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अखिल भारतीय समन्वित काजू अनुसंधान परियोजना

ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

वार्षिक प्रतिवेदन
ANNUAL REPORT
2011-12

परियोजना समन्वयकर्ता
डा. पि. एल. सरोज

PROJECT COORDINATOR
Dr. P.L. Saroj

भाकृअनुप
ICAR

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प्राक्कथन

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की 26 वार्षिक प्रतिवेदन प्रस्तुत है । इस प्रतिवेदन में अप्रैल 2009 से मार्च 2010 तक की अनुसंधान उपलब्धियाँ तथा अन्य जानकारी सम्मिलित की गई है ।

इस परियोजना में चौदह केंद्र है, जैसे भारत की पूर्व तट मैं चार; बापट्ला (आंध्र प्रदेश), भुवनेश्वर (उड़ीसा), झारग्राम (प. बंगाल) और वृद्धाचलम् (तमिल नाडु); पश्चिम तट पर दो केंद्र और एक उपकेंद्र जैसे माडक्कतरा केंद्र (केरल) और पिलिकोड उपकेंद्र (केरल) तथा वेंगुर्ले (महाराष्ट्र); मैदानी भाग में दो केंद्र, एक चिंतामणि (कर्नाटक) और दूसरी जगदलपुर (छत्तीसगड) में स्थित है और इस परियोजना का अनुसंधान कार्यसूची को कार्यान्वयन करते है ।

XI प्लान का इस साल में गुजरात तथा झारखण्ड में क्रमशः परिया तथा दारीसाई में नया केन्द्र प्रारंभ करने से केन्द्रों का खुल संख्या 14 तक बड गई है । इसके अतिरिक्त प्रत्येक कर्नाटका, गोवा और मेधालया में भी केन्द्रोंकार्य कर रहा है ।

प्रतिवेदन में चालू तेरह अनुसंधान परियोजनाओं कि उपलब्धियों की क्षेत्रीय स्तर पर विषयानुसार, जैसे फसल सुधार (3), फसल प्रबंधन (6) और फसल संरक्षण (4) के विविध विषयों को संबंधित बारह अनुसंधान परियोजनाओं की उपलब्धियों को संकलित करके प्रस्तुत की गई है ।

इस प्रतिवेदन मे दो अध्याय है, जैसे,

1. तकनीकी : जिसमे परियोजना और क्षेत्रीय तौर पर प्राप्त प्रायोगिक उपलब्धियाँ, और

2. संस्थानीय : जिसमे इतिहास, कर्मचारी, वित्तीय प्रावधान, मौसम की आँकड़े और शोध प्रकाशन शामील हैं ।

(डा. पि. एल. सरोज)
निदेशक एवं परियोजना समन्वयकर्ता

पुत्तुर : 574 202
दिनांक : 03.11.2012

ABOUT THIS REPORT

This is the twenty eigth 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 2011 to March 2012.

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

There are thirteen research projects pertaining to different disciplines such as Crop Improvement (3) Crop Management (6) and Crop Protection (4). The results reported by each centre are compiled region-wise and discipline wise and presented in this report.

This report consists of two chapters, they are:

1. Technical : consisting of project wise and region wise experimental results from different centres and
2. Organisation: consisting of history, staff, budgetary provisions, functioning, meteorological data and research publications.

(P. L. SAROJ)
DIRECTOR & PROJECT COORDINATOR

Puttur : 574 202
Dated : 03.11.2012

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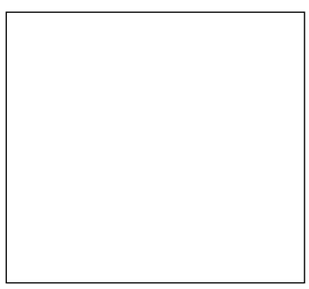


परियोजना समन्वयकर्ता की रिपोर्ट

अखिल भारतीय समन्वित मसाला व काजू अनुसंधान पारयोजना 1971 में चौथी पंच वार्षिक योजना में शुरु की गई, जिसका मुख्यालय केंद्रिय रोपण फसल अनुसंधान संस्थान, कासरगोड में था। सातवी पंचवार्षिक योजना में इस परियोजना को दो स्वतंत्र परियोजनावों - एक काजू व दूसरी मसाले में विभजित किया गया। अखिल भारतीय समन्वित काजू अनुसंधान पारयोजना का मुख्यालय नव निर्मित राष्ट्रीय काजू अनुसंधान केंद्र पुतूर में 1986 को स्थानांतरित किया गया ।

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना के आठ केंद्र और एक उपकेंद्र है, जिसमें चार केंद्र 1971 में अखिल भारतीय समन्वित मसाले व काजू अनुसंधान परियोजना के शुरुवात में बापट्ला (ए.एन.जी.आर.ए.यू पहले ए.पी.ए.यू) माडक्कतरा (केरल कृषि विश्वविद्यालय, आनक्कायम् से स्थानांतरित), वेंगुर्ले (डॉ. बाला साहेब कोंकण कृषि विद्यापीठ) और वृद्धाचलम (तमिलनाडु कृषि विश्वविद्यालय) में प्रारंभ किया गया। पाँचवीं पंचवार्षिक योजना में एक केंद्र, भुवनेश्वर (औ.यू.ए.टी.) और छटवी पंचवार्षिक योजना में दो केन्द्र, एक झारग्राम (बी.सी.के.वि) और दूसरा चिंतामणि (यू.ए.एस) को सम्मिलित किया गया। आठवीं योजना में एक केंद्र - जगदलपुर (आई.जी.ए.यू) और एक उपकेंद्र पिलिकोड (के.ए.यू.) प्रारंभ किया गया । XI प्लान का इस साल में दो केंद्र शुरू किया गया जिसमें एक केंन्द्र पारिया (एन.ए.यू.) में और एक केंन्द्र दारीसाई (बी.ए.यू.) में और तीन केंन्द्रों - अरभावि (यू.एच.एस.), बारापानी और गोवा (बा.कृ.अनु.प.) में कार्यप्रवृत हुए ।

परियोजना का 2011-12 में बजट आबंटन रु.266.67 लाख (रु.200.00 लाख भा.कृ.अ.प. का अंश) था और व्यय रु. 351.98 लाख (रु.263.98 लाख भा.कृ.अ.प. का अंश) था।

निम्न लिखित विधियों से काजू की उत्पाद और उत्पादन क्षमता बढाना इस पारयोजना के लक्ष्य है:

1. निर्यात स्तर की गुठली, रोग एवं कीट सहन/निरोधी के अधिक उपज देनेवाली प्रजातियों का विकास ।
2. विभिन्न कृषि-मौसमी परिस्थितियों में काजू फसल के लिए कृषि प्रौद्योगिकी का मानकीकरण ।
3. लागत प्रभावी, दक्ष पीडक एवं रोग प्रबंधन विधियों का विकास ।

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

फसल सुधारः

अब तक विविध प्रादेशिक क्षेत्रीय काजू जीन बैंकों में कुल 1241 जननद्रव्य एक्सशानो संरक्षित हुआ है । जननद्रव्य संग्रहण, संरक्षण, मूल्यांकन, निरूपण एवं सूचीकरण प्रयोगों में बापटला में BLA-39/4 की अधिकतम संचयी उपज (82.85 कि.ग्रां./पेड) दर्ज की गई। भुवनेश्वर में 56 काजू एक्सशानो की औसत छिलकन 28 प्रतिशत से अधिक देखी गई। जगदलपुर में 13 कटाई के दौरान अधिकतम संचयी उपज (63.35 कि./पेड) NRC-137 में पायी गई । झारग्राम में पुष्पित शाखाए और गुटली / मी² की अधिकतम संख्या JGM-149 क्रमशः 11.5 और 31.9 पायी गई, जबकि JGM-147 क्रमशः 10.2 तथा 24.9 से अनुसरित पायी गई । वेंगुर्ला में अधिकतम औसत पुष्पगुच्छ / मी² RFRS-188 में (18.0/मी²) देखा गया ।

प्रजाति मूल्यांकन परीक्षणों में भुवनेश्वर में काजू संकर H-303 की अधिकतम संचयी उपज (112.4 कि.ग्रां/पेड) और NRCC सलेक्शन-2 (102.97 कि.ग्रां. / पेड) देकर अनूसरित पायी गई । H-367 में अधिकतम् गुठली वजन (10.20 ग्रां.) और सेब वजन (70.37 ग्रां.) जगदलपुर में दर्ज किया गया । झारग्राम में अधितम गुठली संख्या (41 गुठली / मी²) H-303 में मिला जबकि H-44/3 (37.1 गुठली / मी²) अनुसरित पायी गई । H-367 में अधिकतम औसत गुठली वजन (10.20 ग्रां.) और सेब वजन (102.7 ग्रां) वेंगुर्ला में दर्ज किया गया ।

बहु स्थानीय परीक्षण-III में भुवनेश्वर में छः कटाई के दौरान H-675 में अधिकतम पुष्प गुच्छ (20/मी²) और संचयी उपज H-85 (21.22 कि.ग्रां./ पेड) रहा, जबकि H-6 (19.36 कि.ग्रां.) इसे अनुसरित किया । माडकत्तरा में छः कटाई की अधिकतम संचयी उपज H-1593 (20.50 कि.ग्रां.) में पाया गया और गोवा-11/6 (18.37 कि.ग्रां.) उपज के साथ उसे अनुसरित किया ।

विमोचित प्रजातियों का बहुस्थानीय परक्षिण-5 में झारग्राम-1 में अधिकतम शाखाए (22.5/मी²) दाखिल हुई और VRI-3 में पुष्पगुच्छ संख्या (16.79 / मी²) भुवनेश्वर में दर्ज हुआ । माडकत्तरा में अधिक पौध छत्रप फैलाव (5.77 मी.) अमृता में पाया गया जिसे उल्लाल-4 (5.66 मी) अनुसरित पायी गई । पिलिकोड में उल्लाल-1 में उभयलिंगी पुष्प अनुपात अधिकतम था और भुवनेश्वर-1 उसे अनुसरित पायी गई ।

संकरण और चयन कार्यक्रम की तहद भुवनेश्वर से विकसित संकर किस्मों में औसत अधिकतम संचयी उपज A-6 (89.7 कि.ग्रां./पेड) और गुठली वजन (9.4 ग्रां.) E-1 में रहा और अधिकतम छिलकन प्रतिशत क्रमशः H-70 (47%), H-134 (40%) और H-122 (39.6%) में पायी गई। H-21 में 15 साल का अधिकतम संचयी उपज (120.75 कि.ग्रां./पौधा) माडकत्तरा से दर्ज की गई। H-10 में गुच्छ फलन पाया गया जिसमें 10-12 गुठली / प्रतिगुच्छ, गुठली वजन (7.4 ग्रां.), आसानी छिलकन और कम पुष्पण समय (53 दिन) दर्ज किया गया।

फसल प्रबंधनः

झारग्राम में 1000 ग्रां. N; 250 ग्रां. P और 250 ग्रां. K / पेड डालने से अधिकतम छत्रप फैलाव, छत्रप क्षेत्र और उपज पाया गया।

भुवनेश्वर में सघन पौध रोपण में उर्वरक प्रयोगों में अधिकतम संचयी उपज S3 यानि 600 पेड / हे (5x4 मी.) (12764.97 कि.ग्रां.) और S2 में 400 पेड / हे (6x4मी) (11592.97 कि.ग्रां.) मिला। S3 में उपज वृद्धि S1 की तुलना में 50.8 प्रतिशत ज्यादा रहा और S2 की तुलना में 10.1 प्रतिशत ज्यादा रहा। प्रति हेक्टर का अधिकतम संचयी उपज (14523 कि.ग्रां. S3M2 उपचार में यानि 600 पेड / हे (5x4 मी) में 150:50:50 कि.ग्रां. NPK /हे. डालने पर प्राप्त हुई। मड़कत्तरा में अधिकतम संचयी उपज (979 कि.ग्रां/हे) 500 पेड /हे. में पायी गयी जो 200 पेड / हे.की तुलना में 147% अधिक प्राप्त हुई।

पिलिकोड में अधिकतम संचयी उपज 2221 क्विं /हे.) 600 पौध / हे. (5x4 मी.) की दूरी में 225 कि.ग्रां. N;75 कि.ग्रां. P; और 75 कि.ग्रां. K; डालने पर दर्ज हुई। वृद्धाचलम में अधिकतम संचयी उपज (3250 कि.ग्रां / हे.) (5x4 मी.) में मिला, जो 10x5 मी. दूरी की तुलना में 1350 कि.ग्रां. / हे. रहकर, 2.40 गुना ज्यादा रहा।

बूँद बूँद सिंचाई परीक्षणों में वेंगुर्ला में नौ साल की अधिकतम संचयी उपज (29.84 कि.ग्रां / पेड) 40 प्रतिशत CPE में सिंचाई देने पर प्राप्त हुआ। वृद्धाचलम में अधिकतम गुठली संचयी उपज (6.20 कि.ग्रां / पेड) 80 प्रतिशत CPE में मिला जबकि बारीनी क्षेत्र से 4.42 कि.ग्रां / पेड दर्ज की गई।

सधन पौध रोपण - अवलोकन परीक्षणों में भुवनेश्वर में 4x4 दूरी पर पौध रोपण से औसत वार्षिक उपज 1067 कि.ग्रां./ हे. रहा, जबकि 11 कटाई का संचयी उपज 19497 कि.ग्रां. / हे. दर्ज हुआ। माडकत्तरा में सधन पौध रोपण में 2811 कि.ग्रां./ हे. उपज मिला जबकि सामान्य पौध रोपण में 858 कि.ग्रां./ हे. उपज दर्ज की गई जो 3.28 गुना ज्यादा था।

झारग्राम में लिए गए काजू में अन्तरफसल परिक्षणों में मेथी की अन्तरफसल लेने से उपज 14.77 क्वि./ हे. रहा और शुद्ध लाभ रु.15346 / हे. मिला, जिसे धनिया फसल 6.74 क्वि./ हे. के साथ अनुसरित पायी गई। काजू में टेपियोका से अधिकतम शुद्ध लाभ रु.93378 मिला जबकि अमारफोफलस से रु.84876 का शुद्धा लाभ माडकत्तरा में देखा गया। पाँच विविध कंदीय फसलों में से श्तालू का अधिकतम उपज 7.29 टन / हे. रहा जबकि आय लगभग रु.182325 / हे. प्राप्त हुआ। वृद्धाचलम में काजू में ग्वार पाठा की अन्तरफसल से लागत अनुपात लाभ 4:1 मिला जबकि शुद्ध लाभ रु.62500 / हे. प्राप्त हुई, और तुलसी के अन्तरफसल से लागत अनुपात लाभ 3.4 था जबकि शुद्ध लाभ रु.42500 / हे. था।

काजू में जैविक प्रबन्धन प्रयोगों में शिफारित उर्वरक + 10 कि.ग्रां. गोबर खाद डालने पर अधिकतम संचयी उपज (3.227 कि.ग्रां./पेड) और 644.5 कि.ग्रां./हे. भुवनेश्वर में दर्ज हुआ। अधिकतम पेड उचाई (2.87 मी.) और छत्रफ फैलाव (3.93 मी.) 25 प्रतिशत N गोबर की खाद + पौध पत्ती जैविक पदार्थ + हरी खाद + जैविक खाद डालने पर मड़कत्तरा में दर्ज किया गया। वेंगुर्ला में अधिकतम गुठली उपज (4.91 कि.ग्रां./पेड और 0.96 टन / हे.) शिफारित उर्वरक + 10 किलो गोबर खाद डालने पर दर्ज किया गया।

फसल संरक्षण :

बापट्ला में L-सैहालोथ्रीन (0.003%) के छिड़काव से पत्ती व पुष्प जालकीट, प्ररोह सूंडी, सेब एव गुठली छेदक आदि कीटों का संक्रमण कम पाया गया। जगदलपुर में L-सैहालोथ्रीन (0.003%) और क्लोरोपैरीफॉस 0.05% के छिडकाव से पुष्पगुच्छ शाखाओं को चाय मच्छर के हानि को कम से कम पाया गया। माडकत्तरा में प्रोफीनोफॉस और L-सैहालोथ्रीन से अनुसूचित उपचार में उपज 3.28, 3.12 और 2.84 कि.ग्रां./पेड मिला जबकि नियन्त्रित पौधे में उपज (2.11 कि.ग्रां./पेड) रहा। परिया में L-सैहालोथ्रीन के उपचार से अधिकतम गुठली उपज 969 कि.ग्रां./ हे. पाया गया और पेड़ क्षति स्कोर 0.86 दर्ज हुआ। वेंगुर्ला में L-सैहालोथ्रीन के उपचार से पौधों में थ्रिप्स का गुठली क्षति स्कोर 1.92 रहा, जबकि नियन्त्रित प्लाट में 8.17 गुठली क्षति स्कोर पाया गया।

काजू तना एवं जड़ छेदक नियन्त्रण प्रायोगों में क्लोरोपैरीफॉस (0.2%) उपचार से, मड़कत्तरा में 100%, भुवनेश्वर में 92%, बापटला में 90.9% तथा जगदलपुर में 77.78% तक संक्रमित पौधों को दुबारा क्षति से बचाया गया। बापट्ला में 25% से ज्यादा छाल धेरा संक्रमित पौधों को 42% तक दुबारा संक्रमण से बचाया गया, जबकि वृद्धाचलम में 63.9% तक पेडों को बचाया सखा।

कीट संक्रमण में जैविक एवं अजैविक कारको का प्रभाव के बारे में लिए गए प्रयोगों में बापट्ला में पत्ती और पुष्प जालकीट की संख्या अधितम एवं न्यूनतम तापमान, सापेक्ष आर्द्रता, वार्षिक वर्षा से 56% प्रभावित हुई। सापेक्ष आर्द्रता और पुष्प थ्रिप्स का संक्रमण का सार्थक रूप से नकारात्मक सहसमन्ध (-0687) भूवनेश्वर में देखा गया। अपेक्षित आर्द्रता एवं वायु वेग के साथ चाय मच्छर का सार्थक रूप से नकारात्मक सहसमन्ध (-0.519 और -0.0305) जगदलपुर में देखा गया। माडकत्तरा में चाय मच्छर और अधिकतम तापमान के बीच नकारात्मक सहसमन्ध (-0.720) दर्ज किया गया।

बापट्ला में संकर H-95-T4 में पत्ती और पुष्प जालकीट की कम हानि (1.14%) पाया गया। जगदलपुर में CARS-7, CARS 17 और CARS-18 में चाय मच्छर क्षति नहीं देखी गई। मड़कत्तरा में K-22-1 में पत्ती सूंडी की संक्रमण 2009-10 और 2010-11 में मुक्त पाया गया। वृद्धाचलम में MLT की सबी प्रविष्टों में और संकरों में चाय मच्छर का क्षति स्कोर 1.00 से 3.00 तक रहा, तथा विभिन्न स्तरों का संक्रमण पाया गया।

तकनिकी हस्तांतरणव

इस साल 2,59,023 कलमों को तैयार करके सरकारी और गैर सरकारी संस्थानो को बाँटा गया। बापट्ला केंन्द्र के वैज्ञानिको ने काजू खेती के बारे में ''फ्रंट लाइन प्रदर्शनी'' को पूर्वगोदावरी जिल्ला के काजू कृषको का बागानो में लिए है। भूवनेश्वर की विज्ञानियों ने उडीसा राज्य काजू विकास मंडली (OSCDC) तथा उडीसा वन विकास मंडली (OFDC) के तहद खुर्दा, गंजाम, कोरापुट तथा अन्य काजू उगानेवाले जिल्ला में पुनर्रोपण का निरीक्षण किया।

चिंतामणी केंन्द्र का वैज्ञानिकों ने ''राष्ट्रीय जीववैविध्य तथा टिकाऊ विकास सेमिनार'' में भाग लिया और कन्नडा में काजू उत्पादन प्रौद्योगिकी के बारे में विचार प्रबंधो प्रस्तुत किया है। जगदलपुर के विज्ञानियों ने बस्तर में काजू पुनश्चेतन कार्यक्रमों में भाग लिया। झारग्राम का विज्ञानि बांकुरा में ''प्रदान'' तथा ''नारी विकास संघ'' से आयोजित काजू उत्पादन प्रौद्योगिकी सेमिनारों में विशेषज्ञ संसाधक के रूप में भाग लिया।

माडकत्तरा केंन्द्र ने तीन काजू उत्पादनों, काजू सेब सोडा, काजू सेब विनेगर तथा काजू सेब चाकोलेट को व्यापारिक स्थर पर आरंभ किया है। काजू उत्पादन प्रौद्योगिकी, काजू संस्करण और काजू सेब उपयोग के बारे में प्रशिक्षण और सेमिनारो पिलिकोड केंन्द्र के वैज्ञानिको से आयोजित हुए।

वेंगुर्ला का विज्ञानियों ने काजू मृदुकांड कलमन, काजू में पोषकांश प्रबंधन, CSRB नियंत्रण तथा काजू में मौल्यवर्धन के बारे में प्रात्यक्षिकी आयोजित किए और मराठी में लोकप्रिय लेखो को प्रकाशित किए।

वृद्धाचलम केंन्द्र ने काजू उत्पादन तथा TMB नियंत्रण के बारे में 30 ''फ्रन्ट लाइन प्रदर्शनी DCCD के प्रायोजना में आयोजित किया है और काजू सेब उत्पादन पर जिल्ला स्तर के सेमिनारों को काजू कृषकों तथा ग्रामीण महिलावों के लिए आयोजित किया है।

PROJECT CO-ORDINATOR'S REPORT

The All India Coordinated Spices and Cashewnut 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, Puttur in 1986.

The AICRP on Cashew has presently fourteen centres, of which four were started at the inception of AICS & CIP in the year 1971 [Bapatla (ANGRAU the then APAU); 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 centres at Arabhavi (UHS) and at 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 2011-12 was ₹. 266.67 lakhs (₹. 200.00 lakhs - ICAR Share) and the expenditure was ₹. 351.98 lakhs (₹. 263.98 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 research findings under different projects with the above objectives have been presented hereunder for 2011-12.

I. CROP IMPROVEMENT

Under the trials on Germplasm collection, conservation, evaluation, characterization and cataloguing the cumulative nut yield was found to be the highest in BLA 39/4 (82.85 kg /tree) at Bapatla. At Bhubaneswar, 56 cashew accessions recorded a mean shelling percentage of more than 28%. The cumulative nut yield was highest in NRC-137 (63.35 Kg) under germplasm evaluation for 13 harvests at Jagdalpur. The number of flowering laterals/m^2 and nuts/m^2 were maximum in JGM-149 (11.5 & 31.9 respectively) followed by JGM – 147 (10.2 & 24.9 respectively)at Jhargram. The mean flowering panicles /m^2 were highest in RFRS 188 (18.0 /m^2) at Vengurla.

The highest cumulative yield (kg/plant) in multi location trial – II for 16 harvests was recorded in cashew type H-303 (112.4) followed by NRCC Sel-2 (102.97) at Bhubaneswar. At Jagdalpur, the highest nut weight (10.20 g) as well as highest apple weight (70.37 g) was observed in H-367. Maximum nuts/m^2 were recorded in H-303 (41 nuts/m^2) followed by M-44/ 3 (37.1 nuts/m^2) at Jhargram centre. The mean nut weight (10.20 g) and mean apple weight (102.7 g) was maximum in H-367 at Vengurla.

At Bhubaneswar, the maximum number of flowering laterals per sq.m. (20.0) was maximum in H 675 and the maximum cumulative nut yield (kg/plant) was obtained in BH 85 (21.22) followed by BH 6 (19.36) for 6 harvests in multi location trial – III. The highest cumulative yield for 6 years was recorded by H-1593 (20.50 kg) followed by Goa 11/6 (18.37 kg) at Madakkathara.

Maximum number of laterals per square meter in multi location trial – V was recorded in Jhargram-1(22.5) but, flowering laterals were maximum in VRI -3 (16.79) at Bhubaneswar. Amrutha recorded maximum canopy spread (5.77 m) followed by Ullal-4 (5.66 m) at Madakkathara. Highest bisexual flower ratio was seen in Ullal-1 followed by Bhubaneswar-1 at Pilicode.

Among the hybrids developed at Bhubaneswar, A-6 was the most promising with cumulative nut yield of 89.7 kg/plant for 13 harvests and E-1 recorded highest nut weight of 9.4 g while, A-9 recorded maximum shelling percentage of 35.6. The highest shelling percentage was recorded in H-70 (47.0 %) followed by H- 134 (40.0%) and H-122 (39.6%) at Jhargram. The highest cumulative yield / tree for 15 years was recorded by H-21 (120.75 kg/tree) at Madakkathara. The hybrid HC 10 displayed cluster bearing habit with 10 -12 nuts /cluster, had bold nuts of 7.4 gms and easy to peel testa with a lowest flowering duration (53 days) at Vridhachalam.

II. CROP MANAGEMENT

Maximum canopy spread as well as canopy area and yield /tree were supported by N1000 P250K250.g/plant at Jhargram, under NPK fertilizer experiments.

Under fertilizer application in high density cashew, at Bhubaneswar, the highest cumulative yield per hectare was recorded in S3 600 plants/ ha (5m x 4m) (12764.97 kg) followed by S2 400 plants/ha (6m x 4m) (11592.97 kg) and percentage of increase in yield per ha in S3 was 50.8 % over S1 and 10.1% over S2. The nut yield per hectare from 500 trees/ha was higher by 979 kg (147%) over 200 trees/ha at Madakkathara. Highest yield (2221.00 kg/ha) was recorded in highest fertilizer dose with closer spacing; 600 plants/ha (5m x 4m) with 225 kg N, 75 kg P2O5, 75 kg K2O /ha. at Pilicode. The highest yield of 3250 kg/ha was obtained in 5 x 4 m spacing at higher fertilizer level which was 2.40 times the yield in 10 x 5 m spacing (1350 kg/ha) at Vridhachalam.

The cumulative yield for nine harvests was maximum (29.84 Kg/tree) in drip irrigation at 40.0% C.P.E. at Vengurla. At Vridhachalam, the nut yield was highest (6.20 kg/tree) in irrigation at 80% CPE when compared to 4.42 kg/tree in unirrigated control.

Under high density planting trials The mean annual nut yield recorded at 4 x 4m spacing was 1067.0 kg/ha and the cumulative yield for 11 harvests was 19497.0 kg./ha at Bhubaneswar. The per hectare yield was significantly higher (3.28 times) under high density planting (2811 kg) as compared to normal density (858 kg) at Madakkathara.

Maximum yield was obtained with intercrops; from Fenugreek (14.77 Q/ha with a net profit of Rs.15346) followed by coriander (6.74 Q/ha) at Jhargram. Intercropping with tapioca led to the highest net profit of Rs. 93378, followed by amorphophallus (Rs. 84876) at Madakkathara. Out of five different tuber crops, elephant foot yam recorded significantly highest yield (7.29 t/ha) and net income of Rs.1,82,325/- per ha. Intercropping of *Aloe vera* with cashew recorded higher BCR value of 4.1 and net profit of Rs.62500 / ha. and *Ocimum sanctum* recorded the BCR of 3.4 with a net profit of Rs. 45,200 / ha. at Vridhachalam

Organic management of cashew indicated maximum cumulative nut yield per plant for 3 harvests, (3.22 kg) as well as per hectare (644.5 kg) in T8 recommended doses of fertilizer + 10 kg FYM at Bhubaneswar. The maximum tree height (2.87m) and canopy spread (NS) (3.93m) was recorded in treatment involving 25% N as FYM + recycling organic residues + green leaf/ green manuring + biofertilisers at Madakkathara. At Vengurla, the maximum nut yield was observed in treatment T8 (Recommended dosage of fertilizer + 10 kg FYM) (4.91 kg/tree and 0.96 t/ha).

III. CROP PROTECTION

L-cyhalothrin 0.003% minimised the incidence of leaf and blossom webber, shoot tip caterpillar, apple and nut borer and leaf miner at Bapatla. At Jagdalpur, the mean damage score due to TMB on shoot and panicle was minimum in L-cyhalothrin 0.003% and chlorpyriphos 0.05%. Profenophos, recommended spray schedule and L-cyhalothrin resulted in yields of 3.28, 3.12 and 2.84 Kg/tree respectively as compared to control (2.11 kg/tree) at Madakkathara. L-cyhalothrin recorded significantly highest nut yield of 969 kg/ha. with least TMB damage score of 0.86 at Paria. At Vengurla, L-cyhalothrin recorded minimum thrips damage score of 1.92 on the nuts, while it was 8.17 in untreated control plot.

Chlorphyriphos 0.2% led to 100% trees of treated trees without re-infestation or persistent

attack by CSRB at Madakkathara, 92.0% at Bhubaneswar, 90.9% at Bapatla and 77.78% at Jagdalpur. Maximum percentage of trees without reinfestation (42.0%) occurred when <25% of bark circumference was damaged at Bapatla, while it was 63.9% at Vridhachalam.

At Bapatla, maximum and minimum temperature, relative humidity and rainfall accounted for 56% of variation in percent shoot damage by leaf and blossom webber. The relative humidity had significant negative correlation (- 0.678) with incidence of the Inflorescence thrips at Bhubaneswar. The TMB damage on shoot at Jagdalpur was negatively influenced by RH and wind velocity negatively influenced (r = - 0.519 and -0.305, respectively). At Madakkathara, significant negative correlation between TMB infestation and maximum temperature (-0.720) was recorded.

Screening of germplasm to major pests of the region indicated the lowest incidence (1.14%) of leaf and blossom webber in T.No. Hy 95-T4 and BLA-139-1 recorded the lowest incidence (2.00%). at Bapatla. At Jagdalpur, the TMB damage was not observed in entries CARS-7, CARS-17 and CARS-18. The variety K-22-1 was found to be free from leaf caterpillar incidence during 2009-10 and 2010-11 at Madakkathara. All the MLT entries and hybrids evalauted at Vridachalam were prone to TMB infestation in varying degrees of susceptibility with damage score of 1.00 to 3.30.

TRANSFER OF TECHNOLOGY

A total of 2,59,023 grafts were produced during the current year and distributed to several government and non-government organizations as well as to cashew.

The scientists of Bapatla Centre organized front-line technology demonstration on cashew in farmers fields located in East Godavari District. The scientists of Bhubaneswar centre participated in evaluation of replanting by Odisha State Cashew Development Corporation and Odisha Forest Development Corporation in Khurda, Ganjam, Koraput and other cashew growing districts. Cashew varieties Jagannath and Balabhadra were released for cultivation in Odisha.

The scientists of Chintamani Centre participated in National level seminar on Biodiversity and sustainable development and published popular articles, booklets in Kannada on various aspects of Cashew production technology.

The scientist of the Jagdalpur Centre were associated in rejuvenation activity in Bastar District.

The scientist of Jhargram centre functioned as resource person in the farmers training programme on cashew cultivation technology organized by PRADAN and Nari Vikasa Sangha in Bankura.

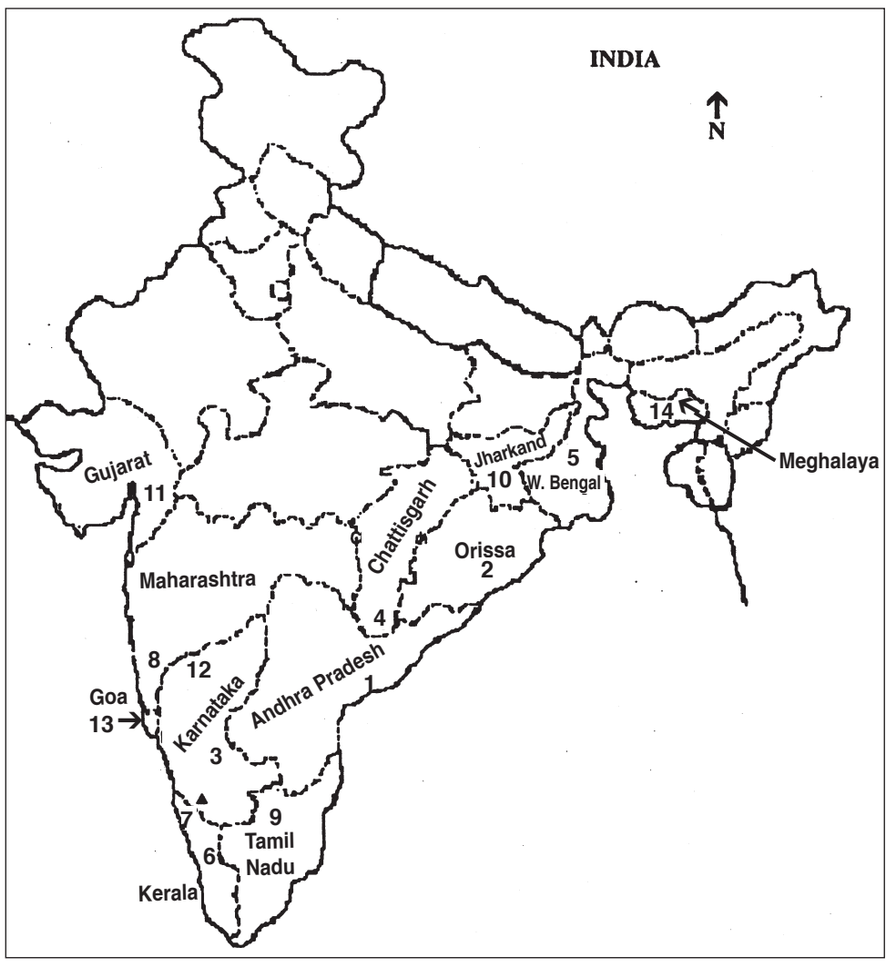
The Madakkathara Centre has launched commercially the following three new cashew apple products viz., cashew apple soda, cashew apple vinegar and cashew apple chocolate.

The scientists of the Pilicode Centre have conducted trainings and seminars on various aspects of cashew viz., cashew production technology, cashew processing and cashew apple utilization.

The scientists of Vengurla Centre conducted demonstrations on cashew softwood grafting, nutrient management in cashew, cashew blossom protection, management of CSRB and value addition of cashew apple and published popular articles in Marati.

The Vridhachalam Centre has conducted 30 front-line technology demonstrations on Cashew production and TMB management sponsored by DCCD and also district level seminars for Cashew farmers and rural women on utilization of Cashew apple.

CENTRES OF AICRP ON CASHEW



HEADQUARTERS OF AICRP ON CASHEW

- Directorate of Cashew Research, Puttur 574 202

AICRP on cashew Centres:

1. Cashew Research Station, (Dr. YSRHU), Bapatla, 522 101, Guntur District, Andhra Pradesh
2. Cashew Research Station, (OUAT), Bhubaneswar 751 003, Orissa
3. Agricultural Research Station, (UAS), Chintamani 563 125, Kolar District, Karnataka.
4. SG College of Agricultural and Research Station, (IGAU), Jagdalpur 494 005, Chattisgarh
5. Regional Research Station, (BCKV), Jhargram - 721 507, Midnapore West District, West Bengal
6. Cashew Research Station, (KAU),Madakkathara 680 651, Kerala
7. Regional Agricultural Research Station, (KAU), Pilicode 671 353, Kasaragod District, Kerala.
8. Regional Fruit Research Station, (Dr. BSKKV), Vengurla 416 516, Maharashtra.
9. Regional Research Station, (TNAU), Vridhachalam 606 001, Cuddalore District, Tamil Nadu.
10. Zonal Research Station, (BAU), Darisai, East Singhbhum Dist., Jharkhand.
11. Agricultural Experimental Station (NAU), Paria-396 145, Valsad District, Gujarat.

Cooperating Centres

12. Kittur Rani Chennamma College of Horticulture (UHS), Arabhavi-591 310, Gokak Taluk, Belgaum district, Karnataka.
13. ICAR Research Complex for Goa, Ela, Old Goa, Goa – 403 402.
14. ICAR Research Complex for North Eastern Hilly Regions, Barapani / Tura-794 005, West Garo Hills Meghalaya.

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

The ten coordinating centres and one sub centre as well as three co-operating centres are located in the East Coast, West Coast and Plains Region (plateau region) of the country.

The centres of the East Coast are located at Bapatla, Bhubaneshwar, Jhargram and Vridhachalam. This zone receives low to medium rainfall ranging from 800 mm to 2000 mm annually and is distributed over a period of 7-8 months from June to January. The soil is mainly sandy, red sandy loam, red loam and laterite. Bapatla centre is situated at an elevation of 54.9 m from mean sea level (MSL) with 40°54' latitude and 80°28' longitude. At Bapatla the annual average rainfall is 1167 mm and the temperature ranges from 17.3 to 37.8°C; the soil is sandy soil with low organic matter, medium N, low P_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 even land has Chintamani, Darisai, Jagdalpur centres and Co-operating centre at Arabhavi in this region. Chintamani comes under Region III (Southern dry region), Eastern dry zone (zone V) of Karnataka and receives average rainfall of 789mm and the temperature ranges from 13.9 to 34.5°C. Centre is situated at an elevation of 300m above MSL, the soil is red sandy loam, deficient in N, medium in P_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.

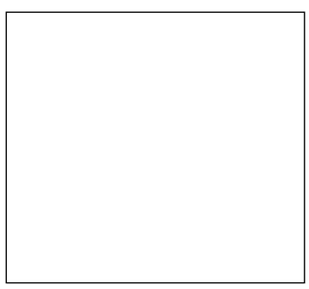
Jagdalpur is located at 17°45' to 20°34' N and 80°15' to 82°15' E longitude with altitude ranging from 550 m to 850 m above MSL with average annual rainfall ranging from 1200-1400mm. The maximum and minimum temperatures are 41°C and 6°C, respectively. Texturally soils are sandy loam to silty loam, with very poor moisture retaining capacity having shallow depth with poor organic matter (0.05%) and pH value (5.5 - 6.5) about normal.

Arabhavi centre is situated in North transitional zone (zone-8) of Karnataka and soils are texturally red sandy loams and having medium to deep soil depth. The average annual rainfall is 1200 mm.

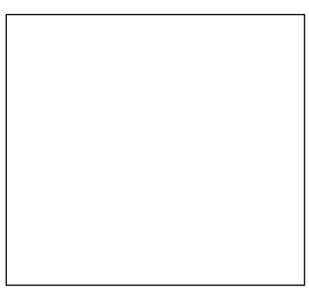
The centre in Barapani / Tura in Meghalaya region is characterized by hilly terran and has deep black loamy soils. The average rainfall ranges between 2500 – 4000mm spread out durind the months of June to November.

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

EXPERIMENTAL RESULTS



I. CROP IMPROVEMENT



I. CROP IMPROVEMENT

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

Centres: East Coast

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast

Madakkathara, Pilicode and Vengurla

Plains / others

Chintamani and Jagdalpur

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:

The cumulative nut yield was found to be the highest in BLA 39/4 (82.85 kg/tree) at Bapatla. At Bhubaneswar, 56 cashew accessions recorded a mean shelling percentage of more than 28%. The cumulative nut yield was highest in NRC-137 (63.35 Kg) under germplasm evaluation for 13 harvests at Jagdalpur. The number of flowering laterals/m^2 and nuts/m^2 were maximum in JGM-149 (11.5 & 31.9 respectively) followed by JGM – 147 (10.2 & 24.9 respectively) at Jhargram. The mean flowering panicles /m^2 were highest in RFRS 188 (18.0 /m^2) at Vengurla.

Germplasm Collection:

During the current year, 3 germplasm collections have been done 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 1241. (Table. 1.1)

Table 1.1 : Cashew germplasm holding in different centres

Centre	No. of accessions		
	Earlier existing	Collected during 2011-12	Existing
East Coast			
Bapatla	132	—	132
Bhubaneshwar	100	1	101
Jhargram	120	1	121
Vridhachalam	208	—	208
West Coast			
Madakkathara	134	—	134
Pilicode	43	—	43
Vengurla	305	—	305
Plains tract/others			
Chintamani	128	—	128
Jagdalpur	68	1	69
Total	**1238**	**3**	**1241**

Germplasm evaluation :

The growth and yield parameters of cashew germplasm conserved at different centres of AICRP-Cashew have been evaluated during 2011-12 and the significant results are reported here.

BAPATLA

Among the accessions evaluated, annual mean nut yield per tree was maximum in BLA 39/4 (16.37 kg) followed by T.No.228 (14.85 kg). However, the cumulative nut yield recorded was highest in BLA 39/4 (82.85 kg /tree) followed by T.No. 5/1 (65.48 kg/tree). The apple weight ranged from 34.5 g to 120 g among the different accessions (Table 1.2).

Table 1.2 : Performance of promising cashew germplasm accessions at Bapatla

Accession No.	Annual mean Nut yield [kg /tree] 2011-12	Cum. yield 11 harvests [kg]	Apple weight [g]	Nut weight [g]	Shelling %
T.No.129	8.85	66.12	35.50	5.11	31.2
T.No.275	12.05	53.50	34.50	3.61	35.4
T.No.228	14.85	57.94	46.50	4.47	32.2
T.No.268	4.52	56.73	45.30	5.29	33.2
BLA 39/4	16.37	82.85	59.00	5.50	33.3
T.No.5/1	5.08	65.48	64.60	4.16	32.0
Hy.95-T4	12.10	53.08	46.00	6.27	35.7

BHUBANESWAR

During the current year, one elite type having early flowering, cluster bearing habit (7 to 8 nuts/ panicle), yellow apple colour, with nut wt. of 5.0 to 6.0g and yield of 8-10 kg/tree was identified and has been collected for planting in the germplasm conservation block.

