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

वार्षिक प्रतिवेदन
ANNUAL REPORT
2006-07

परियोजना समन्वयकर्ता
डा. एम. गोपालकृष्ण भट

PROJECT COORDINATOR
Dr. M. Gopalakrishna Bhat

राष्ट्रीय काजू अनुसंधान केंद्र
(भारतीय कृषि अनुसंधान परिषद्)
पुत्तूर - 574 202, दक्षिण कन्नड, कर्नाटक

NATIONAL RESEARCH CENTRE FOR CASHEW
(Indian Council of Agricultural Research)
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प्राक्कथन

अखिल भारतीय समन्वित काजू अनुसंधान परियोजना की बाइसवी वार्षिक प्रतिवेदन प्रस्तुत है। इस प्रतिवेदन में अप्रैल 2005 से मार्च 2006 तक की अनुसंधान उपलब्धियाँ तथा अन्य जानकारी सम्मिलित की गई है।

इस परियोजना में आठ केंद्र तथा एक उपाकेंद्र 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 केंद्र (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।

प्रतिवेदन में चालू बारह अनुसंधान परियोजनाओं कि उपलब्धियों की क्षेत्रीय स्तर पर विषयानुसार, जैसे फसल सुधार (3), फसल प्रबंध (5), और फसल सरंक्षण (4) के विविध विषयों को संबंधित बारह अनुसंधआन परियोजनाओ 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 तकनीकी प्रायोगिक उपलब्धियाँ, और
2. संस्थानीय : जिसमे इतिहास, कर्मचारी, वित्तीय प्रावधान, मौसम की आँकड़े और शोध प्रकाशन शामील हैं।

(एम गोपालकृष्ण भट)
निदेशक एवं परियोजना समन्वयकर्ता

पुत्तुर - 574 202
दिनांक :

ABOUT THIS REPORT

This is the twenty second 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 2005 to March 2006.

There are eight project centres and one sub centre, four in the East Coast of India, namely, Bapatla (Andhra Pradesh); Bhubaneshwar (Orissa); Jhargram (West Bengal) and Vridhachalam (Tamil Nadu), two centres and one sub centre in the West Coast, namely, Madakkathara (Kerala) and Pilicode (Kerala) (Sub centre); Vengurla (Maharashtra) and one each in Plains Region, namely, Chintamani (Karnataka) and Jagdalpur (Chhattisgarh) which are implementing the research programmes.

There are twelve research projects pertaining to different disciplines such as Crop Improvement (3) Crop Management (5) 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.

(M. GOPALAKRISHNA BHAT)
DIRECTOR & PROJECT COORDINATOR

Puttur 574 202
Dated :

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CHAPTER II : ORGANISATION

CHAPTER 1 : TECHNICAL

परियोजना समन्वयकर्ता की रिपोर्ट

अखिल भारतीय समन्वित मसाला व काजू अनुसंधान पारयोजना 1971 में चौथी पंच वार्षिक योजना में शुरु की गई, जिसका मुख्यालय केंद्रीय 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 छटठी 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। अखिल भारतीय समन्वित काजू अनुसंधान परियोजना के यह केंद्र 8 काजू उगानेवाला राज्यों में स्थित है और यह विभिन्न राज्य कृषि विश्वविद्यालयों के प्रशासनिक नियंत्रण में है।

परियोजना का 2005-06 में बजट आबंटन रु. 120.00 लाख (रु. 90.00 लाख भा.कृ.अ.प. का अंश) था और व्यय रु. 124.14 लाख (रु. 93.11 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 प्रारंभिक विविध परियोजनाओं से प्रतिवेदन अवधि में प्राप्त मुख्य परिणामों, विविध विभागों में प्रस्तुत है।

फसल सुधार :

काजू जननद्रव्य को पहचान करके, संग्रह करके तथा अपना अपना प्रादेशिक काजू क्षेत्रीय जीन बैंको (RCFGB) **मे संरक्षण करने से खुल** 1261 **काजू जननद्रव्य संरक्षित है। जननद्रव्य परीक्षण प्रयोगो मे सन्** 2005 **मे** BBSR-1 **बापट्ला मे** 3.00 **कि ग्रां की अत्यधिक गुटली उपज दिया। भुवनेश्वर मे छः एक्सशनो ने** 8.00 **ग्रां से अधिक औसत गुटली वजन दिखाया। चिंतामणि केंद्र मे** 14 **फसलो में** 44/1 ARSC (Vengurla-5) **ने** 246.93 **कि ग्रां की अत्यधिक संचयी उपज दिया। जगदलपुर केंद्र मे स्थानिक संग्रहण** CARS-10, **ठंड** (2-25 c) **की छोटी अवधि को बरदास्त कर सका, जिसमे दूसरे संग्रहणो जैसे पत्ता नही गिरा। झारग्राम केंद्र मे** JGM-34/3 **ने** 13 **फसलो मे** 158.36 **कि ग्रां की संचयी उपज दिया, जहाँ पर हो** 7 **आशाजनक जननद्रव्य एकसेशनो मे** 29 **से अधिक छिलकन प्रतिशतता पाया गया। माडकत्तरा केंद्र मे** H-8-10 **तथा उल्लाळ-**4 **मे अत्याधिक गुटली वजन रहा। तटीय महाराष्ट्र का हरकुल, कुब्भारमट और शॅनोली बुद्रक से संग्रहित तीन एक्सशनो मे** 10.0 **ग्रां से अधिक वजन दार 'जुम्बो' गुटली मिला। सुनामी बाधित कडलूर और नागपट्टीणं स्थित काजू बगानो से चार काजू पेडो को पहचाना गया, जो क्षारपानी आप्लवन को सहने का संभवता दिखाई।**

बापट्ला का बहुस्थानीय परीक्षण (MLT-II) **मे पेड सं** 10/19 **का अत्यधिक वार्षिक उपज** 12.02 **कि ग्रां, सन** 2005 **मे मिला जो** 10 **फसलो मे** 48.24 **कि ग्रां का गरिष्टतम संचयी गुटली उपज दिया। वैसे ही, भुवनेश्वर मे** 10**वी फसल तक** H-320 **और** H-303 **क्रमशः** 65.30 **और** 61.00 **कि ग्रां की संचयी उपज दिया। चिंतामणि की किस्मो का परीक्षणो में** H-320 **और** NRCC Sel-2 **वार्षिक गुटली उपज मे समानुरुपता दिखाया, और सन** 2005 **मे क्रमशः** 19.50 **कि ग्रां प्रति पेड और** 17.20 **कि ग्रां प्रति पेड की अत्यधिक उपज दिया। मडकत्तरा केंद्र मे** H-303 (5.21 **कि ग्रां प्रति पेड**) **और** H-1608 (5.19 **कि ग्रां प्रति पेड**) **से अत्यधिक वार्षिक गुटली उपज मिला।** M-44/3 **मे छिलकन प्रतिशतता** 32.50 **रहा, जिसके निकट मे** 3/28 **और** 3/33, **वेगुर्ला मे** 32.0 **छिलकन प्रतिशतता**

दिखाई। वृद्धाचलम मे H-320, अधिकतम गुटली वजन (7.80 ग्रां) दिखाया।

बापट्ला मे कुब्ज प्रकार KGN-1 का कायकी गुण स्थानिक तुलना प्रकार के समानुरूप रहा, लेखिन चिंतामणि, झारग्राम, वेंगुर्ला व वृद्धाचलम मे KGN-1 का वृद्धि अपना-अपना स्थानिक तुलना प्रकारो से ज्यादा रहा। भुवनेश्वर और पिलिकोड केंद्रो पर KGN-1 ने कुब्जता दिखाया।

विमोचित किस्मो मे, वेगुर्ला-4 बापट्ला मे अत्यधिक पौधा ऊचाई (8.40 मी) दिखाया, जिसके अनुसरण मे वेगुर्ला-5 (4.50 मी) रहा। अत्यधिक द्विलिंग पुष्प BBSR-1 (289.50) मे दाखिल हुआ और उसे कनका (217.50) अनुसरण किया। झारग्राम मे झारग्राम-1 मे अत्यधिक पौधा ऊचाई (3.08 मी) और अधिकतम औसत छत्री विस्तार (3.14 मी) पाया गया और अत्यधिक कांड घेरा (29.67 से मी) वेगुर्ला-4 मे पाया गया।

H-36 और H-65 नामक हैब्रिडो ने बापट्ला मे 7.0 ग्रां से अधिक गुटली वजन दिखाई। भुवनेश्वर मे पाया गया हैब्रिडो में A6 अत्यंत आशाजनक रहा, जिसमे अधिकतम गुटली उपज (9.00 कि.ग्रां/पेड), तथा 9.0 ग्रां की गुटली वजन और 34.00 तक की छिलकन प्रतिशतता मिला। मडकत्तरा के सभी अधिक उपजवाली हैब्रीडों को सामान्यतः P-3-2 जनक रहा और BLA-139-1 व BLA-39-4 जननी रही। वृद्धाचलम मे मूल्यांकित आट आशाजनक हैब्रिडों मे, H-10 (M10/4 x M 26/1) अत्यधिक गुटली उपज (7.58 कि. ग्रां./पेड) दिया।

फसल प्रबंधन :

बापट्ला के NPK प्रयोगों मे 500 ग्रां N का प्रमाण, 7.29 कि. ग्रां. प्रति पेड का सार्थक अधिकतम फसल दिया, लेखिन P तथा K का प्रमाण सार्थकता नही दिखाई। झारग्राम-1 की छः फसलों तक की संचयी उपज पर N,P,K का पारस्परिक प्रभाव ने दिखाया कि 500:250:250 NPK प्रति पेड लगाने से गरिष्ट संचयी उपज (33.32

कि.ग्रां/पेड) मिलेगा। मडकत्तरा मे तीनो पोषकांशो को बडाने से उपज मे भी क्रमिक वृद्धी हुआ और 500:250:250 कि.ग्रां. NPK प्रति पेड मे अधिकतम उपज (5.40 कि.ग्रां/पेड) मिला। वृद्धाचलम मे 1000:125:250 NPK/पेड लगाने से छतरी विस्तार (6.95 मी) और वार्षिक गुटली उपज (6.82 कि.ग्रां/पेड) गरिष्ट रहा।

भुवनेश्वर मे उच्छ धनत्व रोपण मे उर्वरक लगाने के प्रयोगो मे अधिक प्रमाण के उर्वरक लगाने से पुष्पण 15 दिन पेडले हुआ और प्रति वर्ग मीटर मे पुष्पित शाखावो की संख्या (16.22) तथा प्रति पुष्पगुच्छ मे अधिकतम गुटली की संख्या (8.10), उर्वरक की गरिष्ठ प्रमाण मे पाया गया। चिंतामणि, जगदलपुर, मडकत्तरा, वेंगुर्ला तथा वृद्धाचलम मे कायिक गुणको ने अंतराल तथा उर्वरक प्रमाणो से सार्थक रूप से प्रभावित हुआ।

