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अखिल भारतीय समन्वित काजू अनुसंधान परियोजना

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

वार्षिक प्रतिवेदन

ANNUAL REPORT

2013-14

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प्राक्कथन

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 30 वी वार्षिक प्रतिवेदन प्रस्तुत है । इस प्रतिवेदन में अप्रैल 2013 से मार्च 2014 तक की अनुसंधान उपलब्धियाँ तथा अन्य जानकारी सम्मिलित की गई है ।

इस परियोजना में चौदह केंद्र है, जैसे भारत के पूर्वी तट में चार, बापट्ला (आंध्र प्रदेश), भुवनेश्वर (उडीसा), झारग्राम (प.बंगाल) और वृद्धाचलम (तमिलनाडु), पश्चिमी तट पर चार केंद्र है जैसे, माडकत्तरा (केरळा), पिलिकोड (केरळा), वेंगुर्ला (महाराष्ट्र) तथा नवसारी (गुजरात) और मैदानी भाग में दो केंद्र, एक होगळगेरे (कर्नाटका) और दूसरा जगदलपुर (छत्तीसगड) में स्थित है । इसके अतिरिक्त कनबर्गि (कर्नाटका), तुरा (मेघालया) और गोवा में केन्द्रों पर भी कार्य हो रहा है ।

प्रतिवेदन में चालू तेरह अनुसंधान परियोजनाओं कि उपलब्धियों का विषयानुसार विवरण प्रस्तुत है, जैसे जननद्रव्य संरक्षण और फसल सुधार, फसल प्रबंधन तथा फसल संरक्षण । इन विविध विषयों से संबंधित बारह अनुसंधान परियोजनाओं की उपलब्धियों को संकलित करके प्रस्तुत किया गया है ।

इस प्रतिवेदन में दो प्रमुख अध्याय है, जैसे, तकनीकी; जिसमे परियोजना और क्षेत्रीय तौर पर विविध केंद्रों से प्राप्त प्रायोगिक उपलब्धियाँ, और संस्थानीय : जिसमे इतिहास, कर्मचारी विवरण, वित्तीय प्रावधान, मौसम की आँकडे और शोध प्रकाशन शामिल है ।

मैं, अखिल भारतीय समान्वित काजू अनुसंधान परियोजना के सभी वैज्ञानिकों एवं स्टाफ के प्रति आभारी हूँ जिनका शोधकार्य इस वार्षिक प्रतिवेदन में समाहित किया गया है । इस वार्षिक प्रतिवेदन को तैयार करने में डा. टी. एन. रविप्रसाद, प्रधान वैज्ञानिक (कृषि कीटशास्त्र) एवं परियोजना एकक प्रमुख तथा श्रीमती रेश्मा के. का भी आभारी हूँ ।

(पी. एल. सरोज)

निर्देशक एवं परियोजना समन्व्यकर्ता

स्थान : पुत्तूर

दिनांक : 14.07.2014

PREFACE

This is the thirtieth 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 2013 to March 2014.

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 Kanbargi (Karnataka), Tura (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.

I express my sincere thanks to all reseach workers of AICRP on Cashew for their research contribution. thanks are also due to Dr. T. N. Raviprasad, Principal Scientist (Agri. Ent.) and Scientist-in-charge (PC Cell) and Mrs. Reshma K. for their efforts in bringing out this Annual Report 2013-14 of AICRP on Cashew.

Place: Puttur
Dated: 14 .07.2014

[P. L. SAROJ]
Director & Project Coordinator

CHAPTER 1 : TECHNICAL

परियोजना समन्वयक का प्रतिवेदन

सन् 1971 में चतुर्थ पंचवार्षिक योजना के दौरान अखिल भारतीय समन्वित मसाले और् सुधार परियोजना (AICS&CIP) को कासरगोड स्थित केंद्रीय रोपड बागवानी फसल अनुसंधान संस्थान, में शुरु किया गया था। सातवीं योजना के दौरान इस परियोजना को दो अलगअलग परियोजनाओं; काजू पर एक और मसाले पर एक में विभाजित किया गया। सन् 1986 में स्वतंत्र अखिल भारतीय समन्वित काजू अनुसंधान परियोजना को पुत्तूर में नव स्थापित राष्ट्रीय काजू अनुसंधान केंद्र (एन्.आर.सी.सी.) में स्थानांतरित किया गया । इस काजू अनुसंधान केंद्र को सन् 2009 में काजू अनुसंधान निदेशालय के स्तर पर उन्नत किया गया ।

वर्तमान में अ.भा.स.का.अ.प. में चौदह केंद्र है, जिसमें से चार केंद्रों सन् 1971 मे ही शुरु किए गए, वो है बापटला (Dr.YSRHU पूर्व ANGR) माडकत्तारा (KAU), आनक्कायम से स्थानांतरित), वेंगुर्ला (BSKKV पूर्व KKV) और् वृद्दाचलम (TNAU), पांचवी योजना के दौरान एक् केंद्र झारग्रम (BCKKV) जोड गया । आठवी योजना के दौरान एक केंद्र जगदलपुर (IGAU) पर और पिलिकोड पर एक उपकेंद्र भी शुरु कर दिया गया । ग्यारहवी योजना मे दो केंद्रो; पारिया (NAU) तथा दारीसाई (BAU) में प्रारंभित हुए, जिसके साथ ही तीन सहयोगी केंद्रो जैसे, कनबर्गी (UHS) तथा गोवा व उत्तरपूर्वी पहाडी क्षेत्र के लिए ICAR अनुसंधान परिसर कें अंतर्गत तूरा में प्रारंभ हुए । इस प्रकार अ.भा.स.का.अ.प. का 14 केंद्रो ने 12 काजू उगाने वाले राज्यो मे स्थित है और विभिन्न कृषि विश्वाविध्यालयो के प्रशासनिक नियंत्रण के अधीन है ।

वर्ष 2013-14 के लिए परियोजना का मूल बजट आंबटन रू 373.33 लाख (रू. 287.00 लाख ICAR अंशदान) और व्यय रू. 334.06 लाख (रू. 254.21 लाख ICAR अंशदान) था ।

काजू का उत्पादन और उत्पादकता बढाने हेतु इस परियोजना ने इन लक्ष्यों की प्राप्ति के लिए कार्यरत है ।

1. अच्छा गिरी गुणवत्ता के साथ अधिक उपज देनेवाली जैविक तथा अजैविक तनाव को सहिष्णुता दिखानेवाली किस्मो का विकास ।
2. विभिन्न कृषि मौसमी परिस्थितियों मे फसल उगाने के लिए तकनिकी का मानकीकरण; और
3. तैयार लागत प्रभावी और कुशल कीट और रोयग प्रबंधन के तरीको का विकास

फसल सुधार:

क्षत्रीय काजू फील्ड जीन बैंक (RCFGB) में अब तक संरक्षित एकसशनों की कुल संख्या 1370 है । गोवा में, 120-180W की गिरी गिनती के साथ 10.0 ग्रां से अधिक गुटलीवाली (14 सं) तथा 8.00-10.00 ग्रां गिरी के साथ 180W से गिरी गिनतीवाली (29 सं) जननद्रव्यो को संरक्षित किया गया है । बापटला में सेब वजन 33.7 ग्रां से 125.0 ग्रां तक 18 एक्सशनो में पाया गया । भुवनेश्वर में सबसे कम फूल अवधि (77 दिन) OC-146 में दर्ज की गई और OC-124 में उच्चतम फूल शाखाए (18.0 प्रति मी^{2}) दाखिल हुआ था । झारग्राम मे किस्म मूल्यांकन प्रयोगो में अधिकतम गुटली / मी^{2} (39.58) H-303 मे रहा ।

वेंगुर्ला में प्रचालित बहुस्थानीय परीक्षणो–III में प्रति पुष्पगुच्छ में अत्यधिक औसत गुटली संख्या (9.78) V-7 में था । झारग्राम मे छिलकन प्रतिशतता माडकत्तरा -1 (37.1%) और VRI-3 (35.40%) में सबसे ज्यादा था जषार्द होगलगेरे पर H-675 (33.0%) और H-1593 (32.73%) में किया । माडकत्तरा मे अधिकतम सेब वजन H-14 (74.0 ग्रां) मे और तीसवाडी-3 (98.3 ग्रां) मे पाया गया । बहस्थानीय परीक्षणों में पिलिकोड मे प्रियंका और अमृता में क्रमशः 12.3 ग्रां तथा 12.0 ग्रां का उच्चतम गिरी वचन प्राप्त हुआ । दारीसाई मे बहुस्थानीय परीक्षणो VI मे प्रति वर्ग मीटर का पुष्पगुच्छ संख्या (16.2), BPP-8 में सबसे ज्यादा था ।

बापट्ला में 14 वी फसल का औसत वार्षिक गुटली उपज (12.5 की ग्रां/पेड) संकर A-9 में दर्ज की गई है; जबकि 14 फसलो का संचयी गुटली उपज संकर A-6 में अधिकतम रहा (100.90 कि ग्रां /पेड) माडकत्तरा में 17 साल का अत्याधिक संचयी उपज (155.95 कि.ग्रां. / पेड) H-21 द्वारा दर्ज की गई थी । अन्य संकरो की तुलना मे होगळगेरे मे अधिकतम औसत गुटली वजन (11.33 ग्रां) और औसत सेब वजन (68.58 ग्रां) H-216

में दर्ज की गई । पिलिकोड मे PLD-57 (OP) सबसे कम चांदवा क्षेत्र (16.81 मी^{2}) के साथ कम से कम लंबाई (1.60 मी) दिखाया । वेगुर्ला मे H-1039 (M-44/3 x BT-22) मे अत्यधिक फलन (34.0 प्रति पुष्पगुच्छ) दर्ज की गई ।

फसल प्रबंधन:

उर्वरक परीक्षणो के तहत बारह साल का अत्यधिक संचयी गुटली उपज (62.69) कि ग्रां/पेड, 1000:250:250 ग्रां NPK / पेड अनुप्रयोग मे दर्ज की गई थी जबकि होगलगेरे मे क्रमशः 500:250:250 ग्रां NPK / पेड तथा 500:125:125 NPK/ पेड से प्राप्त उपज 58.71 कि ग्रां / और 57.26 कि ग्रां / पेड में पाया गया । झारग्राम मे 1500:250:375 NPK (कि ग्रां/है) लगाने से अधिकतम गुटली / मी^{2}) (24.63) का उत्पादन मिला । उच्च धनत्व काजू रोपण के साथ उर्वरक प्रयोगो मे, बापट्ला मे 11.43 कि ग्रां/पेड का अधिकतम वार्षिक गुटली उपज, 10 x 5 मी (200 पेड/हे) तथा 75:25:25 कि. ग्रां / हे का उर्वरक लगाने से मिला । भुवनेश्वर मे 11 फसलो का संचयी उपज / हे (15.14 क्विं/हे) 600 पेड / हे मे दर्ज की गई थी । बापट्ला मे सामान्य धनत्व रोपण मे मिली संचयी उपज (1533 कि ग्रां/हे) की तुलना मे उच्च धनत्व रोपण का संचयी उपज (5081 किग्रां / हे) अत्यधिक रहा ।

होगळगेरे मे 80% CPE पर सिंचाई देने से अधिकतम पेड ऊचाई (5.41 मी), तना परिधि (91.12 से.मी) और औसत सेब वजन (33.56 ग्रां) दर्ज की गई । अंतराल फसल परीक्षणो मे रू. 42,123/– प्रति हेक्टेर का अत्यधिक लाभ पारिया मे काजू + भिंडी मे पाया गया और यह लाभ वृद्धाचलम मे रू. 34,167/– प्रति हेक्टर रहा । कनबर्गी मे लिए हुए जैविक प्रबंधन परीक्षणो मे 50% N FYM के रूप मे + जैव उर्वरक का उपचार मे प्रति वर्ग मीटर मे शाखावों का अत्यधिक संख्या (14.10) दर्ज किए गए । वेंगुर्ला मे 25% N FYM पुर्नुचक्रण + जैविक अवशेषो का वनर्चक्रण + इन सिटू खाद / हरी पत्ती खाद का सम्मिललित अनुप्रयोग से प्रति वर्ग मीटर का फल संख्या अत्यधिक (40.42) रहा ।

फसल संरक्षण:

बापट्ला में, चाय मच्छर और अन्य पत्ते वाले कीटो का प्रबंधन के लिए कीटनाशको का मूल्यांकन प्रयोगो मे L-सैहालोथ्रिन (0.003%) ने पत्ती और पुष्पगुच्छ जालकीट, परोह इल्ली, पत्ती सुरंग कीट तथा सेब और गुटली छेदक के प्रबंधकन मे प्रभावी पाया गया । थ्रिप्स का नुकसान स्कोर, भुवनेश्वर मे L- सैहालोथ्रिन उपचार से सेब मे 1.0 से कम था । होगलगेरे मे L- सैहालोथ्रिन अनुप्रयोग से अधिकतम गुटली उपज (7.46 कि ग्रां / पेड) दर्ज की गई ।

उपचारात्मक नियंत्रण परीक्षणों मे क्लोरोपैरीफॉस (0.2%) उपचार से वेंगुर्ला, होगळगेरे और भुवनेश्वर मे बिना पुनआक्रमणवाली पेडो का प्रमाण क्रमशः 93.33, 88.89 और 82.00 प्रतिशत था ।

प्रौद्योगिकी हस्तांतरण

चालू वर्ष मे कुल 6,09,934 काजू कलमो को उत्पादित करके सरकारी और गैर सरकारी संगठनो के साथ साथ काजू कृषको को भी वितरित किए गए । NHM के तहत बापट्ला केंद्र की वैज्ञानिको ने काजू और कोको विकास निदेशालय, कोच्चि, के सहयोग से फ्रंट–लाईन प्रौद्योगिकी प्रदर्शनो का आयोजन किया । खुर्दा, नयागढ और ढेंकनाल जिलो मे काजू पुनरोपण कार्यक्रम की संयुक्त सत्यापन मे शामिल थे । जगदलपुर केंद्र के वैज्ञानिको ने "छत्तीसगढ के बस्तर क्षेत्र मे छोटे पैमाने पर काजू और काजू प्रसंस्करण के बारे मे प्रशिक्षण" का आयोजन किया । माडकत्तरा केंद्र से दो नये काजू सेब उप्तादो; हलवा तथा कुकीस को वर्तमान मे लाभदायक रुप से बेचे जा रहे सिरप, सोडा, जाम, अचार, कौंडी तथा RTS के साथ शामिल किया गया ।

TSP योजना के तहत, पारिया केंद्र के वैज्ञानिको ने काजू की खेती तथा मृदू कांड कलम बनाने पर वलसाद का धरमपुर और कपराडा तालूको मे प्रशिक्षण आयोजित किया, जिसमे 200 से अधिक किसानो ने भाग लिया । तूरा केंद्र के वैज्ञानिको ने पश्चिम गारो पहाडी क्षेत्र मे वैज्ञानिक काजू खेती को बढावा देने के लिए गांबेग्रे, बोकमाग्रे और बलालग्रो गावों मे फ्रंट लाइन प्रौद्योगिकि प्रदर्शनी को आयोजित किए।

PROJECT CO-ORDINATOR'S REPORT

The All India Coordinated Spices and Cashew nut Improvement Project (AICS & CIP) was started during the IV Five Year Plan in 1971 with its headquarters located at the Central Plantation Crops Research Institute, Kasaragod. During the VII Plan, the ongoing project (AICS & CIP) was bifurcated into two separate projects, one on Cashew and another on Spices. The headquarters of the independent All India Coordinated Research Project (AICRP) on Cashew was shifted to the newly established National Research Centre for Cashew (NRCC), Puttur in 1986. The NRCC was upgraded to Directorate of Cashew Research, Puttur in 2009.

The AICRP on Cashew has presently fourteen centres, of which four Centres were started at the inception of AICS & CIP in the year 1971 [Bapatla (Dr. YSRHU the then ANGRAU); Madakkathara (KAU, shifted from Anakkayam); Vengurla (BSKKV the then KKV) and Vridhachalam (TNAU)]. During the V Plan, one centre at Bhubaneswar (OUAT) and in the VI Plan, two centres, one at Jhargram (BCKVV) and another at Chintamani (UAS) were added. During VIII Plan, one centre at Jagdalpur (IGAU) and a sub centre at Pilicode (KAU) were also started. During the XI Plan, two centres started functioning, one at Paria (NAU) and the other at Darisai (BAU) along with three cooperating centres at Arabhavi (UHS), Barapani and Goa under ICAR Institutes. These centres of AICRP on Cashew are located in 12 cashew-growing states of the country and are under the administrative control of different State Agricultural Universities.

The original budget allocation of the project for the year 2013-14 was Rs. 373.33 lakhs (Rs. 287.00 lakhs-ICAR Share) and the expenditure was Rs. 334.06 lakhs (Rs. 254.21 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 have been presented hereunder.

GERMPLASM CONSERVATION AND CROP IMPROVEMENT

The total number of accessions conserved so far in the Regional Cashew Field Gene Banks (RCFGBs) is 1370. At Goa, germplasm accessions having jumbo nut more than 10.0g with kernel count of 120-180W (14 nos.) and bold nut of 8.0 – 10.0g with kernel count more than 180W (29 nos.) have been conserved. The apple weight at Bapatla ranged from 33.7 g to 125.0 g across the top 18 germplasm accessions. The accession, OC 146 recorded lowest flowering duration of 77 days and OC 124 produced highest flowering laterals (18.0/m^2) at Bhubaneswar. Maximum nuts/m^2 was reported in H-303 (39.58) from Jhargram under varietal evaluation trials.

In multi-location trial III, the mean number of nuts per panicle was maximum in V-7 (9.78 per panicle) at Vengurla. The shelling percentage was highest in Madakkathara – I (37.1%) and VRI – 3 (35.4%) at Jhargram followed by H-675 (33.00) and H-1593 (32.73) at Hogalagere. The maximum apple weight was observed in Tiswadi-3 (98.3g) at Goa and in H-14 (74.0 g) at Madakkathara. At Pilicode under multilocation trial V the highest nut weight of 12.3g and 12.0g was observed in Priyanka and Amrutha, respectively. Under multilocation trial VI at Darisai, the number of panicles per sq.m was the highest in BPP-8 which had 16.2 panicles.

The hybrid A9 recorded highest mean annual nut yield of 12.5 kg/plant at 14th harvest at Bapatla; while, the maximum cumulative nut yield was 100.90 kg for 14 harvests in hybrid A6. The highest cumulative yield/tree for 17 years (155.95

kg/tree) was recorded by H-21 at Madakkathara. At Hogalagere, H-216 recorded highest mean nut weight of 11.33 g and the highest mean apple weight of 68.58 g. In comparison to the hybrids, PLD-57 (OP) was the shortest (1.60 m) with lowest canopy area (16.81 m^2) at Pilicode. At Vengurla, H-1039 (M-44/3 x B.T.22) recorded highest fruit set per panicle (34.0).

CROP MANAGEMENT

Under fertilizer trials, the highest cumulative nut yield for twelve years (62.69 kg/tree) was recorded with 1000 : 250 : 250 NPK g/plant followed by 500 : 250 : 250 NPK g/plant and 500 : 125 : 250 NPK g/plant with 58.71 kg/tree and 57.26 kg/tree, respectively at Hogalagere. At Jhargram, the plants receiving 1500:250:375 NPK kg/ha produced maximum nuts/m^2 (24.63). At Bapatla in the trials on fertilizer application under high density cashew plantations, the annual nut yield per tree was highest (11.43kg/tree) in 10 x 5m (200 plants/ha.) with fertilizer application of 75:25:25 kg/ha. Maximum cumulative yield over 11 harvests (15.14 q/ha) was recorded in 600 plants/ha. at Bhubaneswar. The highest cumulative yield of 5081 kg/ha was recorded with high density plot compared to the normal density plot (1533kg/ha) at Bapatla. Irrigation at 80% CPE recorded significantly highest tree height (5.41m), stem girth (91.12 cm) and maximum mean apple weight (33.56 g) at Hogalagere. Under intercropping trials, the highest net profit of Rs. 42,123/- per ha was obtained in cashew + okra at Paria and it was Rs. 34,167/- at Vridhachalam.

At Kanbargi, in trials on organic management of cashew more number of laterals/m^2 (14.10) were recorded in 50 % N as FYM + bio-fertilizers. Application of 25% N as FYM + Recycling of organic residues + in situ green manuring/green leaf manuring + bio-fertilizers recorded maximum fruits/m^2 (40.42) at Vengurla.

CROP PROTECTION

Evaluation of insecticides for management of TMB and other foliage insect pests indicated that L-cyhalothrin (0.003%) was effective in managing the leaf and blossom webber, shoot tip caterpillar, leaf miner and apple and nut borer at Bapatla. Thrips damage score was less than 1.0 in the apple in case of L-cyhalothrin (0.003%) at Bhubaneswar. The maximum nut yield (7.46 kg/tree) was recorded in L-cyhalothrin (0.003%) treatment at Hogalagere.

In the curative control trials, chlorpyriphos (0.2%) recorded 93.33, 88.89 and 82.00 per cent trees without reinfestation at Vengurla, Hogalagere and Bhubaneswar respectively.

TRANSFER OF TECHNOLOGY :

A total of 6,09,934 grafts were produced during the current year and distributed to several government and non-government organizations as well as to cashew growers. The scientists of Bapatla centre organized front line technology demonstrations in collaboration with the Directorate of Cashew and Cocoa Development, Kochi, under NHM. Scientists of Bhubaneswar Centre were involved in the joint verification of replanting programme of cashew in Khurda, Nayagarh and Dhenkanal districts.

The scientists of Jagdalpur centre conducted trainings on cashew processing under the project 'Enhancement of income for tribals through small scale cashew nut & cashew apple processing in Bastar region of Chhatisgarh'. Two new cashew apple products viz., halva and cookies were launched by Madakkathara Centre and syrup, jam pickle, candy, soda and RTS are being sold profitably.

Under TSP scheme scientists of Paria Centre organized trainings on cashew cultivation and soft wood grafting in Dharampur and Kaparada taluks, Valsad in which more than 200 farmers participated. The scientists of Tura Centre organized Front line demonstrations were conducted in Gambegre, Bokmagre and Balalgere villages of West Garo Hills to promote scientific cultivation techniques for cashew.

CENTRES OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

HEADQUARTERS OF AICRP ON CASHEW

Directorate of Cashew Research, Puttur 574 202

Centres of AICRP on cashew:

1. Cashew Research Station, (YSRHU), Bapatla-522 101, Guntur District, Andhra Pradesh
2. Cashew Research Station, (OUAT), Bhubaneswar-751 003, Odisha
3. Zonal Research Station, (BAU), Darisai-832304, Barakhursi, East Singhbhum Dist., Jharkhand.
4. ICAR Research Complex for Goa, Ela, Old Goa, Goa - 403 402.
5. Horticulture Research Station, (UHS), Hogalagere-563 138, Srinivaspura Tq, Kolar Dist., Karnataka.
6. SG College of Agriculture and Research Station, (IGAU), Jagdalpur - 494 005 Bastar, Chattisgarh
7. Regional Research Station, (BCKV), Jhargram - 721 507, Midnapore West Dist., West Bengal
8. Horticulture Research Station (UHS), Kanbargi- 590 016, Belgaum Dist., Karnataka.
9. Cashew Research Station, (KAU),Madakkathara - 680 651 Trichur Dist., Kerala
10. Agricultural Experimental Station (NAU), Paria-396 145, Valsad Dist., Gujarat.
11. Regional Agricultural Research Station, (KAU), Pilicode - 671 353, Kasaragod Dist., Kerala.
12. Regional Fruit Research Station, (Dr. BSKKV), Vengurla - 416 516, Vengurla Dist., Maharashtra.
13. Regional Research Station, (TNAU), Vridhachalam-606 001, Cuddalore Dist., Tamil Nadu.
14. ICAR Research Complex for NEH Regions, Tura-794 001, West Garo Hills Meghalaya.

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

Presently, 14 coordinating 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_2O_5 and K_2O. 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_2O_5 and K_2O. 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_2O_5 and high in K_2O. The climate is semi arid (dry), AWC 125 mm.

The centres in the West Coast are located at Madakkathara, Pilicode, Vengurla and Navasari 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 heavy black soils 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 plain even land and has Hogalagere, Darisai, Jagdalpur and Kanbargi centres in this region.

Hogalagere 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. This centre is situated at an elevation of 300m above MSL, the soil is red sandy loam, deficient in N, medium in P_2O_5 and high in K_2O. 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' 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.

Kanbargi 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.

The centre at 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 centre at Goa is characterized by lateritic soils having shallow to medium depth. The centre is situated at an altitude of 25 - 40m above the MSL. This centre receives rainfall ranging from 2800 mm to 3800 mm spread out during June to December.

EXPERIMENTAL RESULTS

I. GERMPLASM CONSERVATION & CROP IMPROVEMENT

I. CROP IMPROVEMENT

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

Centres:
East Coast : Bapatla, Bhubaneshwar, Jhargram and Vridhachalam
West Coast : Goa, Madakkathara, Paria, Pilicode and Vengurla
Plains/others : Darisai, Hogalagere, Kanbargi, Jagdalpur and Tura

The objectives of the project are:

(a) To evaluate the existing germplasm of cashew in different centres
(b) 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
(c) To establish clonal germplasm conservation blocks in different centres

SUMMARY:

At Goa, germplasm accessions having jumbo nut more than 10.0g with kernel count of 120-180W (14 nos.) and bold nut of 8.0 – 10.0 g with kernel count more than 180W (29 nos.) have been conserved. At Goa, 14 jumbo bold nut types and 29 bold types have been conserved. At Bapatla, the apple weight ranged from 33.7 g to 125.0 g across the top 18 germplasm accessions. The accession, OC 146 recorded lowest flowering duration of 77 days and OC 124 produced highest flowering laterals (18.0/m^2) at Bhubaneswar. While at Vengurla, maximum number of flowering laterals per sq.m. was highest in RFRS 181 (16.67/m^2).

Germplasm Collection:

During the current year, 10 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 1370 (Table. 1.1)

Table 1.1 : Cashew germplasm accessions existing in different centres

Centre	Earlier existing	Collected in 2013-14	Total existing
Bapatla	132	--	132
Bhubaneshwar	102	2	104
Jhargram	150	--	150
Vridhachalam	208	--	208
Goa	81	8	89
Madakkathara	138	2	140
Paria	--	--	--
Pilicode	43	--	43
Vengurla	305	1	306
Darisai	--	--	--
Hogalagere *	128	--	128
Kanbargi	--	--	--
Jagdalpur	70	--	70
Tura	--	--	--
Total	**1357**	**13**	**1370**

* Conserved at Chintamani

Germplasm evaluation :

The details of growth and yield parameters of cashew germplasm conserved at different centres of AICRP-Cashew have been evaluated.

BAPATLA

Among the accessions, mean nut yield per tree during this year was maximum in T.No.228 (16.17 kg) followed by BLA 39/4 (15.8kg). However, cumulative nut yield was found to be the highest in the entry BLA 39/4 as 98.65 kg /tree followed by accession, T.No-129 [74.17 kg /tree].

Apple weight ranged from 33.7g to 125.0g across the top 18 germplasm accessions (Table. 1.2)

Table 1.2 : Yield parameters of promising cashew germplasm at Bapatla

Accession No.	Mean nut wt (g)	Mean apple wt (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/ tree) (for 12 hvsts)
Priyanka	11.56	125.0	32.35	7.10	47.94
T.No.129	5.00	37.50	25.50	8.05	74.17
T.No.275	3.79	33.70	29.28	14.57	68.07
T.No.12/1	4.51	44.90	23.06	7.62	44.46
T.No.18/3	5.52	48.30	27.72	6.61	36.39
T.No.3/4	5.67	56.20	19.75	7.22	46.21
T.No.8/7	3.70	50.00	27.56	4.63	43.78
T.No.4/5	3.17	39.00	29.78	6.45	48.75
T.No.30/1	6.67	60.00	25.64	8.15	42.24
T.No.228	4.81s	47.20	23.91	16.17	74.11
T.No.268	5.93	44.20	24.62	6.66	63.39
BLA 139-1	4.82	65.80	29.04	5.95	42.74
T.No.17/5	4.64	61.20	28.23	5.67	51.92
BLA 39/4	4.56	55.00	31.39	15.8	98.65
T.No.5/1	4.60	50.80	29.34	6.53	72.01
Ch.gudem	5.16	49.20	24.03	6.68	47.52
Hy.95-T4	5.90	50.00	30.00	11.35	64.43
T.No.2/14	5.84	63.10	26.71	5.47	41.10

BHUBANESWAR

Among cashew germplasm evaluated at Bhubaneswar centre, 59 accessions had bold nut (average nut weight range from 7.0g - 17.5g) and 80 accessions had shelling percentage ≥ 28. A total of 17 accessions were observed to be early flowering (November to December), 73 accessions were mid season type (December to January) and 10 accessions were late bearing (January-February).

The accession OC-124 recorded mean tree height, mean stem girth, mean canopy spread and mean canopy area of 5.7m, 68.0cm, 9.0m in E-W & 6.1m in N-S and 44.75m^2 respectively.

Three promising accessions viz., OC 146, OC 147 and OC 148 had desirable vegetative and yield parameters (Table 1.3).

Table 1.3: Growth parameters of promising cashew germplasm at Bhubaneswar

Accession No.	Year of planting	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean canopy area (m^2)
				E-W	N-S	
OC 124	2003	5.7	68.0	9.0	6.1	44.75
OC 146	2004	4.2	44.3	5.1	5.3	21.23
OC 147		4.6	56.2	6.6	4.7	25.06
OC 148		5.1	54.2	6.7	5.9	31.16

The accession OC 147 recorded the maximum flowering duration with 95 days, having 4.0 numbers of nuts per panicle. OC 146 recorded lowest flowering duration of 77 days. The accession OC 124 produced highest flowering laterals (18.0/$m^{2)}$ followed by OC 148 (17.4m^2) and OC 147 (14.7m^2). Highest number of nuts/ panicle was produced in OC 148 (5.0) followed by OC 147 (4.0) and OC 124 (4.0) (Table. 1.4).

Table 1.4 : Yield parameters of promising germplasm at Bhubaneswar

Accession No.	Mean flowering duration (days)	No. of flowering laterals/m^2	Ratio of male: bisexual flowers	Mean no. of nuts/ panicle
OC 124	79	18	7.11	4.0
OC 146	77	11.5	6.22	3.0
OC 147	95	14.7	2.31	4.0
OC 148	81	17.4	2.29	5.0

OC-146 had the maximum average nut weight (8.6g), apple weight (70.4 g) with a shelling of 32.0%. The accession OC-148 produced maximum annual yield of 9.5 kg/tree as well as cumulative yield of 18.5 kg/tree at 7th harvest stage (Table. 1.5).

Table 1.5 : Yield parameters of promising germplasm at Bhubaneswar

Accession	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) for 6th harvest
OC 124	7.8	63.3	29.0	8.0	14.3*
OC 146	8.6	70.4	32.0	7.0	13.4
OC 147	7.4	65.0	30.4	8.5	15.7
OC 148	8.4	55.8	29.7	9.5	18.5

* Cumulative nut yield at 7th harvest

DARISAI

At Darisai Centre, 11 accessions (OC- 55, OC-56, OC-68, OC-78, OC-92, OC-101, OC-109, OC- 120, OC-121, OC-124 and OC- 129) have been conserved for characterization and evaluation. Among the promising germplasm accessions, tree height ranged from 1.2m to 1.8m, stem girth

(24.0-380 cm) and canopy spread in E-W and N-S directions ranged from 2.25 to 3.70 and 1.75 to 4.10m respectively. The highest number of flowering laterals per m^2 (22.0) were observed in OC-92 (Table. 1.6).