Out of the 94 accessions evaluated, 58 accessions had bold nut type (nut wt.7.0 g to 12.4 g) and 56 accessions recorded shelling percentage more than 28 per cent. Accession OC-55 recorded maximum shelling of 36.9 per cent and 24 accessions had 4 to 7 nuts/panicle.

Cumulative nut yield (kg/plant) for 7 harvests ranged from 8.08 to 12.65 in 15 accessions. The promising accessions were OC-102 (3.29 kg/plant), OC-121 (3.32kg/plant) and OC-149 (4.04 kg/plant) based on mean annual nut yield (Table 1.3).

Table 1.3 : Performance of promising cashew germplasm accessions at Bhubaneswar

Accession No.	Nut weight (g) Nut Yield	(kg/plant) Cum. nut	Yield (kg/plant)	Shelling (%)
2003 - 6 harvests				
OC55	11.5	0.10	11.30	36.9
OC56	6.0	0.95	12.65	29.8
OC78	8.13	0.99	11.39	35.0
OC83	5.8	2.81	10.51	31.8
OC92	10.0	0.25	12.45	31.7
OC102	8.0	3.29	10.89	31.9
OC107	7.0	1.24	10.00	34.0
OC108	7.0	2.52	10.62	32.7

2004 – 5 harvests				
OC147	9.4	2.5	6.9	31.7
OC148	7.6	2.82	7.82	33.0
OC149	7.4	4.04	6.54	32.1
2005 - 4th harvest				
OC154	6.0	0.9	2.3	29.8
OC155	7.4	0.67	2.87	30.1
2006 - 3rd harvest				
OC157	6.2	0.88	2.68	33.9
2007 - 2nd harvest				
OC158	8.0	0.46	1.96	28.1
2008 - 1st harvest				
OC159	10.3	0.08	0.53	28.8

CHINTAMANI

Among the promising germplasm accessions, tree height ranged from 4.6 to 6.2 m, stem girth (97-159 cm) and canopy spread in E-W and N-S directions ranged from 9.0 to 14.7 and 7.0 to 16.4 m. The highest number of flowering laterals per m^2 (34.0) and maximum number of fruits per panicle (7.30) were observed in Vengurla-5 (Table 1.4).

Table 1.4 : Performance of promising cashew germplasm accessions at Chintamani

Accession	Year of planting	Tree ht. (m)	Girth (cm)	Canopy spread (m)		Flowering laterals (m^2)	No. of fruits/ panicle
				E-W	N-S		
3/108 Gubbi (2/6 ARSC)	1982	4.7	97	9.9	9.6	18.25	3.5
Vetore-56 (27/1 ARSC)	1983	4.6	121	10.9	8.1	25.75	4.8
5/23Kundapur (03/1ARSC)	1982	6.1	98	10.9	10.5	18.5	5.4
5/37 Manjeri (41/3 ARSC)	1985	5.9	141	14.7	16.4	24.25	6.3
Vengurla - 5 (44/1 ARSC)	1985	6.2	159	13.7	13.8	34.0	6.8
K-3-C (56/1 ARSC)	1993	4.7	101	9.0	7.0	17.75	3.2

Among the promising accessions, the accession 44/1- ARSC (Vengurla-5) recorded highest nut yield of 38.42 kg/tree followed by 41/3 ARSC (5/37- Manjeri) which recorded nut yield of 35.25 kg/tree. The accession 27/1- ARSC (Vetore-56) recorded highest nut weight of 7.8 g with 31.6 shelling per cent followed by accession 41/3 - ARSC (5/37 - Manjeri) which recorded 7.7 g nut weight and 30.3 per cent shelling.

The highest cumulative nut yield of 397.65kg/ tree was recorded in 44/1-ARSC (Vengurla -5) followed by 41/3-ARSC (5/37 Manjeri) and 2/6-ARSC (3/108-Gubbi) which recorded 374.94 kg/tree and 297.57 kg/tree, respectively (Table 1.5).

Table 1.5 : Performance of promising cashew germplasm accessions at Chintamani

Accession	Year of planting	Nut Yield (kg/tree)	Cumulative nut yield (kg/tree)	Nut weight (g)	Shelling (%)	Yield (kg/m^2)
3/108 Gubbi (2/6 ARSC)	1982	12.24	297.57 (26hvts)	6.1	30.9	0.13
Vetore-56 (27/1 ARSC)	1983	21.51	207.30 (25hvts)	7.8	31.6	0.24
5/23 Kundapur (03/1ARSC)	1982	13.65	217.35 (26hvts)	7.6	30.6	0.12
5/37 Manjeri (41/3 ARSC)	1985	35.25	374.94 (23hvts)	7.7	30.3	0.15
Vengurla - 5 (44/1 ARSC)	1985	38.42	397.65 (23hvts)	5.6	30.4	0.20
K-3-C (56/1 ARSC)	1993	15.50	143.71 (15hvts)	7.4	30.4	0.25

Description of 102 accessions of germplasm collections were made as per the descriptions developed by DCR, Puttur.

JAGDALPUR

Out of the ten accessions of DCR planted during 1996-97, the highest nut yield/tree was obtained in NRC-138 (8.20 Kg), followed by NRC–137 (7.50 Kg). The cumulative nut yield was highest in NRC-137 (63.35 Kg) for 13 harvests. Mean nut weight was found to be highest in NRC-138 (8.60g) followed by NRC-130 (8.30g) and NRC-140 (8.20g). Shelling per cent was highest in case of NRC- 131 (31.25%) (Table 1.6).

Table 1.6 : Performance of promising cashew germplasm accessions at Jagdalpur

Accession	Mean Ann. Nut Yield (Kg)	Cum. yield Kg/Plant (13 harvests)	Mean nut weight (g)	Mean apple weight (g)	Shelling (%)
NRC- 130	5.40	30.38	8.30	61.35	28.20
NRC- 131	3.25	28.83	7.60	45.00	31.25
NRC- 136	3.20	27.15	7.50	53.65	28.50
NRC- 137	7.50	63.35	7.80	39.20	30.50
NRC- 138	8.20	53.68	8.60	50.60	30.10
NRC- 140	3.50	33.05	8.20	87.50	28.50
NRC- 190	3.10	22.35	7.0	50.25	28.10
NRC- 191	6.50	42.61	7.20	48.50	30.50
NRC- 192	3.20	25.29	7.10	40.60	28.30
NRC- 193	6.20	45.97	7.40	58.50	30.20

JHARGRAM

Among the 77 secondary accessions conserved, 33 performed better with respect to various growth and yield parameters. Nine germplasm accessions had plant height of more than 5.0 m. JGM – 232 was the tallest with 5.7 m height followed by JGM – 221 & JGM – 227, both having 5.2 m height. JGM – 216 had the maximum canopy spread of 6.9 m. The canopy area was the maximum in JGM – 213 (65.2 m^2). JGM- 293 had the maximum flowering intensity (20.3 /m^2) followed by JGM – 321 (20.0/m^2) and JGM – 312 (19.0/m^2).

The highest number of nuts/m^2 was produced by JGM – 282 (88.8) followed by JGM- 321 (82.3) and JGM- 319 (66.8). The number of nuts/m^2 in cluster bearing types was as follows; JGM – 325 (17.3), JGM – 319 (15), JGM – 282 (14.8) and JGM – 321 (13). Nine germplasm accessions had bold nuts having more than 7.0 g nut weight and JGM-216 had a nut weight of 8.9 g, nut yield of 13.5 kg/tree and a shelling percentage of 32.0. Other promising germplasms were JGM-239, JGM-282, JGM-251, JGM- 231, JGM- 247 and JGM- 293 (Table 1.7 and 1.8).

Table 1.7 : Performance of promising cashew germplasm accessions at Jhargram

Accession No.	Plant Height (m)	Trunk Girth (Cm)	Canopy Area (m^2)	Flowering / m^2	Nuts/ m^2
Planted during 2005					
JGM- 227	5.2	65	46.8	5.25	38.5
JGM- 230	4.9	58	35.8	11.5	52.0
JGM- 231	5.0	56	41.2	14.3	23.8
JGM- 232	5.7	70	45.2	10.3	36.0
JGM- 234	5.0	58	39.7	7.25	28.3
JGM- 251	5.0	62	44.4	9.5	35.5
JGM- 247	4.9	70	45.9	12.5	32.3
JGM- 242	4.7	56	45.0	7.25	37.8
JGM- 239	5.0	60	44.8	11.8	22.0
JGM- 236	5.0	63	34.5	13.5	29.3
Planted during 2006					
JGM- 282	4.2	46	27.9	11.3	88.8
JGM- 291	4.2	44	28.0	11.5	21.8
JGM- 293	4.4	54	42.2	20.3	22.8
JGM- 296	4.2	50	31.9	14.3	43.5
JGM- 297	4.2	50	36.0	7.75	24.3
JGM- 312	4.0	48	22.1	19.0	39.0
JGM- 310	3.9	40	21.3	13.0	32.5
JGM- 303	4.6	55	38.7	14.0	38.3
JGM- 298	4.5	55	34.9	10.3	26.5
Planted during 2007					
JGM -319	4.5	50	28.1	15.0	66.8
JGM - 321	3.2	35	18.1	20.0	82.3
JGM - 325	3.8	3.7	31.1	11.5	50.5
JGM - 216	3.7	5.0	65.2	12.8	23.3

Table 1.8 : Performance of promising cashew germplasm accessions at Jhargram

Accession No.	Mean nut wt (g)	Shelling %	Yield (kg/tree)	Yield/m² (g)	Cum. yield (kg/tree)
Planted during 2004					
JGM - 216	8.9	32.0	13.5	0.21	50.90
Planted during 2005					
JGM- 227	3.59	31.5	6.47	0.14	14.03
JGM- 230	3.52	34.1	6.55	0.18	13.50
JGM- 231	7.47	36.9	7.3	0.18	17.95
JGM- 232	4.41	35.6	7.17	0.16	16.84
JGM- 251	7.24	34.3	11.4	0.26	19.61
JGM- 247	7.00	33.3	10.4	0.23	12.90
JGM- 242	5.40	29.6	9.18	0.20	16.48
JGM- 239	8.21	30.6	8.09	0.18	12.43
Planted during 2006					
JGM- 282	4.68	34.4	11.6	0.42	14.89
JGM- 312	5.12	36.5	4.42	0.20	4.54
JGM- 310	7.83	31.3	5.42	0.25	4.97
JGM- 303	6.05	34.9	8.96	0.23	4.15
Planted during 2007					
JGM -319	4.03	32.8	7.56	0.27	11.30
JGM - 321	3.66	37.7	5.46	0.30	6.88
JGM - 325	3.47	34.3	5.44	0.18	8.43
JGM - 216	8.90	32.0	13.5	0.21	50.90

The germplasms were on par with respect to plant height, trunk girth, trunk height and canopy spread. Significant differences were observed with respect to canopy area. Maximum canopy area was recorded in JGM-148 (69.8 m²) followed by JGM-147 (54.3m²). Flowering laterals/m², nuts/m² and nuts/panicle were maximum in JGM-149 (11.5, 31.9 and 7.8) followed by JGM-147 (10.2, 24.9 and 6.6). The annual nut yield /tree as well as cumulative yield /tree were highest in JGM-148. The accessions JGM-147 and JGM-149 were found to be promising for the red and laterite zone of West Bengal (Table 1.9, 1.10 and 1.11).

Table 1.9 : Growth parameters of promising cashew primary clonal germplasm at Jhargram

Name of Selection	Accn. No.	Plant height (m)	Trunk girth (cm)	Canopy Spread (m)	Canopy Area (m²)
N –1	JGM – 147	5.7	64.0	6.8	54.3
N –2	JGM – 148	5.7	70.0	7.9	69.8
N – 3	JGM – 149	4.9	67.3	6.6	46.6
R – 1	JGM – 150	5.5	61.7	5.9	28.9
G – 34 (7)	JGM – 151	5.2	61.7	6.4	20.7
G – 34 (1)	JGM – 152	4.8	68.7	6.4	17.3
	S Em ±	0.288	4.136	0.475	7.660
	C.D.at 5%	0.638	9.157	1.052	16.959
	CV%	6.7	7.7	8.7	23.7

Table 1.10: Yield attributes of promising cashew primary clonal germplasm collections at Jhargram

Name of Selection	Accn. No.	Duration of flowering (days)	Flowering laterals/m²	Vegetative flush/m²	Nuts/ m²	Nuts/ panicle
N – 1	JGM – 147	85	10.2	6.5	24.9	6.6
N – 2	JGM – 148	89	8.8	2.8	24.8	6.5
N – 3	JGM – 149	75	11.5	3.1	31.9	7.8
R – 1	JGM – 150	77	6.5	3.2	7.2	3.4
G – 34 (7)	JGM – 151	80	10.4	5.8	15.0	3.6
G – 34 (1)	JGM – 152	65	9.9	10.4	14.3	3.3
	S Em +		1.009	0.860	4.894	0.924
	C.D.at 5%		2.234	1.904	1.084	2.046
	CV%		12.9	19.9	30.4	21.7

Table 1.11 : Yield attributes of promising cashew primary clonal germplasm collections at Jhargram

Name of Selection	Accn. No.	Nut weight (g)	Yield (Kg/tree)	Shelling %	Cum. Yield Kg/tree (4th harvest)
N – 1	JGM – 147	5.6	7.7	33.6	19.4
N – 2	JGM – 148	6.2	10.7	34.7	36.5
N – 3	JGM – 149	5.1	7.5	35.9	18.2
R – 1	JGM – 150	6.3	1.2	38.0	5.4
G – 34 (7)	JGM – 151	7.5	2.3	32.3	12.5
G – 34 (1)	JGM – 152	7.8	1.9	21.8	8.4
	S Em +	0.310	1.640	3.220	3.404
	C.D.at 5%	0.686	3.631	7.129	7.536

MADAKKATHARA

The accession Kainur recorded a maximum height (7.40 m) and had the highest canopy spread, EW (7.80 m) and NS (9.50 m) followed by Mannur (6.61m). The accession Mannur recorded the maximum girth (88.00 cm) followed by Kainur (84.00 cm). The highest annual yield was recorded by ARL-1 (3.90 kg/tree) followed by Pathanoor (3.10 kg/tree) during the current season. The maximum cumulative yield was obtained in Pathanoor (19.10 kg) followed by Kunjithai (17.55 kg/tree) (Table 1.12).

Table 1.12 : Performance of cashew germpasm accessions at Madakkathara

Variety	Height (m)	Girth (cm)	Canopy spread EW (m)	Canopy spread NS (m)	Nut wt. (g)	Annual yield (kg/tree)	Cum. Yield kg/tree (5 hvsts)
KTR-1	4.73	64.75	4.20	4.17	7.05	2.30	13.13
KTR-3	5.65	71.00	5.37	4.00	7.40	1.65	10.39
Kiralur	6.18	78.00	5.50	4.90	8.16	2.10	10.48
Mannur	6.61	88.00	5.40	6.70	7.45	2.02	10.21
Kainur	7.40	84.00	7.80	9.50	7.30	2.50	14.52
Ummanoor	5.97	75.50	5.52	6.42	7.95	2.75	14.41
Kottukkal	4.85	63.00	5.10	5.10	7.34	1.66	8.22
Peechi	5.25	67.67	5.70	5.43	8.16	2.00	9.45
Kunjithai	5.75	59.50	5.65	4.65	8.05	2.95	17.55
Pathanoor	5.37	68.50	4.90	5.30	9.18	3.10	19.10
ARL-1	6.00	69.00	5.50	5.30	7.30	3.90	10.00
KTR-2	5.40	59.00	5.05	5.40	8.00	2.25	9.76
ARL-2	5.37	73.00	4.50	5.00	6.50	1.90	13.20
ODR	5.25	54.75	4.72	4.57	7.82	2.90	13.83

PILICODE

Among the 81 diverse types identified, 43 types were planted in the germplasm block for evaluation at this centre during 1998, 2000 and 2002. The accession PLD-4 was superior in yield (6.80 kg/plant) and cumulative nut yield (29.44 kg) followed by PLD-12 (25.87 kg). The number of panicles per square meter was highest in PLD-15. The dwarf variety, PLD-57 was utilized for hybridisation programmes in combinations with the varieties MDK-1 and ANK-1.

Among the germplasm accessions planted during 2003, the accession, PLD-40 had higher bisexual flower ratio (13.06) followed by PLD-62 (11.43) (Table 1.13 & 1.14).

Table 1.13 : Performance of cashew germpasm accessions at Pilicode

Accn. No./ variety	Plant height (m)	Collar girth (cm)	Canopy spread (m)		Nut yield (kg/plant)	Cum. nut yield (kg/plant)
			E-W	N-S		
PLD 57	3.37^{f}	0.39^{f}	4.35^{f}	4.62^{e}	1.20^{f}	2.22^{i}
PLD-12	8.50^{b}	1.04^{b}	10.84^{b}	10.50^{b}	6.52^{ab}	25.87^{b}
PLD-20	8.50^{b}	0.87^{c}	9.25^{c}	11.00^{b}	2.72^{de}	7.39^{g}
PLD-17	9.30^{a}	1.06^{ab}	11.00^{b}	10.75^{b}	2.45^{e}	5.29^{h}
PLD-18	8.43^{b}	0.87^{c}	11.00^{b}	10.25^{a}	2.82^{de}	8.03^{f}
PLD-19	8.50^{b}	1.14^{a}	14.00^{a}	12.00^{a}	2.82^{de}	7.54^{g}
PLD 15	6.40^{e}	0.80^{cd}	6.75^{e}	7.00^{b}	3.00^{d}	9.70^{e}
PLD-16	7.75^{cd}	0.59^{e}	5.50^{f}	5.00^{e}	4.55^{c}	16.33^{d}
PLD-4	7.40^{d}	0.85^{cd}	6.89^{e}	6.75^{b}	6.80^{a}	29.44^{a}
PLD-3	9.40^{a}	0.81^{cd}	8.70^{cd}	7.50^{c}	4.40^{c}	16.43^{d}
PLD-1	8.00^{bc}	0.77^{d}	7.50^{de}	7.45^{c}	6.12^{b}	24.85^{c}
Mean	7.77	0.83	8.70	8.43	3.94	13.91
F test	**	**	**	**	**	**
CD 0.05	0.550	0.095	1.249	0.747	0.48	0.479

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

Table 1.14 : Performance of cashew germpasm accessions at Pilicode

Accession No./ variety	Plant height (m)	Collar girth (cm)	Canopy spread (m)		Male: Bisexual flowers ratio
			E-W	N-S	
PLD 75	4.00^{ef}	0.30^{d}	3.00^{e}	3.50^{e}	4.25^{bcd}
PLD 54	3.90^{f}	0.50^{bc}	6.56^{bc}	6.13^{bc}	4.53^{bcd}
PLD 44	3.00^{g}	0.30^{d}	3.00^{e}	3.50^{e}	2.76^{de}
PLD 64	4.50^{de}	0.30^{d}	3.00^{e}	3.50^{e}	3.20^{cde}
PLD 62	5.00^{c}	0.76^{a}	7.50^{a}	9.00^{a}	11.43^{a}
PLD 40	7.00^{ab}	0.70^{a}	6.00^{bcd}	6.50^{b}	13.06^{a}
PLD 48	6.60^{b}	0.40^{c}	5.20^{d}	6.50^{b}	4.76^{bc}
PLD 67	7.00^{a}	0.50^{bc}	5.70^{cd}	4.70^{d}	5.57^{b}
PLD 66	6.00^{b}	0.53^{bc}	6.50^{bc}	5.00^{cd}	4.29^{bcd}
PLD 45	4.93^{d}	0.56^{b}	6.50^{bc}	6.00^{bc}	4.66^{bcd}
PLD 82	7.00^{ab}	0.60^{b}	6.70^{ab}	7.00^{b}	2.05^{e}
Mean	5.52	0.53	5.43	5.58	5.51
F test	**	**	**	**	**
CD @5%	0.544	0.111	0.908	1.191	2.006

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

VENGURLA

Among the 14 types RFRS 184 recorded the lowest mean height (4.10m) and mean girth (26.0 cm) whereas, mean laterals/m^2 and flowering panicles per sq.m. were highest in RFRS 184 i.e. 30.0 and 18.0 per sq.m. respectively. RFRS 173 recorded the highest yield i.e. 2.660 Kg /plant.

Among the 10 types RFRS 191 recorded the lowest mean height (3.60m) and mean girth (40.0cm). The mean laterals per sq.m. were found to be maximum (30.0 per sq.m.) in RFRS 188 while, mean flowering panicles per sq.m. were highest in RFRS 188 (18.0 per sq. m.). RFRS 192 recorded the highest yield i.e. 0.740 Kg /plant (Table 1.15 & 1.16).

Table 1.15 : Performance of cashew germpasm accessions at Vengurla

Cashew type	Height (m)	Plant girth (cm)	Spread (m)	Laterals / m^2	Panicle / m^2	Fruit Set / m^2	Nut wt (g)	Yield kg/ tree	Flowering duration (days)	Shelling %
RFRS 171	5.40	66.0	6.50	28.5	16.5	27.5	8.0	1.86	110.5	26.00
RFRS 172	6.16	68.3	6.25	28.3	15.7	21.3	5.8	0.99	118.5	28.00
RFRS 173	6.06	64.3	6.02	25.7	14.0	26.3	5.0	2.66	113.5	26.00
RFRS 174	6.76	72.0	6.27	28.0	15.7	23.0	4.9	0.62	116.5	28.00
RFRS 175	6.96	55.1	4.79	28.0	16.0	20.0	6.1	0.15	99.3	28.00
RFRS 176	5.40	60.3	5.90	27.3	14.7	15.0	4.8	1.00	115.0	26.00
RFRS 177	5.75	62.0	6.08	29.5	17.5	18.0	6.4	1.08	119.5	31.00
RFRS 178	7.00	71.5	6.85	28.0	16.0	19.0	7.8	2.31	113.0	22.00
RFRS 179	6.30	49.3	4.50	26.3	14.7	19.0	6.6	0.30	111.0	25.80
RFRS 180	8.36	64.6	6.00	28.3	16.0	20.5	6.1	0.92	110.7	28.00
RFRS 181	6.56	52.0	4.57	14.7	17.0	9.0	7.1	0.55	114.5	33.33
RFRS 182	5.93	51.3	5.19	22.5	16.0	17.0	5.0	0.07	114.0	27.50
RFRS 183	6.40	78.0	10.10	25.0	14.0	22.0	5.3	0.46	113.7	27.00
RFRS 184	4.10	26.0	3.22	30.0	18.0	11.0	6.3	0.11	112.0	26.6

Table 1.16 : Performance of cashew germpasm accessions at Vengurla

Cashew type	Plant height (m)	Plant girth (cm)	Spread (m)	Panicles / m^2	Fruit set / m^2	Nut wt (g)	Yield (kg/ plot)
RFRS 185	5.85	44.0	5.13	10.0	14.5	-	0.08
RFRS 186	5.20	36.3	4.18	13.3	19.3	-	-
RFRS 187	5.97	49.7	6.30	15.7	13.0	8.6	0.290
RFRS 188	5.95	56.0	6.65	18.0	-	-	-
RFRS 189	5.85	62.0	5.35	16.5	12.0	8.3	0.070
RFRS 190	5.35	55.5	6.10	15.5	14.0	-	-
RFRS 191	3.60	40.0	4.10	16..0	-	-	-
RFRS 192	4.80	40.0	4.80	17.0	24.0	5.8	0.740
RFRS 193	5.60	39.0	4.25	16.5	-	-	-
RFRS 194	5.20	38.5	5.38	15.0	16.0	-	-

VRIDHACHALAM

The germplasm accessions planted during 1999 were evaluated for their performance.

Cashew accession from Tirukattupalli, TK - 1 recorded the highest cumulative nut yield of 45.68 kg / tree in 10 harvests. The accession KK - 1 from Kanyakumari district recorded the highest nut weight of 7.40 g and the highest shelling percentage of 28.5 (Table 1.17).

Table 1.17 : Performance of cashew germplasm accessions at Vridhachalam

Acc.No	Nut yield / plant (Kg)	Cumulative nut yield / plant (Kg) (10 th harvest)	Mean weight/ nut (g)	Shelling %
Year of planting 1999				
VSK 1	7.62	40.75	6.8	27.6
VSK 2	6.11	39.47	7.2	27.8
SL 1	8.95	43.47	7.0	27.4
TK 1	8.65	45.68	6.4	27.7
NK 1	5.58	36.34	6.4	28.1
KK 1	6.45	36.04	7.4	28.5
PV 1	5.82	35.85	6.4	27.7

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 :

Chintamani and Jagdalpur

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

SUMMARY:

The highest cumulative yield (kg/plant) for 16 harvests was recorded in cashew type H-303 (112.4) followed by NRCC Sel-2 (102.97) at Bhubaneswar. At Jagdalpur, the highest nut weight (10.20 g) as well as highest apple weight (70.37 g) was observed in H-367. Maximum nuts/m^2 were recorded in H-303 (41 nuts/m^2) followed by M-44/ 3 (37.1 nuts/m^2) at Jhargram centre. The mean nut weight (10.20 g) and mean apple weight (102.7 g) was found maximum in H-367 at Vengurla.

Experimental Details:

Design	:	RBD
Replications	:	Three
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
Year of Planting	:	1992 (1993 at Bapatla, 2002 at Jhargram, 1994 at Vridhachalam)

BHUBANESWAR

The highest plant height was recorded in H 255 (8.0m) followed by BPP -3/33 (7.9m) and BPP-10/ 19 (7.3m). The maximum trunk girth (137.7cm) was recorded in H-255 followed by BPP-3/33 (117.3cm) and BPP-3/28 (112.2 cm). Canopy spread was maximum in H-255 (13.6m in E-W & 13.3 in N-S) followed by H 320 (11.7m in E-W & 11.9 in N-S) and NRCC Sel-2 (11.5m in E-W & 11.0 in N-S). The number of laterals as well as, flowering laterals were maximum in H-303 followed by NRCC Sel-2 (Table 1.18).

The highest cumulative yield (kg/plant) for 16 harvests was recorded in H-303 (112.4) followed by NRCC Sel-2 (102.97), H-68 (96.36) and H-320 (87.12). These cashew varieties recorded significantly superior cumulative nut yield compared to the other entries of MLT-92. H-303 registered significantly highest annual mean nut yield of 4.00 kg per plant at 16th harvest. The nut weight, shelling percentage and nuts per panicle in these promising cashew types varied from 8.0 to 8.8, 30.5 to 31.5 per cent and 2 to 3 nuts / panicle, respectively (Table 1.19 & 1.20).

Based on the performances of the thirteen entries of MLT-92 for 19 years, H-303, NRCC Sel-2, H-68 and H-320 were found promising for cultivation in Odisha.

Table 1.18 : Growth & flowering characters of cashew types in MLT- II at Bhubaneswar

Cashew types	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		No. of flowering laterals/m^2
			E–W	N–S	
NRCC Sel -1	6.4	73.4	10.7	10.1	12.5
NRCC Sel -2	6.6	106.8	11.5	11.0	15.1
M 44/3	5.1	58.5	7.0	7.6	13.6
M 15/4	6.6	96.6	9.7	9.0	11.4
BPP 3/33	7.9	117.3	11.1	10.6	14.3
BPP 10/19	7.3	110.5	11.2	11.6	11.0
BPP 30/1	7.0	109.7	11.5	10.2	11.8
BPP 3/28	6.9	112.2	11.7	10.8	19.3
H 303	6.0	100.7	10.5	11.0	19.0
H 320	6.8	100.4	11.7	11.9	17.8
H 255	8.0	137.7	13.6	13.3	16.3
H 367	5.7	100.4	10.4	10.2	12.4
H 68	6.5	102.5	11.5	10.7	17.7

Table 1.19 : Yield parameters of cashew varieties in MLT- II at Bhubaneswar

Varieties	Nut yield (kg/ plant)	Cum. nut yield (kg/ plant) (16 harvests)	Nut weight (g)	Shelling (%)
NRCC Sel-1	1.35	45.95	8.5	30.8
NRCC Sel-2	1.67	102.97	8.8	31.5
M 44/3	0.85	40.75	5.2	29.5
M 15/4	0.81	38.81	7.5	28.5
BPP 3/33	1.26	62.16	7.5	31.5
BPP 10/19	0.68	47.58	6.5	31.0
BPP 30/1	1.66	48.36	6.8	28.0
BPP 3/28	0.87	57.57	7.6	30.5
H 303	4.00	112.40	8.2	31.5
H 320	2.22	87.12	8.5	30.5
H 255	0.98	43.48	10.1	32.5
H 367	1.54	70.84	9.3	29.0
H 68	2.06	96.36	8.0	31.2
Sem +	0.545	1.148		
C.D. 5%	1.591	3.352		

Table 1.20 : Yield and yield attributing characters of promising cashew types in MLT-II at Bhubaneswar

Cashew types	Nut weight	Shelling (%)	Yield (kg/plant)	Cum. nut yield 16 hvsts.
H 303	8.2	31.5	4.0	112.4
NRCC Sel-2	8.8	31.5	2.22	102.97
H 68	8.0	31.2	1.67	96.36
H 320	8.5	30.5	2.06	87.12

CHINTAMANI

The highest tree height was recorded in the entries NRCC Sel-1 (6.23 m) and H-255 (6.22 m) followed by M-15/4 (6.04 m) and H–320 (5.98 m). The lowest tree height was observed in M-44/3 (5.07 m). The stem girth varied from 77.16 to 109.26cm. The highest girth was recorded by NRCC Sel-1 (109.26 cm) followed by Ullal-1 (104.18 cm). The canopy spread in E-W and N-S directions were non–significant. However, the highest E-W spread was noticed in NRCC-1 (9.89m) and N-S spread was noticed in NRCC Sel-1 (10.79m).

The highest number of flowering laterals/m^2 were observed in M-44/3 (26.10) followed by NRCC Sel-1 (25.30). The nut yield per tree varied significantly. Highest nut yield of 12.56 kg/tree was noticed in H-320 followed by M-44/3 (12.10 kg/tree). Over a period of 17 harvests, H-320 recorded highest cumulative yield (157.41 kg/tree) followed by the entries NRCC Sel-2 (137.49 kg/tree) and M-44/3 (124.40 kg/tree). H-320 recorded highest nut weight of 8.9 g followed by H-68 and H-367 with nut weight of 8.8 & 8.7g and lowest nut weight was obtained in TN-10/19 (5.3g) followed by M-44/3 (6.0g). The shelling percentage was highest in TN-10/19 (32.1%) followed by M-44/3 (31.4%) and H-320 (31.2%) (Table 1.21 & 1.22).

Table 1.21 : Growth characters of cashew in MLT-II at Chintamani

Cashew entries	Tree ht. (m)	Trunk girth (cm)	Canopy spread(m)		No. of flowering laterals/m^2
			E-W	N-S	
H – 68	5.72	99.15	7.40	8.29	18.6
H – 367	5.32	91.04	8.18	7.59	20.2
H – 303	5.19	99.76	8.45	8.54	15.5
H – 255	6.22	103.13	9.72	10.15	22.5
H – 320	5.98	92.28	8.64	8.72	22.4
M -44/3	5.07	79.57	7.23	7.39	26.1
M -15/4	6.04	97.05	8.33	8.59	23.2
NRCC Sel-1	6.23	109.26	9.89	10.79	25.3
NRCC Sel-2	5.79	77.16	7.10	7.12	21.9
TN- 30/1	5.18	89.28	8.35	8.39	21.4
TN -3/33	5.82	97.39	8.62	9.23	20.1
TN -10/19	5.69	94.83	8.92	8.52	21.7
TN -3/28	5.62	97.10	8.82	10.26	16.8
Ullal – 1	5.79	104.18	9.18	9.28	18.7
S.Em ±	0.31	9.69	0.66	0.94	1.53
C.D @ 5%	NS	NS	NS	NS	5.00

Table 1.22 : Yield and yield attributing characters of cashew entries in MLT-II at Chintamani

Cashew entries	Nut yield (Kg/tree)	Cumulative yield (kg/tree) 17 harvests	No. of fruits/ panicle	Nut weight (g)	Shelling (%)	Apple weight (g)
H -68	5.10	57.11	4.1	8.8	30.9	85.00
H-367	6.85	91.31	5.2	8.7	30.7	95.00
H- 303	5.90	104.08	4.7	8.1	27.7	55.00
H- 255	5.43	91.28	5.5	8.3	29.5	50.00
H- 320	12.56	157.41	6.4	8.9	31.2	90.00
M- 44/3	12.10	124.40	5.8	6.0	31.4	40.00
M -15/4	9.85	120.41	5.7	7.7	29.5	55.00
NRCC -1	6.25	94.55	5.4	8.0	30.2	40.00
NRCC -2	10.15	137.49	5.6	8.1	30.2	55.00
TN -30/1	9.45	106.07	4.9	6.6	28.2	60.00
TN -3/33	5.40	80.17	4.7	7.6	30.1	75.00
TN -10/19	4.96	77.10	4.8	5.3	32.1	30.00
TN -3/28	8.15	103.40	5.6	7.1	30.6	70.00
Ullal – 1	10.05	103.05	5.7	7.2	30.8	35.00
S.Em ±	0.63	-	-	-	-	-
C.D @5%	1.90	-	-	-	-	-

JAGDALPUR

The maximum plant height (4.73 m) as well as trunk girth (69.37cm) was recorded in H–68 followed by Sel-1, V-4 and H-255. Canopy spread was found to be maximum in V-4 (E-W/N-S = 5.52/ 5.37m). Nut yield (kg/tree) was highest for H-68 (5.13 kg) followed by V-4, H-367 and H-303. The cumulative yield (Kg/tree) was highest for H-68 (23.94kg) with nine harvests. Nut weight (10.20 g) as well as apple weight (70.37g) was highest for H-367 (Table 1.23 & 1.24).

Table 1.23 : Yield and yield attributing characters of promising cashew types in MLT-II at Jagdalpur

Varieties/ Genotype	Plant height (m)	Girth (cm)	Canopy spread (m)	
			E-W	N-S
3/28	3.90	61.40	4.47	4.60
3/33	4.22	58.62	4.73	4.85
30/1	3.42	54.78	4.08	4.68
10/19	3.98	57.98	4.43	4.58
VRI-1	3.17	51.95	3.82	3.87
VRI-2	2.68	41.62	3.40	3.17
H-68	4.73	69.37	4.70	5.12
H-255	3.87	64.93	4.93	5.15
H-367	3.67	60.75	5.17	5.4
H-320	3.60	58.25	4.53	5.25
H-303	4.07	61.57	4.45	4.75
Sel-1	3.90	65.60	4.75	4.68
Sel-2	3.13	50.73	4.42	4.42
V-4	4.38	65.37	5.52	5.37
SE(m)	0.24	2.85	0.27	0.25
CD 5%	0.69	8.31	0.80	0.73

Table 1.24 : Yield and yield attributing characters of promising cashew types in MLT-II at Jagdalpur

Varieties/ Genotype	Mean ann. nut yield (Kg/tree)	Cum. nut yield (9 hvsts)	Nut weight (g)	Apple weight (g)	Shelling %
3/28	2.37	11.43	7.83	52.00	30.37
3/33	2.50	12.55	7.15	50.37	30.70
30/1	2.43	13.37	7.33	45.35	28.83
10/19	2.57	14.07	5.90	50.32	30.73
VRI-1	1.77	9.80	6.77	47.93	30.97
VRI-2	2.47	12.71	6.93	46.17	30.53
H-68	5.13	23.94	9.83	55.37	30.80
H-255	3.67	15.47	10.07	61.52	30.63
H-367	4.65	18.48	10.20	70.37	30.45
H-320	3.83	16.88	9.03	51.10	28.40
H-303	4.50	22.35	8.70	52.30	29.97
NRCC Sel-1	1.90	11.07	7.80	51.80	31.17
NRCC Sel-2	3.30	16.68	8.10	43.25	29.57
V-4	4.83	22.52	9.57	55.30	30.57
SE(m)	0.36	-	0.21	2.37	-
CD 5%	1.05	-	0.61	6.90	NS

JHARGRAM

The varieties evaluated were found to be on par with respect to plant height, trunk girth, canopy spread, canopy area, flowering/m^2 and vegetative flush /m^2.

Maximum nuts/m^2 were recorded in H-303 (41 nuts/m^2) followed by M-44/ 3 (37.1 nuts/m^2) and Tree No. 3/33 (32 nuts/m^2). The nuts/panicle was highest in H-303 and T. No 3/28 (8 nuts/panicle) which was followed by Tree No. 10/19, M-44/3 and Tree No. 3/33 (7 nuts/panicle). H- 320, H- 303, H-255 and Tree No. 3/28 had bold nuts (7 g nut weight). H-367, NRCC Sel-1, NRCC Sel-2 and M- 15/4 had medium sized nuts (6.1 – 6.8g nut weight). Yield was highest in case of H-303 (10.6 kg/tree) followed by tree No.3/28 (10 Kg/tree). Varieties like Tree No.10/19, H-320, Tree No .3/ 33, H-367 and H- 255 produced 6 - 7 Kg nuts /tree.

The varieties, H-303, H-255 and Tree No. 3/ 28 were on par and yielded between 21.3 to 23.5 Kg/tree based on cumulative yield/tree at 6th harvest. Varieties such as, M-44/3, T. No. 10/19 and M-15/4 had better cumulative yield (Table 1.25 & 1.26).

Table 1.25 : Growth parameters of different varieties under MLT – II at Jhargram

Variety	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Duration (Days)	Flowering /m^2
T.No.30/1	4.5	52.7	5.0	69	18.5
T.No.3/33	5.1	66.0	5.6	75	9.5
T.No.10/19	5.7	68.7	5.8	77	14.9
T.No.3/28	5.4	67.3	6.9	69	7.8
H – 68	4.7	47.0	5.2	70	11.3
H – 367	5.4	59.3	5.1	90	13.0
H – 303	4.5	50.7	5.3	72	11.1
H – 255	5.3	70.7	6.2	77	9.4
H – 320	4.9	64.7	5.6	70	12.4
M – 44/3	3.8	49.7	5.1	80	18.3
M – 15/4	4.7	52.0	5.4	68	11.9
NRCC Sel-1	4.3	50.3	4.6	65	3.7
NRCC Sel-2	4.1	56.0	4.8	80	20.3
S. Em (±)	0.348	9.436	0.596		2.299
C.D. at 5%	0.718	19.476	1.230		4.745
CV%	8.93	19.90	13.43		22.57

Table 1.26 : Yield parameters of different varieties under MLT – II at Jhargram

Variety	Mean No. of nuts /m²	Nut weight (g)	Yield (Kg/tree)	Cum. Yield (Kg/tree) 6th harvest	Shelling %
T.No.30/1	23.9	5.1	4.6	11.7	29.9
T.No.3/33	32.0	5.2	6.6	15.3	33.2
T.No.10/19	29.7	5.6	7.0	17.8	35.0
T.No .3/28	25.0	7.0	10.0	21.3	32.3
H – 68	21.4	4.9	3.9	9.6	30.7
H – 367	20.1	6.8	6.2	13.0	33.8
H – 303	41.0	7.0	10.6	23.5	29.9
H – 255	17.6	7.1	6.1	22.2	33.1
H – 320	24.0	7.1	6.9	15.5	29.3
M – 44/3	37.1	5.2	5.9	18.7	32.1
M – 15/4	24.6	6.1	5.4	17.3	31.6
NRCC Sel-1	6.3	6.8	1.2	4.7	33.8
NRCC Sel-2	29.1	6.3	5.9	16.2	32.8
S.Em (±)	5.372	0.673	2.140	2.967	1.88
C.D. at 5%	11.09	1.80	4.42	6.12	3.88
CV %	25.77	13.4	42.4	22.84	7.19

MADAKKATHARA

The maximum height was recorded by T-107/3 (8.40 m) followed by H- 320 (8.25 m).and highest stem girth was recorded by T-107/3 (134.83 cm) followed by H – 255 (126.89 cm). T-107/3 recorded highest canopy spread (11.21 m) followed by H-255 (9.81 m), but all varieties evaluated were on par. The apple weight differed significantly and T-40/1 recorded the highest apple weight (95.41 g) followed by H- 367 (78.50 g).

The highest nut weight was recorded by T-3/28 (9.23 g) followed by H- 367 and M-15/4 (8.61 g). There was significant difference for annual nut yield and the highest yield was recorded by H-303 (8.34 kg/ tree/ year) followed by H-320 (7.66 kg/tree/ year). The highest cumulative yield for 15 years was recorded by H- 303 (76.48 kg) followed by H-320 (67.13 kg) (Table 1.27 & 1.28).

