75.75	Yellow	5.2	0.53
7.	Priyanka	76.23	11.20	6.47	74.77	Yellow	7.1	0.70
8.	Kanaka	62.37	9.90	6.76	76.96	Yellow	6.8	0.57
9.	Amritha	55.90	11.35	5.30	80.51	Yellow	5.1	0.53
10.	K-22-1	45.10	7.80	6.44	79.82	Yellow	<b>10.5</b>	0.39
11.	Bhuvaneshwar 1	75.03	5.25	8.07	79.97	Yellow	7.0	0.55
12.	BPP 8	96.75	10.35	8.50	80.62	Yellow	6.8	0.56
13.	PLD-57	35.76	6.45	5.54	117.46	Pinkish Yellow	8.5	0.54
	<b>Mean</b>	<b>55.03</b>	<b>8.38</b>	<b>6.21</b>	<b>78.44</b>	-	-	-

### VRIDHACHALAM

The characterization of germplasm for cashew apple was done in 20 germplasm types along with the three released varieties at Vridhachalam. The juice recovery of the accessions evaluated ranged from 49 % to 80 %. VRI 2 recorded the highest juice recovery of 80%. Vitamin C content was more in VRI 3 and M103/7. The germplasm accessions NF 69, VRI2, VRI3, VRI (Cw) H1 recorded highest total sugars. TSS was highest in K 10/1, M 30/1 and A 5/3. Tannin content ranged between 0.05 – 0.1 g/ 100g (Table 1.92 and 1.93).





Table 1.92 : Physical characters of apple in different germplasm at Vridhachalam

Germplasm details	Mean nut weight	Apple Wt.	Apple nut ratio	Colour of apple	Juice recovery (%)
K 10/1	4.2	30.4	7.7	Yellow orange	60
M 30/1	5.4	35.2	7.0	Yellow orange	55
M 76/2	6.2	55.2	8.6	Yellow	65
TAF 11	6.2	43.2	6.6	Orange	63
105/4	6.4	55.2	8.4	Yellow	49
ME 3/2	6.2	58.4	9.8	Yellow orange	54
S10	6.0	37.0	6.0	Orange	65
M45/7	6.8	52.4	7.6	Yellow	67
NF 57	5.0	30.4	6.0	Yellow	64
M103/7	4.6	12.4	9.5	Yellow	51
NF 40	5.0	10.5	7.6	Yellow orange	59
M31/1	4.6	10.4	9.0	Red	65
NF 63	5.0	40.6	7.8	Yellow	57
M33/2	6.8	55.2	8.2	Orange	61
A 5/3	6.0	58.4	10.1	Yellow	56
M10/4	5.5	58.0	10.5	Yellow	60
NF 60	4.8	30.2	6.8	Yellow orange	60
M8/1	5.0	50.4	10.2	Orange yellow	62
NF 69	7.0	55.2	7.8	Orange	55
88/4	4.8	54.0	11.2	Orange	60
VRI 2	5.2	50.2	9.1	Yellow	<b>80</b>
VRI3	7.0	55.0	7.9	Orange	75
VRI (Cw)H1	7.1	51.2	7.5	Pink with yellow tinge	77

Table 1.93 : Bio-chemical characters of Cashew apple in different germplasm at Vridhachalam

Germplasm details	Total Sugars (%)	TSS ( <sup>o</sup> brix)	Acidity	Tannin Content (g/100g)	Vitamin C (mg/100g)
K 10/1	3.52	<b>13.80</b>	0.33	0.10	292.15
M 30/1	3.10	<b>13.20</b>	0.13	0.08	290.20
M 76/2	3.33	12.25	<b>0.08</b>	0.08	237.25
TAF 11	3.82	11.40	0.10	0.06	154.90



105/4	4.98	11.00	0.15	0.08	288.23
ME 3/2	3.84	12.10	0.20	0.08	290.20
S10	4.01	11.90	0.18	0.06	282.35
M45/7	3.82	11.30	0.23	0.06	213.72
NF 57	3.51	12.70	0.15	0.06	243.14
M103/7	3.50	11.80	<b>0.38</b>	0.06	<b>303.92</b>
NF 40	3.61	11.20	0.15	0.07	268.63
M31/1	3.69	11.30	0.18	0.07	211.76
NF 63	3.87	12.40	0.23	0.09	252.94
M33/2	3.82	11.80	0.18	0.07	152.94
A 5/3	4.10	<b>12.90</b>	0.23	0.05	245.09
M10/4	3.39	10.60	0.23	0.08	211.76
NF 60	3.81	10.20	0.15	0.07	241.17
M8/1	3.82	11.80	0.15	0.08	176.47
NF 69	<b>8.01</b>	9.00	0.28	0.08	274.51
88/4	3.42	11.20	0.26	0.08	235.29
VRI 2	<b>10.02</b>	11.90	0.23	0.07	245.20
VRI3	<b>11.80</b>	11.40	0.21	0.08	<b>312.00</b>
VRI (Cw)H1	<b>9.02</b>	10.40	0.20	0.08	274.00





## Gen.6: Varietal Screening of Cashew Apple for preparation of RTS and Jam

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

The objective of this trial is to find out a suitable variety of cashew apple for preparation of RTS and Jam

### BAPATLA

During the year, the organoleptic evaluation of RTS for different varieties of cashew apple showed higher scores were recorded in cashew variety BPP-8 with respect to colour, flavour, appearance, sweetness and overall acceptability. Regarding shelf life, all the varieties are shown good condition at room temperature (Table 1.94 and 1.95).

**Table 1.94 : Evaluation of organoleptic score of RTS for cashew apple at Bapatla Centre**

S.No.	Variety	Taste	Colour	Flavour	Overall acceptability	Shelf life Days
1.	BPP-1	3.00	3.00	3.00	3.00	Good condition
2.	BPP-2	3.10	3.30	2.75	2.75	"
3.	BPP-3	3.00	2.85	2.50	2.75	"
4.	BPP-4	2.75	2.70	2.50	3.25	"
5.	BPP-5	3.30	3.10	3.00	2.75	"
6.	BPP-6	2.75	2.75	3.25	3.25	"
7.	<b>BPP-8</b>	<b>3.40</b>	<b>3.45</b>	<b>3.50</b>	<b>3.75</b>	"
8.	BPP-9	3.30	3.30	3.30	3.25	"
9.	BPP-10	3.00	3.15	2.75	2.50	"
10.	BPP-11	3.10	3.25	2.50	2.75	"
	SEm+	0.141	0.1	0.142	0.125	
	CD (5%)	0.419	0.298	0.423	0.371	

(1=Poor, 2= Fair, 3=Good, 4= very good 5= Excellent)





**Table 1.95 : Evaluation of organoleptic score of jam for cashew apple at Bapatla Centre**

S.No.	Variety	Taste	Colour	Flavour	Overall Acceptability	Shelf Life Days
1.	BPP-1	3.35	2.75	3.25	2.75	Good condition
2.	BPP-2	3.00	2.75	3.00	2.75	"
3.	BPP-3	2.75	3.00	2.75	3.00	"
4.	BPP-4	2.50	2.50	3.00	3.10	"
5.	BPP-5	2.50	3.00	3.20	2.75	"
6.	BPP-6	3.00	3.30	3.10	3.20	"
7.	BPP-8	<b>3.40</b>	<b>3.40</b>	<b>3.35</b>	<b>3.15</b>	"
8.	BPP-9	2.75	2.50	2.80	3.00	"
9.	BPP-10	3.00	2.75	2.90	2.85	"
10.	BPP-11	2.50	3.00	3.00	2.50	"
	<b>SEM<sub>±</sub></b>	<b>0.151</b>	<b>0.160</b>	<b>0.144</b>	<b>0.115</b>	
	<b>CD (5%)</b>	<b>0.45</b>	<b>0.476</b>	<b>NS</b>	<b>0.342</b>	

(1=Poor, 2= Fair, 3=Good, 4= very good 5= Excellent)

During the year, the organoleptic evaluation of Jam for different varieties of cashew apple showed higher scores were recorded in cashew variety BPP-8 with respect to colour, Flavour, appearance, sweetness and overall acceptability. Regarding shelf life, all the varieties are shown good condition at room temperature.

#### Compilation of four years data

Ten varieties screened for cashew apple for preparation of RTS and jam. Among the 10 varieties for organoleptic evaluation of RTS and jam, BPP-8 variety showed highest scores with respect to colour, Flavour, appearance and overall acceptability in all the three consecutive years 2012-13, 2013-14, 2014-15 & 2015-16 respectively.

#### HOGALAGERE

Five varieties of cashew apples were collected and RTS was prepared. They were evaluated for their organoleptic properties. Scientists and students of College of Horticulture, Kolar were involved in preparation and evaluation of the products. Among the varieties, C-1 (Chintamani-1) recorded highest flavor (4.40), Taste (4.00) and overall acceptability (4.80) which was followed by V-4 & V-3. Least score was obtained in V-7 & UN-50 (Table 1.96).





Five different cashew varieties apples were used to prepare Jam. Their evaluation revealed that Jam prepared from Chintamani-1 (C-1) apples scored highest with respect to colour, flavor, taste and texture. The overall acceptability was also found to best for C-1 (4.40). This variety was followed by Vengurla-4 (4.20), Vengurla-7 (3.40) and least score was obtained for Vengurla-3 (3.00) (Table 1.97).

**Table 1.96 : Sensory evaluation score of cashew apple RTS stored under ambient condition for six months at Hogalagere Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Overall Acceptability	Shelf Life (Months)
1.	<b>C-1</b>	3.80	4.00	4.00	4.40	4.80	6
2.	<b>V-3</b>	3.40	3.20	3.00	3.40	3.20	6
3.	<b>V-4</b>	3.60	3.80	4.80	3.60	4.20	6
4.	<b>V-7</b>	2.80	2.60	3.60	3.60	3.00	6
5.	<b>UN-50</b>	2.60	2.60	3.60	3.00	3.00	6

**Table 1.97 : Evaluation of organoleptic score of jam for cashew apple at Hogalagere Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability	Shelf Life (Months)
1.	<b>C-1</b>	3.60	3.80	4.20	4.20	4.60	4.40	6
2.	<b>V-3</b>	3.40	3.20	3.30	3.60	3.40	3.00	6
3.	<b>V-4</b>	3.60	3.60	4.00	4.00	4.20	4.20	6
4.	<b>V-7</b>	3.20	2.80	3.40	3.40	3.00	3.40	6
5.	<b>UN-50</b>	2.80	2.40	3.20	3.20	3.20	3.20	6

### JAGDALPUR

Among the 10 cashew genotypes tested for preparation of jam, CARS-6 had the maximum score with respect to colour, flavor and total acceptability. However the maximum score for taste was 4.0 in CARS-8 (Table 1.98).

**Table 1.98 : Organoleptic evaluation of jam prepared from different genotypes of cashew at Jagdalpur**

Genotypes	Taste	Colour	Flavour	Total acceptability
CARS-1	3.6	3.0	3.2	3.2
CARS-2	3.0	3.4	2.8	3.4
CARS-3	3.8	3.4	3.4	3.0
CARS-4	3.2	3.6	2.8	3.3
CARS-5	3.4	3.2	3.4	2.8
CARS-6	3.7	<b>4.2</b>	<b>3.9</b>	<b>3.6</b>
CARS-8	<b>4.0</b>	3.6	3.2	3.4



CARS-9	3.0	3.2	3.4	2.7
CARS-10	3.5	3.8	3.5	3.2
CARS-11	2.9	3.6	3.1	3.1

## JHARGRAM

Table 1.99 : Evaluation of organoleptic score of RTS for cashew apple at Jhargram Centre

Sl. No.	Variety	Taste	Colour	Flavour	Overall Acceptability	Shelf Life (Months)	Mean Score	Overall acceptability
1.	K-22-1	4	Yellow	5	4	2	4.33	4
2.	BPP- 8	6	Yellow	5	6	2	5.66	6
3.	Bhaskara	5	Yellow	5	5	2	5.00	5
4.	Madakkathara - I	5	Yellow	5	4	2	3.66	4
5.	Madakkathara – II	5	Yellow	5	4	2	3.66	4
6.	Ullal- 4	8	Yellow	5	7	2	6.66	7
7.	Vengurla- 4	4	Yellow	5	4	2	4.33	4
8.	NRCC- 2	5	Yellow	5	5	2	5.00	5
9.	Bhubaneswar- I	3	Yellow	5	4	2	4.00	4
10.	Vengurla- 6	6	Yellow	5	5	2	5.33	5

Table 1.100 : Evaluation of organoleptic score of jam for cashew apple at Jhargram Centre

S.No.	Variety	Taste	Colour	Flavour	Overall Acceptability	Shelf Life (Months)	Mean Score	Overall acceptability
1.	K-22-1	6	Brown	5	6	3	5.66	3
2.	BPP- 8	6	Brown	5	6	3	5.66	3
3.	Bhaskara	6	Brown	5	6	3	5.66	3
4.	Madakkathara - I	6	Brown	5	6	3	5.66	3
5.	Madakkathara – II	6	Brown	5	6	3	5.66	3
6.	Ullal- 4	6	Brown	5	6	3	5.66	3
7.	Vengurla- 4	6	Brown	5	6	3	5.66	3
8.	NRCC- 2	6	Brown	5	6	3	5.66	3
9.	Bhubaneswar- I	6	Brown	5	6	3	5.66	3
10.	Vengurla- 6	6	Brown	5	6	3	5.66	3





**KANABARGI**

**Table 1.101 : Evaluation of organoleptic score of RTS for cashew apple at Kanabargi Centre**

Sl. No.	Variety	Appearance	Taste	Colour	Flavour	Juice recovery for RTS (%)	Overall Acceptability	TSS (° Brix)
1.	Vengurla-1	3.50	3.43	3.50	3.40	49.3	3.40	12.2
2.	Vengurla-2	3.80	3.80	3.80	4.10	45.8	3.80	14.4
3.	Vengurla-3	4.24	4.03	4.24	3.90	51.5	3.80	12.6
4.	Vengurla-4	4.50	4.20	4.50	4.33	40.1	4.20	12.1
5.	Vengurla -5	3.70	3.53	3.70	3.83	55.6	3.63	14.3
6.	Vengurla -6	3.90	3.17	3.90	3.37	55.8	3.37	13.5
7.	Vengurla -7	3.88	3.57	3.88	3.67	43.9	3.50	14.4
8.	Ullal-1	3.03	3.40	3.03	3.20	44.1	3.40	11.1
9.	Ullal-2	3.03	3.00	3.03	3.03	54.0	2.80	14.2
10.	Ullal-4	3.23	3.90	3.23	3.37	50.9	3.50	15.7
	<b>Mean</b>	<b>0.151</b>	<b>0.085</b>	<b>0.151</b>	<b>0.094</b>		<b>0.077</b>	
	<b>SEM±</b>	<b>0.700</b>	<b>0.340</b>	<b>0.700</b>	<b>0.380</b>		<b>0.310</b>	

Among all varieties studied for preparation of RTS, Vengurla-2, 3, 4 and 7 varieties recorded higher scores for colour and appearance, flavor, taste and overall acceptability. Over storage period, reduction in scores of all sensory parameters for all varieties was noticed. Among the varieties studied for preparation of RTS Ullal-2 recorded lowest scores for all sensory parameters (Table 1.101).

**Table 1.102 : Evaluation of organoleptic score of jam for cashew apple at Kanabargi Centre**

Sl. No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability	TSS (° Brix)	Pulp recovery for Jam (%)
1.	Vengurla-1	4.17	4.13	4.17	4.12	4.07	2.96	12.2	64.5
2.	Vengurla-2	4.56	4.30	4.56	3.85	4.28	4.40	14.4	63.2
3.	Vengurla-3	3.96	3.39	3.96	3.44	3.15	3.56	12.6	59.7
4.	Vengurla-4	4.15	3.39	4.15	3.41	3.19	3.40	12.1	61.1
5.	Vengurla -5	4.31	3.38	4.31	3.59	4.02	3.77	14.3	57.9
6.	Vengurla -6	3.73	3.52	3.73	3.59	3.67	3.78	13.5	56.5
7.	Vengurla -7	4.27	3.82	4.27	3.71	4.06	4.20	14.4	61.6
8.	Ullal-1	4.37	3.70	4.37	3.57	4.00	4.30	11.1	68.8
9.	Ullal-2	4.20	3.90	4.20	3.92	3.95	3.98	14.2	67.6
10.	Ullal-4	4.35	3.84	4.35	3.66	4.17	4.10	15.7	64.7
	<b>Mean</b>	<b>0.071</b>	<b>0.144</b>	<b>0.071</b>	<b>NS</b>	<b>0.087</b>	<b>0.068</b>		
	<b>SEM±</b>	<b>0.257</b>	<b>0.500</b>	<b>0.257</b>	<b>NS</b>	<b>0.355</b>	<b>0.270</b>		



Among all varieties studied for preparation of Jam, variety Vengurla-7 and Ullal-4 recorded higher scores for colour and appearance, flavor, taste, texture and overall acceptability. Over storage period, reduction in scores of all sensory parameters for all varieties was noticed. Jam prepared from Vengurla-6 variety was having lowest scores for all quality parameters (Table 1.102).



### MADAKKATHARA

The length and weight of cashew apple was observed to be maximum in the variety Panama (10.00cm & 195.06g, respectively). Highest TSS (14.5%) was observed in Madakkathara-1 and the lowest in Kanaka (10.01%). Kanaka had the maximum tannin content (0.56%) and Amrutha, the minimum (0.23%). Acidity was minimum in the variety Panama (0.25%) while it was maximum in Madakkathara-1, Dhana and Raghav (0.44%). K-22-1 gave maximum juice yield (95.75%) followed by Kanaka (83.78%), and Madakkathara-2 had the least juice recovery (49.01%).

The results of the organoleptic evaluation of RTS drink indicated that Dhana recorded high score with respect to to colour and appearance. The variety Priyanka had the highest score for taste, flavour and overall acceptability. Sulabha had the highest score for sweetness (Table 1.103 and 1.104).



**Table 1.103 : Evaluation of organoleptic score of RTS for cashew apple at Madakkathara Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability
1.	Poornima	8.82	8.77	7.02	8.95	8.77	8.14
2.	Dhana	9.09	8.00	9.95	8.32	8.00	7.70
3.	Sulabha	8.07	7.45	8.70	6.59	7.45	8.77
4.	Kanaka	6.18	6.34	6.66	5.50	6.34	6.70
5.	Panama	8.02	8.30	7.86	7.84	8.30	8.39
6.	K-22-1	8.48	9.27	8.34	9.16	9.27	8.68
7.	Vridhachalam -3	4.59	4.09	4.86	5.09	4.09	4.52
8.	Amrutha	7.77	7.68	7.52	8.55	7.68	7.45
9.	Madk II	7.82	7.77	7.98	7.57	7.77	8.50
10.	Dhamodar	3.36	4.32	3.70	4.30	4.32	4.05
11.	Priyanka	8.70	10.23	8.68	9.66	10.23	9.20
12.	Raghav	6.16	5.55	5.41	6.20	5.55	5.55
13.	Madakkathara I	3.93	3.23	4.30	3.27	3.23	3.34
	Kendalls W(a)*	0.327	0.349	0.298	0.314	0.299	0.308

**Table 1.104 : Evaluation of organoleptic score of jam for cashew apple at Madakkathara Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability
1.	Poornima	5.89	6.97	5.14	5.36	6.97	6.94
2.	Dhana	7.19	6.08	7.11	5.81	6.08	6.86
3.	Sulabha	8.19	10.58	7.42	10.08	10.58	9.50
4.	Kanaka	8.08	6.53	7.28	6.22	6.53	5.69
5.	Panama	6.08	5.08	7.78	4.69	5.08	5.11
6.	K-22-1	7.03	6.14	6.36	6.36	6.14	6.36
7.	Vridhachalam -3	9.36	7.33	9.86	7.44	7.33	7.64
8.	Amrutha	7.14	7.25	7.44	7.64	7.25	8.08
9.	Madk II	5.19	4.78	5.08	4.72	4.78	4.08
10.	Dhamodar	5.22	4.89	6.11	6.53	4.89	5.17
11.	Priyanka	9.39	8.33	8.81	9.00	8.33	7.25
12.	Raghav	5.86	8.75	6.33	8.61	8.75	9.19
13.	Madakkathara I	6.36	8.28	6.28	8.53	8.28	9.11
	Kendalls W(a)*	0.154	0.214	0.137	0.218	0.172	0.219



## PILICODE

Among the varieties tried, PLD 75 had high overall acceptability when processed in to cashew apple RTS. This was followed by PLD 62, PLD 40 and PLD 45. RTS prepared from PLD 40 had the highest score for appearance. Regarding colour, RTS prepared from PLD 40 had the highest score. RTS prepared from PLD 62 had highest score for flavor. Among varieties tried, PLD 40 had the highest overall acceptability. The score was highest for PLD 40 for appearance of the product (Jam). PLD 40 had the highest score for colour, whereas PLD 67 had the highest score for flavour. Highest score for taste was obtained for the variety, PLD 67 and PLD 40 (Table 1.105 and 1.106).

**Table 1.105 : Evaluation of organoleptic score of RTS for cashew apple at Pilicode Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability	Shelf Life (Months)	Mean Score
1.	PLD 75	2.68	2.56	2.68	2.98	2.80	<b>2.98</b>	3	2.78
2.	PLD 54	2.56	2.32	2.68	2.52	2.68	2.64	3	2.57
3.	PLD 44	2.57	2.67	2.98	2.96	2.66	2.82	3	2.78
4.	PLD 64	2.68	2.68	2.68	2.84	2.76	2.72	3	2.73
5.	PLD 62	2.80	2.60	<b>3.00</b>	2.96	2.80	<b>2.95</b>	3	2.85
6.	PLD 40	<b>2.92</b>	<b>2.96</b>	2.92	2.78	2.80	<b>2.96</b>	3	2.89
7.	PLD 48	2.76	2.68	2.68	2.80	2.76	2.84	3	2.75
8.	PLD 67	2.60	2.64	2.80	2.92	2.88	2.88	3	2.79
9.	PLD 66	2.68	2.68	2.82	2.72	2.76	2.85	3	2.75
10.	PLD 45	2.76	2.76	2.80	2.92	2.86	<b>2.90</b>	3	2.83
11.	PLD 82	2.74	2.64	2.68	2.80	2.76	2.84	3	2.74
	<b>Mean</b>	<b>2.70</b>	<b>2.65</b>	<b>2.79</b>	<b>2.84</b>	<b>2.77</b>	<b>2.85</b>	<b>3</b>	<b>2.77</b>

**Table 1.106 : Evaluation of organoleptic score of jam for cashew apple at Pilicode Centre**

S.No.	Variety	Appearance	Taste	Colour	Flavour	Texture	Overall Acceptability	Shelf Life (Months)	Mean Score
1.	PLD 75	2.60	2.68	2.48	2.60	2.56	2.72	12	<b>2.61</b>
2.	PLD 54	2.40	2.48	2.72	2.54	2.76	2.88	12	<b>2.63</b>
3.	PLD 44	2.50	2.48	2.50	2.48	2.88	2.64	12	<b>2.58</b>
4.	PLD 64	2.56	2.66	2.80	2.68	2.80	2.74	12	<b>2.71</b>
5.	PLD 62	2.52	2.36	2.32	2.52	2.48	2.60	12	<b>2.47</b>
6.	PLD 40	<b>2.88</b>	<b>2.96</b>	2.84	<b>2.92</b>	2.96	<b>2.96</b>	12	<b>2.92</b>
7.	PLD 48	2.68	2.64	2.88	2.68	2.84	2.84	12	<b>2.76</b>
8.	PLD 67	2.68	2.58	<b>2.96</b>	<b>2.92</b>	2.68	2.66	12	<b>2.75</b>
9.	PLD 66	2.56	3.52	2.46	2.68	2.88	2.68	12	<b>2.80</b>
10.	PLD 45	2.56	2.32	2.54	2.54	2.65	2.48	12	<b>2.52</b>
11.	PLD 82	2.67	2.45	2.60	2.58	2.65	2.50	12	<b>2.58</b>
	<b>Mean</b>	<b>2.60</b>	<b>2.65</b>	<b>2.65</b>	<b>2.65</b>	<b>2.74</b>	<b>2.70</b>	<b>12</b>	<b>2.66</b>



## VENGURLE

The data with respect to organoleptic evaluation of RTS of different cashew varieties (Table 1.107) showed that the highest total acceptability score (3.71) was recorded in cashew variety Vengurla-4 and Vengurla-6. However, the maximum shelf life of RTS (134 days) was observed in Vengurla-2.

**Table 1.107 : Organoleptic evaluation of RTS in different varieties at Vengurla Centre**

Variety	Taste	Colour	Flavour	Total acceptability	shelf life in days
V-1	2.86	3.00	2.86	2.90	113
V-2	3.00	3.29	3.00	3.09	134
V-3	3.43	3.00	3.14	3.19	129
V-4	3.71	3.71	3.71	3.71	119
V-5	3.28	3.29	3.29	3.29	126
V-6	3.71	4.00	3.42	3.71	130
V-7	3.57	3.43	3.42	3.47	124
V-8	3.71	3.14	3.29	3.38	126

The data presented in (Table 1.108) revealed that organoleptic evaluation score of jam was found maximum in cashew Vengurla-4 variety with respect to total acceptability (3.86). Similarly, the maximum shelf life of jam (172 days) was observed in Vengurla-4.

**Table 1.108 : Organoleptic evaluation of Jam in different varieties at Vengurla Centre**

Variety	Taste	Colour	Flavour	Total acceptability	shelf life in days
V-1	4.14	3.57	3.57	3.76	140
V-2	3.57	3.57	3.57	3.57	147
V-3	3.28	3.28	3.00	3.19	163
V-4	4.00	4.00	3.57	3.86	172
V-5	3.00	3.00	3.00	3.00	149
V-6	3.43	3.00	3.28	3.24	158
V-7	3.57	3.57	3.00	3.38	170
V-8	2.86	3.28	2.86	3.00	161

## VRIDHACHALAM

The Experiment on Varietal screening of Cashew apple for preparation of RTS and Jam was



initiated. RTS and Jam were prepared from eight varieties and organoleptic evaluation was done (Table 1.109(a) and 1.109(b)).

**Table 1.109 : a. RTS**

Variety	Taste	Colour	Flavour	Total acceptability	pH	Shelf life in days
VRI2	4	5	5	6	4.8	90 days
VRI3	7	7	5	6	4.6	
VRI(Cw)H1	8	7	5	8	4.2	
Vengurla 4	7	5	5	6	4.8	
Bhaskara	7	5	5	6	4.5	
Priyanka	7	7	5	6	4.8	
Madak- 2	7	7	5	6	4.6	
BPP 8	7	7	5	6	4.2	

**Table : b. Jam**

Variety	Taste	Colour	Flavour	Total acceptability	Shelf life in days
VRI2	7	5	8	7	180 days
VRI3	7	7	7	7	
Cw)H1	7	7	7	7	
Vengurla 4	5	7	7	7	
Bhaskara	5	7	7	7	
Priyanka	7	5	7	7	
Madak- 2	7	5	7	7	
BPP 8	7	7	7	7	







## II. CROP MANAGEMENT







## II. CROP MANAGEMENT

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

**Centres:** **East Coast** : Bhubaneshwar  
**Plains / others** : Hogalagere

To objective of the experiment is to investigate the effect of nutrient management approaches on growth, yield and soil properties

**Experimental Design** : Randomized Block Design

**No. of replications** : 3

**Treatments:**

T<sub>1</sub> -100% RDF (500:250:250g NPK/Plant)

T<sub>2</sub> -100% RDF + FYM @ 10kg/Plant/Year

T<sub>3</sub> - T<sub>2</sub> + 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> - T<sub>2</sub> + Foliar Spray of Secondary and micro-nutrients (0.5% ZnSO<sub>4</sub> +0.1% Solubor + 0.5% MgSO<sub>4</sub>)

T<sub>5</sub> - T<sub>3</sub> +Foliar Spray of Secondary and micro-nutrients (0.5%ZnSO<sub>4</sub> +0.1% Solubor + 0.5% MgSO<sub>4</sub>)

T<sub>6</sub> - Control

#### BHUBANESWAR

The experiment was laid out during the year 2014. Cashew variety Balabhadra was planted at a spacing of 7m x 7m .The experimental block is under establishment stage and the crop is at initial stage of vegetative growth. The results from this experiment will be recorded, analysed and interpreted from the third year onwards.

#### HOGALAGERE

Application of 100% RDF+10 Kg FYM along with 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>), Secondary and micronutrients (0.5% ZnSo<sub>4</sub>+ 0.1% Boran + 0.5% Mg SO<sub>4</sub>) (T<sub>5</sub>) was found to be significantly superior with respect to mean nut yield (4.70 Kg/tree), Plant height (2.73m), Stem girth (11.68 cm) and canopy height (1.73 m) parameters over other treatments. This treatment was followed by T<sub>3</sub> which had mean nut yield (4.09 Kg/tree) and then T<sub>4</sub> (3.80 Kg/tree). Least mean nut yield was observed in T<sub>6</sub> treatment (1.68 Kg/tree). The treatment T<sub>5</sub> was also found to be numerically superior with respect to canopy diameter (4.43 m), Canopy spread (E-W-4.40 m & N-S 4.45 m) and mean nut weight (35.84 g) and was on par with T<sub>3</sub> & T<sub>4</sub> treatments. However, the control treatment (T<sub>1</sub>) recorded least response with respect to all the growth and yield parameters (Table 2.1 and 2.2). The Tea Mosquito Bug infestation was low irrespective of the treatments.





Table 2.1 : Vegetative parameters of cashew at HREC, Hogalagere

Treatments	Plant height (m)	Stem girth (cm)	Canopy height (m)	Canopy spread (m)		Canopy diameter (m)
				E-W	N-S	
T <sub>1</sub>	2.10	10.45	1.60	4.00	3.93	3.95
T <sub>2</sub>	2.25	10.70	1.62	4.05	3.95	4.07
T <sub>3</sub>	2.35	10.92	1.65	4.21	4.12	4.17
T <sub>4</sub>	2.33	10.93	1.63	4.18	4.05	4.12
T <sub>5</sub>	2.73	11.68	1.73	4.40	4.45	4.43
T <sub>6</sub>	1.83	9.91	1.60	3.77	3.85	3.81
<b>S.EM</b>	<b>0.08</b>	<b>0.22</b>	<b>0.02</b>	<b>0.07</b>	<b>0.10</b>	<b>0.09</b>
<b>CD@5%</b>	<b>0.24</b>	<b>0.67</b>	<b>0.07</b>	<b>0.22</b>	<b>0.29</b>	<b>0.28</b>
<b>CV</b>	<b>6.63</b>	<b>4.16</b>	<b>2.62</b>	<b>3.48</b>	<b>4.66</b>	<b>4.45</b>

Table 2.2 : Yield parameters of cashew at HREC, Hogalagere

Treatments	Flowering duration (Days)	Apple weight (g)	Mean nut weight (g)	Nut yield (Kg/plant)	Shelling (%)	TMB Infestation	Cumulative yield (Kg/tree) (No.of harvest: 1)
T <sub>1</sub>	107	33.16	5.36	2.57	29.0	low	2.57
T <sub>2</sub>	108	33.60	5.84	3.25	29.0	low	3.25
T <sub>3</sub>	108	34.02	5.99	4.09	29.5	low	4.09
T <sub>4</sub>	112	34.00	6.03	3.80	29.5	low	3.80
T <sub>5</sub>	112	35.84	6.15	4.70	29.5	low	4.70
T <sub>6</sub>	107	32.10	4.76	1.68	28.5	low	1.68
<b>S.EM</b>	<b>2.71</b>	<b>0.64</b>	<b>0.08</b>	<b>0.09</b>	<b>0.30</b>	-	<b>0.09</b>
<b>CD@5%</b>	<b>8.17</b>	<b>1.92</b>	<b>0.24</b>	<b>0.27</b>	<b>0.91</b>	-	<b>0.27</b>
<b>CV</b>	<b>4.97</b>	<b>3.78</b>	<b>2.74</b>	<b>5.41</b>	<b>2.07</b>	-	<b>5.41</b>



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

**Centres:** **East Coast** : Bapatla, Bhubaneshwar and Jhargram  
**West Coast** : Madakkathara and Pilicode  
**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.

### Experiment Details :

Design	:	Split plot
Main plot : Plant density	:	S <sub>1</sub> 200 plants/ha (10m x 5m)
		S <sub>2</sub> 400 plants/ha (6m x 4m)
		S <sub>3</sub> 600 plants/ha (5m x 4m)
Sub-plot : Fertilizer dose/ha:		M <sub>1</sub> 75 kg N, 25 kg P <sub>2</sub> O <sub>5</sub> , 25 kg K <sub>2</sub> O
		M <sub>2</sub> 150 kg N, 50 kg P <sub>2</sub> O <sub>5</sub> , 50 kg K <sub>2</sub> O
		M <sub>3</sub> 225 kg N, 75 kg P <sub>2</sub> O <sub>5</sub> , 75 kg K <sub>2</sub> O
Fertilizers application level	:	1 <sup>st</sup> year : 1/5 <sup>th</sup>
		2 <sup>nd</sup> year : 2/5 <sup>th</sup>
		3 <sup>rd</sup> year : 3/5 <sup>th</sup>
		4 <sup>th</sup> year : 4/5 <sup>th</sup>
		5 <sup>th</sup> year : Full dose

### BAPATLA

During the year, results obtained from planting densities cum fertilizer trial it is evident that trees planted at closer densities i.e. 5m x 4m apart have given higher plant heights, canopy height, stem girth, canopy diameter, canopy spread area and flowering intensity. Annual nut yield per tree was highest 13.34 kg per tree in 10m x 5m spaced trees applied with fertilizer levels at 225:75:75 kg/ha [S<sub>1</sub>M<sub>3</sub>] which is followed by treatment S<sub>1</sub>M<sub>2</sub> [11.18kg/tree]. Cumulative nut yields are also highest in S<sub>1</sub>M<sub>1</sub> (75.07kg/tree) followed by S<sub>1</sub>M<sub>2</sub> (69.06kg/tree). Results have indicated that at closer densities vegetative parameters are at higher values and at wider densities yields are higher.

The mean canopy height was found to be non significant at different levels of spacings, fertilizers and their interaction. The maximum canopy height (4.61 m) was recorded in S<sub>1</sub>. Among the different levels of fertilizers the maximum canopy height (4.58m) was recorded in M<sub>1</sub> (75kg N, 25kg P<sub>2</sub>O<sub>5</sub> and 25kg K<sub>2</sub>O) and minimum canopy height (4.35m) was recorded in M<sub>2</sub> (150 kg N, 50kg P<sub>2</sub>O<sub>5</sub> and 50kg K<sub>2</sub>O). The interaction between spacing's and fertilizers was found to be non significant. However, the highest canopy height was recorded in S<sub>1</sub>M<sub>1</sub> (4.93m) (Table 2.3 and 2.4).