Table 1.6 : Performance of promising cashew germplasm at Darisai

Accession no	Tree ht.(m)	Girth (cm)	Canopy spread (m)		Flowering lateral (m^2)
			E-W	N-S	
OC-55	1.35	26	2.70	3.40	11.60
OC-56	1.45	27	3.70	4.00	19.50
OC-68	1.80	38	3.20	2.50	17.75
OC-78	1.45	32	2.50	2.75	16.25
OC-92	1.60	35	3.50	3.25	22
OC-101	1.55	34	2.50	3.75	17.50
OC-109	1.55	34	3.60	3.90	19.50
OC-120	1.20	25	2.60	3.90	20.50
OC-121	1.30	24	2.90	4.10	20.00
OC-124	1.60	36	2.25	1.75	12.80
OC-129	1.40	26	2.50	2.60	16.25

GOA

Presently, a total of 81 germplasm accessions of cashew with 14 jumbo bold nut types, 29 bold types, 12 medium nut and high yielders, 23 high yielders/ cluster bearers irrespective of nut size and 3 dwarf canopy type have been conserved.

Table 1.7: Growth and yield parameters of accessions at Goa

Accession name	Tree height (m)	Mean nut wt. (g)	Nut yield (kg) (2012)	Shelling (%)	Mean apple wt. (g)	TSS (°B)
Ladfem-1	7.8	8.8	18.5	28.6	85.6	11.8
Ladfem-2	5.1	7.8	12.5	28.2	81.4	12.4
Keri-1	8.6	9.1	8.4	28.4	98.6	11.2
Nirankal-1	6.3	7.7	22.5	29.5	78.5	11.8
Curti-1	8.7	8.1	26.4	29.2	80.5	12.6

In the accessions, nut yield per tree varied from 8.4 kg (Keri-1) to 26.4 kg (Curti-1) with average nut weight of 9.1g and 8.1g, and apple weight of 98.6 g and 80.5g, respectively. A trial has been initiated to characterise 14 local bold nut cashew genotypes namely, 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 Balli-1/ Goa-1 (Check). Valpoi-2 showed vigorous growth with maximum tree height of 4.8m with collar girth of 65cm and canopy spread of 6.5m (N-S) and 6.3m (E-W).

Nut yield varied from 0.21 kg/tree (BKL-2 and Tudal-3) to 0.56 kg/tree (Bardez-8/98) as against 0.45kg /tree recorded in Goa-1).Valpoi-2, Bardez-9 and Tiswadi-3 had nut weight of more than 10g with higher apple weight of 105.0, 110.5g and 110.5g respectively. Genotypes like Valpoi-1, Tiswadi-7, Tudal-1, Mayem-1 and BKL-1 had an average nut weight of more than 8.0g (Table. 1.7 & 1.8).

Table 1.8 : Performance of bold-nut genotypes of cashew at Goa

Genotype	Mean height (m)	Girth (cm)	Canopy spread (m)		Nut yield (kg/tree)	Mean nut Wt. (g)	Mean apple Wt. (g)
			N - S	E - W			
Valpoi-1	3.2	38	3.8	3.9	0.33	8.6	81.5
Valpoi-2	4.8	65	6.5	6.3	0.22	10.1	105.0
Valpoi-3	3.3	42	3.5	3.2	0.45	7.9	110.5
Bardez-8/98	3.5	44	4.6	4.1	0.56	7.6	78.5
Bardez-9	3.4	39	3.1	3.8	0.50	10.1	110.5
Tiswadi-3	3.4	40	4.2	4.6	0.38	10.2	98.4
Tiswadi-7	4.0	35	3.3	3.0	0.38	8.2	82.0
Tudal-1	2.8	33	3.6	2.9	0.44	8.9	95.5
Tudal-3	3.6	35	2.8	4.9	0.21	8.5	90.6
Mayem-1	4.1	45	6.1	6.8	0.38	8.1	78.5
BKL-1	3.3	40	3.5	3.0	0.36	8.3	92.8
BKL-2	2.9	38	3.0	3.4	0.21	8.0	88.6
FMGDI-1	2.6	38	3.3	3.0	0.33	9.2	89.5
Goa-1 (Check).	4.1	50	5.5	4.3	0.45	7.9	80.4
S.Em(±)	0.22	0.05	0.53	0.37	0.05	0.271	6.115
CD@5%	0.61	15.3	1.47	1.03	NS	0.761	16.951

JAGDALPUR

The mean stem girth was maximum (98.40 cm) in NRC-192. The lowest flowering duration (68 days) was recorded in NRC-140 while, longest flowering duration (114 days) was recorded in NRC 190. Maximum number of flowering laterals / m^2 was observed in NRC -137 (14.25).

Mean nut weight was found to be the highest for NRC-138 (8.50g) followed by NRC-140 and NRC-130. Shelling was found to be the highest in NRC- 131 (30.80%)

The nut yield/tree was highest for NRC-138 (8.90 Kg), followed by NRC–137 (8.60 Kg). The cumulative nut yield was highest in NRC-137 (71.95 Kg) for 14 harvests. (Table. 1.9 & 1.10).

Table 1.9 : Growth parameters of promising cashew germplasm at Jagdalpur

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Flowering duration (days)	No. of flowering laterals / m^2	Mean no. of nuts/panicle
			E-W	N-S			
NRC- 130	4.10	65.40	6.20	5.65	106	12.25	3.60
NRC- 131	5.30	68.15	6.75	7.20	87	11.50	4.30
NRC- 136	5.40	70.15	6.95	6.10	83	11.25	4.50
NRC- 137	5.10	80.60	7.10	6.25	84	14.25	6.25
NRC- 138	5.85	88.10	7.85	6.50	70	13.75	4.80
NRC- 140	4.25	75.10	5.95	5.10	68	12.75	3.10
NRC- 190	5.10	80.45	7.25	6.40	114	12.00	4.10
NRC- 191	4.10	80.20	6.10	5.75	76	14.00	3.85
NRC- 192	6.10	98.40	9.30	8.50	110	10.75	3.70
NRC-193	5.00	78.60	7.10	6.20	112	13.25	4.20

Table 1.10 : Yield parameters of promising cashew germplasm at Jagdalpur centre

Accession No.	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/ tree) (for 14 harvests)
NRC- 130	8.10	62.50	27.50	5.80	36.18
NRC- 131	7.50	46.30	30.80	4.10	32.93
NRC- 136	7.00	52.25	29.00	4.30	31.45
NRC- 137	7.60	42.40	30.40	8.60	71.95
NRC- 138	8.50	56.20	29.60	8.90	62.58
NRC- 140	8.40	90.40	29.10	4.20	37.25
NRC- 190	7.20	50.70	27.60	4.00	26.35
NRC- 191	7.00	49.10	30.20	7.25	49.86
NRC- 192	7.40	43.20	29.50	4.50	29.79
NRC-193	7.30	56.00	29.80	6.80	52.77

MADAKKATHARA

Among the accessions evaluated, Kainur recorded maximum height (8.00 m) followed by Mannur (7.33 m). Mannur recorded maximum girth (94.33 cm) followed by Kainur (92.00 cm). Maximum no. of flowering laterals per sq.m. (12.00) was recorded in Kunjithai and ARL-1 during the current season (Table. 1.11).

Table 1.11 : Growth and yield parameters of promising germplasm at Madakkathara

Variety	Height (m)	Girth (cm)	canopy spread EW (m)	Canopy spread NS (m)	No. of Flowering laterals / (m^2)	Ratio of bisexual: total flowers
KTR-1	5.50	78.33	5.80	7.48	6.86	0.400
KTR-3	6.42	80.00	7.50	6.50	6.90	0.393
Kiralur	6.70	87.00	5.76	6.40	8.00	0.410
Mannur	7.33	94.33	7.40	7.45	7.42	0.421
Kainur	8.00	92.00	7.35	7.50	7.42	0.463
Ummanoor	7.08	80.00	6.90	5.36	7.00	0.362
Kottukkal	6.10	86.00	4.65	4.55	8.90	0.356
Peechi	5.62	70.50	6.00	5.60	9.00	0.362
Kunjithai	7.00	68.50	6.30	6.25	12.00	0.381
Pathanoor	7.15	81.75	4.45	4.80	9.80	0.322
ARL-1	6.95	76.00	5.00	5.20	12.00	0.358
KTR-2	6.65	62.00	5.07	5.85	11.00	0.352
ARL-2	6.45	77.50	5.91	5.95	10.90	0.353
ODR	6.45	64.00	4.80	5.55	11.90	0.384

PILICODE

The accession, PLD 17 had the highest plant height Highest number of flowering branches/m^2 (13.25) was observed in PLD 62. Higher ratio of bisexual flowers to total flowers was observed in PLD 67 while PLD 62 and PLD 45 recorded higher seed set (4.25/m^2) (Table. 1.12 & 1.13).

Table 1.12: Yield parameters of promising cashew germplasm at Pilicode

Accession No.	No. of flowering laterals / m^2	Ratio of bisexual : total flowers	Nuts/ m^2
PLD 75	2.333e	0.190bc	2.666cd
PLD 54	7.916c	0.154de	4.833a
PLD 44	2.250e	0.229b	1.000ef
PLD 64	1.333e	0.091fg	0.000f
PLD 62	13.250a	0.077g	4.250ab
PLD 40	7.000c	0.076g	1.750cde
PLD 48	4.750d	0.116fg	2.750cd
PLD 67	4.583d	0.201bc	1.666de
PLD 66	4.500d	0.162cd	2.000cde
PLD 45	10.750b	0.340a	4.250ab
PLD 82	7.000c	0.117ef	3.000bc
CD at 5%	1.703	0.040	1.263

Table 1.13 : Yield parameters of promising cashew germplasm at Pilicode

Accession No.	Mean nut wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree)
PLD 1	7.840	35.850	2.575	33.65
PLD 3	8.300	29.225	1.750	23.41
PLD 4	6.735	31.940	3.425	40.125
PLD 12	9.990	25.885	2.250	34.546
PLD 15	8.175	27.940	0.900	13.55
PLD 16	8.550	25.890	4.600	25.19
PLD 17	8.550	27.275	4.125	12.915
PLD 18	9.005	30.530	0.300	11.25
PLD 19	8.500	28.425	1.350	11.845
PLD 20	13.100	19.350	3.400	13.995
PLD 57	3.030	29.100	0.325	3.015
S.Em(±)	0.077	0.179	0.148	-
CD at 5%	0.140	0.324	0.269	-

TURA

Presently, 45 early fruiting germplasm were collected in West Garo Hills, Meghalaya. Out of these accessions, only 11 have been screened on the basis of bold nut size and early fruiting. The promising germplasm accessions are RCCN 1, 16, 17, 18, 19, 20, 21, 22, 23, 24 and 25 which have been planted for further evaluation.

VENGURLA

Among the 14 types, RFRS 171 recorded the lowest mean height (5.8 m) and mean girth (35.3 cm) in RFRS 184 whereas, mean laterals m^2 were highest in case of RFRS 180 i.e. 25.33 per sq.m and flowering panicles per sq.m. was the highest in RFRS 181 (16.67 per sq. m) (Table 1.14).

Table 1.14 : Growth and yield parameters of promising germplasm at Vengurla

Name of the type	Plant height (m)	Plant girth (cm)	Spread mean (m)	Laterals /m^2	Panicle/m^2
RFRS 171	5.8	74.0	6.6	24.0	14.00
RFRS 172	6.3	74.0	7.0	22.0	15.00
RFRS 173	6.4	73.0	6.0	18.33	12.67
RFRS 174	7.1	80.0	6.5	21.00	14.33
RFRS 175	7.3	64.0	5.0	21.00	15.00
RFRS 176	5.7	68.6	6.0	25.00	15.50
RFRS 177	6.0	80.5	6.3	25.00	16.00
RFRS 178	7.4	81.3	6.9	22.00	15.50
RFRS 179	6.6	56.6	5.1	22.00	9.00
RFRS 180	8.6	71.6	6.3	25.33	15.33
RFRS 181	7.0	60.3	5.1	24.00	16.67
RFRS 182	7.0	72.0	5.0	18.00	13.00
RFRS 183	6.9	86.0	9.2	27.00	15.00
RFRS 184	6.8	35.3	4.4	21.00	12.67

Among the 10 types RFRS 191 recorded the lowest mean height (4.00 m). The mean laterals per sq.m. was maximum (26.0/m^2) and the mean panicles per sq.m. were also highest in RFRS 194 (16.50/m^2) (Table 1.15).

Table 1.15: Growth and yield parameters of promising germplasm at Vengurla

Name of the type	Plant height (m)	Plant girth (cm)	Spread mean (m)	Laterals /m^2	Panicle/m^2
RFRS 185	6.2	55.5	5.8	15.5	10.5
RFRS 186	5.8	44.0	5.2	16.33	10.33
RFRS 187	6.66	59.3	6.3	18.33	12.33
RFRS 188	6.3	61.5	6.5	16.0	10.00
RFRS 189	6.2	70.5	6.1	19.5	14.00
RFRS 190	5.6	64.5	6.5	19.0	14.00
RFRS 191	4.0	50.0	5.2	17.0	13.00
RFRS 192	5.00	45..0	5.0	16.0	10.00
RFRS 193	5.6	42.0	3.6	20.5	12.50
RFRS 194	5.6	46.0	4.4	26.0	16.50

VRIDHACHALAM

Among the accessions evaluated 302362 and 302363 had least mean canopy area. The flowering duration was minimum (69 & 70days) in 302361 and 302365 respectively. No. of flowering laterals /m^2, nuts/ m^2 and nuts per panicle were maximum in 302361. The cashew accession 302361 recorded the highest annual nut yield of 7.65 kg/tree and highest cumulative yield of 53.33 kg/tree in eleven harvests (Table 1.16 & 1.17).

Table 1.16 : Growth parameters of promising cashew germplasm at Vridhachalam centre

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy area (m^2)	No. of flowering laterals / m^2
302360	5.10	58.0	48.0	15.50
302361	6.50	69.3	54.5	19.00
302362	5.40	58.5	37.7	16.75
302363	5.70	52.6	37.6	15.00
302364	5.70	61.3	48.4	18.75
302365	5.20	63.5	50.6	15.75
302366	5.90	65.6	54.6	16.75
S.Em(±)	0.18	2.08	2.69	NS

Table 1.17 : Yield parameters of promising cashew germplasm at Vridhachalam

Accession No.	Mean Flowering duration (days)	Nuts/ m^2	Mean apple wt. (g)	Mean Nut Wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 11 harvests)
302360	76	29.0	52.5	7.6	30.2	6.22	42.26
302361	69	36.5	65.5	7.0	29.7	7.65	53.33
302362	75	28.8	55.5	6.4	28.2	6.05	41.90
302363	75	29.8	62.5	6.4	28.0	6.54	42.88
302364	77	34.8	55.2	7.0	29.6	6.85	50.25
302365	70	29.6	42.6	6.4	27.8	6.95	52.25
302366	80	20.5	63.8	7.0	28.0	6.56	46.03
S.Em(±)	0.47	0.32	1.01	0.28	0.56	0.31	1.56
CD at 5%	1.24	1.14	2.13	0.63	1.12	0.68	2.98

Gen.3. Varietal Evaluation Trials

1. Multi Location Trial – II

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

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

SUMMARY:

The least flowering duration was recorded in Ullal-1 (68 days) and highest number of flowering laterals/m^2 were observed in M-44/3 (26.69) at Hogalgere. Maximum nuts/m^2 H-303 (39.58) was reported from Jhargram. The mean apple weight (107.66 g) was found to be maximum in H-367at Vengurla.

Experimental Details:

Varieties	:	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
D.C.R., Puttur	:	VTH 107/3, VTH 40/1
Design	:	RBD
Replications	:	Three
Year of Planting	:	1992 (1993 at Bapatla, 2002 at Jhargram, 1994 at Vridhachalam)

HOGALAGERE

The highest tree height was recorded in NRCC-Sel-1 with 6.40 m. The mean stem girth varied from 80.03 to 111.00 cm. The highest stem girth was recorded by NRCC-1 (111.00 cm) followed by Ullal-1 (105.38 cm). The highest E-W (10.88 m) and N-S (11.18 m) spread as well as mean canopy area (115.15 m^2) was noticed in NRCC-Sel-1 (Table 1.18).

Table 1.18 : Growth parameters of cashew genotypes at Chintamani

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean canopy area (m^2)
			E-W	N-S	
T.No. 30/1	5.26	92.87	8.53	8.68	74.04
T.No. 3/33	5.89	98.97	8.93	9.59	85.64
T.No. 10/19	5.72	97.10	9.16	8.64	79.14
T.No. 3/28	5.80	100.43	9.01	10.39	93.61
H- 68	6.06	100.37	7.81	8.54	66.70
H- 255	6.37	104.27	10.30	10.36	112.72
H- 303	5.28	101.10	9.73	8.73	84.94

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean canopy area (m^2)
			E-W	N-S	
H- 367	5.52	92.09	8.43	7.90	66.60
M- 15/4	6.18	100.03	8.68	8.84	76.73
M- 44/3	5.25	81.36	7.69	7.73	56.21
NRCC-Sel-1	6.40	111.00	10.88	11.18	115.15
NRCC-Sel-2	5.90	80.03	7.70	7.30	59.44
Ullal-1	5.83	105.38	9.23	9.62	88.79
S.Em(±)	0.05	0.41	0.09	0.05	-
CD at 5%	0.14	1.25	0.27	0.16	-

The mean number of flowering laterals per m^2 ranged from 16.00 to 26.89. The highest number of flowering laterals/m^2 were observed in M-44/3 (26.69) followed by NRCC-Sel-1 (25.89). The highest flowering duration was observed in H-367 (93 days) followed by H-320 with 82 days. The least flowering duration 68 days was noticed in Ullal-1 The number of nuts and panicle ranged per m^2 from 7.42 to 43.12 and 4.36 to 6.73, respectively. The number of nuts per m^2 was in H-303 (43.12) followed by M-44/3 (38.94) and T.No.10/19 (30.99). The accession H-320 recorded highest nuts per panicle (6.73) as compared to other accessions (Table 1.19).

Table 1.19 : Yield parameters of cashew genotypes at Chintamani

Accession No.	Mean no. of flowering laterals / m^2	Mean Flowering duration (days)	Mean no. of nuts/ m^2	Mean no. of nuts/panicle
T.No. 30/1	22.05	71	24.76	5.04
T.No. 3/33	20.21	73	34.11	4.78
T.No. 10/19	22.06	79	30.99	5.04
T.No. 3/28	17.06	70	27.10	5.85
H- 68	18.97	72	23.00	4.36
H- 255	23.13	78	18.69	5.65
H- 303	16.00	79	43.12	4.85
H- 320	22.94	82	26.32	6.73
H- 367	20.52	93	21.29	5.43
M- 15/4	23.89	70	26.07	5.96
M- 44/3	26.69	81	38.94	6.01
NRCC-Sel-1	25.89	73	7.42	5.67
NRCC-Sel-2	22.11	81	21.28	5.81
Ullal-1	18.72	68	26.86	5.81
S.Em(±)	0.14	0.18	0.06	0.03
CD at 5%	0.42	NS	0.19	0.10

The accession H-320 recorded highest nut weight of 9.09 g followed by H-68 and H-367 with nut weight of 8.84 g & 8.83 g. The highest mean apple weight was recorded in H-367 with 9.09 g followed by H-320 and H-68 with mean apple weight of 91.10 g & 85.76 g, respectively. The shelling percentage was highest in TN-10/19 (32.49) followed by M-44/3 (32.23) and H-320

(32.23%). Highest nut yield of 13.09 kg/tree was noticed in H-320 followed by M-44/3 (12.49 kg/tree) (Table. 1.19). Over a period of 18 harvests, H-320 recorded highest cumulative yield (157.78 kg/tree) followed by NRCC-Sel-2 (138.04 kg/tree) and M-44/3 (124.97 kg/tree) (Table. 1.20).

Table 1.20 : Yield parameters of cashew genotypes at Chintamani

Accession No.	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean nut yield (kg/tree)	Cum. yield (kg/tree) (for 18 harvests)
T.No. 30/1	6.61	62.12	28.97	10.11	107.54
T.No. 3/33	7.74	76.41	31.14	5.69	81.02
T.No. 10/19	5.64	32.63	32.49	5.10	78.07
T.No. 3/28	7.37	70.09	31.07	8.13	104.58
H- 68	8.84	85.76	32.05	5.21	57.87
H- 255	8.37	51.79	31.27	5.63	92.60
H- 303	8.22	55.70	28.50	6.15	104.71
H- 320	9.09	91.10	32.23	13.09	157.78
H- 367	8.83	95.97	31.83	6.99	91.26
M- 15/4	7.91	56.65	31.03	10.03	120.81
M- 44/3	6.16	41.67	32.23	12.49	124.97
NRCC-Sel-1	8.09	41.42	31.85	6.62	95.67
NRCC-Sel-2	8.12	55.95	32.01	10.34	138.04
Ullal-1	7.38	36.00	31.11	10.20	104.03
S.Em(±)	0.05	0.26	0.18	0.04	-
CD at 5%	0.16	0.79	0.54	0.13	-

JAGDALPUR

The maximum tree height (5.57m) was recorded in V-4, whereas, the maximum stem girth (76.23cm) was recorded in H-68 followed by V-4, NRCC Sel-1 and H-255. Canopy spread in V-4 was found to have largest coverage (EW/NS=5.98/5.83m). The maximum no of flowering laterals/m^2 (15.83) as well as nuts per panicle (6.20) was recorded in H-303. Nut yield (Kg/tree) was highest for H-68 (6.13kg) followed by V-4 & H-367. Nut weight (10.10g) as well as apple weight (72.97g) was highest in H-367. The shelling percentage was recorded to be maximum for NRCC Sel-1 (31.13) followed by H-68 and V-4 (Table 1.21 & 1.22).

Table 1.21 : Growth parameters of cashew accessions at Jagdalpur

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Flowering duration (days)	Mean no. of flowering laterals / m^2	Mean no. of nuts/panicle
			E-W	N-S			
T.No. 30/1	3.95	66.22	4.40	4.93	113	12.17	3.87
T.No. 3/33	4.60	71.28	5.20	5.30	68	13.33	3.67
T.No. 10/19	4.27	69.38	4.88	4.83	89	11.17	3.80
T.No. 3/28	4.40	70.27	4.80	5.02	70	11.33	4.07
H- 68	5.28	76.23	5.23	5.53	87	14.67	5.33
H- 255	4.42	71.63	5.33	5.57	100	13.75	3.80
H-303	4.83	68.33	4.92	5.03	108	15.83	6.20

Accession No.	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Flowering duration (days)	Mean no. of flowering laterals / m^2	Mean no. of nuts/panicle
			E-W	N-S			
H- 320	4.23	64.03	5.03	5.75	71	13.42	5.67
H- 367	4.32	66.00	5.40	5.80	72	13.50	3.53
M- 15/4	3.15	47.37	4.07	3.50	93	9.75	4.20
M- 44/3	3.65	61.73	4.47	4.22	91	11.75	3.73
NRCC-Sel-1	4.67	72.73	5.25	5.12	66	10.58	3.40
NRCC-Sel-2	3.83	57.20	4.65	4.77	107	11.50	4.20
V-4	5.57	72.93	5.98	5.83	73	14.58	5.87
S.Em(±)	0.27	2.87	0.28	0.26	-	0.54	0.23
CD at 5%	0.78	8.36	0.82	0.75	-	1.58	0.69

Table 1.22 : Yield parameters of cashew accessions at Jagdalpur

Accession No.	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 10 harvests)
T.No. 30/1	7.20	45.30	28.13	2.90	16.27
T.No. 3/33	7.10	50.83	30.33	3.07	15.62
T.No. 10/19	5.80	52.68	29.93	3.10	17.17
T.No. 3/28	7.87	52.13	29.77	3.03	14.46
H- 68	9.77	57.93	30.47	6.13	30.07
H- 255	9.90	64.57	29.47	4.23	19.70
H- 303	8.57	53.90	29.27	4.93	27.28
H- 320	9.33	52.37	29.17	4.33	21.20
H- 367	10.10	72.97	30.07	5.27	23.75
M- 15/4	7.07	48.07	29.90	3.00	15.71
M- 44/3	6.73	47.97	30.77	2.30	12.10
NRCC-Sel-1	7.50	52.90	31.13	2.53	13.60
NRCC-Sel-2	8.03	44.13	30.03	3.93	20.61
V-4	9.60	57.30	30.40	5.93	28.45
S.Em(±)	0.23	2.34	0.50	0.34	-
CD at 5%	0.67	6.81	1.44	0.99	

JHARGRAM

Maximum nuts/m^2 was observed in H-303 (39.58) followed by T.No. 30/1 (30.67) and M- 44/3 (27.25). The varieties, M- 15/4, H- 320, T.No. 3/33, H- 367, NRCC-Sel-2, H-255, NRCC-Sel-1 and H-68 were on par with respect to nuts/m^2. H-303 had also highest nuts/panicle (8.0), yield/tree (9.3 Kg) and cumulative yield /tree (32.8 Kg/tree) at 7th harvest. The other varieties having better nut weight were NRCC Sel-2 (6.17g) and H-320 (6.1g). The cumulative yield was higher in varieties 3/28 (26.7 Kg/tree), H-255 (26.4 Kg/tree) and T.No. 10/19 (23.2 Kg/tree) (Table. 1.23).

Table 1.23 : Yield parameters of different varieties at Jhargram

Variety	Nuts/m^2	Nuts/ Panicle	Nut weight (g)	Apple Weight (g)	Yield (Kg/ tree)	Cumulative Yield (Kg/ tree) for 7 harvests	Shelling %
T.No.30/1	30.67	6.67	4.87	31.3	6.77	18.5	28.70
T.No.3/33	18.25	5.58	4.70	43.3	4.86	20.1	33.75
T.No.10/19	24.42	4.58	5.04	44.5	5.41	23.2	33.28
T.No .3/28	20.92	6.75	5.59	39.5	5.36	26.7	34.50
H – 68	9.50	3.58	5.42	30.5	1.78	11.4	33.28
H – 367	15.17	3.00	5.96	27.3	3.26	16.3	35.23
H – 303	39.58	8.00	5.91	35.0	9.30	32.8	33.34
H – 255	11.75	3.17	6.74	36.7	4.20	26.4	33.08
H – 320	19.67	5.25	6.10	38.8	5.47	21.0	28.81
M – 44/3	27.25	4.17	4.62	32.0	4.08	22.6	32.29
M – 15/4	20.75	4.08	4.84	26.8	4.19	21.4	33.76
NRCC - Sel - 1	10.67	1.67	5.76	27.5	1.60	6.3	38.43
NRCC - Sel - 2	14.50	3.33	6.17	26.2	3.59	19.8	31.12
SEm ±	1.79	0.35	0.15	1.2	0.45	1.3	0.54
C.D. at 5%	3.64	0.71	0.31	2.44	0.92	2.64	1.10

MADAKKATHARA

The maximum height was recorded by H-68 and H-320 (9.17 m). The maximum girth was recorded in T-107/3 (139.43 cm). T-10/19 recorded highest canopy spread (9.00 m) T-107/3 recorded highest canopy spread (9.00m) followed by T-30/1 (8.86 m). T-107/3 recorded maximum days of flowering (158) followed by T-3/33 (156) days. Highest sex ratio was recorded in T-40/1 (0.580) followed by T-30/1 (0.423) (Table 1.24 & 1.25).

Table 1.24 : Vegetative characters of different genotypes at Madakkathara

Genotypes	Height (m)	Girth (cm)	Canopy spread -EW (m)	Canopy spread - NS (m)	Mean canopy spread (m)
T 30/1	8.32	113.51	8.33	8.86	8.59
T 3/33	8.68	118.28	8.88	8.80	8.84
T 10/19	8.33	116.33	9.00	8.00	8.50
T3/28	9.05	118.16	7.54	7.57	7.55
H-68	9.17	116.80	8.58	8.31	8.44
H-367	7.76	95.33	8.84	7.98	8.41
H303	8.67	125.32	8.87	7.82	8.34
H-255	8.80	121.66	8.68	8.50	8.59
H-320	9.17	113.88	8.60	7.86	8.23
M 44/3	8.29	113.58	7.82	8.67	8.24
M 15/4	7.64	118.55	7.40	8.02	7.71
T 107/3	9.03	139.43	8.70	9.00	8.85
T 40/1	9.07	106.10	8.00	8.25	8.12
H-1608	8.83	117.78	8.93	8.46	8.69
C.D. at 5%	NS	NS	NS	NS	

Table 1.25 : Flowering characters of cashew genotypes at Madakkathara

Genotypes	Dur. of flowering	Sex Ratio	No. of panicles / (m^2)	No. of fruits/panicle
T30/1	122	0.423	9.39	5
T 3/33	156	0.145	12.16	6
T 10/19	151	0.145	10.40	4
T 3/28	149	0.108	9.73	6
H-68	121	0.375	11.04	5
H-367	149	0.128	10.51	5
H-303	130	0.326	10.17	6
H-255	144	0.083	11.00	4
H-320	137	0.084	10.42	6
M 44/3	140	0.141	13.38	6
M 15/4	151	0.191	8.77	4
T 107/3	158	0.146	9.36	4
T 40/1	135	0.580	9.02	4
H-1608	146	0.141	9.09	4
CD. at 5%	13.79	0.191		

VENGURLA

The maximum height and spread were recorded in T-30/1 (7.57 m and 10.60 m respectively), whereas maximum girth was observed in T-3/28 (112.47 cm). The mean nut weight (9.73 g) and mean apple weight (107.66 g) was found to be maximum in H-367. While, the maximum cumulative yield for 11 harvests (40.26 Kg/tree) was recorded in H-303, which was followed by H-30/1 (33.26 Kg/tree) and H-255 (32.60 Kg/tree) (Table 1.26).

Table 1.26 : Growth and yield parameters of different varieties at Vengurle

Variety /type	Mean Height (m)	Mean Girth (cm)	Mean Spread (m)		Mean Spread (m)	Mean Laterals /m^2	Mean panicles /m^2
			E.W.	N.S.			
H-255	4.83	70.83	6.17	6.43	6.30	28.67	17.50
H-303	5.67	84.23	7.83	8.37	8.07	26.30	16.50
H-320	6.77	105.27	9.40	8.97	9.17	28.75	18.56
H-367	3.73	57.23	5.33	5.37	5.33	25.56	17.47
NRCC - Sel - 1	6.50	106.10	8.77	9.03	8.90	26.36	15.83
NRCC - Sel - 2	6.00	83.70	8.57	9.03	8.77	29.22	18.43
M-44/3	6.73	106.30	10.23	8.70	9.43	18.33	12.56
M-15/4	5.73	85.70	7.40	7.77	7.57	19.58	12.33
T-10/19	3.37	51.53	5.07	4.87	4.93	27.00	16.75
T-3/28	7.27	112.47	9.13	8.63	8.87	18.72	16.87
T-3/33	4.50	80.50	8.40	7.80	8.07	27.17	17.33
T-30/1	7.57	110.0	10.40	10.87	10.60	28.22	16 .69
SEm ±	1.05	16.84	1.43	1.41	1.39	4.64	2.66
CD at 5%	N.S.	N.S.	N.S	N.S.	N.S.	N.S.	N.S.

2. Multi Location Trial – III

Centres: **East Coast** : Bapatla, Bhubaneshwar 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.