Table 1.27 : Vegetative characters of cashew genotypes under MLT II at Madakkathara

Source	Genotypes	Height (m)	Girth (cm)	Mean canopy spread (m)
Bapatla	T 30/1	7.51	109.16	8.59
	T 3/33	7.85	111.00	8.33
	T 10/19	7.56	110.34	8.16
	T3/28	7.87	113.00	7.47
Vengurla	HY 68	7.87	110.34	8.39
	HY 367	6.76	93.25	7.33
	HY 303	8.02	120.91	8.24
	HY 255	8.21	126.89	9.66
	HY 320	8.25	105.16	8.95
Vridhachalam	M 44/3	6.83	108.50	7.93
	M 15/4	7.09	111.91	7.81
DCR, Puttur	T 107/3	8.40	134.83	10.77
	T 40/1	7.36	101.50	8.73
Check (Dhana)	HY 1608	7.93	119.00	9.84
CD (0.05)		NS	NS	

Table 1.28 : Flowering characters of cashew genotypes in MLT II at Madakkathara

Genotypes	Duration of flowering (days)	Flowering intensity / m^2	Nut wt (g)	Shelling %	Mean Ann. Nut Yield (kg/tree)	Cum. nut Yield 15 hvsts. (kg/tree)
T30/1	119	5.34	7.60	24.20	2.90	30.30
T 3/33	121	4.71	8.14	22.90	2.35	27.75
T 10/19	111	7.00	7.40	23.67	2.62	21.62
T 3/28	123	7.50	9.23	24.50	3.05	39.30
H 68	125	5.58	8.27	26.30	2.73	29.36
H 367	131	6.94	8.60	24.10	3.27	33.30
H 303	134	7.26	8.26	21.30	8.34	76.48
H 255	130	7.31	8.25	22.40	2.66	28.38
H 320	150	5.80	8.28	22.87	7.66	67.13
M 44/3	125	6.29	8.60	23.40	3.58	38.56
M 15/4	122	6.58	8.61	24.20	4.35	47.57
T 107/3	124	4.28	8.14	24.30	2.56	29.11
T 40/1	121	6.37	7.93	24.70	3.29	35.95
H 1608	148	7.93	7.87	23.16	5.45	56.98
CD (0.05)	53.65	3.19	3.55		1.21	

VENGURLA

The hybrids/ varieties differed significantly for mean yield (kg/tree & t/ha), mean nut weight (g) and mean apple weight (g). The maximum height and spread was reported in variety 30/1 (7.12m and 10.38 m respectively); whereas the maximum girth was observed in NRCC Sel.1 (103.0 cm).

H-30/1 produced significantly highest mean yield (6.38 kg/tree & 1.27 t/ha) and was found significantly superior over other treatments, this was followed by H-367 (6.3 kg/tree & 1.26 t/ha). The mean nut weight (10.20g) and mean apple weight (102.7g) were found to be maximum in H-367 whereas, the maximum cumulative yield for last nine harvests (33.22 Kg/tree) was recorded in H-303, followed by H- 30/1 (25.55 Kg/tree) and H-255 (24.85 Kg/tree) (Table 1.29).

Table 1.29 : Growth and yield characters of cashew genotypes in MLT II at Vengurla

Variety /type	Mean Height (m)	Mean Spread (m)	Mean Flowering. duration (Days)	Mean Fruit set /m^2	Mean Yield (kg/ tree)	Mean Nut weight (g)	Mean Shelling (%)	Cum. Yield Kg/ tree 9 hvsts.
H- 255	6.15	9.15	110.73	19.92	5.92	9.47	29.3	24.85
H-303	5.20	7.53	117.07	28.08	5.45	7.60	28.3	33.22
H- 320	6.38	8.98	114.17	18.19	5.28	7.40	28.0	20.20
H-367	4.11	7.93	117.30	19.97	6.30	10.20	28.3	20.96
NRCC Sel.1	5.99	8.87	109.50	19.08	5.31	8.60	28.00	20.70
NRCC Sel.2	5.51	8.31	108.33	24.19	3.67	7.93	27.3	14.36
M-44/3	3.09	4.78	77.93	14.55	1.12	3.13	19.7	8.88
3/28	4.56	6.24	72.73	15.03	1.99	41.67	18.3	10.04
10/19	6.84	9.62	116.87	26.52	5.11	5.97	25.7	17.37
3/33	5.21	8.01	112.23	18.08	3.43	6.60	29.7	15.86
30/1	7.12	10.38	109.90	27.83	6.38	6.57	27.3	25.55
SEm ±	0.86	1.21	16.26	4.23	2.17	0.89	4.02	-
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	3.60	N.S.	-

VRIDHACHALAM

The maximum plant height was recorded by T-10/19 (5.22 m) and maximum stem girth was observed in M-107/3 (68.42cm). A consistently higher annual nut yield was observed in M-44/3 and M-15/4 of Vridhachalam. H-320 recorded the highest nut weight of 7.6 g. Highest shelling percentage of 28.4 was recorded in M-107/3 of DCR, Puttur and H-367 of Vengurla (Table 1.30 & 1.31).

Table 1.30 : Vegetative characters of cashew genotypes in MLT II at Vridhachalam

Variety/Genotype	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Duration of flowering (days)
BAPATLA				
T. 30/1	4.72	54.44	4.9	64
T. 3/33	3.96	50.46	5.0	64
T.10/19	5.22	62.24	6.6	60
T. 3/28	4.36	58.16	6.2	64
VENGURLA				
H 68	4.22	54.46	6.3	66
H 367	4.16	59.22	6.2	60
H 303	5.10	64.64	6.4	65
H 255	4.62	58.62	5.3	65
H 320	4.46	49.84	6.3	61
VRIDDHACHALAM				
M 44/3	4.68	52.46	6.0	66
M 15/4	4.88	66.24	6.8	64
DCR, PUTTUR				
107/3	5.14	68.42	6.4	66
40/1	4.44	58.16	6.0	62
CD (0.05%)	0.79	0.13	NS	

Table 1.31 : Yield and Yield attributing characters of cashew types in MLT II at Vridhachalam

Variety/ Genotypes	Flowering intensity/ m^2	Nut weight (g)	Yield (kg/tree)	Cum. yield (kg/tree) (13 harvests)	Shelling (%)
T. No. 30/1	15.12	7.0	5.25	39.37	27.8
T. No. 3/33	13.28	7.2	6.65	39.32	28.2
T. No. 10/19	11.26	7.0	6.02	38.46	28.0
T. No. 3/28	15.68	6.8	5.54	40.34	28.2
H 68	12.84	6.6	6.85	41.57	27.6
H 367	15.68	6.8	6.62	41.30	28.4
H 303	14.36	6.8	5.98	43.06	28.0
H 255	14.68	7.4	5.46	38.08	28.2
H 320	14.22	7.6	8.08	46.49	28.2
M 44/3	15.38	5.8	6.54	47.00	28.0
M 15/4	15.68	6.6	6.98	47.80	28.2
M 107/3	15.28	6.8	6.21	39.17	28.4
M 40/1	15.46	7.2	6.45	44.08	28.2
CD(0.05)		0.42	0.64		NS

2. Multi Location Trial – III

Centres: East Coast

Bapatla, Bhubaneshwar and Vridhachalam

West Coast

Madakkathara and Vengurla

Plains / others

Chintamani

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 Bhubaneswar, the maximum number of flowering laterals per sq.m. (20.0) was maximum in H 675 and the maximum cumulative nut yield (kg/plant) was obtained in BH 85 (21.22) followed by BH 6 (19.36) for 6 harvests. The highest cumulative yield for 6 years was recorded by H-1593 (20.50 kg) followed by Goa 11/6 (18.37 kg) at Madakkathara.

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
Total	6	4
Replications – Three	Spacing 7.5 x 7.5 m	Plot size - 4 plants per plot

BAPATLA

Among the 11 genotypes evaluated, plant height was highest in H-32/4 (4.44 m) which was closely followed by H-11(4.00m). Maximum trunk girth and canopy spread was recorded with BPP-8 variety i.e. 64.33cm, 6.12m [E-W] and 6.56m [N-S] respectively. Duration of flowering was found to be shortest in H-662 (97days) followed by H-22/1(105 days). Number of panicles produced per square meter canopy area was highest with H-675 which had 16.2 panicles (Table 1.32).

Table 1.32 : Performance of cashew varieties/genotypes in MLT III at Bapatla

Variety/ Genotype	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		Duration of flowering	Flowering intensity/ m^2
			E-W	N-S		
Goa 11/6	3.73	60.33	6.50	6.56	121	14.6
H 662	2.70	46.00	4.65	4.75	97	13.6
H 32/4	4.44	58.66	5.31	5.45	120	12.9
K 22/1	3.63	68.00	5.64	6.32	105	14.7
H 11	4.00	60.66	5.15	4.95	131	14.9

H 675	3.65	57.25	6.25	6.42	115	16.2
H 14	3.43	71.52	5.3	5.48	128	11.1
BPP-8	4.03	64.33	6.12	6.56	120	13.9
H 1597	3.95	60.25	5.42	5.65	118	16.5
BH 6	3.10	52.33	6.15	6.16	136	11.7
BH 85	3.70	54.33	8.37	8.26	131	13.5

The mean nut yield per tree during the year was highest in BH-6 (4.06kg) followed by BPP-8 (3.85kg). Cumulative nut yield per tree was also highest in BPP-8 which gave 21.75 kg/tree at 5th harvest and was followed by H-32/4 with 14.00 kg/tree. Mean apple weight was highest in BPP-8 with 69.67 g which was followed by H-32/4 (62.0g) (Table 1.33).

Table 1.33 : Performance of cashew varieties/genotypes in MLT III at Bapatla

Variety/ Genotype	Nut yield /tree (Hvst.5) (kg)	Cum. nut yield /tree 4 hvts (kg)	Nut weight (g)	Apple weight (g)	Shelling (%)
Goa 11/6	3.72	12.64	6.35	48.7	32.06
H 662	2.70	5.14	7.49	52.2	35.34
H 32/4	3.75	14.00	6.85	62.0	31.22
K 22/1	3.63	7.94	5.75	50.2	31.19
H 11	3.43	8.49	5.77	46.5	30.66
H 675	3.28	8.06	4.34	56.2	34.15
H 14	3.39	11.34	5.65	46.3	32.09
BPP-8	3.85	21.75	8.37	68.2	28.48
H1597	3.62	10.38	5.35	58.9	30.34
BH 6	4.06	12.39	7.03	55.0	34.41
BH 85	3.54	9.65	6.22	45.3	34.02

BHUBANESWAR

The hybrid H-32/4 recorded maximum plant height (4.75m) and trunk girth (73.92 cm) and canopy spread (7.94 m in E-W & 7.9 m in N-S direction) was maximum in 2/16 (local check). The hybrid H-11 recorded maximum number of laterals per sq. m. (21.72) but flowering laterals per sq.m. (20.0) was maximum in H-675 (Table 1.34).

Table 1.34 : Vegetative and flowering characters of cashew types inMLT- III at Bhubaneswar

Cashew types	Plant height (m)	Trunk girth (cm)	Canopy spread		No. of flowering laterals/m^2
			E-W	N-S	
BH 6	4.46	67.58	7.09	7.45	15.83
BH 85	4.62	68.12	7.34	7.56	18.97
H 1597	4.35	69.89	6.89	6.95	3.65
K 22-1	2.11	16.44	2.42	1.97	12.33
H 662	3.39	34.55	4.19	4.11	13.39
H 675	2.25	48.00	3.42	3.73	20.00
H 11	4.29	63.11	7.09	7.37	18.75
H14	3.90	51.00	5.56	5.79	17.91

H 32/4	4.75	73.92	7.26	7.16	8.29
Goa 11/6	4.54	67.50	7.23	6.73	13.03
H 2/16 (Local Check)	4.73	67.50	7.94	7.90	3.58
Sem ±	0.46	4.65	0.43	0.45	1.71
CD(5%)	1.36	13.72	1.27	1.34	5.04

Table 1.35 : Yield & Yield attributing characters of cashew types in MLT-III at Bhubaneswar

Cashew types	Nut yield (kg/plant)	Cum. nut yield at 6th harvest	Nut weight (g)
BH 6	7.66	19.36	8.8
BH 85	7.52	21.22	7.8
H 1597	1.24	9.44	8.8
K 22-1	0.73	5.23	6.0
H 622	0.91	5.31	8.0
H 675	1.37	5.27	4.0
H 11	5.90	14.3	6.3
H 14	2.85	9.55	5.6
H 32/4	2.23	12.73	7.0
Goa 11/6	6.08	15.98	7.7
H 2/16 (Local check)	1.96	11.66	9.7
SEM±	0.668	0.32	
CD (5 %)	1.969	0.94	

Table 1.36 : Yield and yield attributing characters of promising cashew types in MLT –III at Bhubaneswar

Cashew types	Nut weight (g)	Nut yield (Kg/plant)	Cum. nut yield (kg/plant)
BH 85	7.8	7.52	21.22
BH 6	8.8	7.66	19.36
Goa 11/6	7.7	6.08	15.98

Maximum cumulative nut yield (kg/plant) was obtained in BH 85 (21.22) followed by BH 6 (19.36) and Goa 11/6 (15.98) at 6th harvest. Among all the entries, BH 6 recorded maximum nut yield of 7.66 kg per plant at 6th harvest, which was followed by BH-85 (7.52kg/plant), Goa 11/6 (6.08 kg/plant) and H-11 (5.9 kg/plant). BH-6, BH-85 and Goa 11/6 recorded significantly superior nut yield (kg/plant) over the local check (H 2/16) and were themselves on par. All the promising cashew types (BH-85, BH-6 and Goa 11/6) of MLT-III are bold nut types (with nut wt. ranging from 7.7 g to 8.8 g) and had cluster bearing habit (4 to 7 nuts /panicle) (Table 1.35 & 1.36).

CHINTAMANI

Significantly highest plant height was recorded in H-32/4 (5.25m) followed by Bhaskara (5.19m). The highest trunk girth was recorded in H-32/4 (79.36 cm) followed by Bhaskara (74.94 cm). The canopy spread of plants significantly varied among entries and the highest E-W & N-S spread was recorded by H-32/4 (8.31 and 8.15m. respectively).

Significantly highest nut yield was recorded by H–32/4 (13.26 kg/tree) followed by H-1593 (12.22 kg/tree) and lowest nut yield was recorded by H–14 (3.35 kg/tree). The cumulative nut yield of six years recorded highest in H-32/4 (39.32 kg /plant) followed by H-1593 (38.77 kg/plant). The highest nut weight was recorded in BH-6 (9.2 g) followed by H-1593 (9.1 g). The shelling percentage of entries ranged from 30.9 to 32.8 per cent (Table 1.37).

Table 1.37 : Growth and yield performance of cashew entries–MLT-III at Chintamani

Entries	Plant ht. (m)	Trunk girth (cm)	Canopy spread (m)		Nut yield (kg/tree)	Cum yield (kg/tree) of 6 harvests	Nut Wt. (g)	Apple Wt. (g)	Shelling (%)
			E-W	N-S					
BH – 6	4.48	73.62	7.42	6.74	9.55	30.41	9.2	76.6	32.0
BH – 85	4.54	71.89	6.76	6.79	8.52	27.88	7.3	43.6	32.0
H – 1593	4.42	71.32	7.10	7.15	12.22	38.77	9.1	82.8	32.2
H – 662	4.41	61.85	7.06	7.12	11.20	31.74	4.9	51.4	30.9
H – 675	4.16	60.21	6.38	6.39	5.40	19.15	4.8	42.5	32.8
H – 32/4	5.25	79.36	8.31	8.15	13.26	39.32	8.8	54.0	31.9
K - 22/1	4.67	69.58	6.62	6.78	11.12	32.00	6.0	80.6	31.7
H –11	4.58	71.27	7.42	7.15	9.05	27.41	6.3	50.4	31.8
H – 14	3.74	51.95	5.45	5.62	3.35	13.91	5.3	33.4	31.1
Bhaskara	5.19	74.94	7.15	6.98	8.26	30.20	8.4	50.1	31.5
Chintamani–1	4.65	70.38	7.06	7.26	12.05	35.77	7.4	56.7	31.2
S.Em ±	0.26	4.24	0.42	0.44	1.32	-	-	-	-
C.D @ 5%	0.75	12.62	1.22	1.30	3.92	-	-	-	-

MADAKKATHARA

The maximum height was recorded in H 662 (6.41 m) followed by BH 85 (5.83 m) and maximum girth was in Dhana (86.58 cm) followed by H-11 (81.60 cm), while maximum canopy spread - EW was also recorded in Dhana (8.19 m) followed by H11 (8.02 m). Maximum canopy spread NS was recorded by genotype H- 662 (8.01 m) followed by Dhana and H 11 (7.89m).

The hybrid, H-662 recorded maximum nut yield/ tree (5.40 kg/tree) followed by variety H 1593 (4.93 kg/tree). The highest cumulative yield for 6 years was recorded by genotypes H-1593 (20.50 kg) followed by Goa 11/6 (18.37 kg) (Table 1.38 & 1.39)

Table 1.38 : Morphological and yield characters of cashew genotypes under MLT III at Madakkathara

Genotypes	Height (m)	Girth (cm)	Canopy spread – EW (m)	Canopy spread – NS (m)	Flowering intensity (m^2)
Dhana	5.14	86.58	8.19	7.89	6.75
H-11	5.60	81.60	8.02	7.89	6.77
H-32/4	5.70	73.90	7.31	7.15	7.15
H-1593	4.38	74.63	7.57	7.48	6.94
BH-6	4.94	74.44	7.51	7.39	5.27
H-662	6.41	81.33	7.67	8.01	5.58
H-675	5.68	79.38	7.25	7.54	7.45

BH-85	5.83	80.75	6.95	7.15	5.32
K-22-1	4.82	80.91	7.10	7.29	6.80
Goa 11/6	5.43	79.50	7.54	7.87	6.55
H-14	5.44	77.10	7.41	7.38	6.72
CD (0.05)	1.10	NS	NS	NS	NS

Table 1.39 : Yield characters of cashew genotypes under MLT III at Madakkathara

Genotypes	Nut wt. (g)	Yield (kg/tree/ year)	Cum. yield (6 years) (kg/tree)
Dhana	8.42	4.11	16.68
H-11	8.21	4.36	15.27
H-32/4	8.25	3.26	14.40
H-1593	8.35	4.93	20.50
BH-6	7.62	4.21	12.17
H-662	5.99	5.40	17.45
H-675	8.55	3.75	13.77
BH-85	6.31	2.44	14.16
H-22-1	8.04	3.90	13.47
Goa 11/6	8.48	3.04	18.37
H-14	8.60	3.29	15.68
CD (0.05)	1.43	1.59	

VENGURLA

The experiment is in the initial stage and the growth parameters did not vary significantly; however, the mean height was in the range of 1.86 m (BH 6) to 2.30 m (V-7), whereas the mean girth was found in the range of 15.80 cm (Hy-675) to 21.22 cm (H-14). The mean spread of the 11 hybrids/ type was in the range of 2.0 m to 2.56 m (Table 1.40).

Table 1.40: Growth characters of cashew genotypes under MLT III at Vengurle (Replanted in 2008)

Variety /Type	Mean height (m)	Mean girth (cm)	Mean spread (m)
11/6	1.95	16.89	2.0
H-11	2.07	20.11	2.49
BH 6	1.86	18.90	2.35
H-14	2.10	21.22	2.22
H-1593	1.98	19.61	2.1
K-22/1	2.08	16.11	2.44
V-7	2.30	19.22	2.37
H-662	2.06	15.89	2.56
32/14	1.92	16.89	2.17
B-H-85	2.09	16.80	2.36
H-675	2.19	15.80	2.14
SEm ±	0.12	1.84	0.30
CD at 5%	N.S.	N.S.	N.S.

VRIDHACHALAM

The mean plant height ranged from 1.70m to 2.68 among the types. The trunk girth ranged from 32.0 cm to 35.8 cm. The mean canopy spread of the types was in the range of 3.12 to 3.80m (Table 1.41).

Table 1.41 : Growth characters of cashew genotypes under MLT III at Vridhachalam

Variety/ Genotypes	Plant height (m)	Trunk girth (cm)	Canopy spread (m)
BH 6	2.68	32.0	3.12
BH 85	2.48	33.0	3.28
H 1593	2.06	35.8	3.80
K 22-1	2.32	33.8	3.44
H 662	2.42	34.2	3.48
H 675	1.70	36.4	3.48
H 11	2.38	35.2	3.16
H 14	1.96	34.6	3.46
H 32/4	2.34	34.2	3.64
Goa 11/6	2.36	32.6	3.28
VRI 2	2.42	32.8	3.42
VRI 3	2.28	32.0	3.20
CD 5%	0.23*	0.42**	0.40*

3. Performance of Released Varieties

(Multi Location Trial – V)

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara, Pilicode and Vengurla

Plains / others :

Chintamani and Jagdalpur

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

SUMMARY :

Maximum number of laterals per square meter was recorded in variety Jhargram-1(22.5) but, flowering laterals were maximum in variety VRI -3 (16.79) at Bhubaneswar.The variety Amrutha recorded maximum spread (5.77 m) followed by Ullal-4 (5.66 m) at Madakkathara. Highest bisexual flower ratio was seen in the Ullal-1 followed by Bhubaneswar -1 at Pilicode.

Treatments :

The earlier trial on performance of released varieties was planted in 1997. This trial on MLT-V has been planted afresh during 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

Among the 25 entries of MLT- V, BPP-6 recorded maximum plant height (3.44m), whereas trunk girth (41.31 cm) and canopy spread (5.28m in E-W and 5.68m in N-S direction) were the maximum in Vengurla-7. Maximum number of laterals per square meter was recorded in variety Jhargram-1 (22.5) but flowering laterals were maximum in variety VRI -3 (16.79) (Table 1.42).

Table 1.42 : Vegetative and flowering parameters of cashew varieties in MLT - V at Bhubaneswar

Cashew types	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		No. of flowering laterals/m^2
			E–W	N– S	
BPP-4	2.88	29.40	3.41	3.14	11.29
BPP-6	3.44	29.75	3.89	3.84	8.85
BPP-8	2.98	35.33	4.35	4.35	6.39
Bhubaneswar-1	2.63	30.08	3.50	3.73	13.88

Chintamani-1	3.16	34.00	4.51	4.72	4.88
Jhargram-1	3.13	34.17	4.47	4.42	14.62
Madakkathara-1	2.98	34.75	3.67	3.55	12.58
Madakkathara-2	2.83	32.10	3.13	3.40	10.60
K-22-1	2.29	27.15	2.60	2.90	14.50
Dhana	2.94	34.57	4.13	4.56	6.58
Kanaka	3.13	31.67	3.35	3.53	14.10
Priyanka	2.29	26.25	3.71	3.18	10.72
Amrutha	2.99	39.13	3.28	3.48	9.50
Vengurla-1	2.33	29.40	3.47	3.67	5.62
Vengurla-4	2.51	28.54	3.21	3.09	13.43
Vengurla-6	2.41	26.53	2.84	3.14	7.88
Vengurla-7	3.23	41.31	5.28	5.68	6.37
VRI-3	2.23	26.00	2.91	3.21	16.79
NRCC Sel-2	2.85	30.41	3.57	4.05	12.50
Ullal-1	2.88	30.80	3.58	3.84	4.60
Ullal-3	2.87	27.70	3.29	3.43	7.30
Ullal-4	2.38	27.33	3.10	2.62	12.25
UN-50	2.95	30.32	3.46	3.46	10.20
Goa-1	2.85	33.00	3.88	4.11	8.66
Bhaskara	3.12	34.25	4.41	4.38	10.05
SEM ±	0.229	3.678	0.395	0.376	1.464
CD (5%)	0.669	NS	1.152	1.097	4.274

Table 1.43 : Yield and Yield attributing characters of promising cashew varieties in MLT-V at Bhubaneswar

Cashew types	Nut yield (kg /plant)	Cum. nut yield (kg/plant) 2 harvests	Nut weight (g)	Apple weight (g)	Shelling (%)
BPP - 4	0.50	0.9	7.2	37.4	29.9
BPP-6	0.15	0.47	6.0	34.5	30.5
BPP-8	0.79	1.83	8.2	57.6	26.7
Bhubaneswar-1	0.97	1.47	6.4	50.0	34.4
Chintamani-1	0.29	0.59	6.8	37.5	32.8
Jhargram-1	0.23	0.56	6.0	42.5	32.4
Madakkathara-1	0.86	1.01	6.5	40.8	31.1
Madakkathara-2	0.26	0.46	8.5	54.5	30.7
K-22-1	0.40	0.78	6.5	52.0	31.5
Dhana	0.46	1.01	8.0	53.5	28.0
Kanaka	1.06	1.56	6.5	43.5	30.8
Priyanka	0.74	1.09	8.0	70.5	29.3
Amrutha	0.45	0.85	8.4	50.5	30.6

Vengurla-1	0.52	0.92	6.5	27.5	31.4
Vengurla-4	1.14	1.7	7.1	35.0	31.0
Vengurla-6	0.71	1.17	8.0	47.0	30.2
Vengurla-7	0.38	0.8	10	54.3	31.2
VRI-3	1.22	1.88	6.9	31.0	33.4
NRCC sel-2	1.06	1.56	7.5	55.5	32.4
Ullal-1	0.19	0.65	7.1	33.0	32.2
Ullal-3	0.27	0.87	9.5	58.2	31.0
Ullal-4	0.35	0.9	8.0	50.0	31.6
UN-50	0.25	0.75	7.6	58.7	31.7
Goa-1	1.07	1.44	7.0	57.0	32.6
Bhaskara	1.13	2.17	6.5	40.0	32.2
Sem±	NS				

Among the 25 entries, variety VRI-3 registered maximum nut yield (1.22 kg/plant) followed by V-4 (1.14 kg/plant) and Goa 11/6 (1.13 kg/plant) at second harvest. Lowest nut yield was recorded in BPP 6 (0.15kg/plant). However, cum. nut yield (kg/plant) was maximum in Bhaskara (2.17) followed by VRI-3 (1.88) and BPP 8(1.83) at second harvest. Maximum numbers of nuts per panicle was recorded in Bhubaneswar - 1(4.3) and Vengurla 7 registered maximum nut weight (10.0g). Priyanka recorded maximum apple weight (70g) and shelling (%) was maximum in Bhubaneswar-1 (34.49%) followed by other entries. However, there was no significant difference among the varieties with respect to growth and yield attributing characters (Table 1.43).

CHINTAMANI

The plant height ranged from 2.02 to 3.66 m and stem girth varied from 34.82 to 49.25 cm. The canopy spread in E-W & N-S directions ranged from 2.01 to 5.24 m and 2.01 to 5.18 m, respectively. The first year yield varied from 0.78 to 2.04kg/plant (Table 1.44).

Table 1.44 : Growth Performance of released varieties at Chintamani

Varieties	Pl. ht (m)	Stem girth (cm)	Canopy spread (m)		Nut yield (kg/plant)
			E-W	N-S	
BPP-4	2.98	37.25	3.85	3.92	1.65
BPP-6	2.86	46..24	3.79	4.10	1.68
BPP-8 (2/16)	3.65	49.25	4.45	5.12	1.49
Chintamani -1	2.96	42.68	4.25	4.22	2.02
Madakkathara-2	3.20	35.80	4.18	4.65	1.52
K-22-1	2.68	37.60	3.98	4.26	1.58
Dhana	2.86	46.52	4.86	5.12	1.92
Amrutha	3.40	45.65	4.85	5.12	1.26
Vengurla -1	2.95	42.55	4.26	4.25	1.45
Vengurla -4	2.98	41.85	4.85	4.18	1.95
NRCC Sel-2	3.42	40.92	4.60	5.10	1.85
Ullal-1	3.21	42.86	5.24	5.18	2.04
Ullal-3	2.88	35.72	3.20	3.62	1.95
Ullal-4	3.24	41.65	4.95	5.15	1.68

UN-50	3.66	44.45	4.82	4.72	1.10
Bhaskara	2.92	35.52	4.42	4.16	1.96
V – 6	2.15	47.85	2.32	2.25	1.15
V – 7	2.89	34.82	2.45	2.32	1.12
V – 8	2.04	37.86	2.52	2.45	1.02
Kanaka	2.10	41.58	2.05	2.02	1.05
Priyanka	2.02	35.92	2.10	2.06	1.15
Goa -1	2.08	36.84	2.05	2.02	1.12
Bhubaneshwar- 1	2.10	35.75	2.02	2.01	1.10
Jhargram	2.06	39.86	2.06	2.04	0.92
Madakathara – 1	2.07	41.54	2.02	2.06	0.78
VRI – 3 (M-26/2)	2.12	36.88	2.01	2.05	0.85

JHARGRAM

The varieties were on par with respect to plant height, trunk girth, trunk height, canopy spread and canopy area (Table 1.45).

Table 1.45 : Growth performance of released cashew varieties under MLT- V at Jhargram

Varieties	Plant Height (m)	Trunk Girth (cm)	Trunk Height (m)	Canopy Spread (m)	Canopy area (m^2)
Bhaskara	1.8	12.3	0.8	1.3	2.55
Madakkathara-II	1.6	12.8	0.5	1.4	2.96
Bhubaneswar-1	1.3	12.8	0.4	1.1	2.04
K-22-1	1.5	11.8	0.5	1.4	2.78
Chintamani-I	1.3	11.8	0.6	0.9	1.22
Ullal - 4	1.6	13.0	0.4	1.6	3.75
Vengurla - 7	1.4	12.8	0.3	1.3	2.52
VRI - 3	1.5	12.0	0.6	1.4	2.55
BPP - 6	1.8	13.8	0.5	1.6	3.56
Amrutha	1.4	13.0	0.4	1.2	2.32
Vengurla- 4	1.4	12.0	0.6	1.2	1.92
Goa -1	1.3	13.3	0.4	1.1	1.92
Madakkathara-I	1.3	10.0	0.6	0.9	1.29
Priyanka	1.8	13.8	0.7	1.6	3.45
BPP- 8	1.6	14.0	0.5	1.5	3.03
Kanaka	1.3	11.3	0.4	1.3	2.15
Vengurla- 1	1.4	11.8	0.4	1.2	2.23
Vengurla- 6	1.5	12.3	0.4	1.3	2.46
Ullal - 3	1.4	11.8	0.5	1.2	1.95
Dhana	1.2	11.8	0.5	1.1	1.51
BPP- 4	1.4	10.8	0.4	1.0	1.79
Un- 50	1.3	10.5	0.6	1.1	1.70
Jhargram-1	1.4	11.3	0.4	1.2	2.24
NRCC-Sel-2	1.2	11.0	0.3	1.1	1.77
Ullal- 1	0.95	9.0	0.6	0.7	0.52
S. Em (±)	0.163	0.129	0.957	0.151	0.534
C.D. at 5%	0.325	0.257	1.910	0.301	1.006
CV %	14.14	32.70	9.76	14.92	29.13

MADAKKATHARA

The variety UN–50 recorded maximum height (4.72 m) followed by Amrutha (4.50 m). Chintamani recorded the highest stem girth (45.80 cm) followed by Jhargram (45.40 cm). With respect to canopy spread (EW), Ullal-4 recorded maximum spread (6.04 m) followed by Ullal - 1 and K-22-1 (5.82 m). With respect to canopy spread (NS) the variety Amrutha recorded maximum spread (5.77 m) followed by Ullal-4 (5.66 m). Highest yield was recorded by Amrutha (1.45 kg/tree) followed by Akshaya (1.28 kg/tree) during the current season (Table 1.46).

Table 1.46 : Growth performance of released cashew varieties under MLT- V at Madakkathara

Variety	Height (m)	Girth (cm)	Canopy spread - EW (m)	Canopy spread - NS (m)	Nut yield (kg/tree)
Goa -1	4.46	38.00	5.08	5.02	0.8
UN 50	4.72	38.60	4.66	5.10	0.78
Ullal-4	4.49	41.40	6.04	5.66	0.64
Ullal -3	4.36	35.80	5.46	5.52	0.84
Ullal-I	4.40	34.20	5.82	5.64	0.86
DCR sel-2	3.89	33.80	4.76	4.48	0.86
V6	3.90	41.00	4.26	4.22	0.88
V4	4.20	39.80	5.16	5.50	1.08
V1	4.11	41.20	5.82	5.50	0.72
Jhargram	4.14	45.40	5.60	5.45	1.00
Chinthamani	4.30	45.80	5.24	5.50	0.76
BPP-4	4.26	43.40	4.28	4.38	0.94
Akshaya	3.91	40.80	3.88	3.94	1.28
Anagha	3.88	36.60	4.30	3.68	1.06
Damodar	4.40	39.00	3.72	3.83	1.20
Raghav	3.65	38.80	3.44	3.42	0.73
Dharasree	3.92	41.00	3.58	3.61	0.97
Sulabha	3.95	39.40	3.66	3.78	0.97
Anakkayam-1	4.05	40.00	4.18	4.14	1.24
Priyanka	4.34	42.60	4.50	4.96	1.10
Dhana	3.93	45.20	4.42	4.22	0.77
Amrutha	4.50	39.75	5.80	5.77	1.45
Vridhachalam-3	4.06	45.20	5.52	5.60	1.14
K-22-1	4.10	44.00	5.82	5.19	1.18
Madakkathara-2	4.17	44.20	4.69	4.98	0.99
Kanaka	4.19	41.60	4.40	4.52	1.04
Madakkathara-1	4.16	44.00	4.40	4.78	0.92
Poornima	3.98	42.60	4.86	4.95	0.22

PILICODE

The plant height and canopy spread differed significantly between the varieties. Tallest plants were observed in the variety, Ullal-1 (3.90m). Canopy girth was highest in the variety Bhubaneswar-1. This variety also produced the highest number of panicles and also the highest number of vegetative branches. The highest bisexual flower ratio was seen in Ullal 1 (Table 1.47).

Table 1.47 : Growth performance of cashew released varieties under MLT- V at Pilicode

Accession No./ Variety	Plant height (m)	Canopy area (m^2)	No. of panicles /m^2	Apple wt, (g)	Nut wt. (g)	Male: Bisexual flowers ratio
NRCC Sel 2	2.420	5.815^{bcdefg}	7.550^{b}	84.60	11.20	9.151^{abc}
MDK 1	3.435	7.935^{abc}	6.790^{bc}	50.50	7.20	6.206^{bcd}

Goa 1	1.696	2.745^{efg}	4.500^{bcde}	-		5.080^{bcd}
Ullal 1	3.902	9.730^{a}	5.885^{bcd}	49.60	7.00	12.893^{a}
MDK 2	3.180	8.260^{abc}	6.220^{bcd}	60.00	7.10	5.617^{bcd}
Bhaskara	2.725	9.345^{ab}	7.520^{b}	52.20	8.80	3.946^{de}
V4	2.402	3.930d^{efg}	7.165^{bc}	53.50	7.40	6.365^{bcd}
Kanaka	2.832	6.620^{abcde}	7.275^{bc}	62.50	8.00	6.438^{bcd}
VRI 3	2.525	7.080^{abcd}	4.375^{bcde}	50.00	6.10	7.008^{bcd}
Amrutha	2.825	6.400^{abcdef}	6.770^{bc}	89.67	11.00	8.127^{bcd}
Ullal 3	2.000	9.850^{a}	1.750^{ef}	70.00	7.30	4.783^{cd}
V7	2.130	4.640^{cdeg}	6.230^{bc}	47.20	9.60	6.451^{bcd}
K-22-1	2.447	3.860^{deg}	7.565^{b}	47.20	8.20	5.206^{bcd}
UN 50	2.266	4.705^{cdefg}	3.250^{cdef}	62.33	10.60	9.296^{abc}
Bhubaneswar 1	2.150	5.190^{cdefg}	17.000^{a}	75.00	5.20	9.500^{ab}
BPP 8	1.850	2.540^{fg}	Unflowered			
BPP 6	2.125	2.260^{g}	6.625^{bc}	60.00	6.00	7.541^{bcd}
Priyanka	2.365	5.230^{cdefg}	7.140^{bc}	57.00	11.40	5.022^{bcd}
Dhana	2.170	2.955^{efg}	2.125^{def}	59.00	8.00	3.986^{de}
Mean	2.497	5.742	6.091			6.454
F Test	NS	**	**			**
CD @ 5%	-	3.911	4.100			4.540

VRIDHACHALAM

The height ranged from 1.70 m to 2.84 m. The canopy spread of types ranged from 3.12 m to 3.64 m. The first year yield ranged from 0.48 Kg to 0.72 Kg among the varieties (Table 1.48).

Table 1.48 : Growth and yield performance of released cashew varieties at Vridhachalam

Varieties	Plant Height (cm)	Stem Girth (cm)	Canopy spread (m)	Nut yield / tree (Kg)
BPP-4	2.68	32.0	3.12	0.50
BPP-6	2.48	33.0	3.28	0.56
BPP-8 (H 2/16)	2.06	35.8	3.80	0.64
Bhubaneshwar-1	2.32	33.8	3.44	0.48
Chintamani-1	2.42	34.2	3.48	0.52
Madakkathara-2	1.70	36.4	3.48	0.64
K-22-1	2.38	35.2	3.16	0.60
Dhana	1.96	34.6	3.46	0.68
Kanaka	2.34	34.2	3.64	0.58
Priyanka	2.36	32.6	3.28	0.72
Amrutha	2.42	32.8	3.42	0.76
Vengurla-4	2.28	32.0	3.20	0.60
Vengurla-6	2.26	38.0	3.44	0.58
Vengurla-7	2.14	32.0	3.48	0.70
VRI-3	2.08	34.6	3.48	0.70
NRCC Sel-2	2.74	36.0	3.16	0.68
Ullal-1	2.66	34.8	3.46	0.62
Ullal-3	2.14	36.0	3.64	0.68
Ullal-4	2.84	34.0	3.64	0.64
Bhaskara	2.46	32.0	3.28	0.70
CD(0.05%)	0.28	0.60	NS	0.12

Gen.4. Hybridization and Selection

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani and Jagdalpur

The project aims at utilizing the accessions with high yield and other desirable traits selected from the germplasm conserved at various AICRP Cashew 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:

Among the hybrids developed at Bhubaneswar, A-6 was found to be the most promising with cumulative nut yield of 89.7 kg/plant for 13 harvests and E-1 recorded highest nut weight of 9.4g while, A-9 recorded maximum shelling percentage of 35.6. The highest shelling percentage was recorded in H-70 (47.0%) followed by H-134 (40.0%) and H-122 (39.6%) at Jhargram. The highest cumulative yield / tree for 15 years was recorded by H-21 (120.75 kg/tree) at Madakkathara. The hybrid HC 10 displayed cluster bearing habit with 10 -12 nuts /cluster, had bold nuts of 7.4 gms and easy to peel testa with a lowest duration of flowering (53 days) at Vridhachalam.

BAPATLA

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

During the year 2011-12 the total number of 1411 crosses have been made. (Table 1.49).

Existing F1 progenies have been evaluated for the duration of flowering, yield, nut weights etc.

Table 1.49 : Details of crossing programme during 2012

Sl. No.	CROSS COMBINATIONS	Number of Crosses made
1	Kankadi X BPP-8	100
2	BPP-8 X Kankadi	225
3	Kankadi X BPP-9	90
4	BPP-9 X Kankadi	440
5	TNo10/19 X Kankadi	290
6	Kankadi X TNo10/19	100
7	BLA 39/4 X Kankadi	24
8	Kankadi X BLA 39/4	142
	TOTAL	1411

Among the different hybrids of 1997 evaluated, duration of flowering ranged from 86 days in H-69 to 149 days in H-1. Annual nut yield at 10th harvest is highest in H-67 (40.25 kg/tree) closely followed by H-36 [28.5kg/tree] and H-73 (28.04kg/tree). However cumulative nut yield was found highest with hybrid H-67 (106.3kg/tree) and closely followed by H-36 [96.8 kg/tree]. Lowest cumulative nut yields were recorded in H-6 (19.54 kg/tree) and H-3 (20.68 kg/tree) (Table 1.50).

Table 1.50 : Performance of cashew hybrids planted during 1997 at Bapatla

Hybrid No.	Cross combination	Duration of flowering	Annual nut yield @ 10th harvest	Cum. nut yield /tree 10 hvts. [kg]
H-9	T 273 x T 72	113	24.90	76.43
H-10	T 273 x T 73	115	17.50	61.28
H-14	T 228 x T2/22	127	23.91	74.13
H-17	T 228 x T2/22	141	24.17	58.92
H-19	T 228 x T2/22	109	22.01	61.56
H-28	BPP-5 x T2/22	131	20.60	53.65
H-36	F.No 3 x T 30/1	104	28.50	96.80
H-38	BPP 6 x T2/22	89	19.60	58.18
H-43	T 228 x T.No 30/1	90	18.99	52.91
H-49	BPP-8 x T 2/22	114	24.78	59.98
H-57	T 2/22 x VRI-2	114	18.15	51.85
H-64	T 71 x T 273	122	22.93	69.23
H-65	T 71 x T 273	144	19.35	58.77
H-67	T 71 x T 273	131	40.25	106.30
H-73	T 71 x T 273	134	28.04	78.56
H-75	T 71 x T 273	131	20.91	54.73
H-76	T 71 x T 273	124	25.09	74.43

Among the hybrids of 1998 duration of flowering ranged from 86 to 142 days. Annual nut yield and cumulative nut yields were found highest in H-94 [9.8 & 21.5kg/tree] followed by H-85 [8.44 & 18.22 kg/tree] (Table 1.51).

Table 1.51 : Performance of cashew hybrids planted during 1998 at Bapatla

Hybrid No.	Cross combination	Duration of flowering	Annual nut yield @ 9th harvest	Cum. nut yield /tree 9 hvts. [kg]
H-82	T.NO. 71 x T.NO. 273	89	5.35	12.15
H-85	BPP-8 x 228	104	8.44	18.21
H-86	BPP-8 x 228	147	5.23	13.13
H-92	Priyanka x VRI-2	94	5.25	13.15
H-94	Priyanka x VRI-2	142	9.80	21.50
H-104	T.No 228 x T.No 30/1	112	4.36	11.91
H-110	Priyanka x BPP-8	137	4.10	11.25
H-112	BPP-8 x Priyanka	131	3.47	10.77

BHUBANESWAR

Among the hybrids planted during 1995, A-6 was found to be the most promising hybrid with respect to cumulative nut yield (89.7kg/plant) for 13 harvests having nut weight of 8.0 g and shelling percentage of 35.4. The hybrid A- 9 was the second best hybrid which recorded cumulative nut yield of 60 kg/plant followed by E1 (50.1 kg/plant) and D1 (42.3 kg/plant). However, A-9 recorded maximum nut yield (8.0 kg/plant) at 13th harvest followed by A-6 (6.0 kg), D1 (5.0 kg) and E-1(4.2 kg). The hybrid E-1 recorded highest nut weight of 9.40 g and A-9 recorded maximum shelling percentage of 35.6.