**Table 2.3 : Effect of tree density and fertilizer levels on growth parameters of cashew at Bapatla centre**

Treatment	Tree height (m)	Stem Girth (cm)	Canopy Height (m)	Ground coverage by canopy (%)
S1M1	5.38	96.95	4.93	112.49
S1M2	4.66	109.64	4.27	102.70
S1M3	4.98	84.20	4.64	116.97
S2M1	4.75	89.46	4.33	150.08
S2M2	5.04	93.94	4.51	128.82
S2M3	4.76	75.26	4.40	150.96
S3M1	5.10	98.00	4.47	93.93
S3M2	4.63	81.99	4.27	187.33
S3M3	4.45	80.60	4.48	190.41
<b>Mean</b>	<b>5.83</b>	<b>90.00</b>	<b>4.48</b>	<b>137.07</b>
<b>SEm ±</b>				
a) Spacing	0.14	3.01	0.11	11.47
b)Fertilizers	0.12	3.33	0.12	10.74
c) Spacing's Fertilizers	0.23	5.60	0.20	19.03
<b>CD at 5%</b>				
a) Spacing	NS	NS	NS	NS
b)Fertilizers	NS	9.91	NS	NS
c) Spacing's Fertilizers	NS	NS	NS	59.86

**Table 2.4 : Effect of tree density and fertilizer levels on yield parameters of cashew at Bapatla centre**

Treatment	Flowering Intensity (m <sup>2</sup> )	Nuts/m <sup>2</sup>	Nuts/Panicle	Nut Yield/tree (kg)	Cumulative nut Yield/tree (kg) (9 Harvests)
S1M1	25.51	37.61	3.45	10.81	75.07
S1M2	25.05	41.76	3.04	11.18	69.06
S1M3	25.89	40.22	3.11	13.34	54.11
S2M1	24.82	47.32	3.62	8.56	48.15
S2M2	27.74	37.38	2.94	7.10	51.34
S2M3	25.84	39.96	2.96	7.54	41.10
S3M1	23.19	21.17	3.13	3.22	42.31
S3M2	24.57	35.96	2.71	8.58	44.43
S3M3	24.23	38.92	3.02	6.38	41.86



Mean	25.20	36.34	3.11	8.52	51.94
<b>Sem ±</b>					
a) Spacing	0.43	2.35	0.06	0.64	--
b)Fertilizers	0.63	1.88	0.09	0.75	--
c) Spacing's Fertilizers	0.99	3.25	0.14	1.23	--
<b>CD at 5%</b>					
a) Spacing	1.48	NS	0.21	2.21	--
b)Fertilizers	NS	NS	0.27	N.S.	--
c) Spacing's Fertilizers	NS	11.28	N.S	N.S.	--

The annual nut yield per tree was found to be significant at different levels of spacings. The maximum nut yield per tree was recorded in  $S_1$  (11.78 kg/tree) followed by  $S_2$  (7.73kg/tree). The annual nut yield per tree was found to be non significant at different levels of fertilizers. However, the maximum nut yield was recorded in  $M_3$  (9.09kg/tree) followed by  $M_2$  (8.95kg/tree).

The interaction between spacings and fertilizers was found to be non significant. However the highest was recorded in  $S_1M_3$  (13.34kg/tree) followed by  $S_1M_2$  (11.18kg/tree).

The mean cumulative nut yield per tree was found highest in  $S_1$  (66.08kg/tree) followed by  $S_2$  (46.86kg/tree) among the spacings. Whereas, among the fertilizers mean cumulative nut yield per tree found maximum in  $M_1$  (75.07kg/tree) followed by  $M_2$  (54.94kg/tree). With regard to interactions, the mean cumulative yield per tree was highest in  $S_1M_1$  (75.07kg/tree) followed by  $S_1M_2$  (69.06kg/tree).

### Compilation of four years data

Results obtained from planting densities cum fertilizer trial it is evident that trees planted at closer densities i.e. 5m x 4m have given higher plant heights, trunk girth, canopy diameter and canopy height. During the year 2012-13, annual nut yield per tree was highest (11.43kg/tree) in 10 x 5m spaced trees applied with fertilizer levels at 75:25:25kg/ha [ $S_1M_1$ ], Cumulative nut yields are also highest in the same treatments i.e.  $S_1M_1$  [43.45kg/tree]. During the year 2013-14, annual nut yield per tree was highest (10.69kg/tree) in 10 x 5m spaced trees applied with fertilizer levels at 150:50:50kg/ha [ $S_1M_2$ ], Cumulative nut yields are also highest in the same treatments i.e.  $S_1M_2$  [51.78kg/tree]. During the year 2014-15, cumulative nut yield was recorded maximum in  $S_1M_1$  (64.26kg/tree). During the year 2105-16, the annual nut yield was recorded maximum in  $S_1M_3$  (13.34kg/tree) and the cumulative nut yields were found highest in  $S_1M_1$  (75.07kg/tree) followed by  $S_1M_2$  (69.06kg/tree). Results have indicated that at closer densities vegetative parameters are at higher values and at wider densities yields are higher.

### BHUBANESWAR

Significant variations for all the yield parameters were recorded due to tree density and levels of fertilizers. On the other hand, the parameters like mean no. of panicles/m<sup>2</sup> and mean apple weight were statistically non-significant due to interaction effect of tree density and levels of fertilizers. The





tree density  $S_1$  (10m x 5m) was significantly superior to both  $S_2$  (6m x 4m) and  $S_3$  (5m x 4m) in respect of number of panicles/m<sup>2</sup> (19.44), nut weight (8.14g), apple weight (67.79g) as well as nut yield (5.66kg/tree). Highest mean annual nut yield was recorded in  $S_3$  (1726.13kg/ha) than  $S_1$  and  $S_2$ . Similarly, nut yield over 14<sup>th</sup> harvest indicated highest nut yield of 62.26kg/tree in highest tree density of  $S_1$  than  $S_2$  and  $S_3$ .

Significantly higher nut weight (7.92g), apple weight (66.18g) as well as annual nut yield (1546.50kg/ha) was recorded with application of higher levels of fertilizers in  $M_3$  (N<sub>225</sub>P<sub>75</sub>K<sub>75</sub> kg/ha). Overall, application of  $M_3$  (N<sub>225</sub>P<sub>75</sub>K<sub>75</sub>) in cashew recorded maximum nut yield and yield attributing parameters including highest annual nut yield of 1546.50kg/ha. Highest cumulative nut yield was observed in  $M_2$  (N<sub>150</sub>P<sub>50</sub>K<sub>50</sub> kg/ha) after 14<sup>th</sup> harvest. Significant variations were recorded for apple weight and annual nut yield (kg/tree and kg/ha) for the interactions of tree density and fertilizer doses and highest cumulative nut yield (kg/tree) was found in  $S_1M_2$ .

The results on economics revealed wide variations for cumulative cost of cultivation, total returns and benefit cost ratio due to different tree density as well as fertilizer levels. The cumulative cost of cultivation over 14<sup>th</sup> harvest ranged from Rs.1,87,414.00 ( $S_1M_1$ ) to Rs. 2,21,227.00 ( $S_3M_3$ ), while cumulative net returns varied from Rs3,47,237.00 ( $S_1M_1$ ) to Rs.7,82,073.00 ( $S_3M_2$ ). Similar trend was also observed for BCR, maximum of 4.77 was recorded the treatment of  $S_3M_2$  (Table 2.5, 2.6 and 2.7).

**Table 2.5 : Effect of tree density and fertilizer levels on growth parameters of cashew at Bhubaneswar centre**

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
S1M1	7.06	90.16	9.75	73.92	142.65
S1M2	7.12	96.34	9.66	73.45	144.16
S1M3	7.27	95.81	9.88	75.52	148.99
S2M1	6.49	75.46	6.66	33.91	135.31
S2M2	6.92	76.65	6.81	35.61	140.25
S2M3	6.84	75.11	7.13	37.54	155.81
S3M1	6.13	68.27	6.18	26.14	130.22
S3M2	6.22	74.95	6.21	29.91	143.82
S3M3	6.44	74.14	6.56	33.15	168.14
<b>SEm ±</b>	<b>0.10</b>	<b>1.53</b>	<b>0.10</b>	<b>0.99</b>	<b>2.77</b>
<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

**Table 2.6 : Effect of tree density and fertilizer levels on growth parameters of cashew at Bhubaneswar centre**

Treatment	Mean no. of panicles/m <sup>2</sup>	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (Kg/tree) (for 14 <sup>th</sup> hvts)
				(Kg/tree)	(kg/ha)	
S1M1	18.14	8.09	63.81	4.97	1016.04	52.43



S1M2	19.81	8.16	68.92	5.88	1175.53	70.26
S1M3	20.36	8.18	70.64	6.12	1224.28	64.08
S2M1	17.12	7.81	62.92	4.06	1621.87	37.07
S2M2	19.91	8.02	64.83	4.10	1641.72	44.19
S2M3	19.26	7.96	64.72	3.94	1575.46	41.98
S3M1	15.26	7.56	60.86	3.12	1560.49	32.44
S3M2	17.30	7.82	61.35	3.56	1778.12	38.14
S3M3	16.26	7.63	63.17	3.68	1839.76	35.83
<b>CD @ 5%</b>	<b>NS</b>	<b>NS</b>	<b>2.56</b>	<b>0.28</b>	<b>31.71</b>	<b>-</b>
<b>SEm±</b>	<b>0.48</b>	<b>0.07</b>	<b>0.86</b>	<b>0.10</b>	<b>10.67</b>	<b>-</b>

**Table 2.7 : Economics of high density planting based on cumulative yield at Bhubaneswar Centre during the year**

<b>Spacing (Density)</b>	<b>Fertilizer Dose NPK (Kg/ha)</b>	<b>Cum. Cost of cultivation (Rs/ha) Over 16<sup>th</sup> no. of years</b>	<b>Cum. Total return of cashew (Rs./ha)</b>	<b>Cum. net return (Rs./ha)</b>	<b>Benefit : Cost Ratio</b>
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	187414	534651	347237	2.85
	M2: 150-50-50	201428	171600	516172	3.56
	M3: 225-75-75	215449	652927	437478	3.03
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	191266	759792	568526	3.97
	M2: 150-50-50	205280	906432	701152	4.42
	M3: 225-75-75	219301	874288	654987	3.98
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	193192	847187	653995	4.38
	M2: 150-50-50	207206	989279	782073	4.77
	M3: 225-75-75	221227	929545	708318	4.20

### HOGALAGERE

Vegetative parameters were recorded in second year of cashew plantation having different spacing and fertilizer levels. Among treatments there were no significant differences with respect to plant height, canopy height, canopy spread and canopy diameter. However, the interaction effect of S<sub>1</sub>M<sub>3</sub> where in manuring application was 90 Kg of N, 20 Kg of P<sub>2</sub>O<sub>5</sub>, 30 Kg of K<sub>2</sub>O per hectare and the spacing was 10 m X 5 m, there was significant increase in stem girth (5.36 m) compared to all the





interactions except S<sub>1</sub>M<sub>2</sub> (5.30 cm) and S<sub>1</sub>M<sub>1</sub> (5.24 cm). Interaction effect of S<sub>1</sub>M<sub>3</sub> treatment recorded numerically superior growth parameters like plant height (1.75 m), canopy height (0.94 m), canopy spread (E-W, 1.64 m & N-S, 1.60 m) and canopy diameter (1.62 m) compared to other treatments (Table 2.8). Based on the primary data of canopy diameter the other parameters such as canopy surface area and ground coverage by canopy have been calculated. They also depict similar trend as that of canopy diameter observations (Table 2.8).

The cashew plants in experimental plot are two years old and hence yield parameters were not available.

**Table 2.8 : Effect of tree density and fertilizer levels on growth parameters of cashew at HREC, Hogalagere centre**

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
S1M1	1.69	5.24	1.53	3.10	3.65
S1M2	1.70	5.30	1.57	3.36	3.92
S1M3	1.75	5.36	1.62	3.54	4.12
S2M1	1.45	4.56	1.21	1.92	4.75
S2M2	1.48	4.57	1.28	2.12	5.36
S2M3	1.60	5.10	1.36	2.61	6.01
S3M1	1.20	4.56	1.00	1.29	3.96
S3M2	1.20	4.55	1.12	1.89	4.95
S3M3	1.30	5.07	1.24	2.24	6.05
<b>Mean</b>	<b>1.49</b>	<b>4.92</b>	<b>1.32</b>	<b>2.45</b>	<b>4.75</b>
<b>SEm ±</b>	<b>0.03</b>	<b>0.05</b>	<b>0.06</b>	<b>0.23</b>	<b>0.40</b>
<b>CD at 5%</b>	<b>NS</b>	<b>0.17</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

**JHARGRAM**

The plants under 6m x 4m spacing and 5m x 4m spacing were pruned during 2013 August. As there was enough space under 10m x 5m spacing, so the plants under those spacing were not pruned. There was significant difference among the different spacing treatments with respect to girth, canopy diameter and canopy surface area. The individual effects of different fertilizer levels did not produce any significant effect on different characters studied. The variation was due to spacing difference, not due to the difference in fertilizer levels. The interaction effects also showed non- significant result on growth parameters in the particular year.

Maximum values with respect to flower bearing laterals /m<sup>2</sup>, nuts/m<sup>2</sup>, yield /tree, yield /unit area were supported by wider spacing (10m x 5m). While nut weight and apple weight was highest with narrow spacing. There was no significant effect of interaction on various yield characters studied. Benefit cost ratio was highest with 10m x 5m spacing + 75-25-25 kg NPK/ha/year (14.3) followed by 10m x 5m spacing + 150-50-50 kg NPK/ha/year (12.0) (Table 2.9, 2.10, 2.11 and 2.12).



**Table 2.9 :** Effect of tree density and fertilizer levels on growth parameters of cashew at Jhargram centre

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
S1M1	6.9	91.3	8.5	90.0	455.3
S1M2	7.1	89.6	8.4	90.7	441.6
S1M3	6.1	81.7	8.4	80.8	442.1
S2M1	6.4	76.6	5.9	47.1	461.1
S2M2	6.3	75.8	6.2	51.4	502.5
S2M3	6.4	72.9	6.0	48.8	466.2
S3M1	6.1	72.2	5.8	46.2	532.1
S3M2	6.1	76.0	5.1	36.9	407.4
S3M3	6.1	66.2	5.6	43.7	497.5
<b>Mean</b>	<b>6.4</b>	<b>78.0</b>	<b>6.7</b>	<b>59.5</b>	<b>467.32</b>
<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>CV%</b>	<b>5.17</b>	<b>9.79</b>	<b>7.41</b>	<b>14.49</b>	<b>13.78</b>

**Table 2.10 :** Effect of tree density and fertilizer levels on yield parameters of cashew at Jhargram centre

Treatment	Mean no. of panicles/ m <sup>2</sup>	Mean no. of nuts/ m <sup>2</sup>	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (Q/ha) (for 9 hvts)
					(Kg/tree)	(Q/ha)	
S1M1	15.4	43.5	4.2	44.5	16.3	32.5	119.0
S1M2	15.7	45.0	3.7	42.7	14.7	29.3	116.8
S1M3	16.1	47.2	4.4	51.0	17.6	35.2	125.0
S2M1	10.2	27.4	5.2	52.8	6.2	24.8	124.1
S2M2	10.3	21.7	4.5	49.1	5.2	20.8	119.4
S2M3	11.3	22.9	5.0	51.9	5.2	21.0	122.7
S3M1	11.1	25.3	5.6	54.7	6.4	32.2	152.4
S3M2	10.2	24.5	4.5	45.9	4.1	20.4	129.4
S3M3	11.8	23.0	4.7	54.7	4.7	23.6	127.0
<b>Mean</b>	<b>12.5</b>	<b>31.2</b>	<b>4.6</b>	<b>49.7</b>	<b>8.9</b>	<b>26.6</b>	<b>126.2</b>
<b>SEm±</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>





**Table 2.11 : Effect of tree density and fertilizer levels on soil nutrient status at Jhargram centre**

Treatment	Available Nitrogen (kg/ha)	Available Phosphorus (kg/ha)	Available Potassium (kg/ha)	Organic Carbon Content of Soil (%)
S1M1	94.1	28.8	199.7	0.5
S1M2	150.5	33.4	238.8	0.4
S1M3	94.1	19.6	212.0	0.5
S2M1	84.7	13.8	75.7	0.4
S2M2	112.9	58.1	340.6	0.4
S2M3	112.9	58.1	340.6	0.4
S3M1	122.3	53.2	258.6	0.4
S3M2	103.5	48.5	316.4	0.4
S3M3	112.9	24.6	145.7	0.5
Mean	109.8	37.5	236.5	0.4
<b>SEm ±</b>	<b>17.2</b>	<b>8.7</b>	<b>47.3</b>	<b>NS</b>
<b>CD at 5%</b>	<b>37.4</b>	<b>19.1</b>	<b>103.0</b>	
<b>CV%</b>	<b>18.2</b>	<b>32.1</b>	<b>25.6</b>	<b>10.0</b>

**Table 2.12 : Economics of high density planting based on cumulative yield at Jhargram Centre**

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 13 years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	95730	1463561	1367832	14.3
	M2: 150-50-50	114543	1489460	1374917	12.0
	M3: 225-75-75	138259	1634383	1496125	10.8
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	116545	926005	809461	6.9
	M2: 150-50-50	151194	817800	666606	4.4
	M3: 225-75-75	170613	860130	689518	4.0
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	161710	1011248	849539	5.3
	M2: 150-50-50	180887	848305	667418	3.7
	M3: 225-75-75	199419	877420	678002	3.4



## MADAKKATHARA

Statistical analysis of the data indicated that the interaction effect of tree densities and fertilizer dose influenced the growth and yield parameters significantly. The interaction effect of tree densities and fertilizer doses were significant with respect to flowering laterals/panicles nut weight and yield (Table). Significant difference could not be observed with respect to the flowering duration which ranged between 62-65 days as observed in the previous year. Flowering laterals per square meter was highest in S1M3 (5), the same was observed in the previous year also. The male bisexual flower ratio did not differ significantly among treatments in the current year also. The highest per tree yield and as well as nut weight were recorded in lower densities with highest dose of fertilizers and cumulative per tree yield in S1M1, as observed in the previous year. The per hectare yield was high in highest density with medium dose of fertilizer, S3M2 (2425kg) (Table 2.13 and 2.14).

The economic analysis of the data on cost of cultivation and returns revealed that the lower density planting with different doses of fertilizer is comparatively less economical. However, the next two higher densities i.e. 400 plants/ha and 500 plants /ha at different levels of fertilizer are economical. However, the highest density with highest doses of fertilizer increased the cost of cultivation and reduced return. The same observation was made in the previous year also (Table 2.15).

**Table 2.13 : Effect of tree density and fertilizer levels on growth parameters of cashew at Madakkathara centre**

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
S1M1	5.90	113.90	9.64	145.74	89.20
S1M2	5.65	106.80	8.49	113.03	88.05
S1M3	5.90	110.45	8.16	104.53	89.02
S2M1	7.82	95.25	6.32	62.71	100.25
S2M2	5.77	96.45	7.34	84.46	108.95
S2M3	6.25	106.80	6.39	64.00	115.42
S3M1	5.95	102.35	5.91	54.83	129.52
S3M2	6.10	110.05	6.65	69.42	150.50
S3M3	5.97	100.67	6.32	62.71	137.95
<b>Mean</b>	<b>6.14</b>	<b>104.74</b>	<b>7.24</b>	<b>84.60</b>	<b>112.09</b>
<b>SEm ±</b>	<b>-</b>	<b>0.55</b>	<b>3.77</b>	<b>-</b>	<b>3.67</b>
<b>CD at 5%</b>	<b>1.53</b>	<b>12.65</b>	<b>NS</b>	<b>23.42</b>	<b>10.87</b>
<b>CV%</b>	<b>16.87</b>	<b>8.14</b>	<b>39.08</b>	<b>25.37</b>	<b>6.55</b>





**Table 2.14 :** Effect of tree density and fertilizer levels on yield parameters of cashew at Madakkathara centre

Treatment	Duration of flowering (days)		No. of panicles / m <sup>2</sup>	Male: Bisexual flowers ratio	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (Kg/tree) (for 9 harvest)
	Range	Mean					(Kg/tree)	(kg/ha)	
S1M1	44-84	64	4.00	2.70	6.45	63.80	8.32	1664	42.16
S1M2	40-86	63	3.25	2.59	6.62	57.50	7.47	1494	38.30
S1M3	56-68	62	5.00	2.59	6.72	64.00	9.37	1874	40.53
S2M1	40-84	62	4.25	2.63	6.10	60.50	4.30	1720	30.57
S2M2	61-69	65	3.75	2.60	6.22	56.50	4.75	1900	34.97
S2M3	40-80	62	4.25	2.56	6.15	60.50	5.05	2020	32.41
S3M1	58-68	63	4.00	2.73	6.15	55.75	4.65	2325	29.46
S3M2	54-72	63	4.00	2.55	6.07	54.25	4.85	2425	30.20
S3M3	5076	63	4.00	2.55	6.07	55.50	4.12	2060	31.45
<b>CD @ 5%</b>	-	<b>NS</b>	<b>1.13</b>	<b>NS</b>	<b>0.28</b>	<b>7.10</b>	<b>1.70</b>	<b>552.94</b>	<b>4.40</b>
<b>S<sub>Em</sub>±</b>	-	-	<b>0.24</b>	-	<b>0.05</b>	<b>2.18</b>	<b>3.67</b>	<b>0.2100</b>	<b>0.001</b>
<b>CV%</b>		<b>4.45</b>	<b>18.83</b>	<b>5.93</b>	<b>3.03</b>	<b>8.17</b>	<b>19.81</b>		<b>8.69</b>

**Table 2.15 :** Economics of high density planting based on cumulative yield at Madakkathara Centre

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 14 years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	285000	724680	439680	1.54
	M2: 150-50-50	305000	722280	417280	1.37
	M3: 225-75-75	300000	776880	476880	1.59
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	315000	834400	519400	1.65
	M2: 150-50-50	325000	861000	536000	1.65
	M3: 225-75-75	330000	880400	550400	1.67
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	355000	944000	589000	1.66
	M2: 150-50-50	370000	964000	594000	1.61
	M3: 225-75-75	395000	910200	515200	1.30



## PILICODE

### Effect of interaction of spacing levels and fertilizer doses on vegetative characters and yield of Cashew variety MDK-1

The doses of fertilizers and the plant density were not found to interact significantly in influencing growth characteristics of variety MDK-1 except for the tree spread in North South Direction and the percentage ground cover by the canopy. Higher percentage ground coverage was observed with S3M2 closer spacing and medium fertilizer dose (**S3**: 500 plants / ha (5m X 4 m), (**M2**: 150 kg N: 50 Kg P<sub>2</sub>O<sub>5</sub>: 50 kg K<sub>2</sub>O). Highest plant spread in North South Direction was reported with S1M1 (**S1**: 200plants/ ha (10 m X 5m), (**M1**: 75 kg N : 25 Kg P<sub>2</sub>O<sub>5</sub>: 25 kg K<sub>2</sub>O) (Table 2.16, 2.17, 2.18 and 2.19).

**Table 2.16 :** Effect of tree density and fertilizer levels on growth parameters of cashew at Pilicode centre

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)		Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
			EW	NS		
S1M1	5.70	0.81	6.22	<b>7.06</b>	31.89	77.24
S1M2	4.88	0.73	5.82	5.24	22.59	49.02
S1M3	5.44	0.76	6.51	6.92	31.31	71.68
S2M1	6.30	0.67	6.02	6.28	34.82	127.42
S2M2	6.00	0.68	5.73	6.33	31.74	120.58
S2M3	6.50	0.54	5.20	4.55	27.90	78.08
S3M1	5.74	0.75	6.12	6.55	30.33	159.49
S3M2	5.30	0.71	4.76	6.83	29.75	<b>191.69</b>
S3M3	5.28	0.67	5.90	5.65	26.12	133.00
<b>Mean</b>	<b>5.68</b>	<b>0.70</b>	<b>5.81</b>	<b>6.16</b>	<b>29.61</b>	<b>112.02</b>
<b>SEm ±</b>	<b>0.31</b>	<b>0.05</b>	<b>1.18</b>	<b>0.43</b>	<b>2.78</b>	<b>13.80</b>
<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.81</b>	<b>NS</b>	<b>25.66</b>
<b>CV%</b>	<b>8.30</b>	<b>10.71</b>	<b>30.51</b>	<b>10.58</b>	<b>14.09</b>	<b>18.48</b>

**Table 2.17 :** Effect of tree density and fertilizer levels on yield parameters of cashew at Pilicode centre

Treatment	Duration of flowering (days)	No. of panicle s/ m <sup>2</sup>	Male: Bisexual flowers ratio	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (Kg/tree) (for 12hvts)
						(Kg/tree)	(kg/ha)	
S1M1	<b>124.33</b>	9.70	0.48	47.33	6.85	5.62	1123.11	56.62
S1M2	122.67	12.33	0.57	50.67	6.90	5.41	1081.18	45.23
S1M3	105.11	11.42	0.56	52.78	6.98	6.51	1302.67	60.77
S2M1	116.78	10.18	0.51	50.00	6.90	3.42	1369.60	50.59
S2M2	<b>100.78</b>	10.68	0.61	55.67	6.82	4.71	1882.87	48.27



S2M3	107.33	9.33	0.49	51.33	7.02	5.38	2151.11	53.32
S3M1	113.56	<b>12.82</b>	0.58	49.77	6.85	4.64	2231.17	49.87
S3M2	115.89	10.10	0.50	50.33	6.87	3.49	1745.00	43.43
S3M3	104.00	8.89	0.53	50.83	6.88	4.10	2048.89	48.69
<b>CD @ 5%</b>	<b>3.47</b>	<b>3.43</b>	<b>NS</b>	<b>1.67</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>SEm±</b>	<b>1.86</b>	<b>0.31</b>	<b>0.03</b>	<b>0.06</b>	<b>0.90</b>	<b>0.95</b>	<b>301.10</b>	<b>6.88</b>

**Table 2.18 :** Leaf Nitrogen and Leaf Potassium content (%) in cashew in different spacing and fertilizer levels at Pilicode Centre

Treatment	Leaf Nitrogen content (%)	Leaf Potassium content (%)
S1M1	2.27	0.92
S1M2	2.34	0.83
S1M3	2.24	0.93
S2M1	2.32	1.06
S2M2	2.14	0.98
S2M3	2.09	0.92
S3M1	2.20	0.98
S3M2	2.00	0.80
S3M3	2.18	0.88
<b>Mean</b>	<b>2.20</b>	<b>0.92</b>

**Table 2.19 :** Economics of high density planting based on cumulative yield at Pilicode Centre

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) Over 16 no. of years	Cum. Total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : Cost Ratio
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	249733.72	628173.11	378439.39	2.52
	M2: 150-50-50	286692.44	539201.97	252509.54	1.88
	M3: 225-75-75	323860.20	709173.18	385312.98	2.19
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	433031.84	1297555.03	<b>864523.19</b>	<b>3.00</b>
	M2: 150-50-50	469408.00	1131679.88	662271.87	2.41
	M3: 225-75-75	515289.52	1188771.83	673482.31	2.31
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	583540.39	1444755.89	861215.50	2.48
	M2: 150-50-50	646786.83	1307689.14	660902.30	2.02
	M3: 225-75-75	711476.59	1494632.09	783155.50	2.10





**Table 2.21 : The influence of different levels of drip irrigation on yield parameters of cashew at Hogalagere**

Treatments	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 1 <sup>st</sup> hvsts)	Shelling (%)
T1 : No irrigation	5.22	30.44	1.33	1.33	29.00
T2 : Irrigation at 20% CPE	5.52	30.70	2.28	2.28	29.00
T3 : Irrigation at 40% CPE	5.85	31.00	2.95	2.95	29.00
T4 : Irrigation at 60% CPE	5.92	33.00	3.56	3.56	29.50
T5: Irrigation at 80% CPE	6.05	37.40	4.21	4.21	30.00
<b>SEm ±</b>	<b>0.08</b>	<b>0.61</b>	<b>0.09</b>	<b>0.09</b>	<b>0.18</b>
<b>CD at 5%</b>	<b>0.25</b>	<b>1.82</b>	<b>0.28</b>	<b>0.28</b>	<b>0.54</b>
<b>CV</b>	<b>3.27</b>	<b>4.16</b>	<b>7.31</b>	<b>7.31</b>	<b>1.35</b>

### VENGURLE

The various irrigation treatments did not significantly influence the growth attributes of cashew (Table 2.22).

**Table 2.22 : Effect of drip irrigation levels on growth parameters of cashew at Vengurle centre**

Treatments	Tree height (m)	Stem girth (cm)	Canopy spread (m)		Canopy surface area (m <sup>2</sup> )	No. of laterals/ m <sup>2</sup>
			E-W	N-S		
T1 : No irrigation	7.79	91.41	8.00	7.82	93.67	25.00
T2 : Irrigation at 20% CPE	7.68	<b>99.34</b>	<b>9.11</b>	8.36	116.33	27.67
T3 : Irrigation at 40% CPE	<b>8.02</b>	98.75	8.61	<b>8.87</b>	<b>116.72</b>	<b>28.87</b>
T4 : Irrigation at 60% CPE	7.94	91.87	8.28	7.23	101.60	<b>29.80</b>
T5: Irrigation at 80% CPE	7.59	98.75	8.48	8.60	108.95	<b>31.87</b>
<b>SEm ±</b>	<b>0.18</b>	<b>3.59</b>	<b>0.39</b>	<b>0.45</b>	<b>8.78</b>	<b>1.04</b>
<b>C.D. at 5%</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>N.S</b>	<b>3.22</b>
<b>CV%</b>	<b>4.82</b>	<b>7.48</b>	<b>9.38</b>	<b>11.07</b>	<b>16.35</b>	<b>7.31</b>



However, the various irrigation levels significantly influenced the flowering and yield attributes during the year (Table 2.23). Irrigation at 80% CPE ( $T_5$ ) recorded significantly maximum number of flowering panicles/ $m^2$  (20.20/ $m^2$ ), sex ratio (0.19) nut weight (10.9 g), apple weight (90.0 g), annual nut yield (7.59 kg/tree) and shelling per cent (31.50 %) and was found superior over rest of the treatments. However, it was at par with treatment  $T_4$  in respect of apple weight (80.0 g) and yield with treatment  $T_4$  (7.11 kg/tree) and  $T_3$  (6.18 kg/tree). The maximum cum. yield for last 14 harvests (67.00 kg/tree) recorded under treatment, irrigation at 80% CPE ( $T_5$ ).

**Table 2.23 : Effect of drip irrigation levels on growth parameters of cashew at Vengurle centre**

Treatments	No. of flowering/panicles/ $m^2$	Male : Bisexual flowers ratio	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Shelling (%)	Cum. yield (kg/tree) for 14 <sup>th</sup> harvest
T1 : No irrigation	15.55	0.16	9.40	65.00	5.11	29.25	47.64
T2 : Irrigation at 20% CPE	16.62	0.17	9.85	70.00	5.58	30.00	53.33
T3 : Irrigation at 40% CPE	17.37	0.18	10.00	75.00	<b>6.18</b>	29.50	54.30
T4 : Irrigation at 60% CPE	18.22	0.18	10.22	<b>80.00</b>	<b>7.11</b>	30.46	52.02
T5: Irrigation at 80% CPE	<b>20.20</b>	<b>0.19</b>	<b>10.90</b>	<b>90.00</b>	<b>7.59</b>	<b>31.50</b>	<b>67.00</b>
<b>SEm ±</b>	<b>0.29</b>	<b>0.009</b>	<b>0.13</b>	<b>3.53</b>	<b>0.50</b>	<b>0.26</b>	-
<b>C.D.@ 5%</b>	<b>0.91</b>	<b>N.S</b>	<b>0.40</b>	<b>10.89</b>	<b>1.55</b>	<b>0.80</b>	-
<b>CV%</b>	<b>3.36</b>	<b>9.87</b>	<b>2.58</b>	<b>9.30</b>	<b>15.97</b>	<b>1.74</b>	

### VRIDHACHALAM

Treatments with irrigation at 80% CPE recorded maximum number of panicles/ $m^2$  and higher male: bisexual flower ratio. Nut yield vary significantly among the treatments. The highest nut yield of 8.2 Kg/tree with a nut weight of 7.2 g, shelling percent of 30.2 and mean cumulative yield of 44.16 kg per tree in 8 harvests was observed in the treatment with irrigation at 80% CPE (Table 2.25).





**Table 2.24 :** Effect of drip irrigation levels on growth parameters of cashew at Vridhachalam centre

Treatments	Mean tree height (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean canopy surface area (m <sup>2</sup> )	No. of laterals / m <sup>2</sup>
			N - S	E - W		
T1 : No irrigation	4.96	78.4	6.4	6.4	58.02	14.2
T2 : Irrigation at 20% CPE	5.44	82.1	7.2	6.8	69.41	16.2
T3 : Irrigation at 40% CPE	6.00	82.4	7.42	7.4	77.78	18.4
T4 : Irrigation at 60% CPE	6.24	82.4	7.8	7.8	86.18	21.8
T5: Irrigation at 80% CPE	<b>6.92</b>	<b>88.2</b>	<b>8.2</b>	<b>7.92</b>	<b>92.02</b>	<b>24.2</b>
<b>SEm ±</b>	<b>0.16</b>	<b>1.04</b>	<b>0.05</b>	<b>NS</b>	<b>3.90</b>	<b>0.7</b>
<b>CD at 5%</b>	<b>0.34</b>	<b>3.16</b>	<b>0.14</b>		<b>5.20</b>	<b>1.4</b>

**Table 2.25 :** Effect of drip irrigation levels on yield parameters of cashew at Vridhachalam centre

Treatments	No. of panicles / m <sup>2</sup>	Male: Bisexual flowers ratio	Nut wt. (g)	Apple wt. (g)	Annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 8 hvsts)	Shelling (%)
T1 : No irrigation	11.2	0.14	<b>6.2</b>	<b>49.6</b>	5.80	<b>30.34</b>	<b>28.0</b>
T2 : Irrigation at 20% CPE	12.4	0.17	6.5	55.4	6.20	33.33	28.4
T3 : Irrigation at 40% CPE	16.2	0.18	6.6	58.8	7.10	37.74	29.0
T4 : Irrigation at 60% CPE	18.6	0.20	<b>7.2</b>	59.4	7.20	38.83	29.6
T5: Irrigation at 80% CPE	<b>21.4</b>	<b>0.23</b>	<b>7.2</b>	<b>65.2</b>	<b>8.20</b>	<b>44.16</b>	<b>30.2</b>
<b>SEm ±</b>	<b>0.6</b>	--	<b>NS</b>	<b>2.4</b>	<b>0.2</b>	--	<b>NS</b>
<b>CD at 5%</b>	<b>1.8</b>	--	--	<b>5.8</b>	<b>0.7</b>	--	--



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

**Centres :** **East Coast** : Bapatla, Jhargram and Vridhachalam  
**Plains / others :** Jagdalpur

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

### Experimental Details :

Planting of cashew at 4m x 4m under high density, with a control plot planted at 8m x 8m spacing with recommended fertilizer dosage.

### BAPATLA

During the year, maximum values were recorded in 4x4 m spacing with respect to the mean plant height (4.88m), mean canopy height (4.46m) and ground area coverage by canopy (160.5%). Whereas 8x8m spacing was recorded the highest mean trunk girth (71.81cm), mean canopy spread (6.49m) and mean canopy surface area (49.69m<sup>2</sup>) (Table 2.26).