SUMMARY :

At Bapatla, the number of panicles per sq.m was highest in H-1597 (24.16). The highest shelling per cent was recorded in H-675 (33.00) followed by H-1593 (32.73) at Hogalagere. Maximum apple weight was recorded in H-14 (74.0 g) at Madakkathara and the mean number of nuts per panicle was maximum in V-7 (9.78 per panicle) at Vengurla.

Experimental Details:

The trial has been initiated in 2003. The trial comprises of 10 test varieties and one local check variety.

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

Replications – Three Spacing 7.5 x 7.5 m Plot size - 4 plants per plot

BAPATLA

Duration of flowering was found to be shortest in Goa 11/6 (83 days) Number of panicles per square meter was highest with H-1597 (24.16) Mean nut yield per tree was highest in BPP-8 (10.31kg). Cumulative nut yield per tree was also highest in BPP-8 which gave 32.06kg/tree for 6 harvests. Mean apple was highest in BPP-8 with 63.16g (Table 1.27).

Table 1.27: Yield parameters of cashew varieties/genotypes at Bapatla

Variety/ Genotype	Duration of Flowering	Flowering/m²	Nut weight (g)	Apple weight (g)	Shelling (%)	Nut yield /tree (at 6th harvest) (Kg)	Cum.Yld./tree (6 hvsts) (Kg/ tree)
Goa 11/6	83.0	21.93	6.27	33.93	29.55	6.35	18.99
H.662	96.0	20.16	7.53	43.43	28.00	3.56	8.70
H.32/4	87.0	23.33	7.00	24.66	24.26	9.41	23.41
K.22/1	92.0	23.06	5.77	40.33	29.34	5.15	13.09
H.11	91.0	22.16	5.90	43.40	29.62	6.61	15.10
H.675	91.0	23.66	4.53	38.90	30.94	5.90	13.96
H.14	105.0	20.76	5.71	34.20	29.76	8.43	19.77
BPP-8	91.0	20.10	8.01	63.16	27.29	10.31	32.06
H.1597	89.0	24.16	5.44	35.73	29.42	8.30	18.68
B.H.6	92.0	16.33	7.12	30.30	30.18	7.01	19.40
B.H.85	94.0	22.33	6.48	36.00	30.77	6.26	15.91
	CD@5%	NS	1.086	9.376	3.197	2.139	---

BHUBANESWAR

BH 85 recorded the maximum flowering duration of 95 days having significantly highest number of nuts per panicle (5.0) and lowest ratio of male: bisexual flowers (2.3). Similarly, H 32/4 and Goa 11/6 recorded lowest flowering duration of 72 days. Significantly highest flowering laterals (19.4/ m^2) were recorded in H-11. The highest numbers of nuts/panicle were produced by BH 85 (5.0). BH-6 recorded significantly highest nut weight (9.8g) and apple weight (86.5 g). The shelling percentage ranged from 28.3 (BPP 8) to 32.4 (BH 6). The cashew type, BH-85 recorded significantly highest annual nut yield of 10.3kg/tree. The cumulative yield/tree over 7th harvest ranged from 7.33 kg (K-22-1) to 31.52 kg (BH-6) (Table 1.28 & 1.29).

Table 1.28 : Yield parameters of cashew genotype at Bhubaneswar

Variety / Genotype	Mean Flowering duration (days)	Flowering laterals /m^2	Ratio of male: bisexual flowers	Mean no. of nuts/ panicle
BH 6	75	16.6	6.22	4.0
BH 85	95	18.5	2.31	5.0
H 1597	85	17.7	5.26	3.0
K 22-1	84	12.9	3.65	3.3
H 622	75	12.3	6.90	3.0
H 675	76	11.8	2.61	4.0
H 11	90	19.4	3.76	4.7
H 14	87	15.2	2.89	4.3
H 32/4	72	15.3	5.67	4.0
Goa 11/6	72	16.9	5.28	4.3
BPP 8 (Local check)	84	16.6	7.11	4.0
SEm (±)	-	1.44	-	0.26
CD at 5%	-	4.24	-	0.78

Table 1.29 : Yield attributing traits of promising cashew types at Bhubaneswar.

Variety /Genotype	Mean nut weight (g)	Mean apple weight (g)	Shelling (%)	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (For 7 harvests)
BH 6	9.8	86.5	32.4	9.0	28.35
BH 85	7.6	70.0	30.0	10.3	31.52
H 1597	7.5	60.3	31.0	5.7	15.16
K 22-1	6.1	43.5	29.8	2.1	7.33
H 622	7.8	62.0	29.7	3.2	8.51
H 675	5.2	41.7	31.2	2.2	7.44
H 11	6.2	30.0	29.5	4.8	19.13
H 14	6.4	38.6	30.1	5.6	15.10
H 32/4	7.8	68.6	28.6	5.1	17.81
Goa 11/6	8.0	60.3	30.8	6.8	22.78
BPP 8 (Check var.)	7.8	63.1	28.3	8.1	19.80
S.Em(±)	0.18	1.34	0.84	0.3	-
CD at 5 %	0.53	3.95	NS	0.96	-

HOGALAGERE

The highest tree height and stem girth were recorded in H-32/4 (5.59 m & 80.10 cm respectively) followed by Bhaskara (5.29 m & 74.70 cm respectively). The highest E-W & N-S spread was recorded in H-32/4 (8.38 and 8.22m respectively). The longest flowering period was noticed in BH-6 (86 days) followed by H-14 (85 days) (Table 1.30).

Table 1.30 : Growth parameters of cashew genotypes at Chintamani

Variety / Genotype	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Mean Flowering duration (days)
			E-W	N-S	
BH 6	4.81	73.97	7.51	6.95	86
BH 85	4.58	71.63	6.85	6.97	76
H 1593	4.50	72.66	7.21	7.24	78
K 22/1	4.80	70.20	6.71	6.95	66
H 662	4.55	61.90	7.17	7.19	61
H 675	4.35	60.93	6.56	6.45	81
H 11	4.63	72.06	7.60	7.24	72
H 14	3.92	52.76	5.70	5.73	85
H 32/4	5.59	80.10	8.38	8.22	75
Bhaskara	5.29	74.70	7.23	7.11	74
Chintamani-1	4.80	71.31	7.14	7.35	71
CD @ 5%	0.25	1.22	0.12	0.13	0.28

The accession H-675 recorded highest number of flowering laterals (20.09) followed by BH-85 and H-11 with 18.99 and 18.83, respectively. The highest number of nuts per panicle was recorded in Bhaskara (10.13) followed by H-675 (7.51). The highest nut weight was recorded in BH-6 (9.14 g) followed by H-1593 (9.10 g). The significantly highest apple weight was recorded in H-1593 (82.69 g) followed by K 22/1 (80.14 g) and BH-6 (76.70 g).

Table 1.31: Yield parameters of cashew genotypes at Chintamani

Variety / Genotype	No. flowering laterals/ m^2	Mean no. of nuts/panicle	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 7 harvests)
BH 6	15.89	5.30	9.14	76.70	32.53	9.62	31.76
BH 85	18.99	5.82	7.36	43.76	32.43	8.57	28.66
H 1593	3.74	7.01	9.10	82.60	32.73	12.28	38.95
K 22/1	12.43	6.87	6.16	80.14	31.73	10.25	32.73
H 662	12.78	5.62	5.05	51.46	31.09	11.25	31.93
H 675	20.09	7.51	4.85	42.62	33.00	5.50	19.88
H 11	18.83	6.81	6.40	50.47	32.03	9.11	27.88
H 14	17.96	4.96	5.37	33.52	31.18	3.40	14.46
H 32/4	8.33	7.19	8.88	54.11	32.17	13.29	40.39
Bhaskara	8.28	10.13	8.44	50.17	31.60	8.29	30.77
Chintamani-1	13.73	6.81	7.45	56.82	31.21	12.10	36.35
CD @ 5%	0.31	0.09	0.14	0.31	0.32	0.06	0.31

Significantly highest nut yield was recorded by H–32/4 (13.29 kg/tree) followed by H-1593 (12.28 kg/tree). The cumulative yield (6 years) was highest in H-32/4 (40.39 kg /plant) followed by H-1593 (38.95 kg/plant) and Chintamani-1 (36.35 kg/plant). The highest shelling percentage was recorded in H-675 (33.00) followed by H-1593 (32.73) and BH-6 (32.53) (Table 1.31).

MADAKKATHARA

Maximum height was recorded H-662 (7.24m) followed by H 675 (6.97 m). Maximum girth was recorded in H-662 (95.87 cm) followed by Dhana (91.58 cm). The above parameters were not differing significantly among the genotypes.

Flowering duration was maximum for H 32/4 (157) and minimum for BH 85 (122) days. The ratio of bisexual flowers: total flowers was highest (0.246) in Dhana which was on par with K-22-1 and Goa 11/6 being 0.201 and 0.202, respectively. Maximum apple weight was recorded by H 14 (74 g) followed by BH 6 (73.94g) (Table 1.32).

Table 1.32 : Morphological and yield characters of cashew genotypes at Madakkathara

Genotypes	Height (m)	Girth (cm)	Canopy spread E-W (m)	Canopy spread N-S (m)	Duration of flowering	Ratio of bisexual: total flowers
Dhana	5.95	91.58	8.56	8.26	125	0.246
H-11	6.01	86.05	9.00	8.86	156	0.098
H-32/4	6.57	80.30	7.45	8.25	157	0.088
H-1593	5.69	79.74	7.85	7.28	148	0.180
BH-6	6.04	79.41	6.83	7.85	143	0.081
H-662	7.24	95.87	8.84	8.98	137	0.070
H-675	6.97	86.55	7.93	8.35	151	0.069
BH-85	6.88	85.34	7.25	7.47	122	0.140
K-22-1	6.02	85.19	7.25	7.36	130	0.201
Goa 11/6	6.82	83.29	8.39	8.39	123	0.202
H-14	5.96	89.89	8.64	8.28	150	0.101
CD@ 5%	NS	NS	NS	NS	13.8	0.18

VENGURLA

The maximum mean height was recorded in BH-6 (3.27 m) whereas the maximum mean girth was found in Goa 11/6 (43.87 cm) and maximum mean spread was in H-675 (5.37 m). Maximum fruit set was found in V-7 (58.44/m^2). Mean no. of nuts per panicle was maximum in V-7 (9.78 per panicle) and mean nut weight of 8.90 in H-11. The above parameters were not differing significantly among the genotypes. (Table 1.33).

Table 1.33 : Growth parameters of cashew genotypes at Vengurla

Variety /Genotype	Mean Height (m)	Mean Girth (cm)	Mean Canopy Spread (m)		Mean Canopy Spread (m)	Mean Laterals /m²
			EW	NS		
Goa - 11/6	3.20	43.87	4.17	4.00	4.07	30.62
H-11	2.80	38.30	5.13	5.10	5.10	30.10
BH-6	3.27	42.63	4.20	4.30	4.23	31.11
H-14	2.77	41.43	4.93	5.20	5.07	30.33
H-1597	2.87	34.20	4.70	4.33	4.43	31.78
K-22/1	2.83	39.93	4.50	4.53	4.50	31.56
V-7	2.90	38.63	4.20	4.20	4.43	32.78
32/14	3.17	38.43	4.63	4.43	4.50	32.00
BH-85	3.10	34.97	3.97	4.20	4.07	31.89
H-675	3.20	33.87	5.27	5.47	5.37	32.67
SEm ±	0.18	3.28	0.43	0.37	0.37	0.68
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

VRIDHACHALAM

Significantly highest plant height was recorded by H-32/4. The flowering laterals were higher in VRI 3 and H14. The nut weight of the genotypes ranged between 6.8 - 7.4g. The shelling percentage was more than 29.0 in all the genotypes tested. The apple sp. was maximum (68.0g) in Goa 11/6. The annual nut yield was highest in H-14 followed by VRI-3 (Table 1.34 & 1.35).

Table 1.34 : Growth parameters of cashew genotypes at Vridhachalam

Variety /Genotype	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy area (m²)	No. of flowering laterals / panicles/ m²
BH 6	2.98	33.0	15.9	15.9
BH 85	2.78	34.0	16.4	16.4
H 1597	2.36	37.8	18.8	18.8
K 22-1	2.62	35.8	17.6	17.6
H 662	2.72	34.2	14.3	14.3
H 675	2.14	39.4	16.6	16.6
H 11	2.68	35.2	18.4	18.4
H 14	2.36	35.6	19.2	19.2
H 32/4	3.14	36.2	18.6	18.6
Goa 11/6	2.66	34.6	15.4	15.4
VRI 3 (Check)	2.58	34.0	19.2	19.2
SEm (±)	0.07	0.56	0.54	0.54
CD @ 5%	0.22	1.12	1.20	1.20

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

Accession No.	Mean flowering duration (days)	Mean nut wt. (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (for 2 harvest)
BH 6	74	7.2	56.4	30.2	1.64	2.12
BH 85	72	6.8	62.2	29.8	1.32	1.88
H 1597	65	7.0	50.8	29.2	1.48	2.12
K 22-1	71	7.2	52.4	28.0	0.96	1.68
H 662	70	6.8	54.0	30.0	1.82	2.52
H 675	69	7.0	63.2	30.2	1.24	1.80
H 11	72	7.2	60.8	29.6	1.88	2.62
H 14	74	7.0	58.4	29.8	1.76	2.52
H 32/4	75	6.8	56.0	29.0	1.34	2.08
Goa 11/6	78	7.4	68.0	29.4	1.46	2.18
VRI 3 (Check)	79	7.2	65.4	29.0	1.84	2.58
	S.Em(±)	0.06	1.88	0.25	0.08	0.13
	CD @ 5%	0.20	3.15	0.62	0.24	0.35

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 : Darisai, Hogalagere, Kanbargi, Jagdalpur and Tura

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.

SUMMARY :

At Bhubaneswar, Priyanka had the highest mean apple weight of 75.75g. At Pilicode, the highest nut weight of 12.3g and 12.0g was observed in Priyanka and Amrutha, respectively. The shelling percentage was highest in Madakkathara –1 (37.1%) followed by VRI – 3 (35.4%) at Jhargram.

Treatments :

This MLT-V trial was initiated in 2006 using the following 25 selected varieties.

Sl. No.	Varieties	Sl. No.	Varieties	Sl. No.	Varieties
1	BPP-4	10	Dhana	19	NRCC Sel-2
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		

BHUBANESWAR

The mean flowering duration was lowest in Bhaskara (71 days) while it was highest in Jhargram-1 (120 days). The maximum number of flowering laterals/ m^2 was recorded in V-4 (16.95). Vengurla-7 recorded significantly highest nut weight of 10.10g which was statistically at par with Priyanka (10.00g). Priyanka produced significantly heaviest apple of 75.75g, closely followed by Dhana (74.00 g) and UN-50 (66.25g).

Significantly highest shelling percentage was observed in Goa-1 (31.60%). The mean annual yield/tree varied significantly from 0.70 kg (Ullal-4) to highest of 4.03 kg (BPP-8).

The cumulative nut yield/tree for three harvests ranged from 1.27 kg in BPP-6 to 5.86 kg in BPP-8 (Table 1.36 & 1.37).

Table 1.36 : Yield parameters of cashew genotypes at Bhubaneswar

Accession	Mean Flowering duration (days)	No. of flowering laterals/ m^2	Ratio of male: bisexual flowers	Mean no. of nuts/ panicle
BPP-4	104	12.83	4.69	2.80
BPP-6	112	9.53	4.86	2.70
BPP-8	86	14.66	6.41	4.00
Bhubaneswar-1	89	14.92	2.93	4.00
Chintamani-1	97	16.20	2.95	3.40
Jhargram-1	120	20.16	8.04	1.00
Madakkathara-1	92	15.67	3.69	3.30
Madakkathara-2	70	15.25	3.77	4.55
K-22-1	84	14.20	5.76	2.97
Dhana	74	14.20	1.7	2.00
Kanaka	95	14.37	0.91	3.05
Priyanka	81	11.00	2.48	2.35
Amrutha	86	12.48	2.76	3.00
Vengurla-1	105	14.83	6.53	3.15
Vengurla-4	100	16.95	2.11	3.15
Vengurla-6	85	11.90	5.51	3.00
Vengurla-7	92	11.58	5.84	3.35
VRI-3	96	16.85	2.61	2.90
NRCC Sel-2	83	16.74	5.12	2.50
Ullal-1	84	12.30	4.15	3.10
Ullal-3	83	10.26	1.74	3.10
Ullal-4	92	8.88	2.77	2.50
UN-50	97	13.81	5.54	1.35
Goa-1	103	13.31	3.49	4.00
Bhaskara	71	15.62	2.49	3.15
SEm (±)	-	0.82	-	0.31
CD at 5%	-	2.4	-	0.91

Table 1.37 : Yield parameters of cashew genotypes at Bhubaneswar

Accession	Mean nut weight (g)	Mean apple weight (g)	Shelling(%)	Mean annual nut yield (kg/tree)	Cum. yield (kg/ tree) for 3rd harvest
BPP-4	6.30	43.00	25.09	1.00	1.90
BPP-6	5.60	33.00	26.60	0.80	1.27
BPP-8	7.70	62.00	29.43	4.03	5.86
Bhubaneswar-1	5.80	45.00	30.77	1.68	3.15
Chintamani-1	7.00	31.00	30.22	1.48	2.07
Jhargram-1	6.30	50.00	28.69	0.73	1.29
Madakkathara-1	7.10	50.00	27.00	1.37	2.38
Madakkathara-2	7.25	52.50	27.82	1.11	1.57
K-22-1	6.40	53.00	26.57	0.95	1.73
Dhana	8.90	74.00	30.56	1.67	2.68
Kanaka	6.30	59.00	30.31	1.80	3.36
Priyanka	10.00	75.75	27.13	1.55	2.64
Amrutha	7.50	38.75	30.31	0.92	1.77
Vengurla-1	7.60	34.65	29.71	1.33	2.25
Vengurla-4	7.70	53.00	30.28	1.68	3.38
Vengurla-6	9.10	58.00	27.98	1.35	2.52
Vengurla-7	10.10	58.00	30.35	3.47	4.27
VRI-3	7.10	34.00	29.79	1.32	3.20
NRCC Sel-2	8.70	51.00	29.65	2.10	3.66
Ullal-1	7.00	45.00	29.73	1.13	1.78
Ullal-3	7.40	53.00	29.40	3.17	4.04
Ullal-4	8.30	49.00	30.22	0.70	1.60
UN-50	8.75	66.25	31.09	1.10	1.85
Goa-1	7.60	61.50	31.60	1.38	2.82
Bhaskara	7.45	63.00	30.45	2.43	4.60
SEm (±)	0.27	4.22	0.72	0.42	-
CD at 5%	0.80	12.33	2.11	1.25	-

HOGALAGERE

Evaluation of 26 genotypes of cashew at Chintamani by Hogalagere Centre revealed that the tree height ranged from 2.07 to 3.65 m and stem girth varied from 34.92 to 49.35 cm. The canopy spread in E-W & N-S directions ranged from 2.07 to 5.32 m and 2.06 to 5.22 m, respectively. The ratio of male to bisexual flowers ranged from 2.98 to 10.54 (Table 1.38).

Table 1.38 : Growth parameters of cashew genotypes at Chintamani

Variety / Genotypes	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		Ratio of male : bisexual flowers
			E-W	N-S	
BPP-4	3.35	37.37	3.90	3.97	6.20
BPP-6	2.85	46.37	3.84	4.14	6.68
BPP-8 (2/16)	3.83	49.35	4.51	5.17	6.77
Bhubaneswar-1	2.23	35.86	2.07	2.06	8.27
Chintamani-1	3.06	42.74	4.31	4.27	6.87
Jhargram-1	2.12	39.95	2.10	2.07	5.51
Madakkathara-1	2.13	41.61	2.07	2.09	4.44
Madakkathara-2	3.29	35.85	4.25	4.70	4.48
K-22-1	2.77	37.74	4.05	4.30	4.98
Dhana	2.96	46.61	4.91	4.65	6.52
Kanaka	2.07	41.64	2.11	2.06	5.88
Priyanka	2.15	36.00	2.13	2.10	3.77
Amrutha	3.50	45.74	4.91	5.16	8.00
Vengurla-1	3.06	42.64	4.30	4.30	4.66
Vengurla-4	3.05	41.90	4.90	4.24	5.65
Vengurla-6	2.23	47.89	2.38	2.30	4.83
Vengurla-7	2.90	34.92	2.50	2.35	6.34
Vengurla-8	2.23	37.90	2.57	2.50	4.77
VRI-3 (M-26/2)	2.12	36.94	2.08	2.09	6.67
NRCC Sel-2	3.51	41.04	4.63	5.17	6.64
Ullal-1	3.49	42.92	5.32	5.22	10.54
Ullal-3	2.83	35.86	3.24	3.67	4.90
Ullal-4	3.65	41.66	5.05	5.20	5.11
UN-50	3.61	44.54	4.84	4.75	8.73
Goa-1	2.13	36.85	2.13	2.06	4.87
Bhaskara	3.19	35.60	4.47	4.20	2.98
S.Em(±)	0.08	0.01	0.01	0.07	0.11
CD at 5%	0.22	0.03	0.03	0.20	0.31

The accession Jhargram-1 recorded highest number of flowering laterals m^2 (9.84) while Bhubaneswar-1 recorded highest number of nuts/ m^2 (7.10) followed by Chintamani-1 and K-22/1 with 6.88 and 6.68, respectively. The highest mean nut weight was recorded in accession Ullal-3 (9.31). The accession UN-50 recorded highest mean apple weight with (48.90) followed by Priyanka and Ullal-4 with 48.86 and 48.22, respectively (Table 1.39). The accessions Chintamani-1 and Ullal-1 recorded highest mean nut yield with (2.70 kg/ tree each) followed by Ullal-3 (2.02 kg/tree). The highest cumulative nut yield for two years was recorded in Bhaskara (1.86 kg/tree). The highest shelling percent was recorded in accession NRCC-Sel-2 (31.54) (Table 1.39).

Table 1.39 : Yield parameters of cashew genotypes at Chintamani

Accession No.	No. of flowering laterals / m^2	Mean no. of nuts/panicle /m^2	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual nut yield (kg/ tree)	Cum. yield (kg/tree) (for 2 hvsts)
BPP-4	9.23	4.66	6.10	34.50	28.77	1.70	0.64
BPP-6	8.12	4.10	4.80	32.15	30.00	1.72	0.23
BPP-8 (2/16)	6.00	5.00	6.31	44.10	23.43	1.55	0.60
Bhubaneswar-1	8.72	7.1	5.30	37.60	29.16	1.16	0.84
Chintamani-1	6.47	6.88	8.34	36.42	28.66	2.07	0.64
Jhargram-1	9.84	4.56	6.01	37.31	30.14	1.01	0.47
Madakkathara-1	7.01	5.68	5.88	36.03	27.26	0.85	0.64
Madakkathara-2	7.31	5.45	6.86	42.33	26.48	1.56	0.23
K-22/1	8.33	6.67	5.93	42.00	29.00	1.64	0.65
Dhana	6.16	2.00	7.43	46.47	26.18	1.98	0.65
Kanaka	8.78	6.65	6.00	38.00	27.89	1.11	0.62
Priyanka	7.68	5.43	6.52	48.86	27.16	1.20	0.55
Amrutha	7.94	6.32	6.82	43.21	28.91	1.32	0.57
Vengurla-1	5.18	4.22	6.11	23.45	28.00	1.48	0.74
Vengurla-4	7.76	6.61	7.00	34.86	29.12	2.01	0.89
Vengurla-6	7.22	3.75	7.40	38.91	29.00	1.20	0.76
Vengurla-7	6.03	5.55	7.23	43.18	30.00	1.16	0.55
Vengurla-8	6.89	3.67	7.10	41.00	27.89	1.07	0.54
VRI-3 (M-26/2)	8.12	3.45	5.76	28.62	28.51	0.92	0.72
NRCC-Sel-2	8.15	6.22	7.10	46.78	31.54	1.90	0.83
Ullal-1	5.22	4.89	7.34	28.78	30.57	2.07	0.66
Ullal-3	7.24	1.88	9.31	46.88	31.09	2.02	0.88
Ullal-4	8.68	4.00	8.45	48.22	30.96	1.76	0.86
UN-50	7.76	2.88	7.89	48.90	30.87	1.16	0.78
Goa-1	6.68	2.34	7.00	47.88	30.65	1.17	0.81
Bhaskara	8.56	6.43	6.81	36.72	31.36	2.02	1.86
S.Em(±)	0.03	0.021	0.01	0.04	0.03	0.01	0.02
CD at 5%	0.10	0.07	0.02	1.31	0.08	0.02	0.05

JHARGRAM

Maximum nuts/m^2 were recorded in Bhubaneswar–1 (31.8) followed by Amrita (28.1). Minimum nuts/m^2 was noticed in case of Madakkathara–2 (5.5). Maximum nuts/panicle was with Amrita (13.8 nuts/panicle) followed by Bhubaneswar–1 (11nuts/panicle) and Vengurla–1 (10.6). More than 7.0 nuts/panicle were recorded in Bhaskara (9.0), K-22-1 (7.4), Vengurla-4 (7.1) and BPP-8 (7.1). Vengurla–7 produced bolder nuts (7.8g), however, other varieties produced nuts below 7.0 g. The shelling percentage was highest in Madakkathara–I (37.1%) followed by VRI–3 (35.4%) (Table 1.40).

Table 1.40 : Yield performance of cashew genotypes at Jhargram

Variety/genotypes	Nuts/m^2	Nuts/Panicle	Nut Weight (g)	Shelling %	Yield (Kg/tree)
Bhaskara	11.4	9.0	5.2	34.4	0.9
Madakkathara 2	5.5	4.0	6.1	33.4	0.4
Bhubaneswar 1	31.8	11.0	3.9	34.3	1.5
K-22-1	7.9	7.4	5.8	34.3	0.7
Chintamani- 1	11.5	4.3	4.6	31.5	0.7
Ullal – 4	20.7	6.1	4.1	34.6	1.1
Vengurla – 7	10.6	3.5	7.8	34.5	1.4
VRI- 3	16.6	5.0	5.2	35.4	1.3
BPP- 6	9.0	6.1	4.3	34.5	0.6
Amrita	28.1	13.8	4.9	31.2	2.0
Vengurla- 4	19.4	7.1	5.0	32.4	1.1
Goa – 1	12.8	3.6	5.9	28.3	1.0
Madakkathara- 1	8.0	2.6	4.1	37.1	0.3
Priyanka	6.9	3.4	6.2	27.8	0.3
BPP- 8	24.6	7.1	5.3	31.0	1.4
Kanaka	17.6	5.0	4.2	34.8	1.0
Vengurla- 1	18.3	10.6	4.2	34.3	1.0
Vengurla- 6	17.8	4.9	5.0	30.1	1.1
Ullal- 3	14.3	4.4	6.2	32.8	1.1
Dhana	8.5	4.1	6.8	27.9	0.7
BPP- 4	11.6	4.6	4.1	33.8	0.6
UN- 50	14.3	6.9	6.0	28.8	1.0
Jhargram- 1	16.9	6.0	4.5	29.6	1.2
NRCC-Sel-2	11.4	3.3	4.7	33.8	0.8
Ullal- 1	14.3	2.6	5.9	27.7	1.4
S.Em(±)	0.8	0.3	0.1	0.3	0.1
CD at 5%	1.6	0.6	0.2	0.6	0.2

MADAKKATHARA

UN-50 recorded maximum height (5.72 m) followed by Madakkathara-2 (5.64m). Variety K-22-1 recorded highest girth (61.54 cm) followed by Madakkathara-1 (59.38 cm). The variety V-1 and Jhargram-1 recorded maximum EW canopy spread (7.00m) followed by UN-50 (6.99 m). Chintamani and Ullal-4 recorded maximum NS spread (7.00 m) followed by Jhargram (6.98 m). Highest yield was recorded by Kanaka (2.85 kg/tree) followed by Sulabha (2.70 kg/tree). The highest cumulative yield was recorded in Dhana (5.64 kg/tree) followed by Jhargram-1 (5.52 kg/tree).

PILICODE

The varieties VRI-3, V7, K-22-1, Ullal 3, Ullal 1, Amrutha and Madakkathara 1 performed better in terms of vegetative parameters. The highest canopy spread of 39.78 m^2 was observed in Vengurla-7 followed by Ullal-1 (38.409 m^2) and Madakkathara-2 (38.310 m^2). Higher number of flowering laterals per sq.m was observed in NRCC-Sel-2, while Madakkathara-1 had higher number of flowering laterals as well as vegetative flushes per sq.m. BPP 6 produced apples with highest weight. Highest nut weight of 11.40g and 11.20g was observed in Priyanka and NRCC Sel-2, respectively (Table 1.41 & 1.42).

Table 1.41 : Growth parameters of cashew genotypes at Pilicode

Accession	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy area (m^2)
BPP-4	-	-	-
BPP-6	2.050fg	0.295ab	12.560cde
BPP-8	1.850g	0.140e	7.327e
Bhubaneswar-1	3.500abcd	0.340ab	20.273bcde
Chintamani-1	-	-	-
Jhargram-1	-	-	-
Madakkathara-1	2.916cdef	0.315abc	25.371abcd
Madakkathara-2	4.097ab	0.397a	38.310a
K-22-1	4.185ab	0.340ab	28.019abc
Dhana	2.085fg	0.235cd	10.861de
Kanaka	3.302bcde	0.397a	30.136ab
Priyanka	2.550efg	0.327abc	24.278abcd
Amrutha	3.398abcde	0.272bc	28.158abc
Vengurla-1	-	-	-
Vengurla-4	1.751g	0.188de	12.586cde
Vengurla-6	-	-	-
Vengurla-7	3.717abc	0.320abc	39.789a
VRI-3	4.250a	0.310abc	37.943a
NRCC Sel-2	2.575defg	0.282bc	24.569abcd
Ullal-1	3.703abc	0.336ab	38.409a
Ullal-3	3.375abcde	0.250bcd	27.262abcd
Ullal-4	-	-	-
UN-50	3.625abc	0.315abc	19.442bcde
Goa-1	1.983fg	0.240cd	11.951cde
Bhaskara	2.647defg	0.393a	27.824abc

Table 1.42 : Yield parameters of cashew genotypes at Pilicode

Accession No.	Ratio of bisexual : total flowers	Nuts/ m^2	Mean nut wt (g)	Mean apple wt. (g)	Mean annual nut yield (kg/tree)
BPP-6	0.168	4.500ab	6.00	60.00	0.100
BPP-8	--	0.000g	-	-	0.000
Bhubaneswar-1	0.083	2.250ef	5.20	75.00	0.200
Madakkathara-1	0.193	4.278abcd	7.20	50.50	3.000
Madakkathara-2	0.182	2.750bcdef	-	60.00	1.500
K-22-1	0.164	3.750abcde	8.20	47.20	0.450
Dhana	0.131	1.250fg	8.00	59.00	0.400
Kanaka	0.084	5.250a	8.00	62.50	0.300
Priyanka	0.161	3.875abcde	11.40	57.00	0.500
Amrutha	0.153	2.875bcdef	11.00	89.67	0.400
Vengurla-4	0.144	1.724fg	7.40	53.50	0.100
Vengurla-7	0.088	4.435abc	9.60	47.20	0.000
VRI-3	1.769	1.500fg	6.10	50.00	0.000
NRCC- Sel-2	0.099	2.416def	11.20	84.60	0.550
Ullal-1	0.091	2.203ef	7.00	49.60	0.000
Ullal-3	0.081	2.000ef	7.30	70.00	0.300
UN-50	0.089	2.750bcdef	10.60	62.33	0.150
Goa-1	0.121	2.500cdef	-	-	0.200
Bhaskara	0.157	3.065bcdef	8.80	52.20	3.500

VRIDHACHALAM

Among different genotypes evaluated, significant differences were recorded with respect to flowering per sq.m BPP-8 and NRCC-Sel-2 produced maximum flowering laterals per sq.m (18.8). The flowering duration ranged from 60 to 76 days among the varieties. Nut weight ranged from 6.0 g to 7.4 g. Highest yield was recorded in Vengurla-7 (1.98 Kg/ tree) and highest cumulative nut yield was recorded in VRI-3 (2.58 kg) for 2 harvests (Table 1.43).