बापट्ला मे सामान्य तथा उच्छ धनत्व रोपण मे कायिक गुणको ने फसल के प्रारंभिक अवस्था मे सार्थक रूप से विभिन्नता नही दिखाया। छटवी फसल मे प्रति पेड का फसल सामान्य धनत्व मे, उच्छ धनत्व रोपण पदति की तुलना मे पार्खि अधिकतता दिखाई। बापट्ला की अन्तराल फसल प्रयोगो मे, अत्यधिकच C:B अनुपात मूँगदाल (1:1:10) तथा उरददाल (1:1:10) मे F1 प्रमाण की उर्वरक मे देखा गया। अन्तराल फसल का आय भुवनेश्वर मे अधिकतम (5,880 / हेक्टर) कोलोकेशिया मे पाया गया जिसके नजदीकी आय बैंगन मे (रू 4,166 / हेक्टर) मिला और मुख्य व अन्तराल फसल की आय क्रमशः काजू + कोलोकेशिया (रू 17,000 / हेक्टर), काजू + लोबिया (रू 15,263 / हेक्टर) और काजू + बैंगन (रू 14,666 / हेक्टर) मे अधिक रहा। झारग्राम मे अधिकतम फसलदेनेवाली अन्तरालफसल थे; 50 प्रतिशत शिफारित उर्वरक प्रमाण मे ज्वार (47.69 क्विंटाल / हेक्टर), मूँगफली (2.42 क्विंटाल / हेक्टर) तथा तूर (7.05 क्विंटाल/हेक्टर) और पूरे उर्वरक प्रमाण मे उरद (4.87 क्विंटाल / हेक्टर) रहा। वृद्धाचलम् मे 1:2.1 की C:B अनुपात उरद मे मिला जिसके नजदीक मे मूँगफली (1:1.19) रहा, लेखिन मूगफली मे रु.16,187/हेक्टर अत्यधिक कुल लाभ मिला।

फसल संरक्षण :

बापट्ला मे दूसरा और तीसरा पुहार के बाद प्ररोह इल्ली, तथा पत्ता और पुष्पगुच्छ जालकीट का नियंत्रण मे सभी कीटनाशक उपचार एक दूसरे से बराबर रहा लेखिन अनुपचरित नियंत्रण से उत्तम रहा। भुवनेश्वर मे होस्टाशियान, λ-सैहालोथ्रीन और प्रोफीनोफॉस जैसे सभी नया कीटनाशको ने शिफरित फुहार सूची की समान पाया गया। बोरान उपचरित पेडो मे थ्रिप्स का औसत संख्या 4.35 प्रति पुष्पगुच्छ रहा लेखिन अनुपचरित पेडों मे उसकी संख्या 5.34 प्रति पुष्पगुच्छ, भुवनेश्वर मे पाया गया। कार्बारिल (0.1%), λ-सैहालोथ्रीन (0.003%) और प्रोफीनोफॉस (0.05%) क्रमशः 5.50, 4.78 तथा 4.65 कि ग्रां/पेड की अधिक उपज देकर, चिंतामणि मे चाय मच्छर पर अत्यधिक प्रभावशाली पाया गया। जगदलपूर मे ट्रैअजोफास उपचार मे अत्यधिक गुटली उपज (142.37 कि ग्रां/हेक्टर) मिला जो प्रोफीनोफास (116.64 कि ग्रां/हेक्टर) से समानता दिखाई, झारग्राम मे 6.90 कि ग्रां/पेड की अधिकतम गुटली उपज शिफारित फुहार सूची मे मिला जिसके बाद प्रोफीनोफास (6.60 कि ग्रां/पेड) रहा। मडकत्तरा और वेंगुर्ला मे, λ-सैहालोथ्रीन निशाने कीटो का नियंत्रण मे अत्यंत प्रभावी उपचार पाया गया। वृद्धाचलम मे शिफारित फुहार सूची मे 7.0 कि ग्रां/पेड का औसत वार्शिक गुटली उपज मिला जो प्रोफीनोफॉस (6.60 कि ग्रां/पेड)।

बापट्ला मे काजू कांड और जड छेदक (CSRB) का रोगहर नियंत्रण प्रयोगो मे लिंडेन 0.2% जिसमे 54.54 से 70.00 प्रतिशत का बिना हानित पेड थे, और उसके बाद काबार्रिल 1.0% रहा जिसमे बिना हानित पेड का प्रतिशतता 45.45 से 66.67 तक रहा। क्लोरोपैरीफास (0.2%) से सिर्फ सूंडी निकालने से 40 प्रतिशत उपचरित पेडो बिना पुनर्हानित रहा। क्लोरोपैरीफास (0.2%) मे बिना पुनर्हानित पेडों का प्रतिशतता अलग-अलग रहा; जगदलपूर मे (66.66), झारग्रम मे (100.0), मडकत्तरा मे (94.90), वेंगुर्ला मे (93.33) जब मोनोक्रोटोफास (0.2%) से 87.50 प्रतिशत उपचरित पेड बिना हानित रहा।

प्रादेशिक प्रमुखतता की कीटो का जीवपरिस्तिथि प्रयोगो मे, अधिकत्म तापमान (r= -

0.31) तथा न्यूनतम तापमान (r= -0.30) प्ररोह इल्ली का क्रिया पर प्रभाव दिखाया जब बारिश और बारिश का दिनो ने सार्थक रूप से पुष्पहुच्छ थ्रिप्स का क्रिया पर ऋणात्मक प्रभाव (क्रमशः r= -0.26 व r= -0.31) दिखाई। भुवनेश्वर मे हल्दी थ्रिप्स पर प्रकाशमान सौर्य धंटा घनात्मक सार्थक प्रभाव दिखाया जब शाम का RH ऋणात्मक प्रभाव दिखाई, काला थ्रिप्स पर प्रकाशमान सैर्य घंटा सार्थक रूप से संबंधित रहा। मडकत्तरा मे सिर्फ कनिष्ट तापमान और बारिश चाय मच्छर संख्या पर सार्थक और ऋणात्मक प्रभाव दिखाई। चाय मच्छर हानि वेंगुर्ला मे RH तथा कनिष्ट तापमान से ऋणात्मक और सार्थक संबंध दिखाया जब थ्रिप्स का हानि, कनिष्ट तापमान और RH से ऋणात्मक सार्थक संबंध दिखाया। वृद्धाचलम मे पत्ता जालकीट का संख्या पर बारिश, RH तथा गरिष्ट तापमान ने सार्थक रूप से ऋणात्मक प्रभाव दिखाया।

बापट्ला मे जननद्रव्यो मे सहिष्णु या निरोधकता पहचानने का प्रयोगो मे, दस एक्सशनो ने प्ररोह इल्ली की करिष्ट हानि; 0.76 से 0.77 प्रतिशत दिखाकर परस्पर समानता दिखाई। भुवनेश्वर मे सभी MLT-2 एनट्रीयो ने प्ररोह इल्ली तथा पुष्पगुच्छ थ्रिप्स का हानि को प्रवण्ता दिखाई जिसका संख्या 24 से 50 प्रति 10 पुष्पगुच्छ।

जगदलपूर मे पुष्पगुच्छ थ्रिप्स का हानि CARS-5, CARS-3 तथा T-30/1 मे क्रमशः कनिष्ट रहा। मडकत्तरा और वेंगुर्ला की सभी एकसशनो ने चाय मच्छर, पत्ता सुरंग कीट, पत्ता और पुष्पगुच्छ जालकीट, सेब और गुटली छेदक तथा पुष्पगुच्छ थ्रिप्स को विविध स्तर की प्रवण्ता दिखाई।

तकनिकी हस्तांतरण :

इस साल मे खुल 4.0 लाख कलमनो तैयार किया गया और काजू कृषको के अलावा विविध सरकारी और गैर सरकारी संस्थाओ को बाँटा गया। काजू कृषि की विविध विचारों, काजू सेब का इस्तमाल, मूल्य वृद्धि तथा अन्य संबंधित पहलुओ पर विविध केंद्रो मे प्रशिक्षण

आयोजित किया गया। काजू उत्पादन के बारे मे विविध केंद्रो का वैज्ञानिको मे रेडियो उपन्यास तथा दूरदर्शन का मुद्रित कार्यक्रम मे शामील थे। सस्य संरक्ष्ण, जल और मिट्टी संरक्षण, रोपण तकनिकी तथा पोषकांश प्रबंधन, वैसे ही काजू संस्करण संबंधी विचारो पर, स्थानीय कृषको, विविध जनजातियो और अन्य ठेकेदारो की फायदे के लिए जनांधोलन आयोजित किया गया।

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 eight centres and one sub-centre; 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. These centres of AICRP on Cashew are located in eight 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 2006-07 was Rs.122.80 lakhs (Rs.92.10 lakhs ICAR Share) and the expenditure was Rs.129.41 lakhs (Rs. 97.06 lakhs ICAR Share).

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

1. Evolving high yielding varieties with export grade kernels, tolerant/ resistant to pests and diseases.
2. Standardizing agro- techniques for the cashew crop under different agro-climatic conditions.
3. Evolving cost effective and efficient pest and disease management practices.

The salient findings during the period under report, under different projects initiated to fulfill these objectives have been presented hereunder under the following sections.

CROP IMPROVEMENT

The total number of accessions conserved in various Regional Cashew Field Gene Banks (RCFGBs) at different AICRP Centres so far is 1272. The germplasm evaluation trials indicated that at Bapatla, the highest cumulative nut yield for 6 harvests was recorded in the entry T.No.268 with 14.66 kg per tree followed by BLA 39/4-1 with 12.55 kg / tree. At Jhargram, the cumulative yield of 14 years was maximum in JGM 34/7 (276.64 Kg/tree) followed by JGM – 70/2 (211.56 kg/tree) and JGM – 48/1 (174.72 kg/tree). Five collections having compact canopy and bunch bearing were collected from Ansurli which had bold nut character (> 8.0 g) and are conserved at Vengurla Centre.

In Multilocation Trial II, the highest cumulative nut yield per tree (11 harvests) was recorded in T.10/19 (61.81 kg) followed by T.30/1(53.19 kg) at Bapatla; H-303 (71.00) followed by H-320 (70.60), NRCC-Sel.-2 (62.50) and H68 (61.70) at Bhubaneswar; H-320 (97.51 kg/tree), NRCC Sel-2 (89.11 kg/tree) and M-15/4 (73.40 kg/tree) (12 harvests) at Chintamani. At Madakkathara H-303, H-320, H-1608 and M-15/4 and T-3/28 gave cumulative yield exceeding 20.00 kg/tree. At Vengurla, the highest cumulative yield was reported by H-303 (6.61 kg/tree) followed by H-255 (5.27 kg/tree). In Multilocation Trial III, at Bhubaneswar, BH-6 recorded maximum nut weight of 9.70 g with 32 shelling percentage while, at Chintamani H 32/4 had highest nut weight of 8.70 g followed by BH-6 (8.55 g). At Vridhachalam, BH-6 recorded highest yield of 0.54 kg/tree during first year.