Among the 1997 planted hybrids, maximum cumulative nut yield per plant was recorded in hybrid A1-85 (84.04 kg) at 11th harvest followed by A1-105 (49.3kg). The nut weight (8.6g) and shelling percentage (32.8%) were found to be maximum in hybrid A1-105.

Hybrid B2-32 showed promising performance with respect to yield and yield attributing parameters among the hybrids planted during 1998. This hybrid recorded cumulative nut yield, annual nut yield, nut weight, shelling percentage and nuts per panicle of 31.7 kg, 5.5 kg, 8.0 g, 30.0% and 4 nuts/panicle, respectively at 10th harvest.

In the 1999 hybrid block, hybrid D3-18 registered highest annual nut yield (4.0 kg/plant) and hybrid D3-11 recorded maximum cumulative nut yield (47.9 kg/plant) for 9 harvests. Nut weight and shelling percentage for the 1999 hybrids varied from 9.2 to 9.4g and 28.0 to 28.2 respectively.

Out of the hybrids planted in the 2000 hybrid block, maximum nut yield (kg/plant), cumulative nut yield (kg/plant), nut weight (g) and shelling percentage (%) at 8th harvest recorded were 2.0, 21.8, 9.0 and 32.6 respectively for F4-18.

Amongst the hybrids planted in 2001, hybrid E5-20 recorded highest cumulative nut yield (19.0kg/plant), annual nut yield (0.6kg/plant) and nut weight (8g) at 7th harvest.

Among three hybrids planted in 2002; J6-6 recorded highest cumulative nut yield (11.4 kg/ plant) for 6 harvests as well as, annual nut yield (2.9 kg/plant) at 6th harvest. Hybrid D6-10 registered maximum nut weight (10.8 g) and highest no. of nuts/panicle (5.0), whereas, shelling percentage was maximum in B6-58 (36.2%).

Out of the hybrids from 2003 planting block, 6 hybrids such as B4-20, B4-23, C1-5, C7-10, J1-13 and J5-55 showed promising performance with respect to yield and yield attributing parameters. Cumulative nut yield recorded was maximum in B4-20 (9.1 kg/plant) for 5 harvests and the hybrid C1-5 registered highest nut weight (10.4 g) (Table 1.52).

Table 1.52 : Performances of promising cashew hybrids at Bhubaneswar

Year of planting	Hybrid no.	Cross combinations	Nut weight (g)	Shelling (%)	Nut yield (kg / plant)	Cum. nut yield (kg / plant)
1995						**13 harvests**
	A6	Bhubaneswar C-2 x VTH 711/4	8.0	35.4	6.0	89.7
	A9	Bhubaneswar C-2 x VTH 711/4	8.0	35.6	8.0	64.0
	D1	Bhubaneswar-1 x Kankady	9.0	29.6	5.0	42.3
	E1	Bhubaneswar C2 x Kankady	9.4	32.0	4.2	50.1
1997						**11 harvests**
	A1-85	Bhubaneswar-1 x H2/16	7.2	31.0	5.0	84.4
	A1-105	Bhubaneswar-1 x H2/16	8.6	32.8	2.5	49.3

1998						**10 harvests**
	B2-32	H 2/16 x M 44/3	8.0	30.0	5.5	31.7
1999						**9 harvests**
	D3-11	M 44/3 x H 2/15	9.4	28.0	3.4	47.9
	D3-18	M 44/3 x H 2/15	9.2	28.2	4.0	36.5
2000						**8 harvests**
	F4-18	M 44/3 x H 2/15	9.0	32.6	2.0	21.8
2001						**7 harvests**
	E5-20	BPP30/1 x H2/16	8.0		0.6	19.0
2002						**6 harvests**
	B6-58	RP1 x VTH 711/4	8.4	36.2	2.0	8.8
	D6-10	M44/3 x VTH 711/4	10.8	32.4	2.0	8.5
	J6-6	BPP30/1 x Kalyanpur bold nut	7.4	-	2.9	11.4
2003						**5 harvests**
	B4-20	V2 x OC 71	8.8	-	1.8	9.1
	B4-23	V2 x OC 71	9.0	-	1.6	7.7
	C1-5	RP-2 x VTH 711/4	10.4	-	1.0	5.7
	C7-10	RP 2 x OC 71	9.0	-	1.8	7.2
	J1-13	RP 1 x OC 22	9.0	-	2.0	8.5
	J5-55	RP 1x OC 71	8.4	-	2.0	6.1

CHINTAMANI

In the cross combinations involving three female and two male parents, 72 nuts were obtained and out of these 56 F_1 seedlings have been planted in the main field for evaluation. The female parents used for crossing are 5/37 Manjeri, 5/23 Kundapur and Vetore-56. The male parents used are Kankadi and G_1-C (Table 1.53).

Table 1.53 : Performance of cross combinations done at Chintamani

Cross Combinations	No. of nuts obtained	No. of F_1 Seedlings raised
5/37Manjeri x Kankadi	12	09
5/37Manjeri x G_1-C	15	11
5/23 Kundapur x Kankadi	10	08
5/23 Kundapur x G_1-C	11	09
Vetore-56 x Kankadi	12	09
Vetore-56 x G_1-C	12	10
Total	72	56

The growth parameters of selected F_1 hybrids during 2011-12 showed plant height ranging from 3.82 to 5.95 m and stem girth varied from 34.00 to 108.00 cm. The canopy spread in E-W & N-S directions ranged from 2.7 to 9.9 m and 2.4 to 7.9 m, respectively. The flowering intensity was highest in H-191 (16.75) and the number of fruits per panicle was highest in H-81 (6.17) (Table 1.54).

Table 1.54 : Growth performance of selected F1 Hybrids at Chintamani planted in 2002

Hybrid No. & Cross combination	Plant ht. (m)	Stem girth (cm)	Canopy spread (m)		Flowering intensity/m²	No. of fruits/ panicle
			E-W	N-S		
H-01 (Ullal-3 x Kankady 7/6)	5.52	96	7.3	7.9	12.50	3.64
H-81 (Ullal-3 x Vetore-56)	5.74	108	9.8	7.5	13.75	5.52
H-151 (NRCC-2 x Vetore-56)	3.82	34	2.7	2.4	14.75	1.56
H-188 (V-5 x Vetore-56)	4.78	66	6.8	7.6	15.50	5.45
H-191 (Ullal-3 x Vetore-56)	4.68	67	6.7	6.9	16.75	3.25
H-216 (2/77-Tuni x Vetore-56)	5.95	94	9.9	7.9	14.50	2.95

Among the F1 progenies, the hybrids planted during 2001 and 2002, H-01 (Ullal-3 x Kankadi), H-81 (Ullal-3 x Vetore-56), H-151(NRCC Sel-2 x Vetore-56), H-188 (V-5 x Vetore-56), H-191 (Ullal-3 x Vetore-56) and H-216 (2/77- Tuni x Vetore-56) recorded an yield of 4.25, 4.62, 0.82, 4.70, 4.35 and 4.48 kg/tree, during the third and sixth year of harvest and cumulative yield of six harvests recorded highest by H-188 (17.37 kg/plant) and lowest was in H-151 (3.42 kg/plant). The average nut weight was 7.5, 10.5, 9.7, 8.8, 10.4 and 11.2 g respectively and shelling per cent ranged between 30.1 and 32.6 (Table 1.55).

Table 1.55 : Yield performance of selected F1 Hybrids at Chintamani

Hybrid No. & Cross Combination	Year of planting	Yield (kg/ tree)	Cu. yield (Kg/tree) of 6 hvts	Nut wt. (g)	Shelling (%)	Apple wt. (g)
H-01 (Ullal-3 x Kankady 7/6)	2001	4.25	12.37 (III hvt.)	7.5	32.6	64.6
H-81 (Ullal-3 x Vetore-56)	2002	4.62	13.27 (III hvt.)	10.5	31.5	62.0
H-151 (NRCC Sel-2 x Vetore-56)	2002	0.82	3.42	9.7	31.2	36.1
H-188 (V-5 x Vetore-56)	2002	4.70	17.37	8.8	31.0	39.2
H-191 (Ullal-3 x Vetore-56)	2002	4.35	16.38	10.4	30.2	51.3
H-216 (2/77-Tuni x Vetore-56)	2002	4.48	17.23	11.2	30.1	68.5

JHARGRAM

The plant height ranged between 6.4 m to 6.9 m among the hybrids H-70, H-51, H-64 and H-110. H-70 had highest trunk girth (96.0 cm) followed by H-69 (93 cm). The canopy spread was maximum in H- 51 (8.8m) and it also had the maximum canopy area (96.9 m^2).

Maximum duration of flowering was recorded with H-110 (91 days) followed by H- 49 & H-126 (90 days) and minimum duration was in case of H-179 (59 days). The flowering density was maximum in H-136 (24.25/ m^2) followed by H-37(18.75 /m^2) and H-3 (17.75/ m^2).

The nut bearing per square meter of canopy area was highest in case of H-37 (58.8/ m^2) followed by H-169 (52.5/ m^2). The maximum number of nuts/ panicle was noticed in H-115 and H-21 having 13.75 nuts/panicle followed by H-1 and H-45 which had 13.25 nuts/panicle. H-119 & H-130 produced bold nuts with a nut weight of more than 7g. Yield was highest in H-37 (17.6 kg/tree) followed by H-39 (16.8 kg/tree), H-169 (16.2 kg/tree) and H-119 (13.5 kg/tree).

The highest shelling percentage was found in H-70 (47.0%) followed by H-134 (40.0%) and H-122 (39.6%). The hybrid H-119 had the maximum cumulative yield i.e. 49.5 kg/tree followed by H-115 with 31.59 Kg/tree at 4th harvest. The hybrids had kernel grade ranging between W 320 to W 180 (Table 1.56 & 1.57).

Table 1.56 : Yield performance of cashew hybrids at Jhargram

Hybrid No.	Year of planting	Duration of flowering	Flowering laterals/m^2	Vegetative laterals/m^2	Nuts /m^2	Nuts /Panicle
H-37	2002	70	18.75	5.0	58.8	8.75
H-39	2002	80	9.0	8.5	49.3	11.75
H-169	2005	77	10.75	5.75	52.5	10.00
H-119	2005	69	7.75	3.5	31.3	11.75
H-65	2002	75	12.0	3.5	42.3	8.00
H-57	2002	65	17.0	7.5	48	6.75
H-33	2002	65	9.75	3.5	31.3	10.75
H- 4	2002	67	11.75	2.0	44.3	11.00
H-122	2004	70	7.75	2.25	43.5	10.75
H-115	2004	86	13.0	3.25	47.5	13.75
H-49	2002	90	15.5	1.25	48.5	7.50
H-109	2004	89	15.5	5.0	40	8.25
H-60	2002	77	16.5	2.75	42.5	7.00
H-130	2004	72	10.75	2.25	20.5	5.25
H-21	2002	74	10.25	7.75	42.3	13.75

Table 1.57 : Yield performance of cashew hybrids at Jhargram

Hybrid No.	Year of planting	Nut weight (g)	Yield Kg/ tree	Shelling %	Cum. yield Kg/ tree
H-37	2002	4.82	17.6	34.9	45.2
H-119	2005	7.42	13.5	34.5	49.5
H-41	2002	5.67	11.5	37.00	49.21
H-30	2002	5.51	11.2	34.3	40.45
H-57	2002	6.55	10.8	29.00	36.10
H-28	2002	4.41	10.3	35.8	41.24
H-1	2002	6.08	10.1	37.3	41.61

H-33	2002	6.67	10.1	37.3	44.89
H-122	2004	5.48	9.01	39.6	29.37
H-115	2004	5.92	8.91	37.3	31.59
H-35	2002	4.74	7.92	32.3	52.79
H-45	2002	4.49	5.74	36.1	40.56
H-134	2004	4.85	3.78	40.00	22.15

MADAKKATHARA

Out of the 56 hybrids planted in 1993, the highest yield was recorded by H 21 (22.53 kg/tree) followed by H 49 (16.00 kg/tree). Highest cumulative yield for 15 years was recorded by H 21 (120.75 kg).

Table 1.58 : Performance of hybrids planted during 1993 at Madakkathara

Hybrid No.	Cross combination	Duration of flowering	No. of fruits/ panicle
10	BLA-139-1 x P-3-2	136	5
21	BLA-39-4 x P-3-2	122	4
22	BLA-39-4 x P-3-2	130	3
30	V-5 x H-1591	138	5
35	V-5 x H-1591	126	5
36	V-5 x H-1591	129	4
44	V-5 x H-1591	127	3
49	V-5 x H-1591	131	4
50	V-5 x H-1591	122	3
51	V-5 x H-1591	126	3

Out of 26 hybrids planted in 1994, highest annual yield/ tree was obtained in H-70 (10.70 kg/ tree). The highest cumulative yield/tree for 14 years was recorded in H-73 (72.80 kg/tree) followed by H-70 (61.35 kg/tree) (Table 1.58, 1.59 & 1.60).

Table 1.59 : Performance of hybrids planted during 1994 at Madakkathara

Hybrid No.	Cross combination	Duration of flowering	No. of fruits/ panicle
69	BLA -39-4 x P-3-2	135	5
70	BLA -39-4 x P-3-2	129	4
72	BLA -39-4 x P-3-2	125	4
73	BLA -39-4 x P-3-2	118	3

Out of the 92 hybrids planted during 1995, H 95 recorded the highest yield (13.00 kg/ha). The highest cumulative yield H 97(52.30 kg/tree) followed by H 95 (44.25 kg/tree).

Table 1.60 : Performance of hybrids planted during 1995 at Madakkathara

Hybrid No.	Cross combination	Duration of flowering	No. of fruits/ panicle
91	V-5 x H-1591	111	5
95	BLA-39-4 x P-3-2	125	5
97	BLA-39-4 x P-3-7	124	4
107	BLA-139-1 x P-3-2	123	3

Performance of selected hybrids

The highest cumulative yield /tree for 15 years was recorded by H21 (120.75 kg/tree). A total of 410 pollinations were done with the below mentioned cross combinations with 5.12 mean percentage of nut set (Table 1.61, 1.62, 1.63 & 1.64).

Table 1.61 : Performance of selected F1 hybrids planted during 1993 at Madakkathara

Hy. No.	Cross combinations (kg/tree)	Annual yield (kg/tree) (15 years)	Cum yield	Nut wt. (g)	Shelling %
21	BLA-39-4 x P-3-2	22.534	120.75	8.60	27.40
22	BLA-39-4 x P-3-2	8.900	74.50	6.20	25.86
35	V-5 x H-1591	4.000	99.00	7.20	26.38
36	V-5 x H-1591	9.000	95.67	9.00	25.30
49	V-5 x H-1591	16.000	73.30	8.60	27.80
50	V-5 3.26 x H-1591	13.000	74.77	9.00	29.60

Table 1.62 : Performance of selected F1 hybrids planted during 1994 at Madakkathara

Hy. No.	Cross combinations	Annual yield (kg/tree)	Cum yield (14 years) (kg/tree)	Nut wt. (g)	Shelling %
70	BLA-39-4 x P-3-2	10.700	61.35	8.10	27.20
73	BLA-39-4 x P-3-2	8.900	72.80	6.80	24.30

Table 1.63 : Performance of selected F1 hybrids planted during 1995 at Madakkathara

Hy. No.	Cross combinations	Annual yield (kg/tree)	Cum yield (13 years) (kg/tree)	Nut wt. (g)	Shelling %
95	BLA-39-4 x P-3-5	13.000	44.25	7.90	27.21
97	BLA-39-4 x P-3-7	10.000	52.30	8.00	25.50

Table 1.64 : Details of crossing programme at Madakkathara

Cross Combinations	No. of pollinations	No. of nuts set	% of nut harvested
Madakkathara – 1 x K-22-1	100	30	5.00
V4 x Dhana	70	32	12.85
Madakkathara -1 x Dhana	100	20	2.00
Kanaka x Dhana	90	18	3.33
Madakkathara – 1 x V4	50	20	4.00
Total	410	120	5.12

PILICODE

The dwarf type PLD-57 was used for hybridization with ANK-1 and MDK-1 with the objective of obtaining hybrid progenies having dwarf stature, higher percentage of bisexual flowers, nut setting and high nut yield. The hybrids obtained from the cross MDK1 x PLD-57 was found to be taller than both the parents (Table 1.65).

Table 1.65 : Growth characteristics of different cashew hybrids involving PLD-57 at Pilicode

Hybrid	Height (m)	Girth (m)	Tree spread (m)		No. of Panicle /sqm	Number of branches not flowered	Male : Bisexual flowers ratio
			N-S	E-W			
PLD 57 graft	2.71^{c}	0.44^{c}	3.43^{c}	3.57^{c}	10.43^{b}	15.50^{d}	2.54^{d}
PLD 57 (OP)	1.30^{d}	0.22^{d}	2.68^{c}	2.56^{d}	5.33^{e}	17.92^{c}	1.92^{f}
PLD 57 x ANK-1	5.38ab	0.62b	5.13b	7.50a	6.25c	17.81c	3.36a
ANK-1 x PLD 57	4.88b	0.65b	5.90ab	6.00b	3.70f	18.25b	2.59c
MDK-1 x PLD57	5.65a	0.75a	6.75a	8.13a	9.15c	18.73a	2.81b
MDK-1	5.00ab	0.61b	5.00b	5.50b	12.75a	12.75e	2.10e
Mean	4.15	0.54	4.81	5.54	7.93	16.82	2.55
F test	**	**	**	**	**	**	**
CD 0.05	0.246	0.046	0.906	0.404	0.311	0.156	0.026

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

VENGURLA

The hybrid H-778 (M-44/3 x B.T.22) recorded the highest annual nut yield (10.98 kg/plant) followed by the hybrid No. 735 (V-2 x B.T.65) with 7.62 kg/plant, and the hybrid H-969 (V-4 x Hy-2/16) 6.45 kg/plant at 9th harvest (Table 1.66).

Table 1.66: Growth and yield performance of promising hybrids at Vengurla

Hybrid No.	Cross combination	Plant height (m)	Plant girth (cm)	Mean spread (m)	Flow. panicles/ m^2	Mean nut wt. (g)	Shelling %	Yield (kg/ tree)
778	M-44/3 x B.T.22	7.80	99	9.45	15.00	8.2	31.0	10.980
1306	H-2/16 x V-4	5.80	73	8.40	17.00	11.7	28.0	5.585
1199	M-26/2 x B.T.1	8.30	91	6.60	18.00	10.0	30.0	5.920
1192	M-26/2 x B.T.1	7.00	91	5.40	19.00	9.7	30.0	5.335
853	V-5 x B.T.1	7.90	112	8.60	18.00	9.8	27.0	5.310
3059	C.Y.T.176 x B.T.65	4.70	26	3.65	18.0	9.4	32.0	4.580
3090	H-320 x B.T.22	3.20	36.0	3.85	17.0	12.4	28.0	4.585
3091	H-320 x B.T.22	4.20	50.0	5.05	18.0	11.4	27.0	4.900
3043	Jawahar 1 x Kolgaon	6.40	50.0	4.75	18.0	12.6	28.0	4.135
3140	A.microcarpum x V-7	4.30	53.0	4.85	19.0	11.0	31.0	5.380
735	V-2 x B.T.65	8.70	102.0	7.55	29.0	10.5	26.0	7.620
969	V-4 x H-2/16	8.20	90.0	6.55	19.0	8.1	30.0	6.445
883	V-4 x H-2/16	8.80	74.0	6.85	18.0	10.9	29.0	5.190
868	V-4 x H-2/16	8.20	84.0	5.95	16.0	11.2	26.0	5.555

In all, 212 hermaphrodite flowers were crossed and from these crosses 116 fruits were set. (68.0 % fruit set). There was a mean fruit retention percentage of 58.62 (Table 1.67).

Table 1.67 : Cashew hybridization programme at Vengurle

Cross Combination	Total No. of flowers crossed	Fruit Retention %
V-4 x M- 44/3	59	62.2
V-4 x M- 26/2	60	55.0
V-4 x Hy.2/16	45	65.0
V-1 x M- 26/2	48	54.16
	212	58.62

VRIDHACHALAM

Among the hybrids evaluated, HC-10 recorded a higher yield of 4.5 kg nuts per tree followed by HC-1 with 4.0 kg nuts / tree. HC-10 showed cluster bearing with 10-12 nuts /cluster and recorded bold nuts of 7.4 g with easy to peel testa with profuse and bearing. The cluster bearing nature of HC-1 resembled VRI-2 and had easy to peel testa.

The hybrid HC-17 showed cluster bearing and the nuts had moderate nut weight (6.5 g). HC-22 showed high yield and bold nut of 8.0 g with cluster of 5-6 and easy to peel testa. HC-24 is a promising hybrid with high fruit set, high yield, bold nut (7.6 g) along with easy to peel testa (Table 1.68 & 1.69).

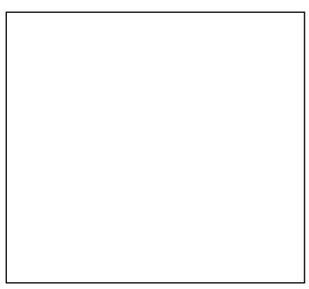
Table 1.68 : Performance of cashew hybrids at Vridhachalam

Hybrid No.	Cross Combinations	Year of planting	Plant Height (m)	Stem girth (cm)	Mean Canopy spread (m)
HC1	VRI2 x VRI 3	2005	3.20	45.0	3.45
HC2	VRI 3 x VSK 2	2005	3.50	44.0	3.20
HC3	VRI 3 x TK 1	2005	3.50	42.2	3.60
HC4	VRI 3 x SL 1	2005	4.00	40.3	3.20
HC 5	VRI 3 x VRI 2	2005	4.00	42.2	2.65
HC6	VRI 3 x KGN 1	2005	3.00	42.5	3.05
HC8	VRI 3 x PKP 1	2005	4.05	40.0	3.8
HC9	VRI 3 x PKP 2	2005	4.50	52.0	4.2
HC10	VRI 3 x KK 1	2006	3.10	31.6	2.63
HC 17	VRI 3 X AM 1	2006	3.40	26.0	2.45
HC 22	VRI 3 x TK 1	2008	2.80	31.0	2.90
HC 24	VRI3 x M 33/3	2008	2.70	29.0	2.40
HC 27	VRI 3 x PV 1	2008	2.80	34.0	2.20
sd			0.56	7.00	0.56
SE			0.20	2.81	0.21
CV%			26.4	18.0	13.0

Table 1.69 : Performance of cashew hybrids at Vridhachalam

Hybrid No.	Duration of flowering (days)	Fruits / panicle	Nut weight (g)	Apple weight (g)	Total yield (kg/plant)
HC1	60	8	6.0	28.2	4.0
HC2	60	4	6.5	34.5	2.0
HC 5	59	5	7.2	43.25	2.0
HC9	55	5	6.2	42.10	3.5
HC10	55	8	7.4	29.80	4.5
HC 17	55	6	6.5	33.40	2.0
HC 22	53	4	8.0	60.10	2.0
HC 24	74	10	7.6	32.60	3.5
sd			0.54		
SE			0.22		
CV%			13.0		

II. CROP MANAGEMENT



II. CROP MANAGEMENT

Agr.1: NPK Fertilizer Experiment

Centres : East Coast :

Bapatla, Jhargram and Vridhachalam

West Coast :

Madakkathara

Plains / others :

Chintamani

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

SUMMARY:

Maximum canopy spread as well as canopy area and yield /tree were supported by N1000 P250K250.g/plant at Jhargram.

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

BAPATLA

The pooled data of past 10 years indicated that the treatment N2P1K1 ie., a fertilizer dose of 1000N: 125P2O5 :125 K2O recorded significantly highest cumulative nut yield of 93.0kg/tree followed by N2P2K1 1000 N: 500 P2O5 : 125 K2O. The plant height, trunk girth, canopy height as well as canopy surface area did not vary significantly among the treatments (Table 2.1).

Table 2.1 : Effect of NPK fertilizer and their interaction on yield of cashew at Bapatla

Treatment	Plant Height (m)	Trunk Girth (cm)	Canopy Height (m)	Canopy surface area (m^2)	Nut Weight (g)	Nut Yield (kg/tree)	Cum. nut yield (kg/tree) (12 hvsts)
N0P0K0	4.45	81.58	4.03	64.67	5.77	15.0	56.1
N0P0K1	3.68	67.35	2.72	34.27	6.62	8.0	49.1
N0P0K2	4.14	82.78	2.87	52.66	5.62	9.7	43.7
N0P1K0	3.10	58.08	3.19	38.88	5.41	6.1	38.0

N0P1K1	4.60	80.75	3.50	73.13	6.15	7.4	44.7
N0P1K2	4.61	78.65	4.43	95.79	5.59	11.3	50.9
N0P2K0	4.50	78.21	4.43	77.92	6.13	11.8	52.4
N0P2K1	4.14	76.50	3.50	49.82	5.95	8.9	43.4
N0P2K2	4.91	86.73	2.93	49.80	5.77	11.1	56.4
N1P0K0	5.19	82.04	4.03	64.67	5.56	18.4	79.0
N1P0K1	5.20	107.21	2.93	31.40	5.34	19.14	77.4
N1P0K2	5.14	99.38	3.74	53.07	5.83	12.4	65.2
N1P1K0	4.68	89.75	2.72	32.19	5.05	10.2	58.1
N1P1K1	2.10	42.50	4.03	19.73	5.05	5.4	58.2
N1P1K2	4.69	103.88	3.19	38.88	5.53	17.6	72.3
N1P2K0	4.91	88.10	4.43	95.79	5.42	18.0	70.2
N1P2K1	4.57	88.25	2.87	52.66	5.42	15.8	76.3
N1P2K2	5.16	97.00	3.74	81.61	5.86	19.8	80.7
N2P0K0	4.42	77.42	2.72	34.27	5.96	11.9	50.9
N2P0K1	5.03	76.17	3.19	34.43	5.61	15.1	65.6
N2P0K2	4.82	95.42	2.87	33.84	5.47	8.8	67.5
N2P1K0	5.33	97.67	4.03	19.73	5.48	15.7	71.7
N2P1K1	5.07	97.08	4.43	95.79	6.20	14.6	93.0
N2P1K2	3.85	77.25	4.43	77.92	5.48	14.5	64.1
N2P2K0	4.63	80.17	3.74	81.61	6.27	16.0	76.5
N2P2K1	5.40	100.08	3.50	73.13	5.35	14.3	87.7
N2P2K2	5.05	114.00	2.93	49.80	6.48	18.0	80.9
CD at 5%	NS	NS	NS	NS	NS	NS	2.26

CHINTAMANI

The nut yield showed significant variation for nitrogen, phosphorus, potash levels and for NP interactions. Whereas, NK, PK, NPK interactions showed non significant variation for yield. The NPK levels showed, highest cumulative yield of 11 years (60.28 kg) at N-1000g, P2O5-250g and K2O-250g. But the highest cost benefit ratio was obtained under N-500g, P2O5-250g and K2O-250g with a cumulative yield of 56.45 kg for 11 harvests (Table 2.2 & 2.3).

Table 2.2 : Performance of Cashew in response to NPK fertilizer treatments at Chintamani

Treatments	Plant ht (m)	Trunk girth (cm)	Canopy spread (m)		Yield (kg/tree)	Cum. yield (kg/tree) 11 hvts
			E-W	N-S		
N0P0K0	4.42	95.0	6.75	6.74	3.52	23.17
N0P0K1	4.18	103.50	6.80	6.62	3.82	29.15
N0P0K2	4.71	105.50	7.48	7.40	3.89	32.94
N0P1K0	4.42	117.50	6.88	7.18	4.01	33.29
N0P1K1	4.82	112.50	7.23	7.32	4.04	34.57
N0P1K2	4.23	104.00	7.32	7.15	4.14	34.88
N0P2K0	4.62	121.00	7.52	7.36	4.05	29.25
N0P2K1	4.92	105.50	6.96	7.24	4.10	29.00
N0P2K2	4.99	127.5	7.86	7.68	4.15	39.99
N1P0K0	4.05	104.5	6.35	6.29	4.04	33.61
N1P0K1	4.18	104.5	6.68	6.66	4.12	33.55
N1P0K2	4.52	94.50	7.15	6.46	4.32	30.66
N1P1K0	4.82	114.00	7.68	7.52	4.56	33.39
N1P1K1	4.12	102.50	7.20	7.38	5.01	36.31
N1P1K2	4.81	99.00	6.95	7.26	5.06	49.47
N1P2K0	4.83	105.50	7.98	7.67	5.16	36.34
N1P2K1	4.23	111.50	7.54	7.48	5.25	38.06
N1P2K2	4.66	106.50	7.46	7.76	5.42	56.45
N2P0K0	4.15	99.50	5.92	6.22	5.32	40.78
N2P0K1	4.42	115.00	7.15	6.71	5.02	41.42
N2P0K2	4.75	93.50	6.78	6.55	5.14	43.37
N2P1K0	4.42	102.00	7.10	7.05	5.65	40.94
N2P1K1	4.73	98.00	7.38	7.16	5.71	42.78
N2P1K2	4.46	107.00	7.26	7.18	5.72	55.06
N2P2K0	4.95	107.50	7.56	7.62	5.89	43.38
N2P2K1	4.72	121.50	7.30	6.95	5.60	45.60
N2P2K2	4.65	102.00	7.72	6.72	5.80	60.28
N	NS	NS	NS	NS	0.04	-
P	0.10	2.48	0.18	0.15	0.04	-
K	NS	NS	NS	NS	0.04	-
NP	NS	NS	NS	NS	0.07	-
NK	NS	NS	NS	NS	NS	-
PK	NS	NS	NS	NS	NS	-
NPK	NS	NS	NS	NS	NS	-
N/P/K	0.30	7.12	0.48	0.39	0.12	-
NP/NK/PK	-	-	-	-	0.21	-
NPK	-	-	-	-	-	-

Table 2.3 : Effect of NPK levels on yield of cashew at Chintamani

	P_0	P_1	P_2	Mean	K_0	K_1	K_2	Mean
N_0	3.79	4.05	4.12	3.99	3.85	4.00	4.08	3.98
N_1	4.21	4.91	5.34	4.82	4.60	4.82	4.98	4.88
N_2	5.45	5.72	5.72	5.63	5.65	5.52	5.65	5.61
Mean	4.48	4.89	5.06	-	4.70	4.78	4.90	-
K_0	4.32	4.76	5.01	4.70				
K_1	4.46	4.92	5.02	4.80				
K_2	4.55	5.02	5.14	4.90				
Mean	4.44	4.90	5.06	-				
		N	P	K	NP	NK	PK	NPK
S.Em +		0.04	0.04	0.04	0.07	0.07	0.07	0.13
C.D @ 5%		0.12	0.12	0.12	0.21	NS	NS	NS

JHARGRAM

The treatments recorded on par response with respect to plant height, trunk girth, flowering per square meter, nut weight, apple weight & cumulative yield at 2nd harvest. Significant differences were noticed among the treatments in terms of their response on canopy spread, canopy area, nuts/m^2, and yield /tree. Maximum canopy spread as well as canopy area and yield /tree were supported by N1000 P250K250. Nuts/m^2 was highest with N500 P125K125 (Table 2.4).

Table 2.4 : Growth and yield characters under different fertilizer treatments (On-farm trial by Jhargram center)

Treatment	Plant height (m)	Trunk girth (cm)	Trunk height (m)	Canopy area (m^2)	Flowering/ m^2	Nuts / m^2	Nut Wt. (g)	Yield (kg/ tree)	Cum. yield (kg/ tree) (2 hvsts)
N500 P125K125	3.30	41.0	0.90	15.5	11.0	14.3	6.47	1.44	3.1
N1000 P250K250	3.43	40.0	0.75	25.1	12.7	13.1	6.50	2.14	3.4
N1500P250K375	3.33	41.0	0.85	18.0	13.1	10.6	6.43	1.23	2.5
S.Em +	0.11	0.82	0.097	0.638	1.01	0.81	0.17	0.14	0.51
C.D. at 5%	0.30	2.27	0.27	1.77	2.81	2.24	0.46	0.38	1.43
C.V%	3.80	1.41	14.3	6.92	10.1	7.82	3.16	10.9	21.1

Agr.2: Fertilizer application in high density cashew plantations

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara, Pilicode and Vengurla

Plains / others :

Chintamani, Jagdalpur

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 Bhubaneswar, the highest cumulative yield per hectare was recorded in S3 600 plants/ha (5m x 4m) (12764.97 kg) followed by S2 400 plants/ha (6m x 4m) (11592.97 kg) and the percentage of increase in yield per ha in S3 was 50.8 % over S1 and 10.1 % over S2. The nut yield per hectare from 500 trees/ ha was higher by 979 kg (147%) over 200 trees/ha at Madakkathara. Highest yield (2221.00 kg/ha) was recorded in highest fertilizer dose with closer spacing; 600 plants/ha (5m x 4m) with 225 kg N, 75 kg P2O5, 75 kg K2O /ha. at Pilicode. The highest yield of 3250 kg/ha was obtained in 5 x 4 m spacing at higher fertilizer level which was 2.40 times the yield in 10 x 5 m spacing (1350 kg/ha) at Vridhachalam.

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		
Total area	:	2.5 ha		
Fertilizers application level	:	1st year	:	1/5th
		2nd year	:	2/5th
		3rd year	:	3/5th
		4th year	:	4/5th
		5th year	:	Full dose

BAPATLA

The trees planted at closer densities i.e. 5m x 4m apart gave higher plant height, trunk girth, canopy diameter and canopy height. Annual nut yield per tree was highest 8.84 kg per tree in 10 x 5m spaced trees applied with fertilizer levels at 75:25:25 kg/ha (S1M1) which is followed by treatment S1M2 (6.52 kg/tree). Cumulative nut yields are also highest in the same treatments i.e. S1M2 (32.02 kg/tree) and S1M1 (30.69 kg/tree). Results indicated that at closer densities growth parameters were higher and at wider densities the nut yields are higher (Table 2.5).

Table 2.5 : Effect of tree density and fertilizer levels on growth and yield of cashew at Bapatla

Treatments	Plant height (m)	Trunk girth (cm)	Mean canopy diameter (m)	Canopy surface area (m^2)	Duration of flowering (days)	Mean nut weight (g)	Nut yield (kg/tree)	Cum. nut yield (kg/tree) (5 hvts)
S_1M_1	4.29	73.74	6.27	37.37	82	7.6	8.84	32.02
S_1M_2	3.98	74.96	5.91	34.40	81	7.56	6.52	30.69
S_1M_3	3.61	55.86	5.65	34.5	79	7.1	5.1	18.26
S_2M_1	3.79	65.18	5.52	27.87	100	7.23	6.11	22.25
S_2M_2	4.64	75.18	5.24	27.88	86	6.96	6.23	26.68
S_2M_3	3.91	49.2	2.96	17.59	80	7.3	6.02	18.89
S_3M_1	4.88	75.76	3.98	17.58	72	7.44	6.11	24.87
S_3M_2	3.61	55.06	5.45	35.3	80	7.2	5.2	20.16
S_3M_3	4.61	55.86	3.33	34.81	80	7.57	6.3	21.32

BHUBANESWAR

Due to spacing, there was significant effect on trunk girth during the year 2011-12. The spacing of 10 m x 5 m with 200 trees / ha (S1) was significantly superior to S2 (6m x 4m i.e., 400 plants / ha) and S3 (5m x 4m i.e., 500 plants / ha) in respect of trunk girth (76.8 cm). No significant difference was observed in respect of plant height and ground area coverage by canopy. Maximum ground coverage by canopy was recorded in S3 (113.6 %) at a spacing of 5m x 4m with 500 plants / ha. Similarly various fertilizer doses have significant effect on plant height and ground area coverage by canopy. M3 (N225P75K75 kg / ha) proved significantly superior to M2 (N150P50K50 kg / ha) and M1 (N75P25K25 kg / ha) for both the growth characters like plant height (5.7m) and ground area coverage by canopy (119.8 %) (Table 2.6).

Table 2.6 : Effect of spacing and fertilizer on growth characters of cashew at Bhubaneswar

Treatments	Plant height (m)	Trunk girth (cm)	Ground area coverage by Canopy (%)
S1 (10mx5m) - 200 plants/ha	5.6	76.8	112.5
S2 (6mx4m) - 400 plants/ha	5.6	65.4	106.1
S3 (5mx4m) - 500 plants/ha	5.3	63.6	113.6
F 'test'	NS	S	NS
SE (m) +	0.138	1.768	2.983
CD 5%	-	6.119	-
M1 (N75P25K25 kg/ha)	5.3	68.3	103.4
M2 (N150P50K50 kg/ha)	5.5	69.3	109.0
M3 (N225P75K75 kg/ha)	5.7	68.2	119.8
F 'test'	S	NS	S
SE (m) +	0.080	1.023	3.274
CD 5%	0.237	-	9.729

No significant variation was observed due to interaction effect of spacing and doses of fertilizer on plant height, trunk girth and ground area coverage by canopy. However, both S1M3 and S2M3; S1M1 and S3M3 treatments recorded maximum plant height (5.8m); trunk girth (77.4cm) and ground area coverage by canopy (129.1 %), whereas minimum plant height (5.1m), trunk girth (61.4 cm) and ground area coverage by canopy (100 %) was recorded in S3M1 and S2M1 treatments respectively. The ground area coverage by canopy exceeds the limit in all treatments, which indicates the plants require pruning. (Table 2.7)

Table 2.7 : Interaction effect of spacing and fertilizer on growth characters of cashew at Bhubaneswar

Treatments		Plant height (m)	Trunk girth (cm)	Ground area coverage by canopy (%)
Spacing	**Fertilizer dose**			
S1 (10mx5m) - 200plants/ha	M1 (N75P25K25 kg/ha)	5.5	77.4	110.0
	M2 (N150P50K50 kg/ha)	5.6	77.2	113.2
	M3 (N225P75K75 kg/ha)	5.8	75.8	114.3
S2 (6mx4m) - 400plants/ha	M1 (N75P25K25 kg/ha)	5.4	66.1	100.0
	M2 (N150P50K50 kg/ha)	5.7	65.5	102.3
	M3 (N225P75K75 kg/ha)	5.8	64.6	116.1
S3 (5mx4m) - 500plants/ha	M1 (N75P25K25 kg/ha)	5.1	61.4	100.2
	M2 (N150P50K50 kg/ha)	5.3	65.2	111.6
	M3 (N225P75K75 kg/ha)	5.7	64.2	129.1
	F 'test'	NS	NS	NS
	SE (m)+	0.138	1.772	5.671
	CD 5%	-	-	-

Due to spacing, the number of flowering panicles / sq. m. was significantly more in S1 (6.6) compared to S2 (4.8) and S3 (3.8). The number of nuts per panicle was maximum in S1 (2.8) and minimum in S3 (1.9). The apple weight was maximum in S3 compared to S1 and S2. Yield per plant did not vary significantly due to spacing. The highest yield per plant was recorded in S1 (1.7 kg). The cumulative nut yield per plant for 10 years was maximum in S1 (42.30 kg) followed by S2 (28.97 kg) and was minimum in S3 (25.54 kg). Highest cumulative yield per hectare was recorded in S3 (12764.97 kg) followed by S2 (11592.97 kg) and was minimum in S1 (8466.53 kg). The percentage of increase in yield per ha in S3 was 50.8 % over S1 and 10.1 % over S2. The increase in yield in S2 was 36.9 % more as compared to S1

Different doses of fertilizer had no significant effect on the number of flowering panicles/m^2, however, M3 produced maximum number of flowering panicles/m^2 (5.60), followed by M2 (4.90) and M1 (4.70). The number of nuts per panicle was found to be maximum in M1 (7.50) followed by M2 (7.30) and minimum in M3 (6.70). The nut weight was highest in M1 (9.00 g) followed by M2 (8.80 g) and M3 (8.70 g). With varying doses of fertilizer application, no significant variation in nut yield per plant was observed. Maximum nut yield per plant was recorded in M3 (1.59 kg) followed by M2 (1.31 kg) and M1 (1.26 kg). The cumulative nut yield per hectare for 10 harvests was highest in M2 (11999.97 kg) and minimum in M1 (9864.20 kg) (Table 2.8)

Table 2.8: Effect of spacing and fertilizer on flowering and yield of cashew at Bhubaneswar

Treatments	No. of Flowering Panicles/ m^2	Nut weight (g)	Yield (kg / plant)	Cum. Yield (kg) 10th harvest	Yield (kg/ha)	Cum. yield (kg/ha) 10 harvests
S1	6.6	9.0	1.70	42.30	339.2	8466.53
S2	4.8	9.1	1.16	28.97	465.0	11592.97
S3	3.8	8.4	1.30	25.54	647.9	12764.97
F 'test'	S		NS		NS	
SE (m) + CD 5%	0.296 1.025		0.408 –		140.014 –	
M1	4.7	9.0	1.26	28.52	499.2	9864.20
M2	4.9	8.8	1.31	35.80	475.8	11999.97
M3	5.6	8.7	1.59	32.70	477.1	10948.30
F 'test'	NS		NS		NS	
SE (m) + CD 5%	0.380 -		0.343 –		123.604 –	

Significant variation was observed among the treatments with respect to flowering panicles / m^2 due to interaction effect of plant density and different levels of fertilizer during the year 2011-12. Treatment S1M2 produced significantly maximum (7.6) flowering panicles / m^2, which is at par with S1M3 (7.0) and S2M3 (6.0). No significant variation was observed with nut yield per plant due to interaction effect. Maximum nut yield per plant was observed in S1M3 (2.713 kg) and minimum in S3M3 (0.688 kg). Maximum cumulative nut yield per hectare was recorded in S3M2 treatment (14523.0 kg) and S1M1 contributed minimum nut yield (7249.0 kg) (Table 2.9).