Table 1.43 : Yield parameters of cashew genotypes in MLT-V at Vridhachalam

Accession No.	Mean flowering duration(days)	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean annual yield (kg/tree)	Cum. yield(kg/tree) (for 2 harvests)
BPP-4	72.0	7.2	50.5	28.8	1.42	1.92
BPP-6	70.0	6.2	65.5	29.4	1.64	2.20
BPP-8	68.0	7.4	49.5	30.2	1.84	2.48
Bhubaneswar-1	66.0	6.6	53.5	28.2	1.02	1.50
Chintamani-1	61.0	6.8	52.0	29.2	1.24	1.76
Jhargram-1	64.0	6.0	54.5	29.0	1.22	1.70
Madakkathara-1	68.0	6.2	48.8	28.6	1.84	2.30
Madakkathara-2	70.0	7.2	48.5	29.4	1.56	2.20
K-22-1	71.0	6.6	37.5	30.2	1.62	2.22
Dhana	68.0	7.0	50.0	28.6	1.46	2.14
Kanaka	64.0	6.6	57.6	29.6	1.66	2.24
Priyanka	66.0	7.4	44.5	29.8	1.78	2.50
Amrutha	70.0	7.2	47.4	27.4	1.44	2.20
Vengurla-1	74.0	6.6	37.5	28.4	1.50	2.08
Vengurla-4	76.0	6.8	45.0	29.6	1.32	1.92
Vengurla-6	72.0	6.8	48.0	27.6	1.46	2.04
Vengurla-7	66.0	7.2	55.4	28.8	1.98	2.56
VRI-3	68	7.2	41.0	30.0	1.88	2.58
NRCC Sel-2	70	7.4	56.5	29.6	1.96	1.64
Ullal-1	72	6.8	43.0	28.8	1.40	2.02
Ullal-3	76	7.0	56.2	29.6	1.22	1.90
Ullal-4	74	7.2	50.4	28.4	1.76	2.4
UN-50	64	7.0	58.4	29.8	1.64	2.16
Goa-1	62	7.0	57.6	30.2	1.82	2.52
Bhaskara	60	6.8	48.0	30.0	1.76	2.46
	S.Em(±)	0.07	1.35	0.16	0.07	0.06
	CD(5%)	0.22	2.92	0.40	0.22	0.15

4. Special Multi Location Trial (MLT – VI)

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

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

SUMMARY :

At Darisai, the number of panicles per sq.m was the highest in BPP-8. At Goa, the maximum apple weight was observed in Tiswadi-3 (98.3g).

Experimental details:

Two rows each, of the belowmentioned cashew varieties comprising of six plants per row.

Varieties :

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

* Local Check for New Centres :
BAU Centre : BPP-8
Paria, Arabhavi & Tura : V-4
Goa : Goa-1 or Goa 2

DARISAI

Duration of flowering was found to be shortest in NRCC-Sel 2 (94 days) followed by H 303 (105 days). Number of panicles per square meter was highest with BPP-8 which had 16.2 panicles (Table 1.44).

Table 1.44 : Growth parameters of different varieties at Darisai

Cashew Variety	Plant height (m)	No of flowering laterals/m²		No of flowering laterals/m²	No of flowering laterals/m²
		E-W	N-S		
NRCC-Sel-2	0.90	10.50	1.70	1.60	14.60
Bhaskara	0.85	8.20	1.60	1.70	8.30
Dhana	0.70	9.30	1.65	1.85	11.2
VRI-3	0.65	11.20	1.80	1.60	8.30
H 1	0.90	14.70	2.20	1.70	13.40
H-303	0.80	14.40	2.30	1.80	12.60
Vengurla-4	0.60	13.20	1.80	2.30	11.40
BPP-8	1.10	15.40	2.40	2.20	16.2

GOA

Priyanka, Bhaskara, V-8 and Tiswadi-3 recorded nut yield of 0.85, 1.10, 0.98 and 0.98 kg/tree respectively as against the corresponding nut yield of 0.35, 0.95, 0.55 and 0.21 kg/tree during the previous year. Maximum apple weight was observed in Tiswadi-3 (98.3g) (Table 1.45).

Table 1.45 : Growth and yield parameters of different varieties at Goa

Variety	Tree Height (m)	Canopy Spread		Nut yield (Kg/tree)		Nut weight (g)		Apple weight (g)	
		N - S	E - W	10-11	11-12	10-11	11-12	10-11	11-12
Vengurla-8	3.4	2.3	3.1	0.55	0.98	8.9	8.2	78.5	78.5
Dhana	2.8	2.5	2.6	--	0.52	7.66	7.55	-	68.5
Raghava	2.8	2.0	2.1	--	0.35	7.82	7.68	-	60.4
Priyanka	3.6	1.86	2.1	0.35	0.85	7.83	8.12	54.6	56.6
Bhaskara	3.1	2.7	2.5	0.95	1.1	7.78	7.75	59.65	55.65
Ullal-3	2.9	2.4	2.5	--	0.65	8.35	8.28	-	70.2
Tiswadi-3	2.8	2.8	2.3	0.21	0.98	9.3	9.8	91.4	98.3
NRCC Sel.2	1.5	0.85	1.0	-	-	-	-	-	-
VRI-3	1.4	0.9	1.1	-	-	-	-	-	-
S.Em(±)	0.28					0.262	2.11	5.55	6.35
CD at 5%	0.71	NS	NS	-	N.S	0.731	0.687	12.25	14.65

TURA

Under this trial, eight released varieties have been planted at 12 plants each with three replications. Bhaskara had the tallest plant height of 2.2m and stem girth of 18cm (Table 1.46).

Table 1.46: Growth parameters of different varieties at Tura

Accession	Mean tree ht.(m)	Main stem girth (cm)	Mean canopy spread(m)	
			EW	NS
Dhana	1.70	15.00	1.7	1.8
V-4	1.60	15.00	1.6	1.7
NRCC-Sel-2	1.60	15.00	1.6	1.6
BPP-8	1.70	15.00	1.9	1.7
H-303	1.80	15.00	1.8	1.7
VRI-3	2.00	17.00	1.9	1.8
VRI(Cw)H-1	0.70	-		
Bhaskara	2.20	18.00	1.9	1.7

Gen.4. Hybridization and Selection

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

The project aims at utilizing 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.

SUMMARY:

A9 recorded highest mean annual nut yield of 12.5 kg/plant at 14th harvest at Bapatla; while the maximum cumulative nut yield was 100.90kg for 14 harvests in Hybrid A-6. The highest cumulative yield /tree for 17 years (155.95 kg/tree) was recorded by H-21 at Madakkathara. At Hogalagere, H-216 recorded highest mean nut weight of 11.33 g and the highest mean apple weight of 68.58 g. In comparison to the hybrids, PLD 57 (OP) was the shortest (1.60m) with lowest canopy area (16.81 m^2) at Pilicode. At Vengurla, H-908 and H-1016 recorded highest panicles per sq.m.(24.0).

BHUBANESWAR

Hybrid D4-6 registered maximum plant height (6.3m), trunk girth (69cm) and canopy spread (8.5m E-W & 6.3m N-S) as well as canopy area (42.99m^2). Hybrid E 5-20 recorded maximum with respect to the all vegetative parameters (5.4m, 70cm, 5.5m for plant height, trunk girth and canopy spread in E-W direction respectively) except canopy spread in N-S direction. Hybrid J 5-13 recorded maximum canopy spread in N-S direction (6.5m) and also maximum mean canopy spread (25.95m^2).

Hybrids J 6-6 and J 6-12 recorded maximum plant of 3.0m each while, trunk girth was maximum in hybrid H6-8 (79cm). Hybrids H 6-6 and H 6-8 recorded maximum mean canopy area of 7.07m^2 each.

The flowering duration varied from 70 days (Hybrid D1) to 95 days (Hybrid A 1-85), and number of nuts/panicle from 2.00 (Hybrid E1) to 5.00 (Hybrid A 1-85 & J 5-13). Hybrid A 1-85 recorded the maximum flowering of 95 days.

A9 recorded highest mean annual nut yield of 12.5 kg/plant at 14th harvest. The maximum cumulative nut yield of 100.90kg for 14 harvests was obtained in Hybrid A6.

A1-85 recorded the mean annual and cumulative nut yield of 12.0 kg and 96.4 kg per plant respectively at 12th harvest. A1-105 recorded the highest shelling percentage (30.3) and mean apple weight (67.4g). D4 - 6 recorded highest shelling of 31.0 per cent while the hybrid F4-18 recorded maximum nut weight (7.8g). Hybrid F4-18 recorded highest cumulative nut yield of 33.1kg/tree for 9 harvests and F4-24 recorded maximum annual nut yield of 10.5kg/tree at 9th harvest. Maximum nut weight (g), mean apple weight (g), mean annual nut weight (kg/plant) and cumulative yield (kg/plant) were obtained in S 6-5 for harvests. (Table 1.47).

Table 1.47 : Yield parameters of different cashew hybrids at Bhubaneswar

Hybrid no.	Cross Combinations	Year of planting	Mean nut wt.(g)	Mean apple wt.(g)	Shelling %	Mean annual nut yield (kg/tree)	Cum. Yield (kg/tree) 14 harvests
A6	Bhubaneswar C-2 x VTH 711/4	1995	8.6	70.0	32.2	11.2	100.9
A9	Bhubaneswar C-2 x VTH 711/4		7.8	52.0	32.0	12.5	76.5
D1	Bhubaneswar-1 x Kankady		9.2	65.0	29.8	6.0	48.3
E1	Bhubaneswar C2 x Kankady		9.0	50.0	30.6	9.3	59.4
							12 harvests
A1-85	Bhubaneswar-1 x H2/16	1997	7.2	67.4	30.3	12.0	96.4
A1-105	Bhubaneswar-1 x H2/16		7.8	58.5	29.7	10.6	59.9
	10th harvest						
D3-11	M 44/3 x H 2/15	1999	10.0	50.0	28.0	10.4	58.3
							9 harvests
D4-6	H 2/16 x M44/3	2000	7.5	35.0	31.0	7.2	28.8
F4-18	M 44/3 x H 2/15		7.8	55.1	30.4	9.3	33.1
F4-24	M 44/3 x H 2/15		7.5	46.0	28.6	10.5	32.3
							8 harvests
E5 - 20	BPP 30/1 x H 2/16	2001	7.6	30.1		5.2	24.2
J5 13	Bhubaneswar -1 x VTH 711/4		8.2	52.0		5.0	26.2
							7 harvests
S6-5	Lokipur x Kankady	2002	10.0	35.0		7.5	15.5

HOGALAGERE

Tree height ranged from 4.73 m to 6.02 m and stem girth varied from 35.50 cm to 110.00 cm. The canopy spread in E-W & N-S directions ranged from 2.94 to 9.93 m and 2.48 to 7.93 m, respectively. The number of flowering laterals/m^2 was highest in H-191 (Ullal-3 x Vetore-56) (16.85) (Table 1.48).

Table 1.48 : Growth parameters of different cashew hybrids at ARS, Chintamani

Hybrid No.	Cross combination	Mean tree ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)		No. of flowering laterals / m^2
				E-W	N-S	
1	H-01 (Ullal-3 X Kankady 7/6)	5.60	96.75	7.62	7.95	12.57
2	H-81 (Ullal-3 X Vetore-56)	5.77	110.00	10.00	5.66	13.81
3	H-151 (NRCC-2 X Vetore-56)	3.86	35.50	2.94	2.48	14.83
4	H-188 (V-5 X Vetore-56)	4.84	66.50	6.86	7.66	15.60
5	H-191 (Ullal-3 X Vetore-56)	4.73	66.25	6.81	6.93	16.85
6	H-216 (2/77-Tuni X Vetore-56)	6.02	95.00	9.93	7.93	14.63
	S.Em(±)	0.01	0.65	0.03	0.77	0.01
	CD at 5%	0.03	1.95	0.08	2.32	0.03

Hybrid H-216 (2/77-Tuni x Vetore-56) recorded highest mean nut weight with 1.33 g and the highest mean apple weight of 68.58 g. The hybrid H-81 (Ullal-3 x Vetore-56) recorded highest number of nuts/m^2 (5.64) and the highest shelling per cent (32.65) was observed in H-01 (Ullal-3 x Kankady 7/6). The hybrid H-188 (V-5 x Vetore-56) recorded highest mean nut yield with (4.77 kg/tree) and the highest cumulative nut yield for seven years was obtained in H-188 (V-5 x Vetore-56) (17.43 kg/tree) (Table 1.49).

Table 1.49 : Yield parameters of different cashew hybrids at Chintamani

Hyb. No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Mean no. of nuts / panicle/ m^2	Shelling %	Mean annual nut yield (kg/tree)	Cum. yield (kg/tree) (7 hvsts)
H-01	(Ullal-3 x Kankady 7/6)	7.61	64.73	3.70	32.65	4.30	12.42(4 hvsts)
H-81	(Ullal-3 x Vetore-56)	10.64	62.21	5.64	31.59	4.66	13.34 (4 hvsts)
H-151	(NRCC-2 x Vetore-56)	10.11	36.20	1.64	31.32	0.93	3.48
H-188	(V-5 x Vetore-56)	8.98	39.33	5.60	31.08	4.77	17.43
H-191	(Ullal-3 x Vetore-56)	10.54	51.43	3.33	30.30	4.43	16.45
H-216	(2/77-Tuni x Vetore-56)	11.33	68.58	3.18	30.18	4.56	17.32
	S.Em(±)	0.03	0.01	0.03	0.02	0.01	0.01
	CD 5%	0.10	0.02	0.08	0.05	0.02	0.04

JHARGRAM

Among the 126 F1 hybrids obtained, 20 were found to be promising. Nuts/m^2 was maximum with H-126 (56.5) followed by H-109 (56). Nut weight was maximum with H-57 (6.6g) followed by H-119 (6g) and H-100 (5.9g). Yield was highest in H-126 (12.9Kg/tree) followed by H-70 (12.4 Kg/tree), H-39 (12.3 Kg/tree) and H-119 (12.1Kg/ tree). All hybrids had more than 28% shelling. H-119 had maximum cumulative yield 61.6 Kg/ tree) followed by H- 35 (60.4 Kg/tree) (Table 1.50).

Table 1.50 : Yield performance of cashew hybrids at Jhargram

Hybrid No.	Nuts/m^2	Nut weight (g)	Yield Kg/tree	Shelling %	Apple Weight (g)	Kernel weight (g)	Cum. Yield Kg/tree
H - 4	40.0	4.0	8.0	28.5	44.3	1.1	27.9
H - 5	41.5	3.5	9.2	32.0	21.0	1.1	30.2
H - 33	28.5	5.0	7.1	36.1	35.0	1.8	52.0
H - 35	24.3	5.1	7.6	36.5	33.6	1.8	60.4
H - 37	37.5	4.1	11	35.1	20.0	1.4	56.2
H - 39	44.5	4.8	12.3	32.7	26.0	1.6	36.6
H - 41	25.0	4.8	8.9	33.4	33.0	1.6	58.1
H - 45	35.3	4.4	8.7	32.2	20.0	1.4	49.3
H - 51	22.0	4.1	7.8	31.2	32.5	1.3	31.9
H - 57	34.0	6.6	6.5	36.9	37.5	2.5	42.6
H - 65	31.5	4.4	10	33.0	40.0	1.5	39.9

Hybrid No.	Nuts/m²	Nut weight (g)	Yield Kg/tree	Shelling %	Apple Weight (g)	Kernel weight (g)	Cum. Yield Kg/tree
H - 69	23.5	4.9	7.8	33.1	52.0	1.6	36.7
H - 70	28.0	5.2	12.4	32.2	50.0	1.7	44.6
H - 98	40.5	5.6	8.2	37.4	40.7	2.1	47.3
H - 100	35.5	5.9	10.2	29.3	41.4	1.7	32.4
H - 109	56.0	3.9	10.2	31.4	22.0	1.2	33.0
H - 115	32.5	5.9	7.6	36.7	54.3	2.2	39.2
H - 119	25.8	6.0	12.1	34.5	43.3	2.1	61.6
H - 123	36.5	4.7	8.6	33.0	50.0	1.6	31.1
H - 126	56.5	5.2	12.9	33.3	43.8	1.7	37.6

MADAKKATHARA

Out of the hybrids planted in 1993, the highest yield was recorded by H 21 (18.20 kg/ tree) followed by H 44 (13.00 kg/tree). Highest cumulative yield for 17 years was recorded by H 21 (155.95 kg/tree). Out of 26 hybrids planted in 1994, highest annual yield/ tree were given by H 70 (10.00 kg/tree). The highest cumulative yield/tree for 16 years were given by H 73 (87.70 kg/tree) followed by H 70 (79.95 kg/tree).

Out of the 92 hybrids planted during 1995, H 97 and H 95 recorded the highest yield (10.00kg/ tree). The highest cumulative yield was recorded in H 97(71.70 kg/tree) followed by H 95 (62.25 kg/tree). The highest cumulative yield /tree for 17 years was recorded by H 21 (155.95 kg/tree).

PILICODE

The hybrids from the cross ANK1 x PLD 57 was found to be tallest but were on par with MDK 1 x PLD 57 which had a higher seed set per sq. m. The hybrids and the parents were statistically on par with respect to sex ratio. Higher number of flowering laterals per unit area was observed in PLD 57 grafts. PLD 57 (OP) was the shortest (1.60m) with lowest canopy area (16.81 m²) (Table 1.51).

Table 1.51 : Mean of growth and yield characteristics of different crosses involving PLD-57

Hybrid	Plant Height (m)	Girth (m)	Canopy area (m²)	No. of Panicle/ m²	Sex ratio	Seed set/ m²
PLD 57 graft	3.25b	0.50cd	47.80de	14.38a	0.12	1.03d
PLD 57 (OP)	1.60c	0.40d	16.81e	6.50b	0.14	0.75d
PLD 57 x ANK 1	5.25a	0.63bcd	82.45cd	3.75c	0.18	2.25c
ANK 1 x PLD 57	5.98a	0.93a	158.50a	3.75c	0.15	6.00a
MDK 1 x PLD 57	5.83a	0.87ab	137.41ab	2.69c	0.16	3.88b
MDK 1	5.40a	0.70abc	101.69bc	2.75c	0.14	2.75c
Mean	4.55	0.67	90.78	5.64	0.15	2.78
F test	**	**	**	**	NS	**
CD at 5%	0.87	0.283	50.64	2.09	-	0.59

*Means superscripted by the same letters do not differ significantly at P=0.05 by Duncan's Multiple Range Test

VENGURLA

On the basis of standard citeria viz.; compact canopy, cluster bearing habit, nut weight (more than 8 g), shelling percentage (more than 28%) and high yield, 28 F1 hybrid seedlings were screened initially as promising hybrids. H-908 and H-1016 recorded highest panicle per sq. m. (24.0) (Table 1.52).

Table 1.52 : Growth and yield performance of new promising hybrids at Vengurle

Hybrid No.	Cross combination	Plant Height (m)	Plant Girth (cm)	Mean Spread (m)	No. of laterals/ m^2	Flow. panicles/ m^2
778	M-44/3 x B.T.22	8.1	108	9.75	33.0	22.0
1135	V-5 x B.T.65	9.7	116	7.05	33.0	20.0
1199	M-26/2 x B.T.1	8.5	100	6.35	33.0	20.0
899	V-4 x Hy-2/16	9.7	110	6.95	33.0	20.0
969	V-4 x Hy-2/16	8.9	86	6.45	33.0	19.0
883	V-4 x Hy-2/16	9.1	98	7.0	30.0	21.0
940	V-4 x Hy-2/16	8.9	78	4.8	29.0	21.0
908	V-4 x Hy-2/16	8.5	108	6.45	52.0	24.0
886	V-4 x Hy-2/16	9.0	108	7.10	33.0	20.0
889	V-4 x Hy-2/16	6.4	75	6.70	34.0	20.0
1003	M-26/2 x B.T.65	8.7	84	7.10	36.0	23.0
1016	M-26/2 x B.T.65	5.2	100	7.80	34.0	24.0
1039	M-26/2 x B.T.65	7.4	100	6.90	35.0	20.0

VRIDHACHALAM

The hybrid HC-1 was on par with VRI-2 in terms of high yield, but had easy peeling testa. HC-24 recorded good fruit set, (42.5 nuts/m^2) along with easy peeling testa. HC-10, HC-25, HC-27 and HC-30 were cluster bearing with bold nuts. The hybrids HC-23 and HC-25 had compact canopy, cluster bearing habit and bold nuts. HC-17 and HC-23 had intensive branching pattern (Table 1.53 & 1.54).

Table 1.53 : Yield parameters of different cashew hybrids at Vridhachalam

Hybrid No.	Cross combination	Mean flowering duration (days)	No. of flowering laterals / m^2	Ratio of male : bisexual flowers	Nuts/m^2
HC1	VRI 2 x VRI 3	60	18	6.1	42.5
HC2	VRI 3 x VSK 2	60	14	12.8	22.6
HC3	VRI 3 x TK 1	58	16	8.1	20.5
HC4	VRI 3 x SL 1	55	13	7.0	30.4
HC 5	VRI 3 x VRI 2	55	15	7.7	25.4
HC6	VRI 3 x KGN 1	62	11	9.5	16.3
HC8	VRI 3 x PKP 1	55	15	8.2	22.0

Hybrid No.	Cross combination	Mean flowering duration (days)	No. of flowering laterals / m²	Ratio of male : bisexual flowers	Nuts/ m²
HC9	VRI 3 x PKP 2	60	11	5.8	35.2
HC10	VRI 3 x KK 1	55	15	6.0	36.6
HC 17	VRI 3 x AM 1	55	10	8.4	28.0
HC 22	VRI 3 x TK 1	53	10	12.2	24.0
HC 23	VRI 3 x AM 1	65	13	6.4	30.0
HC 24	VRI 3 x M 33/3	74	11	5.3	38.2
HC 25	VRI 3 x M 33/3	60	8	4.7	40.0
HC 27	VRI 3 x SL 1	75	13	3.9	42.5
HC 30	VRI 3 x PV 1	60	12	5.4	34.2
S.Em ±		0.25	0.48	0.36	0.52

Table 1.54 : Yield parameters of different cashew hybrids at Vridhachalam

Hybrid No.	Cross combination	Mean nut wt (g)	Mean apple wt. (g)	Shelling %	Mean nut yield (kg/tree)	Cum. yield (kg/tree) (for 4/5 harvests)
HC1	VRI2 x VRI 3	6.0	28.5	28.0	4.50	18.0
HC2	VRI 3 x VSK 2	6.5	34.0	26.5	2.50	16.0
HC3	VRI 3 x TK 1	6.8	42.6	25.0	1.50	10.0
HC4	VRI 3 x SL 1	7.0	38.0	26.0	3.50	18.0
HC 5	VRI 3 x VRI 2	7.2	48.0	28.5	2.50	15.0
HC6	VRI 3 x KGN 1	6.0	62.5	26.2	1.50	8.0
HC8	VRI 3 x PKP 1	6.8	55.4	26.5	1.80	8.5
HC9	VRI 3 x PKP 2	6.2	42.5	26.2	3.00	13.0
HC10	VRI 3 x KK 1	7.4	30.0	29.5	3.50	15.0
HC 17	VRI 3 x AM 1	6.5	34.8	27.4	2.50	14.0
HC 22	VRI 3 x TK 1	8.0	58.4	29.3	2.50	10.0
HC 23	VRI 3 x AM 1	7.8	34.2	28.0	2.00	8.0
HC 24	VRI3 x M 33/3	7.6	36.0	26.7	1.80	9.8
HC 25	VRI3 x M 33/3	7.8	34.5	30.5	3.50	10.5
HC 27	VRI 3 x SL 1	8.0	52.6	32.8	3.00	12.8
HC 30	VRI 3 x PV 1	8.2	55.8	26.3	2.50	10.5
S.Em ±		0.22	0.32	0.23	0.27	

Gen.5: Characterization of germplasm for cashew apple.

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

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

BAPATLA

Among the 12 genotypes evaluated, the maximum apple weight and nut weight were recorded in Priyanka (125.0 g and 11.56 g respectively). Highest apple to nut ratio was observed in BLA 139-1 (13.65). Higher juice recovery was recorded in T-17/5, T3/4, H-95-T4, T-12/1 (Table 1.55).

Table 1.55 : Physical parameters of cashew germplasm for cashew apple.

Germplasm	Yield (kg/tree)	Apple wt (g)	Nut wt (g)	Apple nut ratio	Juice recovery (%)
Priyanka	7.08	125.0	11.56	10.81	62.3
T. 2/14	5.47	63.10	5.84	10.80	88.4
T.17/5	5.67	61.20	4.64	13.18	94.3
T. 5/1	6.53	50.80	4.60	11.04	83.4
BLA. 139/1	5.95	65.80	4.82	13.65	90.1
BLA. 39/4	15.8	25.00	4.56	5.48	85.2
T. 3/4	7.22	56.20	5.67	9.91	90.2
T. 8/7	4.63	50.00	3.70	13.51	85.3
T. 18/3	6.61	48.30	5.52	8.75	85.2
H 95-T4	11.35	50.00	5.90	8.47	90.2
T. 12/1	7.62	44.90	4.51	9.95	90.3
T. 228	16.17	47.20	4.81	9.81	85.6
S.Em(±)	0.22	1.97	0.46	0.46	0.96
CD at 5%	0.64	5.82	1.37	1.37	2.84

Total soluble sugars ranged from 9.6° Brix to 13.9° Brix among the genotype studies however, highest was found in Priyanka of 13.9 Brix. Highest Vit-C content was registered in T.No. 8/7 of 100 mg/ 100 g. Lowest tannin content and lowest acidity were observed in Priyanka i.e. 3.16 mg/100 g and 0.48% respectively (Table 1.56).

Table 1.56 : Chemical parameters of cashew germplasm for cashew apple.

Germplasm	TSS (°Brix)	Vitamin-C(mg/100 g)	Tannins(mg/100 g)	Acidity (%)
Priyanka	13.9	87.50	3.16	0.48
T.No. 2/14	12.6	81.25	3.50	0.64
T.No.17/5	12.3	87.50	3.53	0.59
T.No. 5/1	9.6	93.25	3.93	1.14
BLA. 139/1	9.7	81.25	3.90	1.24
BLA. 39/4	9.9	62.50	3.85	0.97
T.No. 3/4	11.4	87.50	3.62	0.90
T.No. 8/7	13.6	100.0	3.25	0.51
T.No. 18/3	14.7	82.50	3.25	0.49
Hy 95-T4	12.5	68.75	3.55	0.64
T.No. 12/1	12.9	68.75	3.57	0.72
T.No. 228	11.4	87.50	3.59	0.89
S.Em(±)	0.67	1.46	0.15	0.03
CD at 5%	1.97	4.31	0.45	0.08

New cashew variety "Bidhan Jhargram – 2" released for cultivation in West Bengal.

The scientists of AICRP on Cashew, Regional Research station, Bidhan Chandra Krishi Viswa Vidyalaya, Jhargram, Paschim Medinipur, West Bengal have made a selection from seedling plantation of H-2/15 of Regional Research Station, Bidhan Chandra Krishi Viswa Vidyalaya, Jhargram, Paschim Medinipur, West Bengal which was evaluated for its performance. It had compact canopy, cluster bearing, bold nuts, high shelling percentage, yielded consistently more than 11.0 Kg. and the tree was free from TMB attack. Recorded highest cumulative yield in the first six harvests (50.0 Kg).

The tree is upright and compact, large sized bottle green coloured leaf with very intensive flowering (12.8 inflorescence/m^2), Inflorescence with compact, medium length, pyramid shape. Mid season flowering type with 3-4 fruits /panicle (maximum 6-7 nuts/panicle) with golden yellow coloured apples having mean apple weight of 63 g and mean juice content of 68.9%. Bold nuts with average nut weight of 9.2g (8.05-9.5 g), kernel weight 2.85 g and 32% shelling with 180W kernel count. Recommended for red and laterite zone of East coast of West Bengal. The yield at 7^{th} harvest was 13.5 Kg/tree.

Comparison of Bidhan Jhargram-2 with other common varieties:

Sl. No	Characters	BPP- 8	Jhargram-1	Bidhan Jhargram-2
1	Branching habit	Intensive	Intensive	Intensive
2	Canopy type	Compact	Medium Compact	Upright and Compact
3	Nut weight	8.2 g	5.0 g	9.28 g
4	Nuts/panicle	4.0	10.0	3.0
5	Yield/tree	12.5 Kg	8.5 Kg	13.50 Kg
6	Yield /ha. (Spacing : 6m x 6m)	22.24 q	19.46 q	25.02 q
7	Cum. yield/tree (for 6 Harvests)	44.5 Kg	36.38 q	50.90 Kg
8	Shelling %	29.0 %	30.0%	31.0%
9	Kernel weight	1.89 g	1.5 g	2.87 g
10	Kernel grade	W 210	W 320	W180

II. CROP MANAGEMENT

II. CROP MANAGEMENT

Hort.1 : NPK Fertilizer experiment

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

The main objective of this project is to study the response of cashew to different doses of NPK fertilizers.

SUMMARY:

The treatment NPK : 1000:250:250g/plant recorded highest cumulative nut yield for (62.69 Kg tree) twelve years with 62.69 kg/tree followed by NPK : 500 : 250 : 250 and NPK : 500 : 125 : 250 with 58.71 kg/tree and 57.26 kg/tree, respectively at Hogalagere. At Jhargram, the plants receiving N: P: K = 1500:250:375 Kg/ha produced maximum nuts/m^2 (24.63).

Experimental Details :

Design : Three factorial confounded design with 27 treatment combinations
Replications : Two
Treatments : N = 0, 500 and 1000 g/plant
P = 0, 125 and 250 g/plant
K = 0, 125 and 250 g/plant
No. of plants per plot : Six

HOGALAGERE

The yield parameters of NPK trial recorded the highest mean nut weight in the treatment N0P0K1 (6.82 g) followed by N2P2K2 and N2P2K0 with 6.67g and 6.46g, respectively. The treatment N2P2K2 recorded highest cumulative nut yield for twelve years with 62.69 kg/tree followed by N1P2K2 and N2P1K2 with 58.71 kg/tree and 57.26 kg/tree, respectively (Table 2.1 & 2.2).