Growth parameters of KGN-1 was similar to the local check at Jhargram. At Chintamani, plant height of KGN-1 was lesser then local check (Chintamani-1) and was higher then the local check at all the other centres.

In hybridization trial, H-10 recorded the highest cumulative yield of 11.03 kg/tree followed by H-36 which gave 10.55 kg/tree at Bapatla. The hybrid, A6 was identified as the most promising hybrid at Bhubaneswar which recorded the highest nut yield of 11.00 kg/plant, highest cumulative nut yield of 41.60 kg / plant at 9th harvest having nut weight of 8.70 g and shelling percentage of 34.00. At Chintamani, H-216 (2/7 Tuni x Vetore-56) recorded an yield of 1.25 kg/tree and shelling percentage of 32.75 during the first harvest. The hybrids developed at Jhargram had high shelling percentage viz., H – 57 (38.96%) followed by H – 27 (37.30%) and H – 69 (35.10%). All the high yielding hybrids developed at Madakkathara had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

CROP MANAGEMENT

The significantly highest cumulative nut yield was recorded in the treatment $N_2P_1K_1$ (33.47 kg/tree) followed by $N_2P_2K_1$ (28.18 kg/tree) at Bapatla. Under on-farm trials, conducted by Bapatla Centre, the number of panicles per square meter and nut yield/tree

were the highest in the highest dose treatment (25.00 /m^2 and 14.25 kg/tree respectively). At Jhargram, nitrogen at a moderate dose (500 g/tree) and phosphorus and potassium at the high dose (250 g/tree) resulted in maximum annual nut yield (12.93 kg/tree). Highest nut yield (8.85 kg/tree) was obtained by application of higher levels of N, P and K fertilizers at the rate of 1000g : 125g P : 250g K per tree at Vridhachalam.

In the trial on fertilizer application in high density cashew plantation, at Bhubaneswar, the cumulative nut yield over 5 years was highest in S_3 (600 plants/ha) (83.40 q/ha) followed by S_2 (400 plants/ha) (74.68 q/ha) and S_1 (200 plants/ha) (38.39 q/ha); and fertilizer dose of 150 N:P:K at 150:50:50 kg/ha was found significantly superior. At Chintamani, the highest yield per plant (3.20 kg/plant) and highest nut yield kg/ha (1575 kg/ha) was recorded with highest dose of fertilizer N: P: K at 225:75:75 kg/ha. The maximum annual nut yield/tree (0.88 kg/tree) and per hectare (325 kg/ha) was recorded by a fertilizer level of 75: 25: 25 kg NPK/ha at Madakkathara Centre. At Vridhachalam, M_1S_3 (75:25:25 kg/ha and 600 pl/ha) resulted in the maximum nut yield per tree (6.50 kg).

In observation trial on high density planting, the mean yield per plant during 6^{th} harvest at Chintamani under high density planting (2.03 kg/tree) was lesser compared to normal planting (6.53 kg/tree). At Madakkathara, the yield per tree was marginally high under normal density (4.12 kg) as compared to high-density planting system (3.66 kg) during the tenth year of planting.

In intercropping trial, the total net returns per hectare from inter-crops as well as main crop at Bhubaneswar after 3 years, revealed that maximum return was received from colocasia (Rs 44,908/-) followed by brinjal (Rs.37,666/-), bhindi (Rs 36,650/-) and cowpea (Rs. 36,398/-). At Jhargram, the cost benefit ratio also depicted that maximum profit could be obtained with cluster bean (Rs.19,142/-), intercropping under cashew plantation followed by pigeon pea (Rs.17,771/-) and

ground nut (Rs.13,923/-). At Madakkathara, the highest net return (Rs. 48766/-) was recorded by tapioca followed by colocasia (Rs. 43290/-).

CROP PROTECTION

In the trial on chemical control of pest complex, at Bhubaneswar, L-cyhalothrin could significantly reduce incidence of shoot tip caterpillar, apple and nut borer and inflorescence thrips. The profit (Rs.35.70 /tree) over control was maximum in L-cyhalothrin treatment. At Chintamani, the yield obtained was highest in the monocrotophos and carbaryl treated trees (5.80 kg/tree), which was on par with Lambda cyhalothrin (5.20 kg/tree) and profenofos (5.40 kg/tree). At Jagdalpur, triazophos and L-cyhalothrin could significantly reduce damage by leaf caterpillar and leaf folder. The maximum yield could be realized in triazophos (0.1%) treatment (153.37 kg/ha) followed by profenophos 0.05% (118.64 kg/ha). At Madakkathara, triazophos and profenophos could reduce incidence of TMB both in shoots and panicles. At Vengurla, L-cyhalothrin significantly reduced damage by inflorescence thrips.

In the curative control trial on Cashew Stem and Root Borer (CSRB), monocrotophos could result in less incidence of CSRB in treated trees at Bapatla, Jagdalpur and Vridhachalam centres. Chlorpyriphos performed best in Bhubaneswar, Jhargram and Vengurla in reducing re-infestation by CSRB. The preferred zone of attack was collar + stem in most of the centres.

In the project on influence of biotic and abiotic factors on the incidence of pest complex, at Bapatla, the populations of leaf and blossom webber and leaf thrips were positively influenced by maximum temperature whereas, leaf folder and leaf miner were influenced negatively by maximum temperature. At Bhubaneswar, the shoot tip caterpillar, leaf miner and leaf beetle did not have significant correlations with any of the weather parameters whereas maximum temperature positively influenced leaf and blossom webber and apple and nut borer populations. At Jagdalpur, activities of leaf folder, leaf caterpillar

and leaf and blossom webber were not influenced by any of the weather parameters. Leaf miner, apple and nut borer, aphids and mealy bug incidence showed positive correlation with maximum temperature at Vengurla.

While screening the germplasm for locating tolerant/resistant types, at Bhubaneswar, all the accessions were found infested by both shoot tip borer (upto 22.50 %) and leaf and blossom webber (upto 10.50 %), Inflorescence thrips (Yellow Thrips and Black Thrips) population with a range of 0-16 numbers/ inflorescence. By application of Borax @ 100 g/tree 8.10% increase in mean nut yield was observed at Bhubaneswar. At Jagdalpur, the minimum population of inflorescence thrips was seen in Ullal-1 followed by CARS-3 and CARS-4. At Vridhachalam, damage score due to TMB was less than 1.5 in H 1608, H 2/16, VTH 59/2 and V 5.

TRANSFER OF TECHNOLOGY

During the year a total of over 3,01,990 grafts have been produced at different centres of AICRP on Cashew and distributed to various Government and Non-Government agencies apart from cashew cultivators. Trainings have been organised on different aspects of cashew cultivation, utilization of cashew apple, value addition and other related aspects by different centres. Theme based campaigns on plant protection, soil and water conservation, planting techniques and nutrient management as well as, processing aspects have been organised for the benefit of local cultivators, tribals and other entrepreneurs. Scientists of different centres have given radio talks and recorded televised programmes on cashew cultivation.

CENTRES OF ALL INDIA COORDINATED RESEARCH PROJECT ON CASHEW

MAP

HEADQUARTERS OF AICRP ON CASHEW

▲ ***National Research Centre for Cashew, Puttur 574 202***

AICRP on cashew Centres:

1. Cashew Research Station, (ANGRAU), 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.

GENERAL CHARACTERISTICS OF CENTRES OF AICRP ON CASHEW

The eight coordinating centres and one sub centre are spread 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 and Vengurla. 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 mms and the temperature ranges from 22 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.

Maidan tract characterized by even land has Chintamani and Jagdalpur centres in this region. Chintamani comes under Region III (Southern dry region), zone V (Eastern dry zone) 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. Jagdalpur is located at 17^o 45' to 20^o 34' N and 80^o 15'to 82^o 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^o C and 6^o 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.

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 total number of germplasm accessions conserved in RCFGBs so far is 1272. At Bapatla, the highest cumulative nut yield (14.66 kg/tree) for 6 harvests was recorded in the entry T.No.268 followed by BLA 39/4-1 with 12.55 kg per tree. At Jhargram, the cumulative yield of 14 years was maximum in JGM 34/7 (276.64 kg/tree) followed by JGM – 70/2 (211.56 kg/tree) and JGM – 48/1 (174.72 kg/tree). Five collections having compact canopy and bunch bearing were collected from Ansurli which had bold nut character (> 8.0 g) at Vengurla Centre.

Germplasm Collection:

During the current year 11 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 1272 (Table 1.1).

Table 1.1: Cashew germplasm holding in different centres.

Centre	No. of accessions		
	Existing	Collected during 2006	Total existing 2006-07
East Coast			
Bapatla	132	--	132
Bhubaneshwar	95	2	97
Jhargram	106	2	108
Vridhachalam	269	--	269
West Coast			
Madakkathara	148	--	148
Pilicode	45	--	45
Vengurla	277	5	282
Maidan tract/others			
Chintamani	128	2	130
Jagdalpur	61	--	61
TOTAL	**1261**	**11**	**1272**

Germplasm Evaluation :

Cashew germplasm available at different AICRP-Cashew Centres have been evaluated for growth and yield parameters during 2006 and relevant particulars are mentioned centrewise.

BAPATLA

Among the accessions, H-95-2 recorded highest plant height (6.30 m), maximum mean spread of canopy recorded in the 6/20 (8.40 m) followed by H-95-5 (8.17 m). Maximum number of bisexual flowers per panicle was recorded in 2/14 (285.50) followed by T.No.277 (233.50). The highest nut yield was obtained in the accession T.No.268 of 6.95 kg/tree followed by BLA 39/4-1 of 6.67 kg/tree. The highest cumulative nut yield since 2001 was recorded in the entry T.No.268 which was 14.66 kg/tree followed by BLA 39/4-1 with 12.56 kg/tree (Table 1.2).