**Table 2.26 : Growth parameters of cashew in normal and high density planting at Bapatla centre**

Spacing	Mean Plant height (m)	Mean Canopy Height (m)	Mean Trunk Girth (cm)	Mean canopy spread (m)	Mean Canopy surface area (m <sup>2</sup> )	Ground area coverage by canopy (%)
4m x 4m	4.88	4.46	68.36	5.72	47.50	160.5
8m x 8m	4.07	3.65	71.81	6.49	49.69	51.58

**Table 2.27 : Yield parameters of cashew in normal and high density planting at Bapatla centre**

Spacing	Date of first Flowering	Date of last Flowering	Duration of Flowering (days)	Mean Flowering laterals/ Sq.mt.	Mean no. of nut / m <sup>2</sup>	Mean no. of nuts/ panicle
4m x 4m	9.2.16	15.5.16	97	23.24	16.68	1.67
8m x 8m	9.2.16	21.5.16	103	24.22	26.35	2.82





Flowering duration was recorded minimum in 4x4m spacing (97.0 days), whereas mean number of flowering laterals, mean number of nuts/m<sup>2</sup> and mean number of nuts per panicle was found highest in 8x8 m spacing (24.22 , 26.35 and 2.82) (Table 2.27).

**Table 2.28 : Yield parameters of cashew in normal and high density planting at Bapatla centre**

Spacing	Mean Nut weight [g]	Mean Apple weight (g)	Nut yield (Kg/ha)	Mean Nut yield Kg/tree (Harvest No.9)	CNY Kg/tree (2008 -2016)
4m x 4m	5.19	43.01	<b>662.5</b>	1.06	13.19
8m x 8m	<b>6.08</b>	54.81	605.28	<b>3.88</b>	<b>21.00</b>

The mean nut yield was recorded highest in 8x8 m spacing (3.88kg/tree) and cumulative nut yield was also recorded highest in 8x8 m spacing (21.00kg/tree) for nine annual harvests (Table 2.28).

**Table 2.29 : Yield and B: C ratio in high density trials at Bapatla Centre**

Harvest	Yeild (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> harvest	268.75	50.00	-8875.00	-3240.00	-0.35	-0.51
2 <sup>nd</sup> harvest	400.00	71.76	-1000.00	-1934.4	-0.04	-0.31
3 <sup>rd</sup> harvest	515.00	112.5	5350.00	-292.5	0.19	-0.04
4 <sup>th</sup> harvest	587.5	142.0	10062.50	2210.0	0.35	0.31
5 <sup>th</sup> harvest	2000.0	436.8	111875.00	23556.0	3.97	3.35
6 <sup>th</sup> harvest	1825	567.8	96500.00	31946.0	3.08	4.09
7 <sup>th</sup> harvest	1487.5	650.52	80312.5	40987.5	2.57	5.25
8 <sup>th</sup> harvest	1012.5	486.7	51000.00	18936.0	1.76	2.05
9 <sup>th</sup> harvest	662.50	605.28	28750	23422	0.43	1.42

**Compilation of three years data**

With respect to the benefit cost ratio in case of 4x4 m spacing, B:C ratio increased up to 5<sup>th</sup> harvest (-0.35 to 3.97) and 6<sup>th</sup> harvest onwards B: C ratio started decreasing rate. Whereas B:C ratio for 8x8 m spacing increased from 1<sup>st</sup> harvest to 7<sup>th</sup> harvest (-0.51 to 5.25) from the 8<sup>th</sup> harvest onwards, B.C Ratio getting decreased (Table 2.29).

**JHARGRAM**

Maximum plant height, canopy spread, canopy area and flowering /m<sup>2</sup> were recorded in 8m x 8m





spacing. It was very clear that when plants were spaced at 8m x 8m, then nuts/m<sup>2</sup>, yield/tree were higher than the trees spaced at 4m x 4m. But yield per unit area (yield/ha) was more in case of trees spaced at 4m x 4m (4537.83 kg/ha) benefit to cost ratio was less in 4m x 4m (Table 2.30, 2.31 and 2.32).

**Table 2.30 : Growth parameters of cashew in normal and high density planting at Jhargram centre**

Spacing	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
4m x 4m	3.5	36.5	3.9	21.2	74.62
8m x 8m	4.1	48.3	5.5	37.0	37.1

**Table 2.31 : Yield parameters of cashew in normal and high density planting at Jhargram centre**

Spacing	Duration of flowering (days)		No. of panicles/m <sup>2</sup>	Nut weight (g)	Apple wt. (g)	Annual nut yield		Cum. nut yield (Kg/tree) 4 hvts)
	Range	Mean				(Kg/tree)	(kg/ha)	
4m x 4m		70	11.3	6.95	50.3	2.19	4537.83	7.26
8m x 8m		73	11.8	7.03	50.4	4.19	2220.75	14.24

**Table 2.32 : Yield and B:C ratio in high density trials at Jhargram centre**

Harvest	Yield (kg/ha.)		Net returns (Rs/ha.)		B:C ratio	
	(4m x 4m)	(8m x 8 m)	(4m x 4 m)	(8m x 8 m)	(4m x 4 m)	(8m x8 m)
1 <sup>st</sup> harvest	1056.3	416.5	55604.5	24580.4	3.0	5.4
2 <sup>nd</sup> harvest	693.8	184.1	30229.5	8309.6	1.6	1.8
3 <sup>rd</sup> harvest	750.0	497.6	34167.0	30258.8	1.9	6.6
4 <sup>th</sup> harvest	1365.8	653.3	77272.3	41154.6	4.2	9.0





## Hort.6: Intercropping in Cashew

**Centres:** **East Coast** : Bapatla, Jhargram and Vridhachalam  
**West Coast** : Madakkathara, Paria and Vengurla  
**Plains / others** : Kanabargi and Darisai

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.

### Experimental Details :

Main plot : 4  
 Sub plots : 3  
 F0 = No additional fertilizer to the intercrop  
 F1 = Additional fertilizer to the intercrop as per the state recommendation  
 F2 = 50% of additional fertilizer applied to the intercrop  
 No. of replications : 3  
 Design : Split plot

### BAPATLA

Among the different intercrops studied during the initial years of cashew the treatment T3 (Cashew +Hibiscus) recorded maximum yield of intercrop 4953 kg/ha and was superior over rest of the treatments and this was followed by T<sub>4</sub> (Cashew + Amaranthus) of 4368 kg/ha and T<sub>2</sub> (Cashew + Cluster Bean) recorded the lowest yield (2995 kg/ha).

Further the economics of growing intercrops, it is seen from the data presented in table that growing marigold as inter crop in cashew orchard give the higher net profit of Rs.89070/- with B:C ratio of 1.97 followed by Cluster bean Rs.60150/- and B:C ratio of 1.50 and the lowest net profit was obtained in growing cashew alone of Rs. 37510/- with B:C Ratio 1.87 (Table 2.33).

**Table 2.33 :Yield and economics of cashew and inter crops in intercropping trail at Bapatla centre**

Treatment details	Yield of intercrop		Yield of cashew		Cost of cultivation (Rs./ha)			Returns (Rs./ha)				C.B Ratio
	Kg/plot	Q/ha	Kg/ tree	Q/ ha	Cashew	Inter crop	Cashew + inter crop	Cashew	Inter crop	Total	Net	
T1 Cashew + Marigold	27.30	42.58	5	7.8	20000	25000	45000	70200	63870	134070	89070	1.97
T2 Cashew + Cluster bean	19.20	29.95	5	7.8	20000	20000	40000	70200	29950	100150	60150	1.50
T3 Cashew + Hibiscus	31.75	49.53	5.1	7.95	20000	15000	35000	79500	9906	89406	54406	1.55



T4 Cashew + Amaranthus	28.00	43.68	5.3	8.26	20000	15000	35000	74340	13104	87444	52444	1.49
T5 Cashew Alone	-	-	4.1	6.39	20000	---	20000	-----	-----	57510	37510	1.87
C.D.@5%	4.28	--	NS	--	--	--	--	--	--	--	--	--
S.Em. ±	1.37	--	0.14	--	--	--	--	--	--	--	--	--

**Sale Price (Rs/Kg)**

Hence it is seen that growing one of the inter crops in cashew in initial years is profitable.

Raw Cashew Nuts	: 90.00	Cluster bean	: 10.00
Marigold	: 15.00	Amaranthus	: 3.00
Hibiscus	: 2.00		

At Cashew Research Station the intercrop trial was conducted with Marigold, cluster bean, Hibiscus, Amaranthus. Among that cashew + Marigold were found as best intercrop under sandy soils situation of cashew plantations. The intercrop Cashew + Marigold has recorded maximum yield and consistent results for 6 years and gave the highest B:C ratio of 1.97.

**Compilation of three years data**

Different intercrops grown in initial years of cashew at Bapatla centre with Marigold, Cluster bean, Amaranthus, Hibiscus. Among all the intercrops Marigold has recorded maximum yield and B:C ratio (3.81, 2.09, 1.62 & 1.97) compared to other intercrops in all the four years. It performed consistently in all four years 2012-13, 2013-14, 2014-15 & 2015-16 respectively.

**JHARGRAM**

Cashew Variety BPP - 8 spaced at 6m x 6m and cowpea, okra, green gram and bottle gourd were grown as intercrops under the 5 year old plantation leaving 2.0 m space from the base of the cashew plants. The available space for intercrops was 65.08%. Benefit to cost ratio revealed that okra was the most profitable crop under cashew orchard followed by bottle gourd and cowpea (Table 2.34).

**Table 2.34 : Yield and economics of cashew and intercrops in intercropping trial at Jhargram Centre**

Treatment details	Yield of intercrop Q/ha	Yield of cashew Q/ha	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
			Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net	
Cashew + Cowpea	13.3	13.1		18000	89600	363253	26514	389767	336021	3.8
Cashew + Okra	15.1	15.8		11000	82600	438313	22657	460970	409555	5.0





Cashew + Bottle gourd	29.7	14.7	71600	9000	80600	409586	14864	424450	373702	4.6
Cashew + Green gram	3.6	12.1		16000	87600	335453	18077	353531	300452	3.4
Cashew alone	--	7.2			89600	201086		201086	153347	2.1
<b>SEm ±</b>									<b>27388</b>	<b>0.32</b>
<b>CD at 5%</b>									<b>59678</b>	<b>0.69</b>
<b>CV%</b>									<b>3.37</b>	<b>3.27</b>

## KANABARGI

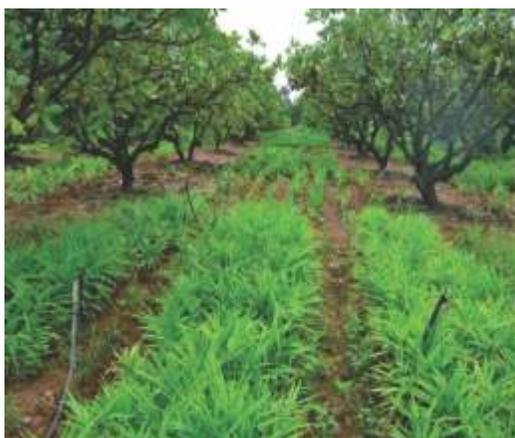
Table 2.35 : Yield and economics of cashew and intercrops in intercropping trial at Kanabargi Centre

Treatment details	Yield of intercrop	Yield of cashew	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Q/ha	Q/ha	Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net	
Cashew + Coleus	11.73	7.35	25,500	78,200	1,03,700	<b>168100</b>	1,40,400	3,08,500	2,04,800	1.97
Cashew + Cowpea	10.11	7.44	25,500	14,200	39,700	<b>174502</b>	45,495	219995	1,80,295	4.54
Cashew + Ginger	76.80	7.06	25,500	1,10,100	1,35,600	<b>168340</b>	2,15,040	383740	2,48,140	1.83
Cashew + Ground nut	14.62	7.40	25,500	23,500	49,000	<b>177400</b>	58,480	235880	1,86,880	3.81
Cashew + Sweet potato	116.06	6.95	25,500	49,800	75,300	<b>163200</b>	98,651	261851	1,86,551	2.48
Cashew + Turmeric	21.52	7.15	25,500	1,01,300	1,26,800	<b>173500</b>	1,66,780	340280	2,13,480	1.68
Cashew alone		6.71	25,500	<b>0</b>	25,500	<b>153800</b>	<b>0</b>	153800	1,28,300	5.03
<b>Mean</b>		<b>4.85</b>			--					
<b>SEm ±</b>		<b>NS</b>			--					



Net profit from main crop and intercrops was recorded from cashew + ginger intercrop (Rs. 2,48,140) followed by cashew + turmeric inter crop ( Rs. 2,13,480). Minimum was recorded in cashew + cowpea intercrop (Rs. 1,80,295).

Highest benefit to cost ratio was recorded in cashew alone (5.03) followed by cashew + cowpea intercrop (4.54) and cashew + ground nut (3.81) whereas minimum was recorded in Cashew + turmeric (1.68) (Table 2.35).



### Conclusion

In initial years of planting, to use open land effectively, it is profitable to grow intercrops like coleus, turmeric and Ginger. Further legumes like ground nut and cow pea can be grown to improve soil health and get additional income.

### MADAKKATHARA

The economic analysis of inter cropping in cashew garden with different medicinal plants revealed that *Koduveli (Plumbago zeylanica)* is the most economical followed by *Adlodakam (Adhatoda vasica)* (Table 2.36).

**Table 2.36 : Yield and economics of cashew and intercrops in intercropping trial at Madakkathara Centre**

Treatment details	Yield of intercrop	Yield of cashew	Cost of Cultivation (Rs/ha)			Returns (Rs/ha)				B:C Ratio
	Q/ha	Q/ha	Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net	
<i>Thippali</i>	17.15	6.5	14500	45000	59500	78000	30870	108870	49370	0.82
<i>Adalodakam</i>	51.50	5.8	14500	50000	64500	69600	103000	172600	108100	1.6





<i>Koduveli</i>	11.50	5.5	14500	45000	59500	66000	92000	158000	98400	1.65
<i>Kattarvazha</i>	70.00	5.8	14500	55000	69500	69600	84000	153600	84100	1.21
<i>Vayambu</i>	-	7.3	14500	40000	54500	87600	-	87600	-	-
<i>Panikkorka</i>	10.65	5.1	14500	45000	59000	61200	63900	125100	80100	1.35

### PARIA

The yield and economics of intercropping in cashew is presented in table. The highest inter crop yield/ha (25.00 q/ha) was recorded in treatment cashew + okra (T2) which was followed by treatment cashew + pigeon pea (T1) in gaining higher yield of intercrops. Highest net return of Rs. 1,35,286 ha<sup>-1</sup> was observed under the inter crop of okra (T2); whereas highest benefit:cost ratio (4.49) was observed under inter crop of pigeon pea (T1). The yield of cashew was found non-significant in all the treatments.

Looking to previous results for five years (2011-12 to 2015-16), the intercrop treatment T2 (cashew with okra) occupied first rank only one time where it occupied four times second position in terms of benefit:cost ratio. The intercrop treatment T1 (cashew with pigeon pea) occupied three times first position in terms of benefit:cost ratio. The difference between B:C ratios of the two treatments are also narrow. Thus it can be concluded that pigeon pea and okra found as best inter crops under study (Table 2.37).

**Table 2.37 : Yield and economics of cashew and intercrops in intercropping trial at Paria Centre**

Treatment details	Yield of intercrop	Yield of cashew	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Q/ha	Q/ha	Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net	
Cashew + Pigeon Pea	13.25	6.55	10000	12800	22800	72072	53000	125072	102272	4.49 <sup>1</sup>
Cashew + Okra	20.50	7.83	10000	22800	32800	86086	82000	168086	135286	4.12 <sup>2</sup>
Cashew + Indian bean (GW-2)	8.50	2.34	10000	10000	20000	25740	29750	55490	35490	1.77 <sup>6</sup>
Cashew + Indian bean (NPS-1)	9.75	2.91	10000	10000	20000	32032	34125	66157	46157	2.31 <sup>5</sup>



Cashew + Cowpea	5.00	5.28	10000	9200	19200	58058	15000	73058	53858	2.81 <sup>4</sup>
Cashew alone	0	3.87	10000	0	10000	42614	0	42614	32614	3.26 <sup>3</sup>

## VENGURLE

From the data presented in (Table 2.38), it is observed that treatment elephant foot yam (T<sub>4</sub>) recorded significantly the highest yield of 61.94 q/ha and at par with greater yam (56.76 q/ha) and both these treatments were found significantly superior over the rest of the treatments.

The main crop cashew in greater yam (T<sub>2</sub>) plot recorded significantly maximum nut yield of 13.47 q/ha and on par with all the treatments except the T<sub>5</sub> i.e. cashew in tapioca plot which recorded lowest nut yield of 11.69 q/ha.

The maximum net returns of Rs. 190322/- were obtained from cashew + greater yam (T<sub>2</sub>) with B:C ratio of 3.24:1, followed by cashew + elephant foot yam greater yam (T<sub>4</sub>) with B:C ratio of 3.15:1

**Table 2.38 : Yield and economics of cashew and intercrops in intercropping trial at Vengurle Centre**

Treatment details	Yield of intercrop	Yield of cashew	Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				B:C Ratio
	Q/ha	Q/ha	Cashew	Inter-crop	Cashew + Intercrop	Cashew	Inter-crop	Total	Net	
T <sub>1</sub> : Lesser Yam	23.16	<b>13.07</b>	48960	36051	85011	156840	92640	249480	164469	2.93:1
T <sub>2</sub> : Greater Yam	<b>56.76</b>	<b>13.47</b>	48960	35878	84838	161640	113520	275160	<b>190322</b>	<b>3.24:1</b>
T <sub>3</sub> : Aerial Yam	9.13	<b>13.14</b>	48960	34505	83465	157680	13695	171375	87910	2.05:1
T <sub>4</sub> :Elephant Foot Yam	<b>61.94</b>	<b>13.38</b>	48960	31585	80545	160560	92910	253470	172925	3.15:1
T <sub>5</sub> :Tapioca	15.47	11.69	48960	13920	62880	140280	6188	146468	83588	2.33:1
<b>Mean</b>	<b>33.29</b>	<b>12.95</b>	<b>48960</b>	<b>30388</b>	<b>79347.8</b>	<b>155400</b>	<b>63790.6</b>	<b>219191</b>	<b>139842.8</b>	-
<b>S.Em.±</b>	<b>3.57</b>	<b>0.28</b>	-	-	-	-	-	-	-	-
<b>CD at 5%</b>	<b>11.01</b>	<b>0.87</b>	-	-	-	-	-	-	-	-
<b>CV%</b>	<b>21.44</b>	<b>4.40</b>	-	-	-	-	-	-	-	-
<b>Control plot Av. cashew yield (q/ha)</b>	-	<b>10.50</b>	<b>48960</b>	-	<b>48960</b>	<b>126000</b>	-	<b>126000</b>	<b>77040</b>	<b>2.57:1</b>





- ##### Area planted with intercrop/ha- 3760 sq. m.  
##### Intercrop plot size - 24 sq. m.; No. of intercrop plots/ha. - 132  
# **Price of produce (Rs./kg):** lesser yam- 40/kg; greater yam- 20/ kg; aerial yam- 15/kg; elephant foot yam- 15/kg; Tapioca- 4/kg  
# Cashew raw nut: Rs.120/- per kg

The soil nutrient status after harvest of different intercrops as well cashew as main crop was estimated during the year 2015-16 and presented in the tables respectively.

The data presented in Table on soil nutrient status of different intercrops indicated that pH of the soil ranged from minimum 4.60 ( $T_1$ ) to maximum 5.10 ( $T_3$ ), electrical conductivity ranged between 0.048  $dSm^{-1}$  ( $T_2$ ) to 0.092  $dSm^{-1}$  ( $T_5$ ) while, organic carbon content varies from 0.7% ( $T_5$ ) to 1.36% ( $T_2$ ). Treatment  $T_2$  (greater yam) recorded significantly maximum available soil N (344.0 kg/ha) and at par with treatment  $T_3$  - aerial yam (331.38 kg/ha). Whereas, available  $P_2O_5$  and  $K_2O$  was found significantly maximum i.e. 20.32 kg/ha and 443.49 kg/ha respectively in  $T_5$  treatment - tapioca (Table 2.39).

**Table 2.39 : Soil analysis data of different intercrops in intercropping trial at Vengurle Centre**

Treatment details	pH (1:2.5)	EC $dS m^{-1}$	OC (%)	N (kg/ha)	$P_2O_5$ (kg/ha)	$K_2O$ (kg/ha)
$T_1$ : Lesser Yam	<b>4.60</b>	0.059	0.74	309.29 (M)	17.88 (M)	375.61 (VH)
$T_2$ : Greater Yam	4.67	<b>0.048</b>	<b>1.36</b>	<b>344.00</b> (M)	18.70 (M)	381.03 (VH)
$T_3$ : Aerial Yam	<b>5.10</b>	0.078	1.09	<b>331.38</b> (M)	17.23 (M)	381.57 (VH)
$T_4$ : Elephant Foot Yam	4.90	0.081	1.25	302.98 (M)	18.25 (M)	404.28 (VH)
$T_5$ : Tapioca	5.08	<b>0.092</b>	<b>0.70</b>	325.07 (M)	<b>20.32</b> (M)	<b>443.49</b> (VH)
<b>SEm <math>\pm</math></b>	-	-	-	<b>4.83</b>	<b>0.44</b>	<b>4.54</b>
<b>CD at 5%</b>	-	-	-	<b>14.91</b>	<b>1.35</b>	<b>14.01</b>

The data presented in (Table 2.40) with respect to soil nutrient status of cashew as main crop indicated that soil pH ranged from minimum 4.70 ( $T_3$ ) to maximum 5.32 ( $T_4$ ), electrical conductivity ranged between 0.046  $dSm^{-1}$  ( $T_2$ ) to 0.089  $dSm^{-1}$  ( $T_3$ ) and it showed safer limit for plant growth. While, organic carbon content varies minimum from 0.66% ( $T_4$ ) to maximum 1.25% ( $T_2$ ). Cashew in greater yam plot ( $T_2$ ) recorded significantly maximum available soil N (391.34 kg/ha) and superior over rest of the treatments. Whereas, available  $P_2O_5$  recorded significantly maximum (20.30 kg/ha) by cashew in tapioca plot ( $T_5$ ). While, available  $K_2O$  content in the soil was observed significantly higher (429.82 kg/ha) when cashew intercropped with Arial Yam ( $T_3$ ).



**Table 2.40 : Soil analysis data of cashew in intercropping trial at Vengurle centre**

<b>Treatment details</b>	<b>pH (1:2.5)</b>	<b>EC dS m<sup>-1</sup></b>	<b>OC (%)</b>	<b>N (kg/ha)</b>	<b>P<sub>2</sub>O<sub>5</sub> (kg/ha)</b>	<b>K<sub>2</sub>O (kg/ha)</b>
T <sub>1</sub> : Cashew in Lesser Yam plot	5.16	0.078	0.82	347.16 (M)	15.96 (M)	386.99 (VH)
T <sub>2</sub> : Cashew in Greater Yam plot	4.56	<b>0.046</b>	<b>1.25</b>	<b>391.34 (M)</b>	18.07(M)	415.71 (VH)
T <sub>3</sub> : Cashew in Aerial Yam plot	<b>4.70</b>	<b>0.089</b>	1.48	356.63 (M)	18.29 (M)	<b>429.82 (VH)</b>
T <sub>4</sub> : Cashew in Elephant Foot Yam plot	<b>5.32</b>	0.072	<b>0.66</b>	332.04 (M)	17.84 (M)	415.04 (VH)
T <sub>5</sub> : Cashew in Tapioca plot	5.08	0.052	0.97	318.76 (M)	<b>20.30 (M)</b>	400.25 (VH)
<b>S.Em. ±</b>	-	-	-	<b>2.64</b>	<b>0.34</b>	<b>4.54</b>
<b>CD at 5%</b>	-	-	-	<b>8.14</b>	<b>1.05</b>	<b>14.02</b>





## Hort.7: Organic Management of Cashew

**Centres:** **East Coast** : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara and Vengurla  
**Plains / others** : Hogalagere, Kanabargi and Jagdalpur

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.

### Treatments:

- T<sub>1</sub>- 100 % N as FYM
- T<sub>2</sub>- 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g
- T<sub>3</sub>- 50 % N as FYM + Bio-fertilizers (200 g)
- T<sub>4</sub>- 100 % N as Vermicompost + Bio-fertilizers (200 g)
- T<sub>5</sub>- Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)
- T<sub>6</sub>- *In situ* green manuring / green leaf manuring to meet 100 % N
- T<sub>7</sub>- 25 % N as FYM + Recycling of organic residue + *In situ* green manuring / green leaf manuring + Bio-fertilizers (200 g)
- T<sub>8</sub>- Recommended doses of fertilizer + 10 kg FYM (Control)

### BHUBANESWAR

The experiment was laid out during the year 2007 in Randomized Block Design with eight treatments of different organic sources on cashew variety H 2/16 (BPP-8) planted at a spacing of 7m x 7m. Only farmyard manure was applied to all the plants during planting.

There were significant variations for nut weight, apple weight, annual nut yield (kg/tree) as well as flowering laterals /panicle due to various organic management inputs. Recommended doses of fertilizer +10kg FYM (Control) T<sub>8</sub> was found to produced significantly highest apple weight (61.51g), nut weight (8.28g), as well as annual nut yield of 1288.24kg/ha than rest of the treatments. Maximum number of panicles/m<sup>2</sup> (21.88) was observed in treatment T<sub>2</sub>. However, stastical parity was observed for most of the parameters with T<sub>7</sub> and T<sub>2</sub>. The results of cumulative nut yield/tree over 7<sup>th</sup> harvest revealed wide variations from 10.18kg in T<sub>6</sub> to maximum of 21.87kg in T<sub>8</sub> in variety BPP-8. The overall results observed during the year revealed the superiority of both T<sub>8</sub> and T<sub>2</sub> among the different organic sources towards cashew production (Table 2.42).



**Table 2.41 : Growth parameters of cashew under organic management at Bhubaneswar centre**

<b>Treatment</b>	<b>Tree height (m)</b>	<b>Stem girth (cm)</b>	<b>Canopy diameter (m)</b>	<b>Canopy surface area (m<sup>2</sup>)</b>	<b>Ground coverage by canopy (%)</b>
T1 - 100 % N as FYM	5.13	73.82	8.26	51.19	104.38
T2 - 100 % N as FYM + Bio-fertilizers Consortium (BFC) 200 g	4.83	74.29	8.31	50.14	108.16
T3 - 50 % N as FYM + BFC (200 g)	4.68	66.81	7.82	46.04	96.24
T4 - 100 % N as Vermicompost + BFC (200 g)	4.61	59.64	8.11	51.08	101.15
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	4.90	72.21	7.42	43.61	92.68
T6 – In situ green manuring / green leaf manuring to meet 100 % N	4.83	68.14	7.61	45.21	96.41
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + BFC (200 g)	4.96	70.81	8.21	52.26	102.92
T8 – Recommended doses of fertilizer + 10 kg FYM (Control)	5.36	73.10	8.72	7.11	114.41
<b>SEm ±</b>	<b>0.16</b>	<b>1.28</b>	<b>0.20</b>	<b>1.49</b>	<b>2.50</b>
<b>CD at 5%</b>	<b>0.48</b>	<b>3.83</b>	<b>0.59</b>	<b>4.46</b>	<b>7.49</b>
<b>CV%</b>	<b>5.63</b>	<b>3.16</b>	<b>4.26</b>	<b>5.19</b>	<b>4.29</b>



**Table 2.42 : Yield parameters of cashew under organic management at Bhubaneswar centre**

Treatment	No. of panicles/ m <sup>2</sup>	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (Kg/tree) (7 <sup>th</sup> No. of hvts)
T1 - 100 % N as FYM	20.16	7.74	54.16	980.26	12.26
T2 - 100 % N as FYM + Bio-fertilizers Consortium(BFC) 200 g	22.14	8.20	58.01	1026.59	1.14
T3 - 50 % N as FYM + BFC (200 g)	21.05	7.81	53.62	960.26	13.31
T4 - 100 % N as Vermicompost + BFC (200 g)	21.65	8.05	60.63	1006.17	13.01
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	19.07	7.96	52.26	905.34	11.91
T6 – In situ green manuring / green leaf manuring to meet 100 % N	18.62	7.80	50.9	860.86	10.18
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + BFC (200 g)	21.13	8.16	55.17	1084.56	16.24
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	21.88	8.28	61.51	1288.24	21.87
<b>Mean</b>	<b>20.71</b>	<b>8.00</b>	<b>55.79</b>	<b>1014.04</b>	<b>14.24</b>
<b>SEm<math>\pm</math></b>	<b>0.65</b>	<b>0.24</b>	<b>1.54</b>	<b>9.96</b>	<b>--</b>
<b>CD at 5%</b>	<b>1.95</b>	<b>0.73</b>	<b>4.61</b>	<b>29.86</b>	<b>--</b>
<b>CV%</b>	<b>5.44</b>	<b>5.25</b>	<b>4.78</b>	<b>1.70</b>	<b>--</b>

**HOGALAGERE**

The cashew plants in experimental plot are two years old and hence flowering and yield parameters were not available.



**Table 2.43 : Growth parameters of cashew under organic management at Hogalagere centre**

<b>Treatment</b>	<b>Tree height (m)</b>	<b>Stem girth (cm)</b>	<b>Canopy diameter (m)</b>	<b>Canopy surface area (m<sup>2</sup>)</b>	<b>Ground coverage by canopy (%)</b>
T1 - 100 % N as FYM	1.80	5.50	1.33	2.89	2.83
T2 - 100 % N as FYM + Bio-fertilizers (Azotobacter + Azospirillum + PSB) 200 g	1.85	5.53	1.67	4.20	4.47
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	1.70	5.48	1.41	3.23	3.18
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	1.86	5.55	1.71	4.45	4.71
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	1.65	5.35	1.33	2.87	2.83
T6 - In situ green manuring / green leaf manuring to meet 100 % N	1.70	5.45	1.33	2.86	2.82
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	1.85	5.55	1.70	4.39	4.63
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	1.96	5.65	1.80	4.89	5.17
Mean	1.80	<b>5.51</b>	1.54	<b>3.72</b>	<b>3.83</b>
SEm ±	0.08	0.18	0.07	<b>0.32</b>	<b>0.34</b>
CD at 5%	0.24	0.53	0.20	<b>0.96</b>	<b>1.02</b>
CV%	<b>7.61</b>	<b>5.50</b>	<b>7.31</b>	<b>14.76</b>	<b>15.24</b>



**JHARGRAM**

There was no significant difference observed among the treatments in terms of their response on Growth and yield parameters studied.

**Table 2.44 :** Growth parameters of cashew under organic management at Jhargram centre

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
T1 - 100 % N as FYM	4.8	68.3	7.1	57.1	62.1
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	5.0	67.8	6.8	55.9	58.0
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	5.0	67.0	7.2	58.8	64.3
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	4.8	67.5	7.5	59.7	69.3
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	4.8	62.3	6.3	48.5	49.1
T6 - In situ green manuring / green leaf manuring to meet 100 % N	4.7	61.3	8.3	57.4	84.5
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	4.8	64.8	6.6	50.0	54.6
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	4.6	73.3	7.3	56.0	65.9
<b>Mean</b>	<b>4.81</b>	<b>66.54</b>	<b>6.31</b>	<b>55.4</b>	<b>56.23</b>
<b>SEm ±</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
<b>CD at 5%</b>					



**Table 2.45 :** Effect of tree density and fertilizer levels on yield parameters of cashew at Jhargram Centre

Treatment	Duration of flowering (days)	No. of panicles/ m <sup>2</sup>	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (Kg/tree) 6 hvts)
T1 - 100 % N as FYM	67	7.6	7.5	50.5	7.9	31.2
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	66	9.3	7.2	51.0	6.7	26.9
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	65	4.4	7.3	52.2	5.9	24.8
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	67	4.4	7.3	50.6	6.5	19.9
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	64	8.4	7.4	50.3	6.2	19.4
T6 - In situ green manuring / green leaf manuring to meet 100 % N	68	6.1	7.4	50.6	5.4	21.7
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	67	8.7	7.3	49.5	6.3	20.8
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	67	6.4	7.5	50.2	3.9	18.5
<b>Mean</b>	<b>66.4</b>	<b>6.9</b>	<b>7.4</b>	<b>50.6</b>	<b>6.1</b>	<b>22.9</b>
<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>

**Constraints:** As biofertilizer consortium was not obtained from IIHR, Bengaluru therefore we used biofertilizer produced by Nodule Research Centre, BCKV, Jhargram.



**KANABARGI****Table 2.46 : Growth parameters of cashew under organic management at Kanabargi centre**

<b>Treatment</b>	<b>Tree height (m)</b>	<b>Stem girth (cm)</b>	<b>Canopy diameter (m)</b>	<b>Canopy surface area (m<sup>2</sup>)</b>
T1 - 100 % N as FYM	2.98	10.08	2.82	15.64
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	4.74	15.67	3.30	24.49
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	2.71	9.81	2.78	14.70
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	2.65	9.78	3.17	16.43
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	2.88	9.83	2.75	16.00
T6 – In situ green manuring / green leaf manuring to meet 100 % N	2.46	8.31	2.53	13.37
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	2.82	10.00	3.37	18.39
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	2.56	10.08	2.94	16.01
<b>Mean</b>	<b>2.97</b>	<b>10.44</b>	<b>2.96</b>	<b>16.88</b>
<b>CD at 5%</b>	<b>0.88</b>	<b>3.70</b>	—	—
<b>SEm ±</b>	<b>0.29</b>	<b>1.22</b>	—	—



**Table 2.47 : Effect of tree density and fertilizer levels on yield parameters of cashew at Kanabargi centre**

<b>Treatment</b>	<b>Annual nut yield (kg/ha)</b>	<b>Cum. nut yield (Kg/tree)</b>
T1 - 100 % N as FYM	635.69	973.56
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	675.54	1027.34
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	315.07	614.27
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	299.31	604.01
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	325.26	621.66
T6 – In situ green manuring / green leaf manuring to meet 100 % N	212.21	561.21
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	280.78	577.18
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	383.64	671.74
<b>Mean</b>	<b>390.94</b>	
<b>SEm ±</b>	<b>250.06</b>	
<b>CD at 5%</b>	<b>82.44</b>	

Highest tree height (4.74 m), trunk girth (15.67 cm), trunk height (0.5 cm) and canopy height (4.24 m) was with 100% N from FYM+Bio fertilizer consortium (200g/tree/year). No significant difference was with respect to canopy diameter and canopy surface area among all the treatments. Similarly nut yield in kg/tree (2.43) and (2.29) and kg/ha (675.54) and (635.69) respectively was highest with 100% N from FYM+Bio fertilizer consortium (200g/tree/year) which was on par with 100% N from FYM (Table 2.46 and 2.47).