Table 2.9: Effect of doses of fertilizer and spacing on flowering and yield attributes of cashew at Bhubaneswar

Treatments	No. of flowering panicles/m^2	Nut weight (g) 10 harvests	Yield (kg/plant) 10 harvests	Cum. yield (kg/plant)	Yield (kg/ha)	Cum. yield (kg/ha)
S_1M_1	5.2	9.0	1.025	35.055	205.0	7249.0
S_1M_2	7.6	9.2	1.350	48.700	270.0	10007.0
S_1M_3	7.0	8.7	2.713	43.153	542.5	8982.5
S_2M_1	4.0	9.0	0.825	26.585	330.0	11168.0
S_2M_2	4.5	8.9	1.300	31.040	520.0	12958.0
S_2M_3	6.0	9.5	1.363	29.333	545.0	12450.0
S_3M_1	4.9	8.9	1.925	23.925	962.5	12629.8
S_3M_2	2.7	8.1	1.275	27.705	637.5	14523.0
S_3M_3	3.9	8.0	0.688	24.988	343.8	13293.3
F 'test'	S		NS		NS	
SE (m) + CD 5%	0.658 1.956		0.594 –		214.088 –	

The leaf nitrogen content was maximum in S1 (2.44 %) followed by S2 (2.29 %) and S3 (2.01 %). The leaf Nitrogen content increased due to higher doses of fertilizer application. M3 recorded maximum leaf Nitrogen (2.35 %) followed by M2 (2.21 %) and minimum in M1 (2.18 %). S1M1 recorded maximum leaf N (2.51 %) and minimum in S3M1 (1.83 %) (Table 2.10).

Table 2.10: Leaf Nitrogen content (%) in cashew in different spacing and fertilizer levels at Bhubaneswar

	M1	M2	M3	Mean
S1	2.51	2.33	2.48	2.44
S2	2.20	2.30	2.37	2.29
S3	1.83	2.00	2.21	2.01
Mean	2.18	2.21	2.35	

The leaf P_2O_5 content increased with decrease in spacing. S1 recorded 0.057 %, whereas S2 and S3 recorded 0.061 % P_2O_5 content. The P_2O_5 content increased with increased doses of P_2O_5 and maximum was recorded in M3 (0.062 %) and minimum in M1 and M2 (0.059 %). S2M3 recorded maximum P_2O_5 % (0.064 %) (Table 2.11)

Table 2.11: Leaf Phosphorous content (%) in cashew in different spacing and fertilizer levels at Bhubaneswar

	M1	M2	M3	Mean
S1	0.058	0.055	0.058	0.057
S2	0.060	0.060	0.064	0.061
S3	0.060	0.061	0.063	0.061
Mean	0.059	0.059	0.062	

Maximum K_2O content was recorded in S2 (0.64 %), followed S3 (0.56 %) and minimum in S1 (0.47 %). In case of doses of fertilizer maximum K_2O content was recorded in M3 (0.60 %) followed by M2 (0.55 %) and minimum in M1 (0.52 %). S2M3 recorded highest K_2O % (0.65 %) followed by S2M2 and S2M1 (0.63 %) and minimum in S1M1 (0.41 %) (Table 2.12).

Table 2.12: Leaf Potassium content (%) in cashew in different spacing and fertilizer levels at Bhubaneswar

	M1	M2	M3	Mean
S1	0.41	0.46	0.54	0.47
S2	0.63	0.63	0.65	0.64
S3	0.51	0.56	0.62	0.56
Mean	0.52	0.55	0.60	

CHINTAMANI

The plant height did not vary significantly, but trunk girth and N-S canopy spread varied significantly among the different plant densities. The nut yield per plant varied significantly among the plant densities. The highest nut yield per plant was recorded in S1 (7.65 kg/plant) and lowest in S3 (4.45 kg/plant). The highest nut yield per ha. was recorded in S3 (22.25 q/ha) and lowest was recorded in S1 (15.30 q/ha).

The plant height, stem girth and canopy spread recorded did not vary significantly among the different levels of fertilizers. However, yield (kg/plant) & yield (q/ha) varied significantly among fertilizer levels. The highest yield kg/plant was noticed in M2 (6.00 kg) and highest yield (q/ha) (20.28 q/ha) was recorded in M2 (Table 2.13)

Table 2.13: Effect of plant density and fertilizer levels on growth and yield of cashew at Chintamani

Treatments	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		Yield (kg/plant)	Cum. yield (kg/tree) 6 hvts.	Yield (Q/ha.)
			E-W	N-S			
Densities	-	-	-	-	-	-	-
S1- 200	4.54	74.45	6.72	7.82	7.65	35.80	15.30
S2 – 400	4.78	67.90	5.96	6.52	5.12	26.05	20.48
S3 – 500	4.92	63.00	5.32	5.65	4.45	23.43	22.25
S .Em ±	0.20	1.31	0.42	0.26	0.10	-	0.30
C.D at 5%	NS	4.52	NS	0.88	0.34	-	1.05
Fertilizer levels	-	-	-	-	-	-	-
M1 - 75 : 25 : 25	4.70	69.17	6.02	6.52	5.62	27.74	19.25
M2 - 150 : 50 : 50	4.84	70.39	6.10	6.64	6.00	29.07	20.28
M3 - 225 : 75 : 75	4.72	63.97	5.88	6.68	5.81	28.71	19.52
S. Em ±	0.08	2.42	0.25	0.25	0.05	-	0.18
C.D at 5%	NS	NS	NS	NS	0.16	-	0.62

Interaction effect of densities and fertilizers did not vary significantly among growth parameters. The yield (kg/plant) and yield (q/ha.) varied significantly among interactions. The highest yield was obtained in S1M2 (7.80 kg/plant) followed by S1M3 (7.45kg/plant) and lowest was in S3 M1 (4.18 kg). The highest yield (q/ha) was obtained in S3 M2 (22.80q/ha) and lowest was in S1 M1 (14.20q/ha) (Table 2.14).

Table 2.14: Interaction effect between plant density and fertilizer levels on growth and yield of Cashew at Chintamani

Interactions	Plant ht.	Stem girth (cm)	Canopy spread (m)		Yield (kg/plant)	Cum. yield (kg/plant) 6 hvts.	Yield (q/ ha.)
			E-W	N-S			
S1 M1	4.45	75.63	6.85	7.82	7.10	34.14	14.20
S1 M2	4.54	77.22	6.96	7.78	7.80	36.08	15.60
S1 M3	4.49	70.50	6.12	7.85	7.45	34.66	14.90
S2 M1	4.62	66.64	5.82	6.02	5.15	25.40	20.60
S2 M2	4.94	67.10	5.85	6.75	5.14	27.05	20.56
S2 M3	4.75	62.11	6.14	6.68	4.92	25.71	19.68
S3 M1	4.82	63.24	5.38	5.76	4.18	21.90	20.90
S3 M2	4.95	60.45	4.95	5.25	4.56	23.56	22.80
S3 M3	4.86	62.29	5.32	5.68	4.45	25.96	22.25
S.Em ±	0.02	4.02	0.32	0.40	0.09	-	0.31
C.D at 5%	NS	NS	NS	NS	0.27	-	1.00

JHARGRAM

The treatments were on par in terms of their response on plant height and canopy height. Variations among the treatments were not significant with regard to trunk girth, biomass removal, flowering /square meter, vegetative flush /square meter, nuts/square meter, nut weight and apple weight. However, significant variations were recorded with respect to canopy spread, canopy area and yield/tree. Application of different doses of fertilizer had no direct effect on canopy spread. The canopy area was the highest (56.7 m^2) under widest spacing and minimum (29.9 m^2) under closer spacing. Individual tree yield was maximum at 10m x 5 m spacing (6.8 kg/tree) (Table 2.15 & 2.16).

Table 2.15: Growth parameters of high density planting at Jhargram

Spacing (Density) N-P-K	Fertilizer dose (m) (Kg/ha)	Plant height (cm)	Trunk girth (m)	Canopy height (m)	Canopy spread (m^2)	Canopy area	Biomass removed (kg/tree)	
							Twigs	Wood
S1: 10m x 5m (200 plant/ha)	M1: 75-25-25	5.7	65.8	4.3	6.6	56.7	7.4	6.4
	M2: 150-50-50	5.6	61.6	4.3	6.3	52.4	10.1	7.6
	M3: 225-75-75	5.6	66.8	4.2	6.4	53.5	6.9	4.3
S2: 6m x 4m (400 plant/ha)	M1: 75-25-25	4.9	63.4	3.4	4.9	52.6	15.3	7.3
	M2: 150-50-50	4.7	64.4	3.2	4.9	31.1	13.0	9.4
	M3: 225-75-75	4.9	60.0	3.4	4.8	31.5	13.2	8.1
S3: 5m x 4m (500 plant/ha)	M1: 75-25-25	5.0	58.6	3.5	4.9	32.8	10.8	6.8
	M2: 150-50-50	5.2	61.0	3.7	4.6	31.8	11.8	7.0
	M3: 225-75-75	4.8	54.5	3.3	4.7	29.9	7.7	3.9
S.Em +		0.21	NS	0.15	0.20	2.38	NS	NS
C.D. at 5%		0.46		0.34	0.45	5.19		
CV %		5.02		5.13	4.70	7.41		

Table 2.16: Yield attributes of high density planting at Jhargram

Spacing (Density)	Fertilizer dose N-P-K (kg/ha)	Duration of flowering (days)	Flowering /m²	Vegeta tive flush /m²	Nuts /m²	Nut weight (g)	Apple weight (g)	Yield (kg/tr.)
S1:	M1: 75-25-25	73	13.1	2.96	33.6	3.3	31.5	6.2
10m x 5m	M2: 150-50-50	79	15.2	2.27	38.4	3.4	34.8	6.8
(200 plant/ha)	M3: 225-75-75	63	16.5	2.35	38.1	3.1	37.5	06.4
S2:	M1: 75-25-25	76	9.6	4.72	21.3	3.5	46.2	3.4
6m x 4m	M2: 150-50-50	73	10.4	4.48	25.9	3.9	43.7	3.2
(400 plant/ha)	M3: 225-75-75	67	12.4	4.27	33.3	3.7	45.7	3.9
S3:	M1: 75-25-25	77	9.0	4.92	26.1	3.6	43.0	3.1
5m x 4m	M2: 150-50-50	72	10.1	4.75	23.3	4.0	42.8	2.9
(500 plant/ha)	M3: 225-75-75	77	10.7	2.50	30.2	3.6	43.3	3.3
C.D. at 5%								0.681
S.Em +			NS	NS	NS	NS	NS	1.48
CV %								9.72

Though pruning was done regularly, more than 80 per cent ground area had been covered under 5m x 4m spacing. While, in 10 m x 5m spacing only 60–70 per cent ground area had been covered at the 9th year after planting. The treatments were found on par with respect to annual yield per unit area at 6th harvest (Table 2.17 & 2.18).

Table 2.17: Effect of tree density and fertilizer application on ground coverage (%) at Jhargram

Treatments	Ground coverage by canopy (%)			Mean
MP/SP	M1: 75-25-25	M2: 150-50-50	M3: 225-75-75	
S1: 10m x 5m (200 plant/ha)	69.50	62.10	64.40	65.33
S2: 6m x 4m (400 plant/ha)	79.70	78.91	75.72	78.11
S3: 5m x 4m (500 plant/ha)	93.23	83.65	86.67	87.85
Mean	80.81	74.89	75.60	
MP/SP- S.Em +	6.67			
C.D. at 5%	4.53			
CV %	10.6			

Table 2.18: Effect of tree density and fertilizer application on annual yield (Q/ha) at Jhargram

Treatments	Annual yield (Q/ha)			Mean
MP/SP	M1: 75-25-25	M2: 150-50-50	M3: 225-75-75	
S1: 10m x 5m (200 plant/ha)	12.5	13.5	12.8	12.9
S2: 6m x 4m (400 plant/ha)	13.8	12.8	15.6	13.8
S3: 5m x 4m (500 plant/ha)	15.5	14.6	16.5	15.5
Mean	13.93	13.5	14.9	
MP/SP- S.Em +	2.67			
C.D. at 5%	5.82			
CV %	3.9			

In all the three densities, yield /ha was less with a lower dose of fertilizer. With the widest spacing (10 x 5 m), the yield /ha was highest (72.76 q /ha.) with a moderate dose of fertilizer but, with narrow spacing the highest fertilizer dose supported the highest yield/ha. Maximum yield /ha was recorded with the narrowest spacing (Table 2.19).

Table 2.19 : Effect of tree density and fertilizer application on cumulative nut yield (Q /ha) at Jhargram (6 harvests)

Treatments	Cumulative nut yield (Quintal /ha)			Mean
MP/SP	M1: 75-25-25	M2: 150-50-50	M3: 225-75-75	
S1: 10m x 5m (200 plant/ha)	45.30	72.76	64.11	60.72
S2: 6m x 4m (400 plant/ha)	47.29	68.96	72.68	62.98
S3: 5m x 4m (500 plant/ha)	48.19	71.97	73.06	64.41
Mean	46.93	71.23	69.95	
MP/SP- S.Em +	9. 90			
C.D. at 5%	21.57			
CV %	19.4			

The benefit : cost ratio indicated that 6 x 4m spacing was the best high density spacing with a low (3.67) or moderate dose of fertilizer (3.13), while benefit : cost ratio in 10 x 5m spacing with a low dose of fertilizer (3.41) was also on par. Therefore, the spacing of 6 x 4m with a fertilizer dose of 75 : 25: 25 Kg NPK /ha or moderate dose i.e. 150 : 50: 50 Kg NPK /ha. would be beneficial (Table 2.20).

Table 2.20: Economics of high density planting based on cumulative yield at Jhargram

Spacing (Density)	Fertilizer dose N-P-K (kg/ha)	Cum. cost of cultivation (Rs/ha) over 9 years	Cum. total return of cashew (Rs./ha)	Cum. net return (Rs./ha)	Benefit : cost
S1: 10m x 5m (200 plant/ha)	M1: 75-25-25	60187	265161	204974	3.41
	M2: 150-50-50	70466	272760	202294	2.87
	M3: 225-75-75	80661	286183	205522	2.55
S2: 6m x 4m (400 plant/ha)	M1: 75-25-25	86057	401805	315748	3.67
	M2: 150-50-50	94950	392300	297350	3.13
	M3: 225-75-75	106032	413430	307398	2.9
S3: 5m x 4m (500 plant/ha)	M1: 75-25-25	107917	361448	253531	2.35
	M2: 150-50-50	118559	411905	293346	2.47
	M3: 225-75-75	128755	412320	283565	2.2

The nutrient removal under different tree densities and fertilizer application indicated an increase in the nutrient removed from soil with an increase in the tree density (Table 2.21).

Table 2.21: Effect of tree density and fertilizer application on nutrient removal on dry weight basis at Jhargram

Parameters	Fertilizer treatments (N-P-K Kg/ha)	Plant density			S.Em +	C.D. at 5%
		200/ha	400/ha	500/ha		
Nitrogen removal (Kg/ha)	M1: 75-25-25	8.32	27.24	33.370.	046	0.132
	M2: 150-50-50	8.86	27.37	34.96		
	M3: 225-75-75	10.16	35.64	32.01		
Phosphate removal (Kg/ha)	M1: 75-25-25	10.99	29.31	38.59	0.008	0.023
	M2: 150-50-50	8.69	39.36	40.27		
	M3: 225-75-75	13.54	29.80	40.16		
Potassium removal (Kg/ha)	M1: 75-25-25	10.56	18.10	26.08	0.007	0.02
	M2: 150-50-50	5.94	29.57	23.01		
	M3: 225-75-75	8.27	19.48	44.63		

MADAKKATHARA

The maximum height was recorded by the highest tree density of 500 trees/ha. The effect of tree densities was statistically significant and the canopy spread was higher under the tree density of 200 trees/ha, over 400 and 500 trees/ha.

The maximum annual nut yield of 3.55 kg/tree was recorded by the tree density of 400 trees/ha. The per/ha yield in 200 trees/ha was 664kg while it was 1420 and 1643 kg in 400 and 500 plants/ha. respectively. The yield from 500 trees/ha was significantly higher than 400 trees/ha. The yield from the tree density of 200 trees was significantly lower than 400 and 500 trees. The per hectare nut yield from 500 trees/ha was higher by 979 kg (147%) over 200 trees/ha.

The cumulative nut yield for seven harvests indicated that a maximum yield of 14.976 kg/tree was recorded by the medium tree density of 400 trees/ha. The lowest yield was recorded by 500 trees per hectare i.e. 14.26 kg. The cumulative per hectare yield for seven years indicated significant increase with increase in tree density. The cumulative yield for 200 plants/ha was only 2931 kg while, the same was 5991 and 7136 kg for 400 and 500 trees/ha, respectively which was statistically significant (Table 2.22).

Table 2.22: Effect of tree densities and fertilizer doses on the growth and yield of cashew at Madakkathara

Treatments	Height (m)	Girth (cm)	Canopy spread–NS (m)	Canopy spread–EW (m)	Mean annual nut yield		Cumulative yield (7 harvests)	
					kg/tree	kg/ha	kg/tree	kg/ha
Densities								
S_1 - 200	4.93	81.5	6.61	7.13	3.32	664	14.65	2931
S_2 -400	4.88	76.2	5.66	6.03	3.55	1420	14.97	5991
S_3 -500	5.12	76.0	5.67	5.83	3.28	1643	14.26	7136
CD (0.05)	NS	NS	NS	0.85	NS	213	NS	354
SEm	0.21	0.04	0.26	0.25	0.14	62	0.217	102
Fertilizer doses								
M_1- 75:25:25	5.04	77.8	5.93	6.33	3.28	1185	14.42	5156
M_2- 150:50:50	4.84	77.7	5.88	6.25	3.46	1291	14.49	5343
M_3- 225:75:75	5.05	78.2	6.13	6.41	3.40	1252	14.97	5558
CD (0.05)	NS	NS	NS	NS	NS	NS	NS	NS
SEm	0.11	0.02	0.15	0.11	0.12	50	0.399	151

The medium fertilizer level of 150 : 50 : 50 kg NPK/ha recorded the minimum tree height while the highest fertilizer level of 225 : 75 : 75 kg NPK/ha recorded the maximum tree girth and NS and EW canopy spread.

The annual nut yield (both per tree and per hectare) was maximum in medium fertilizer dose (150: 50: 50 kg NPK/ha.). The cumulative yield for seven years led to marginal variation between the fertilizer doses, with 225: 75: 75 kg NPK/ha recording the highest cumulative yield with respect to per tree and per hectare yield (Table 2.23).

Table 2.23: 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)	Annual yield		Cum. yield (7 years)	
					kg/tree	kg/ha	kg/tree	kg/ha
S1 M1	5.05	84.5	6.78	7.23	3.51	704	15.83	3166
S1 M2	4.48	73.5	6.30	6.60	3.19	638	14.12	2824
S1 M3	5.28	86.5	6.75	7.58	3.25	652	14.01	2803
S2 M1	4.90	72.2	5.50	6.03	3.48	1392	14.24	5696
S2 M2	4.83	79.7	5.58	5.90	3.74	1498	14.75	5904
S2 M3	4.93	76.7	5.90	6.15	3.42	1370	15.93	6372
S3 M1	5.18	76.7	5.50	5.75	2.85	1459	13.21	6607
S3 M2	5.23	79.7	5.78	6.25	3.47	1737	14.60	7302
S3 M3	4.95	71.5	5.73	5.50	3.52	1733	14.97	7499
CD (0.05)	NS	SIG	NS	**	NS	NS	NS	NS
SEm	0.20	0.03	0.26	0.20	0.21	87	0.690	261

PILICODE

Spacing influenced plant height and male: bisexual flowers ratio. Yield per plant and yield per hectare was highest with medium plant density (S2-400 plants). The fertilizer doses did not influence vegetative and yield characteristics significantly. The highest yield per plant observed was to be on par in low (10.28 and 11.31kg respectively) and high fertilizer dose.

The doses of fertilizers and the plant density significantly influenced vegetative and yield characteristics except for the characters plant height, NS Canopy spread, number of flowering panicles and male: bisexual flowers ratio.

Medium dose of fertilizer with wider spacing (M2S1) had higher trunk girth (0.79 m). Higher fertilizer dose with medium spacing (M3S2) had highest spread in EW direction and higher canopy area (24.77 m^2). Highest yield per plant was recorded in higher fertilizer dose with medium spacing (M3S2). Highest yield per hectare (2221.00 kg/ha) was recorded in higher fertilizer dose with closer spacing (M3S3) which was on par with higher fertilizer dose with medium spacing (M3S2) (2188.00 kg/ha). The male : bisexual flower ratio was not significantly influenced by either spacing/ fertilizer dosage or their interactions (Table 2.24, 2.25 and 2.26).

Table 2.24 : Effect of spacing on vegetative characters and yield of cashew at Pilicode

Treatments	Plant height (m)	Girth (m)	Canopy area (m^2)	No. of flowering panicle per m^2	Male: Bisexual flowers ratio	Yield (kg/plant)	Yield per ha (kg/ha)
S1	4.390	0.700^a	22.361	13.277	6.337	3.429^c	685.600^b
S2	4.258	0.539^b	24.971	14.277	5.971	4.778^a	1910.00^a
S3	4.463	0.653^a	22.732	13.374	6.389	3.772^b	1884.00^a
F test	NS	**	NS	NS	NS	**	**
CD@ 5%	-	0.068	-	-	-	0.577	575.950

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

Table 2.25: Effect of Fertilizer on vegetative characters and yield at Pilicode

Treatments	Plant height (m)	Girth (m) (m^2)	Canopy area panicle per m^2	No. of flowering flowers ratio	Male: Bisexual (kg)	Yield per plant	Yield per ha (kg/ha)
M1	4.448	0.634	24.337	13.958	6.547	4.301^{ab}	1626.400^{a}
M2	4.482	0.653	24.027	12.651	6.077	3.103^{b}	1130.411^{b}
M3	4.181	0.604	21.701	14.319	6.073	4.574^{a}	1723.622^{a}
F test	NS	NS	NS	NS	NS	**	**
CD @ 5%	-	-	-	-	-	0.644	261.869

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

Table 2.26: Interaction effect of spacing and doses of fertilizer application on growth and yield of cashew at Pilicode

Treatments	Plant height (m)	Trunk girth (m)	Canopy area (m^2)	No of flowering panicle/m^2	Male: Bisexual flowers ratio	Yield per plant (kg)	Yield/ha (Q)
M1S1	4.41	0.58	27.47	13.02	6.15	3.44	688.20
M1S2	4.35	0.55	22.17	15.08	5.99	5.35	2140.00
M1S3	4.58	0.76	23.36	13.76	7.47	4.10	2051.67
M2S1	4.52	0.79	21.53	12.74	7.36	3.03	606.73
M2S2	4.58	0.57	27.96	12.96	4.58	3.50	1402.00
M2S3	4.33	0.58	22.58	12.24	6.27	2.76	1382.50
M3S1	4.23	0.72	18.07	14.06	5.48	3.80	761.87
M3S2	3.83	0.48	24.77	14.77	7.32	5.47	2188.00
M3S3	4.47	0.60	22.25	14.11	5.41	4.44	2221.00
F test	NS	**	**	NS	NS	**	**
CD @ 5%	-	0.124	10.216	-	-	1.521	627.534

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

VENGURLA

The widest spacing S1 (10m x 5 m) was significantly superior over S2 (6m x 4m) and S3 (5m x 4m) in respect of mean height, mean spread, mean canopy height and mean canopy area of the plant. Mean canopy area was maximum (78.07 m^2) in 10 x 5m spacing, which had highest mean spread of 9.88m.

All of the growth characters were not significantly influenced due to fertilizer levels. However, 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.

None of the growth attributes and yield attributes were significantly influenced due to the interaction effect between spacing and fertilizer levels. The maximum yield was observed in S1 M1 (3.49 kg/ tree) followed by S1 M3 (3.14kg /tree) (Table 2.27 & 2.28)

Table 2.27: 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 area (m^2)	Mean canopy surface area (m^2)
S1 200 plants/ha (10m x 5m)	6.92	98.39	9.85	6.29	78.07	104.06
S2 400 plants/ha (6m x 4 m)	2.56	82.66	3.10	1.94	7.81	38.81
S3 500 plants/ha (5m x 4m)	5.73	92.96	5.44	5.31	23.75	43.60
SE m±	0.17	4.15	0.31	0.18	5.18	14.58
CD at 5%	0.68	N.S.	1.22	0.73	20.36	N.S.
M1 75 kg N : 25 kg P_2O_5 : 25 kg K_2O/ha	4.98	87.66	5.99	4.49	34.76	76.24
M2 150 kg N : 50 kg P_2O_5 : 50 kg K_2O/ha	5.13	94.32	6.28	4.63	38.76	64.79
M3 225 kg N : 75 kg P_2O_5 : 75 kg K_2O/ha	5.09	92.03	6.12	4.42	36.10	45.44
SEm±	0.08	2.12	0.23	0.12	3.35	12.34
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

Table 2.28 : Interaction effect of spacing and fertilizer on growth and yield of cashew at Vengurla

Treat-ments	Mean height (m)	Mean girth (cm)	Mean canopy area (m^2)	Mean canopy spread (m)	Mean No. of panicle / m^2	Mean nut wt. (g)	Mean yield kg/ tree	Mean yield (t/ha)	Cum. yield (kg/ tree)	
S_1M_1	6.80	95.9	75.82	9.80	17.00	9.4	3.49	0.70	12.29	Cum. yield for 9 harvest Kg/tree
S_1M_2	7.05	102.8	84.09	10.20	16.5	10.0	3.07	0.62	10.54	
S_1M_3	6.91	96.33	74.29	9.56	17.3	10.0	3.14	0.63	15.47	
S_2M_1	2.50	75.87	7.83	3.11	11.9	9.0	0.62	0.25	4.68	Cum. yield for 8th harvest Kg/tree
S_2M_2	2.65	84.06	7.85	3.10	17.1	10.0	0.58	0.23	5.10	
S_2M_3	2.52	88.06	7.75	3.10	11.9	9.9	0.69	0.28	6.16	
S_3M_1	5.64	91.12	20.64	5.05	18.4	10.0	1.24	0.62	7.08	
S_3M_2	5.69	96.03	24.34	5.55	17.0	9.7	1.45	0.73	6.82	
S_3M_3	5.85	91.72	26.26	5.70	15.8	10.4	2.02	1.02	7.07	
SEm±	0.13	3.67	5.80	0.40	1.45	0.30	0.50	0.16	-	
CD at 5%	N.S	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	-	

VRIDHACHALAM

The highest yield in 6 x 4m spacing was 2600 kg/ha which was higher than the yield in 10 x 5 m spacing (1350 kg/ha). The yield in 5 x 4 m spacing was 3250 kg/ha at higher fertilizer level. The spacing of 10 x 5m with a fertilizer dose of 225 kg N:75 kg P_2O_5 :75kg K_2O/ha was the best spacing treatment with the maximum yield (6.75 kg/tree). The trees in 6 x 4m has covered 83.32 per cent and in 5 x 4 m spacing covered 83.0 per cent of ground coverage area indicating the need for pruning for better light penetration (Table 2.29, 2.30, 2.31 & 2.32).

Table 2.29: Effect of plant density and fertilizer application on vegetative characters at Vridhachalam

Treatments	Plant height (m)	Trunk girth (cm)	Mean canopy diameter (m)	Canopy height (m)	Canopy surface area (m^2)
S1M1	8.50	47.0	5.50	7.25	27.5
S1M2	8.25	47.5	5.80	7.50	27.5
S1M3	8.50	47.5	5.50	7.50	28.0
S2M1	8.60	44.5	5.50	7.25	19.5
S2M2	8.60	45.0	5.25	7.50	20.5
S2M3	8.75	46.5	5.80	7.50	20.0
S3M1	5.25	41.8	4.50	4.25	16.5
S3M2	5.25	43.25	4.50	4.50	16.8
S3M3	6.00	43.50	4.50	5.50	16.5
CD(0.05%)	0.085	0.125	0.022	0.055	0.068

Table 2.30: Effect of plant density and fertilizer application on yield attributes at Vridhachalam

Treatments	Duration of flowering (days)	Mean nut weight (g)	Mean apple weight (g)	Mean Ann. Nut yield (kg/plant)	Cum. yield kg/plant (9 harvests)
S1M1	60	6.8	50.5	6.50	40.0
S1M2	60	6.8	52.0	6.50	40.5
S1M3	60	6.8	51.5	6.75	40.5
S2M1	58	6.9	50.25	6.25	40.0
S2M2	58	6.8	51.5	6.25	40.5
S2M3	58	6.9	52.0	6.50	40.5
S3M1	70	6.8	51.5	6.25	38.5
S3M2	69	6.9	52.0	6.25	39.75
S3M3	69	6.9	50.5	6.50	40.5
CD(0.05%)		NS	NS	0.012	0.056

Table 2.31: Effect of plant density and fertilizer application on ground coverage at Vridhachalam

Treatments	Ground area coverage by canopy (%)			Mean
MP/SP	M1	M2	M3	
S1	55.0	55.0	56.0	55.33
S2	81.25	85.4	83.3	83.32
S3	82.50	84.0	82.5	83.00
Mean	72.92	74.57	73.9	
MP SEd				0.001
CD				0.054
SP SEd				0.001
CD				0.052

Table 2.32: Effect of plant density and fertilizer application on mean annual nut yield (kg/ha) at Vridhachalam

Treatments	Cashew Yield (kg/ha)			Mean
MP/SP	M1	M2	M3	
S1	1300	1300	1350	1316.6
S2	2500	2500	2600	2533.3
S3	3125	3125	3250	3166.6
Mean	2308.3	2308.3	2400.0	
MP SEd				0.122
CD				0.650
SP SEd				0.122
CD				0.770

Agr.3: Drip irrigation trial

Centres : East Coast :
Vridhachalam

West Coast :
Vengurla

Plains / others :
Chintamani

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

SUMMARY

The cumulative yield for nine harvests was maximum (29.84 kg/tree) in irrigation at 40.0% C.P.E. at Vengurla. At Vridhachalam, the nut yield was highest (6.20 kg/tree) in irrigation at 80% cumulative pan evaporation when compared to 4.42 kg/tree in unirrigated control.

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

CHINTAMANI

Among different levels of irrigation, irrigating the crop at 80% CPE (T5) recorded significantly highest plant height (5.32 m) and stem girth (91.08 cm). There was no significant difference in canopy spread among irrigation levels. However, maximum E-W and N-S spread was recorded in T5 (8.41 m & 8.52 m). Nut yield varied significantly among the treatments. The highest nut yield of 13.84 kg/tree with a nut weight of 7.3 g. and shelling per cent of 32.1 and cumulative yield of 6 harvests (68.39 kg) was observed in 80% CPE (T5). However, from the point of water use efficacy, irrigating the crop at 60% CPE (T4) was more beneficial than 80% CPE (T5) (Table 2.33).

Table 2.33: Effect of drip irrigation levels on growth and yield of cashew at Chintamani

Treatments	Plant ht (m)	Stem girth cm)	Canopy spread (m)		Nut yield (kg/ tree)	Cum. yield (kg/tree) 6 hvts	Nut wt. (g)	Shelling (%)
			E - W	N - S				
T1 : No irrigation	4.54	80.54	7.92	8.12	8.10	39.91	6.8	30.0
T2 : Irrigation at 20% CPE	4.72	82.46	8.15	8.18	9.85	48.85	7.0	30.1
T3 : Irrigation at 40% CPE	4.76	87.67	8.20	8.39	11.56	56.47	7.1	31.4
T4 : Irrigation at 60% CPE	5.25	88.83	8.38	8.39	13.4	65.08	7.2	31.3
T5: Irrigation at 80% CPE	5.32	91.08	8.41	8.52	13.84	68.39	7.3	32.1
S. Em ±	0.11	0.96	0.16	0.16	0.92	-	-	-
C.D. at 5%	0.33	2.94	NS	NS	2.80	-	-	-

VENGURLA

The mean yield was maximum (8.22 kg/tree) (1.18 t/ha.) in irrigation at 20% CPE. Cumulative yield for nine harvests was maximum (29.84 kg/tree) in the irrigation treatment at 40 percent C.P.E (Table 2.34).

Table 2.34: Effect of drip irrigation on growth and yield of cashew at Vengurla

Treatments	Mean plant height (m)	Mean stem girth (cm)	Mean canopy area m^2	Mean flow. duration (days)	Mean fruit set/m^2	Mean yield kg/ tree	Mean yield t/ ha	Mean nut weight (g)	Cum. yield for 9 hvsts (kg/tr.)
T1 : No Irrigation	6.87	80.8	49.57	114.08	22.26	6.87	0.98	9.9	26.81
T2 : Irrigation 20% CPE	6.51	84.2	51.47	111.75	25.54	8.22	1.18	9.7	28.30
T3 : Irrigation 40% CPE	7.05	85.79	50.19	111.77	24.31	7.28	1.04	9.9	29.84
T4 : Irrigation 60% CPE	7.20	81.31	47.54	114.52	23.17	5.67	0.81	9.9	26.46
T5 : Irrigation 80% CPE	6.67	87.25	52.61	111.77	23.01	7.29	1.04	9.6	28.74
SEm±	0.16	2.79	3.69	1.76	1.77	1.53	0.21	0.23	-
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	-

VRIDHACHALAM

Irrigating the cashew plants at 80% of cumulative pan evaporation led to maximum growth parameters [plant height (4.42 m), trunk girth (45.0cm), canopy spread (2.60 m)]. The nut yield was the highest (6.20 kg/tree) in T5 - irrigation at 80% cumulative pan evaporation when compared to 4.42 kg/tree in unirrigated control (Table 2.35).

Table 2.35: Effect of drip irrigation on growth of cashew at Vridhachalam

Treatments	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Mean weight/ nut (g)	Yield (kg/tree) 3 rd harvest	Cumulative yield 3 harvests (kg/tree)
T1 - No irrigation	3.12	39.5	2.06	6.2	4.42	6.66
T2 - Irrigating 20% of CPE	3.48	40.2	2.24	6.2	4.84	7.30
T3 - Irrigating 40% of CPE	3.86	42.0	2.44	6.6	5.20	7.82
T4 - Irrigating 60% of CPE	4.08	43.6	2.52	7.2	5.86	8.58
T5 - Irrigating 80% of CPE	4.42	45.0	2.60	7.4	6.20	9.34
CD (0.05%)	0.18	0.26	0.64	0.24	0.56	-

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

Centres : East Coast :
Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :
Madakkathara and Vengurla

Plains / others :
Chintamani and Jagdalpur

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

SUMMARY:

The mean annual nut yield recorded at 4 x 4m spacing was 1067.0 kg/ha and the cumulative yield for 11 harvests was 19497.0 kg./ha at Bhubaneswar. The per hectare yield was significantly higher (3.28 times) under high density planting (2811 kg) as compared to normal density (858 kg) at Madakkathara.

Experimental Details :

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

BAPATLA

During the year 2011-12, maximum values for growth parameters were recorded with 4 x4 density level. Highest cumulative yield of 3256 kg/ha was recorded with high density plot compared to the normal density plot where the yield obtained was only 965 kg/ha (Table 2.36).

Table 2.36: Data on growth and yield parameters of high density planting and normal planting at Bapatla

Spacing	Plant height (m)	Trunk girth (cm)	Mean canopy diameter (m)	Canopy surface area (m^2)	Mean nut weight (g)	Nut yield (kg/tree) (5 hvts)	Nut yield (kg/ha)	Cum. yield (kg/tree)	Cum. yield (kg/ha)
4m x 4 m	3.69	48.83	7.58	76.98	5.26	3.2	2000	5.21	3256
8m x 8 m	2.97	51.73	8.47	65.62	5.9	2.8	436.8	6.19	965

BHUBANESWAR

The mean annual nut yield recorded at 4 x 4m spacing was 1067.0 kg/ha and the cumulative yield for 11 harvests was 19497.0 kg./ha

The yield under farm level high-density trials at Dhenkanal was 1325.0 kg / ha at 11th harvest. The yield was drastically reduced due to unfavourable climatic condition (very low temperature i.e around 8°C) during flowering and very high temperature (more than 40°C) during fruit set at both the places.

CHINTAMANI

The mean yield under high density planting (0.28 kg/tree during 11th harvest) was lower compared to normal planting (8.92 kg/tree during 11th harvest). However, the mean nut yield (175 kg/ha) and mean cumulative nut yield (6694 kg/ha) were higher in high density planting in comparison to normal planting (1392kg/ha and 7772kg/ha). The diagonal thinning of trees in 0.2 ha area was taken in the month of August-2010 (Table 2.37).

Table 2.37: Effect of high density planting on growth and yield of cashew at Chintamani

Parameters	High density planting (4 x 4m)	Normal planting (8 x 8m)	Diagonally Thinned Plants
Plant height (m)	4.30	5.75	4.35
Stem girth (cm)	59.00	93.5	64.20
Canopy spread (m)	5.10	8.72	5.54
E - W			
N - S	4.92	8.65	5.24
Yield (kg/tree)	0.28	8.92	2.02
Yield (kg/ha)	175	1392	644
Cumulative Yield 11 harvests			
Kg/tree	10.71	49.82	-
Kg/ha	6694	7772	-

The yield per unit area (1363 kg/ha) and the B:C ratio (3.14) were highest under high density planting up to 7th harvest compared to normal density (975 K/ha. and B:C ratio of 2.46). After 7th harvest the yield and B:C ratio was decreased in high density and increased in normal density. Hence, high density planting in cashew may be retained up to 7th harvest with canopy management and later diagonal thinning of trees needs to be done (Table 2.38).

Table 2.38 : Yield and B:C ratio in high density trials at Chintamani

Harvest	Yield (kg/ha.)		Net returns (Rs/ha.)		B:C ratio	
	(4x4 m)	(8x8 m)	(4x4 m)	(8x8 m)	(4x4 m)	(8x8 m)
1st harvest	325	172	4,400	1,004	1.73	1.22
2nd harvest	525	296	10,350	4,064	2.38	1.68
3rd harvest	594	429	10,384	6,444	1.94	1.72
4th harvest	831	647	18,409	13,233	2.31	1.68
5th harvest	975	830	23,950	19,860	2.41	2.32
6th harvest	1269	956	40,912	27,888	3.05	2.55
7th harvest	1363	975	49,239	30,675	3.14	2.46
8th harvest	1000	1014	30,000	32,784	2.15	2.37
9th harvest	344	1095	-6,984	43,080	0.76	2.60
10th harvest	219	1400	-14,232	85,800	0.52	3.36

Selling price of cashew: Rs. 32.0, 34.0, 36.0, 39.0, 42.0, 48.0, 53.0, 56.0, 64.0 & 72.0 per kg of nuts during 1st to 10th harvest respectively.

JHARGRAM

The experiment is in initial stage and relevant data is being recorded.

MADAKKATHARA

The yield per tree was 22.3 per cent higher under normal density (5.503 kg) as compared to high-density planting system (4.498 kg) during the fifteenth year after planting. The per hectare yield was significantly higher (3.28 times) under high density planting (2811 kg/ha) as compared to normal density (858 kg/ha). The mean values of canopy spread indicated that there was interlocking of canopy under high density planting leading to shading. The mean data under normal density planting also indicated higher canopy spread (9.50 and 9.25 m for NS & EW) than the spacing, indicating shading. Tree height, tree girth and canopy spread were appreciably high in normal density planting.

The cumulative yield for twelve years was higher under normal density planting 53.207 /tree over high density planting 46.613 /tree. However, the cumulative yield for twelve harvests was significantly higher under high density system (29133 kg/ha) as compared to normal density planting (8300 kg/ha). The increase was 3.51 times than that of normal density planting (Table 2.39).

Table 2.39: Effect of high density planting on growth and yield attributes at Madakkathara

Parameters	High density planting (4m x 4m)			Normal planting (8m x 8m)
	Max.	Min.	Mean	Mean
Tree height (m)	6.8	5.9	6.30	7.22
Trunk girth (cm)	120.0	62.0	91.1	97.4
Canopy spread - NS (m)	12.7	4.1	8.17	9.50
Canopy spread - EW (m)	11.4	4.1	6.97	9.25
Yield (kg/tree/annum)	5.925	2.350	4.498	5.503
Yield (kg/ha/annum)			2811	858
Cum. yld (kg/ tree) 12 harvests			46.613	53.207
Cum. yld (kg/ ha.) 12 harvests			29133	8300

VENGURLA

The mean height was 6.15m and canopy area was 19.30 m^2 under high density trials. The mean cumulative yield for 7 harvests was 6.64 Kg/plant (Table 2.40).