Table 1.2 : Performance of cashew accessions at Bapatla

Accession Number	Plant Height (m)	Plant Spread (m)		No.of bisexual flowers	Annual Nut yield/tree (Kg) (2005-06)	Cumula-tive Nut yield/tree (Kg) (2001-06)
		E-W	N-S			
T.NO.71	5.50	7.03	6.20	114.75	5.12	10.05
T.NO.233	4.55	4.80	7.30	170.00	2.43	10.54
T.NO.268	4.62	7.96	7.30	116.75	**6.95**	**14.66**
T.NO.277	5.40	7.13	6.50	**233.50**	3.06	8.13
2/14	4.93	6.10	5.70	**285.50**	4.03	8.55
5/1	6.07	8.02	7.10	119.50	5.90	10.47
6/20	5.30	**8.70**	**8.10**	197.25	4.34	9.06
9/8L	3.60	6.40	7.85	204.25	4.80	11.67
15/4	4.90	4.80	4.80	215.75	3.35	10.68
40/1	5.07	6.07	4.95	127.00	5.04	9.89
Hy-94-5	4.20	7.20	5.50	95.52	3.70	7.83
Hy-95-2	**6.30**	6.05	8.30	76.65	4.20	8.13
Hy-95-4	**6.16**	7.33	6.83	96.75	5.80	11.69
Hy-95-5	5.50	**8.65**	**7.70**	125.52	4.83	9.45
BLA 39/4-1	4.30	6.00	5.50	98.25	**6.67**	**12.56**

BHUBANESWAR

Two elite types were collected from Bapatla, Andhra Pradesh and Ranasinghpur, Bhubaneswar which had nut weight of more than 8.00 g with yellow apple. Out of the 55 germplasm accessions planted in the year 2002 the nut yield (kg/plant) ranges from 0.9 -1.8 in 15 nos. of accessions at second harvest having nut weight (g) ranging from 4.50 to 9.70 and shelling (%) from 28 to 42. From the 25 germplasm accessions planted during 2003 at first harvest highest nut yield each of 0.40 kg/plant was recorded in accession no. OC 123 & OC 124 with shelling percentage of 28 % & 29 % and nut weight of 6.60 g and 7.40 g respectively. Nut weight exceeds 7.00 g in 33 accessions (Table 1.3).

Table 1.3 : Performances of promising germplasm accessions during 2006 at Bhubaneswar

Accession No.	No. of nuts/panicle	Nut weight (g)	Apple weight (g) & colour	Nut yield (kg/ plant)	Cumulative nut yield (Kg/plant)	Shelling (%)
OC37	1	**9.5**	55(Y)	0.1	0.2	22
OC55	3	5.4	38(Y)	**0.9**	1.1	29
OC56	4	5.3	30(Y)	**1.1**	1.5	31
OC59	3	4.5	23(R)	**1.0**	1.1	42
OC60	3	**7.0**	50(R)	**1.2**	1.5	28
OC65	3	5.7	75(Y)	**1.0**	1.3	29
OC66	4	5.2	43(R)	**1.8**	2.3	32
OC69	2	**10.9**	66(YR)	0.6	1.0	26
OC77	2	5.3	45(R)	**0.9**	1.0	33
OC83	3	5.9	45(R)	**1.0**	1.1	28
OC84	1	**9.1**	65 (R)	**1.2**	1.3	28
OC85	1	**15.1**	62(Y)	0.1	0.2	27
OC92	3	4.7	46(Y)	**1.0**	1.1	30
OC100	3	**7.3**	28(Y)	**0.9**	1.0	28
OC102	3	5.1	37(Y)	**0.9**	1.0	29
OC109	3	6.0	47(Y)	**1.7**	1.8	28
OC110	3	4.6	29(YR)	**0.9**	1.0	36
OC111	1	**12.4**	60(Y)	0.3	0.3	25
OC113	2	**9.7**	61(Y)	**1.2**	1.5	28
OC128	1	**15.0**	65(Y)	0.1	0.1	23
OC129	2	**10.2**	61(Y)	0.3	0.3	29

N. B.: R- Red, Y-Yellow, RY- Reddish Yellow, YR-Yellowish Red

CHINTAMANI

Among the four promising accessions, Vengurla-5 recorded highest annual nut yield of 23.0 kg/tree with a mean nut yield of 14.99 kg/tree followed by ME- 4/4 which recorded nut yield of 22.0 kg/tree.

The accession ME-4/4 recorded highest mean nut weight of 7.94 g with shelling percentage (30.0%) followed by 5/37 Manjeri having a nut weight of 7.22 g and 29.50 percent shelling. The accession ME-4/4 has consistently recorded least incidence of TMB.

The variety Vengurle-5 recorded highest cumulative yield of 270 kg/tree followed by ME-4/4 and 5/37 Manjeri which recorded 260 kg/tree and 258 kg/tree, respectively (Table 1.4).

Table 1.4 : Yield performance of promising germplasm accessions at Chintamani

Accession	Year of planting	Nut Yield (kg/tree)	Cumulative yield (kg/tree)	Mean nut Yield (kg/tree)	Mean nut weight(g)	Shelling (%)
3/108 Gubbi	1982	25.00	240.67 (22 yrs)	10.94	6.18	28.0
ME - 4/4	1985	22.00	259.80 (18 yrs)	14.43	7.94	30.0
5/37 Manjeri	1985	20.00	257.59 (18 yrs)	14.31	7.22	29.5
Vengurla - 5	1985	23.00	269.93 (18 yrs)	14.99	6.45	27.4

Four local accessions having bold nut character have been identified and planted for further evaluation. A total of 99 accessions from germplasm collections were described as per IPGRI descriptors (Table 1.5).

Table 1.5: Germplasm collections at Chintamani

Taluk	Age in years	Accession	Spread (m)		Nut yield(kg)	Nut wt.(g)	Shelling %
			E-W	N-S			
Mulbagal	22	HGS-1	5.4	5.2	14.0	10.80	33.29
Sidlaghatta	30	U.K-1	4.8	4.5	12.0	9.15	28.81
Mulbagal	15	MMN-1	19.0	18.0	25.0	9.12	28.17
Chintamani	25	G.R-1	10.0	9.6	25.0	7.98	28.12

JAGDALPUR

The plant height was maximum (3.88 m) in NRC-192. Canopy spread was wider in NRC-192 (E-W/N-S = 6.16/6.02 m). Highest Nut weight (9.00 g) & apple weight (96.50 g) was recorded in NRC-140. The number of fruits per panicle was maximum in NRC-137 (4.24). Nut yield/tree was highest for NRC-137 (6.80 kg), followed by NRC-138 (5.90 Kg). The cumulative nut yield was highest in NRC- 137 (23.50 kg) with 8 harvests. Mean nut yield was found to be highest for NRC-137 (2.93 kg) followed by NRC-191 (2.12 kg). Shelling was found highest in NRC- 137 (32.08%) followed by NRC-138 (32.02%) (Table 1.6).

Table 1.6 : Performance of NRCC germpalsm at Jagdalpur

Accession	Year of planting	Yield during 2006-07 (Kg)	Cum. yield Kg/Plant (08 No. of harvests)	No. of fruits/ panicle	Mean weight/ nut (g)	Mean weight/ apple (g)	Shelling (%)
NRC- 130	1996-97	2.13	8.83	2.36	8.30	60.40	29.60
NRC- 131	1996-97	1.81	10.95	3.50	8.20	47.20	29.80
NRC- 136	1996-97	2.25	8.65	3.24	7.50	60.20	31.80
NRC- 137	1996-97	**6.80**	**23.50**	4.24	7.25	61.00	32.80
NRC- 138	1996-97	5.90	16.91	3.60	8.30	67.30	32.20
NRC- 140	1996-97	2.85	12.24	2.80	9.00	96.50	28.00
NRC- 190	1996-97	2.50	6.87	3.32	6.50	58.20	32.15
NRC- 191	1996-97	3.45	16.97	3.44	6.80	37.80	28.31
NRC- 192	1996-97	1.20	3.64	2.53	7.60	59.40	28.50
NRC- 193	1996-97	3.24	13.58	3.20	6.80	46.50	27.25

JHARGRAM

The mean nut weight of the three accessions namely JGM – 34/7, JGM – 48/1 and JGM – 34/3 was 8.80 g, 8.20 g and 7.80 g respectively. Excepting JGM – 34/7, the other two accessions had higher shelling percentage. JGM – 38/6 had also high shelling percentage (33.26%) with a nut weight of 5.60 g. Maximum yield was recorded in JGM – 34/7 (28.33 kg/tree) followed by JGM – 70/2 (17.63 kg/tree) and JGM – 38/6 (16.55 kg /tree). The cumulative of 14 years was maximum in JGM 34/7 (276.64 kg/tree) followed by JGM – 70/2 (211.56 kg/tree) and JGM – 48/1 (174.72 kg/tree) (Table 1.7).

Table 1.7 : Performance of promising germplasm accessions at Jhargram.

Accession No.	Year of planting	Mean nut wt (g)	Mean Apple wt (g)	Shelling %	Yield (kg/tree)	Cum. yield (kg/tree) 14 harvests
JGM – 6/5	1986	6.00	14.50	30.35	9.67	130.48
JGM – 18/2	1984	6.20	55.00	29.89	7.51	123.32
JGM – 34/3	1984	7.80	51.25	32.97	9.62	167.98
JGM – 34/7	1984	8.80	57.50	27.93	28.33	276.64
JGM – 38/6	1985	5.60	37.86	33.26	16.55	148.98
JGM – 48/1	1983	8.20	72.50	33.69	14.56	174.72
JGM – 48/2	1983	7.00	50.00	27.03	7.26	87.12
JGM – 70/2	1984	7.20	50.00	34.74	17.63	211.56

MADAKKATHARA

Highest yield was obtained in H-8-10 (10.70 kg) followed by Brazil Malavi (8.80 kg), V1 (8.80 kg) and H-3-9 (8.70 kg). The highest nut weight was recorded in H 8-8 (10.20 g) followed by Brazil Malavi (9.20 g) (Table 1.8).

Table 1.8: Yield and yield attributes of promising germplasm accessions at Madakkathara

Accession No	Year of plantin g	Nut yield (kg/tree)	Cum. Yield (kg/tree)	Mean nut wt (g)	Mean apple wt. (g)	Shelling %
V3	1990	8.40	26.10	7.30	49.70	27.23
H-3-9	1989	8.70	29.70	8.60	83.40	25.90
A-microcarpa	1998	8.30	30.30	7.60	92.30	26.60
UN-50	1986	6.50	16.60	7.10	83.40	25.80
H-8-10	1989	10.70	29.70	8.50	56.00	27.40
H-8-8	1989	6.80	14.80	10.20	94.60	26.30
Brazil Malavi	1996	8.80	12.10	9.20	91.00	25.60
V-1	1990	8.80	19.30	6.60	58.20	25.50

PILICODE

Among the five accessions planted in 1998, PLD – 4 was found to be superior in yield and cumulative nut yield than PLD – 3 and all other varieties are on par for all for the above characters. The canopy spread of the trees significantly varied between the accessions. PLD -12, PLD -17, and PLD -20 were on par and superior

to the other types planted during the year 2000. PLD-57, the dwarf type was used for hybridization programme with MDK-1 and ANK-1 (Table 1.9).