## MADAKKATHARA

Statistical analysis of the data recorded significant variation among the treatments with respect to growth parameters viz., height, girth, canopy surface area and ground coverage by canopy. There was significant effect for different treatments on yield parameters of cashew. Highest duration of flowering was observed in T7 (120days), maximum flowering laterals/panicles in T2 (8nos.) and highest nut weight in T7 (8.13). Lowest nut weight (6.20g) was recorded in T6. Highest annual nut yield was recorded in T5 (3.84kg/ha) followed by T3 (3.52kg/ha) and maximum cumulative nut yield in T3 (11.04kg/tree) followed by T6 (10.80kg/tree) (Table 2.48 and 2.49).

**Table 2.48 : Growth parameters of cashew under organic management at Madakkathara centre**

Treatment	Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
T1 - 100 % N as FYM	4.96	65.91	6.84	26.33	56.10
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	4.75	66.38	6.69	32.81	56.53
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	4.36	61.41	6.63	36.74	56.83
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	4.96	74.08	7.37	34.03	58.23
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	4.82	65.08	7.11	36.38	60.33
T6 – In situ green manuring / green leaf manuring to meet 100 % N	5.04	62.26	7.34	32.28	65.83
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	5.07	71.75	7.08	33.87	68.76
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	4.42	62.58	6.43	40.51	66.70



<b>Mean</b>	<b>4.80</b>	<b>66.18</b>	<b>6.93</b>	<b>34.11</b>	<b>61.16</b>
<b>SEm ±</b>	<b>0.55</b>	<b>3.77</b>	<b>1.04</b>	<b>3.67</b>	<b>3.67</b>
<b>CD at 5%</b>	<b>0.53</b>	<b>10.43</b>	<b>0.93</b>	<b>6.30</b>	<b>8.24</b>
<b>CV%</b>	<b>10.71</b>	<b>15.02</b>	<b>9.31</b>	<b>17.61</b>	<b>12.84</b>

**Table 2.49 : Effect of tree density and fertilizer levels on yield parameters of cashew at Madakkathara Centre**

Treatment	Duration of flowering (days)		No. of panicles/ m <sup>2</sup>	Nut weight (g)	Apple wt. (g)	Annual nut yield (kg/ha)	Cum. nut yield (Kg/tree) (3 No. of hvts)
	Range	Mean					
T1 - 100 % N as FYM	94-124	109	6.0	7.6	74.66	3.35	9.92
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	88-138	113	8.0	7.16	72.33	2.56	9.60
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	96-118	107	6.66	7.33	68.66	3.52	11.04
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	87-127	107	7.0	7.83	72.00	3.50	10.55
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	90-108	99	6.66	7.73	66.66	3.84	10.24
T6 - In situ green manuring / green leaf manuring to meet 100 % N	86-120	103	5.33	6.20	81.00	3.00	10.80
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	100-140	120	6.33	8.13	77.66	3.25	10.16
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	95-135	115	6.33	8.06	73.00	2.77	9.28
<b>Mean</b>	-	<b>109.12</b>	<b>6.53</b>	<b>7.50</b>	<b>73.24</b>	<b>3.22</b>	<b>10.20</b>
<b>SEm ±</b>		<b>4.40</b>	-	<b>0.45</b>	<b>2.69</b>	-	<b>0.64</b>
<b>CD at 5%</b>		<b>9.24</b>	<b>2.18</b>	<b>0.96</b>	<b>5.66</b>	<b>0.71</b>	<b>1.36</b>
<b>CV%</b>		<b>8.05</b>	<b>31.84</b>	<b>12.2</b>	<b>7.36</b>	<b>21.26</b>	<b>12.73</b>



## VENGURLE

Data pertaining to vegetative growth parameters during the period under reporting was recorded and presented in (Table 2.50). It is revealed from the data that there was no significant difference among the various treatments in respect of growth attributes.

**Table 2.50 : Growth parameters of cashew under organic management at Vengurle centre**

Treatment		Tree height (m)	Stem girth (cm)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Ground coverage by canopy (%)
T1	100 % N as FYM	3.87	50.33	4.37	26.79	30.95
T2	100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	4.13	51.16	4.36	28.68	31.34
T3	50% N as FYM + BCF (200g/tree) + Rock phosphate	3.86	50.89	4.03	24.32	26.15
T4	100% N as Vermicompost + BCF (200g/tree)	3.96	<b>49.33</b>	4.36	26.67	31.10
T5	Recycling of organic residue with the addition of 20 % cow dung slurry (20% weight of organic residue as cow dung slurry)	3.91	50.50	<b>3.85</b>	24.21	<b>23.10</b>
T6	<i>In situ</i> green manuring/green leaf manuring to meet 100% (Retain litter + planting cowpea)	<b>4.51</b>	<b>53.83</b>	<b>4.72</b>	<b>33.17</b>	<b>35.93</b>
T7	25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring/green leaf manuring + BCF (200g/tree)	<b>3.50</b>	51.33	4.23	<b>23.42</b>	28.73
T8	Recommended dose of fertilizer + 10 kg FYM (Control)	4.47	52.50	4.64	32.77	35.08
<b>Mean</b>		<b>4.03</b>	<b>51.24</b>	<b>4.32</b>	<b>27.50</b>	<b>30.38</b>
<b>SEm±</b>		<b>0.30</b>	<b>2.67</b>	<b>0.36</b>	<b>4.05</b>	<b>4.88</b>
<b>CD @ 5%</b>		<b>N.S.</b>	<b>N.S.</b>	<b>N.S.</b>	<b>N.S.</b>	<b>NS</b>
<b>CV %</b>		<b>13.00</b>	<b>9.04</b>	<b>13.49</b>	<b>25.51</b>	<b>27.80</b>

The various organic treatments had significantly influenced the flowering, fruiting and yield attributes except the flowering duration (Table 2.51). The treatment T<sub>5</sub> (Recycling of organic residue with the addition of 20 % cow dung slurry) recorded significantly the maximum flowering panicles/m<sup>2</sup>



(25.60/m<sup>2</sup>) and nut weight (9.27 g) however, it was found on par with all the treatments except T<sub>1</sub>(8.27 g) and T<sub>8</sub> (8.57 g) with respect to nut weight. Whereas, significantly the maximum apple weight (116.6 g) was recorded in T<sub>1</sub> (100 % N as FYM) and it was on par with treatment T<sub>4</sub> - 100% N as Vermicompost + BCF (110.0g).

The annual nut yield of cashew cv. Vengurla-4 under organic management was recorded significantly maximum 1412.3 kg/ha in treatment T<sub>4</sub>(100% N as Vermicompost + BCF) however, it was on par with treatments T<sub>8</sub>(1332.8 kg/ha), T<sub>6</sub> (1285.2 kg/ha) and T<sub>2</sub>(1276.4 kg/ha) while, the lowest yield of 540.60 kg/ha was obtained by recycling of organic residue with the addition of 20 % cow dung slurry (T<sub>5</sub>). Cumulative yield for last 5 harvests was observed maximum in treatment T<sub>8</sub>(25.83 kg/tree).

**Table 2.51 : Effect of tree density and fertilizer levels on yield parameters of cashew at Vengurle centre**

Treatment	Duration of flowering (days)		Flow. panicl. /m <sup>2</sup>	Nut wt. (g)	Apple wt. (g)	Annu. nut yield (kg/ha)	Cum. nut yield (kg/tree) 5 <sup>th</sup> harvest
	Range	Mean					
T1 100 % N as FYM	84-102	95.00	16.70	8.27	<b>116.6</b>	970.4	16.07
T2 100% N as FYM + Biofertilizers consortium (BCF) (200g/tree)	85-107	<b>97.67</b>	16.50	<b>8.83</b>	81.7	<b>1276.4</b>	20.16
T3 50% N as FYM + BCF (200g/tree) + Rock phosphate	87-102	94.00	16.53	<b>9.23</b>	96.6	776.6	16.51
T4 100% N as Vermicompost + BCF (200g/tree)	86-104	95.33	16.03	<b>8.83</b>	<b>110.0</b>	<b>1412.3</b>	18.03
T5 Recycling of organic residue with the addition of 20 % cow dung slurry (20% weight of organic residue as cow dung slurry)	85-102	94.33	<b>25.60</b>	<b>9.27</b>	90.0	540.6	11.08
T6 <i>In situ</i> green manuring /green leaf manuring to meet 100% (Retain litter +planting cowpea)	87-100	94.33	15.50	<b>8.90</b>	83.3	<b>1285.2</b>	19.15





T7	25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring/green leaf manuring + BCF (200g/tree)	90-104	95.33	18.87	<b>9.03</b>	90.0	750.7	17.14
T8	Recommended dose of fertilizer + 10 kg FYM (Control)	88-103	94.33	15.63	8.57	95.0	<b>1332.8</b>	<b>25.83</b>
	<b>Mean</b>	-	<b>95.04</b>	<b>17.67</b>	<b>8.87</b>	<b>95.41</b>	<b>1043.12</b>	<b>17.99</b>
	<b>SEm ±</b>	-	<b>1.33</b>	<b>0.72</b>	<b>0.17</b>	<b>4.16</b>	<b>141.42</b>	-
	<b>CD @ 5%</b>	-	<b>NS</b>	<b>2.19</b>	<b>0.53</b>	<b>12.62</b>	<b>428.97</b>	-
	<b>CV %</b>	-	<b>2.43</b>	<b>7.10</b>	<b>7.42</b>	<b>7.55</b>	<b>23.48</b>	-

The data on economics of cashew under organic management (Table 2.52) revealed that the maximum net returns of Rs. 1,30,423/- was obtained from treatment T<sub>4</sub> (100% N as Vermicompost + BCF) with B:C ratio of 4.34:1.

**Table 2.52 : Yield and economics of cashew under organic management at Vengurle Centre**

Treatment details		Yield of cashew (kg/ha)	Cost of Cultivation (Rs./ha)	Returns (Rs./ha)		B:C Ratio
				Total	Net	
T1	100 % N as FYM	970.36	114000	116443	2443	1.02:1
T2	100% N as FYM + BCF (200g/tree)	1276.36	117060	153163	36103	1.31:1
T3	50% N as FYM + BCF (200g/tree) + Rock phosphate	776.56	76260	93187	16927	1.22:1
T4	100% N as Vermicompost + BCF (200g/tree)	<b>1412.36</b>	39060	169483	<b>130423</b>	<b>4.34:1</b>
T5	Recycling of organic residue with the addition of 20 % cow dung slurry (20% weight of organic residue as cow dung slurry)	<b>540.60</b>	42120	64872	22752	1.54:1
T6	<i>In situ</i> green manuring /green leaf manuring to meet 100% (Retain litter + planting cowpea)	1285.20	40080	154224	114144	3.85:1
T7	25% N as FYM + Recycling of organic residues + <i>In situ</i> green manuring/green leaf manuring + BCF (200g/tree)	750.70	59460	90084	30624	1.52:1
T8	Recommended dose of fertilizer + 10 kg FYM (Control)	1332.80	42467	159936	117469	3.77:1



The treatment-wise soil nutrient status after harvest of crop was estimated during the year. The data presented in Table indicated that experimental site was lateritic clay loam in texture, pH of the soil ranged from minimum 3.92 ( $T_5$ ) to maximum 4.98 ( $T_2$ ) while, electrical conductivity ranged from 0.029  $dSm^{-1}$  ( $T_4$ ) to 0.071  $dSm^{-1}$  ( $T_5$ ). Treatment  $T_3$  (50% N as FYM + BCF + Rock phosphate) recorded significantly maximum available soil N (359.78 kg/ha) while, available  $P_2O_5$  was found significantly maximum in  $T_5$  (18.64 kg/ha) and at par with  $T_8$  (18.25 kg/ha). Whereas, available  $K_2O$  recorded significantly maximum in  $T_6$  (421.68 kg/ha) and superior over rest of the treatments.

### VRIDHACHALAM

**Table 2.53 : Growth parameters of cashew under organic management at Vridhachalam centre**

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy diameter (m)	Mean canopy surface area ( $m^2$ )	Ground coverage by canopy (%)
T1 - 100 % N as Locally available source (FYM)	5.10	54.2	6.45	58.93	61.58
T2 - 100 % N as FYM + Bio-fertilizers consortium( 200 g/tree/year)	5.02	53.8	6.48	59.48	64.60
T3 - 50 % N as FYM + Bio-fertilizers Consortium (200 g) + Rock phosphate	4.95	52.4	6.60	61.70	62.58
T4 - 100 % N as Vermicompost + Bio-fertilizers consortium( 200 g/tree/year)	4.97	54.6	6.62	62.08	65.62
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20 % weight of organic residue as cow dung slurry)	5.02	51.8	7.00	69.41	67.69
T6 – In situ green manuring / green leaf manuring to meet 100 % N	5.10	56.4	6.90	67.44	65.62
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers consortium( 200 g/tree/year)	5.27	58.4	6.80	65.50	63.59
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	<b>5.48</b>	<b>59.8</b>	<b>7.35</b>	<b>76.52</b>	<b>80.76</b>
<b>CD @ 5%</b>	<b>0.302</b>	<b>2.512</b>	<b>0.312</b>	<b>1.625</b>	<b>3.721</b>
<b>SEm±</b>	<b>0.095</b>	<b>1.151</b>	<b>0.175</b>	<b>0.821</b>	<b>1.752</b>
<b>CV %</b>	<b>3.40</b>	<b>3.25</b>	<b>3.24</b>	<b>3.75</b>	<b>3.24</b>





**Table 2.54 : Yield parameters of cashew under organic management at Vridhachalam Centre**

Treatment	Duration of flowering (days)		Mean flowering laterals/panicles per m <sup>2</sup>	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield (kg/ha)*	Cum. nut yield (Kg/tree) (7 hvts)
	Range	Mean					
T1 - 100 % N as FYM	60-70	65	20.0	6.9	55.2	1050	27.15
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	59-71	65	17.0	6.8	55.0	956	26.68
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	63-69	66	16.5	6.8	56.2	960	25.5
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	61-71	66	16.5	6.8	55.4	1090	29.75
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	61-69	65	15.0	6.9	57.4	1050	28.35
T6 - In situ green manuring / green leaf manuring to meet 100 % N	62-70	66	19.2	6.9	55.6	1060	27.10
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	60-70	65	19.4	6.9	55.8	1150	31.25
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	64-72	68	<b>22.0</b>	<b>7.1</b>	<b>58.0</b>	<b>1470</b>	<b>35.75</b>
<b>CD @ 5%</b>		<b>3.85</b>	<b>1.042</b>	<b>0.401</b>	<b>3.425</b>	<b>0.302</b>	<b>0.812</b>
<b>SEm±</b>		<b>1.819</b>	<b>0.501</b>	<b>0.190</b>	<b>1.381</b>	<b>0.131</b>	<b>0.348</b>
<b>CV %</b>		<b>3.30</b>	<b>3.421</b>	<b>3.25</b>	<b>3.413</b>	<b>3.321</b>	<b>3.402</b>

**Table 2.55 : Cost benefit ratio of cashew under organic management at Vridhachalam Centre**

Treatment	Materials required	Cost of Material	Cost of Cultivation	Mean annual nut yield (kg/ha)*	Income @Rs.100/Kg of raw nuts	BC ratio
T1 - 100 % N as FYM	FYM 40 tonnes	20000	35000	1050	105000	3:1
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	40 T FYM and Biofertilizers	24000	39000	956	95600	2.5:1
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	20 T FYM & Biofertilizers	14000	29000	960	96000	3.3:1



T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	10 T Vermicompost	50000	65000	1090	109000	<b>1.7:1</b>
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	Organic residue collection and labour cost	15000	30000	1050	105000	3.5:1
T6 – In situ green manuring / green leaf manuring to meet 100 % N	Growing cost of green manure 3 seasons	20000	35000	1060	106000	3:1
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	FYM 10 tonnes + Growing cost of green manure	20000	35000	1150	115000	3.3:1
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	Urea 440 Kg SSP 150 Kg Potash 80 Kg FYM 2 T	5000	20000	<b>1470</b>	147000	<b>7.4:1</b>

The Benefit to cost ratio is high (7.4:1) in T8 with recommended dose of fertilizers and lowest in T4 (1.7:1) with 100 per cent Nitrogen given in the form of vermicompost. The lower benefit cost ratio is due to high cost of vermicompost (Table 2.55).





## Evaluation of production potential of newly developed cashew variety Jhargram-2 at different spacing

**Centres:**      **East Coast**      : Jhargram  
                  **West Coast**     : Paria  
                  **Plains / others** : Darisai

The objective of this trial is to arrive at appropriate spacing for Jhargram-2 at different centres.

### JHARGRAM

Table 2.56 : Effect of different levels of spacing on growth of cashew at Jhargram Centre

Treatments	Plant height (m)	Trunk girth (cm)	Mean canopy diameter (m)	Percent ground cover area	Canopy surface area (m <sup>2</sup> )
S <sub>1</sub> - 10m X 10m	1.7	17.0	2.2	3.7	6.9
S <sub>2</sub> - 8m x 8m	1.8	17.3	2.4	7.0	8.1
S <sub>3</sub> - 7m X 5m	1.6	18.3	2.6	15.0	8.3
S <sub>4</sub> - 4m x 4m	2.1	17.0	2.2	25.1	8.4
<b>Mean</b>	<b>1.8</b>	<b>17.37</b>	<b>2.33</b>	<b>12.7</b>	<b>7.94</b>
<b>SEm±</b>	<b>0.08</b>	<b>0.76</b>	<b>0.12</b>	<b>1.89</b>	<b>0.68</b>
<b>CD (5%)</b>	<b>0.38</b>	<b>3.63</b>	<b>0.57</b>	<b>9.04</b>	<b>3.25</b>



## Hort.8 : Spacing cum fertilizer trial

Centres: Plains / others : Darisai, Kanabargi, Paria and Tura

The objective of this trial is to arrive at an appropriate spacing and fertilizer doses for maximizing returns from cashew.

### PARIA

The results on effect of different levels of spacing and fertilizers on growth and yield of cashew at Paria are presented in Table 2.57. This year was second year of fruiting. All the growth as well as yield parameters were observed to be non-significant at individual as well as interaction level. Earlier year (2014-15) data showed some level of significance in case of yield parameters which may be due to the first fruiting year.

Table 2.57 : Effect of different levels of spacing and fertilizers on growth and yield of cashew at Paria

Treatments	Trunk girth (m)			Mean of Spacing	SEm/ CD at 5%	Pl.ht. (m)			Mean of Spacing	SEm/ CD at 5%
	F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>			F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>		
S <sub>1</sub>	0.51	0.43	0.41	0.44	0.314/ NS	3.88	3.63	3.68	3.73	0.347/ NS
S <sub>2</sub>	0.48	0.55	0.41	0.48		4.17	4.73	3.32	4.07	
S <sub>3</sub>	0.44	0.49	0.40	0.44		4.93	4.18	3.53	4.22	
Mean of Ferti.	0.47	0.49	0.40			4.33	4.18	3.51		
SEm/ CD at 5%	0.045/NS					0.352/NS				
Interaction effect:						Interaction effect:				
SEm/ CD at 5%	0.077/NS					0.610/NS				
CV%	29.34					26.37				



Treatments	Mean canopy area (m)			Mean of Spacing	SEm/CD at 5%	No. of nuts/plant			Mean of Spacing	SEm/CD at 5%
	F1	F2	F3			F1	F2	F3		
S1	4.58	4.41	4.42	4.47	0.367/ NS	288.33	158.50	131.33	192.72	62.412/ NS
S2	4.83	5.69	4.24	4.92		301.00	244.00	325.50	290.17	
S3	4.27	4.97	3.88	4.37		204.50	212.33	237.17	218.00	
<b>Mean of Ferti.</b>	<b>4.56</b>	<b>5.02</b>	<b>4.18</b>			<b>264.61</b>	<b>204.94</b>	<b>231.33</b>		
<b>SEm/CD at 5%</b>	<b>0.457/NS</b>					<b>38.991/NS</b>				
<b>Interaction effect:</b>						<b>Interaction effect:</b>				
<b>SEm/CD at 5%</b>	<b>0.792/NS</b>					<b>67.535/NS</b>				
<b>CV%</b>	<b>29.90</b>					<b>50.07</b>				
Treatments	Yield kg/plant			Mean of Spacing	SEm/CD at 5%	Yield q/ha			Mean of Spacing	SEm/CD at 5%
	F1	F2	F3			F1	F2	F3		
S1	2.243	1.215	1.031	1.496	0.506/ NS	8.97	4.86	4.12	5.98	1.140/ NS
S2	2.380	1.933	2.583	2.298		5.61	4.56	6.10	5.42	
S3	1.609	1.677	1.867	1.718		2.51	2.62	2.91	2.68	
<b>Mean of Ferti.</b>	<b>2.076</b>	<b>1.609</b>	<b>1.827</b>			<b>5.70</b>	<b>4.01</b>	<b>4.38</b>		
<b>SEm/CD at 5%</b>	<b>0.305/NS</b>					<b>0.884/NS</b>				
<b>Interaction effect:</b>						<b>Interaction effect:</b>				
<b>SEm/CD at 5%</b>	<b>0.529/NS</b>					<b>1.531/NS</b>				
<b>CV%</b>	<b>49.88</b>					<b>56.48</b>				



## KANABARGI

**Table 2.58 :** Vegetative and yield parameters in cashew as influenced by three spacing levels during the year at Kanabargi Centre

Treatments	Tree height (m)	Trunk girth (cm)	Trunk height (m)	Canopy height (m)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Nut yield kg/tree	Nut yield kg/ha
Spacing 1 (8m x 8m)	3.05	11.80	0.99	2.06	3.23	23.02	1.55	241.80
Spacing 2 (10m x 10m)	2.96	11.84	0.96	2.00	2.78	17.80	0.93	381.56
Spacing 3 (6.5 x 6.5m)	2.80	10.98	0.82	1.98	2.91	19.09	0.97	383.41
<b>Treatment Mean</b>	<b>2.94</b>	<b>11.54</b>	<b>0.93</b>	<b>2.01</b>	<b>2.97</b>	<b>19.97</b>	<b>1.15</b>	<b>335.59</b>
<b>CD 5%</b>	<b>0.43</b>	<b>1.23</b>	<b>0.32</b>	<b>0.45</b>	<b>0.46</b>	<b>9.72</b>	<b>0.68</b>	<b>61.81</b>
<b>SEm±</b>	<b>0.14</b>	<b>0.41</b>	<b>0.11</b>	<b>0.15</b>	<b>0.15</b>	<b>3.24</b>	<b>0.11</b>	<b>20.60</b>

**Table 2.59 :** Vegetative and yield parameters in cashew as influenced by three fertilizer levels at Kanabargi

Treatments	Tree height (m)	Trunk girth (cm)	Trunk height (m)	Canopy height (m)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Nut yield kg/tree	Nut yield kg/ha
Fertilizer 1 (52:13:13g NPK/plant/year)	2.90	11.20	0.87	2.02	3.05	20.36	1.57	310.43
Fertilizer 2 (78:20:20g NPK/plant/year)	2.97	10.92	1.02	1.95	2.88	18.47	1.69	338.08
Fertilizer 3 (117:29:29g NPK/plant/year)	2.95	11.83	0.89	2.06	2.99	21.07	1.82	358.25
<b>Treatment Mean</b>	<b>2.94</b>	<b>11.32</b>	<b>0.93</b>	<b>2.01</b>	<b>2.97</b>	<b>59.91</b>	<b>1.69</b>	<b>335.59</b>
<b>CD 5%</b>	<b>0.19</b>	<b>0.77</b>	<b>0.20</b>	<b>0.25</b>	<b>0.29</b>	<b>6.10</b>	<b>0.37</b>	<b>70.68</b>
<b>SEm±</b>	<b>0.06</b>	<b>0.26</b>	<b>0.07</b>	<b>0.08</b>	<b>0.10</b>	<b>2.03</b>	<b>0.12</b>	<b>23.56</b>

Nut yield in kg/tree was highest with S<sub>2</sub>F<sub>3</sub> (2.26 kg/tree) which was on par with S<sub>3</sub>F<sub>2</sub> (1.90 kg/tree) and S<sub>1</sub>F<sub>2</sub> (1.61 kg/tree) and nut yield in kg/ha was highest and on par with S<sub>2</sub>F<sub>3</sub> (511.33 kg/tree) and S<sub>3</sub>F<sub>2</sub> (451.09 kg/ha) (Table 2.60).





Table 2.60 : Vegetative and yield parameters in cashew as influenced by spacing cum fertilizer interaction effect

Sl. No.	Treatments	Tree height (m)	Trunk girth (cm)	Trunk height (m)	Canopy height (m)	Canopy diameter (m)	Canopy surface area (m <sup>2</sup> )	Nut yield kg/tree	Nut yield kg/ha
1	S <sub>1</sub> F <sub>1</sub>	3.07	11.70	0.98	2.10	3.35	24.39	1.54	240.24
2	S <sub>1</sub> F <sub>2</sub>	3.07	11.73	0.99	2.08	3.27	23.24	1.61	251.16
3	S <sub>1</sub> F <sub>3</sub>	2.99	11.97	1.01	1.98	3.06	21.43	1.50	234.00
4	S <sub>2</sub> F <sub>1</sub>	2.95	10.95	0.82	2.13	2.91	19.88	1.60	321.33
5	S <sub>2</sub> F <sub>2</sub>	2.86	10.22	1.16	1.70	2.41	12.49	1.56	312.00
6	S <sub>2</sub> F <sub>3</sub>	3.07	12.34	0.91	2.16	3.01	21.02	2.26	511.33
7	S <sub>3</sub> F <sub>1</sub>	2.66	10.95	0.82	1.84	2.88	16.83	1.56	369.72
8	S <sub>3</sub> F <sub>2</sub>	2.96	10.80	0.91	2.06	2.96	19.68	1.90	451.09
9	S <sub>3</sub> F <sub>3</sub>	2.79	11.17	0.75	2.04	2.89	20.78	1.39	329.43
<b>Treatment Mean</b>		<b>2.94</b>	<b>11.31</b>	<b>0.93</b>	<b>2.01</b>	<b>2.97</b>	<b>19.97</b>	<b>1.66</b>	<b>335.59</b>
<b>CD 5%</b>		<b>0.32</b>	<b>1.34</b>	<b>0.35</b>	<b>0.44</b>	<b>0.50</b>	<b>10.56</b>	<b>0.65</b>	<b>122.41</b>
<b>Sem</b>		<b>0.11</b>	<b>0.45</b>	<b>0.12</b>	<b>0.15</b>	<b>0.17</b>	<b>3.52</b>	<b>0.22</b>	<b>40.80</b>





### III. 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

**Centres:** **East Coast** : Bapatla, Bhubaneswar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara, Vengurla and Paria  
**Plains / others** : Hogalagere, Kanabargi and Jagdalpur

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.

#### Treatment details:

T1- Thiamethoxam (0.1 and 0.2 ml/L)  
T2- Carbosulfan (2 ml/L)  
T3- Buprofezin (2 ml/L)  
T4- *Beauveria bassiana* WP (1g/L)  
T5- *Beauveria bassiana* WP (5 g/L)  
T6- L-cyhalothrin (0.6 ml/L)  
T7- Untreated check

#### BAPATLA

Table 3.1 : Efficiency of different insecticides against pest complex in Cashew at Bapatla centre

	Treatment	Leaf and blossom webber damaged shoots (%)		Shoot tip caterpillar damaged shoots (%)		Apple and Nut Borer damage (%)	Leaf miner damage (%)	
		Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T <sub>1</sub>	Thiamethoxam 25 WG (0.1 g/l)	29.38 (32.81)	17.48 (24.71) <sup>e</sup>	37.15 (37.54)	25.43 (30.27) <sup>e</sup>	22.31 (28.18) <sup>f</sup>	25.53 (30.34)	11.36 (19.68) <sup>c</sup>
T <sub>2</sub>	Thiamethoxam 25 WG (0.2 g/l)	30.26 (33.36)	14.67 (22.51) <sup>d</sup>	38.20 (38.16)	23.38 (28.90) <sup>d</sup>	20.42 (26.85) <sup>e</sup>	24.52 (29.67)	10.75 (19.13) <sup>c</sup>
T <sub>3</sub>	Carbosulfan 25 EC (2 ml/l)	30.07 (33.24)	11.75 (20.04) <sup>c</sup>	36.17 (36.96)	13.42 (21.48) <sup>c</sup>	13.50 (21.55) <sup>c</sup>	24.50 (29.66)	8.82 (17.27) <sup>c</sup>



T <sub>4</sub>	Buprofezin 25 SC (2 ml/l)	27.52 (31.63)	18.42 (25.41) <sup>e</sup>	38.34 (38.24)	28.25 (32.09) <sup>f</sup>	17.32 (24.58) <sup>d</sup>	25.63 (30.40)	18.00 (25.09) <sup>e</sup>
T <sub>5</sub>	<i>Beauveria bassiana</i> WP (1 g/l)	29.34 (32.79)	16.34 (23.83) <sup>de</sup>	36.26 (37.01)	22.68 (28.43) <sup>d</sup>	18.25 (25.28) <sup>de</sup>	26.23 (30.79)	17.36 (24.61) <sup>e</sup>
T <sub>6</sub>	<i>Beauveria bassiana</i> WP (5 g/l)	30.51 (33.52)	15.54 (23.21) <sup>de</sup>	36.82 (37.34)	22.08 (28.02) <sup>d</sup>	16.37 (23.85) <sup>cd</sup>	24.32 (29.54)	14.06 (22.02) <sup>d</sup>
T <sub>7</sub>	λ – Cyhalothrin 5 EC (0.6 ml/l)	30.18 (33.31)	3.49 (10.76) <sup>a</sup>	35.44 (36.52)	1.74 (7.57) <sup>a</sup>	4.47 (12.20) <sup>a</sup>	25.44 (30.28)	0.83 (5.21) <sup>a</sup>
T <sub>8</sub>	Monocrotophos 36 SL (1.4 ml/l) at flushing, Chlorpyriphos 20 EC (2.5 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage.	30.17 (33.30)	8.63 (17.07) <sup>b</sup>	36.43 (37.11)	7.51 (15.90) <sup>b</sup>	9.04 (17.49) <sup>b</sup>	26.75 (31.13)	3.70 (11.09) <sup>b</sup>
T <sub>9</sub>	Untreated check	29.34 (32.78)	25.54 (30.34) <sup>f</sup>	37.37 (37.67)	30.35 (33.41) <sup>g</sup>	28.27 (32.11) <sup>g</sup>	26.45 (30.94)	30.11 (33.27) <sup>f</sup>
	<b>CD (0.05)</b>	<b>NS</b>	<b>1.658</b>	<b>NS</b>	<b>2.153</b>	<b>3.16</b>	<b>NS</b>	<b>2.616</b>
	<b>SEM±</b>	<b>0.694</b>	<b>0.565</b>	<b>0.678</b>	<b>0.733</b>	<b>1.078</b>	<b>0.894</b>	<b>0.891</b>

Figures in parentheses are arc sin transformed values

Figures followed by same alphabet (s) are not differing significantly at 5% level.

The treatment T<sub>7</sub> (λ-Cyhalothrin 0.6 ml/l) offered better control against Apple and nut borer damage followed by T<sub>8</sub> (Monocrotophos 36 SL (1.4 ml/l) at flushing, Chlorpyriphos, 20 EC (2.5 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage. With regard to leaf miner the treatment T<sub>7</sub> (λ-Cyhalothrin 0.6 ml/l) was found to be effective in reducing the pest population and damage on leaf followed by the treatment T<sub>8</sub> (Monocrotophos 36 SL (1.4 ml/l) at flushing, Chlorpyriphos 20 EC (2.5 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage. Population of ants and spiders were maximum in untreated check. However, among the treated plots the treatment T<sub>5</sub> (*Beauveria bassiana* WP @ 1 g/l) recorded maximum population of ants and spiders followed by the treatments T<sub>4</sub> (Buprofezin 25 SC @ 2 ml/l) and T<sub>6</sub> (*Beauveria bassiana* WP @ 5 g/l) at 30 days after 3<sup>rd</sup> spray (Table 3.1 and 3.2).

**Table 3.2 : Influence of different insecticides on natural enemies and pollinators in cashew at Bapatla centre**

	Treatment	Mean No. per 52 inflorescence at 30 days after 3 <sup>rd</sup> spray	
		Ants	Spiders
T <sub>1</sub>	Thiamethoxam 25 WG (0.1 g/l)	0.60 (0.77) <sup>e</sup>	0.90 (0.95) <sup>e</sup>
T <sub>2</sub>	Thiamethoxam 25 WG (0.2 g/l)	0.53 (0.72) <sup>e</sup>	0.65 (0.81) <sup>f</sup>
T <sub>3</sub>	Carbosulfan 25 EC (2 ml/l)	0.54 (0.73) <sup>e</sup>	0.50 (0.71) <sup>g</sup>



T <sub>4</sub>	Buprofezin 25 SC (2 ml/l)	1.80 (1.34) <sup>c</sup>	1.63 (1.27) <sup>b</sup>
T <sub>5</sub>	<i>Beauveria bassiana</i> WP (1 g/l)	1.93 (1.39) <sup>b</sup>	1.65 (1.28) <sup>b</sup>
T <sub>6</sub>	<i>Beauveria bassiana</i> WP (5 g/l)	1.80 (1.34) <sup>c</sup>	1.55 (1.24) <sup>c</sup>
T <sub>7</sub>	λ – Cyhalothrin 5 EC (0.6 ml/l)	0.20 (0.45) <sup>f</sup>	0.00 (0.00) <sup>h</sup>
T <sub>8</sub>	Monocrotophos 36 SL (1.4 ml/l) at flushing, Chlorpyrifos 20 EC (2.5 ml/l) at flowering and Profenofos 50 EC (1 ml/l) at fruit & nut development stage.	1.48 (1.21) <sup>d</sup>	1.25 (1.12) <sup>d</sup>
T <sub>9</sub>	Untreated check	9.83 (3.13) <sup>a</sup>	7.35 (2.71) <sup>a</sup>
	<b>CD (0.05)</b>	<b>0.901</b>	<b>0.413</b>
	<b>SEM±</b>	<b>0.307</b>	<b>0.141</b>

Figures in parentheses are square root transformed values

Figures followed by same alphabet (s) are not differing significantly at 5% level

### BHUBANESWAR

There was no incidence of TMB during the period under report. Shoot tip caterpillar (STC), leaf miner, inflorescence thrips and apple and nut borer were predominant pests observed during flushing, flowering and fruit setting in cashew. Significant reduction of STC, leaf miner, thrips and apple and nut borer were observed in the insecticidal treatment as compared to untreated control. The incidence of shoot tip caterpillar varied from 9.33 to 11.20 per cent damaged shoot before insecticide application. The damage shoot per cent was the lowest in T<sub>7</sub> (1.30) followed by T<sub>6</sub> (1.74) and T<sub>3</sub> (2.73) while untreated control recorded 12.86 per cent damaged shoot. Incidence of leaf miner varied from 7.25 to 8.24 per cent damaged leaf before spray and was non significant. Damaged leaf by folder was the lowest in treatment T<sub>7</sub> (1.43 %) closely followed by T<sub>6</sub> (2.62%) and T<sub>3</sub> (2.96 %) while untreated control recorded 11.14 per cent damaged leaf one month after 3<sup>rd</sup> spray.