Table 2.1 : Effect of NPK fertilizer doses on growth parameters of cashew at Chintamani

Treatment	Mean plant height (m)	Mean stem girth(cm)	Mean canopy spread (m)		Mean nut Weight (g)	Mean annual nut yield(Kg/tree)	Cum. nut yield (Kg/tree) 12hvsts.
			E-W	N-S			
N0P0K0	4.86	98.80	6.95	6.94	5.94	3.66	24.10
N0P0K1	4.59	107.64	7.00	6.82	6.82	3.97	30.32
N0P0K2	5.18	109.72	7.70	7.62	5.79	4.05	34.26
N0P1K0	4.86	122.20	7.09	7.40	5.57	4.17	34.62
N0P1K1	5.30	117.00	7.45	7.54	6.33	4.20	35.95
N0P1K2	4.65	108.16	7.54	7.36	5.76	4.31	36.28
N0P2K0	5.08	125.84	7.75	7.58	6.31	4.21	30.42
N0P2K1	5.41	109.72	7.17	7.46	6.13	4.26	30.16
N0P2K2	5.48	132.60	8.10	7.91	5.94	4.32	41.59
N1P0K0	4.45	108.68	6.54	6.48	5.73	4.20	34.95

Treatment	Mean plant height (m)	Mean stem girth(cm)	Mean canopy spread (m)		Mean nut Weight (g)	Mean annual nut yield (Kg/tree)	Cum. nut yield (Kg/tree) 12hvsts.
			E-W	N-S			
N1P0K2	4.97	98.28	7.36	6.65	6.00	4.49	31.89
N1P1K0	5.30	118.56	7.91	7.75	5.20	4.74	34.73
N1P1K1	4.53	106.60	7.42	7.60	5.20	5.21	37.76
N1P1K2	5.29	102.96	7.16	7.48	5.70	5.26	51.45
N1P2K0	5.31	109.72	8.22	7.90	5.58	5.37	37.79
N1P2K1	4.65	115.96	7.77	7.70	5.58	5.46	39.58
N1P2K2	5.12	110.76	7.68	7.99	6.04	5.64	58.71
N2P0K0	4.56	103.48	6.10	6.41	6.14	5.53	42.41
N2P0K1	4.86	119.60	7.36	6.91	5.78	5.22	43.08
N2P0K2	5.23	97.24	6.98	6.75	5.63	5.35	45.10
N2P1K0	4.86	106.08	7.31	7.26	5.64	5.88	42.58
N2P1K1	5.20	101.92	7.60	7.37	6.39	5.94	44.49
N2P1K2	4.90	111.28	7.48	7.40	5.64	5.95	57.26
N2P2K0	5.44	111.80	7.79	7.85	6.46	6.13	45.12
N2P2K1	5.19	126.36	7.52	7.16	5.51	5.82	47.42
N2P2K2	5.12	106.08	7.95	6.92	6.67	6.03	62.69
SEm ±	0.02	1.26	1.02	1.10	0.12	0.39	0.11
CD at 5%	NS	NS	NS	NS	0.36	1.17	0.32

The interaction effects indicated highest yield of 5.89 (Kg/tree) in N2P1 followed by 5.76 (Kg/tree) in by 5.76 kg/tree in N2K2 which were higher than the mean yield of 5.16 kg / free recorded in P1P2

Table 2.2 : Interaction effect of NPK levels on yield of cashew (Kg/tree) at Chintamani

	P0	P1	P2	Mean Yld.	K0	K1	K2	Mean Yld.
N0	3.98	4.13	4.18	4.09	3.89	3.89	4.12	3.97
N1	4.42	5.08	5.44	4.98	4.75	4.79	5.08	4.87
N2	5.76	5.89	5.80	5.82	5.70	5.61	5.76	5.69
Mean Yld.	4.72	5.03	5.14	-	4.78	4.76	4.99	-
K0	4.49	4.84	5.09	4.81				
K1	4.51	5.10	5.00	4.87				
K2	4.61	5.16	5.06	4.94				
Mean Yld.	4.54	5.03	5.05	-				
		N	P	K	NP	NK	PK	NPK
	S.Em(±)	0.03	0.03	0.04	0.06	0.07	0.07	0.15
	C.D @ 5%	0.09	0.10	0.11	0.16	0.22	0.21	0.48

JHARGRAM

There were no significant differences among the treatments in terms of their response on plant height, trunk girth, canopy spread and canopy area. Significant difference among the treatments was recorded with respect to flowering/m^2, nuts/m^2, nut weight, yield/tree and cumulative yield/tree for 3 harvests. Maximum flowering was noticed with a minimum dose of fertilizer. The plants receiving N:P:K=1500:250:375 Kg/ha produced maximum nuts/m^2 (24.63), while yield was highest in plants which received N:P:K=500:125:125 Kg/ha (Table 2.3).

Table 2.3 : Growth and yield characters of BPP – 8 under different fertilizer treatments at Jhargram

Treatment	Nuts/ m^2	Nut Weight (g)	Yield (kg/tree)	Cum. Yield (kg/tree) 3 harvests
N-500 P-125 K-125	23.73	6.07	6.15	9.25
N-1000 P-250 K-250	20.00	6.70	5.96	9.36
N-1500 P-250 K-375	24.63	6.07	6.09	8.59
SEm±	0.82	0.12	0.11	0.17
CD at 5%	2.30	0.34	0.31	0.45

Hort.2 : Fertilizer application in high density cashew plantations

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

SUMMARY:

At Bapatla, annual nut yield per tree was highest (11.43kg/tree) in 10 x 5m (200 plants/ha.) with fertilizer application of 75:25:25 kg/ha. Maximum cumulative yield/tree over 11 harvests was recorded in 600 plants / ha with NPK being 150 : 50 : 50 kg/ha (15.14 q) at Bhubaneswar. At Jhargram, benefit cost ratio was highest (3.27) at 6m x 4m (400 plants/ha.) and fertilizer dose of 150: 50:50 Kg NPK /ha. Highest mean nut weight of 12.00g was observed at Pilicode at 200 plants / ha and fertilizer dose of 225 kg N : 75 Kg P2O5: 75 kg K2O.

Experiment Details :

Design	:	Split plot		
Main plot : Plant density	:	S1 200 plants/ha (10m x 5m)		
		S2 400 plants/ha (6m x 4m)		
		S3 600 plants/ha (5m x 4m)		
Sub-plot : Fertilizer dose/ha	:	M1 75 kg N, 25 kg P2O5, 25 kg K2O		
		M2 150 kg N, 50 kg P2O5, 50 kg K2O		
		M3 225 kg N, 75 kg P2O5, 75 kg K2O		
Fertilizers application level	:	1st year	:	1/5th
		2nd year	:	2/5th
		3rd year	:	3/5th
		4th year	:	4/5th
		5th year	:	Full dose

BAPATLA

Annual nut yield per tree was highest (11.43kg/tree) in 10 x 5m with fertilizer application of 75:25:25 kg/ha [S1M1] followed by S1M2 (10.40 kg/tree). Cumulative nut yields were also highest in S1M1 (43.45 kg/tree) and S1M2 (41.09 kg/tree). The vegetative parameters were higher at closer densities and at wider densities the nut yields were found to be higher (Table 2.4).

Table 2.4 : Effect of tree density and fertilizer levels on growth and yield of cashew at Bapatla

Treatment	Plant height (m)	Trunk girth (cm)	Canopy surface area (m^2)	Duration of flowering (days)	Mean nut weight (g)	Mean apple weight (g)	Nut yield (Kg/tree) at 6th harvest	Cum. nut yield (Kg/ tree)(6 hvsts)
S1M1	4.87	94.3	75.46	107	7.56	53.40	11.43	43.45
S1M2	4.32	83.50	57.48	109	7.60	54.56	10.40	41.09
S1M3	4.10	63.45	54.27	107	7.78	57.10	6.65	24.91
S2M1	4.15	70.42	46.46	111	7.25	51.18	7.80	30.05
S2M2	4.00	65.22	41.29	97	7.48	53.40	6.76	33.44
S2M3	3.66	61.00	37.00	99	7.52	52.30	6.15	25.04
S3M1	5.26	94.65	60.80	98	7.36	54.80	6.68	31.55
S3M2	4.82	85.54	46.55	107	7.42	53.60	5.84	26.00
S3M3	4.70	59.86	30.72	100	7.20	52.16	4.36	25.68
S.Em±	0.26	2.27	2.34	2.96	0.21	2.43	0.60	---
CD at 5%	0.80	6.89	7.08	8.96	NS	NS	1.83	----

BHUBANESWAR

Significant effect on stem girth, canopy diameter and canopy surface area was observed due to tree density. The tree density, S1 was significantly superior to S2 and S3 in respect of stem girth (83.30 cm), canopy diameter (8.47 m) and canopy surface area (56.92 m^2). No significant difference was observed in respect of tree height and ground area coverage by canopy. However, maximum tree height of 6.26 m in S1 and ground area coverage by canopy was recorded in S2 (128.92 %).

No significant difference on all the vegetative growth parameters was observed due to various levels of fertilizers. However, M2 (NPK 150:50:50kg/ha) recorded maximum stem girth (75.81 cm) and M3 (NPK 225:75:75 kg/ ha) recorded maximum for all the other growth characters like tree height (6.03 m), canopy diameter (7.04 m), canopy surface area (40.36 m^2) and ground area coverage by canopy (132.96 %) (Table 2.5 & 2.6).

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

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy diameter (m)	Mean canopy surface area (m^2)	Ground coverage by canopy (%)
S1	6.26	83.30	8.47	56.92	122.20
S2	6.04	71.63	6.27	31.02	128.92
S3	5.71	69.16	5.65	25.38	128.56
S.Em±	0.227	1.864	0.287	3.504	0.690
CD@5%	NS	6.451	0.992	12.126	NS
M1	5.98	73.61	6.57	35.62	118.14
M2	5.99	75.81	6.78	37.44	128.58
M3	6.03	74.67	7.04	40.26	132.96
S.Em±	0.082	0.976	0.166	1.771	5.124
CD@5%	NS	NS	NS	NS	NS

S1M1 recorded maximum plant height (6.44 m), which was at par with S1M2 (6.36 m), S2M3 (6.10 m) and S2M2 (6.09 m). No significant differences on stem girth, canopy diameter, canopy surface area and ground area coverage by canopy were recorded due to interaction effect of tree density and levels of fertilizers. However, S1M2 treatment recorded maximum stem girth (84.62 cm), S1M3 for canopy diameter (8.71m) and canopy surface area (59.74m^2) as well as S3M3 for ground area coverage by canopy (144.29 %) (Table 2.5 & 2.6).

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

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy diameter (m)	Mean canopy surface area (m^2)	Ground coverage by canopy (%)
S1M1	6.44	83.33	8.41	56.22	126.24
S1M2	6.36	84.62	8.29	54.81	121.49
S1M3	5.98	81.95	8.71	59.74	118.85
S2M1	5.93	71.46	6.03	28.65	118.62
S2M2	6.09	72.03	6.33	31.66	132.40
S2M3	6.10	71.42	6.45	32.76	135.73
S3M1	5.58	66.04	5.28	22.00	109.56
S3M2	5.53	70.79	5.71	25.86	131.83
S3M3	6.00	70.65	5.96	28.27	144.29
S.Em(±)	0.42	NS	NS	NS	NS
CD @ 5%	0.14	1.69	0.29	3.07	8.88

Significant variations only for flowering laterals/ panicle, nut weight and nut yield/tree were recorded due to tree density. On the other hand, the levels of fertilizer had significant influence for nut weight, apple weight, annual nut yield/tree as well as nut yield/ha. Significantly maximum flowering laterals/panicle per sq.m. (6.68), nut weight (8.96g) and annual nut yield/tree (3.65kg) were recorded with S1 (10m x 5m).

Although, no significant variations were recorded for apple weight and yield/ha. The treatment S2M3 recorded highest values for the apple weight (65.88 g) and S2M2 had highest yield / ha. (830.00 Kg)

The cumulative yield/tree over the 11th harvests indicated that both wider tree density, and recommended levels of fertilizer recorded higher yield. No significant variations were recorded for the interactions of tree density and fertilizer doses. However, maximum cumulative yield/tree for 11 harvests was recorded by the treatment, S3M2 (15140.50kg) (Table 2.7).

Table 2.7 : Yield characters of cashew under different spacing and fertilizer doses at Bhubaneswar

Treatment	Mean flowering laterals/ m^2	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (Kg/tree) (11 hvsts)
				(kg/tree)	(kg/ha)	
S1M1	6.23	8.63	60.63	3.25	649.50	7898.50
S1M2	6.83	9.18	61.20	4.08	816.00	10823.00
S1M3	6.98	9.08	60.43	3.62	724.50	9707.00
S2M1	5.08	8.23	52.63	1.24	497.00	11665.00
S2M2	6.33	8.83	61.53	2.08	830.00	13788.00
S2M3	6.38	8.98	65.88	2.03	811.00	13261.00
S3M1	4.20	6.90	49.48	0.94	470.00	13099.80
S3M2	4.70	7.95	59.58	1.24	617.50	15140.50
S3M3	4.65	8.05	59.78	1.52	758.75	14052.05
S.Em(±)	NS	NS	NS	NS	NS	
CD @ 5%	0.55	0.40	2.43	0.22	77.27	

The cumulative cost of cultivation over 11 harvests ranged from Rs.1,54,803.00 (S1M1) to Rs.1,88,616.00 (S3M3) while cumulative net return varied from Rs.1,21,644.50 (S1M1) to Rs.3,55,322.50 (S3M2). Similar trend was also observed for BCR, wherein maximum of 3.04 was recorded in the treatment of S3M2 (Table 2.8).

Table 2.8 : Economics of high density planting based on cumulative yield at Bhubaneswar

Spacing (Density)	Fertilizer Dose NPK (Kg/ha)	Cum. Cost of cultivation (Rs/ha) for 11 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	154803	276447.50	121644.50	1.79
	M2: 150-50-50	168817	378805.00	209988.00	2.24
	M3: 225-75-75	182838	339745.00	156907.00	1.86
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	158655	408275.00	249620.00	2.57
	M2: 150-50-50	172669	482580.00	309911.00	2.79
	M3: 225-75-75	186690	464135.00	277445.00	2.49
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	160581	458493.00	297912.00	2.86
	M2: 150-50-50	174595	529917.50	355322.50	3.04
	M3: 225-75-75	188616	491821.75	303205.75	2.61

DARISAI

Due to spacing effect, there was significant improvement of trunk girth. The spacing of S1 (8×8m) was significantly superior over S2 (6.5×6.5m) and S3 (5×5m) in respect of trunk girth. No significant difference was observed in respect of plant height and ground area coverage by the canopy.

Similarly, various fertilizer doses had significant effect on plant height and ground area coverage by canopy. M3 proved significantly superior to M2 and M1 for the growth characters like plant height and ground coverage (Table 2.9).

Table 2.9 : Effect of spacing and fertilizer on the growth characters at Darisai

Treatments	Plant height(m)	Trunk girth(cm)	Ground area coverage by canopy (%)
S1 (8m×8m)- 156 plants/ha	1.12	43.6	97.50
S2 (6.5m×6.5m)- 240 plants/ha	1.12	32.4	98.60
S3 (5m×5m)- 400 plants/ha	1.06	30.8	109.0
f test	NS	*	NS
SEm ±	0.119	1.568	2.863
CD 5%	-	6.52	-
M1 N75 P25 K25 kg/ha	1.10	40.6	98.40
M2 N150 P50 K50 kg/ha	1.25	41.8	103.60
M3 N225 P75 K75 kg/ha	1.45	40.2	118.6
f Test	*	NS	*
SEm ±	0.085	1.020	3.207
CD @ 5%	0.105		4.95

HOGALAGERE

The mean tree height ranged from 4.51 to 4.97 m, mean stem girth from 60.66 to 77.35 cm, mean canopy spread in E-W and N-S directions from 5.22 to 6.91m and 5.30 to 7.86 m, and mean flowering duration ranged from 60 to 69 days (Table 2.10).

Table 2.10 : Effect of tree density and fertilizer levels on growth parameters of cashew at Chintamani

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy diameter (m)		Duration of flowering (days)
			E-W	N-S	
S1M1	4.51	75.60	6.91	7.86	65.00
S1M2	4.62	77.35	8.09	7.85	62.00
S1M3	4.54	71.03	6.19	7.91	60.00
S2M1	4.71	67.06	5.87	6.12	63.00
S2M2	4.93	67.66	5.95	6.79	66.00
S2M3	4.77	62.21	6.23	6.76	64.00
S3M1	4.84	63.27	5.46	5.82	67.00
S3M2	4.97	60.66	5.22	5.30	68.00
S3M3	4.86	62.37	5.40	5.75	69.00
S.Em(±)	0.02	0.11	0.32	0.02	0.02
CD at 5%	0.07	0.34	0.97	0.06	0.06

The effect of tree density and fertilizer levels on yield parameters of cashew showed that the highest mean flowering laterals/m^2 was recorded in the treatment S1M2 (13.20) followed by S2M3 and S1M1 with 11.64 and 11.00, respectively.

The treatment S3M2 recorded highest mean nut weight (3.99g) followed by S2M2 and S2M3 with 3.89g and 3.55g, respectively. The highest mean apple weight was recorded in S3M2 (37.00) followed by S2M1 and S2M3 with 36.88g

and 36.00g, respectively. The treatment S1M2 recorded highest mean nut weight (7.79 kg/tree) followed by S1M3 and S1M1 with 7.48 kg/tree and 7.12 kg/tree, respectively.

The highest mean nut yield per hectare was recorded in S3M2 (23.05 q/ha) followed by S3M3 (22.45 q/ha) and S3M1 (21.15 q/ha). The highest mean cumulative nut yield for seven years was recorded in S1M2 (36.15 kg/tree) followed by S1M3 and S1M1 with 34.68 kg/tree and 34.20 kg/tree, respectively (Table 2.11).

Table 2.11 : Effect of tree density and fertilizer levels on yield parameters of cashew at Chintamani

Treatment	Mean panicles/m²	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (Kg/tree) (7 hvsts)
				(Kg/tree)	(q/ha)	
S1M1	11.00	2.87	27.11	7.12	14.20	34.20
S1M2	13.20	3.21	29.45	7.79	15.58	36.15
S1M3	16.10	3.02	26.80	7.48	14.96	34.68
S2M1	8.82	3.34	36.88	5.16	20.64	25.48
S2M2	9.98	3.89	35.59	5.17	20.68	27.16
S2M3	11.64	3.55	36.00	4.96	19.84	25.76
S3M1	8.34	3.45	34.18	4.23	21.15	22.01
S3M2	9.74	3.99	37.00	4.61	23.05	23.62
S3M3	8.95	3.49	35.95	4.49	22.45	26.03
S.Em(±)	0.05	0.10	0.01	0.01	0.08	0.02
CD @ 5%	0.14	0.31	0.03	0.04	0.22	0.06

JHARGRAM

Growth parameters were higher in wider spacing as compared to the lower spacings. Canopy area was maximum (59.73 m²) at a plant density of 200 plants/ha followed by 400 plants/ha (47.07 m²) (Table 2.12).

Table 2.12 : Growth and flowering parameters of high density planting at Jhargram

Spacing (density)	Fertilizer Dose N-P-K (Kg/ha)	Plant Height (m)	Trunk girth (cm)	Canopy spread (m)	Canopy area (m²)	Flowering /m²	Biomass removed (Kg/tree)
S1: 10m x 5m (200 Plants)	M1: 75-25-25	6.1	71.7	6.6	57.40	15.1	6.3
	M2: 150-50-50	6.1	72.0	6.8	59.73	14.9	8.8
	M3: 225-75-75	6.0	68.6	6.8	57.73	16.0	5.4
S2: 6m x 4m (400 Plants)	M1: 75-25-25	5.8	69.7	5.5	40.97	11.9	10.3
	M2: 150-50-50	6.0	71.0	5.9	47.07	12.4	11.9
	M3: 225-75-75	5.7	63.6	5.8	43.67	11.6	13.5
S3: 5m x 4m (500 Plants)	M1: 75-25-25	6.1	66.9	5.4	42.10	12.4	17.7
	M2: 150-50-50	6.2	64.1	5.4	41.17	11.7	17.1
	M3: 225-75-75	5.9	63.2	5.5	42.87	12.4	15.8
S.Em(±)	NS	4.50	0.34	4.42	0.81	1.86	
CD at 5%		9.81	0.74	9.63	1.76	4.05	

In case of 6m x 4m spacing with a lower dose of fertilizer, 100 percent ground area had been covered. At a spacing of 10m x 5m, 69 to 74 percent ground area had been covered by the canopy. Significant variation was noticed among the spacing with respect to ground coverage (%) by canopy , but differences in the fertilizer doses did not have any positive influence on the ground coverage (%) by canopy (Table 2.13).

Table 2.13 : Effect of tree density and fertilizer application on ground coverage at Jhargram

Treatment	Ground Coverage (%) by Canopy			
	M1: 75-25-25	M2: 150-50-50	M3: 225-75-75	Mean
S1: 10m x 5m (200 plants)	69.09	73.84	72.33	71.75
S2: 6m x 4m (400 plants)	99.35	114.87	111.10	108.44
S3: 5m x 4m (500 plants)	118.0	113.2	106.9	112.7
Mean	95.48	100.64	96.78	
MP/SP – S.Em(±)	9.63			
CD at 5%	20.98			

Table 2.14: Yield parameters of high density planting at Jhargram

Spacing (Density)	Fertilizerdose N-P-K(Kg/ha)	Nuts/m²	Nut Weight (g)	Apple weight (g)	Yield (Kg/ tree)	Yield/ha (Q)	Cum.yld. (Q/ha) 7 hvsts
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	35.75	4.26	34.50	8.72	17.43	62.73
	M2: 150-50-50	35.22	3.94	36.03	8.07	16.15	62.43
	M3: 225-75-75	32.33	3.90	37.53	7.27	14.55	62.73
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	16.42	4.95	36.50	3.31	13.23	85.99
	M2: 150-50-50	20.08	4.73	36.00	4.37	17.48	86.44
	M3: 225-75-75	23.53	4.61	37.83	4.68	18.70	90.67
S3: 5m x 4m (500 plant/ha)	M1: 75-25-25	19.19	4.32	26.67	3.54	17.69	81.81
	M2: 150-50-50	24.42	3.91	32.90	3.89	19.46	92.13
	M3: 225-75-75	19.72	4.17	34.07	3.45	17.24	90.30
SEm (±)	2.08	0.20	1.31	0.42	1.32	2.75	
CD at 5%	4.53	0.44	2.86	0.92	2.87	5.99	

Table 2.15 : Economics of high density planting at Jhargram

Spacing (Density)	Fertilizer Dose N-P-K (Kg/ha)	Cum. Cost of cultivation (Rs/ha)-10 years	Cum. Total return of cashew (Rs./ha)	Cum.net return (Rs./ha)	Benefit: Cost
S1: 10m x 5m (200plant/ha)	M1: 75-25-25	66804	265161	277362	3.15
	M2: 150-50-50	79126	272760	284065	2.59
	M3: 225-75-75	91164	286183	296368	2.25
S2: 6m x 4m (400plant/ha)	M1: 75-25-25	96348	401805	411066	3.27
	M2: 150-50-50	107284	392300	404536	2.77
	M3: 225-75-75	120209	413430	426520	2.55
S3: 5m x 4m (500plant/ha)	M1: 75-25-25	120045	361448	373831	2.11
	M2: 150-50-50	132730	411905	425527	2.21
	M3: 225-75-75	144769	412320	424388	1.93

It was observed that with plant density of 200 plants/ha, nuts/m^2 was maximum at the lowest dose of fertilizer. At 400 plants/ha nut density per unit area of canopy was maximum with the highest dose of fertilizer. Irrespective of the doses of fertilizer applied, plants spaced at 10m x 5m produced maximum nuts/m^2 and yield /tree. The treatments were on par with respect to nut weight.

Though yield /tree was minimum under 500 plant/ha, per unit area yield was maximum at the same density. Data on cumulative yield /ha showed maximum yield under 5m x 4m spacing followed by 6m x 4m spacing (Table 2.14).

Benefit cost ratio was highest (3.27) at 6m x 4m and fertilizer dose of 150:50:50 Kg NPK /ha followed by 10m x 5m spacing with 75:25:25 Kg NPK/ha (Table 2.15).

MADAKKATHARA

The tree height was maximum at a tree density of 500 trees/ha and minimum was in plots with plant density 200 per ha. The girth didn't differ significantly among treatments. The canopy spread both North-South and East-West differed significantly among treatments. Maximum canopy spread in both directions was high in plants with lowest density i.e. 200 plants per ha.

Considering the interaction effect, the height was not influenced by different spacing and fertilizer doses. However, the girth was high in plants under S1 M1 treatment. This was significantly superior to S1 M2 but was on par with other treatments. The interaction effect of spacing and fertilizer doses were significant. The canopy spread was maximum in S1M1, S1M2 and S1M3 plots. The canopy spread reduced as the spacing was reduced (Table 2.16 & 2.17).

Table 2.16 a : Effect of tree densities on the growth and yield of cashew at Madakkathara

Densities	Plant height (m)	Stem girth (cm)	Canopy spread (m)	
			N-S	E-W
S1 - 200	5.20	89.7	8.09	8.25
S2 -400	5.36	90.7	6.47	6.89
S3 -500	5.46	90.0	5.58	5.96
SEm (±)	NS	NS	NS	NS
CD at 5%	0.17	1.46	0.16	0.12

Table 2.16 a : Effect of tree densities on the growth and yield of cashew at Madakkathara

Fertilizer Doses	Plant Height (m)	Stem Girth (cm)	Canopy spread(m)	
			N-S	E-W
M1- 75:25:25	5.32	91.6	6.67	7.01
M2- 150:50:50	5.36	89.5	6.74	7.03
M3- 225:75:75	5.33	89.2	6.73	7.06
SEm (±)	0.17	1.46	0.16	0.12
CD at 5%	NS	*	*	*

Table 2.17 : Interaction effect between tree densities and fertilizer doses on growth and yield of cashew at Madakkathara

Treatments	Height (m)	Girth (cm)	Canopy spread –NS (m)	Canopy spread – EW (m)
S1 M1	5.10	93.0	8.00	8.19
S1 M2	5.27	87.5	8.14	8.15
S1 M3	5.22	88.7	8.14	8.41
S2 M1	5.40	91.5	6.70	7.05
S2 M2	5.37	90.7	6.45	6.92
S2 M3	5.30	90.0	6.27	6.70
S3 M1	5.46	90.5	5.32	5.77
S3 M2	5.45	90.5	5.65	6.03
S3 M3	5.47	89.0	5.77	6.07
SEm (±)	0.03	2.52	0.28	0.21
CD at 5%	NS	0.18	NS	NS

PILICODE

The fertilizer doses significantly influenced the vegetative characteristics of MDK-1 except trunk girth. Tree height increased with an increase in fertilizer doses. Tallest plants were observed with higher fertilizer dose (M3: 225 kg N: 75 Kg P_2O_5: 75 kg K_2O). Canopy area also increased with increasing fertilizer dose (Table 2.18).

The fertilizer doses influenced the fruit set per unit area and mean nut weight. The medium fertilizer dose (M2: 150 kg N : 50 Kg P_2O_5: 50 kg K_2O) resulted in higher seed set per unit area. Lower dose of fertilizer (M1: 75 kg N : 25 Kg P_2O_5: 25 kg K_2O) resulted in higher mean nut weight of 9.31g. Mean nut weight decreased with increasing fertilizer doses (Table 2.19).

Table 2.18 : Effect of fertilizer on vegetative and yield characters at Pilicode

Treatment	Plant Height (m)	Stem (m)	Spread Cancopy (m)	Canopy area (m^2)	% Ground coverage by canopy
M1	4.43	0.59	4.67	28.01	120.01
M2	4.39	0.60	4.93	35.30	136.74
M3	4.81	0.59	5.05	37.49	125.27
F test	**	NS	NS	**	**
CD @ 5%	0.32	-	-	1.18	2.54

Table 2.19 : Effect of fertilizer on yield characters of cashew variety at Pilicode

Treatment	No. of panicles per m^2	Bisexual: total flowers ratio	Seed set/ m^2	Flowering duration (Days)	Mean apple weight(g)	Mean nut weight (g)
M1	9.90	0.20	5.57	121.44	56.23	9.31
M2	9.62	0.18	10.16	112.33	51.33	8.20
M3	9.38	0.16	6.97	107.44	43.50	6.84
F test	NS	NS	**	NS	NS	**
CD @ 5%	-	-	2.24	-	-	1.73

Higher number of flowering panicles per sq.m. (11.15) was obtained with wider spacing of 10 x 5 m (200 plants/ha.) followed by 5 x 4 m (600 plants/ha)(9.45) Flowering duration was extended with wider spacing (124.11days) (Table 2.20 & 2.21).

Table 2.20 : Effect of spacing on vegetative characters and yield of cashew at Pilicode

Treatment	Plant height (m)	Stem (m)	Spread Canopy (m)	Canopy area (m^2)	% ground coverage by canopy
S1	4.269	0.63	5.21	33.78	80.93
S2	4.754	0.52	4.22	29.17	125.11
S3	4.612	0.62	5.22	37.85	175.97
F Test	NS	NS	**	**	**
CD @5%	-	-	0.74	1.06	1.00

Table 2.21 : Effect of spacing on yield characters of cashew at Pilicode

Treatment	No of panicles /m^2	No. of branches not flowered	Bisexual: total flowers ratio	Seed set/m^2	Fruit set/ m^2	Flowering duration (days)	Mean apple weight(g)	Mean nut weight (g)
S1	11.15	7.99	0.18	8.46	7.07	124.11	46.50	8.47
S2	8.31	6.41	0.18	5.38	3.94	105.67	46.92	7.16
S3	9.45	6.41	0.18	8.86	6.64	111.44	57.64	8.72
F Test	**	NS	NS	NS	**	**	NS	NS
CD @5%	1.65	-	-	-	2.54	12.13	-	-

Higher plant height was observed at 225 kg N : 75 Kg P_2O_5: 75 kg K_2O, and 400 plants / ha (6m x 4m). Higher plant spread and canopy area was seen in higher fertilizer dose with wider spacing (M3: 225 kg N : 75 Kg P_2O_5: 75 kg K_2O, S1: 200 plants / ha (10 m x 5m) (Table 2.22).

Table 2.22 : Interaction effect of spacing and doses of fertilizer application on growth parameters at Pilicode

Treatment	Plant Height (m)	Girth (m)	Canopy area (m^v)	% Ground cover by canopy
M1S1	4.17	0.64	18.51	45.01
M1S2	4.49	0.51	29.96	134.72
M1S3	4.67	0.61	35.56	180.28
M2S1	3.97	0.58	31.50	92.90
M2S2	4.27	0.56	32.00	134.26
M2S3	4.95	0.65	43.07	183.05
M3S1	4.68	0.68	52.00	104.89
M3S2	5.50	0.47	25.54	106.32
M3S3	4.25	0.61	34.93	164.59
F test	**	NS	**	**
CD @ 5%	0.82	-	1.45	1.95

Highest mean apple weight (67.10 g) nut weight of 12.00g was observed with lower fertilizer dose (225 kg N : 75Kg P_2O_5: 75 kg K_2O) and with closer spacing S1: 200 plants / ha (10 m x 5m) (Table 2.23).

Table 2.23 : Interaction effect of spacing and fertilizer doses on yield parameters at Pilicode

Treatment	No of flowering panicle per m^2	Bisexual: total flowers ratio	Seed set/ m^2	Flowering duration (Days)	Mean apple weight(g)	Mean nut weight(g)
M1S1	10.53	0.18	7.43	137.67	50.00	8.93
M1S2	7.99	0.20	3.52	110.33	51.60	7.00
M1S3	11.18	0.23	5.77	118.33	67.10	12.00
M2S1	10.38	0.20	8.67	126.00	45.33	9.43
M2S2	9.43	0.17	8.45	98.67	56.17	7.67
M2S3	9.06	0.16	13.36	112.33	52.50	7.50
M3S1	12.56	0.17	9.28	110.67	44.17	7.05
M3S2	7.50	0.16	4.17	108.00	33.00	6.80
M3S3	8.09	0.14	7.44	103.67	53.33	6.67
F test	NS	NS	NS	NS	NS	**
CD @ 5%	-	-	-	-	-	1.37

VENGURLA

Spacing of 10m x 5m was significantly superior over 6m x 4m and 5m x 4m in respect of mean height, mean spread and mean canopy area of the plant. All the growth characters were not influenced significantly due to fertilizer levels (Table 2.24).