Table 1.9: Biometric observations of Cashew germplasm at Pilicode

Accession No./Variety	Plant Height (m)	Collar Girth (cm)	Canopy Spread(m)		No.of Panicle/ m^2	Yield of nuts/plnt (Kg)	Cum. nut yield /tree(Kg)
			E-W	N-S			
PLD-1	6.15	62.50	5.80	5.10	1.75	3.65	8.61
PLD-3	6.65	81.50	6.25	4.75	1.25	2.39	4.34
PLD-4	6.93	81.16	3.70	7.60	1.96	4.91	10.30
PLD-15	6.20	63.00	5.80	4.95	1.12	3.00	4.70
PLD-16	5.80	60.50	4.25	4.10	1.50	3.85	9.08
PLD-12	6.93	77.67	6.77	7.76	3.42	0.00	1.10
PLD-17	7.50	92.00	8.90	9.30	1.00	0.00	0.35
PLD-18	7.55	76.00	6.60	6.80	1.50	0.00	0.77
PLD-19	7.40	54.00	4.80	5.80	1.75	0.00	0.00
PLD-20	8.10	90.00	9.70	8.30	2.00	0.00	0.40
PLD-57	0.67	16.77	2.18	2.37	5.80	0.200	0.30
CD 0.05	NS	NS	1.92	1.64	NS	2.05	1.5

VENGURLA

During 2005-2006, five local types were collected from Banda region of Sindhudurg district and are planted for evaluation.

The 14 types from Thane, Raigad, Kolhapur and Sindhudurg districts were evaluated for growth and yield characters. The accession RFRS-171, 172, 176 and 178 had bold nut character wherein nut weight was more than 10.00 g (Table 1.10).

Table 1.10 : Growth and yield observations of germplasm collection during 2001-02 at Vengurla

Accession No.	Height (m)	Girth (cm)	Spread (m)		Laterals /Sq. m	Panicles /Sq. m	Yield (g)	Nut weight (g)	Apple weight (g)
			E.W.	N.S.					
RFRS 171	3.75	43.50	3.82	4.62	21.50	13.00	0.17	12.15	50.00
RFRS 172	4.00	44.33	4.53	4.47	29.00	21.00	0.12	12.56	54.66
RFRS 173	4.13	48.67	4.81	4.73	28.00	17.33	0.53	6.50	45.00
RFRS 174	4.38	49.00	4.35	4.45	20.33	12.00	0.08	6.50	55.00
RFRS 176	3.53	41.33	4.73	4.55	21.00	14.00	0.06	12.00	47.00
RFRS 178	4.25	37.33	4.57	6.00	30.00	23.50	0.08	7.00	80.00
RFRS 180	4.22	42.33	6.05	4.62	23.33	16.33	0.10	10.33	54.33
RFRS 181	2.80	18.00	3.70	3.55	22.00	19.00	-	-	-
RFRS 183	4.45	55.00	6.10	6.80	30.00	20.75	0.20	8.00	55.00

Five collections having compact canopy and bunch bearing were collected from Ansurli which had bold nut character (> 8.00 g) (Table 1.11).

Table 1.11: Information of new germplasm at Vengurla

Name of type	Collection site	Nut weight (g)	Apple weight (g)	Apple colour	Peculiar characters
SVK-1	Ansurli (Banda)	8.6	83.56	Red	Compact canopy and bunch bearing
SVK-2	Ansurli (Banda)	9.2	72.0	Red	Compact canopy and bunch bearing
SVK-3	Ansurli (Banda)	9.0	79.50	Yellow	Compact canopy and bunch bearing
SVK-4	Ansurli (Banda)	8.5	64.63	Red	Compact canopy and bunch bearing
SVK-5	Ansurli (Banda)	8.8	67.50	Red	Compact canopy and bunch bearing

VRIDHACHALAM

Eight germplasm accessions collected from Cuddalore, Karaikal, Tanjore and Kanyakumari district during 1999 were evaluated. All the accessions had an nut weight of more than 5.80 g and shelling percentage exceeding 27.00 (Table 1.12).

Table 1.12 : Performance of cashew germplasm accessions at Regional Research Station, Vridhachalam

Accession No.	Year of planting	Nut yield / plant (Kg)	Cumulative nut yield / plant(Kg) (5^{th} harvest)	Nut weight (g)	Mean weight/ apple (g)	Shelling %
VSK 1	1999	3.10	10.66	6.60	52.40	27.40
VSK 2	1999	3.45	11.28	6.80	50.90	27.80
SL 1	1999	3.63	11.67	7.00	68.40	28.40
TK 1	1999	3.33	11.95	5.80	64.80	27.70
NK 1	1999	3.33	10.97	6.60	55.20	28.00
KK 1	1999	2.60	9.71	7.40	54.60	28.20
PV 1	1999	3.00	10.55	6.00	58.60	28.20
AM	1999	2.32	9.38	6.20	44.80	27.40

Among the accessions TK 1, SL 1 and VSK 2 had cumulative yield exceeding 11.00 kg/tree in five harvests.

Gen.3. Varietal Evaluation Trials

2. 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 nut yield per tree (11 harvests) was recorded in T.10/19 (61.81 kg) followed by T.30/1(53.19 kg) at Bapatla; H 303 (71.00) followed by H 320 (70.60), NRCC-Sel.-2 (62.50) and H 68 (61.70) at Bhubaneswar; H-320 (97.51 kg/tree), NRCC Sel-2 (89.11 kg/tree) and M-15/4 (73.40 kg/tree) (12 harvests) at Chintamani. At Madakkathara, H-303, H-320, H-1608 and M-15/4 and T-3/28 gave cumulative yield exceeding 20.00 kg/tree. At Vengurla, the highest cumulative yield was recorded in H-303 (6.61 kg/tree) followed by H-255 (5.27 kg/tree).

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
Puttur	:	VTH 107/3, VTH 40/1
Year of Planting	:	1992 (1993 at Bapatla, 2002 at Jhargram, 1994 at Vridhachalam)

BAPATLA

The entry T.No 3/33 (5.66 m) followed by H-68 (5.20 m) recorded highest plant height and whereas T.No 3/33 (97.50 cm) followed by H-320 (95.00 cm) recorded maximum stem girth but are on par with each other. The M-44/3 (27.33) followed H-367 (26.83) recorded maximum number of flowering laterals per square meter (26.80) (Table 1.13).

Table 1.13 : Performance of cashew varieties/genotypes in MLT II at Bapatla

Variety/ Genotype	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		Number of flowering laterals m^{-2}
			E-W	N-S	
Hy-3/28	4.88	89.50	8.44	8.13	26.33
T.No.3/33	5.66	97.50	9.18	9.73	25.50
T.No.10/19	5.12	84.50	9.48	8.77	20.36
T.No.30/1	4.36	75.00	7.89	7.63	26.58
H-68	5.20	99.00	10.07	9.57	25.80
H-367	4.77	86.70	9.96	8.27	26.80
H-303	4.75	88.50	8.87	8.70	26.75
H-255	4.10	74.66	6.98	7.12	25.03
H-320	5.15	95.00	9.79	10.43	25.08
M-44/3	4.02	71.90	8.43	7.18	27.33
M-15/4	4.92	72.60	5.32	5.77	26.50
T.No.107/3	4.95	82.33	8.70	6.46	24.75
T.No. 40/1	4.01	80.20	4.60	6.24	26.00
CD at 5%	**NS**	**18.29**	**NS**	**NS**	**2.36**

H 320 (115.00 days) recorded highest number of flowering days followed by H 3/28 (113.00 days).

The maximum mean annual nut yield per tree was recorded in the T. 10/19 (13.57 kg) followed by M 44/3 (10.91 kg) (10.91 kg). The cumulative nut yield per tree was recorded highest in T.10/19 (61.81 kg) followed by T.30/1 (53.19 kg) in eleven annual harvests. The highest nut weight was recorded in H-320 (10.50 g) followed by H-303 (10.55 g). The number of nuts per panicle was highest in M-44/3 (7.11) followed by T.3/33 (5.55) and the shelling percentage was highest in T.10/19 (33.24%) followed by T.107/3 (31.15%). The apple weight of 94.16 g was recorded in T.No.10/19 followed by H-255 (87.33 g) (Table 1.14).

Table 1.14 : Performance of cashew varieties/genotypes in MLT II at Bapatla

Variety/ Genotype	Nut yield/tree (11^{th} harvest) (kg)	Cum. nut yield/tree 11-harvests (kg)	Number of nuts/ Panicle	Nut weight (g)	Duration of Flowering (in days)	Apple weight (g)	Shelling (%)
Hy-3/28	8.24	37.63	4.20	9.25	113	59.50	26.29
T.No.3/33	7.41	38.71	5.55	6.66	108	73.00	29.08
T.No.10/19	13.57	61.81	5.35	6.58	105	**94.16**	**33.24**
T.No.30/1	10.51	53.19	5.15	6.70	102	52.33	28.40
H-68	9.46	36.04	2.05	7.24	112	72.50	28.77
H-367	8.33	32.88	3.90	8.60	112	71.00	27.22
H-303	9.46	30.85	3.33	10.50	112	41.66	25.67
H-255	6.05	24.96	3.25	9.48	112	**87.33**	28.41
H-320	7.92	32.70	5.25	10.66	115	76.50	28.20
M-44/3	10.91	52.53	7.11	5.70	**88**	20.00	29.58
M-15/4	9.18	43.47	4.85	7.18	109	67.00	31.05
T.No.107/3	7.76	25.16	4.25	7.17	109	40.83	**31.15**
T.No. 40/1	7.58	35.55	4.00	9.16	**81**	70.00	25.94
CD at 5%	**2.30**		**0.94**	**0.46**		**2.64**	**1.04**

BHUBANESWAR

Maximum height was observed in H 255 (6.40 m) followed by BPP 10/19 (5.90 m). Maximum canopy spread of 11.10 m in E-W direction was recorded in BPP 3/28 as well as in H 68 followed by H 255 (10.40). N-S canopy spread was observed to be maximum in H 255 (11.7m) followed by BPP 10/19 (10.60 m). In H 255 maximum tree trunk girth of 123 cm was recorded followed by BPP 3/28(121 cm). In the cashew type M 44/3 lowest vegetative parameters were observed in plant height (3.50 m), N-S canopy spread (3.90 m), E-W canopy spread (5.20 m) and tree trunk girth (52.00 cm). The number of flowering laterals/m^2 was maximum in H 303 (24) followed by H 68 (23), M 15/4 (23), BPP 3/33 (23) and H 367 (22) but minimum in NRCC-Sel-1 (10) (Table 1.15).