Population of Inflorescence Thrips varied from 5.83 – 6.82 per inflorescence before the insecticidal treatment and was non significant. Lowest population of IT was observed in T-7 (0.28) closely followed by T<sub>2</sub> and T<sub>3</sub> and were at par as compared to 7.25 per inflorescence in case of untreated control. With respect to intensity of damage on the cashew fruits it varied from 0.13 to 1.44 among the insecticidal treatments. The lowest damaged fruits observed in T<sub>7</sub> followed T<sub>2</sub> and T<sub>3</sub> as compared to 1.25 in untreated control. Significant variation in Apple and nut borer incidence was found among the insecticidal treatments the most effective being T<sub>7</sub> (0.95) followed by T<sub>6</sub> and T<sub>3</sub>. The untreated check recorded 7.75% damaged fruits. Cashew nut yield per tree varied from 1.74 – 2.55 kg / tree in the treated plot as compared to 1.70kg/tree in the untreated control. Treatments viz. T<sub>3</sub>, T<sub>6</sub> and





T7 produced significantly higher yield among the insecticides. Rest of the treatments were at par with the untreated check.

Spider population varied from 0.98-3.98 among the treatments and were significantly different. Highest spider population was recorded in untreated control (4.03 per inflorescence) which was at par with T5. Treatments T4 and T6 also recorded 3.5 spider population per inflorescence (Table 3.3).

**Table 3.3 : Efficacy of different insecticides against pest complex & spiders in cashew at Bhubaneswar centre**

Treatment	Leaf miner (%)		Shoot tip caterpillar damaged shoots (%)		Spiders (specify species)	Apple and nut borer damage (%)	Thrips damage score on nuts	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	30 days after 3 <sup>rd</sup> spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T1 Thiamethoxam (0.1ml/l)	8.09 (2.93)	6.05 (2.56)	10.16 (3.26)	7.74 (2.87)	2.33 (1.67)	5.23 (2.27)	6.21 (2.59)	2.54 (1.73)
T2 Thiamethoxam (0.0.2ml/l)	7.44 (2.81)	3.86 (2.09)	11.20 (3.42)	3.44 (1.99)	2.08 (1.60)	4.51 (2.23)	6.20 (2.57)	0.78 (1.12)
T3 Carbosulfan (2ml/l)	7.62 (2.84)	2.96 (1.86)	11.16 (3.40)	2.73 (1.79)	1.13 (1.25)	2.51 (1.72)	6.62 (2.67)	0.62 (1.03)
T4 Buprofezin (2ml/l)	7.39 (2.79)	7.60 (2.85)	11.03 (3.39)	8.50 (3.00)	3.20 (1.91)	6.15 (2.45)	6.82 (2.70)	6.00 (2.54)
T5 <i>Beauveria bassiana</i> (1g/l)	8.24 (2.95)	4.89 (2.32)	9.39 (3.14)	5.84 (2.52)	3.98 (2.11)	3.76 (1.95)	6.05 (2.56)	5.73 (2.49)
T6 <i>Beauveria bassiana</i> (5g/l)	7.67 (2.85)	2.62 (1.76)	9.84 (3.21)	1.74 (1.49)	3.45 (1.98)	1.33 (1.24)	6.00 (2.54)	4.14 (2.15)
T7 L cyhalothrin (0.6ml/l)- Profenophos	7.25 (2.78)	1.43 (1.39)	9.33 (3.13)	1.30 (1.34)	0.98 (1.21)	0.95 (0.98)	5.83 (2.51)	0.28 (0.87)
T8 Untreated Check	7.99 (2.91)	11.14 (3.41)	10.16 (3.26)	12.86 (3.65)	4.03 (2.13)	7.75 (2.87)	6.57 (2.65)	7.25 (2.78)
	<b>S.Em(±)</b>	<b>NS</b>	<b>0.01</b>	<b>0.65</b>	<b>0.11</b>	<b>0.03</b>	<b>NS</b>	<b>0.05</b>
	<b>CD(0.05)</b>		<b>0.1</b>	<b>0.19</b>	<b>0.27</b>	<b>0.46</b>		<b>0.13</b>



## HOGALAGERE

The TMB damage at 7 days and 15 days after the spray were ranged from 0.65 to 1.45 and 0.42 to 1.64 on young shoots and 0.99 to 1.29 and 0.71 to 1.40 on panicles were recorded (Table). In both cases, the damage on shoots and panicles at 7 days and 15 days after each spray was significantly reduced in the treatment sprayed with Thiamethoxam 25 WG (0.2g/l) in all the sprays. This was followed by Lambda cyhalothrin 5 EC (0.6ml/l) and Carbosulfan 25EC (2ml/l) in all the three sprays. Whereas, the treatment with *Beauveria bassiana* (1 & 5 g/l) and Buprofezin (2 ml/l) were found least effective in controlling the TMB. The results on efficacy of different treatments against apple and nut borer, thrips and aphids indicated similar trend in management of these pests on cashew and recording enhanced nut yield (Table 3.4). However the maximum spider and predatory coccinellid population was recorded in treatment *Beauveria bassiana* (1 & 5 g/l) followed by Buprofezin (2ml/l) treatments as compared to remaining treatments.

**Table 3.4 :** Efficacy of different insecticides against tea mosquito bug incidence in cashew at HREC, Hogalagere centre

Treatments		On shoots (%)			On panicles (%)		
		BS	7 DAS	15 DAS	BS	7 DAS	15 DAS
T <sub>1</sub>	Thiamethoxam 25WG (0.1 g/l)	1.68	0.73	0.72	1.55	1.86	0.75
T <sub>2</sub>	Thiamethoxam 25 WG (0.2 g/l)	1.49	0.65	0.42	1.55	0.99	0.71
T <sub>3</sub>	Carbosulfan 25 EC (2 ml/l)	1.32	0.77	0.43	1.33	1.38	0.88
T <sub>4</sub>	Buprofezin 25 SC (2 ml/l)	1.21	0.79	0.61	1.34	1.21	0.86
T <sub>5</sub>	<i>Beauveria bassiana</i> (1 g/l)	1.72	0.76	0.74	1.60	1.91	0.77
T <sub>6</sub>	<i>Beauveria bassiana</i> (5 g/l)	1.61	0.70	0.68	1.50	1.77	0.71
T <sub>7</sub>	L - Cyhalothrin 5 EC @ 0.6ml/l)	1.74	0.72	0.13	1.26	1.58	0.72
T <sub>8</sub>	Untreated control	1.36	1.45	1.64	1.21	1.29	1.40
	<b>Mean</b>	<b>1.52</b>	<b>0.82</b>	<b>0.67</b>	<b>1.42</b>	<b>1.50</b>	<b>0.85</b>
	<b>SEm ±</b>	<b>NS</b>	<b>0.05</b>	<b>0.05</b>	<b>NS</b>	<b>0.09</b>	<b>0.05</b>
	<b>CD at 5%</b>	<b>-</b>	<b>0.16</b>	<b>0.15</b>	<b>-</b>	<b>0.28</b>	<b>0.14</b>





**Table 3.5 : Efficacy of different insecticides against pest complex , natural enemies pollinators in cashew at HREC Hogalagere centre**

Treatment	Apple and nut borer damage (%)		Thrips damage score on nuts		Aphids / Mealy bugs damage (%fruits attacked)		Spiders (Oxyopes sweta)		Menochilus sexmaculatus	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T <sub>1</sub> Thiamethoxam 25WG (0.1 g/l)	2.34	1.93	1.61	0.98	1.64	0.86	2.82	1.43	2.29	1.04
T <sub>2</sub> Thiamethoxam 25 WG (0.2 g/l)	2.85	1.08	1.75	0.32	1.33	0.30	2.51	1.17	2.50	1.65
T <sub>3</sub> Carbosulfan 25 EC (2 ml/l)	2.47	1.32	1.42	0.61	1.94	0.61	2.35	1.47	2.05	1.25
T <sub>4</sub> Buprofezin 25 SC (2 ml/l)	2.30	1.62	1.18	0.62	1.87	0.77	2.33	1.56	2.45	1.26
T <sub>5</sub> <i>Beauveria bassiana</i> (1 g/l)	2.29	1.95	1.53	1.21	1.44	0.83	2.16	1.97	2.18	1.56
T <sub>6</sub> <i>Beauveria bassiana</i> (5 g/l)	2.30	1.72	1.06	0.72	1.73	0.77	2.23	1.89	2.27	1.67
T <sub>7</sub> L-Cyhalothrin 5 EC @ 0.6ml/l)	2.14	1.41	1.46	0.61	1.02	0.34	2.36	1.95	2.37	2.19
T <sub>8</sub> Untreated control	2.33	2.42	1.77	1.85	1.32	1.53	2.15	2.07	2.15	1.80
<b>Mean</b>	<b>2.38</b>	<b>1.68</b>	<b>1.47</b>	<b>0.87</b>	<b>1.54</b>	<b>0.75</b>	<b>2.36</b>	<b>1.69</b>	<b>2.28</b>	<b>1.55</b>
<b>CD at 5%</b>	<b>NS</b>	<b>0.11</b>	<b>NS</b>	<b>0.07</b>	<b>NS</b>	<b>0.04</b>	<b>-</b>	<b>0.27</b>	<b>-</b>	<b>0.33</b>
<b>SEm ±</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>--</b>	<b>NS</b>	<b>0.09</b>	<b>NS</b>	<b>0.11</b>

**JAGDALPUR**

**Table 3.6 : Efficacy of different insecticides against pest complex in cashew at Jagdalpur centre**

Treatments	On shoots (%)		On panicles (%)	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T-1:Thiamethoxam (0.1 and 0.2ml/l)	0.00 (1.00)	0.00 (1.00)	0.03 (1.01)	0.11 (1.05) <sup>a</sup>
T-2 : Carbosulfan (2 ml/l)	0.00 (1.00)	0.00 (1.00)	0.06 (1.03)	0.37 (1.16) <sup>b</sup>
T-3: Buprofezin (2ml/l)	0.00 (1.00)	0.00 (1.00)	0.08 (1.03)	0.34 (1.15) <sup>b</sup>
T-4:Beauveria bassiana (1g/l)	0.00 (1.00)	0.00 (1.00)	0.09 (1.04)	0.34 (1.15) <sup>b</sup>
T-5:Beauveria bassiana ( 5g/l)	0.00 (1.00)	0.00 (1.00)	0.08 (1.03)	0.40 (1.18) <sup>b</sup>
T-6:L-cyhalothrin (0.6ml/l)	0.00 (1.00)	0.00 (1.00)	0.04 (1.02)	0.12 (1.05) <sup>a</sup>
T7: Untreated check	0.00 (1.00)	0.00 (1.00)	0.10 (1.05)	1.13 (1.45) <sup>c</sup>
<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>0.05</b>
<b>SEm ±</b>				<b>0.01</b>
<b>CV%</b>				<b>9.25</b>



Infestation of TMB was absent in all the treatments during shoot stage due to low pressure of TMB. After that, population increased gradually causing damage to the plant at panicle stage. However, their damage score was less than 1 score. Pretreatment infestation was at par in all treatment at panicle stage. At 30 days after 3<sup>rd</sup> spray, treatment T1 (Thiamethoxam 0.1 ml/l) was received minimum damage score of TMB and on par with T6 (L-cyhalothrin 0.6ml/l). Remaining treatments T2 (Carbosulfan 2ml/l), T3 (Buprofezin 2ml/l), T4 (Beauveria bassiana 1g/l) and T5 (Beauveria bassiana 2g/l) were at par with each other and superior over control (Table 3.6).

**Table 3.7 : Efficacy of different insecticides against pest complex in cashew at Jagdalpur**

Treatment	Leaf miner (%)		Leaf folder (%)		Leaf caterpillar (%)		Thrips damage score on nuts	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T-1:Thiamethoxam (0.1 and .2ml/l)	15.5 (23.16) <sup>a</sup>	8.91 (17.31) <sup>a</sup>	17.6 (24.80) <sup>b</sup>	11.10 (19.44) <sup>c</sup>	21.60 (27.64)	13.09 (21.19) <sup>c</sup>	1.81 (7.72) <sup>c</sup>	0.83 (5.23) <sup>a</sup>
T-2 : Carbosulfan (2 ml/l)	17.8 (24.91) <sup>a</sup>	14.48 (22.32) <sup>c</sup>	21.5 (27.60) <sup>c</sup>	10.71 (19.08) <sup>c</sup>	25.40 (30.23)	14.20 (22.11) <sup>c</sup>	1.93 (7.90) <sup>c</sup>	1.34 (6.63) <sup>c</sup>
T-3: Buprofezin (2ml/l)	21.6 (27.68) <sup>b</sup>	11.00 (19.35) <sup>b</sup>	14.2 (22.11) <sup>a</sup>	10.18 (18.55) <sup>bc</sup>	24.60 (29.68)	12.74 (20.88) <sup>c</sup>	1.74 (7.56) <sup>c</sup>	0.84 (5.25) <sup>a</sup>
T-4:Beauveria bassiana (1g/l)	24.8 (29.87) <sup>b</sup>	17.73 (24.88) <sup>de</sup>	18.1 (25.19) <sup>bc</sup>	11.33 (17.47) <sup>ab</sup>	22.70 (28.40)	12.68 (20.83) <sup>c</sup>	1.54 (7.13) <sup>b</sup>	1.38 (6.74) <sup>c</sup>
T-5:Beauveria bassiana ( 5g/l)	17.1 (24.38) <sup>a</sup>	17.60 (24.78) <sup>d</sup>	13.8 (21.78) <sup>a</sup>	8.08 (16.49) <sup>a</sup>	22.80 (28.49)	9.24 (16.39) <sup>a</sup>	1.47 (6.94) <sup>a</sup>	1.30 (6.53) <sup>c</sup>
T-6:L-cyhalothrin (0.6ml/l)	17.4 (24.65) <sup>a</sup>	10.98 (18.33) <sup>ab</sup>	15.3 (23.02) <sup>ab</sup>	7.62 (15.98) <sup>a</sup>	23.00 (28.64)	9.96 (17.38) <sup>a</sup>	1.84 (7.79) <sup>c</sup>	1.14 (6.10) <sup>b</sup>
T7: Untreated check	16.8 (24.10) <sup>a</sup>	19.43 (26.14) <sup>e</sup>	17.38 (24.51) <sup>b</sup>	16.27 (23.76) <sup>d</sup>	24.90 (29.92)	19.65 (26.29) <sup>d</sup>	1.83 (7.76) <sup>c</sup>	1.90 (7.91) <sup>d</sup>
<b>CD at 5%</b>	<b>2.621</b>	<b>1.33</b>	<b>2.54</b>	<b>1.50</b>	<b>NS</b>	<b>1.56</b>	<b>0.34</b>	<b>0.38</b>
<b>SEm ±</b>	<b>0.873</b>	<b>0.44</b>	<b>0.857</b>	<b>0.711</b>	<b>0.853</b>	<b>0.483</b>	<b>0.11</b>	<b>0.15</b>
<b>CV%</b>	<b>16.87</b>	<b>12.05</b>	<b>17.03</b>	<b>15.32</b>	<b>14.88</b>	<b>14.62</b>	<b>9.07</b>	<b>8.06</b>

In Leaf miner damage, no significant difference was recorded among treatments except treatment T3 and T4 during pretreatment observation. Significantly minimum percent incidence recorded in T1 (Thiamethoxam (0.1 and 0.2ml/l) with 8.91 per cent which was on par with T6 (L-cyhalothrin @ 0.6ml/l) with 10.98 at 30 days after 3<sup>rd</sup> spray. In leaf folder damage, pretreatment infestation recorded least in T5, T6 and T3 over remaining treatments. At 30 days after 3<sup>rd</sup> spray, treatment T6 (L-cyhalothrin @ 0.6ml/l) gave minimum damage with 7.62 per cent and was at par with T5 (Beauveria bassiana @ 5g/l) and T4 (Beauveria bassiana @1g/l) with 8.08 and 11.33 per cent, respectively (Table 3.7).





**Table 3.8 : Efficiency of different insecticides against pest complex in cashew at Jagdalpur centre**

Treatment	Leaf caterpillar (%)		Thrips damage score on nuts	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T-1:Thiamethoxam (0.1 and .2ml/l)	21.60 (27.64)	13.09 (21.19) <sup>c</sup>	1.81 (7.72) <sup>c</sup>	0.83 (5.23) <sup>a</sup>
T-2 : Carbosulfan (2 ml/l)	25.40 (30.23)	14.20 (22.11) <sup>c</sup>	1.93 (7.90) <sup>c</sup>	1.34 (6.63) <sup>c</sup>
T-3: Buprofezin (2ml/l)	24.60 (29.68)	12.74 (20.88) <sup>c</sup>	1.74 (7.56) <sup>c</sup>	0.84 (5.25) <sup>a</sup>
T-4:Beauveria bassiana (1g/l)	22.70 (28.40)	12.68 (20.83) <sup>c</sup>	1.54 (7.13) <sup>b</sup>	1.38 (6.74) <sup>c</sup>
T-5:Beauveria bassiana ( 5g/l)	22.80 (28.49)	9.24 (16.39) <sup>a</sup>	1.47 (6.94) <sup>a</sup>	1.30 (6.53) <sup>c</sup>
T-6:L-cyhalothrin (0.6ml/l)	23.00 (28.64)	9.96 (17.38) <sup>a</sup>	1.84 (7.79) <sup>c</sup>	1.14 (6.10) <sup>b</sup>
T7: Untreated check	24.90 (29.92)	19.65 (26.29) <sup>d</sup>	1.83 (7.76) <sup>c</sup>	1.90 (7.91) <sup>d</sup>
<b>CD at 5%</b>	<b>NS</b>	<b>1.56</b>	<b>0.34</b>	<b>0.38</b>
<b>SEm ±</b>	<b>0.853</b>	<b>0.483</b>	<b>0.11</b>	<b>0.15</b>
<b>CV%</b>	<b>14.88</b>	<b>14.62</b>	<b>9.07</b>	<b>8.06</b>

For leaf caterpillar damage, pretreatment population was at par among treatments. At 30 days after 3rd spray, significantly minimum damage of 9.24 per cent was recorded in treatment T5 (Beauveria bassiana @ 5g/l) which was at par with T6 (L-cyhalothrin @ 0.6ml/l) with 9.96 per cent. All the treatments were significantly superior over control. In nut thrips damage, there was significant difference among the treatments. At 30 days after 3<sup>rd</sup> spray, treatment T1 (Thiamethoxam @ 0.1 and 0.2 ml/l) having significantly minimum damage with 0.83 score which was on par with T3 (: Buprofezin @2ml/l) with 0.84 score. All the treatments were significantly superior over control (Table 3.8).

**Table 3.9 : Influence of different insecticides on natural enemies and pollinators in cashew at Jagdalpur centre**

Treatment	Spiders ( <i>Oxyopus</i> sp)	LBB ( <i>Menochilus sexmaculata</i> )	Mirids ( <i>Cyrtorhinus lividipenis</i> )	Brumus ( <i>Brumus</i> sp.)
	30 days after 3 <sup>rd</sup> spray	30 days after 3 <sup>rd</sup> spray	30days after 3 <sup>rd</sup> spray	30 days after 3 <sup>rd</sup> spray
T-1:Thiamethoxam (0.1 and 0.2ml/l)	0.41 (1.18) <sup>bc</sup>	0.38 (1.17) <sup>c</sup>	0.25 (1.18) <sup>c</sup>	0.23 (1.10) <sup>b</sup>



T-2 : Carbosulfan (2 ml/l)	0.37 (1.16) <sup>c</sup>	0.51 (1.23) <sup>b</sup>	0.08 (1.03) <sup>e</sup>	0.20 (1.09) <sup>bc</sup>
T-3: Buprofezin (2ml/l)	0.40 (1.18) <sup>bc</sup>	0.69 (1.29) <sup>a</sup>	0.10 (1.05) <sup>d</sup>	0.26 (1.12) <sup>a</sup>
T-4: Beauveria bassiana (1g/l)	0.43 (1.19) <sup>b</sup>	0.73 (1.31) <sup>a</sup>	0.09 (1.04) <sup>d</sup>	0.29 (1.13) <sup>a</sup>
T-5: Beauveria bassiana (5g/l)	0.29 (1.13) <sup>d</sup>	0.63 (1.27) <sup>ab</sup>	0.13 (1.06) <sup>d</sup>	0.16 (1.07) <sup>d</sup>
T-6: L-cyhalothrin (0.6ml/l)	0.21 (1.10) <sup>e</sup>	0.34 (1.15) <sup>c</sup>	0.66 (1.28) <sup>b</sup>	0.18 (1.08) <sup>cd</sup>
T7: Untreated check	0.55 (1.24) <sup>a</sup>	0.54 (1.24) <sup>b</sup>	0.75 (1.32) <sup>a</sup>	0.29 (1.13) <sup>a</sup>
<b>CD at 5%</b>	<b>0.02</b>	<b>0.04</b>	<b>0.02</b>	<b>0.01</b>
<b>SEm ±</b>	<b>0.009</b>	<b>0.001</b>	<b>0.007</b>	<b>0.003</b>
<b>CV%</b>	<b>9.58</b>	<b>8.62</b>	<b>8.20</b>	<b>7.618</b>

Population of all natural enemies was maximum in untreated tree except the lady bird beetle maximum in treatment T4 followed by T3 and T5. Among the treatments, spider found maximum in number in T4 followed by T1 and T3. The mirid bug population was significantly maximum (0.66 number/tree) in T6 over all the treatments. Significantly maximum population of *Brumus* sp. recorded in T4 (0.29 number/tree) followed by T3 (0.26 number/tree) (Table 3.9).

### JHARGRAM

All the insecticidal treatments were found to be superior to the untreated check. All the insecticides significantly controlled leaf and blossom webber and leaf miner after last round of spray and were statistically at par. Least infestation of apple and nut borer was observed on trees treated with lambda cyhalothrin @ 0.6 ml/L which was statistically at par with buprofezin and carbosulfan @ 2 ml/L while *Beauveria bassiana* was found least effective after last spray. Again L-cyhalothrin and carbosulfan were superior to control thrips while *Beauveria bassiana* @ 1g/L and 5g/L and thiamethoxam @ 0.1g/L were least effective (Table 3.10).

**Table 3.10 : Efficacy of insecticides against pest complex in cashew at Jhargram**

Treatment	Before spray		After first spray		After last spray				
	LBW	LM	LBW	LM	LBW	LM	ANB	Thrips	
								Nut	Apple
Thiamethoxam 0.1g/L	11.60 (19.90)	7.68 (16.08)	6.00 (14.10) <sup>bc</sup>	3.85 (11.28) <sup>c</sup>	0.08 (0.92) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	10.35 (18.72) <sup>bc</sup>	6.58 (14.54) <sup>ab</sup>	8.92 (17.32) <sup>ab</sup>
Thiamethoxam 0.2 g/L	12.05 (20.29)	7.92 (16.34)	5.36 (13.25) <sup>c</sup>	3.01 (9.96) <sup>c</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	8.16 (16.15) <sup>bcd</sup>	3.75 (10.95) <sup>ab</sup>	7.22 (15.52) <sup>bc</sup>
Carbosulfan @2 ml/L	11.59 (19.89)	7.85 (16.26)	5.21 (13.17) <sup>c</sup>	6.51 (14.39) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	4.59 (12.37) <sup>cd</sup>	1.50 (7.65) <sup>b</sup>	6.43 (14.46) <sup>bc</sup>
Buprofezin @2ml/L	11.81 (20.07)	7.77 (16.18)	3.57 (10.65) <sup>d</sup>	3.05 (10.03) <sup>c</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	4.55 (12.16) <sup>cd</sup>	6.50 (13.66) <sup>ab</sup>	5.87 (13.91) <sup>c</sup>



<i>Beauveria bassiana</i> @1 g/L	11.44 (19.36)	7.79 (16.20)	7.14 (15.42) <sup>b</sup>	4.28 (11.94) <sup>bc</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	12.28 (19.86) <sup>b</sup>	7.50 (15.85) <sup>a</sup>	12.22 (20.36) <sup>a</sup>
<i>Beauveria bassiana</i> @ 5g/L	11.66 (19.95)	7.96 (16.38)	5.36 (13.25) <sup>c</sup>	3.21 (10.28) <sup>c</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	9.99 (17.98) <sup>bc</sup>	6.92 (14.61) <sup>ab</sup>	10.91 (19.24) <sup>a</sup>
Lambda cyhalothrin @ 0.6ml/L	11.45 (19.77)	8.01 (16.44)	5.36 (13.25) <sup>c</sup>	3.38 (10.59) <sup>c</sup>	0.00 (0.00) <sup>b</sup>	0.00 (0.00) <sup>b</sup>	3.23 (10.30) <sup>d</sup>	1.97 (7.88) <sup>b</sup>	6.74 (15.02) <sup>bc</sup>
Untreated Control	11.61 (19.90)	7.98 (16.41)	16.67 (24.04) <sup>a</sup>	11.00 (19.36) <sup>a</sup>	4.02 (11.45) <sup>a</sup>	1.53 (7.04) <sup>a</sup>	20.06 (26.57) <sup>a</sup>	10.08 (18.16) <sup>a</sup>	11.14 (19.48) <sup>a</sup>
	<b>0.9 (NS)</b>	<b>0.4 (NS)</b>	<b>1.9</b>	<b>4.1</b>	<b>2.1</b>	<b>1.0</b>	<b>6.4</b>	<b>5.9</b>	<b>2.8</b>

Figure in the parentheses are arc sin transformed values.

- TMB – Tea Mosquito Bug, LM – Leaf Miner, LBW – Leaf and Blossom Webber, ANB – Apple and Nut Borer

## MADAKKATHARA

### Tea mosquito bug damage

Tea mosquito bug intensity was very low during the season. At seventh day after second spray, comparatively less damage was observed in thiamethoxam @0.2g/l *Beauveria bassiana* @1g/l and -cyhalothrin (Table 3.11). At 15<sup>th</sup> day of second spray, all the treatments recorded comparatively less damage and were superior to control. At 30<sup>th</sup> day of spray, the damage was less in all the treatments except in buprofezin, which was on par with control. On panicle, at seventh day after second spray, thiamethoxam 0.1g/l & 0.2g/l *Beauveria* 1g/l & 5g/l, -cyhalothrin and KAU POP recorded comparatively less damage. At 15<sup>th</sup> day, -cyhalothrin recorded least damage and thiamethoxam 0.1g/l & 0.2g/l *Beauveria* 1g/l & 5g/l and KAU POP were on par with λ-cyhalothrin.

### Insect pests other than tea mosquito bug

Insect pests other than tea mosquito were absent during the season. The leaf minor infestation was noticed during the flushing stage. However no significant difference was observed among treatments. Apple and nut borer infestation was observed only during the second spraying period and was to very minimum level (1.5 to 2.2 per cent). Thrips infestation was not at all observed during the season (Table 3.12).

### Influence on natural enemies

There was no significant difference in population of black ants after spray. However, the treatments were significantly different with respect to red ant population not necessarily reduction in all the cases because an increased trend was noticed in all the cases after third spray. Control trees harbored significantly high red ant population before as well as during second spray observation and *B. bassiana* @ 1g/l was on par with control. In third spray observation, control itself harbored maximum red ant population though statistically not significant from other treatments. Spider population was absent in the experiment plot before as well as after spray (Table 3.13).



**Table 3.11 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Madakkathara centre (Second spray)**

Treatments		On shoots (%)			On panicles (%)		
		Before spray	7 days after spray	15 days after spray	Before spray	7 days after spray	15 days after spray
T1	Thiamethoxam (0.1g/l)	0.051 (0.742)	0.048 (0.740) <sup>ab</sup>	0.004 (0.710) <sup>c</sup>	0.033 (0.730)	0.043 (0.737) <sup>b</sup>	0.047 (0.712) <sup>b</sup>
T2	Thiamethoxam (0.2g/l)	0.083 (0.763)	0.019 (0.721) <sup>b</sup>	0.000 (0.707) <sup>c</sup>	0.171 (0.815)	0.047 (0.739) <sup>b</sup>	0.011 (0.714) <sup>b</sup>
T3	Carbosulfan (2ml/l)	0.127 (0.790)	0.126 (0.790) <sup>a</sup>	0.047 (0.739) <sup>b</sup>	0.149 (0.803)	0.144 (0.801) <sup>ab</sup>	0.133 (0.790) <sup>ab</sup>
T4	Buprofezin (2ml/l)	0.089 (0.767)	0.052 (0.742) <sup>ab</sup>	0.000 (0.707) <sup>c</sup>	0.021 (0.721)	0.070 (0.754) <sup>ab</sup>	0.119 (0.781) <sup>ab</sup>
T5	<i>Beauveria bassiana</i> WP (1g/l)	0.041 (0.735)	0.021 (0.722) <sup>b</sup>	0.005 (0.710) <sup>c</sup>	0.105 (0.777)	0.012 (0.715) <sup>b</sup>	0.102 (0.774) <sup>ab</sup>
T6	<i>Beauveria bassiana</i> WP (5g/l)	0.053 (0.744)	0.036 (0.732) <sup>ab</sup>	0.010 (0.714) <sup>c</sup>	0.051 (0.742)	0.036 (0.732) <sup>b</sup>	0.007 (0.712) <sup>b</sup>
T7	L-cyhalothrin (0.6 ml/l)	0.150 (0.803)	0.022 (0.723) <sup>b</sup>	0.008 (0.712) <sup>c</sup>	0.139 (0.795)	0.049 (0.741) <sup>b</sup>	0.003 (0.709) <sup>b</sup>
T8	POP, Kerala	0.084 (0.764)	0.047 (0.739) <sup>ab</sup>	0.007 (0.712) <sup>c</sup>	0.059 (0.748)	0.040 (0.735) <sup>b</sup>	0.007 (0.712) <sup>b</sup>
T9	Untreated check	0.065 (0.750)	0.083 (0.763) <sup>ab</sup>	0.109 (0.779) <sup>a</sup>	0.053 (0.744)	0.201 (0.835) <sup>a</sup>	0.201 (0.835) <sup>a</sup>
	<b>Mean</b>	<b>0.083</b>	<b>0.050</b>	<b>0.021</b>	<b>0.087</b>	<b>0.071</b>	<b>0.07</b>
	<b>SEm ±</b>	<b>0.024</b>	<b>0.013</b>	<b>0.012</b>	<b>0.033</b>	<b>0.027</b>	<b>0.036</b>
	<b>CD at 5%</b>	<b>0.077</b>	<b>0.055</b>	<b>0.017</b>	<b>0.095</b>	<b>0.077</b>	<b>0.110</b>
	<b>CV%</b>	<b>5.42</b>	<b>3.04</b>	<b>2.96</b>	<b>7.51</b>	<b>6.27</b>	<b>8.29</b>

**Table 3.12 : Efficacy of different insecticides against Pest complex in cashew at Madakkathara centre (Second spray)**

Treatment		Leaf miner (%)		Apple and nut borer damage (%)		Thrips damage score on nuts	
		Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T1	Thiamethoxam (0.1g/l)	6.207 (1.417)	0.0	0.0	0.0	0.0	0.0
T2	Thiamethoxam (0.2g/l)	13.1 (2.367)	0.0	0.0	0.0	0.0	0.0



T3	Carbosulfan (2ml/l)	19.87 (2.707)	0.0	0.0	0.0	0.0	0.0
T4	Buprofezin (2ml/l)	15.903 (2.497)	0.0	0.0	0.0	0.0	0.0
T5	<i>Beauveria bassiana</i> WP (1g/l)	11.29 (2.273)	0.0	0.0	0.0	0.0	0.0
T6	<i>Beauveria bassiana</i> WP (5g/l)	15.397 (2.157)	0.0	0.0	0.0	0.0	0.0
T7	L-cyhalothrin (0.6 ml/l)	6.067 (1.410)	0.0	0.0	0.0	0.0	0.0
T8	POP, Kerala	15.453 (2.153)	0.0	0.0	0.0	0.0	0.0
T9	Untreated check	5.187 (1.367)	0.0	0.0	0.0	0.0	0.0
	<b>Mean</b>	<b>12.05</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>	<b>0.0</b>

**Table 3.13 :** Influence of different insecticides on natural enemies and pollinators in cashew at Madakkathara centre

Treatment	Spiders ( <i>Oxyopes sweta</i> , <i>Tetragnatha spp.</i> , <i>Thomisus spp.</i> )		Black ants		Red ants ( <i>Oecophylla smaragdina</i> )	
	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray	Before spray	30 days after 3 <sup>rd</sup> spray
T1 Thiamethoxam (0.1g/l)	0.833 (1.049)	0.000	1.167 (1.138)	0.000	0.000 <sup>b</sup> (0.707)	1.046 <sup>b</sup> (1.129)
T2 Thiamethoxam (0.2g/l)	0.000 (0.707)	0.000	0.167 (0.805)	0.000	0.000 <sup>b</sup> (0.707)	0.353 <sup>b</sup> (0.702)
T3 Carbosulfan (2ml/l)	0.000 (0.707)	0.000	1.833 (1.288)	0.000	0.000 <sup>b</sup> (0.707)	1.046 <sup>b</sup> (1.129)
T4 Buprofezin (2ml/l)	0.000 (0.707)	0.000	2.167 (1.520)	0.000	0.000 <sup>b</sup> (0.707)	3.342 <sup>b</sup> (1.799)
T5 <i>Beauveria bassiana</i> WP (1g/l)	0.167 (0.805)	0.000	0.000 (0.707)	0.000	11.333 <sup>a</sup> (3.023)	5.864 <sup>b</sup> (1.899)
T6 <i>Beauveria bassiana</i> WP (5g/l)	0.167 (0.805)	0.000	1.167 (1.138)	0.000	3.833 <sup>b</sup> (1.626)	1.046 <sup>b</sup> (1.129)
T7 L-cyhalothrin (0.6 ml/l)	0.000 (0.707)	0.000	0.000 (0.707)	0.000	0.000 <sup>b</sup> (0.707)	1.046 <sup>b</sup> (1.129)



T8	POP, Kerala	0.000 (0.707)	0.000	1.167 (1.138)	0.000	4.200 <sup>b</sup> (1.678)	1.046 <sup>b</sup> (1.129)
T9	Untreated check	0.500 (0.943)	0.000	0.000 (0.707)	0.000	18.133 <sup>a</sup> (4.303)	14.041 <sup>a</sup> (3.650)
	<b>Mean</b>	<b>0.185</b>	<b>0.0.00</b>	<b>0.852</b>	<b>0.000</b>	<b>4.167</b>	<b>3.203</b>
	<b>SEm ±</b>	<b>0.324</b>	-	<b>0.346</b>	-	<b>0.204</b>	<b>0.598</b>
	<b>CD at 5%</b>	<b>0.92</b>	-	<b>1.037</b>	-	<b>NS</b>	<b>1.339</b>
	<b>CV%</b>	<b>31.15</b>		<b>58.40</b>		<b>62.78</b>	<b>57.74</b>

### PARIA

The population of Tea Mosquito Bug (TMB) on shoots and panicles ranged between 1.29 to 1.43 and 1.24 to 1.45, respectively before spraying the insecticides. All the treatments were observed to be significantly superior over the control for reducing the TMB population on shoots and panicles after spraying the insecticides. Among the insecticidal treatments, treatment (T4) Buprofezin was observed to be superior for the management of TMB on shoots and panicles followed by carbosulfan application (i.e. T3) (Table 3.14).