Table 2.24 : Effect of spacing and fertilizer on growth and yield of cashew at Vengurla

Treatments	Mean Height (m)	Mean Girth (cm)	Mean Spread (m)	Mean Canopy height (m)	Mean Canopy surface area (m^2)
S1 200 plants/ha (10m x 5m)	7.50	107.43	10.11	6.90	138.35
S2 400 plants/ha (6m x 4 m)	4.34	97.50	3.64	3.60	24.04
S3 500 plants/ha (5m x 4m)	6.32	102.21	5.73	5.77	59.46
SE m±	0.23	3.71	0.27	0.23	7.04
CD at 5%	0.92	N.S	1.1	0.93	27.68
M1 = 75 : 25 : 25 (N : P_2O_5 : K_2O kg /ha)	5.84	101.6	6.34	5.18	70.23
M2 = 150 : 50 : 50 (N : P_2O_5 : K_2O kg /ha)	6.21	104.6	6.70	5.61	78.22
M3 = 225 : 75 : 75 (N : P_2O_5 : K_2O kg /ha)	6.11	100.94	6.44	5.47	73.41
S.Em(±)	0.12	2.58	0.23	0.11	4.88
CD at 5%	N.S	N.S	N.S	N.S.	N.S

The fertilizer dose M2 (150 kg N : 50 kg P_2O_5 : 50 kg K_2O /ha) was superior than M1 (75 kg N : 25 kg P_2O_5 : 25 kg K_2O /ha) and M3 (225 kg N : 75 kg P_2O_5 : 75 kg K_2O /ha) in respect of mean height, mean girth, mean spread, mean canopy height and mean canopy area (Table 2.25).

Table 2.25 : Interaction effect of spacing and fertilizer on growth and yield of cashew at Vengurla

Treatment	Mean Height (m)	Mean Girth (cm)	Canopy Height	Mean Canopy Spread (m)	Mean Canopy area (m^2)	Mean No. of lateral /m^2	Mean No. of panicle/ m^2
S1M1	7.36	105.60	6.73	10.03	134.16	29.50	19.22
S1M2	7.63	111.60	7.06	10.43	146.90	33.20	19.46
S1M3	7.50	105.10	6.90	9.86	134.00	29.75	17.91
S2M1	3.93	98.56	3.13	3.60	21.63	32.50	21.36
S2M2	4.70	97.10	4.00	3.83	27.50	34.50	20.61
S2M3	4.40	96.83	3.66	3.50	23.00	32.60	18.93
S3M1	6.23	100.63	5.70	5.40	54.90	31.50	18.59
S3M2	6.30	105.10	5.76	5.83	60.26	32.60	19.93
S3M3	6.43	100.90	5.86	5.96	63.23	31.33	20.27
S.Em(±)	0.23	3.71	0.23	0.27	7.09	0.52	0.78
CD at 5%	N.S	N.S.	0.93.	1.06	27.68	NS	N.S

Hort.3: Drip irrigation trial

Centres :
East Coast : Vridhachalam
West Coast : Vengurla
Plains/others : Hogalagere

The trial aims at studying the response of cashew to supplementary irrigation during critical stages of growth and development.

SUMMARY

Irrigation at 80% CPE recorded significantly highest tree height (5.41m), stem girth (91.12 cm) and maximum mean apple weight (33.56 g) at Hogalagere. The cumulative yield for eleven harvests was maximum in irrigation at 80 percent CPE 45.92 Kg/tree at Vengurla.

Experimental Details :

Treatments : 5

T1 : No Irrigation

T2 : Irrigation 20% of cumulative pan evaporation (CPE).

T3 : Irrigation 40% of cumulative pan evaporation (CPE).

T4 : Irrigation 60% of cumulative pan evaporation (CPE).

T5 : Irrigation 80% of cumulative pan evaporation (CPE).

Spacing = 7 x 7m

Planting material = Softwood grafts

Variety = Chintamani : Chintamani-1
Vengurla : Vengurla-7
Vridhachalam : VRI-3

HOGALAGERE

Among different levels of irrigation applied, irrigating the crop at 80% CPE recorded significantly highest tree height (5.41m) and stem girth (91.12 cm), mean canopy spread in E-W and N-S directions (8.47 m & 8.59 m) compared to remaining irrigation schedules. The highest number of flowering laterals/m^2 was recorded in irrigation at 20% CPE (18.71) followed by irrigation at 40% CPE and irrigation at 80% CPE with 16.49 and 15.56, respectively. The lowest number of flowering laterals were recorded in unirrigated plots (15.04) (Table 2.26).

The maximum mean nut weight was recorded in irrigation at 80% CPE (7.40g) followed by irrigation at 60% CPE and irrigation at 20% CPE with 7.26g and 7.20g, respectively. The minimum nut weight was recorded in unirrigated plots (6.81). The maximum mean nut yield and cumulative nut yield for seven years was recorded in irrigation at 80% CPE (13.94 kg/tree & 68.52 kg/tree) followed by irrigation at 60% CPE (13.51 kg/tree & 65.18 kg/tree) and irrigation at 40% CPE (11.64 kg/tree & 56.57 kg/tree).

Table 2.26 : Effect of drip irrigation levels on growth parameters of cashew at Chintamani

Treatments	Mean tree height (m)	Mean stem girth (cm)	Mean canopy spread (m)		No. of flowering laterals / m²
			E - W	N - S	
T1 : No irrigation	4.61	80.70	8.07	8.19	15.04
T2 : Irrigation at 20% CPE	4.76	82.58	8.16	8.26	18.71
T3 : Irrigation at 40% CPE	4.80	87.78	8.24	8.43	16.49
T4 : Irrigation at 60% CPE	5.32	89.03	8.43	8.41	15.11
T5: Irrigation at 80% CPE	5.41	91.12	8.47	8.59	15.56
SEm ±	3.12	53.94	5.17	5.23	1.77
CD at 5%	5.09	88.09	8.44	8.54	5.26

The maximum mean apple weight was noticed in irrigation at 80% CPE (33.56 g) followed by irrigation at 60% CPE and irrigation at 40% CPE with 33.29g and 32.68 g, respectively. Providing irrigation at 80% CPE recorded higher shelling percent (32.24) followed by irrigation at 60% CPE and irrigation at 40% CPE with 31.45 and 31.44, respectively. The lower shelling percent was noticed in the treatment in unirrigated plots (30.03) (Table 2.27).

Table 2.27 : Effect of drip irrigation levels on yield parameters of cashew at Chintamani

Treatments	Mean nut wt. (g)	Mean apple wt. (g)	Shelling (%)	Mean annual nut yield (kg/tree)	Mean cum. yield (kg/tree) 7 harvests
T1 : No irrigation	6.81	31.21	30.03	8.15	39.99
T2 : Irrigation at 20% CPE	7.20	32.43	30.18	9.91	48.98
T3 : Irrigation at 40% CPE	7.18	32.68	31.44	11.64	56.57
T4 : Irrigation at 60% CPE	7.26	33.29	31.45	13.51	65.18
T5: Irrigation at 80% CPE	7.40	33.56	32.24	13.94	68.52
SEm ±	4.48	0.01	19.42	7.24	35.35
CD at 5%	7.32	0.02	31.71	11.82	57.72

VENGURLA

The growth and yield attributing characters were found to be non-significant. However, mean fruit set/m² (65.00) and mean no. of nuts/ panicle (11.82) was found maximum in irrigation at 80% CPE (Table 2.28).

Table 2.28 : Effect of drip irrigation on growth and yield attributing characters at Vengurla

Treatment	Mean Plant Height (m)	Mean Stem Girth (cm)	Mean Canopy Spread (m)	Mean Canopy area (m²)	Mean Canopy Surface area (m²)	Mean No. of laterals/ (m²)	Mean No. of panicle /m²
T1 : No Irrigation	7.45	90.30	7.78	48.93	96.35	28.99	10.75
T2 : Irrigation 20%CPE	7.30	95.48	8.40	56.78	104.30	28.00	11.08
T3 : Irrigation 40% CPE	7.40	94.98	8.48	57.65	109.90	29.42	14.67
T4 : Irrigation 60% CPE	7.63	88.13	7.90	49.60	101.20	28.21	12.38
T5 : Irrigation80% CPE	7.25	95.13	8.35	55.80	102.55	29.08	12.92
S.Em(±)	0.23	2.89	0.32	4.08	5.23	0.80	1.503
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

VRIDHACHALAM

Among the different levels of irrigation, irrigating the crop at 80% CPE recorded significantly highest plant height, girth and canopy surface area. Nut yield varied significantly among the treatments.

Table 2.29 : Effect of drip irrigation on growth of cashew at Vridhachalam

Treatments	Plant Height (m)	Trunk Girth (cm)	Mean canopy spread (m)	Canopy surface area (m^2)		No. of flowering laterals / m^2
				E - W	N - S	
T1 - No irrigation	3.42	40.5	4.02	4.26	9.65	13.06
T2 - Irrigating 20% of CPE	3.98	42.2	4.34	4.69	14.50	15.50
T3 - Irrigating 40% of CPE	4.12	44.0	4.12	4.38	18.68	16.75
T4 - Irrigating 60% of CPE	4.56	45.8	4.64	4.43	23.86	16.78
T5 - Irrigating 80% of CPE	4.91	52.2	5.10	4.64	32.49	18.24
S.Em ±	0.25	2.02	0.20	NS	3.94	0.87
CD at 5%	0.46	4.18	0.45		5.19	1.68

Table 2.30 : Effect of drip irrigation levels on yield parameters of cashew at Vridhachalam

Treatments	Mean nut wt. (g)	Mean apple wt. (g)	Mean annual nut yield (kg/tree)	Mean cum. yield (kg/tree) (5 hvts)	Shelling(%)
T1 - No irrigation	6.2	50.6	5.84	12.50	28.0
T2 - Irrigating 20% of CPE	6.2	58.2	6.54	13.84	28.4
T3 - Irrigating 40% of CPE	6.8	61.2	7.80	15.62	29.0
T4 - Irrigating 60% of CPE	7.2	57.6	7.86	16.44	29.6
T5 - Irrigating 80% of CPE	7.4	66.6	8.90	18.24	30.2
S.Em ±	NS	2.60	0.54	1.02	NS
CD at 5%	5.20	1.26	2.06		

The highest tree girth (52.20 cm), maximum canopy spread (5.10m) and number of flowering laterals per nut yield of 8.90 kg/tree with a nut weight of 7.4 g and shelling percent of 30.2 was also observed in 80% CPE (Table 2.29 & 2.30).

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

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

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

SUMMARY:

The highest cumulative yield of 5081 kg/ha was recorded with high density plot compared to the normal density plot (1533kg/ha) at Bapatla. Maximum plant height (3.14 m), canopy spread (3.13 m^2) and canopy area (17.17 m^2) were recorded in 8m x 8m spacing at Jhargram.

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

Maximum values for growth parameters were recorded with 4 x 4 m spacing. The highest cumulative yield of 5081.00 kg/ha was recorded with high density plot compared to the normal density plot where the yield obtained was only 1533.00 kg/ha (Table 2.31).

Table 2.31 : Data on growth and yield parameters of high density and normal planting at Bapatla

Spacing	Plant height (m)	Trunk girth(cm)	Mean canopy meter(m)	Dur of flowering (days)	Mean nut weight (g)	Mean apple weight (g)	Nut yield (Kg/tree) at 6th hvst	Nut yield (Kg/ ha)	Cum. yield (Kg/tree) (6 hvsts)	Cum. yield (Kg/ha)
4m x 4m	4.10	55.44	4.29	101	5.35	53.40	2.92	1825	8.13	5081.00
8m x 8 m	3.27	58.24	5.16	96	5.81	57.60	3.64	567.8	9.83	1533.00

HOGALAGERE

The maximum tree height (6.11 m), mean stem girth (95.63 cm), mean canopy spread in E-W and N-S directions (9.07 & 8.89) and number of flowering laterals (5.48) were noticed in normal planting as compared to high density planting (Table 2.32).

Table 2.32 : Growth parameters of cashew in normal and high density planting at Chintamani

Spacing	Mean tree height (m)	Mean stem girth (cm)	Mean canopy diameter (m)		Mean flowering laterals/ m^2
			E-W	N-S	
4m x 4m	4.79	61.00	5.50	5.21	3.46
8m x 8m	6.11	95.63	9.07	8.89	5.48

The yield parameters in high density planting recorded lowest mean nut weight (5.13), mean apple weight (27.89), mean nut yield (1.2 kg/tree & 11.19 kg/ha) and cumulative nut yield (11.19 kg/tree & 6994kg/ha) as compared to normal planting (Table 2.33).

Table 2.33 : Yield parameters of cashew in normal and high density planting at Chintamani

Spacing	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield		Cum. nut yield (Kg/tree) (12 harvests)	
			(kg/tree)	(kg/ha)	(kg/tree)	(kg/ha)
4m x 4m	5.13	27.89	1.20	183.00	11.19	6994.00
8m x 8m	5.44	32.21	9.11	1423.00	51.23	7991.88

JHARGRAM

There were significant differences between the two different spacings with respect to plant height, canopy spread and canopy area. Maximum plant height (3.14 m), canopy spread (3.13 m^2) and canopy area (17.17 m^2) were recorded in 8m x 8m spacing. No significant differences were noticed with respect to flowering /m^2. The number of nuts per sq. m was higher (21.22) at 8 x8 m while it was significantly lesser (15.42) at 4 x 4m. Yield/ tree was higher at 8m x 8m (2.67 kg) compared to 4m x 4m (1.69) but yield per unit area (q/ha) was more in 4m x 4m spacing (10.55g /ha) (Table 2.34).

Table 2.34 : Growth and flowering attributes of high density observational trial of cashew at Jhargram

Treatment	Plant height (m)	Trunk girth (cm)	Canopy spread (m^2)	Canopy area (m^2)	Flowering /m^2	Nuts/m^2	Nut weight (g)	Yield/ tree (Kg)	Yield/ha (q)
8m x 8m	3.14	24.25	3.13	17.17	13.06	21.22	5.54	2.67	4.16
4m x 4m	2.38	21.00	2.46	10.13	13.54	15.42	5.41	1.69	10.55
S.Em(±)	0.15	1.99	0.27	1.88	NS	2.23	0.12	0.47	2.32
CD at 5%	0.33	4.38	0.59	4.14		4.91	0.26	1.04	5.11

Hort.6: Intercropping in Cashew

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

SUMMARY :

The highest income of Rs. 1,76,180/- was obtained by intercropping elephant foot yam at Vengurla. Similarly, the highest net profit of Rs. 42,123/- per ha was found in cashew + okra at Paria and it was Rs. 34,167/- at Vridhachalam.

Experimental Details :

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

JHARGRAM

Cowpea, green gram and bottle gourd were grown as intercrops under the one year old plantation at 1.0 m distance from the plant. Maximum benefit cost ratio was obtained with bottle gourd (1.79) followed by cowpea (1.73) (Table 2.35).

Table 2.35 : Yield and economics of cashew and intercrops at Jhargram

Treatments	Cost of cultivation (Rs/ha)			Yield of intercrop Q/ha	Return from intercrop (Rs/ha)	Net return (Rs/ha)	Benefit : Cost
	Cashew	Intercrop	Total				
Cashew + Green gram	28,458	7623	36081	7.44	44,640	8559	1.24
Cashew + Cowpea	28,458	10632	39090	68.4	68,400	29310	1.75
Cashew + Bottle gourd	28,458	12500	40958	146.88	73,440	32482	1.79

Price of intercrops : Green gram = Rs. 60, Cowpea = Rs. 10, Bottle gourd = Rs 5/Kg

PARIA

Plant growth parameters showed significant varitation for trunk girth, plant height and E-W canopy; while remaining parameters were found to be non-significant. The highest yield/ha (26.29

q/ha) was recorded in intercropping of okra. The highest net profit of Rs. 42,123 per ha was also found in cashew + okra followed by cashew + Indian bean (Rs.21,104/ha) (Table 2.36).

Table 2.36 : Yield and economics of cashew and intercrops at Paria

Treatment details	Yield of intercrop (q/ha)	Yield of cashew (q/ha)	Returns (Rs./ha)				C:B Ratio
			Cashew	Inter-crop	Total	Net	
T1: Cashew + Pigeon pea	14.452	1.14	7952	28906	36858	18058	0.963
T2: Cashew + Okra	26.291	0.74	5201	65722	70923	42123	1.461
T3: Cashew + Indian bean	10.16	0.83	5810	20312	26122	10122	0.634
T4: Cashew + Indian bean	12.193	0.95	6636	30468	37104	21104	1.322
T5: Cashew + Cowpea	6.27	1.05	7336	15675	23011	7811	0.515
T6: Cashew alone	-	0.16	1120	0	1120	-6880	-0.86
S.Em(±)		0.0018					
CD @ 5%		NS					

VENGURLA

Out of five different tuber crops evaluated, elephantfootyamrecordedsignificantlyhigheryield (33.5 kg/plot and 4.42 t/ha) followed by greater yam (23.25 kg/plot & 3.06 t/ha) and tapioca (11.12 kg/plot & 1.46 t/ha). In addition to this, the main crop of cashew recorded a mean yield of 5.43 kg/ tree and 0.85 t/ha. The highest income of Rs. 1,76,180/-was obtained by intercropping with elephant foot yam (Table 2.37).

Table 2.37 : Yield observations of Intercrops in cashew at Vengurle

Treatment	Inter Crops	Spacing (cm)	Yield (Kg/ plot)	Yield (t/ha)	Local Market Rate (Rs/Kg)	Income (Rs/ha)
T1	Lesser Yam (Kangar)	60 x 60	4.0	0.53	60/-	31,680/-
T2	Greater Yam (Ghorkand)	60 x 75	23.25	3.06	30/-	92,070/-
T3	Aerial Yam (Karanda)	100 x 60	9.88	1.30	40/-	52,170/-
T4	Elephant foot Yam (Suran)	75 x 75	33.5	4.42	40/-	1,76,180/-
T5	Tapioca	100 x 60	11.12	1.46	4/-	5,876/-
S.Em(±)			2.61			
CD at 5%			8.03			
Yield of Cashew (V-1)		8m x 8m	5.43 kg/tree	0.85	100/-	84,700/-

VRIDHACHALAM

The highest net profit of Rs. 34,167/- was obtained from cashew + okra intercropping. Among the intercrops, cashew + amaranthus recorded higher C:B ratio (3.08) followed by cashew + okra (2.71) (Table 2.38).

Table 2.38 : Performance of intercrops in cashew orchard at Vridhachalam

Treatment	Yield of intercrop		Total Cost of Cultivation (Rs.)	Total Returns intercrops/ ha (Rs)	Net profit/ ha (Rs)	C:B Ratio
	Kg/plot (40 m^2)	Kg/ha				
T1 - Cashew + cluster bean	28.3	7083	15000	35416.67	20416.67	2.33
T2 - Cashew + okra	21.7	5417	20000	54166.67	34166.67	2.71
T3 - Cashew + ridge gourd	16.0	4000	25000	40000.00	15000.00	1.60
T4 - Cashew + amaranthus	16.3	4083	10000	40833.33	30833.33	3.08
T5 - Control (Cashew alone)	-	-	5000	-	-	-

Hort.7: Organic Management of Cashew

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

The objective of this trial are 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.

SUMMARY:

Significantly highest trunk girth of 70.83 cm was recorded with application of 100% N as FYM at Bhubaneswar. At Kanbargi, more number of laterals/m^2 (14.10) were recorded in 50 % N as FYM + biofertilizers. Number of nuts /m^2 and yield /tree were highest in case of 100% N as FYM at Jhargram. At Madakkathara, maximum height was recorded (3.46 m) in plants that received green leaf manuring. Application of 25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers recorded maximum fruit set (40.42/m^2) at Vengurla.

Treatments:

T1 - 100 % N as FYM

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

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

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

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

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

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

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

BHUBANESWAR

Application of recommended dose of fertilizer (T8), significantly produced maximum plant height (4.88 m), canopy diameter (7.69 m), canopy surface area (46.57 m^2) and ground coverage by canopy (95.04 %) than rest of the treatments. Significantly highest trunk girth of 70.83 cm was recorded with application of 100% N as FYM (T1) closely followed by T2, T5, T8 and T7. The treatment with 100 % N as Vermicompost + Bio-fertilizers @200 g recorded minimum values for all the growth parameters (Table 2.39).

Table 2.39 : Growth parameters of cashew under organic management at Bhubaneswar

Treatment		Mean tree height (m)	Mean stem girth (cm)	Mean canopy dia. (m)	Mean canopy surface area (m^2)	Ground coverage by canopy (%)
T1	100 % N as FYM	4.78	70.83	7.28	41.69	85.08
T2	100 % N as FYM +Biofertilizers (Azatobacter + Azospirillum + PSB) 200 g	4.45	70.17	6.88	37.24	76.00
T3	50 % N as FYM + Bio- fertilizers (200 g)	4.53	63.83	6.94	37.93	77.41
T4	100 % N as Vermicompost + Bio-fertilizers (200 g)	4.25	55.00	6.44	32.68	66.70
T5	Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	4.50	69.33	7.22	40.94	83.55
T6	In situ green manuring /green leaf manuring to meet 100 % N	4.55	66.00	7.04	39.20	79.99
T7	25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	4.65	67.67	6.96	38.06	77.68
T8	Recommended doses of fertilizer + 10 kg FYM (Control)	4.88	68.50	7.69	46.57	95.04
	SE (m) ±	0.11	1.43	0.16	1.73	3.54
	CD @ 5%	0.33	4.34	0.48	5.26	10.74

DARISAI

Recommended doses of inorganic fertilizer with 10 kg FYM resulted in maximum plant height (2.40m) and ground area coverage by canopy (58.4%) followed by 100% N as FYM in which plant height was 2.10 m. The maximum trunk girth (42.6 cm) was recorded with 100% N as FYM followed by recommended dose of inorganic fertilizer+10kg FYM (38.6 cm)(Table 2.40).

Table 2.40 : Growth parameters of cashew under organic management at Darisai

Treatments	Plant height(m)	No of panicles/ m^2	Canopy spread N-S (m)	Canopy spread E-W (m)	Girth (cm)
T1 - 100% N as FYM	2.10	1.4	2.27	2.30	42.6
T2 - 100% N as FYM and BF (200gm)	1.98	1.7	1.85	1.60	36.4
T3 - 50% N as FYM and BF (200gm)	1.94	0.9	2.40	2.50	33.2
T4 - 100% N as Vermicompost and BF (200gm)	2.00	1.9	2.70	2.60	34.8
T5 - Recycling of organic residue with the addition of 20% cow dung slurry (by weight of organic residue)	1.76	3.2	2.80	2.30	35.9
T6 - In situ green manuring/green leaf manuring to meet 100% N	1.87	2.8	2.50	2.35	36.7
T7 - 25% N as FYM and Recycling of organic residue, In situ green manuring, BF (200gm)	1.92	2.4	2.67	2.65	37.4
T8 - RDF+10kg FYM (control)	2.40	6.3	2.60	2.55	38.6

JHARGRAM

Significant variations among the treatments were noticed with respect to yield attributes. Nuts /m^2 and yield /tree were highest in case of 100% N as FYM, i.e 100 Kg /tree, which was followed by treatment where 100% N as FYM + Biofertilizers (Azospirillum + Azotobactor + PSB) were applied. Cumulative yield for 3 harvests showed that the highest value was with 100% N as FYM and lowest with Recycling of organic residue with the addition of 20 % cow dung slurry (Table 2.41).

Table 2.41 : Growth parameters of cashew under organic management at Jhargram

Treatment	Mean flowering laterals/ m^2	Mean nut weight (g)	Mean apple weight (g)	Mean annual nut yield (kg/ha)	Cum. nut yield (kg/ tree) (3 hvts)
T1 - 100 % N as FYM	14.3	6.3	55.0	7.1	8.9
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	16.7	6.1	56.6	5.5	7.0
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	17.3	6.1	54.4	4.5	5.7
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	15.9	6.5	53.8	3.9	5.1
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	16.2	6.8	55.8	3.6	4.8
T6 – In situ green manuring / green leaf manuring to meet 100 % N	17.2	6.8	59.8	3.7	5.2
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	16.6	6.5	60.1	3.9	5.2
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	14.9	6.3	56.6	3.6	5.0
S.Em(±)	1.51	0.1	0.4	0.3	0.4
CD @ 5%	3.24	0.22	0.88	0.64	0.78

KANBARGI

Among the organic treatments evaluated, no significant difference with growth parameters was observed. However, highest plant height (145.10cm) and plant spread (160.30cm EW & 169.40 cm NS) was observed in recycling of organic residue with the addition of 20 % cow dung slurry (20 % weight of organic residue as cow dung). More number of laterals/m^2 (14.10) were recorded in 50 % N as FYM + Biofertilizers.

MADAKKATHARA

Maximum tree height was recorded (3.46 m) with the application of green leaf manuring. This was on par with 100 % N as FYM, 100% N as FYM + BF, 100% N as VC + BF and in 25% N as FYM + recycling organic residues + green leaf/ green manuring + BF. The girth and canopy spread (both NS & EW) of the plants did not vary significantly in response to various treatments (Table 2.42).

Table 2.42 : Growth parameters of cashew under organic management at Madakkathara

Treatments	Height (m)	Girth (cm)	Canopy spread –NS (m)	Canopy spread –EW (m)
T1 – 100 % N as FYM	3.23	60.0	5.53	5.00
T2 – 100% N as FYM + BF	2.96	46.0	5.46	5.13
T3 – 50% N as FYM + BF	2.60	48.3	5.20	5.33
T4 – 100% N as VC + BF	2.80	54.3	5.00	5.90
T5 – Recycling organic residues	2.33	65.0	5.33	5.36
T6 – Green leaf/ green manuring	3.46	56.0	5.20	5.53
T7 – 25% N as FYM + recycling organic residues + green leaf/ green manuring + BF	3.23	54.3	5.10	5.60
T8 – RDF + 10 kg FYM (Control)	3.00	48.3	4.53	5.13

VENGURLA

The treatment, RDF + 10 Kg FYM (control) recorded higher mean height (4.10 m), mean canopy height (4.37 m), mean canopy height (3.40 m). Whereas, in situ green manuring / green leaf manuring to meet 100% N recorded maximum mean canopy area (17.10 m^2) and mean canopy surface area (30.23 m^2). In case of mean fruit set/ m^2 the treatment, 25% N as FYM + Recycling of organic residues + In situ green manuring/ green leaf manuring + Biofertilizers, recorded least flowering duration (98.4 day). The highest number of panicles per sq.m (17.42) was observed in T6 i.e., in situ green manuring / green leaf manuring to meet 100% N (Table 2.43 & 2.44).

Table 2.43 : Growth parameters of cashew under organic management at Vengurla

Treatments	Mean Plant ht. (m)	Mean Stem Girth (cm)	Mean Canopy Spread (m)	Mean Canopy height (m)	Mean Canopy Surface area (m^2)
T1 - 100% N as FYM	3.43	45.63	4.00	2.77	22.73
T2 - 100% N as FYM + Biofertilizers (Azatobacter + Azospirillum + PSB*)	3.67	46.58	4.00	2.97	24.90
T3 - 50% N as FYM + Biofertilizers	3.37	46.30	3.53	2.73	20.03
T4 - 100% N as Vermicompost + Biofertilizers	3.47	44.80	4.03	2.70	22.57
T5 - Recycling of organic residues with addition of 20% cow dung slurry	3.47	46.47	3.47	2.83	18.83
T6 - In situ green manuring/green leaf manuring to meet 100% N	4.10	48.83	4.33	2.37	30.23
T7 - 25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers	3.10	46.83	4.00	2.47	19.57
T8 - RDF + 10 kg FYM (Control)	4.10	47.33	4.37	3.40	29.53
S.Em(±)	0.29	2.76	0.31	0.30	3.49
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.

Table 2.44 : Yield parameters of cashew under organic management at Vengurla.

Treatments	Mean No. of laterals/ m^2	Mean No.of panicle /m^2	Mean Flowering duration (days)
T1 - 100% N as FYM	25.83	15.08	103.5
T2- 100% N as FYM + Biofertilizers (Azatobacter + Azospirillum + PSB*)	24.92	15.17	105.3
T3 - 50% N as FYM + Biofertilizers	23.67	16.92	100.7
T4 - 100% N as Vermicompost + Biofertilizers	26.08	15.58	105.4
T5 - Recycling of organic residues with addition of 20% cow dung slurry	25.00	15.92	103.3
T6 - In situ green manuring/green leaf manuring to meet 100% N	31.33	17.42	100.8
T7 - 25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers	26.00	15.33	98.4
T8 - RDF + 10 kg FYM (Control)	26.58	14.58	103.5
S.Em(±)	1.40	0.52	2.16
CD at 5%	N.S.	1.57	N.S.

VRIDHACHALAM

Application of inorganic fertilizers recorded the highest values for panicles per sq.m (22.5) mean surface area (32.5m^2), mean, nut yield (6.00kg/ tree) and cumulative yield 15.5kg/tree followed by 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g) (28.8 m^2; 20.0; 5.50 kg/tree respectively)(Table 2.45 & 2.46).

Table 2.45 : Growth parameters of cashew under organic management at Vridhachalam

Treatment	Mean tree height (m)	Mean stem girth (cm)	Mean canopy surface area (m^2)	Ground coverage by canopy (%)
T1 - 100 % N as FYM	3.8	41.5	26.4	53.0
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	3.8	39.5	26.8	62.7
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	3.6	39.5	27.6	67.3
T4 - 100 % N as Vermicompost + Bio-fertilizers (200 g)	3.6	42.5	28.5	67.3
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	3.8	39.5	26.0	72.9
T6 – In situ green manuring / green leaf manuring to meet 100 % N	3.6	43.0	28.5	68.6
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	3.8	44.5	28.8	71.0
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	3.8	43.5	32.5	59.4
S.Em(±)	0.208	2.319	1.580	3.509
CD @ 5%	0.097	1.0813	0.736	1.636

Table 2.46 : Yield parameters of cashew under organic management at Vridhachalam

Treatment	Mean flowering duration (days)	Mean lowering laterals/ m^2	Mean nut weight (g)	Mean apple wt. (g)	Mean annual nut yield (kg/ha)	Cum. nut yield (Kg/tree) (4 hvts)
T1 - 100 % N as FYM	65	18.0	6.8	52.0	4.00	12.0
T2 - 100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	68	17.5	6.8	53.5	4.00	12.6
T3 - 50 % N as FYM + Bio-fertilizers (200 g)	65	18.0	6.8	52.5	4.5	12.2
T4 -100 % N as Vermicompost + Bio-fertilizers (200 g)	66	15.0	6.9	55.0	4.25	14.5
T5 - Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	65	17.5	6.8	50.0	4.25	13.8
T6 – In situ green manuring / green leaf manuring to meet 100 % N	65	18.5	6.8	50.5	4.25	12.5
T7 - 25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	68	20.0	6.8	55.0	5.50	14.8
T8 - Recommended doses of fertilizer + 10 kg FYM (Control)	68	22.5	6.9	57.5	6.00	15.5
S.Em(±)	3.730	1.041	0.383	3.009	0.257	0.752
CD at 5%	1.739	0.485	0.178	1.403	0.119	0.350

Hort.8 : Spacing cum fertilizer trial

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

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

KANBARGI

Plant height was highest (131.20cm) in 8m x 8m spacing followed by 10m x 10m spacing (120.10cm). Interaction effect of spacing and fertilizer resulted in highest plant height in S2F2 (134.60cm) followed by S1F2 (133.70cm). Stem girth was highest in S1F3 (37.97cm) (Table 2.47 & 2.48).