Table 1.15 : Vegetative & flowering characters of cashew types in MLT- 1992 at Bhubaneswar

Cashew types	Height of plant (m)	Girth of trunk (cm)	Canopy spread (m)		No. of laterals / m^2	No. of flowering laterals / m^2	Duration of flowering (days)
			E-W	N– S			
NRCC-Sel. -1	4.50	83	8.70	8.70	15	10	65
NRCC-Sel. -2	4.80	87	9.10	8.90	22	19	59
M 44/3	3.50	52	3.90	5.20	23	20	70
M 15/4	4.90	100	8.70	8.40	28	23	66
BPP 3/33	5.50	100	7.50	7.50	26	23	76
BPP 10/19	5.90	99	9.70	10.60	18	16	61
BPP 30/1	5.30	88	9.50	8.20	22	19	96
BPP 3/28	5.60	121	11.10	10.40	24	20	76
H 303	5.20	84	8.60	7.90	25	24	90
H 320	5.40	96	10.00	9.40	25	20	89
H 255	6.40	123	10.40	11.70	24	21	71
H 367	4.50	107	10.00	9.60	23	22	80
H 68	5.00	120	11.10	9.00	26	23	66

The highest cumulative yield at 11^{th} harvest (kg/plant) was recorded in H 303 (71.00) followed by H 320 (70.60), NRCC-Sel.-2 (62.50) and H 68 (61.70). Four types had bold nut with nut weight more than 7.00 g, shelling percentage more than 28% and high yielding ability of 2 t/ha. High nut yielders (kg/plant) were H 303 (10.00) followed by NRCC Sel.-2 (9.90) and H 68 (9.40). Apple weight was recorded to be highest in H 367 (91.00 g) followed by M 15/4 (71.00 g) and NRCC-Sel.-1 (68.00 g), where as lowest apple weight was observed in M 44/3 (27.00 g) (Table 1.16).

Table 1.16: Yield and yield attributing characters of cashew types in MLT-1992 at Bhubaneswar

Cashew types	Nut yield (kg/ plant)	Cumulative nut yield (kg/ plant) (11 harvests)	Apple weight (g)	No of Nuts / panicle	Nut weight (g)	Shelling (%)
NRCC-Sel. -1	3.20	27.80	68	3	8.70	31.50
NRCC-Sel. -2	9.90	62.50	48	3	8.60	30.10
M 44/3	1.70	26.20	27	5	5.20	31.00
M 15/4	1.20	26.20	71	1	8.70	30.00
BPP 3/33	6.50	44.70	64	2	7.00	30.20
BPP 10/19	4.30	33.50	63	2	7.00	29.00
BPP 30/1	5.30	55.20	40	4	6.40	29.00
BPP 3/28	7.40	42.90	46	3	7.80	31.50
H 303	10.00	71.00	58	3	9.90	28.70
H 320	5.30	70.60	58	2	9.10	29.60
H 255	2.40	34.50	63	1	9.40	31.10
H 367	3.30	51.00	91	2	10.00	29.10
H 68	9.40	61.70	65	3	8.40	30.50
SE (m) $\pm$ C.D. 5%	1.70 4.95					

CHINTAMANI

Highest tree height of 5.92 m was recorded in the entry NRCC-Sel-1 followed by H-255 (5.64 m) and H-320 (5.50 m).

There was no significant difference in stem girth and it varied from 72.10 to 100.17 cm. Among the entries, the maximum girth was recorded in Ullal-1 (100.17 cm) followed by H-255 (98.44 cm) and the minimum girth was observed in NRCC Sel-2 (72.10 cm).

Significant differences were observed in canopy spread and the highest canopy spread in E-W was recorded by M-15/4 (9.30 m) followed by H-255 (9.28 m), NRCC Sel-1 (9.26 m) and TN-3/33 (9.18 m). The least canopy spread in E-W direction was observed in M-44/3 (7.70 m). Significantly highest N-S canopy spread was recorded by H-255 (9.72 m) followed by H-320 (9.56 m), NRCC Sel-1 (9.51 m) and M-15/4 (9.34 m). The lowest canopy spread in E-W direction was noticed M-44/3 (7.41 m).

The highest number of flowering laterals/m^2 were observed in M-44/3 (15.00) followed by TN-3/33 (14.80) and H-320 (14.00).The least flowering laterals per square meter were recorded by H-303 (5.00) (Table 1.17).

Table 1.17: Growth parameters of cashew entries in MLT-II at Chintamani

Cashew entries	Height of plant (m)	Girth of plant (cm)	Canopy spread(m)		No.of flowering laterals/m^2
			E-W	N-S	
H – 68	5.36	96.94	8.90	9.31	7.00
H – 367	4.78	87.89	8.52	8.33	12.00
H – 303	4.78	95.28	9.10	9.12	5.00
H – 255	5.64	98.44	9.28	9.72	8.00
H – 320	5.50	88.21	8.98	9.56	14.00
M 44/3	4.53	73.72	7.70	7.41	15.00
M 15/4	5.40	92.10	9.30	9.34	10.25
NRCC Sel-1	5.92	96.28	9.26	9.51	8.50
NRCC Sel-2	5.38	72.10	7.82	8.36	12.00
TN 30/1	4.69	86.78	8.35	8.25	9.50
TN 3/33	5.30	92.28	9.18	9.00	14.80
TN 10/19	5.20	88.42	8.12	9.34	8.25
TN 3/28	5.26	87.45	8.62	9.10	11.00
Ullal – 1	5.28	100.17	8.78	8.43	10.50
S.Em ±	0.25	6.57	0.36	0.25	-
CD(P = 0.05)	0.73	N.S	1.04	0.73	-

The nut yield per tree varied significantly and the highest nut yield of 21.83 kg/tree was obtained in H-320 followed by NRCC Sel-2 (17.15 kg/tree) and lowest was in H-68 (7.13 kg) followed by H-367 (8.57 kg/tree).

The entry H-320 recorded highest cumulative yield (97.51 kg/tree) followed by the entries NRCC Sel-2 (89.11 kg/tree) and M-15/4 (73.40 kg/tree) for 12 harvests. H-320 recorded highest nut weight (8.92 g) followed by H-255 (8.90 g) and lowest nut weight was obtained in TN-10/19 (5.15 g) followed by M-44/3 (5.27 g). The shelling percentage was highest in Ullal-1 (29.60%) and TN-10/19 (29.0%) and the least shelling percentage was observed in H-68 (26.10%) (Table 1.18).

Table 1.18 : Yield and yield attributing characters of cashew entries in MLT-II at Chintamani

Cashew entries	Nut Yield (kg/plant)	Cum. yield (kg/tree) 12 harvests	No. of nuts/ panicle	Nut weight (g)	Shelling (%)	Apple weight (g)
H-68	7.13	32.00	6.00	7.58	26.10	85.00
H-367	8.57	57.20	4.50	8.70	29.20	95.00
H- 303	11.18	69.29	3.50	8.12	27.50	55.00
H- 255	13.38	57.46	5.20	8.90	28.60	50.00
H- 320	21.83	97.51	8.00	8.92	28.90	90.00
M 44/3	16.33	71.33	5.00	5.27	27.50	40.00
M 15/4	17.12	73.40	4.00	7.42	28.00	55.00
NRCC Sel-1	9.90	60.50	6.00	7.90	28.15	40.00
NRCC Sel-2	17.15	89.11	5.80	8.45	29.20	55.00
TN 30/1	10.75	64.82	3.60	7.00	28.70	60.00
TN 3/33	11.97	50.12	5.00	7.74	27.80	75.00
TN 10/19	14.08	49.00	4.81	5.15	29.00	30.00
TN 3/28	17.00	61.34	6.56	7.21	28.40	70.00
Ullal – 1	13.62	56.74	6.06	6.95	29.60	35.00
Sem ±	0.37	-	-	-	-	-
CD (P = 0.05)	1.08	-	-	-	-	-

JAGDALPUR

The hybrid, H- 68 was found superior over all the varieties for plant height (3.04 m) and trunk girth (49.33 cm). H-367 had the largest canopy coverage (E-W/N-S=3.14/3.23m). The varieties H-303, 3/33 & 30/1 flowered earlier while 3/28, 10/19, H-68, H-255, H-367, H-320, VRI-1, VRI-2 & V-4 flowered in mid season. NRCC Sel-1 was found the only late flowering variety with lowest flowering duration of 26 days. The number of fruits/ panicle was maximum in H-68 (6.37) followed by H-303, and Vengurla-4. The annual yield (kg/tree) was significantly highest for H-68 (1.92 kg) and the cumulative yield (kg/tree) was highest for H-68 (5.86 kg). Nut weight was highest for Hybrid -255 (10.00 g), while apple weight was highest in Vengurla-4 (67.80 g). Shelling % was recorded maximum for NRCC Sel –1 (34.15) (Table 1.19 and 1.20).

Table 1.19 : Performance of different varieties under MLT II at Jagdalpur

Varieties/ Genotype	Plant height (m)	Girth (cm)	Canopy Spread (m)		Duration of Flowering (Days)	No. of fruits / panicle
			E--W	N--S		
3/28	2.48	43.78	241.25	240.83	40	2.85
3/33	2.48	42.48	266.25	290.97	44	3.08
30/1	2.13	37.22	249.17	260.83	49	2.68
10/19	2.84	46.33	255.00	272.08	37	3.63
VRI-1	1.79	31.00	188.53	198.00	31	2.72
VRI-2	1.37	27.26	127.17	139.17	35	2.60
H-68	3.04	49.33	292.50	297.50	38	6.37
H-255	2.21	43.56	249.44	275.27	37	2.88
H-367	2.45	48.89	314.22	323.50	35	2.60
H-320	2.33	47.44	312.08	312.78	36	3.70
H-303	2.67	44.00	284.17	302.25	31	5.73
NRCC-Sel-1	2.48	40.15	230.33	239.79	26	2.40
NRCC-Sel-2	1.98	29.44	156.17	165.67	34	1.63
Vengurla-4	2.58	43.89	241.00	263.42	36	4.97
SE(m)	0.15	-	10.53	12.42	-	0.13
CD 5%	0.44	NS	30.62	36.13	-	0.38

Table 1.20 : Performance of different varieties under MLT II at Jagdalpur

Varieties/ Genotype	Nut yield (Kg/tree) 4th harvest	Cum. Nut yield (No. of harvests 04)	Nut weight (g)	Apple weight (g)	Shelling %
3/28	0.73	2.20	7.20	52.47	30.32
3/33	0.64	2.02	7.33	49.93	31.17
30/1	0.84	3.12	7.07	33.47	28.30
10/19	0.70	3.01	5.67	41.87	30.97
VRI-1	0.33	1.19	5.93	37.27	33.42
VRI-2	0.30	1.02	5.53	41.33	31.20
H-68	1.92	5.86	9.47	58.67	30.25
H-255	0.80	2.65	10.00	49.67	31.48
H-367	0.93	2.64	9.80	56.20	30.22
H-320	0.78	2.94	8.27	57.33	27.33
H-303	1.45	5.47	9.13	49.13	30.33
NRCC-Sel-1	0.73	1.86	8.07	47.40	34.15
NRCC-Sel-2	0.63	2.33	8.93	31.00	31.02
Vengurla-4	1.53	4.54	9.20	67.80	31.18
SE(m)	0.04	-	0.38	1.24	0.62
CD 5%	0.14	-	1.13	2.55	1.80

JHARGRAM

T. No. 3/.28 had the maximum height (2.56 m). Excepting NRCC Sel– 2 and H – 367, the trunk girth of the other varieties were more than 20 cms. The maximum period of flowering occurred in T.No. 10/19 (73 days) and the minimum flowering period was noticed in M- 15/4 (58 days).