It is revealed from the data presented in Table 3.15 and 3.16 that all the insecticidal treatments significantly reduced the incidence of thrips over the control in cashew. In nut thrips damage, minimum damage was observed in treatment (T4) Buprofezin with 0.07 nut trips damage score after spray followed by the treatment (T3) carbosulfan with 0.11 score. The maximum yield (6.70 kg/tree) was recorded in the treatment of Buprofezin. The populations of natural enemies were recorded before 3rd spray and 30 days after spraying. Population of natural enemies was maximum in untreated trees after spray. Maximum population of ant (0.20) and spider (0.18) within the treated trees were recorded in (T3) carbosulfan. In the treated trees, population of lady bird beetle was highest (0.12) in the treatment of Beauveria Bassiana (T6).

**Table 3.14 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Paria centre**

Sl.No.	Treatments	On shoots (Damage score 0-4)		On panicles (Damage score 0-4)	
		Before spray	30 days after spray	Before spray	30 days after spray
T1	Thiamethoxam 25% WG 1g/10 lit	1.43	0.93	1.32	0.88
T2	Thiamethoxam 25% WG 2g/10 lit	1.38	0.68	1.41	0.55
T3	Carbosulfan 25% EC 20ml/10 lit	1.40	0.32	1.24	0.29
T4	Buprofezin 25% SC 20 ml/10 lit	1.35	0.28	1.34	0.19
T5	Beauveria Bassiana 10 g/10 lit	1.36	1.14	1.29	1.16
T6	Beauveria Bassiana 50 gm/10 lit	1.29	0.88	1.26	0.85



T7	L-cyhalothrin 5% EC 6 ml /10 lit	1.34	0.60	1.39	0.46
T8	Untreated control	1.42	1.72	1.45	1.56
	<b>S.Em. ±</b>	<b>0.064</b>	<b>0.075</b>	<b>0.046</b>	<b>0.079</b>
	<b>CD at 5%</b>	<b>NS</b>	<b>0.23</b>	<b>NS</b>	<b>0.26</b>
	<b>CV%</b>	<b>8.17</b>	<b>11.51</b>	<b>5.90</b>	<b>15.04</b>

**Table 3.15 : Efficacy of different insecticides against pest complex in cashew at Paria centre**

Sr. No.	Treatments	Thrips damage score on nuts		Yield (Kg/plant)
		Before spray	30 days after spray	
T1	Thiamethoxam 25% WG 1g/10 lit	0.39	0.32	3.15
T2	Thiamethoxam 25% WG 2g/10 lit	0.49	0.27	4.19
T3	Carbosulfan 25% EC 20ml/10 lit	0.55	0.11	5.52
T4	Buprofezin 25% SC 20 ml/10 lit	0.52	0.07	6.70
T5	Beauveria Bassiana 10 g/10 lit	0.42	0.37	3.79
T6	Beauveria Bassiana 50 gm/10 lit	0.47	0.40	4.32
T7	L-cyhalothrin 5% EC 6 ml /10 lit	0.45	0.29	4.38
T8	Untreated control	0.52	0.61	2.41
	<b>S.Em. ±</b>	<b>0.066</b>	<b>0.035</b>	<b>0.35</b>
	<b>CD at 5%</b>	<b>NS</b>	<b>0.11</b>	<b>1.06</b>
	<b>CV%</b>	<b>24.15</b>	<b>19.68</b>	<b>14.07</b>

**Table 3.16 : Influence of different insecticides on natural enemies and pollinators in cashew at Paria centre**

Sl. No	Treatments	Ants		Spider		lady bird beetle	
		Before spray	30 days after spray	Before spray	30 days after spray	Before spray	30 days after spray
T1	Thiamethoxam 25% WG 1g/10 lit	0.12	0.10	0.15	0.12	0.10	0.03
T2	Thiamethoxam 25% WG 2g/10 lit	0.13	0.08	0.08	0.01	0.05	0.02
T3	Carbosulfan 25% EC 20ml/10 lit	0.17	0.20	0.15	0.18	0.08	0.08
T4	Buprofezin 25% SC 20 ml/10 lit	0.12	0.13	0.10	0.06	0.06	0.09
T5	Beauveria Bassiana 10 g/10 lit	0.11	0.08	0.08	0.07	0.04	0.06
T6	Beauveria Bassiana 50 gm/10 lit	0.08	0.06	0.11	0.13	0.11	0.12



T7	L-cyhalothrin 5% EC 6 ml /10 lit	0.20	0.15	0.10	0.04	0.06	0.02
T8	Untreated control	0.15	0.22	0.13	0.20	0.05	0.13
	<b>S.Em. ±</b>	<b>0.026</b>	<b>0.014</b>	<b>0.018</b>	<b>0.011</b>	<b>0.016</b>	<b>0.013</b>
	<b>CD at 5%</b>	<b>NS</b>	<b>0.0420</b>	<b>NS</b>	<b>0.0340</b>	<b>NS</b>	<b>0.0391</b>
	<b>CV%</b>	<b>33.20</b>	<b>19.19</b>	<b>27.49</b>	<b>19.08</b>	<b>40.42</b>	<b>32.45</b>

## VENGURLE

**Table 3.17 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Vengurle centre**

Treatments		On shoots (%)		On panicles (%)	
		Before spray	15 days after spray	Before spray	15 days after spray
T <sub>1</sub>	Thiamethoxam	0.307	0.153	0.336	0.259
T <sub>2</sub>	Carbosulfan	0.331	0.144	0.355	0.302
T <sub>3</sub>	Buprofezin	0.369	<b>0.139</b>	<b>0.336</b>	<b>0.278</b>
T <sub>4</sub>	<i>Beauveria bassiana</i> 1g/lit	0.278	0.149	0.210	0.350
T <sub>5</sub>	<i>Beauveria bassiana</i> 5g/lit	0.240	0.139	0.364	0.312
T <sub>6</sub>	L-cyhalothrin	0.268	0.143	0.441	0.321
T <sub>7</sub>	Untreated check	0.326	0.206	0.365	0.297
	<b>S.Em ±</b>	<b>0.030</b>	<b>0.019</b>	<b>0.038</b>	<b>0.028</b>
	<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>	<b>NS</b>
	<b>CV%</b>	<b>19.89</b>	<b>24.65</b>	<b>21.07</b>	<b>18.81</b>

Among the insecticidal treatments, the treatment T<sub>3</sub> Buprofezin recorded lower incidence of tea mosquito bug over control on shoot and panicle followed by the treatment T<sub>5</sub> *Beauveria bassiana* 5g/lit on shoot and T<sub>1</sub> Thiamethoxam on panicle (Table 3.17 and 3.18).

**Table 3.18 : Efficacy of different insecticides against Thrips incidence in cashew at Vengurle centre**

		Before spray	30 days after spray
T <sub>1</sub>	Thiamethoxam	0.259	0.180
T <sub>2</sub>	Carbosulfan	0.298	0.190
T <sub>3</sub>	Buprofezin	0.341	0.187
T <sub>4</sub>	<i>Beauveria bassiana</i> 1g/lit	0.240	0.187
T <sub>5</sub>	<i>Beauveria bassiana</i> 5g/lit	0.245	0.175





T <sub>6</sub>	L-cyhalothrin	0.249	0.180
T <sub>7</sub>	Untreated check	0.259	0.218
	<b>SEm ±</b>	<b>0.022</b>	<b>0.018</b>
	<b>CD at 5%</b>	<b>NS</b>	<b>NS</b>
	<b>CV%</b>	<b>16.57</b>	<b>18.44</b>

### VRIDHACHALAM

The results of evaluation of insecticides against TMB revealed that after first, second and third spraying, the efficacy of different insecticides was at par, but statistically superior over untreated control. The pre-treatment damage score of TMB was non-significant in all treatments including the untreated control. Gradual reduction of fresh infestation was observed two weeks after each round of spray (Table 3.19 and 3.20).

**Table 3.19 : Effect of insecticides 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)			
		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 ml/lit. all the three sprays	1.075 (1.688)	0.750 (1.323)	0.425 (1.194)	0.150 (1.072)	3.200 (2.049)	0.750 (1.322)	0.450 (1.204)	0.250 (1.118)	3.475 (2.115)	0.325 (1.151)	0.100 (1.049)	0.00825 (1.004)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	1.765 (1.658)	1.005 (1.44)	0.750 (1.323)	0.550 (1.245)	3.100 (2.025)	0.950 (1.396)	0.600 (1.265)	0.4525 (1.205)	3.425 (2.104)	0.425 (1.194)	0.300 (1.14)	0.300 (1.14)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	1.225 (1.658)	1.225 (1.491)	1.050 (1.432)	0.750 (1.323)	3.350 (2.085)	1.125 (1.457)	0.825 (1.351)	0.7575 (1.326)	3.225 (2.055)	0.675 (1.294)	0.500 (1.225)	0.500 (1.225)
T4	<i>Beauveria bassiana</i> WP @ 1 g/lit.	1.425 (1.687)	1.425 (1.557)	1.325 (1.525)	1.025 (1.423)	3.250 (2.061)	1.150 (1.466)	1.075 (1.44)	4.950 (2.27)	3.125 (2.031)	0.850 (1.36)	0.650 (1.285)	0.650 (1.285)
T5	<i>Beauveria bassiana</i> WP @ 5 g/lit.	1.300 (1.673)	1.300 (1.516)	1.350 (1.533)	1.075 (1.440)	3.225 (2.055)	1.125 (1.457)	1.050 (1.432)	0.875 (1.369)	3.275 (2.068)	0.875 (1.369)	0.600 (1.265)	0.600 (1.265)
T6	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	1.475 (1.732)	0.475 (1.214)	0.250 (1.118)	0.095 (1.046)	3.250 (2.062)	0.550 (1.245)	0.325 (1.151)	0.050 (1.025)	3.200 (2.049)	0.150 (1.072)	0.009 (1.004)	0.00325 (1.002)
T7	Thiamethoxam 25 WG @ 0.2 ml/lit. all the three sprays	1.775 (1.703)	0.775 (1.332)	0.375 (1.172)	0.150 (1.072)	3.325 (2.08)	0.725 (1.313)	0.450 (1.204)	0.255 (1.12)	3.200 (2.049)	0.275 (1.129)	0.325 (1.14)	0.00875 (1.004)



T8	Untreated control	2.150 (1.688)	2.350 (1.829)	2.725 (1.930)	2.925 (1.981)	3.175 (2.043)	3.450 (2.109)	3.600 (2.145)	3.775 (2.185)	3.500 (2.121)	3.550 (2.133)	3.600 (2.145)	3.525 (2.127)
	<b>C.D.</b>	<b>NS</b>	<b>0.054</b>	<b>0.032</b>	<b>0.033</b>	<b>NS</b>	<b>0.054</b>	<b>0.039</b>	<b>0.541</b>	<b>NS</b>	<b>0.023</b>	<b>0.095</b>	<b>0.006</b>
	<b>SEm ±</b>	<b>0.019</b>	<b>0.018</b>	<b>0.011</b>	<b>0.011</b>	<b>0.014</b>	<b>0.018</b>	<b>0.013</b>	<b>0.183</b>	<b>0.012</b>	<b>0.008</b>	<b>0.032</b>	<b>0.002</b>

DAS – Days After Spraying

Values in the parentheses are  $\sqrt{x+0.5}$  transformed values

**Table 3.20 : Efficacy of insecticides on TMB population / 52 leader shoot at Vrindhachalam (Mean of four replications)**

Treatment	Pre-Treatment Count /52 leader shoots	Post-treatment count (Mean TMB population/52 leader shoots)			Pre-Treatment Count /52 leader shoots	Post-treatment count (Mean TMB population/52 leader shoots)			Pre-Treatment Count /52 leader shoots	Post-treatment count (Mean TMB population/52 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	
T1	Thiamethoxam 25 WG @ 0.1 ml/lit. all the three sprays	2.125 (1.768)	0.550 (1.245)	0.075 (1.037)	0.040 (1.02)	2.450 (1.857)	0.600 (1.265)	0.085 (1.042)	0.050 (1.025)	2.6875 (1.92)	0.009 (1.004)	0.008 (1.004)	0.00489 (1.002)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	2.050 (1.746)	0.750 (1.323)	0.425 (1.194)	0.065 (1.032)	2.375 (1.836)	0.7875 (1.337)	0.150 (1.072)	0.081 (1.04)	2.7625 (1.94)	0.163 (1.075)	0.029 (1.014)	0.0125 (1.006)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	2.150 (1.775)	0.850 (1.36)	0.6 (1.265)	0.075 (1.037)	2.5375 (1.881)	0.8825 (1.372)	0.55 (1.245)	0.288 (1.134)	2.825 (1.956)	0.078 (1.038)	0.05 (1.025)	0.0325 (1.016)
T4	<i>Beauveria bassiana</i> WP @ 1 g/lit.	2.175 (1.782)	0.875 (1.369)	0.675 (1.294)	0.085 (1.042)	2.500 (1.871)	1.150 (1.466)	0.840 (1.356)	0.500 (1.224)	2.650 (1.91)	0.175 (1.083)	0.065 (1.032)	0.05 (1.025)
T5	<i>Beauveria bassiana</i> WP @ 5 g/lit.	2.150 (1.775)	0.85 (1.36)	0.6875 (1.299)	0.0725 (1.036)	2.475 (1.864)	1.300 (1.516)	0.6425 (1.282)	0.450 (1.204)	2.650 (1.91)	0.150 (1.072)	0.084 (1.041)	0.05 (1.025)
T6	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	2.225 (1.795)	0.375 (1.172)	0.05 (1.025)	0.029 (1.014)	2.600 (1.897)	0.450 (1.204)	0.055 (1.027)	0.016 (1.008)	2.650 (1.91)	0.004 (1.002)	0.0025 (1.001)	0.00125 (1.001)
T7	Thiamethoxam 25 WG @ 0.2 ml/lit. all the three sprays	2.15 (1.775)	0.6 (1.265)	0.0725 (1.036)	0.0425 (1.021)	2.350 (1.83)	0.575 (1.255)	0.083 (1.04)	0.043 (1.021)	2.700 (1.923)	0.0085 (1.004)	0.006 (1.003)	0.00425 (1.002)
T8	Untreated control	2.125 (1.768)	2.25 (1.803)	2.325 (1.823)	2.450 (1.857)	2.500 (1.871)	2.625 (1.904)	2.675 (1.917)	2.700 (1.923)	2.775 (1.943)	2.840 (1.096)	2.855 (1.963)	2.875 (1.968)
	<b>C.D. (0.05%)</b>	<b>NS</b>	<b>0.02</b>	<b>0.026</b>	<b>0.02</b>	<b>NS</b>	<b>0.016</b>	<b>0.042</b>	<b>0.026</b>	<b>NS</b>	<b>0.031</b>	<b>0.061</b>	<b>0.007</b>
	<b>SEm ±</b>	<b>0.019</b>	<b>0.011</b>	<b>0.009</b>	<b>0.007</b>	<b>0.005</b>	<b>0.019</b>	<b>0.014</b>	<b>0.009</b>	<b>0.01</b>	<b>0.019</b>	<b>0.021</b>	<b>0.002</b>

PTC – Pre Treatment Count ; DAS – Days After Spraying

Values in the parentheses are  $\sqrt{x+0.5}$  transformed values



**Table 3.21 : Efficacy of insecticides against foliar pests at Vridhachalam (Mean of four observations)**

Treatment	Mean damage after 3 <sup>rd</sup> spray										Yield (Kg per tree)	
	TMB Damage %		Leaf Miner %		Leaf and Blossom Webber %		Apple and Nut Borer %		Leaf Thrips Population (Nos.)			
	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS	PTC	30 DAS		
T1	Thiamethoxam 25 WG @ 0.1 ml/lit. all the three sprays	3.45 (10.699)	2.575 (9.227)	4.550 (12.308)	1.6 (7.259)	3.58 (10.9)	0.7375 (4.916)	1.125 (6.076)	0.0775 (1.502)	8.5625 (3.092)	0.45 (1.203)	5.225
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	3.65 (11.009)	2.6125 (9.297)	4.575 (12.344)	1.725 (7.538)	3.6925 (11.072)	0.75 (4.956)	1.175 (6.217)	0.026 (0.768)	8.25 (3.041)	0.525 (1.235)	4.775
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	3.6625 (11.028)	2.75 (9.541)	4.500 (12.236)	1.825 (7.76)	3.49 (10.759)	0.9375 (5.551)	1.15 (6.146)	0.0175 (0.751)	8.15 (3.024)	0.5 (1.224)	4.875
T4	<i>Beauveria bassiana</i> WP @ 1 g/lit.	3.7875 (11.217)	2.5875 (9.249)	4.425 (12.134)	1.925 (7.97)	3.575 (10.892)	0.8375 (5.244)	1.125 (6.076)	0.0275 (0.928)	8.375 (3.061)	0.475 (1.214)	4.725
T5	<i>Beauveria bassiana</i> WP @ 5 g/lit.	3.575 (10.891)	2.6 (9.272)	4.500 (12.242)	1.9 (7.92)	3.677 (11.049)	0.6625 (4.646)	1.05 (5.874)	0.025 (0.901)	8.75 (3.121)	0.55 (1.245)	4.85
T6	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	3.625 (10.968)	2.1625 (8.445)	4.700 (12.515)	0.8475 (5.277)	3.5275 (10.816)	0.66 (4.647)	1.000 (5.737)	0.001 (0.181)	8.3125 (3.051)	0.225 (1.104)	5.8125
T7	Thiamethoxam 25 WG @ 0.2 ml/lit. all the three sprays	3.45 (10.699)	2.475 (9.047)	4.6375 (12.427)	1.325 (6.599)	3.6 (10.93)	0.8075 (5.151)	1.075 (5.945)	0.0025 (0.285)	8.75 (3.122)	0.5 (1.224)	4.7875
T8	Untreated control	3.5 (10.774)	3.55 (10.855)	4.665 (12.467)	4.735 (12.56)	3.5075 (10.79)	3.525 (10.82)	1.075 (5.945)	1.2625 (6.446)	8.375 (3.061)	8.65 (3.106)	3.7375
	<b>C.D.</b>	<b>NS</b>	<b>0.401</b>	<b>NS</b>	<b>0.387</b>	<b>NS</b>	<b>0.488</b>	<b>NS</b>	<b>0.481</b>	<b>NS</b>	<b>0.055</b>	
	<b>SEm ±</b>	<b>0.121</b>	<b>0.135</b>	<b>0.14</b>	<b>0.131</b>	<b>0.134</b>	<b>0.165</b>	<b>0.121</b>	<b>0.163</b>	<b>0.042</b>	<b>0.018</b>	

PTC- Pre Treatment Count; DAS: Days After Spraying

Values in the parentheses are arc sine  $\sqrt{\text{per cent}}$  transformed values for per cent damage and  $\sqrt{x+0.5}$  transformed values for population numbers.

The population trend of TMB and other foliar feeding insects was recorded. Thirty days after 3<sup>rd</sup> spray, all the insecticides effective in controlling TMB populations to zero as against 2.8 bugs/ 52 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 3.21 and 3.22).



**Table 3.22 : Effect of insecticide sprays on natural enemies at Vridhachalam**

Treatment		Mean number of natural enemies / pollinators in 52 inflorescence 30 days after 3 <sup>rd</sup> spray			
		Spiders	Ants	Coccinellids	Cotesia
T1	Thiamethoxam 25 WG @ 0.1 ml/lit. all the three sprays	4.175 (2.274)	5.05 (2.459)	2.45 (1.856)	5.775 (2.601)
T2	Carbosulfan 25 EC @ 2 ml/lit. all the three sprays	3.95 (2.225)	5.225 (2.495)	2.025 (1.737)	5.5 (2.548)
T3	Buprofezin 25 % SC @ 2 ml/lit. all the three sprays	4.175 (2.274)	5.2 (2.489)	2.7375 (1.933)	5 (2.445)
T4	<i>Beauveria bassiana</i> WP @ 1 g/lit.	3.85 (2.202)	5.2 (2.49)	2.56 (1.886)	5.5 (2.548)
T5	<i>Beauveria bassiana</i> WP @ 5 g/lit.	3.95 (2.225)	5.35 (2.52)	2.2 (1.788)	5.75 (2.597)
T6	Lambda-Cyhalothrin 5 EC @ 0.6ml/lit. all the three sprays	3.95 (2.225)	5.3 (2.51)	1.975 (1.725)	5.45 (2.537)
T7	Thiamethoxam 25 WG @ 0.2 ml/lit. all the three sprays	3.9 (2.213)	5.4 (2.53)	2.5 (1.871)	5.3 (2.51)
T8	Untreated control	5.225 (2.495)	7.1875 (2.861)	5.7625 (2.6)	11.0625 (3.472)
	<b>CD (0.05%)</b>	<b>0.062</b>	<b>0.072</b>	<b>0.087</b>	<b>0.154</b>
	<b>SEm ±</b>	<b>0.021</b>	<b>0.024</b>	<b>0.029</b>	<b>0.052</b>

Values in the parentheses are  $\sqrt{x+0.5}$  transformed values

The mean population of natural enemies was considerably reduced in sprayed trees, but in unsprayed trees higher number of natural enemies were observed throughout the season.





## Ent. 2: Control of cashew stem and root borer

### Expt. 2. Curative control trial

**Centres:** **East Coast** : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara and Vengurla  
**Plains / others** : 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.

#### Treatment details:

- T1 - Fipronil swabbing – 2 ml/L
- T2 - Neem oil swabbing 5 % suspension
- T3 - Imidachloprid – Swabbing and drenching – 2 ml/ L
- T4 - Chlorpyrifos (10 ml/L)
- T5 - Treated check (only removal of grubs)
- T6 - Untreated check

#### BAPATLA

During the year, among the insecticides evaluated as post extraction prophylaxis, Fipronil (Swabbing) @ 2 ml/l and Imidacloprid (Swabbing and drenching) @ 2ml/l have offered protection to the tune of 80.95% trees without re-infestation followed by Chlorpyrifos 10 ml/l (Treated Check) with 78.26 % trees without re-infestation. The other treatments neem oil 5% (Swabbing) and sealer cum healer has offered 66.67 and 58.82 percent protection without re-infestation and are superior over the control treatment which recorded 33.33 % trees without re-infestation. Preferential zone of attack is collar +root in 34.23 percent of trees (38/111) followed by collar in 33.33 percent of trees (37/111) (Table 3.23 and 3.24).

**Table 3.23 : Efficacy of insecticides as Post extraction prophylaxies (PEP) against cashew stem and root borer at Bapatla**

Trt. No	Treatment	% Trees without reinfestation
1.	Fipronil Swabbing [2 ml/l]	80.95
2.	Neem oil Swabbing [5%]	66.67
3.	Imidachloprid [2 ml/l] (Swabbing and Drenching)	80.95
4.	Sealer cum Healer	58.82
5.	Chlorpyrifos [10 ml/l] (Treated Check)	78.26
6.	Un treated check (only removal of CSRB grubs)	33.33



**Table 3.24 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Bapatla**

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	12	0	0.00	12	100.00
	60-80cm	31	8	25.81	23	74.19
	80-100 cm	28	7	25.00	21	75.00
	>100 cm	40	17	42.50	23	57.50
<b>Total</b>		<b>111</b>	<b>32</b>	<b>28.83</b>	<b>79</b>	<b>71.17</b>
Age of the tree	< 10 years	0	0	0.00	0	0.00
	10-15 years	45	15	33.33	30	66.67
	>15years	66	17	25.76	49	74.24
<b>Total</b>		<b>111</b>	<b>32</b>	<b>28.83</b>	<b>79</b>	<b>71.17</b>
Zone of attack	C + R	38	13	34.21	25	65.79
	C + S	14	2	14.29	12	85.71
	R	4	0	0.00	4	100.00
	S	11	2	18.18	9	81.82
	C	37	10	27.03	27	72.97
	C + S + R	7	5	71.43	2	28.57
<b>Total</b>		<b>111</b>	<b>32</b>	<b>28.83</b>	<b>79</b>	<b>71.17</b>
Yellowing of canopy	Canopy yellowing	9	6	66.67	3	33.33
	Canopy not yellowing	102	26	25.49	76	74.51
<b>Total</b>		<b>111</b>	<b>32</b>	<b>28.83</b>	<b>79</b>	<b>71.17</b>
% of bark circumference damaged	<25	69	12	17.39	57	82.61
	26-50	24	11	45.83	13	54.17
	51-75	10	5	50.00	5	50.00
	>75	8	4	50.00	4	50.00
<b>Total:</b>		<b>111</b>	<b>32</b>	<b>28.83</b>	<b>79</b>	<b>71.17</b>

### BHUBANESWAR

Maximum recovery (91.7%) of plant was observed in case chlorpyrifos swabbing (10 ml/l) followed by fipronil swabbing (2ml/l) (77.3%). In case control i.e. extraction of CSRB grub, 57.14 per cent of the plant were recovered from reinfestation. In case of stem girth less than 60cm, reinfestation of treated trees was below 25 per cent. With the increase in stem girth i.e. above 60 cm reinfestation of





CSRB was found to be higher. Plants of 80-100 cm diameter were reinfested more in comparison to other groups. In plants of age group below 5 year percentage reinfestation of CSRB was nil and plants of age group 5-10 years and 10-15 years showed reinfestation of 32-33 per cent. Plants of more than 15 years were however more vulnerable to borer attack. Plants of collar+stem+root zone of damage were more prone to attack of CSRB (42.4 % reinfestation) followed by stem (36.4 %) and C+S zone (34.5%). Yellowing of canopy showed 40.0 per cent reinfestation while not yellowing showed 34.7 % of re attack by the pest. The per cent reinfestation was not there in less than 25 per cent bark damage. With the increase in damage to bark the reinfestation by the pest also increased gradually, highest being observed in >75% damage in bark (54% re infestation) (Table 3.25 and 3.26).

**Table 3.25 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Bhubaneswar centre**

Treatment	No of trees treated	No. of trees without reinfestation	Recovery (%)
Fipronil swabbing (2ml/l)	22	17	77.3
Neem oil swabbing (5% suspension)	24	15	62.5
Imidacloprid- Swabbing & drenching (2ml/l)	24	17	70.8
Chlorpyrifos (10ml/l)	24	22	91.7
Treated check (only removal of grub)	14	08	57.1
Untreated check	15	0	0.0
<b>Total</b>	<b>123</b>	<b>79</b>	<b>64.2</b>

**Table 3.26 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Bhubaneswar Centre**

Physical parameters		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	7	24.1	22	75.9
	60-100 cm	37	39.36	57	110.7
	> 100 cm	nil	0	-	-
<b>Total</b>		<b>44</b>	<b>35.8</b>	<b>79</b>	<b>64.2</b>
Age of the tree	<10 years	4	33.3	8	66.6
	10-15 years	31	32.6	64	67.4
	>15 years	9	56.3	7	43.8
<b>Total</b>		<b>44</b>	<b>35.8</b>	<b>79</b>	<b>64.2</b>



Zone of attack	C + R	4	28.6	10	71.4
	C + S	20	34.5	38	65.5
	R	2	28.6	5	71.4
	S	4	36.4	7	63.6
	C + S + R	14	42.4	19	57.6
<b>Total</b>		<b>44</b>	<b>35.8</b>	<b>79</b>	<b>64.2</b>
Yellowing of canopy	Canopy yellowing	10	40.0	15	60.0
	Canopy not yellowing	34	34.7	64	65.3
<b>Total</b>		<b>44</b>	<b>35.8</b>	<b>79</b>	<b>64.2</b>
% of bark circumference damaged	< 25	0	0	12	100.0
	26-50	6	23.1	20	76.9
	51-75	18	37.5	30	62.5
	>75	20	54.1	17	45.9
<b>Total</b>		<b>44</b>	<b>35.8</b>	<b>79</b>	<b>64.2</b>

### HOGALAGERE

Infestation and reinfestation of the CSRB grubs were observed in the trees treated with insecticides. The treatment with Fipronil swabbing (2ml/l) during Oct.-Nov., Jan.- Feb. and April - May and Chlorpyrifos (0.2%) were found most effective treatments against grubs of CSRB with 84.62% and 83.33% trees without reinfestation, respectively. However, the other treatments also maintained their superiority in suppressing the population over control. In treated check, where only grubs extraction was adopted, it was observed that 37% trees could recover (Table 3.27).

The incidence of cashew stem and root borer was monitored randomly at fortnightly interval in neglected cashew gardens. Trees with 60-100 cm stem girth showed maximum damage (93.75%) and with respect to age of trees, more than 15 years old trees were highly prone to CSRB damage (81.82%). The zone of CSRB attack was noticed maximum at collar + stem (83.33%) and canopy yellowing of trees was observed in 75 per cent of treated trees. The per cent bark circumference damage in less than 25 per cent was 80 per cent of the infested trees (Table 3.28).

**Table 3.27 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Hogalagere centre**

Treatment	Total number of trees treated	No. of trees without reinfestation / persistant attack	% trees without reinfestation / persistant attack
Fipronil swabbing @ 2ml/l (during Oct.-Nov., Jan. - Feb. and April - May)	13	11	84.62



Neem oil swabbing 5% suspension	11	5	45.45
Imidacloprid 17.8 SL @ 2ml/l as swabbing and drenching	9	6	66.67
Chlorpyriphos 20 EC @ 10ml/l	12	10	83.33
Treated check - only removal of CSRB grubs	8	3	37.50
Untreated control	8	2	25.00

**Table 3.28 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at HREC, Hogalagere Centre**

Physical parameters		No. plants observed after PEP	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	12	4	33	8	67
	60-100 cm	16	15	94	1	6
	> 100 cm	13	6	46	7	54
<b>Total</b>		<b>N=41</b>	<b>N=25</b>		<b>N=16</b>	
Age of the tree	<10 years	0	0	0	0	0
	10-15 years	1	0	0	1	0
	>15 years	11	9	82	2	18
<b>Total</b>		<b>N=12</b>	<b>N=9</b>		<b>N=3</b>	
Zone of attack	C + R	5	1	20	4	80
	C + S	12	10	83	2	17
	C + S + R	6	3	50	3	50
<b>Total</b>		<b>N=23</b>	<b>N=14</b>		<b>N=9</b>	
Yellowing of canopy	Canopy yellowing	12	9	75	3	25
	Canopy not yellowing	5	3	60	2	40
<b>Total</b>		<b>N=17</b>	<b>N=12</b>		<b>N=5</b>	
% of bark circumference damaged	< 25	15	12	80	3	20
	26-50	15	5	33	5	67
	51-75	8	2	25	6	75
	>75	0	0	0	0	0
<b>Total</b>		<b>N=38</b>	<b>N=19</b>		<b>N=19</b>	



## JAGDALPUR

The result revealed that treatment T1 (Fipronil swabbing @ 2ml/l) led to maximum recovery of 77.78 per cent trees without re-infestations followed by treatment T4 (Chlorpyrifos@10ml/l) (Table 3.29).

**Table 3.29 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Jagdalpur centre**

Treatment	Total number of trees treated	No. of trees re-infested	No. of trees without reinfestation / persistent attack	% trees without reinfestation / persistent attack
T1 : Fipronil swabbing (2ml/l)	18	4	14	77.78
T2 : Neem oil swabbing (5%)	18	8	10	55.56
T3 : Imidacloprid (2 ml/l)	18	6	12	66.67
T4 : Chlorpyrifos (10ml/l)	18	5	13	72.22
T5: Treated check (only removal of CSRB grubs)	18	10	8	44.45
T6 : Untreated check	18	12	6	33.34
<b>Total</b>	<b>108</b>	<b>44</b>	<b>64</b>	

The physical parameters of different treated trees were also recorded and details are given in Table. In case of stem girth less than 60 cm, reinfestation of treated tree was less. With the increase in stem girth i.e. above 60 cm, reinfestation of CSRB was found to be higher. Below 10 years old trees were free from the attack of CSRB. While, plants of age group 10-15 years showed 31.03 per cent reinfestation. Preferential zones of attack of re-infestations by cashew stem and root bores in the tree were C + S zone followed by C+S+R, zone with 37.50 and 27.78 per cent re-infested trees, respectively. The canopy of cashew trees infested by CSRB was not yellowed. Trees with 26-50 per cent bark circumference damage had maximum re-infestation with 63.46 per cent followed by 51-75 per cent bark circumference damage (40.00% re-infestation) (Table 3.30).

**Table 3.30 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Jagdalpur Centre**

Physical parameters		No. of trees treated	No. of trees infested after PEP	% of trees reinfested	No. of trees not reinfested after PEP	% of trees not reinfested
Stem girth	< 60 cm	5	1	20	4	80
	60-100 cm	72	22	<b>30.56</b>	50	69.44
	> 100 cm	25	11	<b>44.00</b>	14	56.00
<b>Total</b>		<b>102</b>	<b>24</b>		<b>78</b>	



Age of the tree	<10 years	8	0	0	8	100
	10-15 years	29	9	<b>31.03</b>	20	68.97
	>15 years	65	18	27.69	47	72.31
<b>Total</b>		<b>102</b>	<b>30</b>		<b>72</b>	
Zone of attack	C	29	6	20.69	23	79.31
	C+R	25	5	20.00	20	80.00
	C+S	16	6	<b>37.50</b>	10	62.50
	R	1	0	0.00	1	100.00
	S	13	2	15.38	11	84.62
	S+R	0	0	0.00	0	0.00
	C+S+R	18	5	<b>27.78</b>	13	72.22
<b>Total</b>		<b>102</b>	<b>24</b>		<b>78</b>	
Yellowing of canopy	Canopy yellowing	40	6	15.00	34	85.00
	Canopy not yellowing	62	20	<b>32.26</b>	42	67.74
<b>Total</b>		<b>102</b>	<b>26</b>		<b>76</b>	
% of bark circumference damaged	< 25	25	7	28.00	18	72.00
	26-50	52	33	<b>63.46</b>	19	36.54
	51-75	15	6	40.00	9	60.00
	>75	10	2	20.00	8	80.00
<b>Total</b>		<b>102</b>	<b>48</b>		<b>54</b>	

## JHARGRAM

Chlorpyrifos (0.2%) was found to be most effective treatment with maximum recovery of 93.45% followed by trees treated with Fipronil (2ml/l). In case of treated check where only grubs were removed showed 72.17% of recovery and in case of untreated check trees only 2.29% showed without reinfestation. Trees with stem girth more than 100 cm showed maximum re-infestation (100%) followed by the trees having stem girth 80 -100 cm (66.67%). Out of the total trees maximum infestation was observed at stem part followed by collar + stem region. Trees infested at stem + collar + root showed 100% re-infestation. Maximum recovery was observed on trees less than 25% and 25 – 50 % bark circumference damage. 100% re-infestation was observed when bark circumference damage more was 75% and those trees also showed canopy yellowing (Table 3.31).