Table 2.47 : Effect of different levels of spacing on growth of cashew

	Treatments	Plant height (cm)	No. of Laterals/m^2	Stem girth (mm)
S1	8m x 8m	131.2	6.8	37.489
S2	10m x 10m	120.1	6.4	33.864
S3	6.5m x 6.5 m	113.3	5.6	34.398
	S.Em±	3.54	0.36	1.04
	CD at 5%	10.62	1.10T	3.132

Table 2.48 : Effect of different levels of fertilizer on growth of cashew

	Treatments	Plant height (cm)	No. of Laterals/m^2	Stem girth (mm)
F1	52:13:13 g NPK/plant /year	119.5	6.0	36.02
F2	78: 20:20 g NPK/plant/year	122.3	6.2	34.77
F3	117: 29: 29g NPK/plant/year	122.8	6.5	34.96
	S.Em±	3.54	0.36	1.04
	CD at 5%	10.62	1.10	3.132

Hort.10: Varietal Screening of cashew apple for preparation of RTS and Jam

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

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

BAPATLA

The organoleptic evaluation of RTS prepared from cashew apple of different varieties showed higher scores for BPP-8 with respect to colour, flavour, appearance, sweetness and overall acceptability. with respect to the shelf life, BPP-1, 2, 5 and 9 had spoilage after 120 days due to growth of fungi and bacteria when stored at room temperature (Table 2.49).

Table 2.49 : Evaluation of organoleptic score of RTS for cashew apple

Variety	Taste	Colour	Flavour	Appearence	Overall Acceptability	Sweetness	Shelf Life (Days)
BPP-1	3.20	3.20	2.80	3.40	3.00	2.40	120
BPP-2	3.00	3.00	2.80	3.40	2.80	2.40	120
BPP-3	2.80	3.20	2.80	3.20	2.80	2.20	-
BPP-4	2.80	3.00	2.80	3.40	2.60	2.20	-
BPP-5	2.60	2.60	2.80	3.60	2.80	2.20	120
BPP-6	2.40	3.00	2.60	3.20	2.60	2.20	120
BPP-8	3.00	3.40	3.00	3.40	3.00	2.60	-
BPP-9	2.80	3.00	2.80	3.20	2.40	2.40	-
BPP-10	2.60	3.00	2.60	2.80	2.20	2.40	-
BPP-11	2.60	3.00	2.40	2.80	2.20	2.20	-
SEm ±	0.214	0.265	0.214	0.316	0.219	0.224	-
CD at 5%	NS	NS	NS	NS	NS	NS	-

VENGURLA

Among the 8 cashew varieties tested for preparation of RTS and jam, V-1 had the highest acceptability of 3.93 with respect to RTS and V-8 had the highest acceptability of 3.83 in case of jam. Maximum score for taste was 3.85 in V-1 in case of RTS and 4.00 in V-8 in case of jam (Table 2.50).

Table 2.50 : Organoleptic evaluation of RTS and jam prepared from different varieties

a. R T S

Variety	Taste	Colour	Flavour	Total acceptability
V-1	3.85	3.71	3.85	3.93
V-2	3.42	3.67	3.14	3.42
V-3	3.42	3.71	3.42	3.06
V-4	3.67	3.42	3.85	3.59
V-5	3.28	3.00	3.00	3.14
V-6	3.28	3.71	3.28	3.55
V-7	3.14	3.42	3.00	3.25
V-8	3.14	3.42	3.14	3.29

b. Jam

Variety	Taste	Colour	Flavour	Total acceptability
V-1	3.57	4.00	4.00	3.71
V-2	3.14	2.42	3.42	3.09
V-3	3.42	3.85	3.42	3.62
V-4	3.00	3.28	3.28	3.17
V-5	3.00	3.71	3.28	3.38
V-6	3.42	3.67	3.67	3.48
V-7	3.42	4.00	3.71	3.69
V-8	4.00	4.00	3.86	3.83

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, Bhubaneshwar, Jhargram and Vridhachalam
West Coast : Madakkathara, Vengurla and Paria
Plains/others : Hogalagere and Jagdalpur

The project aims at identifying the effective insecticides among 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.

SUMMARY:

At Bapatla, L-cyhalothrin (0.003%) was found to be effective in controlling the leaf and blossom webber, shoot tip caterpillar, leaf miner and apple and nut borer. Thrips damage score was less than 1.0 in the apple in case of L-cyhalothrin (0.003%) at Bhubaneswar. The maximum nut yield (7.46 kg/tree) was recorded in the treatment L-cyhalothrin 0.003% at Hogalagere. At Vengurla, the least damage by thrips (0.77) was recorded in the treatment of acetamiprid (0.004%).

Treatment details:

T1 - Neem oil soap (4%) followed by L- cyhalothrin (0.6ml/l) followed by neem oil soap
T2 - Imidacloprid (0.6ml/lt)
T3 - Acetamaprid 20SP(0.5 g/l)
T4 - L-cyhalothrin 0.003%
T5 - Monocrotophos 0.05% at flushing, chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage.
T6 – Untreated control

BAPATLA

L-cyhalothrin (0.003%) was found to be effective in controlling the leaf and blossom webber and the treatments neem oil soap (4%) followed by L-cyhalothrin (0.6ml/l) followed by neem oil soap and monocrotophos 0.05% at flushing, chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit and nut development stage were found be on par with each other against leaf and blossom webber. With regard to shoot tip caterpillar, leaf miner and apple and nut borer, L-cyhalothrin (0.003%) was found to be more effective compared to rest of the treatments (Table 3.1).

Table 3.1 : Efficacy of certain new insecticides against pest complex in cashew at Bapatla

Treatment	Shoot tip caterpillar damaged shoots (%)	Apple and nut borer damage (%)	Thrips damage score at 30 DAS	LBW damage shoots (%) 30 DAS	Leaf miner (%) 30 days after 3rd spray
T-1 Neem oil soap (4%) - L-Cyhalothrin -(0.003%) - neem oil soap (4%)	15.30 (21.8) c	14.3 (22.0)c	1.8 (6.5)b	9.45 (17.6)b	6.6 (15.0)b
T-2 Imidacloprid (0.6 ml/l) all 3 sprays	17.10 (23.8)cd	17.30 (24.1)d	0.6 (4.4)a	18.37 (24.8)c	11.5 (19.9)c
T-3 Acetamiprid (0.5g/l) all 3 sprays	18.5 (24.6) d	14.20 (21.4)c	0.8 (4.1)a	16.9 (24.2)c	15.20 (22.6) d
T-4 L-cyhalothrin (0.003%) all 3 sprays	0.0 (0.0)a	6.40 (14.4)a	0.85 (4.1)a	3.67 (10.9)a	0.4 (1.6)a
T-5 Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage.	9.10 (17.1)b	12.0 (19.8)b	1.80 (8.3)c	10.44 (18.9)b	15.6 (22.6)d
T-6 Untreated control	36.70 (36.5)e	27.0 (31.9)e	2.85 (9.8)d	22.68 (28.2)d	32.4 (34.0)e
CD at 5%			0.31	3.80	3.31

Figures in parentheses are arc sin transformed values.
Figures followed by same alphabet (s) are not differing significantly at 5% level.

BHUBANESWAR

All the insecticidal treatments were found significantly superior over the untreated control. Least incidence of TMB (0.10) was observed in L-cyhalothrin, while incidence of TMB was 1.09 in untreated control. Treatment L-cyhalothrin (0.003%) + prophenophos + L-cyhalothrin was the most effective in reducing leaf miner damage. Among the insecticidal treatments both L-cyhalothrin and L-cyhalothrin (0.003%) + prophenophos + L-cyhalothrin were significantly most effective against the pest and were at par.

Thrips damage score was less than 1.0 on the apple in case of L-cyhalothrin (0.003%) + prophenophos + L-cyhalothrin and L-cyhalothrin alone, which were at par. The thrips damage score was greater than 2.0 recorded in untreated control (Table 3.2).

Table 3.2 : Efficacy of insecticides against pest complex in cashew at Bhubaneswar

Treatment	TMB damage score	Leaf miner (% damaged leaves) 30 Day	STC (% damaged shoots)	Thrips damage score	
				On apple	On nut
T-1 Neem oil soap (4%) - L-cyhalothrin -(0.003%) - neem oil soap (4%)	0.43	0.09 (1.04)b	23.82 (29.20)b	31.00 (33.80)b	38.28 (38.26)c
T-2 Imidacloprid 17.8 SL (0.6 ml/l) all 3 sprays	0.17 (0.82)	2.42 (1.70)	0.99 (1.21)	1.19 (1.30)	0.46 (0.97)
T-3 Acetamiprid 20 SP (0.5G/l) all 3 sprays	(0.81)	3.08 (1.88)	1.37 (1.36)	1.15 (1.28)	0.36 (0.93)
T-4 L-cyhalothrin (0.003%) all 3 sprays	0.10 (0.76)	2.17 (1.63)	0.55 (1.02)	1.07 (1.25)	0.20 (0.83)
T-5 L-cyhalothrin (0.003%)- Prophenophos -L-cyhalothrin	0.13 (0.79)	1.08 (1.25)	0.52 (1.00)	0.94 (1.20)	0.10 (0.77)
T-6 Untreated control	1.37 (1.47)	26.53 (5.19)	3.84 (1.95)	2.50 (1.73)	0.46 (0.97)
CD at 5%	0.129	0.34	0.27	0.064	0.087

HOGALAGERE

TMB damage at 15 days after spray ranged from 0.72 to 3.45 on young shoots and 0.77 to 3.52 on panicles in the treatment with L-cyhalothrin 0.003% in all the sprays followed by recommended spray for the region and Triazophos. Chlorpyriphos and profenofos were least effective in controlling the TMB and were at par with unsprayed check. The maximum nut yield (7.46 kg/tree) was recorded in the treatment L-cyhalothrin 0.003% followed by recommended spray for the region (5.32 kg/tree) and triazophos 0.1% (4.52 kg/tree) (Table 3.3).

Table 3.3 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Chintamani

Treatments		TMB damage (0-4 scale)				Nut Yield (Kg/tree)
		On shoots (%)		On panicles (%)		
		BS	15 DAS	BS	15 DAS	
T1	Recommended spray for the region	3.41	1.20	3.47	1.10	5.32
T2	Chlorpyriphos 0.05%	3.50	1.55	3.42	1.77	2.74
T3	Triazophos 0.1 %	2.77	1.27	3.65	1.20	4.52
T4	L - Cyhalothrin 0.003 %	3.57	0.72	3.37	0.77	7.46
T5	Profenofos 0.05 %	2.80	1.55	3.22	1.90	2.18
T6	Unsprayed check	3.72	3.45	3.77	3.52	1.68
SEm+		0.56	0.07	0.14	0.08	0.21
CD at 5%		1.68	0.22	0.41	0.24	0.58

* TMB – Tea Mosquito Bug, BS-Before spray, DAS- Days after spray

The minimum damage by apple and nut borer (6.32%), leaf miner (0.70%), thrips on nuts (0.25) as well as on apple (0.16), aphids (0.10) and mealy bug (0.50) was recorded in L-cyhalothrin 0.003% followed by recommended spray for the region and triazophos treatments at Chintamani.

JAGDALPUR

The damage score by TMB on shoots was least (0.01) in L-cyhalothrin while in panicles it was least (0.01) in acetamiprid treatment. L-cyhalothrin was most effective against leaf folder (21.65% damaged leaves) and leaf caterpillar (23.87% damaged leaves). Profenophos was effective on leaf miner (19.26% damaged leaves) and on thrips damage on nuts (0.66) (Table 3.4).

Table 3.4 : Efficacy of different insecticides against tea mosquito bug incidence in cashew at Jagdalpur

Treatments		TMB		Leaf miner (%)	Leaf folder (%)	Leaf caterpillar (%)	Thrips damage score on nuts
		On shoots (%)	On panicles (%)				
T1	Neem oil soap (4%) followed by L- cyhalothrin (0.6ml/l) followed by Neem oil soap	0.09 (1.04)b	0.09 (1.04)b	23.82 (29.20)b	31.00 (33.80)b	38.28 (38.26)c	1.36 (1.53)b
T2	Imidacloprid (0.6ml/lt)	0.06 (1.02)b	0.02 (0.01)a	33.68 (35.45)c	36.80 (37.32)cd	28.84 (32.46)b	1.31 (1.51)b
T3	Acetamiprid 20SP(0.5 g/l)	0.02 (0.01)a	0.01 (0.01)a	23.92 (29.26)b	33.97 (35.67)bc	26.87 (32.20)a	1.59 (1.60)bc
T4	L-cyhalothrin 0.003%	0.01 (0.01)a	0.04 (0.02)a	22.35 (28.18)b	21.65 (27.71)a	23.87 (29.23)a	0.85 (1.35)a
T5	Profenophos	0.05 (0.02)a	0.05 (0.02)a	19.26 (26.01)a	24.42 (29.59)a	28.73 (32.55)b	0.66 (1.28)a
T6	Untreated control	1.12 (1.22)c	0.89 (1.35)c	40.25 (39.36)d	39.00 (38.63)d	42.97 (40.93)c	1.97 (1.76)d
	CD at 5%	0.03	0.05	1.46	1.88	2.72	0.13

MADAKKATHARA

After the third spray, no damage of TMB was observed with exception of triazophos and profenophos treatments which recorded 0.17 damage score. The damage on panicles was nil after third spray and the maximum yield was realized from the recommended packages of practices of KAU (2.92kg/tree) followed by chlorpyriphos (2.35kg/tree) (Table 3.5).

Table 3.5 : Effect of different insecticides against damage by tea mosquito bug in cashew at Madakkathara

Treatments	Incidence of TMB		Nut yield (kg/tree/yr)(2012-13)
	Shoot After 3rd spray	Panicle After 3rd spray	
T-1: KAU POP	0.000	0.000	2.92
T-2: Chlorpyriphos	0.000	0.000	2.35
T-3: Triazophos	0.017	0.000	1.15
T-4: L-cyhalothrin	0.000	0.000	1.59
T-5: Profenophos	0.017	0.000	2.09
T-6: Control	0.000	0.000	2.32

PARIA

The least damage score caused by TMB (0.95 & 1.01) respectively for shoots and panicles) was recorded in the treatment of acetamiprid 0.004% and also by thrips (0.77) with the same treatment. The lowest infestation (17.77 % & 12.39 % respectively for leaf miner and apple and nut borer) was found in the treatment of L-cyhalothrin (0.003%), which was statistically at par with acetamiprid. Similarly, the lowest infestation (15.36 % & 12.62 % respectively for leaf and blossom webber and shoot tip caterpillar) were recorded in the treatment of acetamiprid, however, it was statistically at par with L-cyhalothrin (0.003%). All the insecticidal treatments were found significantly superior to untreated control.

VENGURLA

All the insecticidal treatments significantly reduced the incidence of TMB over control. Among the insecticidal treatments, Lambda-cyhalothrin (0.003%) was significantly superior over rest of the treatments after first, second and third spray followed by recommended spray schedule for the region and acetamiprid (0.5 g/l) all the three sprays . Imidachloprid could significantly reduce the incidence of thrips compared to all treatments after third spray, it was followed by L-cyhalothrin (0.003%) (Table 3.6).

Table 3.6 : Incidence of tea-mosquito bug in various treatments at Vengurla

Treatment details	TMB Damage score after third spray	Thrips damage score	Pre treatment damage	Mean
T1	First spray with Neem oil soap (4%) followed by L-cyhalothrin (0.003%) as second spray within 15 days followed by neem oil soap (4%) as third spray	0.23	0.16	0.10
T2	Imidachloprid 17.8 SL (0.6ml/l) all the three sprays	0.24	0.19	0.07
T3	Acetamaprid 20 SP (0.5 g/i) all the three sprays	0.20	0.13	0.10
T4	L-cyhalothrin (0.003%-0.6ml/l) all the three sprays	0.16	0.08	0.09
T5	Recommended spray schedule for the region	0.14	0.12	0.11
T6	control	0.20	0.29	0.19
	SEm ±	0.02	0.36	0.14
	CD at 5%	NS	0.11	0.04

Ent. 2: Control of cashew stem & 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.

SUMMARY:

Chlorpyriphos (0.2%) recorded 93.33per cent trees without reinfestation at Vengurla and 88.89% trees without reinfestation at Hogalagere. Maximum recovery (82%) of treated trees was observed in chlorpyriphos (0.2%) followed by triazophos (0.2%) at Bhubaneswar. At Vridhachalam, 63.9% of trees which recovered had less than 25% damaged bark circumference, while, trees having 26-50% bark damage recorded only 16.2% recovery.

Treatments :

T1 = Carbaryl (1%)
T2 = Chlorpyriphos (0.2%)
T3 = Monocrotophos (0.2%)
T4 = Lindane (0.2%)
T5 = Metarhizium anisopliae fungus spawn 250gm/tree + 500gm neem cake
T6 = Control (only removal of CSRB stages)

BHUBANESWAR

Maximum recovery (82%) of treated trees was observed in chlorpyriphos (0.2%) followed by triazophos (0.2%). In control involving only extraction of CSRB grub, 33 per cent of the treated trees recovered from reinfestation, but the frequency of treatment was more than 3. In case of stem girth less than 60cm, reinfestation of treated trees was the least i.e. 13 per cent. With the increase in stem girth i.e. above 60 cm reinfestation of CSRB was found to be higher (>24 %). Tree in the age group less than 5 years showed no reinfestation of CSRB and those in age group 10-15 years and > 15 years showed 33.0 and 36.0 per cent reinfestation respectively. The zone of attack was more in collar + stem + root (75%). Similarly, more than 50–75 per cent bark damage showed higher CSRB reinfestation (Table 3.7 & 3.8).

Table 3.7: Efficacy of post extraction prophylaxis treatments (PEP) againt CSRB at Bhubaneswar.

Treatment	No. of trees treated	No. of trees without reinfestation	Recovery (%)
Chlorpyriphos (0.2%)	17	14	82.0
Triazophos (0.2%)	15	10	67.0
Untreated check (removal of grub only)	12	4	33.0

Table 3.8 : Physical parameters of CSRB treated trees

Parameters		No. of trees treated	No. of reinfested	% reinfested	No. of trees not reinfested	% of trees not reinfested
Stem girth (cm)	< 60 cm	8	1	13	7	87
	60-80 cm	17	4	24	13	76
	80-100 cm	15	4	27	11	73
	>100 cm	7	2	29	5	71
	Total:	47	11		36	
Age of tree (yrs)	<5	5	0	0	5	100
	5-10	22	2	9	20	91
	10-15	14	5	36	9	64
	>15	6	2	33	4	67
	Total	47	9		38	
Zone of attack	C+R	8	2	25	6	75
	C+S	12	5	42	7	58
	R	3	0	0	3	100
	S	8	1	13	7	87
	C+S+R	16	12	75	4	25
	Total	47	20		27	
Yellowing of canopy	Yellowed	4	3	75	1	25
	Not yellowed	43	22	51	21	49
	Total	47	25		22	
%bark circumference damage	<25	10	2	20	8	80
	26-50	14	2	14	12	86
	51-75	17	14	82	3	18
	>75	6	6	100	0	0
	Total	47	22		23	

HOGALAGERE

Chlorpyriphos (0.2%) was found to be effective against CSRB resulting in 88.89% trees without reinfestation. In treated check, where only grubs extraction of pest stages was adopted, it was observed that only 28.57 percent of treated trees could recover (Table 3.9).

Table 3.9 : Efficacy of post extraction prophylaxis (PEP) treatments against CSRB at Chintamani

Treatment	Total number of trees treated	No. of trees without reinfestation	% trees without reinfestation
Carbaryl 1.0%	15	10	66.67
Chlorpyriphos 0.2%	21	18	88.89
Monocrotophos 0.2%	20	12	60.00
Lindane 0.2%	18	16	85.71
Untreated check (only removal of CSRB grubs)	21	6	28.57
Treated check with most effective treatment under prophylactic trials	17	7	41.18
Total	112	69	-

Trees with 60-100 cm stem girth showed maximum damage (50.00 %) and trees more than 15 years old were prone to CSRB damage. The zone of CSRB attack was maximum at collar + root + stem (64.81%) and canopy yellowing of trees was observed in 12.96 per cent of treated trees. The bark circumference damage was less than 25 per cent in 57.41 per cent of the infested trees.

Among the insecticides evaluated as post extraction prophylaxis, chlorpyriphos (0.2%) recorded the highest (80%) recovery of treated trees followed by monocrotophos (0.2%) and carbaryl (1%) with 60% per cent recovery. Swabbing with 5 per cent neem oil soap recorded 50 per cent recovery. In untreated check with grub extraction only the recovery was only 13.3 per cent (Table 3.10).

MADAKKATHARA

Table 3.10 : Efficacy of post extraction prophylaxis (PEP) against CSRB (post prophylaxis treatments) at Madakkathara

	Treatment details	% trees without reinfestation
T-1	Carbaryl (1%)	60.0
T-2	Chlorpyriphos (0.2%)	80.0
T-3	Monocrotophos (0.2%)	60.0
T-4	Untreated check (grub-extraction only)	13.3
T-5	Most effective prophylactic treatment (swabbing neem oil soap 5%)	50.0

Out of total trees re-infested, 61 per cent of the trees had stem girth of more than 100 cm. In trees with stem girth less than 60 cm re-infestation by the pest was not observed. Cent per cent of trees re-infested were within the age group of more than 10 years. Out of 26 re-infested trees, 59 per cent had infestation at collar and stem region (Table 3.11).

Table 3.11 : Physical parameters of treated trees at Madakkathara

Physical parameters		No. of trees	No. of trees	Per cent of trees
		Without re- infestation	With re- infestation	
Stem girth (cm)	<60	2	0	0
	60 - 80	3	1	2
	80 – 100	14	17	37
	>100	34	28	61
Total		53	46	
Age in years	< 5	0	0	0
	5 -10	0	0	0
	10 – 15	24	30	65
	>15	29	16	35
Total		53	46	
% of bark circumference damaged	< 25	20	13	28
	25 – 50	17	15	33
	50 – 75	10	13	28
	>75	6	5	11
Total		53	46	
Zone of attack	C + R	5	6	13
	C + S	25	27	59
	R	14	4	9
	C	2	1	2
	C + R + S	7	8	17
Total		53	46	
Canopy yellowing	Yellowed	0	0	0
	Not yellowed	53	46	100
	Total	53	46	

VENGURLA

Chlorpyriphos (0.2%) recorded 93.33 per cent trees without reinfestation followed by Chlorpyriphos (0.1%) (73.34 per cent)

In control treatment with only physical removal of grubs, the percentage of trees without reinfestation was least (53.33 %) (Table 3.12).

Table 3.12 : Efficacy of post extraction properties against CSRB at Vengurle

Treatment details	% trees without infestation
Treatment % tree without reinfested	
T1- Carbaryl (1%)	Not available
T2- Chloropyriphos (0.2%)	93.34
T3- Monocrotophos (0.2%)	-
T4 Chloropyriphos (0.1%)	73.34
T5- Effective treatment in prophylactic trail (Swabbing Neem oil 5% during Oct.- Nov., Jan. – Feb. and April - May)	60.00
T6- Physical removal of grubs - Control	53.33

VRIDHACHALAM

Maximum recovery of 44.00% was noted in monocrotophos (0.2%) treated trees, which was on par with chlorpyriphos (0.2%) treated trees with 40.30% recovery. Treatments with carbaryl (1.0%), Lindane (0.2%) and neem oil (5.0%) led to 37.5, 30.0 and 35.0% recovery respectively as against mere 5.55% recovery in untreated control, involving removal of grubs. Chlorpyriphos reduced CSRB infestation, with a mean cost of Rs.60 per tree. Nearly 63.9% of trees recovered had less than 25% damaged bark circumference, while trees with 26-50% bark damage recorded only 16.2% recovery. Trees with 51-75% and more than 75% bark damage with yellowing of canopy did not show any recovery (Table 3.13 & 3.14).

Table 3.13 : Efficacy of post extraction prophylaxis (PEP) treatments against CSRB at Vridhachalam

Treatment	Total number of trees treated	No. of trees without reinfestation / persistant attack	% trees without reinfestation / persistant attack
Carbaryl 1.0%	24	09	37.50
Chlorpyriphos 0.2%	27	11	40.30
Monocrotophos 0.2%	25	11	44.00
Lindane 0.2%	20	06	30.00
Untreated check			
(only removal of CSRB grubs)	18	01	05.55
Treated check with most effective treatment under prophylactic trails	20	07	35.00

Table 3.14 : Physical parameters of treated cashew trees under post extraction prophylaxis (PEP) trial at Vridhachalam

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	08	06.0	19	14.2
	60-100 cm	47	35.0	19	14.2
	> 100 cm	34	25.4	07	05.2
Total		89	66.4	45	33.6
Age of the tree	<10 years	22	16.4	35	26.1
	10-15 years	31	23.1	06	04.5
	>15 years	36	26.9	04	03.0
Total		89	66.4	45	33.6
Zone of attack	C + R	20	15.0	07	05.2
	C + S	08	06.0	24	18.0
	C + S + R	61	45.5	14	10.3
Total		89	66.5	45	33.5

Physical parameters		No. of trees infested after PEP	% out of total trees	No. of trees not reinfested after PEP	% out of total trees
Yellowing of canopy	Canopy yellowing	42	31.4	0.0	0.0
	Canopy not yellowing	47	35.0	45	33.6
Total		89	66.4	45	33.6
% of bark circumfer-ence damaged	< 25	22	16.4	39	29.1
	26-50	31	23.1	06	04.4
	51-75	24	18.0	00	00
	>75	12	09.0	00	00
Total		89	66.5	45	33.5

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

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

The objective of the experiment is to investigate the population dynamics of pests of regional importance and to correlate it to prevalent weather parameters.

SUMMARY:

Maximum temperature had positive correlation with tea mosquito bug (TMB) activity at Bhubaneswar, Hogalagere and Vengurla Centres. However, rainfall and minimum temperature had negative correlation with TMB at Bhubaneswar, Madakkathara, Paria and Vengurla. Yellow thrips and black thrips incidence had significant negative correlation with minimum temperature and RH at Bhubaneswar. At Paria, the leaf miner was significantly negatively correlated with evaporation rate and sun shine hours (r=-0.57307). The apple and nut borer showed positive correlation with maximum temperature and significant negative correlation with minimum temperature at Vengurla.

BAPATLA

All weather parameters accounted for 80.56 percent variation in percent shoot damage by leaf and blossom webber (r=0.8056), while they accounted for 37.29% of total variation in percent leaf damage by leaf miner (r=0.3729) and for 42.44 percent variation in percent leaf damage by leaf folder (r=0.4244). The weather parameters accounted for 58% of total variation in percent shoot damage by shoot tip caterpillar (r=0.5891). The weather parameters accounted for 52% of total variation in percent nut damage by ANB (r=0.52278) (Table 3.15).

Table 3.15: Correlation of weather parameters with pest complex of cashew at Bapatla

wether parameters	Leaf & blossom webber	Leaf Miner	Leaf folder	Shoot tip caterpillar	Apple & nut borer
Maximum Temp	0.08489	0.06797	-0.00968	-0.54173	-4.05267
Minimum Temp	0.14854	-0.75323	-0.67814	-0.60267	2.35874
RH (m)	0.04082	-0.29384	-0.38725	-0.49972	-0.88798
RH (e)	-0.03318	0.14071	0.07869	0.13761	-0.26017
Rain fall	-0.00191	0.00891	0.02278	0.01105	-0.10778

BHUBANESWAR

Maximum temperature (0.276) and bright sunshine hour (0.427) showed positive correlation with TMB, but established a negative correlation with the rainfall. In case of leaf miner and shoot tip caterpillar, a positive correlation was observed between pest incidence and all the environmental parameters. In case of yellow thrips and black thrips minimum temperature and RH had significant negative correlation with pest incidence. The population of thrips was maximum during the month of March i.e. 6.2 per panicle. Aphids *(Toxoptera odinae)* showed a positive

correlation with all environmental parameters. The correlation study on CSRB and environmental parameters revealed a positive correlation for maximum and minimum temperature and negative correlation for the remaining weather factors (Table 3.16).

Table 3.16 : Correlation of weather parameters with the pests complex of cashew at Bhubaneswar

Cashew Pests	Temp. (Max)	Temp (Min)	RH (morn)	RH (evn)	RF	BSH
TMB	0.276	-0.534	-0212	-0.406	-0.072	0.427
LM	0.759	0.701	0.324	0.568	0.595	0.832
STC	0.998	0.934	0.198	0.668	0.958	0.865
YT	0.425	-0.136	-0.624	-0.638	-0.426	0.454
BT	0.324	-0.314	-0.536	-0.322	-0.334	0.446
Aphids	0.912	0.853	0.233	0.814	0.979	0.877
CSRB	0.756	0.568	-0.586	-0.025	-0.224	0.036

TMB-Tea Mosquito Bug, LM- Leaf miner, STC- Shoot tip caterpillar, YT- Yellow thrips, BT- Black thrips, CSRB- Cashew stem and root borer

HOGALAGERE

Maximum temperature (0.298) and sunshine hours (0.478) had a positive relation with TMB, but negative correlation with morning and evening relative humidity (-0.222 & -0.419) and rainfall (-1.023). Mealy bug had negative correlation with minimum temperature (-0.723), evening relative humidity (-0.493) and rainfall (-0.491).

Apple and nut borer had negative correlation with evening relative humidity (-0.569) and rainfall (-0.590). Leaf miner showed the positive correlation with morning and evening relative humidity (0.490 and 0.181) The infestation of thrips showed negative correlation with minimum temperature (-0.300), evening relative humidity (-0.367) and rainfall (-0.380) and positive correlation with maximum temperature (0.005) The aphid infestation had a positive correlation with maximum temperature (0.005), morning relative humidity (0.913), number of rainy days (0.800) and sunshine hours (0.406) (Table 3.17).

Table 3.17: Correlation of weather parameters and different insect pests recorded on cashew at Chintamani

Weather Parameters	TMB	CSRB	MB	ANB	LM	Thrips	Aphids
X1 - Maximum Temp	0.298	0.807	0.039	0.030	- 0.041	0.005	0.005
X2 - Minimum Temp	- 0.564	0.510	- 0.723	0.878	- 0.680	- 0.405	- 0.350
X3 - RH (m)	-0.222	- 0.440	0.275	0.238	0.490	0.913	0.913
X4 - RH (e)	- 0.419	- 0.311	- 0.493	- 0.569	0.181	- 0.371	- 0.372
X5 - Rain fall	-1.023	- 0.362	- 0.491	- 0.590	- 0.382	- 0.397	- 0.391
X6 - No. of rainy days	- 0.998	- 0.818	- 0.701	- 0.682	- 0.717	- 0.700	0.800
X7 - Bright sunshine hours	0.478	0. 422	0.561	0.637	0.315	0.385	0.406

* Significant at 0.05 level

TMB -Tea mosquito bug; CSRB - Cashew stem & root borer; MB - Mealy bug; ANB - Apple & nut borer; LM - Leaf miner;

MADAKKATHARA

Minimum temperature, wind velocity and evaporation had a significant positive correlation with the activity of TMB whereas, significant negative correlation was observed with relative humidity. None of the abiotic factors influenced the activity of leaf miner. Thrips activity was positively correlated with maximum temperature, bright sunshine hours and evaporation and significant negative correlation with relative humidity and rainy days. Apple and nut borer incidence had significant positive correlation with sunshine hours wind velocity and evaporation and established a negative correlation with relative humidity.