All the varieties were having 2 – 5 nuts per panicle. Nut weight was maximum in H – 367 (7.67 g) followed by H – 255 (7.13 g). H – 255 yielded maximum (0.85 Kg/tree). The shelling percentage was very appreciable in all the varieties and except NRCC – 1 it was more than 30 percent (Tables 1.21 & 1.22).

Table 1.21 : The growth parameters of different varieties under MLT – II at Jhargram

Variety	Plant Height (m)	Trunk Girth (cm)	Trunk Height (m)	Canopy Spread (m)	Canopy area (m^2)	Duration (Days)
T.No.10/19	2.07	22.83	0.14	2.31	8.14	73
T.No.3/33	2.20	25.36	0.18	2.44	9.09	64
T.No.3/28	2.56	23.50	0.16	2.81	12.26	59
T.No.30/1	2.08	21.50	0.16	2.33	8.26	59
H – 68	1.94	20.23	0.35	1.91	5.28	65
H – 367	1.95	17.23	0.13	2.25	7.58	66
H – 303	2.03	20.87	0.16	1.95	7.99	61
H – 255	2.27	26.23	0.15	2.97	13.81	69
H – 320	2.05	22.27	0.31	2.57	8.72	60
M – 44/3	2.44	26.20	0.17	2.60	12.92	68
M – 15/4	1.95	25.40	0.16	2.27	7.65	58
NRCC Sel-1	2.34	26.17	0.15	2.83	11.69	64
NRCC Sel-2	1.62	14.83	0.11	2.60	8.21	64
S. Em ($\pm$)	0.0672	0.5156	0.08	0.07	1.222	
C.D. at 5%	0.139	1.064	0.17	0.16	2.522	
CV	5.49	3.97	78.32	5.48	22.62	

Table 1.22 : The yield parameters of different varieties under MLT – II at Jhargram

Variety	Flowering/m^2	Nuts /m^2	Nuts/ Panicle	Nut wt (g)	Apple Wt (g)	Yield (Kg/tree)	Shelling %
T.No.10/19	25.66	16.0	5.41	5.13	36.00	0.67	30.24
T.No.3/33	27.00	8.50	4.00	4.60	50.67	0.40	33.07
T.No.3/28	23.33	13.58	4.41	5.67	31.00	0.50	34.87
T.No.30/1	25.00	10.42	5.00	5.27	43.67	0.45	34.76
H – 68	29.33	13.50	3.75	5.80	47.47	0.44	33.65
H – 367	27.00	5.75	2.91	7.67	57.67	0.33	31.40
H – 303	27.00	19.42	5.53	5.533	51.33	0.74	31.87
H – 255	27.00	8.75	4.08	7.13	46.17	0.85	33.49
H – 320	28.33	10.92	3.33	5.40	57.00	0.52	34.00
M – 44/3	33.83	15.25	4.01	4.133	42.33	0.82	34.04
M – 15/4	33.00	9.92	3.16	4.93	36.00	0.37	32.02
NRCC –Sel-1	26.33	10.5	3.41	5.27	50.33	0.60	28.59
NRCC –Sel- 2	30.33	9.67	4.00	5.60	42.33	0.44	33.41
S. Em ($\pm$)	2.985	2.375	0.621	0.248	3.172	0.1978	1.48
C.D. at 5%	6.16	4.903	1.282	0.513	6.546	0.408	3.06

MADAKKATHARA

There was no significant difference in tree height among genotypes. Girth and canopy spread differed significantly among the genotypes, with the highest values recorded by T 107/3 (119.33cm) and H 1608 (7.95 E-W, 7.99 N-S), respectively.

There was difference among genotypes for flowering intensity/m2. Highest flowering intensity was recorded in T 107/3 (8.13) and lowest by H 1608 (5.33). The flowering duration was maximum for T 40/1 (146 days) and minimum for Hy 255 (101 days). There was significant difference among genotypes for annual nut yield only. The highest yield was recorded by H-303 (9.17 kg/tree/year) followed by T 107/3 (4.53 kg/tree/year). T 40/1 recorded the highest apple weight (75.0g) followed by T 3/28 (74.0g). H-303, H-320, H-1608 and M-15/4 and T-3/28 gave cumulative yield exceeding 20.00 kg/tree. (Tables 1.23 & 1.24).

Table 1.23 : Performance of different varieties under MLT II at Madakkathara

Variety	Height (m)	Girth (cm)	Canopy spread		Duration of flowering	Flowering intensity/ m^2
			E-W (m)	N-S (m)		
T 30/1	6.54	85.50	8.18	8.04	138	6.67
T 3/33	6.57	92.92	8.71	8.46	115	7.25
T 10/19	5.83	88.17	7.93	7.19	125	7.38
T 3/28	6.43	93.64	6.70	7.45	141	5.75
Hy 68	5.94	93.50	8.56	7.84	102	5.58
Hy 367	4.72	75.92	6.92	7.27	116	9.58
Hy 303	5.83	96.08	8.13	7.40	117	6.33
Hy 255	6.40	104.86	8.62	8.64	101	8.25
Hy 320	6.49	88.00	7.48	7.88	137	6.00
M 44/3	4.84	75.58	9.55	9.50	133	8.08
M 15/4	5.08	89.33	7.90	7.42	115	6.67
T 107/3	6.72	119.33	8.37	8.76	106	8.13
T 40/1	5.59	84.75	7.93	8.14	146	6.58
H1608	5.52	94.44	7.95	7.99	107	5.33
CD 5%	NS	6.62	--	--	8	1.29

Table 1.24 : Yield and yield attributes of cashew types in MLT II at Madakkathara

Variety	Nut Yield during 06-07 (kg/tree)	Cum. nut Yield (kg/tree)	Harvest No.	Nut wt (g)	Apple wt. (g)	Shelling %
T 30/1	2.87	14.70	12	7.00	40.66	24.50
T 3/33	1.33	11.88	4	6.41	50.00	22.90
T 10/19	0.80	7.55	4	6.89	56.00	23.67
T 3/28	3.87	20.50	11	7.80	74.00	24.50
Hy 68	3.80	14.99	10	8.73	57.00	26.30
Hy 367	3.67	14.42	5	8.35	81.00	24.10
Hy 303	9.17	28.20	15	11.40	56.00	21.30
Hy 255	2.00	13.12	6	9.28	55.67	22.40
Hy 320	4.37	24.27	13	8.90	69.33	22.87
M 44/3	2.83	17.52	8	8.26	61.66	23.40
M 15/4	3.23	23.98	9	7.17	40.33	24.20
T 107/3	4.53	14.26	13	9.00	60.49	24.30
T 40/1	2.10	16.70	8	9.00	75.00	24.70
H1608	4.10	23.54	9	9.90	72.00	23.16
CD (0.05)	1.63	1.23		0.71	11.37	0.57

VENGURLA

The maximum height and girth were recorded in T-30/1 (5.81 m and 80.56 cm respectively) while the maximum EW spread was recorded by H 255 (8.27 m) while NS spread was maximum in variety 10/19 (8.07 m).

There was no significant difference in number of laterals per m^2 whereas the maximum number of panicles per m^2 was observed in variety M-44/3. The yield of these varieties did not differ significantly. The nut weight and apple weight was maximum in H-367 (10.96 g and 79.16 g respectively). The yield was in the range of 0.66 kg/tree (M-15/4) to 2.14 kg/tree (H-320). The highest cumulative yield was reported by the type H-303 (6.61 kg/tree) followed by H-255 (5.27 kg/tree) (Table 1.25).

Table 1.25 : Growth and yield observations (2006 season) MLT-1992 at Vengurla

Variety /type	Mean height (m)	Girth (cm)	Spread (m)		Flowering panicles /m^2	Flowering duration (Days)	Fruit set /m^2	Yield (kg/ tree)	Cum. Yield for kg/ tree (3^{rd} harvest)	Nut weight (g)	Apple weight (g)	Shelling (%)
			E.W.	N.S.								
H.No. 255	5.06	72.83	**8.27**	7.82	28.04	115.25	10.86	0.95	5.27	10.16	69.16	30.00
H. No. 303	4.27	61.02	5.85	5.55	20.55	117.55	30.36	2.00	6.61	8.10	74.83	30.00
H. No. 320	5.50	77.83	6.71	6.72	21.58	122.33	20.50	2.14	3.40	8.33	68.73	30.00
H.No.367	3.88	56.41	6.78	6.53	29.00	113.86	14.66	1.00	4.34	**10.96**	**79.16**	27.00
NRCC-Sel.1	5.37	80.08	7.55	7.91	16.66	113.41	16.41	1.11	3.94	8.33	64.83	30.00
NRCC-Sel.2	5.58	61.16	7.41	7.25	21.37	118.33	20.42	0.79	2.77	6.63	50.06	30.00
M-44/3	3.89	52.33	5.35	5.17	**39.58**	116.75	17.13	0.70	2.99	6.10	45.90	32.50
M-15/4	4.97	61.08	6.44	6.63	26.25	114.50	13.91	0.66	2.87	7.33	59.70	30.50
T-10/19	5.52	75.75	7.95	**8.07**	26.50	119.16	12.83	1.44	2.67	6.63	60.13	28.00
T-3/28	5.75	70.63	6.86	6.92	11.44	111.47	9.58	1.24	1.94	6.00	65.83	32.00
T-3/33	5.35	56.41	7.40	8.05	23.71	116.91	13.86	1.37	3.51	7.56	45.90	32.00
T-30/1	**5.81**	**80.56**	8.17	7.71	24.33	116.61	15.00	1.57	4.41	5.43	67.46	30.00
SEm ±	0.28	6.33	0.51	0.47	3.90	2.48	3.16	0.47	-	0.66	2.67	-
CD at 5%	0.83	18.55	1.51	1.43	11.45	N.S.	9.25	N.S.	-	1.95	7.84	-

VRIDHACHALAM

The maximum plant height was recorded by T 10/19 (5.22 m) and maximum stem girth was observed in M 107/3 (68.42 cm). A consistent higher annual nut yield was observed in M 44/3 and M 15/4 types of Vridhachalam. H 320 recorded the highest nut weight of 7.80 g. Highest shelling percentage of 29.60 was recorded in M 107/3 (Table 1.26 & 1.27).