**Table 3.31 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Hogalgere centre**

Treatment	% trees without reinfestation / persistent attack
Fipronil swabbing (2 ml/l)	89.96
Neem oil swabbing @5% suspension	77.46
Imidacloprid swabbing and drenching @ 2ml/l	82.18



Chlorpyrifos @ 10 ml/lit	93.45
Untreated check (only removal of CSRB grubs)	72.17
Treated check with most effective treatment under prophylactic trails	2.29

**Table 3.32 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Jhargram centre**

Physical Parameters of trees observed					
		No. of trees in each category			
		Without reinfestation	% of trees	With reinfestation	% of trees
Stem girth (in cm)	<60	9	81.82	2	18.18
	60 – 80	16	94.12	1	5.88
	80 – 100	1	33.33	2	66.67
	>100	0	0.00	1	100
<b>Total</b>		<b>26</b>		<b>6</b>	
In yrs	<5				
	5-10	0	0	2	100
	10 – 15	26	86.67	4	13.33
	> 15				
<b>Total</b>		<b>26</b>		<b>6</b>	
% bark circumference damaged	< 25	21	100	0	0
	25 – 50	3	50	3	50
	50 – 75	2	50	2	50
	> 75	0	0	1	100
<b>Total</b>		<b>26</b>		<b>6</b>	
Zone of attack	C + R	1	50	1	50
	C + S	4	100	0	0
	R				
	S	21	95.45	1	4.55
	C + R + S	0	0	4	100
<b>Total</b>		<b>26</b>		<b>6</b>	
Canopy yellowing	a) Yellowed	0	0	3	100
	b) No yellowing	26	89.65	3	10.35
<b>Total</b>		<b>26</b>		<b>6</b>	

### MADAKKATHARA

Among the insecticides tested for curative control after Post Extraction Prophylaxis, swabbing of fipronil @ 2ml/l recorded 100 per cent recovery followed with imidchloprid (90%) and chlorpyrifos (80%). Swabbing with neem oil soap 5 per cent recorded 65 per cent recovery of treated trees and the recovery in untreated check with grub extraction only was 36.8 per cent.





### Physical parameters of treated trees under post extraction prophylaxis trial against cashew stem and root borer at Madakkathara centre.

Stem girth was found to be the prominent factor in infestation. Out of total trees recovered after treatment, 81 per cent of the trees were under the category with stem girth of 60-100cm. However, the per cent decreased to 70 per cent among the trees with stem girth of more than 100 cm. The infestation was found to have significant relation with age of trees. When the age factor is taken in account, only 66 per cent of trees among the age group of more than 15 years have recovered in place of 100 per cent in trees below 15 years age. Out of 22 trees treated, 50 per cent of them have got persistent attack among those with infestation both at collar, stem and root region together. Among those treated trees with more than 75 per cent loss of bark damage, only 25 per cent have been recovered after treatment (Table 3.33 and 3.34).

**Table 3.33 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Madakkathara centre**

Treatment	Total number of trees treated	No. of trees without reinfestation / persistent attack	% trees without reinfestation / persistent attack
Fipronil swabbing 2ml/l	19	19	100%
Neem oil swabbing 5% (50ml/l)	20	13	65%
Imidachloprid swabbing and drenching 2ml/l	20	18	90%
Chlorpyriphos drenching 10 ml/l	20	16	80%
Treated check-grub removal only	19	8	36.8%

**Table 3.34 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Madakkathara Centre**

Physical parameters		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	-	-	-	-
	60-100 cm	7	19	30	81
	> 100 cm	18	30	43	70
<b>Total</b>		<b>25</b>		<b>73</b>	



Age of the tree	<10 years	-	-	-	-
	10-15 years	-	-	25	100
	>15 years	25	34	48	64
<b>Total</b>		<b>25</b>		<b>73</b>	
Zone of attack	C + R	7	15	40	85
	C + S	2	13	13	87
	C	5	36	9	64
	C + S + R	11	50	11	50
<b>Total</b>		<b>25</b>		<b>73</b>	
Yellowing of canopy	yellowing	2	67	1	33
	no yellowing	23	24	72	76
<b>Total</b>		<b>25</b>		<b>73</b>	
% of bark circumference damaged	< 25	9	43	12	57
	26-50	5	14	32	86
	51-75	5	16	27	84
	>75	6	75	2	25
<b>Total</b>		<b>25</b>		<b>73</b>	

### VENGURLE

Table 3.35 : Efficacy of insecticides as post extraction prophylaxis (PEP) against cashew stem and root borer (CSRB) at Vengurle centre

Treatment	Total number of trees treated	No. of trees without reinfestation / persistent attack	% trees without reinfestation / persistent attack
Fipronil swabbing 2ml/lit	20	19	95
Neem oil swabbing 5%	20	11	55
Imidachloprid swabbing and dranching 2ml/lit	20	15	75
Chlorpyriphos 10ml/lit	20	18	90
Treated check (only removal of grub)	20	9	45
Untreated check	20	6	30



The results indicated that the treatment T<sub>1</sub> (Fipronil swabbing 2ml/lit) recorded 95.00 per cent trees without reinfestation followed by treatment T<sub>4</sub> Chlorpyriphos (0.2%) 90.00 per cent trees without reinfestation. Reinfestation was more in Control (T<sub>6</sub>) (Table 3.35)

**Table 3.36 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Vengurle Centre**

Physical parameters		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	10	8.33	40	33.33
	60-100 cm	13	10.83	20	16.67
	> 100 cm	20	16.67	17	14.17
<b>Total</b>		<b>43</b>	<b>35.83</b>	<b>77</b>	<b>64.17</b>
Age of the tree	<10 years	6	5.0	12	10.0
	10-15 years	12	10.0	50	41.67
	>15 years	25	20.83	15	12.5
<b>Total</b>		<b>43</b>	<b>35.83</b>	<b>77</b>	<b>64.17</b>
Zone of attack	C + R	12	10.0	45	37.5
	C + S	16	13.33	11	9.17
	C + S + R	15	12.50	21	17.5
<b>Total</b>		<b>43</b>	<b>35.83</b>	<b>77</b>	<b>64.17</b>
Yellowing of canopy	Canopy yellowing	2	1.66	-	-
	Canopy not yellowing	41	34.17	77	64.17
<b>Total</b>		<b>43</b>	<b>35.83</b>	<b>77</b>	<b>64.17</b>

During the year total 120 trees are treated for cashew stem and root borer management. The data on the physical parameter of infested tree and not infested tree was recorded and presented in (Table 3.36).

The tree having the stem girth >100 cm recorded more prone to CSRB damage, where as it was minimum in tree having the stem girth <60 cm. Regarding age of tree the tree; having age more than 15 year more prone to CSRB infestation. Whereas the tree having the age <10 year recorded less infestation of cashew stem and root borer. In case of zone of attack the collar+ stem recorded more infestation of stem and Root borer where as it was minimum in collar + root. Bark circumference damaged the bark removed 51-75 percent showed more number of tree infested where as the bark removed >25 percent showed more tree without reinfestation after the removal of grub.



### VRIDHACHALAM

Maximum recovery of 55.17% was observed in chlorpyriphos 20 EC @10 ml/lit. of water as swabbing and drenching of CSRB infested trees as against mere recovery of 6.25 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 46.66 and 46.15% 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.72/-, Rs.81/- and Rs. 83/- respectively (Table 3.37).

**Table 3.37 : Efficacy of certain insecticides as curative control against CSRB at Vridhachalam**

Treatment		No. of trees treated	No. of trees without reinfestation from CSRB	Mean % recovery of trees from CSRB	Frequency of treatment	Cost of treatment /tree
T <sub>1</sub>	Fipronil 5% SC Swabbing@ 2ml/lit.	30	14	46.66 <sup>b</sup>	3	81.00
T <sub>2</sub>	Neem Oil suspension 5% Suspension and Swabbing and Drenching	25	9	36.00 <sup>c</sup>	3	70.00
T <sub>3</sub>	Imidachloprid 17.8 SL Swabbing and Drenching @ 2ml/lit.	26	12	46.15 <sup>b</sup>	3	83.00
T <sub>4</sub>	Chlorpyriphos 20 EC @ 10ml / lit. Swabbing and Drenching	29	16	55.17 <sup>a</sup>	3	72.00
T <sub>5</sub>	Treated check (only removal of CSRB grubs followed).	16	01	6.25 <sup>d</sup>	3	40.00
T <sub>6</sub>	Untreated check.	20	-	-	-	-
<b>Total</b>		<b>126</b>	<b>52</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 (83.33%) 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 (73.85%) were more susceptible to attack





of CSRB. Preferential zone of attack of re-infestations by CSRB in the trees were Collar + Root zone followed by Collar + Stem + Root and Collar + Stem with 71.79, 62.50 and 59.26 per cent re-infested trees respectively. Yellowing of canopy showed 94.64 per cent re-infestation. Trees with less than 25 per cent bark circumference damage had maximum re-infestation with 44.12 per cent followed by 51-75 per cent bark circumference damage (25.00% 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 3.38).

**Table 3.38 :** Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) curative trial observed at Vridhachalam

Physical Parameters		Total no. of trees treated	No. of trees reinfested	% of trees reinfested	No. of trees not reinfested	% of trees not reinfested
Stem girth	60 cm	7	2	28.57	5	71.43
	60-80 cm	64	38	59.38	26	40.63
	80-100 cm	24	20	83.33	4	16.67
	100 cm	31	14	45.16	17	54.84
<b>Total</b>		<b>126</b>	<b>74</b>		<b>52</b>	
Age of the tree	10 years	0	0			
	10-15 years	61	26	42.63	35	57.38
	15 years	65	48	73.85	17	26.15
<b>Total</b>		<b>126</b>	<b>74</b>		<b>52</b>	
Zone of attack	Collar+Root	39	28	71.79	11	39.29
	Collar+Stem	27	16	59.26	11	40.74
	Root	5	0	0	5	100.00
	Stem	10	5	50.00	5	50.00
	Collar	11	5	45.45	6	54.56
	Stem+Root	2	0	0	2	100.00
	Collar+Stem+Root	32	20	62.50	12	37.50
<b>Total</b>		<b>126</b>	<b>74</b>		<b>52</b>	
Yellowing of canopy	Canopy yellowing	56	53	94.64	3	5.36
	Canopy not yellowing	70	21	30.00	49	70.00
<b>Total</b>		<b>126</b>	<b>74</b>		<b>52</b>	
% of bark circumference damaged	25	68	30	44.12	38	55.88
	26-50	46	11	2.17	35	76.09
	51-75	12	3	25.00	9	75.00
	75	0	0	0	0	0
<b>Total</b>		<b>126</b>	<b>74</b>		<b>52</b>	



### Ent.3: Influence of biotic and abiotic factors on the incidence of pest complex of cashew

**Centres:** **East Coast** : Bapatla, Bhubaneswar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara, Paria and Vengurla  
**Plains / others** : 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

In case of Leaf and Blossom Webber, the results revealed that all weather variables together in question accounted for 65.13 percent variation in the percent shoot damage ( $R^2=0.6513$ ). The data indicated that Min.Temp. ( $X_2$ ) and Relative Humidity (m) ( $X_3$ ) independently exerted significant negative correlation and Relative Humidity (e) ( $X_4$ ) exerted significant positive correlation. Leaf miner incidence showed significant positive correlation with Max.Temp ( $X_1$ ) and significant negative correlation with Min.Temp. ( $X_2$ ). With regard to Leaf folder incidence showed significant negative to Max. Temp ( $X_1$ )

Shoot tip caterpillar population showed significant positive correlation with Min.Temp. ( $X_2$ ) and significant negative correlation with Max.Temp ( $X_1$ ) and Relative Humidity (e) ( $X_4$ ). With regard to Apple and nut borer all five independent variables have accounted for 68.69% of total variation in percent nut damage by Apple and nut borer (ANB) ( $R^2=0.6869$ ). and showed significant positive correlation with Max.Temp ( $X_1$ ) and non-significant negative correlation with Relative Humidity (m) ( $X_3$ ) and Relative Humidity (e) ( $X_4$ ).

**Table 3.39 : Influence of abiotic factors on the activity of pest complex of cashew at Bapatla centre**

Variable	Leaf and blossom webber	Leaf miner	Leaf Folder	Shoot Tip Caterpillar	Apple and Nut borer
$X_1$ -Maximum Temp	0.116	1.322*	-0.436*	-0.264*	0.215*
$X_2$ -Minimum Temp	-0.874*	-0.808*	-0.077	0.617*	0.066
$X_3$ -RH (m)	-0.204*	0.016	0.002	0.237	-0.050
$X_4$ -RH (e)	0.242*	0.208	-0.029	-0.359*	-0.029
$X_5$ -Rain fall	-0.022	-0.040	-0.020	0.018	0.003
$R^2$ Value	0.6513	0.2797	0.8115	0.5561	0.6869
% Variation	65.13	27.97	81.15	55.61	68.69





## BHUBANESWAR

Insect pests incidence was comparatively lower during the year under report. Different insect pests viz shoot tip caterpillar, leaf miner and folder built up initially from mid of July with the initiation of new leaves and continued upto October. Again the incidence of insect pests took place coinciding with flowering and fruiting. Low temperature (15 to 20° C) continued upto first week of February. Other associated environmental conditions were also quite conducive for the pest but sudden rise in maximum temperature more than 40°C from the beginning of April onwards caused adverse effect on most of the pests. During this period STC, inflorescence thrips and leaf miner was noticed (Table 3.40).

During vegetative period maximum damage by STC was around 4.4 % damaged shoot during September last week to October first week. Both maximum and minimum temperature had significant positive correlation with the STC. Leaf miner incidence began from first of August with 14.26 % damaged leaf. Maximum incidence took place during mid of September to mid of October (more than 20 per cent damaged leaf) and then gradually the population was decreased. Both Maximum temperature, RH (Evening), rainfall and sunshine were positively correlated. With respect to leaf folder incidence none of the environment factors found significantly correlated.

The incidence of STC inflorescence and leaf miner was quite low during flowering and fruiting period of cashew during the year. Maximum temperature was positively correlated to STC incidence while both Maximum and minimum temperature were positively correlated to inflorescence thrips and leaf miner. But with the increase of temperature above 40°C and 25°C (max and min temp. respectively) the population had declined. Besides, the Bright Sun shine hours also positively correlated to leaf miner in the beginning (Table 3.41).

**Table 3.40 : Influence of abiotic factors on the activity of pestcomplex of cashew during vegetative growth phase at Bhubaneswar centre**

Weather Parameters	Leaf miner	Shoot tip caterpillar	Leaf folder
X1 - Maximum Temp	0.55432*	0.44977	0.103228
X2 - Minimum Temp	0.55835	0.33156	0.65084
X3 - RH (m)	0.29407	0.20088	0.290663
X4 - RH (e)	0.41467*	0.170623	0.73408
X5 - Rain fall	0.13158*	-0.24082	0.593492
X6 - No. of rainy days	-	-	
X7 - Bright sunshine hours	0.11996*	0.23253	-0.55818
X8 - Wind velocity	-	-	
X9 - Rate of evaporation	-	-	
<b>R</b>	<b>0.78</b>	<b>0.75</b>	<b>0.68</b>



**Table 3.41 : Correlation of weather parameters with the pests of regional importance at Bhubaneswar in flowering and fruiting period**

Weather parameters	STC	IT	LM
Temp (max)	0.25579*	0.71931*	0.72776*
Temp (min)	-0.28346	0.87281*	0.85596*
RH (Morn)	0-0.13767	0.556054	0.593898
RH (Even)	0.161313	0.520705	0.511669
Rainfall	0.331567	0.362569	-0.14645
BSH	0.0806	0.58296	0.68029*
<b>R</b>	<b>0.79</b>	<b>0.88</b>	<b>0.93</b>

### HOGALAGERE

The correlation between TMB incidence and weather parameters revealed that morning relative humidity and evening relative humidity ((0.210 & 0.346) had a positive correlation, but negative correlation was established with maximum temperature (-0.600), minimum temperature (-0.778), rainfall (-0.139) and with number of rainy days (-0.264). The activity of CSRB was observed throughout the year but its peak activity was noticed during December, April and May. Maximum and Minimum temperatures had positive correlation (0.239 & 0.066) with the incidence of the pest. Mealy bug had positive correlation only with maximum temperature (0.482) and negative correlation with rest of the weather parameters.

Apple and nut borer had positive correlation with maximum and minimum temperatures (0.849 & 0.507) and negative correlation with rest of the weather parameters. The infestation of thrips showed positive correlation with maximum and minimum temperatures (0.795 & 0.215) and negative correlation with rest of the weather parameters. The aphid infestation had a positive correlation with maximum temperature (0.126) and negative correlation with Rest of the parameters.

Variation with respect to various pest incidences is evident over years of observations and even with the occurrence of natural enemies of pests. However, correlation of pests with the weather parameters seems to be consistent over years (Table 3.42).

**Table 3.42 : Correlation of weather parameters and different insect pests recorded on cashew at Hogalagere**

Weather Parameters	TMB	CSRB	MB	ANB	Thrips	Aphids
X1 - Maximum Temp ( <sup>0</sup> C)	-0.600	0.239	0.482	0.849	0.795	0.126
X2 - Minimum Temp ( <sup>0</sup> C)	-0.778	0.066	-0.064	0.507	0.215	-0.562
X3 - RH (m) (%)	0.210	-0.577	-0.596	-0.642	-0.731	-0.152
X4 - RH (e) (%)	0.346	-0.362	-0.671	-0.852	-0.938	-0.425
X5 - Rain fall (mm)	-0.139	-0.351	-0.628	-0.352	-0.651	-0.646
X6 - No. of rainy days (no.)	-0.264	-0.425	-0.696	-0.353	-0.689	-0.729

**JAGDALPUR****Table 3.43 : Influence of abiotic factors on the activity of pest complex of cashew at Jagdalpur centre**

Weather Parameters	Leaf miner	Shoot TMB	Panicle TMB	Leaf folder	Leaf caterpillar
X1 - Maximum Temp	-0.338	-0.291	-0.284	<b>-0.771**</b>	<b>-0.804**</b>
X2 - Minimum Temp	<b>0.465*</b>	-0.377	-0.228	-0.277	0.316
X3 - RH (m)	0.387	-0.324	0.392	<b>0.734**</b>	<b>0.638**</b>
X4 - RH (e)	<b>0.459*</b>	-0.370	0.227	0.315	0.234
X5 - Rain fall	-0.336	-0.186	0.361	-0.287	<b>-0.436*</b>
X6 - No. of rainy days	-0.269	0.071	0.23	-0.164	-0.269
X7 - Bright sunshine hours	<b>0.491*</b>	-0.330	-0.018	-0.398	-0.395
X8 - Wind velocity	-0.163	-0.326	-0.201	-0.359	-0.388
X9 - Rate of evaporation	<b>-0.494*</b>	-0.181	-0.358	<b>-0.772**</b>	<b>-0.537**</b>

**Table 3.44 : Influence of abiotic factors on the activity of pest complex of cashew at Jagdalpur centre**

Weather Parameters	Nut thrips	Apple thrips	Mealy bugs
X1 - Maximum Temp	<b>0.838**</b>	<b>0.636**</b>	-0.321
X2 - Minimum Temp	-0.374	-0.288	-0.153
X3 - RH (m)	<b>-0.436*</b>	<b>-0.419*</b>	0.347
X4 - RH (e)	-0.369	-0.361	-0.167
X5 - Rain fall	0.122	0.158	<b>-0.419*</b>
X6 - No. of rainy days	0.09	0.094	-0.148
X7 - Bright sunshine hours	<b>0.461*</b>	<b>0.471*</b>	0.208
X8 - Wind velocity	0.315	0.277	-0.146
X9 - Rate of evaporation	0.287	0.24	-0.258

During the year, maximum incidence of pest was observed during new growth of flush and flower. In case of leaf folder and leaf caterpillar, a highly significant positive correlation was recorded with relative humidity (morning) while, maximum temperature and rate of evaporation showed highly significant negative correlation. Incidence of nut and apple thrips was significant positively influenced by maximum temperature and bright sun shine hour while, relative humidity ( morning) influenced the pest in a significant negative pattern. Leaf miner activity was significant positively influenced by minimum temperature, relative humidity (evening) and and bright sun shine hour whereas, significant negative correlation was observed with rate of evaporation. Significant negative correlation was found between mealy bug and rainfall (Table 3.43 and 3.44).



### JHARGRAM

The result revealed all the weather parameters studied has negative correlation to tea mosquito bug. Leaf miner showed significant positive correlation with minimum RH and rainfall and leaf and blossom webber showed a negative correlation with the maximum temperature. A significant negative correlation was observed between apple nut borer (ANB) and the relative humidity while thrips showed significant negative correlation with the maximum and minimum temperature (Table 3.45).

**Table 3.45 : Influence of abiotic factors on the activity of pest complex of cashew at Jhargram centre**

Weather Parameters	TMB	LM	LBW	ANB	Thrips
X1 - Maximum Temp	-0.573	-0.069	-0.129	0.151	-0.872**
X2 - Minimum Temp	-0.787**	0.407	0.045	-0.359	-0.916**
X3 - RH (m)	-0.053	0.571	0.425	-0.800**	0.317
X4 - RH (e)	-0.638*	0.840**	0.452	-0.916**	-0.342
X5 - Rain fall	-0.579*	0.657*	0.120	-0.526	-0.366
X6 - No. of rainy days	-0.604*	0.385	-0.273	-0.380	-0.476

### MADAKKATHARA

The correlation analysis with regard to tea mosquito bug and weather factors revealed that morning relative humidity had a significant negative correlation with the damage by tea mosquito bug, whereas significant positive correlation was established with wind velocity. However during last year, minimum temperature, relative humidity and rainy days had a significant negative correlation whereas significant positive correlation was established with bright sunshine hours and wind velocity.

Insect pests other than tea mosquito bug were absent during the reporting year and the data was not sufficient for correlation studies. During last year, morning relative humidity had shown significant negative correlation with leaf miner damage. Thrips activity was positively correlated with maximum temperature and evaporation and significant negative correlation was established with relative humidity. Apple and nut borer incidence had significant positive correlation with sunshine hours, maximum temperature and evaporation and established a negative correlation with relative humidity during previous year (Table 3.46).

**Table 3.46 : Influence of abiotic factors on the activity of pest complex of cashew at Madakkathara centre**

Weather Parameters	Tea mosquito bug			
	Anakkayam-1	Madakkatahra-1	Kanaka	Dhana
X1 - Maximum Temp	-0.076	-0.151	-0.039	-0.015
X2 - Minimum Temp	-0.206	-0.244	-0.329	-0.232
X3 - RH (m)	-0.472*	-0.300	-0.592**	-0.292
X4 - RH (e)	-0.156	-0.035	-0.331	-0.108
X5 - Rain fall	-0.263	-0.186	-0.246	-0.182
X6 - No. of rainy days	-0.306	-0.211	-0.293	-0.197





X7 - Bright sunshine hours	0.380	0.459*	0.183	0.285
X8 - Wind velocity	0.540**	0.346	0.754**	0.356
X9 - Rate of evaporation	0.050	-0.128	-0.411	-0.062

\* = r at 5 % level of significance, \*\* = r at 1% level of significance

### PARIA

Insect pest incidence was comparatively lower during the year under report. Tea Mosquito Bug and thrips positively correlated with morning and evening relative humidity while negatively influenced by other weather parameters. The regression equation worked out for predicting TMB damage was observed significant and explained 88.30 % variation whereas thrips damage was varied at 65.97 % against abiotic factors (Table 3.47 and 3.48).

**Table 3.47 : Influence of abiotic factors on the activity of pest complex of cashew at Paria centre**

Weather Parameters	Correlation coefficient (r)		Regression coefficient	
	TMB	Thrips	TMB	Thrips
Max. Temp.	-0.725*	-0.274	-0.030	-0.033
Min.Temp.	-0.761*	-0.216	-0.116	-0.013
Mor. RH (%)	0.490	0.230	0.006	0.005
Eve. RH (%)	0.094	0.358	0.001	0.003
Sun shine hours	-0.413	-0.432*	-0.202	0.020
Wind velocity	-0.349	-0.605*	-0.409	-0.377
Evaporation	-0.726*	-0.594*	0.131	0.153
R2			0.883	0.659
% Variation			88.30	65.97
R value			0.939	0.812

\* = significant at 5 %

**Table 3.48 : Monthly weather parameters recorded at Paria**

Month	Max. Temp.	Min. Temp.	Mor. RH	Eve. RH	Sun-shine hours	Wind velocity	Eva.	Rainfall (mm)	Rainy Days
April	35.41	20.83	79.35	47.57	9.87	3.95	6.44	0.0	0
May	36.51	24.86	76.08	54.05	10.43	5.51	7.68	0.0	0
June	33.06	25.14	82.45	71.78	6.15	6.64	4.50	287.3	12
July	31.28	25.72	87.94	77.26	5.41	8.28	4.15	635.3	11
August	30.94	24.77	92.41	77.42	4.80	4.93	2.97	263.3	10
September	32.01	22.48	89.83	70.30	5.89	3.19	3.57	410.5	8
October	35.47	21.26	81.22	56.59	8.00	1.40	3.82	51.8	3



November	34.86	16.02	71.78	39.88	8.57	1.12	3.53	0.0	0
December	32.62	11.00	77.35	52.63	8.57	1.42	3.24	0.0	0
January	31.64	9.31	77.95	33.16	8.76	1.65	3.29	0.0	0
February	32.00	11.72	83.91	44.78	8.98	2.19	4.09	0.0	0
March	35.85	15.42	69.26	39.55	9.36	2.35	5.69	0.0	0
<b>Total:</b>								<b>1648.2</b>	<b>44</b>

### VENGURLE

The data revealed that during the year, the TMB incidence showed negative significant correlation with minimum temperature and evening relative humidity ( $r=-0.763$ ) ( $r=-0.680$ ) respectively. Whereas incidence of TMB showed negative correlation with rainfall. The incidence of Thrips showed negative significant correlation with minimum temperature and evening relative humidity ( $r=-0.876$ ) ( $r=-0.778$ ) respectively. The incidence of thrips showed negative correlation with rain fall. In the year 2015-16 the incidence of Apple and Nut borer showed negative significant correlation with minimum temperature ( $r=-0.763$ ) and negative correlation with maximum temperature evening relative humidity and rain fall (Table 3.49).

**Table 3.49 : Influence of abiotic factors on the activity of pest complex of cashew at Vengurle centre**

Weather Parameters	TMB	THRIPS	ABN
X1 - Maximum Temp	0.166	0.272	-0.037
X2 - Minimum Temp	-0.763*	-0.876*	-0.763*
X3 - RH (m)	0.363	0.402	0.386
X4 - RH (e)	-0.680*	-0.778*	-0.438
X5 - Rain fall	-0.467	-0.530	-0.349

\* - Significant at 5% level of significance.

$r = 0.576$  at 5% level of significance

### VRIDHACHALAM

The incidence of TMB was confined to flushing through fruiting season. Its activity was observed from first week of February to third week of April. Maximum TMB damage was observed during the second week of March with mean damage score ranging between 1.69 and 2.76. Nut borer activity during non-bearing periods could not be traced out. Cashew leaf miner was found from August to March with a maximum of 2.2% leaf damage during first fortnight of February. Cashew leaf folder was also observed from August 2015 - March 2016 with 2.8% to 4.8% leaf damage observed in young plantations. Maximum damage was noticed during August 2015 and also in August 2016. Whereas, Leaf and blossom webber damage was observed maximum during June 2015 and 2016. Cashew Leaf thrips population (8.03) was noticed in April 2016. Leaf folder damage (7.3%) was observed during August - 2016. However, shoot tip caterpillar was observed during January to





February - 2016. The CSRB damage (30%) was prevailing throughout the season but maximum was recorded during August 2016.

Correlation studies revealed that sunshine (hours) were significant and positively correlated with the TMB population. Relative Humidity (Morning %) and Rainy days were significant and negatively correlated with TMB population. Rainfall had significant negatively correlated with Leaf and blossom webber per cent damage. Rainy days and sunshine hours were significant and positively correlated with leaf miner per cent damage (Table 3.50). Whereas, rainfall and wind speed were significant and negatively correlated with the population of ants.

Based on the regression analysis (Table) 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 2015 to October 2016. The regression equation indicated that a decrease in 1°C of maximum temperature reduced the TMB population by 0.1 per 52 Leader shoots. Similarly, morning and evening Relative humidity also reduced TMB population by 0.1 and 0.02, respectively per 52 Leader shoots. But, increase in 1 km/hr of wind speed decreases the TMB population. Increase in Rainfall reduces the Leaf and blossom webber damage to 0.03%. When 1 km/hr of wind speed decreases the Leaf miner damage was decreased to 1%. Increase in rainy days decreased the leaf thrips population (1 No.). Decrease in rainy days decreases the apple and nut borer infestation. Decrease in sun shine hours decreases the CSRB damage to 1%.

The multiple regression equations were developed for predicting the pests and natural enemies of cashew by using regression models. by using regression models and the coefficient of determination ( $R^2$ ) indicated that pests observed viz., 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) were predicted to an extent of 95, 70, 90, 88, 62, 55, 82 and 79 per cent respectively. Similarly, for the natural enemies viz, population of spiders (Y9), ants (Y10), coccinellids (Y11), braconids (Y12) and wasp (Y13) were predicted to an extent of 51, 80, 61, 58 and 75 per cent respectively.

**Table 3.50 : 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 (°C) (X1)	0.095	0.690	-0.121	0.269	0.422	-0.343	-0.771	-0.437
Maximum temperature (°C) (X2)	-0.081	1.027	0.214	-0.394	0.212	0.406	-0.452	1.458



Relative Humidity (Morning%) (X3)	-0.145*	-0.732	0.139	0.069	0.288	-0.198	-0.148	-0.100
Relative Humidity (Evening%) (X4)	-0.017	0.470	-0.023	-0.149	0.076	0.171	-0.003	-0.042
Rainfall (X5)	0.006**	-0.034*	-0.001	0.018	0.005	-0.012	-0.005	-0.019
Rainy days (X6)	-0.190**	0.492	0.362*	-0.593	-0.424	0.817	0.099	1.699
Wind speed(Km/hr.) (X7)	0.074	-0.280	-0.575	0.982	0.273	-0.485	-0.276	2.169
sunshine (hours) (X8)	0.543**	-1.736	0.406*	1.779	0.321	0.059	0.193	-0.992

\*significant at 1% level; \*\*significant at 5% level.

**Table 3.51 : 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)	-0.182	0.003	0.052	0.083	0.147
Maximum temperature (°C) (X2)	-0.056	0.567	0.040	-0.001	-0.015
Relative Humidity (Morning%) (X3)	0.061	0.205	-0.010	0.145	0.058
Relative Humidity (Evening%) (X4)	-0.025	0.218	0.013	-0.063	-0.003
Rainfall (X5)	-0.001	-0.022*	-0.001	0.001	-0.006
Rainy days (X6)	0.163	0.462	-0.077	-0.055	0.109
Wind speed(Km/hr.) (X7)	-0.158	-1.158*	0.121	0.266	-0.207
sunshine (hours) (X8)	0.014	-1.482	-0.383	-0.116	0.091

\*significant at 1% level; \*\*significant at 5% level





**Table 3.52 : Regression analysis between pests of cashew and weather parameters during June - 2015 and October - 2016 at Vridhachalam.**

Sl. No.	Biotic factors	Regression equation	R <sup>2</sup>
1.	TMB Population(Y1)	$Y1 = 11.73 + 0.1 (X1) + (- 0.1) (X2) + (- 0.1) (X3) + (- 0.02) (X4) + 0.01 (X5) + (- 0.2) (X6) + 0.1 (X7) + 1 (X8)$	0.95**
2.	Leaf and blossom webber (% damage) (Y2)	$Y2 = -2.84 + 1 (X1) + 1 (X2) + (- 1) (X3) + 0.5 (X4) + (- 0.03) (X5) + 0.5 (X6) + (- 0.3) (X7) + (- 2) (X8)$	0.70NS
3.	Leaf miner (% damage) (Y3)	$Y3 = -16.18 - 0.1 (X1) + 0.2 (X2) + 0.1 (X3) + (- 0.02) (X4) + (- 0.001) (X5) + 0.4 (X6) + (- 1) (X7) + 0.4 (X8)$	0.90**
4.	Leaf thrips Population(Y4)	$Y4 = 0.68 + 0.3 (X1) + (- 0.4) (X2) + 0.1 (X3) + (- 0.1) (X4) + 0.02 (X5) + (- 1) (X6) + 1 (X7) + 2 (X8)$	0.88**
5.	Apple and nut borer (% damage) (Y5)	$Y5 = -49.20 + 0.4 (X1) + 0.2 (X2) + 0.3 (X3) + 0.1 (X4) + 0.01 (X5) - 0.4 (X6) + 0.3 (X7) + 0.3 (X8)$	0.62NS
6.	Leaf folder (% damage) (Y6)	$Y6 = 0.53 + (- 0.3) (X1) + 0.4 (X2) + (- 0.2) (X3) + 0.2 (X4) + (- 0.01) (X5) + 1 (X6) + (- 0.5) (X7) + 0.1 (X8)$	0.55NS
7.	Shoot tip caterpillar (% damage) (Y7)	$Y7 = 48.99 + (- 1) (X1) + (- 0.5) (X2) + (- 0.1) (X3) + (- 0.003) (X4) + (- 0.01) (X5) + 0.1 (X6) + (- 0.3) (X7) + 0.2 (X8)$	0.82*
8.	CSRB (% damage) (Y8)	$Y8 = -14.69 + (- 0.4) (X1) + 1 (X2) + (- 0.1) (X3) + (- 0.04) (X4) + (- 0.02) (X5) + 2 (X6) + 2 (X7) - 1 (X8)$	0.79*

\*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).

**Table 3.53 : Regression analysis between natural enemies of cashew and weather parameters during June - 2015 and October - 2016 at Vridhachalam.**

Sl. No.	Biotic factors	Regression equation	R <sup>2</sup>
1.	Spiders(Y9)	$Y9 = 5.02 + (- 0.2) (X1) + (- 0.1) (X2) + 0.1 (X3) + (- 0.03) (X4) + (- 0.002) (X5) + 0.2 (X6) + (- 0.2) (X7) + 0.01 (X8)$	0.51NS
2.	Ants(Y10)	$Y10 = -32.35 + 0.004 (X1) + 1 (X2) + 0.2 (X3) + 0.2 (X4) + (- 0.02) (X5) + 0.5 (X6) + (- 1) (X7) + (- 1) (X8)$	0.80*
3.	Coccinellids(Y11)	$Y11 = 2.51 + 0.1 (X1) + 0.04 (X2) + (- 0.01) (X3) + 0.01 (X4) + (- 0.001) (X5) + (- 0.1) (X6) + 0.1 (X7) + (- 0.4) (X8)$	0.61NS
4.	Braconids(Y12)	$Y12 = -9.06 + 0.1 (X1) + (- 0.001) (X2) + 0.1 (X3) + (- 0.1) (X4) + 0.001 (X5) + (- 0.1) (X6) + 0.3 (X7) + (- 0.1) (X8)$	0.58NS
5.	Wasp(Y13)	$Y(13) = -7.34 + 0.1 (X1) + (- 0.02) (X2) + 0.1 (X3) + (- 0.003) (X4) + (- 0.01) (X5) + 0.1 (X6) + (- 0.2) (X7) + 0.1 (X8)$	0.75NS

\*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).



## Ent.4: Screening of germplasm to locate tolerant / resistant types to major pests of the region

**Centres:** **East Coast** : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam  
**West Coast** : Madakkathara and Vengurla  
**Plains / others** : 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, among the 40 accessions screened to identify the tolerant lines against the pests of cashew and various accessions showed gradations of incidence as given in the table.