Table 2.40: Growth observations of high density planting at Vengurla

Mean height (m)	Mean girth (cm)	Mean canopy diameter (m)	Canopy height (m) (m^2)	Mean canopy area (days)	Mean flowering duration area (m^2)	Mean canopy surface kg/plant	Mean cumulative yield (for 7 harvests)
6.15	87.21	4.92	5.57	19.30	119.1	46.51	6.64

Agr.6: Intercropping in Cashew

Centres : East Coast :
Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :
Madakkathara and Vengurla

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:

Maximum yield was obtained from Fenugreek (14.77 Q/ha with a net profit of Rs.15346) followed by coriander (6.74 Q/ha) at Jhargram. Intercropping with tapioca led to the highest net profit of Rs. 93378, followed by amorphophallus (Rs. 84876) at Madakkathara. Out of five different tuber crops, elephant foot yam recorded significantly highest yield (7.29 t/ha) which had a income of Rs.1,82,325/- per ha. Intercropping of *Aloe vera* with cashew recorded higher BCR value of 4.1 and net profit of Rs.62500 / ha. and *Ocimum sanctum* recorded the BCR of 3.4 with a net profit of rs. 45,200 / ha. 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 the state recommendation

F2 = 50% of additional fertilizer applied to the intercrop

No. of replications : 3

Design : Split plot

BAPATLA

During the year 2011-12, cluster bean, marigold, amaranthus and gogu were grown as intercrops. Clusterbean recorded maximum yield of 9097 kg/ha and gave higher cost benefit ratio 3.7 and led to maximum net returns of Rs. 94,002/- (Table 2.41).

Table 2.41 : Yield and net returns of intercrops and main crop in cashew inter crop trial at Bapatla

Treatment details		Yield of intercrop		Yield of cashew		Cost of Cultivation (Rs./ha)			Returns (Rs./ha)				C:B Ratio
		Kg/plot	Q/ha	Kg/tree	Q/ha	Cashew	Intercrop	Cashew	Cashew + Intercrop	Intercrop	Total	Net	
T1	Cashew+ Cluster bean	32.5	90.97	8.76	5.6	10,000	15,000	25000	28032	90970	1,19,002	94,002	3.70
T2	Cashew+ Marigold	57.5	15.00	9.0	5.76	10,000	10,875	20875	28800	37500	66,300	45,425	2.17
T3	Cashew + Amaranthus	57.5	112.64	10.2	6.53	10,000	5,235	15,235	32,640	18022	50,662	35427	2.33
T4	Cashew + Gogu	40.0	107.63	10.1	6.45	10,000	5,564	15,564	32,320	26,908	59,228	43664	2.81
T5	Cashew Alone	——	———	10.2	6.53	10,000	———	10,000	35235	--—	35,235	25235	2.50

Sale price (Rs./Kg)

Raw cashew nuts	50=00	Cluster bean	10=00	Marigold	20=00
Amaranthus	1=60	Gogu	2=50		

JHARGRAM

Intercrops such as coriander, dill and fenugreek were grown in open canopy area under 5m x 4m spacing. Maximum yield was obtained from fenugreek (14.77 q/ha) followed by coriander (6.74 q/ha). Significant difference was noticed in the yield of cashew between cashew grown alone and cashew grown with intercrops. The yield of cashew was 1.28 q/ha without an intercrop, while it was more than 2 q/ha with intercrops. The cost benefit ratio (0.41) confirms that cashew + fenugreek was the most profitable practice followed by cashew + dill (Benefit Cost ratio = 1.0 : 0.41) (Table 2.42).

Table 2.42 : Performance of intercrops in cashew at Jhargram

Treatment Details	Yield of intercrop Q/ha	Yield of cashew (Q/ha)	Cost of cultivation (Rs./ha)			Returns (Rs./ha.)				Benefit : Cost
			Cashew	Inter-crop	Cashew + Intercrop (Rs./ha)	Cashew @ Rs. 80/kg	Inter crop (Rs./ ha)	Total (Rs. (Rs./ ha)	Net Profit (Rs./ ha)	
T1: Cashew + Coriander	6.74	2.04	23500	14262	37762	16320	23590	39910	2148	0.057
T2 : Cashew + Dill	5.59	2.61	23500	7000	30500	20800	13975	34775	4275	0.14
T3 : Cashew + Fenugreek	14.77	2.38	23500	14165	37665	19040	33971	53011	5346	0.41
T4 : Cashew (alone)	—	1.28	23500	—	23500	10240	—	10240	13260	-

Price of intercrops : 1. Coriander seed : Rs. 35/Kg 2. Dill Seed : Rs. 25/Kg 3. Fenugreek Seed : Rs. 23/Kg

MADAKKATHARA

A marginal influence of intercropping on the growth of the main crop of cashew was recorded. All the growth attributes of cashew viz., height, girth and canopy spread (NS and EW) recorded marginal increase in their values in intercropped plots over the sole crop of cashew.

Table 2.43 : Economics of intercropping of tuber crops in cashew at Madakkathara

Intercrop grown	Tuber mean yield		Total return from intercrop (Rs./ ha)	Net profit (Rs. /ha)	C: B ratio
	(Kg/ plot)	t / ha *			
Coleus	28.0	11.023	187391	81001	1.76
Colocasia	28.9	11.378	193426	73361	1.61
Tapioca	40.6	15.984	191808	93378	1.95
Sweet potato	25.2	9.921	168657	60487	1.56
Amorphophallus	39.3	15.472	278496	84876	1.44

* Area planted with inter crops : 8929 m^2

Intercrop grown	Price of produce (Rs/ kg):	Cost of cultivation (Rs/ ha):
Coleus	17	106390
Colocasia	17	120065
Tapioca	12	98430
Sweet potato	17	108170
Amorphophallus	18	193620

In terms of tuber yield, tapioca recorded the maximum yield (15.984 t/ha) followed by amorphophallus (15.472 t/ha). The lowest tuber yield was recorded by sweet potato (9.921 t/ha). With respect to total returns, the highest value was recorded by amorphophallus, followed by colocasia and tapioca. With respect to net profit, tapioca ranked first (Rs. 93378), followed by amorphophallus (Rs. 84876). The highest C: B ratio (1.95) was recorded by tapioca followed by coleus (1.76). The lowest net return (Rs. 60487) was recorded by sweet potato. The lowest C: B ratio was recorded by amorphophallus (Table 2.43).

PARIA

The highest yield/ha of intercrops (3577 kg/ha) was recorded in T2 (Cashew + okra) which was followed by T5 (Cashew + cowpea) (1849 kg/ha) and T1 (Cashew + pigeon pea) (1826 kg/ha). The highest net profit of Rs. 46,145 / ha was found in T2 (Cashew + okra) and it was followed by T1 (Cashew + pigeon pea). However, highest B:C ratio is 3.17 under treatment T1 which was followed by treatment T2 (1.82) (Table 2.44 & 2.45).

Table 2.44 : Plant growth parameters under intercropping trials in cashew at Paria

Treatments	Trunk girth (cm)	Plant height (m)	Mean canopy spread (m)
T1: Cashew + Pigeon pea	6.63	0.81	0.305
T2: Cashew + Okra	6.38	0.83	0.475
T3: Cashew + Indian bean	8.25	0.80	0.505
T4: Cashew + Indian bean	11.13	0.98	0.830
T5: Cashew + Cowpea	9.13	0.89	0.900
T6: Cashew alone	14.26	1.47	1.005
S.Em.+	2.35	0.19	
C.D.@ 5%	NS	NS	
CV%	54.89	39.68	

Table 2.45 : Yield and economics of intercropping in cashew at Paria

Treatments	Yield		Total Cost of Intercrops (Rs/ha)	Total Returns from intercrops (Rs/ha)	Net Profit ratio (Rs/ha)	B:C
	Kg/plot	Kg/ha				
T1: Cashew + Pigeon pea (Vaishali)	3.99	1826	13,125	54,780	41,655	3.17
T2: Cashew + Okra (GO2)	7.82	3577	25,395	71,540	46,145	1.82
T3: Cashew + Indian bean (GW-2)	2.88	1316	9,160	19,740	10,580	1.16
T4: Cashew + Indian bean (NPS-9)	3.33	1522	9,160	22,830	13,670	1.49
T5: Cashew + Cowpea (GC-4)	4.04	1849	8,160	18,490	10,330	1.27
T6: Cashew alone	0.00	0.00	0.00	0.00	0.00	-
S.Em.+		100				
C.D.@ 5%		302				
CV%		11.92				

VENGURLA

Out of five different tuber crops, elephant foot yam recorded significantly higher yield (55.25 kg/ plot and 7.29 t/ha) which was followed by lesser yam (31.50 kg/plot & 4.15 t/ha) and greater yam (20.75 kg/plot & 1.15 t/ha). The main crop, cashew recorded an average yield of 11.9 kg / tree and 1.86 t/ ha (Table 2.46).

Table 2.46: Economics of intercropping tuber crops in cashew at Vengurla

Treat-ments	Intercrops	Yield (kg/ plot)	Yield t/ha	Local market rate Rs./kg	Income Rs./ha
T1	Lesser Yam (Kangar)	31.50	4.15	40/-	1,66,320/-
T2	Greater Yam (Ghorkand)	20.75	1.15	40/-	46,200/-
T3	Aerial Yam (Karanda)	8.75	2.73	40/-	1,09,560/-
T4	Elephant foot Yam(Suran)	55.25	7.29	25/-	1,82,325/-
T5	Tapioca	9.25	1.22	4/-	4,884/-
	SEm±	2.372	0.311		
	CD at 5%	7.310	0.959		
	Yield of Cashew (V1)	11.90 kg/tree	1.86	85/-	1,57,794/-

VRIDHACHALAM

Intercropping of *Aloe vera* with cashew recorded higher BCR value of 4.1. *Ocimum sanctum* intercropped in cashew showed sustained performance for four years and *Aloe vera* + cashew for three consecutive years. Hence, *Ocimum* and *Aloe vera* could be promoted as profitable intercrops in cashew (Table 2.47).

Table 2.47 : Economics of intercropping medical and aromatic crops in cashew at Vridhachalam

Treatments		Yield from intercrops		Total cost of cultivation intercrops + cashew (Rs./ha)	Total returns intercrops+ cashew (Rs./ha)	Net profit (Rs/ha)	BCR
		(kg/plot 15 m^2)	kg/ha				
T1	Cashew+*Ocimum sanctum* (leaves and stem)	6.5	650	18700	63900	45200	3.4
T2	Cashew+*Catharanthus* roseus (leaves and stem)	4.0	400	18040	59000	40900	3.2
T3	Cashew+*Phyllanthus niruri* (leaves and stem)	2.5	250	14750	38400	23650	2.6
T4	Cashew+*Aloe vera* (leaves)	14.25	1425	20000	82500	62500	4.1
T5	Cashew alone	4.5	800	10000	54000	44000	4.4
	SEd	0.012					
	CD(0.05)	0.056**					

Agr.7: Organic Management of Cashew

Centres : East Coast :
Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :
Madakkathara and Vengurla

Plains / others :
Chintamani and Jagdalpur

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

SUMMARY:

The maximum cumulative nut yield per plant for 3 harvests, (3.22 kg) as well as per hectare (644.5 kg) was recorded in T8- recommended doses of fertilizer + 10 kg FYM at Bhubaneswar. The maximum tree height (2.87m) and canopy spread (NS) (3.93m) was recorded in treatment involving 25% N as FYM + recycling organic residues + green leaf/ green manuring + biofertilisers at Madakkathara. At Vengurla, the maximum nut yield was observed in treatment T8 (Recommended dosage of fertilizer + 10 kg FYM) (4.91 kg/tree and 0.96 t/ha) .

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

No significant variation was recorded in plant height, trunk girth and ground area coverage by canopy due to various organic treatments. However, recommended doses of fertilizer + 10 kg FYM (Control) resulted in maximum plant height (4.3 m) and ground area coverage by canopy (63.1 %) followed by 100 % N in which plant height was 4.1 m and in 50 % N as FYM + Bio-fertilizers (200 g), in which ground area coverage by canopy was 54.1 %. The maximum trunk girth (52.3 cm) was recorded with 100 % N as FYM followed by recommended doses of fertilizer + 10 kg FYM (Control) (51.6 cm) (Table 2.48).

Table 2.48: Vegetative and yield characters under organic management of cashew at Bhubaneswar

Treatments		Canopy spread (m)	No. of panicles/ sq. m.	Nut weight (g)	Nut yield (kg/plant)	Nut yield (kg/ha)	Cum. nut yield (kg/ha) 3 harvests
T1	100 % N as FYM	53.8	1.8	9.0	0.367	73.3	397.6
T2	100 % N as FYM + Bio-fertilizers (Azatobacter + Azospirillum + PSB) 200 g	47.1	1.9	9.2	0.533	106.7	425.1
T3	50 % N as FYM + Bio-fertilizers (200 g)	54.1	0.9	9.5	0.817	163.3	594.7
T4	100 % N as Vermicompost+ Bio-fertilizers (200 g)	39.9	1.9	8.9	0.169	33.7	198.3
T5	Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung)	41.4	2.7	9.0	1.083	216.7	446.5
T6	In situ green manuring / green leaf manuring to meet 100 % N	46.3	3.4	8.9	0.533	106.7	240.4
T7	25 % N as FYM + Recycling of organic residue + In situ green manuring / green leaf manuring + Bio-fertilizers (200 g)	51.6	2.1	8.1	0.543	108.7	576.9
T8	Recommended doses of fertilizer + 10 kg FYM (Control)	63.1	7.4	8.0	2.133	426.7	644.5
	F 'test'	NS	*		NS	NS	
	SEM±	4.631	1.1	0.376	75.112		
	CD (0.05)	3.3	–	–			

Significantly maximum number of panicles / sq. m. (7.4) was observed in T8 i.e. Recommended doses of fertilizer + 10 kg FYM (Control). Maximum nuts / panicle (3.0), apple weight (69.7 g) and nut weight (9.5 g) was recorded in T8 i.e. Recommended doses of fertilizer + 10 kg FYM (Control), T5 i.e. Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung) and in T3 i.e. 50 % N as FYM + Bio-fertilizers (200 g) respectively.

The highest nut yield per plant (2.133 kg) as well as per hectare (426.7 kg) was recorded in T8 i.e. Recommended doses of fertilizer + 10 kg FYM (Control) followed by T5 i.e Recycling of organic residue with the addition of 20 % cow dung slurry (20.0 % weight of organic residue as cow dung) (1.083 kg / plant and 216.7 kg/ha). The cumulative nut yield at 3rd harvest, maximum cumulative nut yield per plant (3.227 kg) as well as per hectare (644.5 kg) was recorded in T8 i.e. Recommended doses of fertilizer + 10 kg FYM (Control) followed by T3 i.e. 50 % N as FYM + Bio-fertilizers (200 g) (2.973 kg and 594.7 kg nut yield per plant and per hectare respectively)

JHARGRAM

The treatments were on par with respect to plant height, trunk girth, canopy spread, canopy area, flowering per square meter, nuts per square meter, nut weight, apple weight, yield/tree and shelling percentage (Table 2.49).

Table 2.49: Vegetative and yield characters under organic management trials on cashew at Jhargram

Treatments	Plant height (m)	Trunk girth (cm)	Canopy area (m^2)	Nuts/ m^2	Nut weight (g)	Yield (kg/ tree)	Cumulative yield (kg /tree)	Shelling %
T 1	3.23	41.3	17.4	14.3	6.3	1.58	1.63	34.1
T 2	3.20	39.7	15.8	14.5	6.6	1.50	01.52	34.1
T 3	3.17	41.3	15.7	9.2	6.5	0.93	1.20	31.7
T 4	3.33	40.0	14.1	12.7	6.3	1.10	1.17	33.6
T 5	3.03	34.0	13.2	12.7	6.7	1.13	1.21	31.2
T 6	2.93	37.3	15.2	13.7	7.2	1.51	1.57	32.0
T 7	3.03	36.7	13.6	12.9	7.1	1.25	1.29	31.8
T 8 (Control)	3.53	43.3	19.9	10.2	6.9	1.35	1.42	32.0
S.Em +	0.19	4.22	2.61	1.69	0.34	0.25		1.732
C.D.at 5%	0.43	9.05	5.59	3.63	0.73	0.536	NS	3.719
C.V%	7.6	13.2	20.5	16.5	6.18	23.9		3.55

MADAKKATHARA

No significant variation was observed among the treatments with respect to plant height, stem girth and canopy spread (NS and EW) of young cashew trees during the third year of treatment. However the maximum height (2.87m) and canopy spread (NS) (3.93m) was recorded in T7 (25% N as FYM + recycling organic residues + green leaf/ green manuring + biofertilisers). T6 (Green leaf / green manuring) recorded the maximum canopy spread (EW). Maximum girth (35.3cm) was recorded by T5 (Recycling of organic residues with addition of 20% cowdung slurry) (Table 2.50).

Table 2.50 : Vegetative and yield characters under organic management trials on cashew at Madakkathara

Treatments	Height (m)	Grith (cm)	Canopy spread-NS (m)	Canopy spread– EW (m)
T1 – 100 % N as FYM	2.67	33.0	3.27	3.30
T2 – 100% N as FYM + BF	2.83	31.3	3.23	3.37
T3 – 50% N as FYM + BF	3.00	28.7	2.80	3.33
T4 – 100% N as VC + BF	2.80	32.3	3.40	3.27
T5 – Recycling organic residues	2.53	35.3	3.37	3.37
T6 – Green leaf/ green manuring	2.87	32.7	3.80	3.87
T7 – 25% N as FYM + recycling organic residues + green leaf/ green manuring + BF	3.13	34.3	3.93	3.77
8 – RDF + 10 kg FYM (Control)	2.67	31.0	3.60	3.40
CD (0.05)	NS	NS	NS	NS

VENGURLA

There was no significant difference among the various treatments in respect of growth attributes. However, treatment T8 (RDF+10 Kg FYM–control) recorded more mean height (3.70) m), mean canopy height (3.25 m), mean canopy spread (4.17 m), mean canopy area (14.27 m2) and mean canopy surface area (26.20 m2) whereas, stem girth (37.07 cm), was observed to be maximum in treatment T6 (In situ green manuring / green leaf manuring to meet 100% N). The maximum nut yield was observed in treatment T8 (Recommended dosage of fertilizer + 10 kg FYM) (4.91 kg/tree and 0.96 t/ha) followed by treatment T2 (100% N as FYM + Biofertilizers (Azatobacter + Azospirillum + Phosphate solubilising bacteria) (4.69 kg/tree and 0.94 t/ha) (Table 2.51 & 2.52).

Table 2.51 : Yield characters under organic management trials on cashew at Vengurla.

Treatments	Mean no. of panicle /m²	Mean nut wt . (g)	Mean yield kg/ tree	Mean yield t/ ha
T1 - 100% N as FYM	16.33	8.00	3.24	0.65
T2 - 100% N as FYM + Biofertilizers (Azatobacter+ Azospirillum+ PSB*)	17.68	8.50	4.69	0.94
T3 - 50% N as FYM + Biofertilizers	17.58	9.10	3.53	0.71
T4 - 100% N as Vermicompost + Biofertilizers	15.50	8.63	2.89	0.58
T5 - Recycling of organic residues with addition of 20% cow dung slurry	15.75	8.27	2.06	0.41
T6 - In situ green manuring/ green leaf manuring to meet 100% N	17.08	8.73	4.11	0.82
T7 - 25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers	14.75	9.13	2.82	0.56
T8 - RDF + 10 kg FYM (Control)	17.42	8.33	4.91	0.96
SEm±	1.13	0.31	0.69	0.13
CD at 5%	N.S	N.S	N.S	N.S

Table 2.52: Vegetative characters under organic management trials on cashew at Vengurla.

Treatments		Mean plant ht. (m)	Mean stem girth (cm)	Mean canopy spread (m)	Mean canopy area (m^2)
T1	100% N as FYM	3.03	33.58	3.63	10.20
T2	100% N as FYM + Biofertilizers (Azatobacter + Azospirillum + PSB*)	3.14	34.16	3.59	10.63
T3	50% N as FYM + Biofertilizers	2.87	33.91	3.19	8.21
T4	100% N as Vermicompost + Biofertilizers	3.06	32.75	3.71	10.96
T5	Recycling of organic residues with addition of 20% cow dung slurry	3.07	35.41	3.21	8.43
T6	In situ green manuring/green leaf manuring to meet 100% N	3.58	37.07	3.87	12.39
T7	25% N as FYM + Recycling of organic residues + In situ green manuring/green leaf manuring + Biofertilizers	2.65	35.16	3.07	7.80
T8	RDF + 10 kg FYM (Control)	3.70	36.41	4.17	14.27
	SEm±	0.24	2.76	0.23	1.28
	CD at 5%	N.S.	N.S.	N.S.	N.S.

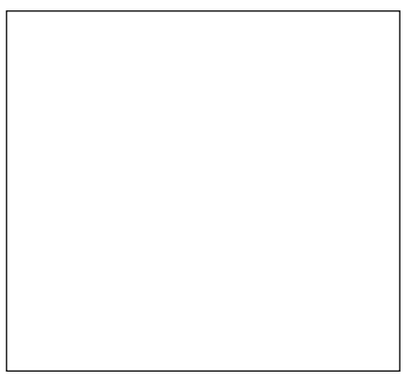
VRIDHACHALAM

The highest mean annual nut yield was recorded in recommended dose of fertilizers + 10 kg FYM (Control) (T8) (4.55 kg/tree). There was no significant difference among the organic treatments with respect to vegetative parameters (Table 2.53).

Table 2.53 : Vegetative and yield characters under organic management trials on cashew at Vridhachalam

Treatments	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		Yield kg/ tree
			E-W	N-S	
T1	3.8	41.5	5.0	5.2	4.00
T2	3.8	39.5	5.8	5.3	4.00
T3	3.6	39.5	5.5	6.0	4.15
T4	3.6	42.5	5.5	6.0	4.20
T5	3.6	44.0	5.5	5.5	3.85
T6	3.5	43.0	5.8	5.8	3.80
T7	3.8	39.5	6.0	5.8	4.00
T8	3.8	43.5	5.6	5.2	4.55
CD(0.05%)	0.012	0.051	0.011	0.011	0.056

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 :
Chintamani and Jagdalpur

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

SUMMARY:

L-cyhalothrin 0.003% minimised the incidence of leaf and blossom webber, shoot tip caterpillar, apple and nut borer and leaf miner at Bapatla. At Jagdalplur, the mean damage score due to TMB on shoot and panicle was minimum in L-cyhalothrin 0.003% and chlorpyriphos 0.05%. The treatments viz., profenophos, recommended spray schedule and L-cyhalothrin resulted in yields of 3.28, 3.12 and 2.84 Kg/tree respectively as compared to control (2.11 kg/tree) at Madakkathara. The treatment with L-cyhalothrin recorded significantly highest nut yield of 969 kg/ha. with the least damage score of 0.86 at Paria. At Vengurla, treatment with L-cyhalothrin recorded minimum damage score of 1.92 on the nuts, while it was 8.17 in untreated control plot.

Experimental details:

T1 - Neem oil soap (4%) followed by L- cyhalothrin (0.6ml/l) followed by neem oil soap

T2 - Imidacloprid (0.6ml/lt)

T3 - Acetamiprid 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 – Un-treated 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 and again by neem oil soap, as well as recommended spray schedule were to be on par with each other against leaf and blossom webber.

The treatment L-cyhalothrin 0.003% offered better control against shoot tip caterpillar and apple and nut borer followed by recommended schedule spray for the region.

With respect to leaf miner, the treatments L-cyhalothrin 0.003% and neem oil soap 4% followed by L-cyhalothrin and again by neem oil soap was found to be effective in reducing the pest population and damage on leaf. None of the chemicals evaluated were found to be safe to the natural enemies. (Table 3.1, 3.2 & 3.3)

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

Treatments		Thrips damage grade at 30 days after 3rd spray (0-4 scale)	Leaf and blossom webber damaged shoots (%)			
			Before spray	30 days after 1st spray	30 days after 2nd spray	30 days after 3rd spray
T1	Neem oil soap (4%) followed by L- Cyhalothrin (0.6ml/l) followed by	1.7 (6.5) b	24.2 (29.4)	18.0 (25.0)b	10.1 (18.4)b	9.3 (17.6)b
T2	Imidacloprid (0.6ml/lt)	0.6 (4.4)a	23.6 (29.0)	20.5 (26.9)bc	18.2 (25.2)d	17.7 (24.8)c
T3	Acetamiprid 20SP (0.5 g/l)	0.7 (4.1)a	24.1 (29.4)	19.6 (26.2)bc	16.5 (23.9)d	16.9 (24.2)c
T4	L-Cyhalothrin 0.003%	0.8 (4.1)a	23.7 (29.1)	12.6 (20.7)a	4.7 (12.4)a	3.7 (10.9)a
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage.	1.7 (8.3)c	24.2 (29.4)	19.0 (25.7)bc	13.2 (21.1)c	10.8 (18.9)b
T6	Untreated Control	2.9 (9.8)d	28.1 (32.0)	27.0 (31.2)d	24.7 (29.7)e	22.7 (28.2)d
	CD (0.05)	0.70	1.64	1.95	1.73	2.3
	CV	14.67	7.31	9.98	10.57	14.65

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

Table 3.2: Efficacy of certain new insecticides against pest complex in cashew at Bapatla

Treatments		Shoot tip caterpillar damaged shoots (%)		Apple and nut borer damage (%)		Leaf miner (%)	
		Before spray	30 days after 3rd spray	Before spray	30 days after 3rd spray	Before spray	30 days after 3rd spray
T1	Neem oil soap (4%) followed by L- Cyhalothrin (0.6ml/l) followed by Neem oil soap	43.86 (41.44)	14.0 (21.8) c	14.0 (21.37)	14.1 (22.0)c	33.5 (35.3)	6.8 (15.0)b
T2	Imidacloprid (0.6ml/lt)	40.99 (39.79)	16.4 (23.8)cd	20.0 (26.51)	16.9 (24.1)d	28.6 (32.3)	11.7 (19.9)c
T3	Acetamiprid 20SP(0.5 g/l)	46.85 (43.17)	17.7 (24.6) d	17.9 (24.73)	13.4 (21.4)c	37.6 (37.7)	14.9 (22.6) d
T4	L-Cyhalothrin 0.003%	49.33 (44.59)	0.0 (0.0)a	23.4 (28.74)	6.2 (14.4)a	33.7 (35.4)	0.3 (1.6)a
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at lowering and carbaryl 0.1% at fruit & nut development stage.	49.77 (44.85)	8.7 (17.1)b	23.5 (28.93)	11.5 (19.8)b	28.8 (32.4)	14.8 (22.6)d
T6	Untreated control	49.13 (44.48)	35.5 (36.5) e	25.9 (30.57)	28.0 (31.9)e	36.4 (37.0)	31.3 (34.0)e
	CD (0.05)	1.53	2.36	2.64	1.54	1.53	1.89
	CV	4.71	15.16	13.07	9.20	4.71	12.99

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

Table 3.3: Efficacy of certain new insecticides against pest complex (minor) in cashew at Bapatla

Treatment		Leaf miner (%)				Mean No. per 52 inflorescence at 30 days after 3rd spray	
		Before spray	30 days after 1st spray	30 days after 2nd spray	30 days after 3rd spray	Ants	Spiders
T1	Neem oil soap (4%) followed by L- cyhalothrin (0.6ml/l) followed by Neem oil soap	33.5 (35.3)	17.9 (24.8)ab	11.6 (19.8)b	6.8 (15.0)b	1.6(7.2)b	1.5 (6.9)b
T2	Imidacloprid (0.6ml/lt)	28.6 (32.3)	21.4 (27.5)c	16.5 (23.9)c	11.7 (19.9)c	0.8 (3.6)d	1.0 (4.8)c
T3	Acetamiprid 20SP(0.5 g/l)	37.6 (37.7)	26.0 (30.6)d	19.6 (26.2)d	14.9 (22.6) d	0.9 (5.3)c	0.9 (3.8)c
T4	L-cyhalothrin 0.003%	33.7 (35.4)	15.4 (22.9)a	5.3 (13.0)a	0.3 (1.6)a	0.1 (1.1)e	0.0 (0.0)d
T5	Monocrotophos 0.05% at flushing, Chlorpyriphos 0.05% at flowering and carbaryl 0.1% at fruit & nut development stage.	28.8 (32.4)	19.8 (26.4)bc	21.4 (27.5)d	14.8 (22.6)d	0.5 (3.6)d	0.4 (3.0)c
T6	Untreated control	36.4 (37.0)	32.1 (34.5)e	37.5 (37.7) e	31.3 (34.0)e	11.1 (19.3)a	13.2 (21.3)a
	CD (0.05)	1.53	1.92	1.81	1.89	1.45	1.73
	CV	4.71	9.19	9.73	12.99	28.80	34.63

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

CHINTAMANI

The population of TMB ranged between 0.09 to 3.05, 0.06 to 3.10 and 0.02 to 3.13 at 30 days after 1st, 2nd and 3rd spray, respectively. L-cyhalothrin was significantly superior over other treatments and recorded lowest population of TMB (0.09, 0.06 and 0.02) in all the three sprays. This was followed by recommended spray for the region and triazophos. The insecticides viz., chlorpyriphos (3.04) and profenofos (3.09) were least effective in controlling the TMB and were on par with unsprayed check (3.13). The maximum nut yield of 7.02kg/ tree was recorded in L-cyhalothrin followed by recommended spray for the region which gave 5.20kg/tree. (Table 3.4)

Table 3.4: Effect of insecticides on the incidence of TMB at Chintamani

Treatments	30 Days after I spray (0-4)	30 Days after II spray (0-4)	30 Days after III spray (0-4)	Mean nut yield (kg/tree)
Recommended spray for the region	1.52^{b}	1.54^{b}	1.57^{b}	5.20
Chloropyriphos 0.05 %	2.86^{d}	2.99^{d}	3.04^{d}	2.62
Triazophos 0.1 %	2.66^{c}	2.69^{c}	2.75^{c}	4.20
L-cyhalothrin 0.003 %	0.09^{a}	0.06^{a}	0.02^{a}	7.02
Profenofos 0.05 %	2.98^{d}	3.04^{d}	3.09^{d}	2.01
Unsprayed check	3.05^{d}	3.10^{d}	3.13^{d}	1.45
C.D @ 5%	0.62	0.03	0.22	-

Thrips damage on immature apple and nuts was found to be low in all the treatments compared to control. The lowest damage score of 0.25 on apple and 0.33 on nuts was recorded in L-cyhalothrin treated trees which was significantly superior over the rest of treatments.

The lowest damage due to aphids (0.22%) and mealy bugs (0.82%) was recorded in recommended spray for the region and L-cyhalothrin treatments respectively.

All the treatments were significantly superior over control in reducing the incidence of leaf miner, apple and nut borer. The lowest damage by leaf miner (0.87%) and by apple and nut borer (0.26%) was recorded in recommended spray for the region and L-cyhalothrin respectively.

The yield data showed that L-cyhalothrin spray recorded the highest yield (7.02 kg/tree) followed by recommended spray for the region (5.20 kg/tree) and triazophos (4.20 kg/tree) (Table 3.5).

Table 3.5 : Evaluation of insecticides for the control of other insect pests of cashew at Chintamani

Treatments	Thrips (0-4)		Aphids (%)	Mealy bugs (%)	Leaf miner (%)	Apple and nut borer (%)
	Apple	Nut				
Recommended spray for the region	1.47^{b}	0.76^{c}	0.22^{a}	1.00^{c}	0.87^{a}	0.42^{b}
Chlorpyriphos 0.05 %	2.21^{d}	1.45^{d}	0.85^{d}	1.06^{d}	1.20^{b}	1.12^{c}
Triazophos 0.1 %	1.79^{c}	0.57^{b}	0.62^{c}	0.89^{b}	1.57^{e}	2.03^{e}
L-cyhalothrin 0.003 %	0.25^{a}	0.33^{a}	0.50^{b}	0.82^{a}	1.46^{c}	0.26^{a}
Profenofos 0.05 %	2.55^{e}	1.59^{e}	1.00^{e}	1.29^{e}	1.52^{d}	1.20^{d}
Unsprayed check	3.10^{f}	2.99^{f}	1.96^{f}	2.97^{f}	6.82^{f}	3.00^{f}
C.D at 5%	0.020	0.11	0.09	0.05	0.016	0.07

JAGDALPUR

The TMB mean damage score was minimum in L-cyhalothrin 0.003% and chlorpyriphos 0.05%, which were on par with Triazophos 0.1%, both on shoot and panicle.

Leaf caterpillar damage was the least in chlorpyriphos 0.05% spray which also minimized the leaf folder damage.

The thrips mean damage grade on nut and per cent leaf miner damage was significantly lowest (0.40 mean damage score) in triazophos 0.1% (Table 3.6).

Table 3.6 : Efficacy of different insecticides against tea mosquito bug (TMB) at Jagdalpur

Treatment	TMB (Tea mosquito bug) Mean Damage Score 0-4 scale on 52 leader shoots		% Leaf Caterpillar damage	% Leaf Folder damage	NUT Thrips Mean damage grade at	% Leaf Miner damage	Yield kg/ha
	Shoot 30 DAS after IIIrd spray	Panicle 30 DAS after IIIrd spray	30 DAS after IIIrd spray	30 DAS after IIIrd spray	30 days after 3rd (0-4 scale)	30 DAS after IIIrd spray	
T-1: Monocrotophos 0.05% at flushing and Carbaryl 0.1% at flowering & fruiting stage.	0.18 (0.82)^{de}	0.67 (0.98)	42.60 (40.74)^{bcde}	28.17 (31.78)^{b}	0.97 (1.19)^{*b}	18.17 (24.84)^{bcde}	248.3^{ab}
T-2 : Chloropyriphos 0.05%	0.00 (0.71)^{a}	0.00 (0.71)	31.91 (34.35)^{a}	34.19 (35.63)^{b}	1.09 (1.26)^{bcde}	10.31 (18.19)^{abc}	293.92^{abc}
T-3 : Triazophos 0.1%	0.02 (0.72)^{abc}	0.07 (0.75)	40.73 (39.63)^{ab}	20.51 (26.82)^{a}	0.40 (0.95)^{a}	5.75 (13.51)^{a}	234.74^{abcd}
T-4 : L-cyhalothrin 0.003%	0.00 (0.72)^{ab}	0.00 (0.71)	39.69 (38.93)^{abc}	37.16 (37.45)^{b}	1.09 (1.25)^{bcd}	12.04 (20.25)^{ab}	178.58^{bcde}
T-5 : Profenophos 0.05%	0.03 (0.73)^{abcd}	0.07 (0.76)	39.40 (38.85)^{abcd}	30.11 (33.15)^{bc}	0.97 (1.21)^{bc}	11.91 (19.80)^{abcd}	332.42^{a}
T-6 : Unsprayed check	0.38 (0.94)^{f}	1.11 (1.22)	50.90 (45.52)^{e}	41.43 (40.06)^{c}	1.65 (1.47)^{f}	25.07 (29.99)^{e}	99.01^{f}
CD at 5%	**(0.07)**	**(NS)**	**(5.70)**	**(7.74)**	**(0.19)**	**(7.02)**	**120.82**

* Figure in parentheses are square root transformed values

MADAKKATHARA

Among the insecticides tested recommended spray schedule (T-1), Triazophos (T-3), L–cyhalothrin (T-4) were effective in minimizing the damage on both shoot and panicles. The damage score recorded for shoots as well as panicles varied between zero (nil) to less than 1 (moderate damage).

Among all treatments recommended spray schedule triazophos (T-3) L–cyhalothrin (T-4) and profenophos (T-5) were found to be effective in deterring TMB damage. The treatments viz.,

profenophos, recommended spray schedule and L-cyhalothrin resulted in yields of 3.28, 3.12 and 2.84 kg/tree respectively as compared to control (2.113 kg/tree). The treatment effect was not significant in case of leaf miner (LM), leaf and blossom webbers (LBW) and nut borers (NB).

Pests like mealy bugs, weevil and thrips were observed in isolated cases only (Table 3.7),

Table 3.7: Effect of different insecticides against damage by tea mosquito bug (TMB) in cashew at Madakkathara

Treatments	Incidence of TMB (Tea mosquito bug) Mean score for 52 leader shoots (0-4 scale)				Nut yield (kg/tree/yr)
	Shoot		Panicle		
	Pre-treatment	30 days after 1st spray	Pre-treatment	30 days after 3rd spray	
T-1: Recommended spray schedule	0.057	0.000	0.000	0.013	3.12
T-2: Chlorpyriphos	0.017	0.025	0.000	0.000	2.19
T-3: Triazophos	0.281	0.006	0.000	0.000	2.45
T-4: L-cyhalothrin	0.052	0.013	0.000	0.013	2.84
T-5: Profenophos	0.019	0.030	0.000	0.019	3.28
T-6: Control	0.069	0.013	0.000	0.019	2.11
DMRT	NS	NS		NS	

Means followed by common alphabets are not significantly different among themselves by DMRT

PARIA

All the insecticidal treatments recorded significantly lower TMB infestation as compared to control. The least infestation score (0.53) was recorded in L-cyhalothrin which was statistically at par with Acetamiprid 20 SP. The next best treatment was found to be Clothianidin in suppressing TMB infestation.

The lowest percent infestation due to leaf miner (7.94) was recoded in the treatment of L-cyhalothrin. The significantly least percent damage by leaf and blossom webber (6.57) was in the treatment with L-cyhalothrin. The lowest STC damage (5.14) was observed in the tratment of L-cyhalothrin, however, it was not significantly different from the insecticidal treatments of Acetamiprid 20 SP.

The treatment of L-cyhalothrin also recorded the lowest (6.24) percent damage of apple and nut borers.

The treatment with L-cyhalothrin recorded significantly highest nut yield of 969 kg/ha (Table 3.8).

Table 3.8: Efficacy of different insecticides against tea mosquito bug (TMB) minor pests at Paria.

Treatments	TMB damage score 15 days after spray	Per cent damage due to				
		LM	LBW	STC	ANB	Yield (kg/ha)
T3 Triazophos 40 EC @ 0.04 %; 1ml/lit	1.16 (0.87)	19.41 (11.13)	18.37 (10.03)	17.46 (9.71)	17.06 (8.69)	615
T4 L-cyhalothrin 5 EC@ 0.003 %; 0.6ml/lit.	0.86 (0.25)	16.24 (7.94)	14.80 (6.57)	12.20 (5.14)	14.24 (6.24)	969
05 Profenophos 50 EC @ 0.05 %; 1ml/lit	1.06 (0.62)	18.34 (10.07)	18.54 (10.15)	15.40 (7.77)	17.21 (8.89)	593
08 Control	1.58 (2.02)	25.45 (18.91)	24.44 (17.20)	21.51 (13.36)	23.87 (16.63)	396
S.Em.	0.02	0.73	0.34	0.70	0.74	41.9
C.D.(0.05)	0.07	2.22	1.03	2.12	2.23	127
CV%	6.87	5.37	5.92	13.22	18.12	10.91

Lm = Leaf miner LBW = leaf & blossom webber
STC = shoot tip caterpillar ANB = Apple & nut borer

VENGURLA

All the insecticidal treatments significantly reduced the TMB incidence over control in cashew. Among the insecticidal treatments, treatment (T4) L-cyhalothrin (0.003%) was observed significantly superior over rest of the treatments (1.20). Treatment with Profenophos (T5) was found to be the second best treatment for the management of TMB which recorded 1.80 damage score (Table 3.9).

Table 3.9: Efficacy of different insecticides against tea mosquito bug (TMB) in cashew at Vengurla.

Sr. No.	Treatment details	Per cent incidence 30 days after Third spray
T1	Recommended spray schedule (monocrotophos 0.05%, Profenophos. 0.05% Carbaryl 0.1%)	3.49 (10.64)
T2	Chloropyriphos 0.05%	3.61 (10.81)
T3	Triazophos 0.01%	3.85 (11.19)
T4	L-cyhalothrin 0.003%	1.20 (3.05)
T5	Profenophos 0.05%	1.80 (7.60)
T6	Control	7.57 (15.85)
T7	Triazophos 0.1%, Profenophos 0.05%, Carbaryl 0.1%.	4.93 (12.6)
	S.E.±	0.835
	C.D. at 5%	2.479

* Figures in parenthesis are arc sine values

All the treatments significantly reduced the incidence of Inflorescence thrips over control. In case of Inflorescence thrips, L-cyhalothrin (0.003%) was found to be significantly superior over rest of the treatments, recording a minimum of 2.16% and 1.92% on apple and nut, respectively (Table 3.10).

Table 3.10: Efficacy of different insecticides against minor pests in cashew at Vengurla

Treatment details		Thrips	
		Per cent incidence 30 days after 3rd spray	
		Apple	Nut
T1	Recommended spray schedule (monocrotophos 0.05%, Profenophos. 0.05%, Carbaryl 0.1%)	4.21 (11.71)	3.61 (10.85)
T2	Chloropyriphos 0.05%	4.33 (11.94)	4.09 (11.57)
T3	Triazophos 0.01%	4.69 (12.43)	4.33 (11.93)
T4	L-cyhalothrin 0.003%	2.16 (8.38)	1.92 (7.88)
T5	Profenophos 0.05%	3.37 (10.43)	3.01 (9.86)
T6	Triazophos 0.1%, Profenophos 0.05%, Carbaryl 0.1%	4.93 (12.78)	5.05 (12.89)
T7	Untreated Control	8.17 (16.55)	8.17 (16.52)
	S.E.±	0.471	0.384
	C.D. at 5%	1.39	1.140

- Figures in parenthesis are arc sine values

VRIDHACHALAM

The efficacy of different insecticides was on par among themselves, but statistically superior over untreated control. The damage score of TMB was non-significant in all treatments including the untreated control. Minimum damage score (0.30) was observed in L-cyhalothrin, recommended spray schedule for the region as well as 'neem oil soap followed by L-cyahlothrin and further followed by neem oil soap'. These treatments were on par with Imidachloprid 17.8 SL (0.6ml/lit) and Acetamaprid 20 SP (0.5g/lit). However, all the insecticides were statistically on par in minimizing the pest incidence (Table 3.11).