PARIA

TMB had significant negative correlation with minimum temperature, maximum temperature, morning relative humidity and evaporation rate (r=-60367). The leaf and blossom webber was significantly negatively correlated with minimum temperature (r=-.68031), maximum temperature, sunshine hours and evaporation rate. Leaf miner was significantly negatively correlated with evaporation rate and sun shine hours (r=-.57307).The apple and nut borer was significantly positively correlated with evaporation rate while it had negatively significantly correlated with minimum temperature and maximum temperature (r=-.55681).

The regression analysis revealed that activity of TMB was varied 61.12 % due to abiotic factors. The damage per cent caused by LBW was also varied upto 68.49 % whereas, the infestation caused by apple and nut borer varied 70.61 % due to various weather factors.

VENGURLA

The TMB Infestation showed positive correlation with maximum temperature & significant negative correlation with minimum temperature, morning humidity & negative correlation with rainfall and rainy days. The apple and nut borer showed positive correlation with maximum temperature and significant negative correlation with minimum temperature, evening humidity rainfall and no. of rainy days. The incidence of thrips showed positive correlation with maximum temperature and morning humidity, but had significant negative correlation with minimum temperature, evening humidity, no. of rainy days and negative correlation with rainfall and morning humidity (Table 3.18).

Table 3.18 : Correlation of parameters at with pest complex of Cashew

	Tea mosquito bug	Apple and nut borer	Thrips
Maximum Temperature	0.373	0.278	0.405
Minimum Temperature	-0.769**	-0.825**	-0.825**
Morning Humidity	-0.339	-0.312	-0.312
Evening Humidity	-0.705**	-0.755**	-0.755**
Rain fall	-0.402	-0.428	-0.322
Rainy days	-0.526	-0.557	-0.419

r = 0.553 at 5% level of significance r = 0.684 at 1% level of significance

VRIDHACHALAM

Aphid population had positive correlation with relative humidity and minimum temperature. The blossom webber, leaf miner, leaf roller and shoot tip caterpillar have negative correlation with maximum temperature (Table 3.19).

Table 3.19 : correlation of weather parameters with pest complex of cashew at Vridhachalam

Weather Parameters	Leaf miner	Shoot tip caterpillar	Leaf and blossom webber	Leaf folder
Maximum Temp	0.22	-0.24	0.46*	-0.44*
Minimum Temp	0.26	0.23	0.32	-0.30
RH (m)	0.30	0.32	-0.28*	-0.32*
RH (e)	0.33	0.33	-0.25*	-0.22
Rain fall	0.42	0.42	-0.22	-0.32
No. of rainy days	0.31*	0.40	-0.26	-0.31
Bright sunshine hours	-0.33	-0.43	0.41	0.32
Wind velocity	-0.34	-0.29	-0.33	-0.36

Ent.4: Screening of germplasm to locate tolerant / resistant types to major pests of the region

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

The objective of this project is to identify germplasm accessions tolerant / resistant to the major pests of the region.

SUMMARY:

At Bapatla, T No. 6/14 recorded with the lowest incidence (1.28%) of leaf miner and T.No.275 had nil incidence of apple and nut borer. Thrips infestation was absent in Pathannur, ARL-1, ARL-2, KTR-2 and ODR accession at Madakkathara. Maximum damage by TMB at Vengurla was recorded in T.No.3/33, which was followed by Vengurle-8.

BAPATLA

T.No.233 recorded with highest incidence of leaf and blossom webber (7.03%) and T.No. 129 recorded nil incidence. The accession ABT-3 has recorded with the highest incidence of leaf miner (13.39%) and T No. 6/14 recorded with the lowest incidence (1.28%). With regard to the incidence of leaf folder, the T.No. 268 has recorded with the highest incidence (7.59%) and T No.244 has recorded with low incidence (0.93%). The accession T.No. 268 has recorded with the highest incidence of shoot tip caterpillar (10.9%) and T.No.2/5 recorded with the lowest incidence (1.41%). The accession line BLA.39/4 has recorded with highest incidence of Apple and nut borer (19.53%) while it was nil in T.No.275.

BHUBANESWAR

All the accessions were infested by leaf miner during early stage of new flush and extent of leaf damage ranged between 15 and 20 per cent. The incidence of shoot tip borer and leaf and blossom webber ranged from 0.5 -5.0 percent in germplasm accessions. Thrips incidence was recorded 0.5 – 5.0 /panicle among the germplasm (Table 3.20).

Table 3.20 : Reaction of germplasm accessions against insect pests in Bhubaneswar

Pest	Accessions	Min. damage	Accessions	Max. damage
LM	-	-	100 Nos (all)	15-20%
STC	OC 31,OC37, OC68130, OC7135, OC 140, OC 160	0.5-1.5%	OC 104,OC129, OC132,OC136,OC149	2-5%
IT	OC6, OC21 OC92, OC109, OC117, OC122, OC137	0.5-1/ panicle	OC22 ,OC107, OC110, OC124,OC158	2-5/panicle
LBW	OC15, OC21, OC55 OC77 126,OC130, OC135, OC158	0.5-2.0%	OC 47,OC100, OC170, OC149	2-5%

STC = Shoot tip caterpillar
LM = Leaf miner
IT = Inflorescence thrips
LBW = Leaf and blossom webber

MADAKKATHARA

TMB damage score varied from 0.002 in Kainoor to maximum 0.088 in Kunjithai. The Leaf miner infestation was not observed in Pathannur, ARL-1 and ARL-2. The maximum (22.05%) infestation was recorded in accession, Kainoor and minimum (1.25%) was in ODR. Shoot webber incidence was seen only in two accessions KTR-1 and Ummannur. Thrips infestation was absent in Pathannur, ARL-1, ARL-2, KTR-2 and ODR accession. The minimum score was recorded by KTR-3 and maximum (0.014) was in Mannur.

VENGURLA

The variety Vengurla-3 recorded lowest TMB infestation which was followed by Vengurla-2, whereas the maximum damage was recorded in 3/33, which was followed by Vengurle-8. The lowest incidence of thrips was observed on H–320 followed by variety NRCC-Sel-2 whereas it was maximum on variety 30/1 and it was followed by variety Vengurle-4.

VRIDHACHALAM

All available F1 hybrids were free from TMB infestation. However, foliage damage caused by leaf and blossom webber, leaf roller, leaf miner and inflorescence caterpillars ranged between 1.0 and 3.0 per cent in different accessions (Table 3.21).

Table 3.21 : Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Vridhachalam centre

Pests Intesting	Min. damage recorded range)	Germplasm	Max. damage recorded (range)	Germplasm
Leaf miner	0.0	44/3, H 1600	2.0-2.6	M 26/2
Leaf and blossom webber	1.0-1.6	H 40	2.6-3.0	H 129, H 1600, H 1608
Leaf folder	0.0	VTH 59/2	2.0-2.6	H 129

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 centre) 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 (Chattisgarh) and a sub Centre at Pilicode (Kerala) was started. During the period of XI plan, two new centres were added – one at Paria in Gujarat during 2009 and another in Darisai in Jharkhand during 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.

Executive Summary :

- Germplasm accessions having jumbo nut (14) and bold nut (29) have been conserved in RCFGB at Goa.
- The highest number of flowering laterals/ m^2 were observed in M-44/3 (26.69) at Hogalgere and the maximum apple weight was recorded in H-14 (74.0 g) at Madakkathara in Multilocation trials.
- At Bapatla; the maximum cumulative nut yield was 100.90kg for 14 harvests in Hybrid A6 and was 155.95 kg/tree for 17 years in H-21 at Madakkathara.
- Characterization of germplasm for cashew apple indicated that total soluble sugars were highest in Priyanka of 13.9 °Brix. at Bapatla.
- In fertilizer experiment at Jhargram, the trees receiving N: P: K = 1500:250:375 Kg/ ha produced maximum nuts/m^2 (24.63).
- Irrigation at 80% CPE recorded significantly highest tree height (5.41m), stem girth (91.12 cm) at Hogalagere.
- The highest net profit was obtained by

intercropping bhendi with cashew at Paria and Rs. 34,167/- at Vridhachalam.

- Trials on organic management of cashew indicated application of 25% N as FYM + recycling of organic residues + in situ green manuring/green leaf manuring + biofertilizers resulted in maximum fruit set (40.42/m^2) at Vengurla.
- Evaluation of insecticides for management of foliage pests indicated that thrips damage score was less than 1.0 in the apple in case of L-cyhalothrin (0.003%) at Bhubaneswar and 0.77 at Vengurla in treatment with acetamiprid 0.004%.
- At Vridhachalam, 63.9% of trees which recovered had less than 25% damaged bark circumference while, trees having 26-50% bark damage recorded only 16.2% recovery in post extraction prophylaxis trials against cashew stem and root borer.

REPORT OF THE ANNUAL GROUP MEETING OF SCIENTISTS OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW-2013

The Annual Group Meeting of Scientists of All India Coordinated Research Project on Cashew-2013 was held during 5 – 7th January 2014 at Bidhan Chandra Krishi Viswavidyalaya, Kalyani, West Bengal. At the outset, Dr. Biswapathi Mandal, Pro-Vice Chancellor welcomed the participants and mentioned that the BCKV had initiated research on cashew way-back in 1970's. He said that there is considerable potential for crop in Medinipur, Contai, Digha as well as 24 Paraganas districts. He indicated that though efforts have been taken by several NGOs, the cashew nut yields in the state are not up to their full potential due to unavailability of suitable varieties. The Annual Group Meeting was inaugurated by Dr. S.K. Malhotra, Asst. Director General (Hort), ICAR, New Delhi. In his Inaugural Address, he mentioned that the efforts of AICRP Cashew should be intensified so as to make the country self sufficient in terms of rawnut production. He anticipated that even with the existing production technology, cashew yields can be enhanced to the tune of 2.0 to 2.5 tonnes/ha. Subsequently, Dr. T.N. Raviprasad, Scientist-in-charge, PC Cell D.C.R., Puttur presented the Action Taken Report of the previous year which was discussed in detail.

Later, the Project Coordinator (AICRP - Cashew), Prof. P.L. Saroj presented the salient achievements of different centres of AICRP-Cashew which have supported production of elite planting material and also the transfer of technology efforts that has led to a wider awareness and helped popularize the scientific cashew technology among farmers. He expressed that concerted efforts should be made for popularization of new varieties and site specific nutrient and water management by the coordinated approach of line departments for improving rawnut productivity. Prof. C. Kole, Hon'ble Vice Chancellor, BCKV, in his presidential remarks extolled the nutrient properties of cashew kernels as well as the opportunities for expanding cashew area in West Bengal. He informed that cashew varieties released from Bhubaneswar could perform well in the traditional cashew growing districts of West Bengal. He mentioned that, continuous research efforts of BCKV has led to release of cashew variety, Bidhan Jhargram-2 which is a high yielder with good shelling percentage.

The research progress and results obtained in various experiments at different AICRP-Cashew centers viz., Bapatla, Bhubhaneswar, Chintamani, Darisai, Jagdalpur, Jhargram, Madakkathara, Paria, Pilicode, Vengurle and Vridhachalam as well as, the co-operating centres viz., Arabhavi and Tura were presented by the scientists of the respective disciplines from each Centre. The presentations were made in three main theme areas viz., Crop

Improvement chaired by Dr. P.C. Lenka, Former Professor, OUAT, Bhubaneswar, Crop Management chaired by Dr. P.K. Chattopadhyay, Former Dean, BCKV, Mohanpur and Crop Protection chaired by Dr. Abraham Verghese, Director, NBAII and Co-chaired by Dr. H.S. Singh, CHES, IIHR, Bhubaneswar. A separate technical sessions was organized regarding Interaction of development departments and research centres which was chaired by Mr. Venkatesha N. Hubballi, Director, DCCD, Kochi. Discussions regarding modalities for implementation of developmental activities being done under the Tribal Sub Plan were explained by Dr. H.S. Singh and Mr. Venkatesha N. Hubballi.

In the Plenary Session, chaired by Dr. N.K. Krishna Kumar, DDG, ICAR, New Delhi the recommendations of different technical sessions were presented. The chairman expressed his concern about hastening the progress of research in cashew. He suggested that finger printing of all released varieties should be done. A map should be developed about TMB occurrence to formulate management strategies. Also a base paper may be developed about diseases of cashew. The AICRP-Cashew centre at Jhargram proposed the release of a new variety "Bidhan Jhargram-2" which had higher nut weight and shelling percentage which was approved by the House for cultivation in red and lateritic soils of West Bengal. Subsequently, the representatives of Nari Vikas Sangh, Mr. Sapan Choudhary and Mr. Shaku Bikas Maiti made presentations on the progress of cashew expansion in tribal areas of Bankura and Purulia. Later, Mr. Hemant Ghosh, of Krishi Vikas Trust explained the benefits obtained by the local tribal farmers by cultivation of cashew and integrated farming.

2. TRANSFER OF TECHNOLOGY :

A total of 609934 grafts were produced during 2013-14 and distributed to several government and non-government organizations as well as to cashew cultivators. The centre wise production of cashew grafts is given below:

Centre	No. of grafts produced
Bapatla	20000
Bhubaneswar	8000
Darisai	00
Goa	5000
Hogalagere	4000
Jagdalpur	130000
Jhargram	2000
Kanbargi	00
Madakkathara	45344
Paria	00
Pilicode	27000
Tura	00
Vengurla	161980
Vridhachalam	173610
TOTAL	**574934**

Inaugural Session of the Annual Group Meeting of AICRP- Cashew-2013 at BCKV, Kalyani, West Bengal

BAPATLA

The scientist of this centre participated in the State level training programme to cashew growers on Cashew Production Technology organized by KVK-Pandirimamidi and conducted diagnostic survey of cashew plantations in various villages of Prakasam, Visakhapatnam, East Godavari , and Guntur districts. They also organized a front line technology demonstration with the financial assistance from the Directorate of Cashew and Cocoa Development-Kochi under NHM.

Three training programmes on production technology , crop management, plant protection measures, value addition and Post harvest management were conducted in Prakasam and Guntur districts. A district level seminar on "Advances in cashew production technology" was held at Narsipatnam, Visakhapatnam district in which farm women and tribal farmers participated.

BHUBANESWAR

The scientists of AICRP on Cashew, Bhubaneswar imparted training to 50 nos. of farmer at Rambha, Ganjam district in collaboration with OFDC on production technology, crop management, plant protection measures, value addition and post harvest management of cashew.

About 50 no. of farmers each from Andhra Pradesh had an exposure visit to the Cashew Research Station, OUAT, Bhubaneswar and went visited the research plots and interacted with the scientists of the project.

Scientists of Cashew research station attended as members in the joint verification programme for evaluation of replanting programme of cashew in the districts of Khurda, Nayagarh, and Dhenkanal executed by Orissa State Cashew Development Corporation and Orissa Forest Development Corporation.

HOGALAGERE

The scientists of this centre delivered several lectures in the training programmes organized by State Department of Agriculture and Horticulture in Chikkaballapur district. More than 23 field visits / discussions were made on various aspects of cashew cultivation and suitable suggestions were provided to the farmers.

JAGDALPUR

The scientists of this centre conducted 2 trainings of 7 days duration on cashew processing under the project 'Enhancement of tribals income through small scale cashewnut & cashew apple processing in Bastar region of Chhattisgarh".

Another training programme on 'Cashew Production, Plant Protection and Processing technologies' was also conducted for benefit of new cashew farmers in Bastar region involving method demonstrations, audio visual presentations, poster and field visits

JHARGRAM

The scientist of the Centre functioned as resource person in the farmers' training programme on cashew cultivation technology organized by State Agricultural Department, Nari Vikas Sangha in Bankura District and Gramin Vikas Trust, KRIBHCO and Dept. of Botany, Vidyasagar University, Medinipur. The scientist of the Centre was involved in organizing the AGM-2013 at BCKV, Kalyani.

MADAKKATHARA

Ten training programmes of one day duration on "Cashew apple utilization" were organized which involved 250 beneficiaries with emphasis on practicals. A district level seminar on cashew was conducted at Kuttikkad, Thrissur on scientific cultivation practices of cashew, plant protection

aspects, improved varieties and post harvest handling of cashew apple and nut.

Two 3-day training programmes on "Cashew Production Technology" were organized at Thrissur and at Wayanad. Various scientific aspects of cashew cultivation from planting to harvest and processing of cashew nut and apple were dealt during these programmes. There were also practical sessions on grafting and processing aspects.

The commercial production unit for value added products from cashew apple established in the research station has earned a net revenue of Rs.4,84,866/- by the sale of different value added products. Two cashew apple products were launched during December 2013, viz., halwa and cookies. Cashew apple products like syrup, jam pickle, candy, soda and RTS are being sold through the new sales outlet near ATIC, Mannuthy.

PARIA

The scientists of this Centre have organized 5 Khedut Shibirs and 20 front line demonstrations in Dharampur and Kaprada talukas of Valsad district. District Level Seminar on Cashew was organized at Sutharpada village of Kaprada taluka in which technical guidance was provided to 345 farmers. Under TSP scheme from DCR, Puttur guidance to 165 farmers was provided on cashew cultivation at Kaprada, Valsad. On farm training to visiting farmers pertaining to cashew cultivation and soft wood grafting has also been done by the scientists of the Centre.

PILICODE

The scientist of the centre has been involved in conducting 10 trainings and seminars on various aspects of cashew cultivation. As a resource person the scientist was involed in resolving several field problems of cashew growers in more than 15 different locations in North Kerala. Three farmers trainings were held at Nileshwar, Periya and Taliparamba in which a total of 150 farmers were trained.

VENGURLA

The scientists of this Centre conducted 11 demonstrations on cashew stem and root borer management and cashew apple utilization in Regional Fruit Research Station, Vengurle thereby creating awareness on these aspects for approximately 175 cashew farmers.

VRIDHACHALAM

The Centre has laid out 10 front-line technology demonstration on TMB management sponsored by DCCD to popularize the production in cashew to improve the productivity. The scientists organized State Level Seminar on Cashew, District Level seminar on Cashew and trainings on Cashew Production technology in which more than 500 farmers were benefitted. Promotion of cashew cultivation through dessimination of latest production technologies to the farming community and other target groups was also taken up by the centre.

BARAPANI

The scientist of this Centre has conducted 4 trainings on propagation of cashew by grafting, nursery management of cashew and rejuvenation of cashew for about 95 farmers. Also, field demonstrations on rejuvenation of old orchards have been conducted by the Centre. Front line demonstrations were conducted in three villages viz., Gambegre, Bokmagre and Balalgere of cashewnut growing areas at Garo Hills to promote scientific cultivation techniques for cashew.

3. STAFF POSITION

HEADQUARTERS:

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Project Coordinator	:	Prof. P.L. Saroj
Scientist-in-charge	:	Dr. T.N. Raviprasad
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Grafter	: Sri. D. Almango (From 3.9.2011)

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Sr. Technical Assistant	: Mr. B. Subramanyam (From 7-10-2013)
Sr. Technical Assistant	: Mr. Somappa Shivappa Jaggal (From 5-10-2013)
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Jr. Horticulturist	: Dr. Mini Poduval
Jr. Entomologist	: Dr. S. Chakraborti (From 1.4.2014)
Sr. Technical Assistant	: Vacant
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	Dr. M.S. Smitha (From 17-10-2013)

Sr. Technical Assistant : Dr. A. Sobhana

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4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2013-14.

Allocation (Rs. in lakhs)

Centre	Details of sanctioned budget					
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total	ICAR share
Bapatla	20.00	0.70	3.00	--	23.70	17.77
Bhubaneshwar	50.00	0.70	3.00	--	53.70	40.27
Hogalagere	26.40	0.70	3.00	--	30.10	22.58
Darisai	17.43	0.70	2.60	--	20.73	15.55
Jagdalpur	30.00	0.50	2.00	--	32.50	24.38
Jhargram	30.00	0.50	2.00	--	32.50	24.38
Madakkathara	45.00	0.70	3.00	--	48.70	36.52
Paria	18.90	0.70	3.00	--	22.60	16.95
Pilicode	14.00	0.30	2.00	--	16.30	12.22
Vengurla	35.00	0.50	2.00	--	37.50	28.12
Vridhachalam	45.00	0.50	2.00	--	47.50	35.62
KRCCH, Arabhavi	0.00	0.50	3.00	--	3.50	2.63
ICAR Res. Compl. For Goa, Goa	0.00	0.50	3.00	--	3.50	2.63
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.50	0.00	--	0.50	0.38
Total	331.73	8.00	33.60	--	373.33	280.00
Provision for TA for PC Cell						1.00
Provision for NEH						1.00
Provision for TSP						5.00
GRAND TOTAL						287.00

Actual Expenditure (Rs. in lakhs)

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency *	Total	ICAR Share
Bapatla	20.91	0.26	2.93	0.00	24.10	18.08
Bhubaneshwar	45.41	0.57	7.65	0.00	53.63	40.22
Hogalagere	7.72	0.49	2.94	0.00	11.15	8.36
Darisai	10.31	0.17	2.42	0.00	12.90	9.68
Jagdalpur	12.21	0.49	2.00	0.00	14.70	11.03
Jhargram	31.56	0.40	2.00	0.00	33.96	25.47
Madakkathara	67.97	0.70	3.00	0.00	71.67	53.75
Paria	15.18	0.21	2.66	0.00	18.05	13.54
Pilicode	7.06	0.34	0.90	0.00	8.30	6.23
Vengurla	30.30	0.45	1.93	0.00	32.68	24.51
Vridhachalam	45.47	0.50	2.00	0.00	47.97	35.98
Total	294.10	4.58	30.43	0.00	329.11	246.85
Cooperating Centres						
KRCCH, Arabhavi	0.00	0.27	1.74	0.00	2.01	1.51
ICAR Res. Compl. for Goa, Goa	0.00	0.48	2.46	0.00	2.94	2.94
ICAR Res. Compl. for NEH, Tura	0.00	0.00	0.00	0.00	0.00	0.00
Total	**0.00**	**0.75**	**4.20**	**0.00**	**4.95**	**4.45**
Provision for TA for PC Cell						0.63
Provision for NEH						0.68
Provision for TSP						1.60
					GRAND TOTAL	**254.21**

METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2013-14

BAPATLA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days	
					(Max)	(Min)
Apr.13	34.7	26.3	76	73	6.90	1.0
May 13	38.3	28.5	72	66	36.7	3.0
Jun.13	37.2	26.1	71	57	125.3	7.0
Jul. 13	33.3	25.1	78	67	193.9	13.0
Aug.13	33.6	25.1	80	65	196.1	11.0
Sep.13	34.3	25.0	79	75	78.5	2.0
Oct. 13	31.7	24.5	89	85	497.9	12.0
Nov.13	30.7	21.3	89	79	62.2	5.0
Dec.13	30.0	17.7	88	63	0.00	0.0
Jan.14	29.8	18.2	92	68	0.00	0.0
Feb.14	30.3	18.7	85	65	3.3	1.0
Mar.14	33.3	20.5	80	65	0.00	0.00

BHUBANESWAR

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
Apr.13	34.7	26.3	76	73	6.90	1.0
May 13	38.3	28.5	72	66	36.7	3.0
Jun.13	37.2	26.1	71	57	125.3	7.0
Jul. 13	33.3	25.1	78	67	193.9	13.0
Aug.13	33.6	25.1	80	65	196.1	11.0
Sep.13	34.3	25.0	79	75	78.5	2.0
Oct. 13	31.7	24.5	89	85	497.9	12.0
Nov.13	30.7	21.3	89	79	62.2	5.0
Dec.13	30.0	17.7	88	63	0.00	0.0
Jan.14	29.8	18.2	92	68	0.00	0.0
Feb.14	30.3	18.7	85	65	3.3	1.0
Mar.14	33.3	20.5	80	65	0.00	0.00

JAGDALPUR

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days	BSH
			(Max)	(Min)			
Apr.13	38.2	24.3	84.8	49.9	85.9	5	6.4
May 13	39.3	27.2	88.2	49.3	12.2	2	7.9
Jun.13	37.6	26.0	85.1	57.4	117.2	11	3.0
Jul. 13	32.2	25.1	94.4	81.6	405.5	22	3.2
Aug.13	32.0	25.2	93.7	81.8	255.3	20	3.6
Sep.13	32.4	25.3	93.7	78.7	110.6	17	3.9
Oct. 13	32.1	22.6	91.4	68.6	61.6	7	6.4
Nov.13	29.7	19.1	93.2	62.2	134.9	6	6.1
Dec.13	29.9	15.3	93.0	44.0	0.0	0	7.6
Jan.14	29.7	15.1	91.5	43.1	0.0	0	6.1
Feb.14	32.3	16.7	89.9	37.6	28.0	2	7.1
Mar.14	37.72	21.55	89.41	30.54	0.0	0	4.6

JHARGRAM

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	RH (%)	Rainfall (mm)	No. of rainy days
			Average		
Apr.13	38.3	22.8	45	5.8	3
May 13	39.4	26.7	53	19.8	9
Jun.13	33.9	26.1	71	22.7	14
Jul. 13	32.2	26.1	82	34.6	20
Aug.13	32.2	25.6	83	30.4	20
Sep.13	32.8	25.0	85	28.1	15
Oct. 13	30.6	22.8	76	28.7	12
Nov.13	29.4	16.1	68	0.0	1
Dec.13	27.2	11.7	65	0.0	0
Jan.14	26.1	11.7	60	0.2	0
Feb.14	28.9	14.4	53	7.3	2
Mar.14	33.3	18.9	45	2.5	0

MADAKKATHARA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days	
					(Max)	(Min)
Apr.13	34.8	25.32	72	0	0	5.98
May 13	33.15	24.75	77.75	55.73	1.75	28.13
Jun.13	28.53	22.75	90.13	227	6.5	6.33
Jul. 13	28.38	22.68	90.2	218.12	6.8	5.12
Aug.13	30.20	23.08	82.88	37.0	3	34.03
Sep.13	29.83	22.35	85	84.83	4	26.13
Oct. 13	30.96	22.92	81.6	75.08	3.4	37.56
Nov.13	32.55	23.8	73.75	20.2	1.0	42.78
Dec.13	31.85	22.2	61.25	0.125	0	58.95
Jan.14	32.96	22.96	51	0	0	63.52
Feb.14	34.75	23.13	58.5	0	0	58.63
Mar.14	36.98	24.2	54.25	0	0	59.98

PARIA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days
Apr.13	35.27	19.32	62.32	13.1	1
May 13	35.43	24.07	64.53	0.0	0
Jun.13	31.80	24.45	85.40	768.5	22
Jul. 13	29.50	24.17	91.32	1196.7	31
Aug.13	29.91	23.76	85.68	385.3	24
Sep.13	31.31	23.15	84.37	400.1	13
Oct. 13	33.74	21.41	73.65	52.1	3
Nov.13	35.06	16.66	60.85	3.2	1
Dec.13	33.69	11.86	60.16	0.0	0
Jan.14	30.73	11.93	66.95	0.5	0
Feb.14	31.56	11.77	63.57	0.0	0
Mar.14	34.67	15.13	59.32	0.0	0

PILICODE

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days
Apr.13	33.8	24.2	74	8.0	3
May 13	33.5	25.4	75	2.6	4
Jun.13	29.9	22.5	89	44.7	28
Jul. 13	29.3	23.0	91	39.4	31
Aug.13	29.4	23.0	87	12.3	24
Sep.13	30.0	23.0	86	6.17	19
Oct. 13	31.5	23.5	84	1.8	16
Nov.13	32.5	22.7	77	0.17	2
Dec.13	32.4	19.1	74	0.5	1
Jan.14	32.6	20.3	76	0	0
Feb.14	32.9	21.4	77	0	0
Mar.14	33.2	22.2	74	0	0

TURA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
Jan. 13	27	7	96	65	0	0
Feb. 13	31	10	94	57	13.4	2
Mar. 13	34	16	80	47	24.8	4
Apr.13	34	16	83	54	213.80	11
May 13	33	17	85	59	505.2	21
Jun.13	35	18	93	48	471.60	19
Jul. 13	33	18	88	59	257.20	17
Aug.13	33	18	80	58	304.5	18
Sep.13	34	18	89	59	394.6	21
Oct. 13	33	17	88	58	234.2	9
Nov.13	28	16	80	50	3	1
Dec.13	25	15	82	50	0	0

VENGURLA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
May 13	33.60	24.8	82.29	67.41	100	5
Jun.13	30.38	24.78	87.57	81.96	988	27
Jul. 13	28.31	24.43	89.71	84.31	1455	35
Aug.13	30.23	24.72	88.17	77.60	303.2	23
Sep.13	30.24	24.03	91.26	79.49	367.4	22
Oct. 13	32.35	24.22	88.86	70.99	131.6	9
Nov.13	34.91	20.63	87.78	55.85	-	-
Dec.13	33.59	16.88	86.39	46.81	6.4	1
Jan.14	33.046	18.95	86.56	52.93	0	0
Feb.14	33.12	18.26	84.03	50.56	0	0
Mar.14	33.62	21.66	84.71	55.42		

VRIDHACHALAM

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)	Rainfall (mm)	No. of rainy days
Apr.13	39.0	24.5	69.4	13.4	1
May 13	42.2	29.9	60.2	-	-
Jun.13	42.4	25.6	63.0	37.2	5
Jul. 13	36.0	25.3	73.0	73.8	5
Aug.13	35.1	25.4	78.4	385.4	10
Sep.13	34.5	24.6	79.8	265.8	10
Oct. 13	35.4	24.1	77.6	113.4	3
Nov.13	31.5	21.7	83.0	231.2	8
Dec.13	30.1	23.8	86.7	68.7	7
Jan.14	29.9	19.4	83.5	13.0	1
Feb.14	31.6	19.9	79.8	2.0	1
Mar.14	32.6	21.3	79.6	12.4	1

8. RESEARCH PUBLICATIONS

BAPATLA

Umamaheswara Rao, 2013. Cashew Production Technology (in Telugu). Technical Bull. p.30 Dr. YSR Horticulture University, Tadepalligudem.

BHUBANESWAR

Sethi, K., Patnaik, A. K., Lenka, P.C. and Das, P.C. 2014. Kajubadam : Aka labhajanaka arthakari phasala.p.48. OUAT,Odisha

JAGDALPUR

Nag, S.K., Patil, S.K., Patel, S., Pradhan, A., Netam, R.S., Paikra, M.S. and Singh, D.P. (2014). Effect of entrepreneurship development through cashew processing on socio-economic status of villagers. American International Journal of Research in Humanities, Arts and Sciences, 5(2), pp 211-213.

PILICODE

Meera Manjusha A.V., Jayaprakash Naik, B. and Abdul Kareem K., Hybridization studies in cashew using the dwarf cashew variety PLD 57, Proc. 26th Kerala Science Congress, held KVASU Campus, Pookode, 28-31, Jan 2014.

Meera Manjusha A.V., Retheesh P.K.. and Abdul Kareem K. 2013, Cashew as an ameliorative crop for hard lateritic regimes of Kerala: Problems and Prospects, Proc. Second International Congress on Ecosystem conservation and Sustainable development, Thiruvananthapuram, 3-5 Oct. 2013.

VRIDHACHALAM

Jeeva,S., 2013. Research and Development Strategies of cashew in Tamil Nadu. National symposium on Cashew. Souvenir, UHS, Shimoga, Karnataka,29-30, Oct.2013 p. 73-78

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