**Table 3.54 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Bapatla centre**

Infestation by	Min. Damage recorded	Germplasm	Max. Damage recorded	Germplasm
Leaf and blossom webber	0.79	T.No.12/1	6.72	Ch.gudem
Leaf miner	1.49	Vetapalem	15.26	ABT-3
Shoot tip caterpillar	0.28	T.No.277	6.62	ABT-3
Leaf folder	0.15	Hy 94-T4	2.82	T.No.233
Apple and nut borer	0.37	T.No.7/12	10.09	T.No.2/3

### BHUBANESWAR

**Table 3.55 : Reaction of germplasm accessions against insect pests in Bhubaneswar**

Pest	Accessions	Min. damage	Accessions	Max. damage
Leaf Miner	100 Nos (all)	0.5-1.0%		
Shoot tip caterpillar	OC 31, OC 36, OC37, OC133, OC 142 and OC152	0.5-1.0%	OC 55, OC 96, OC132, OC149	2-3% damaged shoot
Inflorescence thrips	OC 31, OC 36, OC 37, OC55, OC91, OC92, OC109, OC117, OC122, OC137	0.5-1/ panicle	OC25 ,OC104, OC110, OC118, OC124, OC158	3-5/panicle
Leaf and blossom webber	OC12, OC55, OC60, OC 124, OC135, OC158	0.5-1.0%	OC 47, OC53, OC105, OC117, OC161	2-3%



**HOGALAGERE**

**Table 3.56 : Screening of MLT-II (MLT-1992) entries for tolerant/resistant to the major pests of the region at HREC, Hogalagere**

Sl. No.	Centre	Entry	Mean damage on 52 leader shoots			Thrips
			TMB	Leaf miner	Apple & nut borer	
1	Vengurla	H-68	1.13	1.14	1.27	0.96
2		H-367	0.75	1.13	1.00	0.79
3		H-303	0.95	0.89	0.69	1.17
4		H-255	1.09	0.75	0.72	1.22
5		H-320 (V-9)	1.08	1.20	1.03	0.91
6	Vridhachalam	M-4/3	0.81	0.92	1.12	1.29
7		M-15/4	0.81	1.03	1.11	1.01
8	NRCC, Puttur	NRCC-1	0.81	0.80	0.71	0.96
9		NRCC-2	1.25	1.17	0.66	0.93
10	Bapatla	TN-30/1	0.91	0.61	0.62	0.87
11		TN-3/33	1.10	0.74	0.84	0.79
12		TN-10/19	1.29	0.83	1.14	1.03
13		TN-3/28	0.72	0.65	0.74	1.22
14	Ullal	Ullal-1	1.00	0.69	0.64	1.28

**Table 3.57 : Screening of MLT III (MLT 2002) entries for tolerant/resistant to the major pests of the region at HREC, Hogalagere**

Sl. No.	Centre	Entry	Mean damage on 52 leader shoots		
			TMB	Leaf miner	Apple & nut borer
1	Bhubaneswar	BH-6	1.15	0.72	1.15
2		BH-85	0.67	0.75	0.88
3	Madakkathara	H-1593	1.21	1.00	0.71
4		K-22-1	1.08	0.91	1.22
5	Vengurla	H-662	1.12	0.91	0.73
6		H-675	1.02	0.75	1.27
7	Puttur	H-32/4	0.81	0.99	1.11
8		Goa-11/6	0.70	0.61	0.89
9	Vridhachalam	H-11	0.72	1.22	1.08
10		H-14	0.96	1.01	1.29
11	Chintamani	Chintamani-1	0.90	0.78	1.01



## JAGDALPUR

**Table 3.58 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Jagdalpur centre**

Infestation by	Min. damage recorded (range)	Germplasm	Max. damage recorded (range)	Germplasm
Leaf miner	4.66	CARS-6	37.33	CARS-4
Leaf folder	9.76	SEL-2	30.33	HY-367
Leaf caterpillar	12.17	C-10/19	30.06	CARS-5
Nut thrips (%)	0.00	AAKHAN, CARS18(02)	0.41	VRI-2
Shoot TMB	0.00	NRC-130,NRC-131,NRC-136,NRC-137,NRC-138,NRC-140, NRC-190, NRC-191, NRC-192, NRC-193,AAKHAN,VTH711/4,CARS-4,CARS-5,CARS-6,CARS-10,CARS-11,CARS-18,HY-303,C-3/28,SEL-1,SEL-2,C-3/33,HY-68,HY-255,VRI-2(26)	0.20	CARS-9
Panicle TMB (%)	0.10	NRC-193 & VTH-711/4 (02)	1.51	NRC-191
Nut borer	0.00	NRC-130,NRC-131,NRC-136,NRC-140, NRC-190, NRC-191, NRC-192, NRC-193,AAKHAN,VTH711/4,CARS-3,CARS-4,CARS-6,CARS-8,CARS-9,CARS-10,CARS-11,CARS-18,C-3/28,C-10/19,HY-68,VRI-1,V-4(23)	0.08	HY-320

It was observed that the incidence of TMB was less during the year. At shoot stage, 26 germplasm accessions were free from the attack of TMB and remaining germplasm were received less than one damage score. Two germplasm namely NRC-193 and VTH-711/4 were free from the attack of panicle TMB. While the germplasm NRC-191 received maximum damage score of 1.51. Leaf miner incidence varied from 4.66 per cent in CARS-6 to maximum 37.33 in CARS-4. Minimum leaf folder infestation was recorded in SEL-2 (9.76%) and maximum in Hy-367 (30.33%). Damage of leaf caterpillar ranged from 12.17 to 30.06 per cent in the germplasm. Thrips damage score was at low level in all the accession except two accessions AAKHAN and CARS-18 having no incidence (Table 3.58).

## JHARGRAM

Almost all the accessions screened were infested by leaf miner and thrips. During the year there was less infestation of leaf and blossom webber. Maximum accessions were free from TMB infestation and only few were infested by TMB (Table 3.59).





**Table 3.59 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Jhargram centre**

Infestation by	Min. damage recorded (range)	Germplasm	Max. damage recorded (range)	Germplasm
Leaf miner	0-5 %	H- 59, H- 112,H- 122	6 – 22%	H-9,H-10,H-12,H-114,H-126,H-132,H-144,H-154,H-157,H-115,H-21,H-133,H-23,H-159,H-161,H-110,H-117,H-134,H-150,H-111,H-120,H-136,H-146,H-173,H-174,H-121,H-41,H-137,H-55,H-178,H-57,H-179,H-180,H-130,H-139,H-147,H-65,H-158,H-162,H-87,H-119,H-28,H-30,H-170,H-36,H-37,H-39,H-58
Leaf and blossom webber	0-5 %	H-114,H-126,H-132,H-154, H-115,H-133,H-23,H-161,H-117,H-111,H-146,H-174,H-121,H-41,H-55,H-178,H-57,H-179,H-180,H-59,H-112,H-122,H-130,H-139,H-65,H-147,H-158,H-137,H-173.H-120,H-150,H-134,H-110,H-159,H-144,H-12,H-9	6 – 21 %	All other accessions.
Flower thrips	0 – 5%	H-115,H-68,H-159	5 – 50 %	All other accessions.

### MADAKKATHARA

The insect pest infestation on fourteen accessions maintained in the germplasm collection is presented in Table 3.60.



**Table 3.60 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Madakkatahra centre**

Infestation by	Min. damage recorded (range)	Germplasm	Max. damage recorded (range)	Germplasm
Tea mosquito bug	0 - 0.1	K1, Kainoor, Pathannur, K2, ARL-1, ARL-2, Peechi and ODR	0.15- 0.312	K3, K5, Mannar, Ummannur and Kottukkal
Leaf miner	0 - 4%	K-3, K-5, Mannar, Kainoor, Ummanoor, Kottukkal, Peechi, Kunjithai, Pathannur, ARL-1, K-2, ARL-2, and ODR	5.15 %	K-1
Apple and nut borer	0 - 2%	K-1, K-3, K-5, Kainoor, Ummanoor, Peechi, Kunjithai, Pathannur, ARL-1, K-2, ARL-2, and ODR	2.1- 3.5%	Mannar and Kottukkal
Flower thrips	0 - 0.1	All above mentioned 14 accessions:- K-1, K-3, K-5, Kainoor, Ummanoor, Kottukkal, Peechi, Kunjithai, Pathannur, ARL-1, K-2, ARL-2, and ODR	0.1- 0.65	Mannar

### VENGURLE

After the screening of cashew germplasm it is found that none of the germplasm found tolerant or resistant to cashew tea mosquito bug only the degree of incidence varied. During the year, the accession No. 3/33 recorded lowest TMB incidence (0.156) where as it was maximum on the variety V-6 (0.340). In case of thrips the accession no 3/28 (0.123) recorded lowest TMB infestation where as it was maximum on variety V-6 (0.199) (Table 3.61).

**Table 3.61 : Screening of cashew germplasm to locate tolerance/resistance to major pests of the region at Vengurle centre**

Infestation by	Min. damage recorded (range)	Germplasm	Max. damage recorded (range)	Germplasm
Tea Mosquito Bug	0.156	3/33	0.340	V-6
Flower thrips	0.123	3/28	0.199	V-6

### VRIDHACHALAM

None of the cashew entries have shown immune or resistant reactions to TMB infestation under field condition





**Table 3.62: Screening of MLT entries against major pests of cashew at Vridhachalam**

MLT entries	TMB (mean damage score 0-4 scale in 52 leader shoots)	Leaf & blossom webber (% shoot damaged / 52 leader shoots)	Leaf miner (% of mined leaves on five laterals)
H 1598	2.1	2.8	1.2
H 1600	2.0	3.2	1.0
H 1608	2.2	3.0	1.3
H 1610	2.4	3.2	2.0
H 129	2.6	3.5	2.0
H 40	3.4	1.8	2.6
H 2/15	2.6	3.0	1.0
H 2/16	3.4	2.3	2.0
H 33/3	1.6	2.8	2.8
H 44/3	2.0	2.3	1.3
M 26/2	2.6	3.0	3.3
ME 20/1	1.0	2.2	1.3
VTH 30/4	2.8	3.0	1.3
VTH 59/2	3.1	3.0	1.0
V 2	2.8	2.3	1.0
V 3	3.2	2.3	3.0
V 4	3.2	2.8	2.3
V 5	1.8	3.0	2.6

Screening of F<sub>1</sub> hybrids revealed that all the cross combinations were susceptible to TMB infestation. However, the damage score was low (1.8) in H 10, H14 and H 16 followed by H 13 and H15, H17 with a mean damage score of 2.2 and 2.3 respectively (Table 3.63).

**Table 3.63 : Screening of F<sub>1</sub> hybrids for tolerance to cashew pests at Vridhachalam**

Hybrid Number	Cross combination	TMB mean damage score 0-4 scale in 52 leader shoots	Leaf & blossom webber % shoot damaged / 52 leader shoots	Inflorescence caterpillars (% of damaged panicle out of 52 panicles)	Leaf miner (% of mined leaves) on five laterals	Apple & Nut borer (% of apples damaged /52 panicles)
H 10	M 10/4 x M 26/1	1.8	3.0	2.3	1.6	0.0
H 11	M 10/4 x M 45/4	2.6	3.6	3.0	1.3	0.0
H 12	M 10/4 x M 75/3	2.5	3.6	2.6	0.0	0.0
H 13	M 26/2 x M 26/1	2.2	3.3	2.3	1.0	0.0
H 14	M 26/2 x M 45/4	1.8	4.8	2.6	1.0	0.0
H 15	M 26/2 x M 75/3	2.2	4.6	2.6	1.8	0.0
H 16	M 44/3 x M 26/1	1.8	4.8	2.3	2.3	0.0
H 17	M 44/3 x M 45/1	2.3	4.6	2.6	2.0	0.0

However, none of the cashew entries have shown immune or resistant reaction to TMB and other foliar feeding insects.



## CHAPTER II : ORGANISATION







## INTRODUCTION

The All India Coordinated Spices and Cashew nut 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 is 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.





## 2. 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 Plains Region (plateau region) of the country.

The centres of the East Coast are located at Bapatla, Bhubaneshwar, 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 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 Bhubaneshwar 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 to 36.2° C, the soil is laterite (oxisol), medium in N, low in P and medium in K contents. The climate is per humid and AWC is 150 mm. At Vengurla average rainfall is 2916 mm and the temperature ranges from 17.4 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 ranged 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 789mm 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 150mm. 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 1200-1400mm. 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 – 4000mm 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.

### 3. TRANSFER OF TECHNOLOGY

#### BAPATLA

The scientists have organized training programme on “Production technology and pest and disease management in cashew 31-03-2016 to 02-04-2016 at Ranastalam, Srikakulam Dist were a total of 150 farmers participated and also training on “Production technology and pest and disease management in cashew 15.09.2016 at Koyyuru, Vishakhapatnam. Training was organized on 02.06.2016 and 17.06.2016 for a batch of 25 women Self Help Group's on Cashew Apple Utilization and Value addition at College of Food Science and Technology, Bapatla.

The Centre organized three days farmers training programme on “Advanced Cashew Production Technology” from 17.02.2017 to 19.02.2017, sponsored by Directorate of Cashew and Cocoa Development, Kochi, at Janga function hall, Jangareddygudem, West Godavari and one day training programme on Cashew at Rastakuntubai, Viziayanagaram Dist.

Under Tribal Sub Plan, the scientists of the Centre had organized the District level seminar on Cashew at Addateegala, East Godavari district. On 15.12.2016 on Advanced Production Technology covering value addition and rejuvenation technique. The Scientists also organized one day training programme on Cashew at Mandasa, Srikakulam Dist under Tribal Sub Plan, Sponsored by DCR-ICAR, Puttur.

#### BHUBANESWAR

The Scientists of the Centre participated and acted as resource person in three days National Level Training Programme on Cashew on 27-28<sup>th</sup> February to 1<sup>st</sup> March 2017 of DCCD sponsored MIDH Scheme. The scientists have also acted as resource person for the Training –cum-exposure visit on “Advance in Production and processing of cashewnut” organized by Odisha State Cashew Development Corporation, Bhubaneswar.

#### DARISAI

Scientific Pruning technique has been imparted to the farmers in a workshop to ensure maximum productivity. Farmers were also trained on the harvesting technique of the Cashew type V-4 which had recorded significantly highest annual nut yield of 1.8 kg/tree.





## JAGDALPUR

The scientist of the centre had taken up one day training programme for about 103 participants on 13.01.2017 and on 31.1.2017 for 74 participants on 'Production technologies, Plant Protection and Processing of cashew nut'. The Centre has also organized three days training programme for batches of 50 participants on 4-6<sup>th</sup> Feb. 2017, 17-19<sup>th</sup> Feb. 2017, 20-22<sup>nd</sup> Feb. 2017 and 7-9<sup>th</sup> March 2017. One day training programme on 'Production technologies, Plant Protection and Processing of cashew nut' was also organized for about 110 farmers. A training programme was organized for unemployed women on cashew apple utilization on 29<sup>th</sup> March 2017 in which 100 women members had participated.

Under TSP programme, seven days training on cashew processing under the project 'Enhancement of tribals income through small scale cashew nut & cashew apple processing in Bastar region of Chhattisgarh" was organized from 24-30<sup>th</sup> March 2017.

## JHARGRAM

The scientist of the centre functioned as resource person in the farmers training programme on cashew cultivation technology were about a total of 189 farmers participated which was organized during 1.9.2016 at Dudhkundi Village, 8.11.2016 and 19.2.2017 at BCKV, Jhargram and 16.3.2017 at Aranya Sundari Mahila Mahasangha, Jhargram, West Bengal.

## MADAKKATHARA

The scientists of the Centre conducted three training programmes of 3 days on Cashew Production Technology to farmers in which about 133 farmers had participated. The scientists have conducted training on cashew apple utilization for unemployed women funded by DCCD. Two district level seminar on cashew was conducted on October and November 2016. A radio talk on "Pest control in cashew" was conducted by the scientist which was telecasted on 24.1.2017.

The tribal sub plan 2016-17 was implemented in three tribal colonies Olakara, Nellyampathy and Attappady. Nursery expansion programme was implemented in Olakara colony in which two hectare area was planted with cashew grafts.

Various activities organised under Tribal Sub Plan are given below

- Planting of cashew grafts as a part of area expansion programme
- Training on nursery management and top working
- Training cum awareness programme on cashew in tribal areas
- Demonstration of plant protection measures in cashew
- Awareness and demonstration on cashew apple utilization

## PARIA

The scientists of the Centre in collaboration with ATMA Project-Valsad had organized a Khedut shibir at village Mandva Ta. Kaparada on 21/03/17 and provided information about scientific cashew cultivation. They have also distributed Novel organic fertilizer (a product of Navsari Agricultural University) to the 300 participants as a part of kit as well as pesticides to the farmers who were earlier provided planting material.



## PILICODE

The scientist of the centre were involved in conducting 5 trainings in which around 125 women farmers were given practical training in cashew apple processing and training was also conducted on value addition of cashew apple and nut processing in which about 50 farmers had attended. Farmers district level training was conducted in Iritty on cashew varieties in which about 150 farmers had participated.

Under TSP field training to farmers was organized on scientific management and value addition in cashew on 21.3.2017 and 25.3.2017 in which about 125 farmers had participated.

## VENGURLA

The Centre had conducted three days training programme and training programme on “Cashew Apple Utilization” for 10 days (14.3.2017 to 23.03.2017) at RFRS sponsored by DCCD in which about 300 farmers had attended. A District level seminar was also organized at KVK, Lanja, Dist. Ratnagiri in which about 150 participants were present. The scientists also organized 2 demonstrations for about 50 farmers on cashew stem and root borer management at RFRS, Vengurle.

Under TSP, 2 days training programme was organized by the scientists in which about 100 participants were present.

## VRIDHACHALAM

The scientists of the Centre had organized four days training programme on “cashew apple utilization” for about 100 farmers. Under TSP Plan, the scientists of the Centre have taken up programme for creating awareness about cashew cultivation and expanding cashew area in tribal region.

## 4. RESEARCH PUBLICATIONS

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#### A. Research Articles

Jaya Prabhavathi, S., Keisar Lourdusamy, D., Vincent S. and Aneesa Rani, M. S. 2016. Efficacy of Curative Treatments Using Insecticides Against Cashew Stem and Root Borer, *Plocaederus ferrugenus* L. (Coleoptera: Cerambycidae). *International Journal of Tropical Agriculture*, Vol. 34 (1):13-16.

#### B. ISBN Book Chapters:

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Research Institute, Anbil Dharmalingam Agricultural College and Research Institute, Trichy - 620 009. pp: 555-558(In Tamil).

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### C. Books with ISBN

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Aneesa Rani, M. S., Keisar Lourdusamy, D., Jaya Prabhavathi, S., Saraladevi, D., Balamohan, T. N., Jawaharlal, M. and Ravi, V. (2016). Hi-tech cashew cultivation stepping stone to bumper yield. Regional Research Station, Tamil Nadu Agricultural University, Vridhachalam (In English).

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## 5. STAFF POSITION

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Asstt. Entomologist	:	Dr. B. Nagendra Reddy (From 15.09.2016)
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## 5. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2016-17

### Allocation

(Rs. in lakhs)

Centre	Details of sanctioned provision					ICAR share
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total	
Bapatla	23.50	1.00	5.50	0	30.00	22.50
Bhubaneshwar	33.38	1.20	6.75	0	41.33	31.00
Hogalagere	23.13	0.70	3.50	0	27.33	20.50
Darisai	5.60	0.65	2.75	0	9.00	6.75
Jagdalpur	9.07	0.80	3.50	0	13.37	10.03
Jhargram	16.67	0.50	3.50	0	20.67	15.50
Madakkathara	41.17	0.50	5.00	0	46.67	35.00
Paria	12.67	0.50	3.50	0	16.67	12.50
Pilicode	4.60	0.50	1.50	0	6.60	4.95
Vengurla	32.38	1.20	7.58	0	41.16	30.87
Vridhachalam	37.30	1.20	5.50	0	44.00	33.00
KRCCH, Arabhavi	0.00	0.25	3.35	0	3.60	2.70
ICAR Res. Compl. For Goa, Goa	0.00	0.25	3.50	0	3.75	3.75
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.50	2.25	0	2.75	2.75
Provision for TA for PC Cell	0.00	0.92	0.00	0	0.00	0.92
Provision for RC for PC Cell	0.00	0.00	3.52	0	0.00	3.52
<b>Total</b>	<b>239.47</b>	<b>10.67</b>	<b>61.20</b>	<b>0</b>	<b>306.90</b>	<b>236.24</b>
<b>Provision for NEH</b>						<b>0.00</b>
<b>Provision for TSP</b>						<b>28.95</b>
<b>GRAND TOTAL</b>						<b>265.19</b>





## Actual Expenditure

(Rs. in lakhs)

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	39.42	1.05	8.95	0.00	49.42	37.06
Bhubaneshwar	54.88	0.60	5.50	0.00	60.98	45.74
Hogalagere	36.14	0.29	7.33	0.00	43.76	32.82
Darisai	15.15	0.23	1.63	0.00	17.01	12.76
Jagdarpur	14.84	0.80	4.62	0.00	20.26	15.20
Jhargram	17.22	0.47	5.91	0.00	23.60	17.70
Madakkathara	55.46	0.31	3.79	0.00	59.56	44.67
Paria	15.43	0.05	3.50	0.00	18.98	14.24
Pilicode	10.30	0.24	1.42	0.00	11.96	8.97
Vengurla	45.33	0.67	9.73	0.00	55.73	41.80
Vridhachalam	55.13	0.49	6.77	0.00	62.39	46.79
KRCCH, Arabhavi	0.00	0.10	3.02	0.00	3.12	2.34
ICAR Res. Compl. For Goa, Goa	0.00	0.45	3.50	0.00	3.95	3.95
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.35	1.00	0.00	1.35	1.35
Provision for TA for PC Cell	0.00	0.92	0.00	0.00	0.00	0.92
Provision for RC for PC Cell	0.00	0.00	3.52	0.00	0.00	3.52
<b>Total</b>	<b>359.3</b>	<b>7.02</b>	<b>70.19</b>	<b>0.00</b>	<b>432.07</b>	<b>329.83</b>
<b>Provision for NEH</b>						<b>0.00</b>
<b>Provision for TSP</b>						<b>28.95</b>
					<b>GRAND TOTAL</b>	<b>358.78</b>



**METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR**

**BAPATLA**

Month	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
April	34.3	25.8	73	69	7.1	3
May	38.9	28.3	63	61	1.5	3
June	35.3	26.0	75	66	167.1	11
July	37.7	26.5	66	48	165.5	11
August	34.5	24.9	81	73	301.8	16
September	33.9	25.2	82	77	205.5	9
October	33.8	23.8	81	75	26.5	4
November	30.5	21.2	86	77	113.7	6
December	30.5	18.8	88	73	9.3	2
January	30.5	17.7	88	65	1.1	2
February	32.2	20.0	87	68	-	-
March	33.7	23.2	79	70	-	-
<b>Total</b>					<b>999.1</b>	<b>67</b>

**BHUBANESWAR**

Months	Temp. (Max)	Temp. (Min)	RH (Max)	RH (Min)	Rainfall (mm)	No. of rainy days	BSH
June	34.73	26.38	88.60	68.97	264.8	19	5.33
July	32.22	25.82	91.81	78.68	222.2	17	5.09
August	31.8	25.5	94	80	247.8	22	4.1
September	31.4	25.4	93	80	238.2	24	3.6
October	32.2	22.6	89	68	132.8	11	6.3
November	31.0	17.4	92	46	20.3	2	7.1
December	30.1	15.1	88	38	0	0	7.2
January	29.75	14.55	89.61	38.23	0	0	6.35
February	33.77	19.09	93.79	38	0	0	7.86
March	34.70	22.78	90.68	42.23	45.4	4	6.55
April	36.90	26.28	87.70	49.10	29.2	1	7.34
<b>Total</b>					<b>1200.7</b>	<b>100</b>	





### DARISAI

Month	Temperature		Humidity %		Rainfall (mm)	Normal Rainfall (mm)
	Max.	Min.	Max.	Min.		
April	39.2	21.4	71.1	29.3	4.2	30.6
May	39.5	24.3	73.2	40.1	137.0	62.0
June	36.3	25.8	83.1	55.5	109.0	218.8
July	31.0	24.7	87.5	76.4	372.3	301.9
August	32.6	25.5	88.1	70.3	282.3	256.1
September	32.4	24.8	89.4	67.1	114.0	184.4
October	31.4	20.7	88.6	68.1	127.0	65.2
November	31.3	13.3	88.3	41.5	0.0	16.8
December	26.9	8.7	87.3	42.8	0.0	10.2
Jan	26.3	10.2	87.2	45.3	0.0	15.7
Feb	29.7	12.4	83.3	42.0	0.0	13.0
Mar	39.2	11.4	94.0	21.0	1.6	25.0
<b>Total</b>					<b>1147.4</b>	<b>1199.7</b>

### HOGALAGERE

Month	Temp (°C)		R.H %		Sunshine (hrs)	Normal Rainfall (mm)	No. of rainy (days)	Rainfall received (mm)
	Max.	Mini.	Morn.	Even.				
April	29.54	21.86	71.5	53.5	27.40	52.2	06	29.54
May	27.50	22.88	69.9	59.6	69.20	89.5	07	27.50
June	25.16	21.70	79.3	61.7	60.60	61.5	05	25.16
July	26.76	21.38	85.5	62.8	74.70	48.8	04	26.76
August	26.83	21.95	89.8	68.0	96.90	115.7	12	26.83
September	28.70	22.55	92.5	64.3	150.60	50.6	03	28.70
October	27.00	19.00	90.0	55.0	126.20	43.0	02	27.00
November	23.53	19.43	93.7	77.8	61.90	384.0	16	23.53
December	24.80	16.94	93.9	68.4	16.30	5.4	01	24.80
January	24.03	15.04	93.6	48.6	2.10	27.0	01	24.03
February	27.29	16.57	91.9	54.6	6.50	00.0	00	27.29
March	34.60	17.80	92.5	24.8	11.60	00.0	00	34.60
<b>Total</b>						<b>704</b>	<b>581.30</b>	<b>325.74</b>



## JAGDALPUR

Month	Temp <sup>o</sup> C		Rainfall mms	Relative Humidity		Vapour Pressure		Wind Vel. Kmph	Evap. mms	Bright Sunshine hours
	Max.	Min.		I	II	I	II			
April	33.5	23.2	117.5	81.7	42.8	19.8	17.6	6.0	6.3	6.1
May	37.4	26.3	95.0	78.1	37.4	22.8	18.7	5.4	6.5	5.6
June	30.4	24.4	466.1	87.8	61.6	22.7	20.6	6.7	3.7	2.1
July	30.5	24.8	156.3	87.0	68.4	22.7	22.7	6.2	4.2	2.4
August	29.3	24.2	347.0	90.5	75.3	22.7	23.1	5.3	3.2	1.9
September	30.4	23.8	337.2	94.1	66.3	23.0	22.4	4.0	2.8	4.2
October	31.8	20.7	10.6	94.5	43.9	20.2	17.0	2.5	3.5	7.3
November	29.6	16.5	0.0	94.6	43.0	16.3	14.5	3.5	3.5	6.4
December	29.6	14.4	10.0	95.7	42.2	14.6	13.3	2.7	2.5	5.6
January	29.0	10.0	0.0	93.1	31.0	10.0	8.7	2.6	2.9	5.2
February	32.9	15.4	10.6	89.9	32.1	14.8	12.3	3.3	4.2	5.5
March	34.9	19.3	75.1	88.9	30.6	18.4	13.4	3.6	5.1	6.4

## JHARGRAM

Month	Temperature <sup>o</sup> C		Relative Humidity (%)		Rainfall (mm)	Rainy days
	Maximum	Minimum	Maximum	Minimum		
April	36.9	22.6	84.9	43.7	104.0	10
May	39.1	25.8	85.6	51.5	71.0	6
June	36.1	26.7	85.3	60.9	181.0	15
July	32.5	25.2	91.8	72.1	576.0	28
August	33.5	25.9	88.2	71.1	189.0	13
September	34.6	25.4	91.9	68.8	489.0	9
October	34.0	22.3	88.3	64.0	44.0	2
November	31.5	17.0	87.4	49.7	0.0	0
December	26.7	13.9	90.3	49.9	8.0	3
January	27.3	11.5	88.4	42.1	20.0	3
February	31.7	17.5	86.9	43.7	0.0	0
March	36.8	20.8	82.3	39.2	5.0	3
<b>Total</b>					<b>1687</b>	<b>92</b>





### MADAKKATHARA

Month & Year	Temperature (°C)		Relative Humidity (%)	Mean sunshine hours (h)	Total Rainfall (mm)	Total Rainy days (No.)
	Max.	Min.	Average			
Apr	33.80	24.58	76.80	6.94	163.40	9.00
May	32.65	24.83	79.75	4.38	215.80	10.00
June	30.88	23.85	86.25	1.75	630.50	23.00
July	30.42	23.58	84.00	3.76	524.40	23.00
Aug	31.13	23.73	82.25	5.70	298.80	15.00
Sept	31.88	23.70	81.50	5.28	242.20	12.00
Oct	32.40	24.14	78.80	5.38	210.90	16.00
Nov	31.53	23.70	73.50	4.68	144.10	7.00
Dec	32.35	23.25	65.50	7.03	88.30	3.00
Jan	33.28	22.90	54.80	8.44	23.80	1.00
Feb	35.55	23.93	59.00	8.30	11.40	1.00
Mar	36.35	25.70	68.75	7.98	0.00	0.00
<b>Total</b>					<b>2553.6</b>	<b>120</b>

### PARIA

Month	Max. Temp.	Min. Temp.	Mor. RH	Eve. RH	Sun shine hours	Wind velocity	Eva.	Rainfall (mm)	Rainy Days
April	35.41	20.83	79.35	47.57	9.87	3.95	6.44	0.0	0
May	36.51	24.86	76.08	54.05	10.43	5.51	7.68	0.0	0
June	33.06	25.14	82.45	71.78	6.15	6.64	4.50	287.3	12
July	31.28	25.72	87.94	77.26	5.41	8.28	4.15	635.3	11
August	30.94	24.77	92.41	77.42	4.80	4.93	2.97	263.3	10
September	32.01	22.48	89.83	70.30	5.89	3.19	3.57	410.5	8
October	35.47	21.26	81.22	56.59	8.00	1.40	3.82	51.8	3
November	34.86	16.02	71.78	39.88	8.57	1.12	3.53	0.0	0
December	32.62	11.00	77.35	52.63	8.57	1.42	3.24	0.0	0
January	31.64	9.31	77.95	33.16	8.76	1.65	3.29	0.0	0
February	32.00	11.72	83.91	44.78	8.98	2.19	4.09	0.0	0
March	35.85	15.42	69.26	39.55	9.36	2.35	5.69	0.0	0
<b>Total</b>								<b>1648.2</b>	<b>44</b>



## PILICODE

Month & year	Temperature ( °C)		Relative humidity (%)	Rainfall (cm)	BSH
	Maximum	Minimum			
April	33.0	24.0	74	115.9	6.1
May	32.6	24.0	83	126.1	4.5
June	31.0	23.0	85	532.6	1.7
July	30.0	23.0	88	963.0	2.7
August	30.0	23.0	88	546.3	3.2
September	31.0	23.0	89	370.2	3.0
October	31.0	24.0	85	265.7	2.2
November	31.0	23.0	82	106.8	3.1
December	32.2	22.0	81	3.7	5.0
January	32.0	20.0	75	0.00	4.7
February	32.0	22.0	76	0.00	2.8
March	33.5	24.5	75	0.00	2.8
<b>Total</b>				<b>3030.3</b>	<b>41.8</b>

## TURA

Month	Max. Temp.	Min. Temp.	RS (%)		Rainfall (mm)	Rainy days
			(Max)	(Min)		
April	23.45	13.06	89	68	115.4	0
May	23.85	12.89	83	67	337.4	4
June	29.35	15.93	87	64	756.6	2
July	33.20	23.10	88	50	307.4	6
August	29.52	21.70	75	66	585.3	16
September	28.37	21.10	80	59	645	19
October	29.00	22.12	77	59	37.4	20
November	28.10	20.83	78	60	00	24
December	28.90	21.63	80	56	00	17
January	28.17	9.32	97.67	28.73	32	6
February	30.01	13.60	77.96	41.37	10.20	4
March	34.20	17.86	95.69	13.99	62.60	7
<b>Total</b>					<b>2889.3</b>	<b>125</b>





## VENGURLA

Month	Temperature (°c)		Humidity (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	Forenoon	Afternoon		
April	33.49	25.42	80.29	64.82	8.20	2.00
May	34.43	25.69	74.53	63.89	35.0	2.00
June	31.32	24.99	84.63	79.78	700.4	24.00
July	31.49	25.07	85.34	75.42	363.6	25.00
August	31.21	24.29	90.67	76.10	367.2	25.00
September	31.37	24.78	89.85	74.81	199.4	17.00
October	33.80	24.96	87.82	70.51	92.00	9.00
November	34.44	21.66	86.64	64.57	48.6	4.00
December	33.58	19.09	90.10	54.57	0.00	0.00
January	33.52	16.26	87.44	48.08	0.00	0.00
February	32.29	19.97	91.98	58.06	0.00	0.00
March	33.37	21.03	87.67	61.00	0.00	0.00
<b>Total</b>					<b>1814.4</b>	<b>108</b>

## VRIDHACHALAM

Month	Temperature °C		Relative Humidity (%)		Rainfall (mm)	No. of rainy days	Wind speed	Sunshine hours
	Max.	Min.	am	pm				
April	35.2	24.4	90.9	65.4	145.0	3	1.65	7.28
May	36.5	26.6	89.8	66.2	92.2	3	0.97	6.2
June	35.9	26.5	91.7	66.3	156.2	7	0.64	6.66
July	36.7	26.1	91.3	64.5	198.4	9	0.30	7.13
August	35.9	25.9	91.2	69.0	103.4	6	0.25	9.65
September	36.3	25.9	91.3	64.5	57.7	3	0.44	6.1
October	33.5	24.6	91.5	74.8	107.8	10	0.52	5.30
November	29.9	23.9	92.3	89.9	572.4	14	1.50	2.48
December	29.9	22.9	91.1	80.9	361.4	10	1.81	2.29
January	31.3	21.2	91.4	77.4	0	0	2.41	6.14
February	33.7	22.2	91.4	76.8	0	0	2.54	8.4
March	35.4	23.9	89.9	70.5	0	0	2.09	8.62
<b>Total</b>					<b>1794.5</b>	<b>65</b>		



## 7. LIST OF DCR PUBLICATIONS

Sl. No.	Publication	Price Rs.
1	Cashew Production Technology (Revised)	60.00
2	Softwood grafting and nursery management in cashew (Revised)	45.00
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4	Catalogue of Minimum Descriptors of Cashew	
	Germplasm accessions - I	165.00
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15	Status of Cashew Germplasm Collection in India (Booklet)	*
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17	Cashew nutritive value Revised (Brochure)	*
18	Insect pests of cashew	*

\* Free of cost

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Address your enquiries to the Director, ICAR - Directorate of Cashew Research (DCR),  
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