Table 3.11: Efficacy of different insecticides against tea mosquito bug (TMB) at Vridhachalam

Treatments	Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)
		30 days after III spray
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	1.0a	0.30a
Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	1.2a	0.33a
Acetamaprid 20 SP (0.5g/lit) all the three sprays	1.2a	0.36a
L-cyhalothrin 0.003% all the three sprays	1.2a	0.30a
Recommended spray for the region	1.0a	0.30a
Untreated check	1.0a	1.26b
CD	0.46	0.33

Means followed by same letter are significantly different by DMRT (P=0.05)

Thirty days after 3rd spray, all the insecticides were effective in controlling TMB populations to zero as against 5.6 bugs/ 52 leader shoots observed in untreated control (Table 3.12).

Table 3.12: Efficacy of insecticides on TMB population at Vridhachalam

Treatments	Pre treatment count/52 leader shoots	Post-treatment count (Mean TMB population/52 leader shoots)		
		30 days after III spray	Yield (kg/ tree)	Ranking
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	1.3_{a}	0.0_{a}	5.6_{ab}	2
Imidachloprid 17.8 SL (0.6ml/lit) all the three sprays	1.6_{a}	0.0_{a}	5.4_{b}	4
Acetamaprid 20 SP (0.5g/lit) all the three sprays	1.3_{a}	0.0_{a}	5.5_{b}	3
L-cyhalothrin 0.003% all the three sprays	1.0_{a}	0.0_{a}	5.0_{c}	5
Recommended spray for the region	1.0_{a}	0.0_{a}	5.9_{a}	1
Untreated check	1.3_{a}	5.6_{b}	3.6_{d}	-
CD	0.35	-	-	-

The per cent damage due to leaf miner, leaf folder, leaf and blossom webber and nut borer was very low in all insecticides treated trees as compared to untreated trees.

All the insecticides treatment decimated the population of spiders, coccinellids, ants and braconid wasp after each round of insecticidal spray. In unsprayed trees, the activity of weaver ants and *Cotesia* wasps was predominant.

Ent. 2: Control of cashew stem and root borer
Expt. 2. Curative control trial

Centres : East Coast :
Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :
Madakkathara and Vengurla

Plains / others :
Chintamani 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:

Chlorphyriphos 0.2% led to a maximum percentage of 100% trees without re-infestation or persistent attack by CSRB at Madakkathara, 92.0% at Bhubaneswar, 90.9% at Bapatla and 77.78 % at Jagdalpur.Maximum percentage of trees without reinfestation (42.0%) occurred when < 25% of bark circumference was damaged at Bapatla, while it was 63.9% at Vridhachalam.

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)

BAPATLA

Among the insecticides evaluated as post extraction prophylaxis, chlorpyriphos 0.2% led to 90.9 % trees without re-infestation or persistent attack followed by carbaryl 0.2% which resulted in 77.3 % trees without re-infestation or persistent attack. Monocrotophos and treated check with neem oil offered 66.60 and 50.00 percent protection and were superior over the control (removal of grubs only) which recorded 33.33 % trees without re-infestation or persistent attack. Preferential zone of attack was collar + root in 42.05 percent of trees followed by collar + root + stem in 34.57 percent of trees.followed by collar + stem 23.36 percent (Table 3.13 & 3.14).

Table 3.13: Efficacy of insecticides as post extraction prophylaxis(PEP) against cashew stem and root borer (CSRB) at Bapatla

Treatments	% Trees without reinfestation / persistant attack
Carbaryl 1.0%	77.30
Chlorpyriphos 0.2%	90.90
Monocrotophos 0.2%	66.60
Lindane 0.2%	Product not available
Untreated check (only removal of CSRB grubs)	33.33
Treated check with most effective treatment under prophylactic trails	50.00

Table 3.14:Physical parameters of cashew stem and root borer infested trees in curative trials at Bapatla

Parameters		Total trees treated	No.of trees in each category	
			Without reinfestation	With re-infestation/ persistant infestation
Stem girth (cm.)	< 60	18	8	10
	60-80	23	16	7
	80-100	46	30	16
	> 100	20	15	5
	Total	**107**	**69**	**38**
Age (Years)	< 5	0	0	0
	5-10	0	0	0
	10-15	52	34	18
	> 15	55	35	20
	Total	**107**	**69**	**38**
% Bark circumference damaged	< 25	64	42	22
	25-50	20	15	5
	50-75	14	9	5
	> 75	09	3	6
	Total	**107**	**69**	**38**
Zone of attack	C+R	45	25	20
	C+S	25	18	7
	R	0	0	0
	S	0	0	0
	C	0	0	0
	C+R+S	37	26	11
	Total	**107**	**69**	**38**
Canopy yellowing	a) Yellowed	5	0	5
	b) Not yellowed	102	69	33
	Total	**107**	**69**	**38**

BHUBANESWAR

Maximum recovery (92%) was obtained in chlorpyriphos (0.2%) treatment followed by monocrotophos (0.2%) treatment. All the infested trees in early stages of infestation, recovered in case of chlorpyriphos treatment whereas, in other treatments the recovery was 15 to 80 %. Maximum cost of treatment (Rs. 96 /tree/year) was involved in neem oil treatment with a recovery of 35%. In the control treatment (only phyto-sanitation) the cost is lesser but number of extractions was maximum (7 times) which is detrimental for recovery of the tree. Both in chlorpyriphos and monocrotophos treatment maximum recovery (92.0 and 80.0, respectively) with minimum cost (Rs. 60 / tree/ year) could be achieved.

It was observed that the stem girth of 60-80 cm had more re-infestation and less than 60 cm stem girth exhibited least re-infestation. When the bark circumference had less 25 % damage then re-infestation was found to be less (Table 3.15 & 3.16).

Table 3.15 : Efficacy of insecticides as post extraction prophylaxis(PEP) against cashew stem and root borer (CSRB) at Bhubaneswar

Treatments	Mean % of trees without reinfestation / persistence of attack
T1 - Carbaryl (1 %)	72.0
T2 - Chlorpyriphos (0.2 %)	92.0
T3 - Monocrotophos (0.2 %)	80.0
T4 - Chlorpyriphos (0.1%)	75.0
T5 - Untreated check (only removal of CSRB grubs)	15.0
T6 - Neem oil (5%)	35.0

Table 3.16:Physical parameters of cashew stem and root borer infested trees in curative trials against CSRB at Bhubaneswar

Physical parameters		No. of trees in each category	
		Without re-infestation	With re-infestation
Stem girth (cm)	<60	60	0
	60-80	12	15
	80-100	3	10
	>100	2	1
Age (Years)	<5	0	0
	5 –10	25	3
	10-15	35	12
	> 15	17	11
	<25	40	7
% Bark circumference damaged	25-30	25	12
	50-75	10	5
	>75	2	3
Zone of attack	C+R	10	2
	C+S	55	5
	R	1	2
	S	5	5
	C+R+S	6	12
Canopy yellowing	Yellow	0	8
	Not yellow	77	18

CHINTAMANI

Chlorpyriphos (0.2%) was the most effective treatment with 95.12% trees without reinfestation. However, the other treatments also maintained their superiority in suppressing the population over control. In treated check, where only grub extraction was adopted, it was observed that 64.54% trees could recover (Table 3.17).

Table 3.17: Efficacy of certain insecticides as curative treatment against CSRB at Chintamani

Treatments	Tress without re-infestation/ persistent attack (%)
T1 - Carbaryl 1.0%	87.37
T2 - Chlorpyriphos 0.2%	95.12
T3 - Monocrotophos 0.2%	81.48
T4 - Chlorpyriphos 0.1%	91.37
T5 - Treated check	89.42
T6 - Untreated check	64.54

The trees with 60-100 cm stem girth, showed highest per cent of damage (50.79%). With respect to age of trees, the trees of more than 15 years were prone to damage. The zone of attack was noticed at collar+root+stem and canopy yellowing of trees was observed in 9.52 per cent of treated trees. The bark circumference damage was less than 25 per cent in 53.97 per cent of the infested trees (Table 3.18).

Table 3.18: Physical parameters of treated cashew trees under curative control trial at Chintamani

Physical parameters		No. of trees infested	% of total trees treated	No. of trees not reinfested	% of total trees not reinfested
Stem girth	< 60 cm	11	17.46	05	11.90
	60-100 cm	32	50.79	23	54.76
	> 100 cm	20	31.74	14	33.33
Total		63	-	42	-
Age of the tree	<10 years	-	-	-	-
	10-15 years	-	-	-	-
	>15 years	63	100.00	42	100
Total		63	-	42	-
Zone of attack	C + R	12	19.05	06	14.29
	C + S	44	69.84	31	73.81
	C + S + R	07	11.11	05	11.90
Total		63	-	42	-
Yellowing of canopy	Canopy yellowing	06	9.52	02	4.76
	Canopy not yellowing	57	90.48	40	95.23
Total		63	-	42	-
% of bark circumference damaged	< 25	34	53.97	28	66.67
	26-50	12	19.05	09	21.43
	51-75	06	9.52	02	04.76
	>75	11	17.46	03	07.14
Total		63	-	42	-

JAGDALPUR

Chlorpyriphos (0.2%) (T_2) led to maximum recovery 77.78 per cent trees without re-infestation. The trees having stem girth of 60-100 cm were more prone to attack by CSRB. The cashew trees aged more than 15 years were more susceptible to attack of this pest.

Preferential zone of attack of re-infestations by cashew stem and root borers in the tree were collar zone (15.56%) followed by stem zone (12.22%) in re-infested trees. The pest re-infestation was maximum (15.56%) in which bark circumference damage was 25-50 per cent followed by 12.22 per cent in the trees having 25 per cent bark circumference damaged (Table 3.19 & 3.20).

Table 3.19:Efficacy of insecticides as post extraction prophylaxis(PEP) against cashew stem and root borer (CSRB) at Jagdalpur

Treatments	% of trees without re-infestation/ persistent attack
T1 : Carbaryl (1.0%)	61.11
T2 : Chlorpyriphos (0.2%)	77.78
T3 : Monocrotophos (0.2%)	55.56
T4 : Chlorpyriphos (0.1%)	50.00
T5 : Untreated check (only removal of CSRB grubs followed)	27.78

Table 3.20:Physical parameters of cashew stem and root borer (CSRB) infested trees observed under curative trials against CSRB at Jagdalpur

Physical parameters		No. of tees re-infested	Percentage of total trees treated	No. of tees not re-infested	Percentage of total trees treated
Stem girth	<60 cm	4	4.44	2	2.22
	60-100 cm	19	21.11	23	25.56
	>100 cm	17	18.89	25	27.78
	Total	**40**	**44.44**	**50**	**55.56**
Age of tree	<10 years	2	2.22	1	1.11
	10-15 years	29	32.22	20	22.22
	>15 years	27	30.00	11	12.22
	Total	**58**	**64.44**	**32**	**35.56**
Zone of attack	C	14	15.56	11	12.22
	C+R	3	3.33	6	6.67
	C+S	9	10.00	19	21.11
	R	1	1.11	2	2.22
	S	11	12.22	8	8.89
	S+R	2	2.22	1	1.11
	C+S+R	0	0.00	3	3.33
	Total	**40**	**44.44**	**50**	**55.56**
Canopy yellowing	a) Canopy yellowed	7	7.78	9	10.00
	b) Canopy not yellowed	35	38.89	39	43.33
	Total	**42**	**46.67**	**48**	**29.63**

% of bark circumference damaged	<25	11	12.22	19	21.11
	25-50	14	15.56	20	22.22
	50-75	6	6.67	11	12.22
	>75	1	1.11	8	8.89
Total	90	32	35.56	58	64.44

*Zone of attack:

a) C+R - Collar + Root, b) C+S - Collar + Stem

b) C+R+S - Collar+Root+Stem d) S - Only Stem

e) R - Only Root

MADAKKATHARA

Among the insecticides evaluated, chlorpyriphos (0.2%) resulted in 100% of trees without re- infestation, after treatment. This was followed by chlorpyriphos (0.1%) showing 90% trees without re-infestation. Percentage trees without re- infestation was least (75.0%) with control (with grub extraction only) after treatment (Table 3.21 & 3.22).

Table 3.21: Efficacy of different insecticides as post extraction prophylaxis (PEP) against CSRB at Madakkathara

Treatments		Percentage trees without re-infestation/ persistent attack
T-1	Carbaryl (1%)	85%
T-2	Chlorpyriphos (0.2%)	100%
T-3	Monocrotophos (0.2%)	80%
T-4	Lindane (0.2%)	90%
T-5	Untreated check (grub-extraction only)	75%
T-6	Maximum prophylactic control (neem oil 5% swabbing + 75 g Sevidol 8% tree)	81.25%

Table 3.22:Physical parameters of cashew stem and root borer (CSRB) infested trees observed under curative trials against CSRB at Madakkathara

Physical parameters		No. of trees each category	
		Without re-infestation	With re-infestation
Stem girth (cm)	<60	23	2
	60 - 80	17	-
	80 – 100	36	3
	>100	28	4
Total		104	9

In yrs	< 5		
	5 -10	22	4
	10 -15	53	10
	>15	20	4
Total		95	18
% of bark circumferences damaged	< 25	23	
	25 – 50	29	5
	50 – 75	35	5
	>75	14	2
Total		101	12
Zone of attack	C + R	5	
	C + S	19	4
	R	4	1
	S	35	7
	C + R + S	33	5
Total		96	17
Canopy yellowing	Yellowed	12	2
	Not yellowed	86	13
Total		98	16

VENGURLA

Chlorpyriphos (0.2%) treatment led to 93.33 per cent trees without reinfestation followed by Chlorpyriphos (0.1%) (86.66 per cent) trees without reinfestation. Trees without reinfestation was least in control (T_6) (33.33 %) wherein, only removal of CSRB grubs was done (Table 3.23 & 3.24).

Table 3.23: Efficacy of different insecticides as post extraction prophylaxis (PEP) against CSRB at Vengurla

Treatments	% trees without reinfestation
T1 - Carbaryl (1%)	66.66
T2 - Chloropyriphos (0.2%)	93.33
T3 - Monocrotophos (0.2%)	46.66
T4 - Chloropyriphos (0.1%)	86.66
T5 - Effective treatment in prophylactic trail (Swabbing neem oil 5% during Oct.- Nov., Jan. – Feb. and April - May)	60.00
T6- Control (grub extraction only)	33.33

Table 3.24:Physical parameters of cashew stem and root borer (CSRB) infested trees observed under curative trials against CSRB at Vengurla

Physical parameters		No. of trees reinfested	Percentage of total trees treated	No. of trees not reinfested	Percentage of total trees treated
Stem girth (cm)	< 60	-	-	-	-
	60 -80	14	15.56	26	28.88
	80 -100	10	11.11	15	16.67
	> 100	8	8.89	17	18.89
Total		**32**	**35.56**	**58**	**64.44**
Zone of attack	C+R	6	6.67	15	16.67
	C+S	5	5.56	6	6.67
	R	10	11.11	12	13.33
	S	4	4.44	13	14.44
	C+R+S	7	7.78	12	13.33
Total		**32**	**35.56**	**58**	**64.44**
Bark circumference damaged	< 25	5	5.56	21	23.33
	25 -50	10	11.11	15	16.67
	50 -75	9	10.00	10	11.11
	> 75	8	8.89	12	13.33
	Total	**32**	**35.56**	**58**	**64.44**

VRIDHACHALAM

Maximum recovery of 42.30% was observed in chlorpyriphos (0.2%) treated trees, which was on par with monocrotophos (0.2%) treated trees with 41.66% recovery. Treatments with carbaryl (1.0%), lindane (0.2%) and neem oil (5.0%) lead to 39.1, 30.0 and 35.0% recovery respectively as against the least recovery of 5.50% in untreated control (Table 3.25).

Table 3.25:Efficacy of different insecticides as post extraction prophylaxis (PEP) against CSRB at Vridhachalam

Treatments		No. of trees treated	No. of trees without reinfestation	Mean % recovery of trees from CSRB	Frequency of treatment	Cost of treatment/ tree
T1	Carbaryl (1%)	23	09	39.13_{b}	3	55.0
T2	Chlorpyriphos (0.2%)	26	11	42.30_{a}	3	58.0
T3	Monocrotophos (0.2%)	24	10	41.66_{a}	3	55.0
T4	Lindane (0.2%)	20	06	30.00_{d}	3	56.0
T5	Untreated check (removal of grubs)	18	01	05.55_{e}	3	30.0
T6	Treated check (Neem oil 5%)	20	07	35.00_{c}	3	60.0
	Total	**131**	**44**	**-**	**-**	**-**

Chlorpyriphos and monocrotophos were at par in reducing the CSRB infestation, with an average treatment cost of Rs.58/= and Rs.55/= respectively.

The extent of re-infestation/recovery was influenced by various physical parameters of trees, and 63.9% of trees which recovered had less than 25% damaged bark circumference, while trees with 26-50% bark damage recorded a low recovery of 13.9%. Trees having more than 75% bark damage with yellowing of canopy did not recover in spite of pesticidal treatment (Table 3.26).

Table 3.26:Physical parameters of cashew stem and root borer (CSRB) infested trees observed under curative trials against CSRB at Vridhachalam

Physical parameters		Total no. of trees treated	No. of trees reinfested	% of trees reinfested	No. of trees not reinfested	% of trees not reinfested
Stem girth (cm)	< 60	27	08	29.6	19	70.4
	60-80	32	20	62.5	12	37.5
	80-100	33	27	81.8	06	18.2
	> 100	39	32	82.0	07	18.0
	Total	**131**	**87**	**-**	**44**	**-**
Age of the tree (years)	< 5	27	05	18.5	22	81.5
	5- 10	30	17	56.6	13	43.4
	10-15	36	30	83.3	06	16.7
	> 15	38	35	92.1	03	07.9
	Total	**131**	**87**	**-**	**44**	**-**
Zone of attack	C+R	26	20	76.9	06	23.1
	C+S	32	08	25.0	24	75.0
	R	23	20	86.9	03	13.1
	S	23	16	69.5	07	20.5
	C+S+R	27	23	85.2	04	14.8
	Total	**131**	**87**	**-**	**44**	**-**
Yellowing of canopy	Canopy yellowed	42	42	100.0	0.0	0.0
	Canopy not yellowed	89	45	50.5	44	49.5
	Total	**131**	**87**	**-**	**44**	**-**
% of bark circumference damaged	< 25	61	22	36.1	39	63.9
	26-50	36	31	86.1	05	13.9
	51-75	23	23	100.0	00	0.0
	>75	11	11	100.0	00	0.0
	Total	**131**	**87**	**-**	**44**	**-**

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 :
Chintamani and Jagdalpur

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

SUMMARY:

At Bapatla, maximum and minimum temperature, relative humidity and rainfall accounted for 56% of variation in percent shoot damage by leaf and blossom webber. The relative humidity had significant negative correlation (-0.678) with incidence of the Inflorescence thrips at Bhubaneswar. The TMB damage on shoot at Jagdalpur was negatively influenced by RH and wind velocity negatively influenced (r = - 0.519 and -0.305, respectively). At Madakkathara, significant negative correlation between TMB infestation and maximum temperature (-0.720) was recorded. The infestation of thrips show positive relationship with maximum temperature (r = 0.346) and negative significant correlation with rainfall (r = -0.608) at Vengurla.

BAPATLA

All five weather variables such as max.temp (x1), min.temp. (x2), relative humidity (m) (x3), relative humidity (e) (x4) and rainfall (x5) accounted for 56% of variation in percent shoot damage by leaf and blossom webber (r = 0.5660).

With regard to apple and nut borer (ANB) all five variables accounted for 42% of variation in percent nut damage by ANB. Minimum temperature was found to exert significant negative effect on percent nut damage (r = -1.2204). Relative Humidity (e) was found to exert significant positive effect on percent nut damage (r=1.542).

All five independent variables accounted for 20 per cent of total variation in percent leaf damage by leaf miner (r =0.2074). None of the variables exerted any effect on the incidence of leaf miner.

Maximum temperature was found to exert significant negative effect on percent shoot damage (r = 0.4153). Rainfall influenced inflorescence thrips population negatively (r = 0.1132) when all other variables tested are at their mean level (Table 3.27).

Table 3.27: Influence of abiotic factors on the activity of pest complex of cashew at Bapatla

Variable	Leaf and blossom webber	Apple and nut borer	Leaf miner	Shoot tip caterpillar	Inflorsence thrips
X1-Maximum Temp	0.09829	0.82399	-0.41539	-0.66482	-0.64161
X2-Minimum Temp	0.03041	-1.22045	-0.11293	-0.19819	-0.33483
X3-RH (m)	0.00513	-0.15421	0.00502	0.01759	-0.11337
X4-RH (e)	-0.02252	0.29451	0.14851	-0.01395	0.17368
X5-Rain fall	0.00958	-0.08742	0.04301	-0.01451	-0.11320

BHUBANESWAR

Hours of bright sunshine had positive significant correlation with the incidence of the shoot tip caterpillar (*Hypatima haligramma*). Minimum temperature and RH had significant negative correlation with incidence of the Inflorescence thrips. Both temperature and rainfall had negative correlation with leaf miner incidence. Maximum temperature had positive significant correlation with the apple and nut borer incidence.

Maximum temperature and RH had positive significant correlation with the incidence of the leaf and blossom webber infestation. Rainfall and RH had positive correlation and bright sunshine hour had negative significant correlation towards incidence of the leaf beetle.

The activity of the cashew stem and root borer was observed throughout the year but its activity was negligible during December and January. Maximum temperature had positive significant correlation with the incidence of the pest.

Study on field parasitation of major pests of cashew indicated that maximum parasitisation of shoot tip caterpillar (1.5%) by *Elasmus* sp. leaf and blossom webber (1.0 %) by *Bracon brevicornis* and leaf miner (2.5 %) by *Sympiesis* sp. were observed.

The different predators present in cashew ecosystem were spiders (*Argeopes* sp., *Oxyopes* sp.), ladybird beetle (*Vigna cinta, Menochilus sexmaculata*) and pollinator, black ant (*Camponotus* sp.) (Table 3.28).

Table 3.28: Influence of abiotic factors on the activity of pest complex of cashew at Bhubaneswar

Pest Complex	Temperatures		RH		Rainfall in (mm)	BSH (%)
	Maximum	Minimum	Maximum	Minimum		
	X_1	X_2	X_3	X_4	X_5	X_6
STC (Y_1)	-0.123	-0.054	-0.029	-0.032	-0.239	0.343
YT (Y_2)	0.455	-0.269	-0.349	-0.722	-0627	0.555
BT (Y_3)	0533	-0.173	-0.313	-0.678	-0.570	0.534
LM (Y_4)	-0.174	0.060	0.118	0.152	-0.069	0.152
A & NB (Y_5)	0.755	0.202	-0.200	-0.447	-0.357	0.505
L&BW (Y_6)	0.625	0.476	0.158	0.002	0.009	0.210
LB (Y_7)	-0.009	0.596	0.642	0.795	0.908	-0.734
CSRB (Y_8)	0.730	0609	-0.069	0.083	0.049	0.090

* = 'r' at 5 % level of significance

STC: Shoot tip caterpillar, YT: Yellow thrips BT: Black thrips
LM: Leaf miner A & NB: Apple and nut borer CSRB: Cashew stem and root borer
LBW: Leaf and blossom webber LB: Leaf beetle

CHINTAMANI

The correlation between the TMB incidence and weather parameters revealed that maximum temperature (0.237) and sunshine hours (0.514) had a positive relation with the activity of the pest, but negative correlation was established with morning and evening relative humidity (-0.325 & -0.400) and rainfall (-0.367). Maximum temperature had positive correlation (0.719) with the incidence of the CSRB.

Mealy bug had negative correlation with minimum temperature (-0.774), evening relative humidity (-0.487) and rainfall (-0.482). Apple and nut borer had negative correlation with evening relative humidity (-0.583) and rainfall (-0.586). Leaf minor showed the positive correlation with morning and evening relative humidity (0.483 and 0.177) and sunshine hours (0.300) but negative correlation with maximum and minimum temperature (-0.032 and -0.660) and rainfall (-0.379).

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 (0.003) and morning relative humidity (0.903) and sunshine hours (0.378) (Table 3.29).

Table 3.29: Correlation between the pest incidence and weather parameters at Chintamani

Weather parameters	Correlation coefficients (r) for pests					
	TMB	CSRB	MB	ANB	LM	Thrips
Max. Temp. ^{0}c	0.237	0.719	0.040	0.021	-0.032	0.003
Min. Temp. ^{0}c	-0.172	0.492	-0.774*	0.862*	-0.660*	-0.300*
RH (Morning) (%)	-0.325	-0.430	0.254	0.227	0.483	0.903
RH (Evening) (%)	-0.400	-0.283	-0.487	-0.583*	0.177	-0.367
Rainfall (mm)	-0.367	-0.339	-0.482	-0.586*	-0.379	-0.380
Bright Sunshine hours	0.514	0.432	0.549*	0.628*	0.300	0.378*

TMB-Tea Mosquito Bug; CSRB-Cashew Stem and Root Borer; MB-Mealy Bug
ANB: Apple and Nut Borer; LM-Leaf Miner
* Significant at 0.05 level

JAGDALPUR

RH (morning) and wind velocity (kmph) negatively influenced (r= -0.519 and -0.305, respectively) TMB damage on shoot. Bright sunshine was significantly positively influenced (r= 0.307) the activity of TMB on shoot. Relative humidity (evening) negatively influenced (r= -0.407) the TMB damage on panicle.

Cashew stem and root borer infestation was observed round the year with infestation ranged from 1.80 to 19.13 per cent. No any meteorological factors had any influence on the infestation of CSRB. None of the weather parameters influenced the incidence of the leaf caterpillar, leaf folder and leaf miner (Table 3.30).

Table 3.30:Influence of abiotic factors on the activity of pest complex of cashew of regional importance at Jagdalpur

Pest Complex	Correlation coefficient values (r) of pests of regional importance						
	Max. Temp °C	Min. Temp °C	Rainfall mms	Relative humidity		Wind vel. kmph	Bright sunshine hours
				I	II		
Shoot TMB	-0.139	-0.519**	-0.193	-0.013	-0.091	-0.305*	0.307*
Panicle TMB	0.554**	-0.091	-0.090	-0.002	-0.407**	0.078	0.362**
Nut TMB	0.393**	0.067	-0.077	-0.040	-0.262	0.085	0.105
Panicle Thrips	0.424**	0.133	-0.088	-0.144	-0.364**	0.116	0.082
Nut thrips	0.458**	0.133	-0.092	-0.116	-0.420**	0.156	0.213
Leaf caterpillar	-0.092	-0.248	-0.064	-0.034	-0.037	-0.174	0.219
Leaf folder	0.218	0.135	-0.110	-0.182	-0.203	0.042	0.151
Leaf miner	0.003	-0.033	0.032	0.044	-0.090	-0.153	0.102
CSRB	-0.092	0.021	-0.094	0.043	0.131	0.100	-0.210
Myllocerus Weevil	-0.349*	0.191	0.082	0.170	0.450**	-0.106	-0.290*

*Value of 'r' significant at 5% level. **Value of 'r' significant at 5% level.

MADAKKATHARA

The incidence of leaf miner showed two peaks of population build up during May - June and September – December. Highest incidence of leaf miner was generally noticed in the months of October to November coinciding with the flushing.

Correlation analysis showed negative (-ve) significant correlations between TMB infestations with maximum temperature (max.temp) (-0.720), minimum temperature (min.temp) (-0.470), bright sunshine (BSS) (-0.760) hours and wind speed (-0.666).

PARIA

The correlation indicated that TMB was significantly negatively correlated with weather parameters viz. maximum temperature, minimum temperature and evaporation rate, whereas thrips was significantly negatively correlated with maximum temperature and minimum temperature.

The infestation of LBW and LM were significantly negatively correlated with maximum temperature, minimum temperature, sunshine hours and evaporation rate. The infestation of ANB was negatively correlated with rainy days only (Table 3.31).

Table 3.31: Influence of abiotic factors on the activity of pest complex of cashew at Paria

	TMB	Thrips	LBW	LM	ANB
Max-temp.	-.72279**	-.45948**	-.69253**	-.49028**	-.22299
Min-temp.	-.82907**	-.65015**	-.85529**	-.72936**	-.30663
RH%	.11788	-.03944	.25669	.02903	.00078
Rain fall	-.24380	.01690	-.45377**	-.40932**	.18924
Rainy days	-.19022	-.24977	-.34023	-.02789	-.28519
Evopo.	-.15053	-.16037	-.31722	.03151	-.36730**
Hrs. of bright sunshine	-.60640**	-.33662	-.69881**	-.81401**	.23598

Critical Value (1 tail) : ± .31766 Critical Value (2 tail) : ± .37315

VENGURLA

The TMB infestation showed positive correlation with maximum temperature (r=0.257) and negative significant correlation with minimum temperature (r=-0.949), rainfall (r=-0.591) & no of rainy days (r=-0.678) & negative correlation with evening humidity (r=-0.774). The infestation of thrips show positive relationship with maximum temperature (r=0.346) and negative significant correlation with minimum temperature (r=-0.916) and rainfall (r=-0.608).

The leaf miner showed positive significant correlation with maximum temperature (r=0.632) negative correlation with rainfall (r=-0.368). The incidence of apple & borer showed negative significant correlation with rainfall (r=-0.452) (Table 3.32).

Table 3.32: Influence of abiotic factors on the activity of pest complex of cashew at Vengurla

	TMB	Thrips	Leaf miner	Apple & Nut Borer
Maximum Temperature	0.257	0.346	0.632*	0.043
Minimum Temperature	-0.949**	-0.916**	-0.168	-0.775
Morning Humidity	-0.145	-0.236	0.138	-0.281
Evening Humidity	-0.774	-0.784**	-0.285	-0.586*
Rain fall	-0.591*	-0.608*	-0.368	-0.452
Rainy days	-0.678*	-0.691**	-0.296	-0.522

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

VRIDHACHALAM

Simple correction studies with regard to TMB revealed that maximum temperature, relative humidity and sunshine had a positive relation with the activity of *H. antonii,* but negative correlation was established with rainfall. Aphid population had positive correlation with relative humidity and minimum temperature. Similarly, blossom webber, leaf miner, leaf roller and shoot tip caterpillar have negative correlation with maximum temperature (Table 3.33).

Table 3.33: Influence of abiotic factors on the activity of pest complex at Vridhachalam

Insect-pests	Temperature		Relative Humidity		Rainfall	Rainy days	Sunshine hours
	Max	Min	AM	PM			
Tea mosquito bug (population) (Y_1)	0.50*	0.23	0.26	*0.23	-0.28	0.39	*0.33
Leaf and blossom webber (Y_2)	0.58*	0.38	-0.30*	-0.26	-0.23	-0.24	0.43
Apple and nut borer (Y_3)	0.50	0.39	0.33	-0.26	-0.20	-0.32	0.28
Leaf miner (Y_4)	0.23	0.28	0.32	0.38	0.49	0.36*	-0.32
Leaf roller (Y_5)	-0.49*	-0.33	-0.36*	-0.24	-0.30	-0.33	0.36
Shoot tip caterpillar (Y_6)	-0.26	0.26	0.38	0.34	0.46	0.42	-0.48
Aphids (Y_7)	-0.28	0.28*	0.36*	0.46*	0.43	0.45*	-0.43
Cashew stem and root borer (Y_8)	0.54*	0.45	-0.23	-0.37	-0.40	-0.38	0.46

* = Significant at 0.05 level

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 :
Chintamani, 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. Hy 95-T4 recorded the lowest incidence (1.14%) of leaf and blossom webber and BLA-139-1 recorded the lowest incidence (2.00%). At Jagdalpur, the TMB damage was not observed in entries CARS-7, CARS-17 and CARS -18 . The variety K-22-1 was found to be free from leaf caterpillar incidence during 2009 – 10 and 2010-11 at Madakkathara. All the MLT entries and hybrids evalauted at Vridachalam were prone to TMB infestation in varying degree of susceptibility with damage score of 1.00 to 3.30.

BAPATLA

During 2011-2012 among the 41 accessions screened to identify the tolerant lines against the pests of cashew, T.No.3/7 has recorded highest incidence of leaf and blossom webber (14.7%) and T.No. Hy 95-T4 recorded the lowest incidence (1.14%). The accession T.No.17/5 has recorded the highest incidence of leaf miner (28.85%) and BLA-139-1 recorded with the lowest incidence (2.00%).

With regard to the incidence of leaf folder, the T.No. Hy 94-T3 has recorded with the highest incidence (11.50%) and Hy 95-T4 has recorded low incidence (0.00). The accession T.No. M 15/4 has recorded the highest incidence of shoot tip caterpillar (19.57%) and T.No.6/14 recorded the lowest incidence (0.85%). The accession line T.No.4/5 has recorded highest incidence of apple and nut borer (47.60%) and T.No.Hy 95-T4 has recorded the lowest incidence (0.00) (Table 3.34).

Table 3.34:Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Bapatla

Germplasm evaluated	I. C. No.	Leaf and blossom webber damaged shoots (%)	Leaf miner damaged leaves (%)	Leaf folder damaged leaves (%)	Shoot tip caterpillar damaged shoots (%)	Apple and nut borer damaged nuts (%)
Priyanka	250140	5.9	9.9	7.92	2.97	13.3
T.No.129	249784	4.0	3.0	6.06	4.04	8.0
T.No.275	249982	7.3	4.6	8.26	4.59	0.0
T.No.274	302488	4.2	8.47	0.0	5.93	9.1
T.No.12/1	—	3.9	7.77	1.9	9.71	10.0
T.No.12/8	—	2.3	6.90	10.3	5.75	35.7
T.No.18/3	—	14.6	12.50	4.2	6.25	25.0
ABT-3	302391	5.3	4.42	5.3	11.50	12.0
ABT-2	302390	6.7	4.20	3.4	1.68	25.0
T.No.3/7	—	14.7	4.41	10.3	4.41	22.2

T.No.3/4	—	10.91	7.27	3.6	5.45	13.3
T.No.1/1	—	10.00	6.45	10.0	5.20	6.3
T.No.8/7	302437	8.08	4.04	0.0	2.02	0.0
T.No.4/3	302442	4.35	3.48	4.3	6.96	7.1
T.No.4/5	—	5.94	3.96	5.0	5.94	46.7
T.No.30/1	302368	6.06	3.79	3.0	2.27	30.0
T.No.228	302376	5.00	5.00	1.7	5.83	13.3
T.No.233	302374	6.61	4.13	4.1	9.09	27.8
T.No.244	302379	6.61	13.22	4.1	4.96	6.3
T.No.268	302381	10.43	2.61	1.74	4.35	20.8
M 15/4		6.52	3.26	4.35	19.57	22.7
BLA 139-1	—	8.00	2.00	4.00	10.00	30.8
T.No.17/5	—	5.77	28.85	1.92	1.92	26.7
BLA 39/4	—	4.35	6.96	5.22	9.57	20.0
T.No.5/1	250025	1.69	5.93	4.24	0.85	33.3
T.No.2/3	302435	6.00	23.00	5.00	16.00	19.4
T.No.10/2	249911	7.27	24.55	1.82	8.18	4.2
T.No.7/12	302434	7.48	12.15	1.87	2.80	0.0
T.No.71	302370	4.67	6.54	5.61	10.28	22.2
T.No.277	302384	7.83	8.70	1.74	10.43	20.0
T.No.2/14	302446	6.40	4.00	0.80	2.40	13.6
T.No.12/6	—	4.84	8.87	0.81	6.45	12.5
Ch.gudem	302409	10.53	27.19	8.77	4.39	5.9
ASRPT	—	7.08	4.42	3.54	2.65	12.5
T.No.40/1	—	5.15	22.68	8.25	3.09	10.0
T.No.6/14	302432	7.69	11.11	5.98	0.85	20.8
Hy 94-T3	—	7.96	15.04	11.50	0.88	11.1
T.No.2/5	302387	4.85	17.48	5.83	3.88	8.7
Hy 94-T4		2.08	18.75	6.25	3.13	10.0
Hy 95-T4		1.14	12.50	0.00	9.09	0.0
Vetapalem		9.00	14.00	5.00	3.00	33.3

BHUBANESWAR

All the accessions were infested by both shoot tip borer (0-5%) and leaf and blossom webber (0-5 %). Inflorescence thrips (yellow thrips and black thrips) population was with a range of 0-10 numbers/ inflorescence (Table 3.25).

Table 3.35:Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Bhubaneswar

Pest	Germplasm	Min. occurrence	Germplasm	Max. Occurrence
STC	OC8, OC10, OC75, OC83, OC65, OC148	0.5 to 1.5%	OC22, OC67, OC70, OC73, OC74, OC80, OC56, OC147	>02 to 5%
IT	OC4, OC10, OC40, OC39, OC12, OC41, OC12, OC58, OC64, OC92	0.5 to 5 No. / panicle	OC29, OC44, OC22, OC65, OC68, OC72, OC78	> 5 to 10 No /panicle
LBW	OC5, OC22, OC9, OC28, OC29, OC46, OC92	0.5 to2.0%	OC58, OC61, OC79, OC81, OC82, OC49, OC108	> 2 to 5 %

CHINTAMANI

The reactions of germplasm/entries (MLT-1992 and MLT-2002) maintained at the centre were observed against TMB. However, none of the yielding germplasm accessions/entries have shown resistant reactions to TMB infestation.

JAGDALPUR

Twelve released varieties and eleven locally collected germplasm were screened against tea mosquito bug incidence, incidence of panicle thrips and mean number of myllocerus beetle. It was observed that the TMB damage was not observed in entries CARS-7, CARS-17 and CARS -18.

The population of myllocerus beetle was not recorded in majority of entries. The inflorescence thrips population was minimum in majority of entries (Table 3.36).

Table 3.36: Screening of cashew germplasm to locate tolerance / resistance to major pests of the region at Jagdalpur.

Accession No.	TMB mean damage score 0-4 scale in 52 leader shoots			Mean No. Myllocerus (beetle in per 52 Shoot)	Inflorescence thrips (mean No. per 52 panicle)
	Shoot	Panicle	Nut		
NRCC SEL-1	0.23	1.04	0.16	0.13	0.25
NRCC SEL -2	0.00	0.00	0.00	0.00	0.13
V-1	0.75	0.00	0.00	0.00	0.75
V-4	0.92	0.00	0.00	0.00	0.13
MDK-2	0.81	0.52	0.00	0.25	0.00
MDK-1	0.26	0.16	0.00	0.13	0.13
K-22	0.33	0.76	0.00	0.00	0.63
Ullal-1	0.00	0.50	0.00	0.38	0.00
Ullal-2	0.78	0.60	0.00	0.00	0.00
VRI-1	0.11	0.64	0.83	0.00	0.00
VRI-2	0.00	0.10	0.00	0.00	0.00
HY-1591	0.00	0.55	0.00	0.00	0.25
CARS-3	0.43	0.00	0.00	0.00	0.00
CARS- 4	0.43	0.00	0.00	0.00	0.00
CARS- 5	0.08	0.00	0.00	0.00	0.00
CARS-6	0.17	0.00	0.00	0.00	0.00
CARS-7	0.00	0.00	0.00	0.00	0.00
CARS-8	0.11	0.00	0.00	0.00	0.00
CARS -9	0.00	0.00	0.00	0.00	0.00
CARS -10	0.08	0.00	0.00	0.00	0.00
CARS -11	0.08	0.00	0.00	0.00	0.00
CARS -17	0.00	0.00	0.00	0.00	0.00
CARS -18	0.00	0.00	0.00	0.00	0.00

MADAKKATHARA

TMB damage score varied from zero (Mannar and Kottukkal) to maximum 0.97 in Kunjithai. The absence of TMB damage/ infestation in accessions viz., Mannar and Kottukkal is promising and should be ascertained in coming years. The leaf miner infestation was moderate to severe throughout the season (Sept- Dec) coinciding the bud break and flushing. The mean percentage infestation (April – March) varied between 0.029 (minimum in K-5) to 16.443 (maximum in ARL-2). Shoot webber incidence per tree recorded were nil in almost all accessions, except in K-1 and Mannar (0.05) and Pathannur (0.2). Leaf caterpillar incidence was absent in all the varieties (Table 3.37).

Table 3.37: Screening of cashew accessions to locate tolerant / resistant types to major insect pests of the region at Madakkathara

Accession	TMB damage score / 20 shoots	Shoot webber/ tree	Leaf miner	Leaf caterpillar
K-1	0.005	0.050	11.86	0.000
K-3	0.039	0.000	15.889	0.000
K-5	0.001	0.000	0.029	0.000
Mannar	0.000	0.050	10.288	0.000
Kainoor	0.0116	0.000	6.666	0.000
Ummannoor	0.007	0.000	5.668	0.000
Kottukkal	0.000	0.000	7.500	0.000
Peechi	0.011	0.000	4.477	0.000
Kunjithai	0.097	0.000	9.805	0.000
Pathannur	0.039	0.200	11.666	0.000
ARL-1	0.240	0.000	9.53	0.000
K-2	0.015	0.000	3.132	0.000
ARL-2	0.042	0.000	16.443	0.000
ODR	0.029	0.000	0.000	0.000

TMB damage score varied from 0.190 (Raghav) to maximum 0.722 in Ullal-3. The leaf miner infestation was moderate to severe throughout the season (Sept-Dec) coinciding the bud break and flushing. Mean percentage infestation (April- Mar) varied between 0.087 (minimum in Vridhachalam) to 21.396 (maximum in Akshaya). Shoot webber incidence per tree recorded were within the range of 0.017 to 2.048. Leaf caterpillar incidence was absent in most of the varieties except in Anagha, Sulabha, Amrutha, Poornima (0.017) and V -6 (0.050). The variety K-22-1 was found to be free from leaf caterpillar incidence during 2009 – 10 and 2010-11 (Table 3.38).

Table 3.38:Screening of cashew varieties to locate tolerant / resistant types to major insect pests of the region at Madakkathara

Variety	TMB damage score / 20 shoots	Shoot webber/ tree	Leaf miner	Leaf caterpillar
Goa -1	0.666	0.104	5.493	0.00
UN-50	0.667	0.134	3.040	0.00
Ullal-4	0.543	0.000	4.634	0.00
Ullal-3	0.722	2.048	6.554	0.00
Ullal-1	0.710	0.080	3.164	0.00
NRCC Sel - 2	0.503	0.050	7.900	0.00
V-6	0.566	0.017	8.989	0.05
V-4	0.672	0.033	8.073	0.00
V-1	0.664	0.050	9.509	0.00
Jhargram	0.503	0.017	5.383	0.00
Chinthamani	0.432	0.000	5.590	0.00
BPP-4	0.613	0.050	10.931	0.00
Akshaya	0.260	0.033	21.396	0.00

Anagha	0.269	0.000	5.881	0.017
Damodar	0.215	0.067	9.531	0.00
Raghav	0.190	0.035	5.588	0.00
Dharasree	0.247	0.083	6.847	0.00
Sulabha	0.409	0.033	5.750	0.017
Anakkayam-1	0.448	0.067	8.641	0.00
Priyanka	0.210	0.033	6.469	0.00
Dhana	0.267	0.167	4.694	0.00
Amrutha	0.286	0.104	3.207	0.017
Vridhachalam-3	0.243	0.000	0.087	0.00
K-22-1	0.589	0.017	7.570	0.00
MDK-2	0.629	0.000	3.182	0.00
Kanaka	0.433	0.033	12.181	0.00
MDK-1	0.437	0.000	2.546	0.00
Poornima	0.411	0.050	4.375	0.017

VENGURLA

The variety V-5 recorded lowest TMB infestation (2.14%) followed by V-4 (2.30%) whereas the maximum per cent damage was recorded in 3/33 (4.61%) followed by 15/4 (4.41%) (Table 3.39).

Table 3.39:Screening of cashew varieties to locate tolerant / resistant types to major insect pests of the region at Vengurla

Varieties	TMB (%)	Varieties	TMB (%)
V - 1	3.60	Hy-303	2.57
V - 2	2.85	M- 44/3	3.22
V - 3	2.73	30/1	3.44
V - 4	2.30	10/19	3.02
V - 5	2.14	3/28	3.24
V - 6	3.27	NRCC Sel.- 1	2.35
V - 7	2.74	NRCC Sel.- 2	2.69
V - 8	3.27	3/33	4.61
H – 320	3.53	15/4	4.41

VRIDHACHALAM

The reaction of different accessions indicated that all the MLT entries and hybrids are prone to TMB infestation in varying degree of susceptibility. The damage score for TMB infestations in various MLT entries ranged from 1.0-3.3 . The score was low in ME 20/1 with mean damage score of 1.0. In other cashew entries, the mean damage score ranged between 1.8 and 3.3. So, none of the cashew entries have shown immune or resistant reactions to TMB infestation under field condition (Table 3.40).

Table 3.40:Screening of cashew varieties to locate tolerant / resistant types to major insect pests of the region at Vridhachalam

MLT entries	TMB mean damage score	Leaf & blossom webber % shoot damaged / 52 leader shoots	Leaf roller (% of rolled leaves) on five laterals	Leaf miner (% of mined leaves) on five laterals	Inflorescence caterpillars (% of damaged panicle out of 52 panicles)
H 1598	2.4	2.8	1.2	1.2	0.0
H 1600	2.0	3.2	1.3	1.0	0.0
H 1608	2.3	3.0	2.0	1.3	0.0
H 1610	2.5	3.2	1.3	2.0	0.0
H 129	2.8	3.3	3.0	2.0	0.0
H 40	3.3	1.8	2.0	2.6	0.0
H 2/15	2.8	3.0	1.3	1.0	0.0
H 2/16	3.3	2.3	2.0	2.0	0.0
H 33/3	1.8	2.8	1.2	2.8	0.0
H 44/3	2.0	2.3	1.3	1.3	0.0
M 26/2	2.6	3.0	1.0	3.3	0.0
ME 20/1	1.0	2.2	1.0	1.3	0.0
VTH 30/4	2.8	3.0	2.2	1.3	0.0
VTH 59/2	3.0	3.0	0.0	1.0	0.0
V 2	2.8	2.3	1.0	1.0	0.0
V 3	3.0	2.3	1.0	3.0	0.0
V 4	3.0	2.8	1.0	2.3	0.0
V 5	1.8	3.0	2.3	2.6	0.0

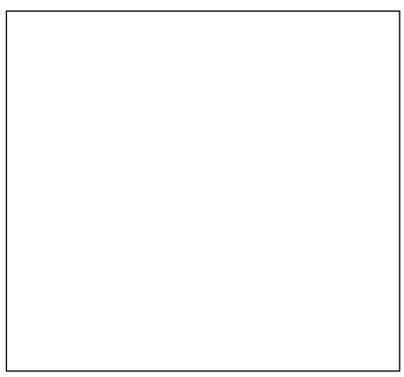
In the case of F_1 hybrids, all the cross combinations were susceptible to TMB infestation. However, the damage score was low (2.0) in H 10, H14 and H 16 followed by H 13 and H17 with a mean damage score of 2.2 and 2.3 respectively (Table 3.41).

Table 3.41: Screening of F1 hybrids for tolerance to cashew pests at Vridhachalam

Hybrid Number	Cross combination	TMB mean damage score	Leaf & blossom webber % shoot damaged / 52 leader shoots	Leaf roller (% of rolled leaves) on five laterals	Leaf miner (% of mined leaves) on five laterals	Apple & Nut borer (% of apples damaged /52 panicles)
H 10	M 10/4 x M 26/1	2.0	3.0	2.3	1.6	0.0
H 11	M 10/4 x M 45/4	2.6	3.6	3.0	1.3	0.0
H 12	M 10/4 x M 75/3	2.5	3.6	2.6	0.0	0.0
H 13	M 26/2 x M 26/1	2.2	3.3	2.3	1.0	0.0
H 14	M 26/2 x M 45/4	2.0	4.8	2.6	1.0	0.0
H 15	M 26/2 x M 75/3	2.3	4.6	2.6	1.8	0.0
H 16	M 44/3 x M 26/1	2.0	4.8	2.3	2.3	0.0
H 17	M 44/3 x M 45/1	2.3	4.6	2.6	2.0	0.0

However, none of the cashew entries have shown immune or resistant reaction to TMB and other foliar feeding insects.

CHAPTER II : ORGANISATION



1. HISTORY, OBJECTIVES, GROWTH AND SALIENT ACHIEVEMENTS

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

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

1. All India Coordinated Cashew Improvement Project and

2. All India Coordinated Spices Improvement Project.

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

The first Workshop of All India Coordinated Spices and Cashew nut Improvement Project was held at Kasaragod in October 1971 in which the research programmes were drawn up, identifying the problems and fixing the priorities. Subsequently, the progress of work was reviewed and research programmes modified/added as per the need in the Workshops held in Trivandrum, Kerala (1972); Coimbatore, Tamil Nadu (1975); Panjim, Goa (1978); Trissur, Kerala (1981); Calicut, Kerala (1983); Trivandrum, Kerala (1985); Bhubaneswar, Orissa (1987); Coimbatore, Tamil Nadu (1989); Bangalore, Karnataka (1993); Kasaragod, Kerala (1995) and Dapoli, Maharashtra (1997); Bhubaneswar, Orissa (1999); and Puttur, Karnataka (2001), National Group discussion in lieu of X Biennial Workshop was held at Kasaragod, Kerala (1991). As per the ICAR directives National Group Meetings are to be organized in place of Workshops. Accordingly, the National Group Meeting of Scientists of AICRP on Cashew was held in NRCC, Puttur, Karnataka during 2004 and in Kerala Agricultural University, Vellanikkara, Thrissur, Kerala in 2005, in ICAR Research Complex for Goa, Goa in 2007 and in Tamil Nadu Agricultural University, Coimbatore in 2009. The National Group Meeting of Scientists of AICRP-Cashew was held at Directorate of Cashew Research during December 2011 in continuation of the Silver Jubilee Celebrations of this Directorate.

Two group discussions were also held, one in horticulture at CPCRI, Regional Station, Vittal (1986) and another in entomology at Trichur (1988). One group discussion was held at Cashew Research Station, Madakkathara to discuss about high density planting with different levels of fertilizer and pruning in cashew plantation and soil fertility based fertilizer recommendations during the year 2000.

ACHIEVEMENTS :

Significant Achievements of AICRP on Cashew (in brief) since inception :

- Since its inception, a total of 29 high yielding cashew varieties have been developed and released to the farmers by different centres of AICRP Cashew.
- Collected local germplasm materials with desirable characters such as high yield, cluster bearing habit, bold sized nuts, short duration of flowering, off season flowering types from different cashew growing regions and are being vegetatively multiplied and field planted in different centres. Number of cashew accessions so far collected and conserved by the Coordinating Centres in Regional Cashew Field Gene Bank comes to 1225.
- At Bhubaneswar, 47 accessions had bold nut character with a nut weight ranging from 7.00g to 15.00 g (OC-128), 81 accessions had shelling percentage ranging from 28.00 to 38.50 (OC-110). At Jagdalpur, the accession NRC-131 had a high shelling percentage of 32.72
- At Vengurla, accessions RFRS 173 and RFRS 177 had higher number of panicles/m2 being 17.33 and 16.50 respectively.
- A local collection, CARS-10 was found to be tolerant to short spells of low temperature (2 – 2.5ºC) at Jagdalpur Centre, which had no leaf shedding as in other collections.
- Four cashew trees indicating possible tolerance to salt water inundation have been identified from Tsunami affected plantations at Cuddalore and Nagapattinam.
- Multi-location trials of cashew have been laid out at different centres to study the yield and other parameters of varieties developed and its suitability at different regions.
- Under spacing trials the cumulative yield for 5 years was highest in 600pl/ha (83.4q/ha) followed by 400pl/ha (74.68q/ha) and 200pl/ha (38.39q/ha) at Bhubaneswar.
- A package of practices has been developed for fertilizer application, spacing and thinning. Application of 500g N; 125g P_2O_5 and K_2O each per tree per year was found to be suitable.
- Intercropping with ginger, turmeric, cluster bean, black gram, horse gram, ground nut, vegetables such as colocasia, tapioca, brinjal, bhindi, cucumber, chillies and medicinal plants with cashew as main crop during the initial stage of orchard development were evaluated and recommended for the economic upliftment of farmers at different locations.
- Under intercropping trials conducted at Bhubaneswar, total net returns per hectare from inter-crops as well as main crop after 4 years revealed that maximum return was received from colocasia (Rs 66,216/-) followed by bhindi (Rs. 58,155/-), while in control it was Rs 40,075/-.At Jhargram, the benefit cost ratio of 2.44 in cashew + bottle gourd which was the most profitable followed by cashew + amaranths (1.93).
- Under hybridization trials, H-68 performed the best at Bhubaneswar by yielding 38kg/tree for 9 harvests during 2004-05 while H-7 and H-17 yielded 76.44kg/tree and 71.35kg/tree for 13 harvests at Madakkathara centre during 2005-06.
- L-cyhalothrin (0.003%), Profenophos (0.05%), Triazopohos (0.1%) could effectively check the damage by tea mosquito bug, leaf and blossom webber, leaf miner, apple and nut borer as well as thrips in most of the centres.
- Chlorpyriphos was the best post extraction treatment resulting in consistently more than 70 per cent of the treated trees without reinfestation at Vengurla, Jhargram, Bhubaneswar, Chintamani and Jagdalpur. Chlorpyriphos 0.2% resulted in 83.33% trees without re-infestation or persistent attack as post extraction prophylaxis at Bapatla, while maximum recovery (90%) was obtained at Bhubaneswar,
- The centres have also been producing quality-planting materials for the respective regions to meet the requirement of farmers and developmental agencies.
- At Vridhachalam, there was 55.20% reduction in number of internodes and 68.75% reduction in internodal length in HC 6 hybrid when compared to HC 9, the tallest hybrid.
- There was an increase in nut yield of 28.34 to 41.68 % in all the treatments over the control plot with maximum increase in L-cyhalothrin spray (41.60%) at Bapatla.

- Highest net returns was recorded by intercropping with amorphophallus (Rs.1,39,639), followed by tapioca (Rs. 1,29,992) at Madakkathara during initial cropping period of cashew.

Salient achievements of the Project during 2011-12 :

- In multilocation trial-II, the highest cumulative yield (kg/plant) for 16 harvests was recorded in cashew type H-303 (112.4) followed by NRCC Sel-2 (102.97) at Bhubaneswar.
- Maximum nuts/m^2 were recorded in H-303 (41 nuts/m^2) followed by M-44/ 3 (37.1 nuts/m^2) at Jhargram centre under multilocation trial-II.
- Among the hybrids developed at Bhubaneswar, A-9 had maximum shelling percentage of 35.6 while the highest shelling percentage of 47.0 per cent was recorded in H-70 followed by 40.0 per cent in H- 134 and 39.6 per cent in H-122 at Jhargram.
- The nut yield per hectare from 500 trees/ha was higher by 979 kg (147%) over 200 trees/ ha at Madakkathara in fertilizer application trials under high density planting.
- At Vridhachalam in the drip irrigation trial, the nut yield was highest (6.20 kg/tree) in irrigation at 80% cumulative pan evaporation when compared to 4.42kg/tree in unirrigated control.
- The treatment with L-cyhalothrin recorded significantly highest nut yield of 969 kg/ha. with the least damage score of 0.86 at Paria under the trials on evaluation of new insecticides for control of TMB and other insect pests.

2. TRANSFER OF TECHNOLOGY :

A total of 259023 grafts were produced during 2011-12 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	4780
Bhubaneswar	22000
Jagdalpur	25200
Jhargram	2000
Madakkathara	30876
Pilicode	32000
Vengurla	62378
Vridhachalam	79789
TOTAL	**259023**

BAPATLA

The scientists of this centre participated in the "District level training programme to cashew growers" organized by the ITDA and KVK-Pandirimamidi at Rampachodavaram-East Godavari District. The scientists organized front-line technology demonstration on cashew in farmers fields located in Prakasam, Krishna, West Godavri and East Godavari Districts with the financial assistance from the Directorate of Cashew and Cocoa Development-Cochin under NHM. Further, 2 radio talks, 7 telecasts pertaining to cashew production were also part of the extension activity by the scientists of the Centre.

BHUBANESWAR

The scientist of AICRP on Cashew, Bhubaneswar were involved in evaluation of replanting of senile cashew plantation planted in the districts of Khurda, Nayagarh, Ganjam, Koraput, Cuttack, Dhenkanal, Angul, Keonjhar and Mayurbhanj by Odisha State Cashew Development Corporation (OSCDC) and Odisha Forest Development Corporation (OFDC).

The scientists of this centre involved in 3 training programmes on production technology, crop management, plant protection measures, value addition and post harvest management of cashew. The scientists of the centre also compiled all the achievements of cashew research done by the scientists of the project since its inception under Orissa University of Agriculture and Technology and released the booklet on "Cashew Research in Odisha". Cashew variety Jagannath (BH-6) and Balabhadra (BH-85) released in the state and are clonally multiplied for distribution to the Director of Horticulture, Government of Orissa and OSCDC for further multiplication and supply to the cashew growers.

CHINTAMANI

The scientists of the Centre participated in National Level Seminar on "Bio-diversity and sustainable development" at Tumkur and presented research article in "First International Symposium on Cashew Nut", held at Agricultural College and Research Institute, Madurai on 9th-12th, December, 2011. The scientists of the centre published popular articles, leaflets and booklets in Kannada on various aspects of cashew cultivation and processing. They also displayed achievements

of the centre by participating in Rashtriya Krishi Mela – 2011 and State Level Cashew Seminar.

JAGDALPUR

The Scientists of the Centre were associated in rejuvenation of old and senile plantations of cashew at Bakawand Block of Bastar district in 294 ha area. The scientists also participated in training programmes and district level seminars on Improved Production and Protection technologies of cashew. The scientists participated in "First International Symposium on Cashew Nut", held at Agricultural College and Research Institute, Madurai on 9th - 12th, December, 2011. Various aspects of scientific agriculture training and rejuvenation techniques of cashew were dealt by the scientists in more than 14 training programmes.

The scientists of the centre delivered TV talk on 'Fertilizer and Insecticide application techniques Cashew production technology for Chhattisgarh' and 'Grafting and training techniques of Cashew

JHARGRAM

The scientist of the Centre functioned as resource person in the farmers training programme on cashew cultivation technology organized by NGO-PRADAN and Nari Vikas Sangha in Bankura District. Regular field visits were under taken to solve the field problems of the cashew farmers.

MADAKKATHARA

The scientists of this Centre participated in various short term training programmes and winter school on nursery management, cashew varieties for Kerala, cultivation and processing of cashew, pest management in cashew and cashew apple processing, post harvest technology, value addition and marketing. Trainings were organized on cashew apple processing for unemployed women and farmers. The scientists also put up stalls in various Zonal and State Level Exhibitions for technology dissemination and sale of cashew grafts. The station has launched commercially the following three new cashew apple products viz., cashew apple soda, cashew apple vinegar and cashew apple chocolate. They participated in the various exhibitions to depict the research achievements of the station as well as for the sale and display of cashew apple products and cashew grafts.

The Centre organized state level farmers' seminars on cashew as part of its extension activity. Radio talks and TV programmes on cashew cultivation, pest management, cashew apple processing and prospects of Cricula silkworm rearing were presented by the Scientists of this Centre.

PILICODE

The scientists of the centre have conducted trainings and seminars on various aspects of cashew and other crops like coconut, vegetables etc. The scientist of the centre has functioned as resource person in resolving the several field problems of cashew growers in more than 15 different locations. Demonstration and training on cashew apple utilization was conducted at RARS, Pilicode.

VENGURLA

The scientists of this Centre conducted demonstrations on cashew softwood grafting and nutrient management in cashew. Farmers' training programmes on crop protection in cashew was also undertaken by the Centre. The scientists also published popular articles in Marathi on various cashew cultivation aspects.

VRIDHACHALAM

The Centre has laid out 30 front-line technology demonstration in cashew production and TMB management sponsored by DCCD to popularize the production in cashew to improve the productivity. Trainings on cashew production technology and apple utilization were organized in order to popularize the use of cashew apple for various edible preparations in which more than 200 farmers and rural women participated. District level seminars on cashew were organized in which 150 beneficaries participated.

PARIA

Farm visits have been done by the scientists of the Centre to disseminate improved cashew production technologies and also to suggest remedial measures in collaboration with the BAIF.

3. STAFF POSITION

HEADQUARTERS

Project Coordinator	:	Dr. M. Gopalakrishna Bhat
Scientist-in-charge	:	Dr. T.N. Raviprasad

PROJECT CENTRES

Cashew Research Station, (Dr. Y.S.R.H.U), Bapatla, 522 101, Guntur District, Andhra Pradesh.

Horticulturist	:	Dr.K.T.Venkata Ramana (24.3.2012) Dr. S. Suryakumari (From 29.3.2012)
Asstt. Horticulturist	:	Vacant
Asstt. Entomologist	:	Mr. Ch.Chinnabbai
Sr. Technical Assistant	:	Sri. M. Sambasiva Rao
Jr. Technical Assistant	:	Mr.Samuel
Grafter	:	Mr. V. Kantha Rao

Cashew Research Station, (OUAT), Bhubaneswar 751 003, Orissa.

Horticulturist	:	Dr. A.K. Pattnaik
Jr. Horticulturist	:	Mrs. Kabita Sethi
Jr. Entomologist	:	Dr. P.C. Dash
Sr. Technical Assistant	:	Sri. A. Mansingh
Jr. Technical Assistant	:	Sri. S. Barik
Grafter	:	Sri. D. Almango (From 3.9.2011)

Agricultural Research Station, (UAS), Chintamani 563 125, Kolar District, Karnataka

Horticulturist	:	Mr. M.N. Narasimha Reddy
Jr. Horticulturist	:	Dr. K.M. Rajanna
Entomologist	:	Ms. Vidya Mulimani
Sr. Technical Assistant	:	Mr. Babu V.
Sr. Technical Assistant	:	Mr. G.V. Narayanaswamy
Grafter	:	Mr. R. Lokesh Babu

Zonal Research Station, (BAU), Darisai, East Singhbhum Dist., Jharkhand

Horticulturist	:	Dr. Prashant Kumar

SG College of Agricultural and Research Station, (IGAU), Jagdalpur 494 005, Chattisgarh

Jr. Horticulturist	:	Mr. M.S. Paikra (From August 2010)
Jr. Entomologist	:	Mr. Khoobi Ram Sahu
Sr. Technical Assistant	:	Vacant
Grafter	:	Mr. Jagdev

Regional Research Station, (BCKV), Jhargram 721 507, Midnapore West District, West Bengal

Horticulturist	:	Vacant
Jr. Horticulturist	:	Dr. Mini Poduval
Jr. Entomologist	:	Vacant
Sr. Technical Assistant	:	Vacant
Jr. Technical Assistant	:	Vacant
Grafter	:	Vacant

Cashew Research Station, (KAU), Madakkathara 680 651, Kerala

Horticulturist	:	Dr. Jose Mathew
Jr. Breeder	:	Mr. Gregory Zachariah
Jr. Entomologist	:	Dr. Gavas Ragesh (from 5.5.2010)
Sr. Technical Assistant	:	Dr. A. Sobhana
Jr. Technical Assistant	:	Mr. M.K. Manoj
Grafter	:	Vacant

Agricultural Experimental Station, (NAU), Paria, Valsad-396 145, Gujarat

Horticulturist	:	Dr. J.P. Makati
Jr. Entomologist	:	Dr. R.B. Patel

Regional Agricultural Research Station, (KAU), Pilicode 671 353, Kasaragod District, Kerala.

Jr. Horticulturist	:	Dr. Meera Manjusha A.V.
Jr. Technical Assistant	:	Ms. Sajina K.V. (From 13th August 2011)

Regional Agricultural Research Station, (KKV), Vengurla 416 516, Maharashtra.

Horticulturist	:	Mr. R.C. Gajbhiye (From 16.4.2010)
Jr. Breeder	:	Mr. R.T. Bhingarde
Jr. Entomologist	:	Mrs. V.K. Zote (From 7.4.2010)
Sr. Technical Assistant	:	Mr. S.P. Salvi (From 2.8.2011)
Jr. Technical Assistant	:	Mr. N.R. Parab

Regional Research Station, (TNAU), Vridhachalam 606 001, Cuddalore District, Tamil Nadu.

Horticulturist	:	Dr. S. Jeeva
Jr. Horticulturist	:	Dr. M. S. Aneesa Rani
Jr. Entomologist	:	Dr. V. Ambethgar
Sr. Technical Assistant	:	Mr. M.K. Sendilnayagam (1.7.2011)
Jr. Technical Assistant	:	Mr. C. Jayachandran
Grafter	:	Mr. C. Gopalakrishnan

CO-OPERATING CENTRES OF AICRP-CASHEW

KRC College of Horticulture, University of Horticulture Sciences, Arabhavi-591 310, Gokak Taluk, Belgaum Dist., Karnataka

Horticulturist	:	Dr. N.K. Hegde
Plant Breeder	:	Dr. R.C. Jagadeesh

ICAR Research Complex for NEH Region, Umiam – 793 103, Barapani, Meghalaya

Horticulturist	:	Dr. A.S. Singh

ICAR Research Complex for Goa, Ela, Old Goa, Goa – 403 402

Horticulturist	:	Dr. A.R. Desai

4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2011-12

Allocation **(Rs. in lakhs)**

Centre	Details of sanctioned provision					ICAR share
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total	
Bapatla	8.00	0.60	6.00	—	14.60	10.95
Bhubaneshwar	30.00	0.70	6.30	—	37.00	27.75
Chintamani	22.08	0.60	3.00	—	25.68	19.26
Jagdalpur	13.00	0.45	4.00	—	17.45	13.09
Jhargram	1.65	0.60	3.00	—	5.25	3.94
Madakkathara	30.00	0.60	6.00	—	36.60	27.45
Pilicode	8.50	0.25	2.00	—	10.75	8.06
Vengurla	20.00	0.70	6.30	—	27.00	20.25
Vridhachalam	26.65	0.60	6.00	—	33.25	24.94
Paria	15.00	0.35	3.00	—	18.35	13.76
Darisai	6.70	0.35	3.00	—	10.05	7.53
KRCCH, Arabhavi	0.00	0.25	4.00	—	4.25	3.19
ICAR Res. Compl. For Goa, Goa	0.00	0.25	4.00	—	4.25	3.19
ICAR Res. Compl. For NEH Region, Barapani	0.00	0.25	4.00	—	4.25	3.19
For need based research programme under unforeseen research needs funds	0.00	0.00	17.94	—	17.94	13.45
Total	**181.58**	**6.55**	**78.54**	**—**	**266.67**	**200.00**

Actual Expenditure **(Rs. in lakhs)**

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency *	Total	ICAR Share
Bapatla	29.30	0.35	3.00	0.00	32.65	24.49
Bhubaneshwar	41.44	0.50	3.00	0.00	44.94	33.70
Chintamani	36.45	0.49	3.00	0.00	39.94	29.95
Jagdalpur	9.60	0.47	3.61	1.71	15.39	11.54
Jhargram	11.31	0.16	2.99	2.92	17.38	13.03
Madakkathara	88.04	0.55	2.84	1.00	92.43	69.32
Paria	12.21	0.14	1.79	0.00	14.14	10.61
Pilicode	16.95	0.18	0.63	0.00	17.76	13.32
Vengurla	27.38	0.16	2.99	0.00	30.53	22.90
Vridhachalam	40.02	0.59	3.00	0.00	43.61	32.71
Cooperating Centres						
KRCCH, Arabhavi	0.00	0.09	1.35	0.00	1.44	1.08
ICAR Res. Compl. For Goa, Goa	0.00	0.25	1.52	0.00	1.77	1.33
ICAR Res. Compl. For NEH Region, Barapani	—	—	—	—	—	—
Total	**312.70**	**3.93**	**29.72**	**5.63**	**351.98**	**263.98**

* = funds utilized either as spill over of 2010-11 or by revalidation.

5. MONITORING OF PROJECT BY PROJECT COORDINATOR

The Project Coordinator reviewed the progress of ongoing research programmes by the Centres through regular receipt of reports, correspondence and discussion with the scientists of each Centre

6. FUNCTIONING OF EACH CENTRE

BAPATLA

The centre has been established during 1971. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The scientists organized front-line technology demonstration on cashew in farmers fields located in Prakasam, Krishna, West Godavri and East Godavari Districts with the financial assistance from the Directorate of Cashew and Cocoa Development-Cochin under NHM. The scientists organized front-line technology demonstration on cashew in farmers fields located in Prakasam, Krishna, West Godavri and East Godavari Districts.

BHUBANESWAR

The centre has been established in 1975. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The training programmes based on different themes such as "production technology, crop management, plant protection measures, value addition and post harvest management" of cashew were organised by the Centre.

The scientist of AICRP on Cashew, Bhubaneswar were involved in evaluation of replanting of senile cashew plantation planted in the districts of Khurda, Nayagarh, Ganjam, Koraput, Cuttack, Dhenkanal, Angul, Keonjhar and Mayurbhanj by Odisha State Cashew Development Corporation (OSCDC) and Odisha Forest Development Corporation (OFDC).

The cashew variety; Jagannath (BH-6) and Balabhadra (BH-85) were released for the state and are being clonally multiplied for distribution to the Director of Horticulture, Government of Orissa and OSCDC for further multiplication and supply to the cashew growers.

CHINTAMANI

The centre has been established in 1980. At present there are three scientists working under the project in the posts of Horticulturist, Jr. Horticulturist and Jr. Entomologist. Presently three projects in Crop Improvement, six in Crop Management and four in Crop Protection are being carried out. The scientists of the centre published popular articles, leaflets and booklets in Kannada on various aspects of cashew cultivation and processing. They also displayed achievements of the centre by participating in Rashtriya Krishi Mela – 2011 and State Level Cashew Seminar.

Regular and timely field visits / discussions were made on various aspects of cashew and suitable clarifications were provided to the farmers.

JAGDALPUR

The centre has been established in 1993. At present there are two scientists working under the posts of Jr. Horticulturist and Jr. Entomologist under the project. Presently there are three projects in Crop Improvement, two in Crop Management and four in Crop Protection, which are allotted to the centre. The Scientists of the Centre were associated in rejuvenation of old and senile plantations of cashew at Bakawand Block of Bastar district in 294 ha area.

The scientists of the centre delivered TV talk on'Fertilizer and Insecticide application techniques', 'Cashew production technology for Chhattisgarh' and 'Grafting and training techniques of Cashew'.

JHARGRAM

The centre has been established in 1982. At present one scientist is working under the project in the post of Junior Horticulturist. One post of Horticulturist and one post of Junior Entomologist is lying vacant. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The scientist of the Centre functioned as resource person in the farmers training programme on cashew cultivation technology organized by NGO-PRADAN and Nari Vikas Sangha in Bankura District.

MADAKKATHARA

The centre has been established in 1972. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being

carried out. The scientists of this Centre participated in various short term training programmes and winter school on nursery management, cashew varieties for Kerala, cultivation and processing of cashew, pest management in cashew and cashew apple processing, post harvest technology, value addition and marketing Radio talks and TV programmes on cashew cultivation, pest management, cashew apple processing and prospects of Cricula silkworm rearing were presented by the Scientists of this Centre.

PILICODE

The centre has been established in 1993. At present there is one scientist working under the project in the post of Junior Horticulturist. Presently three projects, two in Crop Improvement and one in Crop Management. Training and seminars have been conducted on cashew propagation, cashew cultivation techniques. The scientist of the centre has functioned as resource person in resolving the several field problems of cashew growers in more than 15 different locations. Demonstration and training on cashew apple utilization was conducted at at RARS, Pilicode.

VENGURLA

The centre has been established in 1970. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The scientists of this Centre conducted demonstrations on cashew softwood grafting and nutrient management in cashew. Farmers' training programmes on crop protection in cashew was also undertaken by the Centre.

VRIDHACHALAM

The centre has been established in 1971. At present three scientists are working as Horticulturist, Junior Horticulturist and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. The Centre has laid out 30 front-line technology demonstration in cashew production and TMB management sponsored by DCCD to popularize the production in cashew to improve the productivity. Trainings on cashew production technology and apple utilization were organized, in order to popularize the use of cashew apple for various edible preparations in which more than 200 farmers and rural women participated.

PARIA

This new centre has been started at Agricultural Experiment Station, Paria, Pardi Taluk, Valsad District in Gujarat under Navsari Agricultural University during 2009. There are two scientists working in this centre as Junior Horticulturist and Junior Entomologist. Three projects under Crop Improvement and two projects under Crop Management and two projects under Crop Protection are being carried out in this Centre.

Farm visits have been done by the scientists of the Centre to disseminate improved cashew production technologies and also to suggest remedial measures in collaboration with the BAIF.

DARISAI

This Centre has been started at Zonal Research Station (ZRS) during 2010 during XI Plan, under Birsa Agricultural University. There are two scientists working in this centre as Junior Horticulturist and Junior Entomologist. Three projects under Crop Improvement and three projects under Crop Management and two projects under Crop Protection are being carried out in this Centre.

CO-OPERATING CENTRES

ARABHAVI

This Co-operating Centre is functioning at Kittur Rani Chennamma College of Horticulture, Arabhavi, Karnataka since 2009. There are two scientists working in this centre as Horticulturist and Plant Breeder. Three projects under Crop Improvement and Three projects under Crop Management and one project under Crop Protection are being carried out in this Centre.

BARAPANI

This Co-operating Centre is functioning at ICAR Research Complex for NEH, Tura, Meghalaya since 2009. There is one Horticulturist working in this centre. Three projects under Crop Improvement and two projects under Crop Management are being carried out in this Centre.

ICAR RESEARCH COMPLEX FOR GOA

This Co-operating Centre is functioning at ICAR Research Complex for Goa, Ela Old Goa, Goa since 2009. There is one Horticulturist working in this centre. Three projects under Crop Improvement is being carried out in this Centre.

7. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2010-11

BAPATLA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall rainy days	No. of (mm)
			(Max)	(Min)		
Apr.11	35.2	27.6	79	78	0	—
May 11	37.2	28.2	74	67	149.5	3
Jun. 11	39.0	28.5	76	68	172.8	8
Jul. 11	32.6	25.1	85	80	364.6	16
Aug. 11	33.3	25.1	85	77	346.8	12
Sep. 11	33.1	25.9	87	77	350.3	13
Oct. 11	32.4	24.6	87	78	179.5	12
Nov. 11	30.4	23.1	90	82	119.0	7
Dec. 11	28.9	18.9	90	72	170.3	3
Jan. 12	29.8	17.2	92	66	0	—
Feb. 12	31.1	18.7	89	64	29.9	2
Mar. 12	33.0	29.1	85	67	0	—

BHUBANESWAR

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days	BSH
			(Max)	(Min)			
Apr.11	36.4	23.9	86.8	45.0	28.2	7	7.0
May 11	37.4	27.0	92.1	56.2	142	9	8.0
Jun.11	35.1	25.5	90.0	64.3	180.3	18	3.8
Jul. 11	32.8	26.1	96.0	83.0	361.5	21	4.1
Aug.11	32.2	26.2	98.3	84.3	419.5	24	3.1
Sep.11	31.3	24.7	95.2	80.3	279.1	17	3.3
Oct. 11	33.4	23.9	92.8	59.9	57.0	6	7.6
Nov.11	32.3	18.1	89.0	39.9	–	–	7.8
Dec.11	29.0	16.0	83.9	39.7	–	–	5.4
Jan.12	28.7	16.3	90.7	51.4	44.4	3	5.9
Feb.12	33.2	16.9	89.2	34.4	–	–	7.8
Mar.12	37.4	22.9	94.4	34.2	–	–	6.7

CHINTAMANI

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
Apr.11	33.57	20.22	63.25	33.00	45.0	5
May 11	34.22	20.60	60.75	43.75	79.0	5
Jun. 11	31.72	20.90	62.20	46.80	10.40	2
Jul. 11	30.35	20.22	71.75	55.50	105.6	11
Aug. 11	29.10	20.16	77.80	61.00	127.0	8
Sep. 11	30.65	19.67	66.75	51.00	17.2	1
Oct. 11	30.02	19.27	72.00	61.25	236.8	9
Nov. 11	27.00	16.08	68.80	59.00	47.8	5
Dec. 11	27.27	12.67	72.25	43.50	15.2	2
Jan. 12	28.70	13.70	80.80	44.40	1.6	-
Feb. 12	31.60	14.50	64.40	33.00	-	-
Mar. 12	34.30	17.50	58.10	23.50	6.4	1

JAGDALPUR

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	BSH
			(Max)	(Min)		
Apr.11	34.6	19.0	86.5	37.7	41.9	7.0
May 11	37.3	22.1	73.2	31.7	92.1	7.3
Jun. 11	31.7	21.5	86.8	59.3	185.1	4.5
Jul. 11	28.6	21.2	87.3	70.2	317.8	2.5
Aug. 11	28.1	21.5	89.0	70.3	378.6	2.6
Sep. 11	27.5	21.0	90.6	68.5	233.3	2.9
Oct. 11	30.0	16.8	83.8	54.7	0.0	8.5
Nov. 11	28.6	10.9	87.2	57.0	0.0	8.5
Dec. 11	27.9	7.6	88.9	34.2	0.8	7.5
Jan. 12	26.7	10.5	90	50	39.4	6.7
Feb. 12	31.5	11.7	88	42	0.0	8.5
Mar. 12	35.2	14.3	86.9	32.6	1.8	8.8

JHARGRAM

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	BSH
			(Max)	(Min)		
Apr.11	35.48	22.4	85.6	48.7	96.4	5
May 11	36.40	24.53	83.87	50.16	84.0	7
Jun. 11	35.45	25.45	86.43	57.4	506.8	14
Jul. 11	33.14	25.32	90.61	70.06	126.0	10
Aug. 11	32.08	25.0	93.93	74.41	463.4	19
Sep. 11	32.05	23.5	91.4	75.4	398.0	17
Oct. 11	33.38	24.31	82.22	57.41	8.4	1
Nov. 11	31.27	18.03	87.9	36.83	0.2	1
Dec. 11	27.25	8.06	88.45	37.32	0.0	0
Jan. 12	25.59	9.21	87.25	52.03	38.4	4
Feb. 12	30.4	16.25	81.41	34.05	46.0	2
Mar. 12	35.62	19.15	72.58	28.45	6.0	1

MADAKKATHARA

Month & Year	Max.Temp. (°C)	Min. Temp. (°C)	Mean RH (%) (Avg.)	Rainfall (mm)	No. of rainy days	BSH
Apr.11	34.3	24.5	—	207.1	5.0	—
May 11	33.0	24.9	—	198.5	7.0	—
Jun. 11	29.3	23.6	—	799.6	27.0	—
Jul. 11	29.1	22.9	—	588.2	26.0	—
Aug. 11	29.4	22.9	—	713.8	25.0	—
Sep. 11	30.0	23.1	—	435.2	15.0	—
Oct. 11	32.1	23.5	—	190.0	9.0	—
Nov. 11	31.4	22.9	—	240.0	9.0	—
Dec. 11	31.9	22.6	—	2.40	0.0	—
Jan. 12	32.8	21.3	—	0.0	0.0	—
Feb. 12	35.1	22.1	—	0.0	0.0	—
Mar. 12	35.2	24.2	—	3.5	1.0	—

PILICODE

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	BSH
			(Max)	(Min)		
Apr.11	33.3	23.7	76.2	2.2	4	-
May 11	32.7	24.8	73.9	1.6	6	-
Jun. 11	29.7	23.4	87.8	35.6	28	-
Jul. 11	29.3	22.9	90.8	33.8	30	-
Aug. 11	29.8	23.2	90.5	25.0	29	-
Sep. 11	29.9	22.8	84.7	19.0	22	-
Oct. 11	31.6	33.0	78.6	9.2	15	-
Nov. 11	32.6	21.5	75.4	4.3	9	-
Dec. 11	33.1	19.4	71.1	0.2	1	-
Jan. 12	32.0	19.5	69.0	0	0	-
Feb. 12	32.9	21.0	69.5	2.2	1	-
Mar. 12	33.0	23.1	69.5	2.6	1	-

VENGURLA

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
Apr.11	32.86	22.95	80.62	62.53	0	0
May 11	33.27	25.47	79.95	66.81	103.6	3
Jun. 11	30.03	24.49	88.03	83.31	1016.2	28
Jul. 11	28.99	24.62	90.36	85.59	1210.4	35
Aug. 11	29.36	24.88	91.60	84.42	667.0	28
Sep. 11	30.47	23.62	92.25	77.50	482.6	19
Oct. 11	33.02	23.41	89.22	75.08	65.8	10
Nov. 11	34.48	20.76	85.53	57.64	20.2	2
Dec. 11	33.01	18.25	89.75	60.21	0	0
Jan. 12	30.78	16.03	88.36	56.16	0	0
Feb. 12	32.11	15.96	84.39	57.49	0	0
Mar. 12	32.11	20.05	85.99	64.56	0	0

VRIDHACHALAM

Month & Year	Max. Temp. (°C)	Min. Temp. (°C)	Mean RH (%)		Rainfall (mm)	No. of rainy days
			(Max)	(Min)		
Apr.11	39.68	28.67	90.08	62.97	155.4	3
May 11	42.23	29.97	84.19	46.18	14.6	1
Jun. 11	41.10	29.40	71.30	72.90	46	2
Jul. 11	39.45	28.60	77.90	66.48	131.4	9
Aug. 11	38.63	26.97	83.60	66.80	153.8	6
Sep. 11	37.40	27.73	87.80	70.40	322.1	6
Oct. 11	35.73	27.11	90.45	85.74	302.2	12
Nov. 11	32.30	22.00	89.33	83.50	572.6	13
Dec. 11	31.80	20.98	88.71	80.74	147.4	4
Jan. 12	32.72	18.35	89.83	83.00	-	-
Feb. 12	34.33	19.53	89.34	77.21	-	-
Mar. 12	39.25	22.40	89.32	80.62	-	-

PARIA

Month & Year	Max.Temp. (°C)	Min. Temp. (°C)	Mean RH (%) (Avg.)	Rainfall (mm)	No. of rainy days	BSH
Apr.11	35.83	19.73	62.13	—	—	—
May 11	35.17	24.47	63.09	0.6	—	—
Jun. 11	33.60	25.99	73.30	1.27	11	—
Jul. 11	30.35	24.57	90.27	810.8	22	—
Aug. 11	29.66	24.25	90.98	1224.5	28	—
Sep. 11	31.05	23.46	84.43	403	13	—
Oct. 11	35.18	20.88	69.18	20.4	1	—
Nov. 11	35.41	15.79	57.95	—	—	—
Dec. 11	33.13	12.07	65.23	—	—	—
Jan. 12	29.81	8.93	64.90	—	—	—
Feb. 12	32.63	9.63	58.95	—	—	—
Mar. 12	35.02	12.70	62.18	—	—	—

8. RESEARCH PUBLICATIONS

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10. LIST OF DCR PUBLICATIONS

Sl. No.	Publication	Price Rs.
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2	Softwood grafting and nursery management in cashew	35.00
3	a) Annotated Bibliography on Cashew (1985-1994)	75.00
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4	Catalogue of Minimum Descriptors of Cashew	
	Germplasm accessions – I	165.00
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