Table 1.26 : Vegetative characters of cashew types in MLT II at Vridhachalam

Variety/ Genotype	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Duration of flowering	Flowering intensity / m^2 (mean of all 4 sides
T. 30/1	4.72	54.44	4.90	70	46.60
T. 3/33	3.96	50.46	5.00	67	36.60
T.10/19	5.22	62.24	6.60	68	40.00
T. 3/28	4.36	58.16	6.20	70	36.70
H 68	4.22	54.46	6.30	68	40.00
H 367	4.16	59.22	6.20	66	43.40
H 303	5.10	64.64	6.40	68	43.00
H 255	4.62	58.62	5.30	71	36.60
H 320	4.46	49.84	6.30	66	43.30
M 44/3	4.68	52.46	6.00	61	45.00
M 15/4	4.88	66.24	6.80	64	53.30
107/3	5.14	68.42	6.40	63	36.70
40/1	4.44	58.16	6.00	66	36.50
SEd	0.27	0.06			
CD 5%	0.79	0.13	NS		

Table 1.27 : Yield characteristics of cashew types in MLT II at Vridhachalam

Variety/ Genotype	No.of fruits / panicle	Yield (kg/tree)	Cum. Yield (kg/tree) (9 harvests)	Nut weight (g)	Shelling (%)
T. 30/1	4.35	4.26	15.84	7.00	27.60
T. 3/33	4.05	4.01	15.61	7.20	28.20
T.10/19	4.15	4.35	15.07	7.20	28.00
T. 3/28	3.90	4.81	16.68	6.80	28.40
H 68	3.86	4.06	16.81	6.40	27.80
H 367	4.45	4.12	16.62	6.60	28.60
H 303	4.62	4.15	19.75	6.80	28.00
H 255	3.90	4.22	14.51	7.60	28.20
H 320	4.40	4.64	18.24	7.80	28.40
M 44/3	4.75	4.21	25.85	6.20	28.50
M 15/4	4.82	5.01	23.62	6.80	28.50
107/3	4.35	4.92	14.88	7.00	29.60
40/1	4.10	4.86	18.43	7.20	29.20
SEd		0.07		0.23	
CD 5%		0.16		0.70	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, BH-6 recorded maximum nut weight of 9.70 g with 32 shelling percentage while at Chintamani H 32/4 had highest nut weight of 8.70 g followed by BH-6 (8.55 g). At Vridhachalam, BH-6 recorded highest yield of 0.54 kg/tree during first year.

Experimental Details :

The trial has been initiated in 2003. The trial comprises of 10 test varieties and 1 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
NRCC, 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

The crop is at initial stage of growth.

BHUBANESWAR

Maximum plant height (2.79 m) and girth (29.75 cm) was observed in H-32/4 and minimum plant height (1.78 m) and girth (18.33 cm) in H 662. The spread of plants was minimum in H-662 in both E-W (2.29 m) as well as N-S (2.14 m) directions. Maximum canopy spread (3.51 m) was observed in BH-85 in E-W direction whereas maximum spread was observed in H-32 / 4 in N-S direction (3.44 m) (Table 1.28).

Table 1.28 : Vegetative character of cashew type at Bhubaneswar

Varieties	Plant height (m) 2006	Girth (cm) 2006	Canopy spread (m)	
			E-W	N-S
BH 6	2.45	26.92	3.05	3.06
BH 85	2.75	29.25	3.51	3.39
H 1597	2.48	28.75	3.25	3.26
K 22-1	2.55	28.97	3.02	3.31
H 662	1.78	18.33	2.29	2.14
H 675	2.29	24.08	2.54	2.70
H 11	2.45	25.92	3.06	3.39
H 14	2.13	21.31	2.47	2.58
H 32/4	2.79	29.75	3.34	3.44
Goa 11/6	2.67	27.58	3.13	3.35
H 2/16(Local Check)	2.59	27.70	2.90	3.28

The highest nut yield of 1.40 kg/plant was observed both in B H6 and H 32/4. Number of nuts/panicle ranges from 2 to 3 in all the types. BH6 recorded maximum nut weight of 9.70 g with 32.00% shelling percentage, whereas minimum nut weight was in H 625 (4.1 g) with 33.20% shelling percentage. But maximum shelling percentage (%) was observed in H11 (33.30) and minimum in H 32 / 4 (28.60) (Table 1.29).

Table 1.29 : Yield and yield attributing characters of cashew types in MLT-1992 at Bhubaneswar

Cashew types	Nut yield (kg/ plant) 1st harvest	Apple weight (g)	No. of Nuts / panicle	Nut weight (g)	Shelling (%)
BH 6	1.40	56	3	9.70	32.00
BH 85	1.03	49	3	7.00	29.10
H 1597	1.03	53	2	7.60	30.30
K 22-1	1.12	49	3	5.50	31.20
H 662	1.16	63	2	8.50	30.70
H 675	0.59	47	3	4.10	33.20
H 11	1.35	51	2	5.80	**33.30**
H 14	0.44	68	2	5.60	32.10
H 32/4	1.40	46	3	7.00	28.60
Goa 11/6	0.78	58	3	7.00	30.00
H 2/16 (Local Check)	1.51	60	3	7.20	29.80
SE (m) ± C.D. 5%	0.311 0.439				

CHINTAMANI

The growth parameters and nut yield recorded significant variation among the varieties / hybrids and maximum plant height was recorded by H-32/4 (3.18 m) followed by Goa - 11/6 (3.01 m) and lowest plant height was recorded by H-14 (2.17 m) followed by H-662 (2.25 m).

Significant variation occurred with respect to stem girth and the highest stem girth was recorded in H-32/4 (41.22 cm) followed by Goa-11/6 (38.75 cm). Canopy spread also varied significantly.

The highest E-W & N-S spread was recorded by H-32/4 (4.55 and 4.56 m respectively). The lowest E-W and N-S spread was recorded by H-14 (2.77 and 2.57 m respectively). Significantly highest nut yield was recorded by H-14 (0.96 kg/tree) followed by BH-85 (0.91 kg/tree) and lowest nut yield was recorded by H-662 (0.49 kg/tree).

H-32/4 had highest nut weight of 8.71 g followed by BH-6 (8.55 g) and lowest nut weight was observed in H-14 (5.15 g). The varieties/hybrids BH-6, BH-85, H-1593 and Goa-11/6 recorded more than 30% shelling (Table 1.30).

Table 1.30 : Growth and yield performance of cashew entries – MLT - III at Chintamani

Entries	Height (m)	Stem girth (cm)	Canopy Spread (m)		Nut yield (kg/tree)	Nut weight (g)	Shelling (%)
			E - W	N - S			
BH – 6	2.57	34.92	4.03	4.02	0.87	8.55	31.60
BH – 85	2.51	37.33	3.74	3.85	0.91	7.58	31.17
H - 1593	2.56	37.83	3.67	3.87	0.60	8.35	30.52
H – 662	2.25	31.25	2.99	3.02	0.49	5.32	29.89
H – 675	2.54	30.30	3.11	2.80	0.71	4.52	31.42
H – 32/4	3.18	41.22	4.55	4.56	0.52	8.71	27.23
K - 22/1	2.57	35.67	3.67	3.51	0.70	5.63	27.83
H –11	2.52	35.58	4.09	4.05	0.55	5.96	24.72
H – 14	2.17	29.67	2.77	2.57	0.96	5.15	29.90
Goa – 11/6	3.01	38.75	3.99	3.79	0.63	8.16	31.48
Chintamani – 1	2.46	30.08	3.65	3.40	0.60	7.65	29.77
S.Em ±	**0.15**	**1.99**	**0.25**	**0.28**	**0.09**	**-**	**-**
C.D at 5%	**0.44**	**5.86**	**0.73**	**0.83**	**0.26**	**-**	**-**

MADAKKATHARA

Maximum height was recorded in H-14 (3.4 m) followed by BH 85 (3.34 m). Whiel maximum girth was shown in BH 85 (41.0 cm) followed by Goa 11/6 (40.25 cm). Maximum canopy spread 3.96 m was recorded in H-14 followed by Goa 11/6 (3.81 m). The variety Goa 11/6 recorded maximum nut yield/ tree (1.57 kg) followed by H-662 (1.13 kg) and H-22-1 (1.13 kg) (Table 1.31).

Table 1.31 : Morphological and yield characters of cashew genotypes under MLT III at Madakkathara

Variety	Height (m)	Girth (cm)	Canopy spread (m)	No. of fruits/panicle	Yield kg/tree/ year
Dhana	2.71	37.08	2.98	5	0.37
H-11	3.26	39.17	3.46	7	0.70
H-32/4	3.08	36.42	3.09	7	0.60
H-1593	2.81	36.92	3.18	8	0.87
BH-6	2.76	35.11	3.12	6	0.60
H-662	3.31	39.42	3.32	5	1.13
H-675	3.11	36.69	2.97	5	0.77
BH-85	3.34	41.00	3.08	6	0.50
H-22-1	2.98	36.50	3.37	6	1.13
Goa 11/6	3.31	40.25	3.81	7	1.57
H-14	3.40	39.08	3.96	6	1.07

VENGURLA

The experiment is in initial stage. The results are non-significant. The experimental grafts of few types have started flowering and fruiting (Table 1.32).

Table 1.32: Growth observations (2005 season) MLT -(2002) at Vengurla

Variety/type	Mean height (m)	Girth (cm)	Spread (m)	
			EW	NS
BH-6	1.00	12.33	0.91	0.87
BH-85	2.15	21.16	2.30	2.24
H-1593	2.25	26.12	2.80	2.74
H-662	1.71	21.05	2.12	2.50
H-675	2.62	21.33	2.55	2.59
H-32/14	2.81	27.05	3.40	3.26
K-22-1	1.96	21.73	1.66	1.92
H-11	1.05	11.66	0.66	0.56
H-14	1.76	16.11	1.56	1.75
Goa 11/6	2.07	17.11	1.87	1.68
Vengurla-7	2.02	21.77	2.43	2.02
SE m ±	0.40	4.34	0.57	0.57
CD at 5%	N.S.	N.S.	N.S.	N.S.

VRIDHACHALAM

Among the entries, maximum plant height and girth was recorded by H 1593 (3.02 m and 23.6 cm respectively). During the first year of bearing, BH 6 of Bhubaneswar recorded the highest yield of 0.54 kg/ tree (Table 1.33).

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

Variety/ Genotypes	Plant height (m)	Trunk girth (cm)	Mean canopy spread (m)	Yield (kg/tree)
BH 6	2.46	20.20	2.72	0.54
BH 85	2.74	21.80	3.00	0.47
H 1593	3.02	23.60	3.34	0.42
K 22-1	2.52	20.80	2.86	0.37
H 662	2.78	22.20	3.02	0.48
H 675	2.86	23.00	3.14	0.52
H 11	2.48	20.60	2.76	0.49
H 14	2.90	23.20	3.18	0.46
H 32/4	2.50	20.60	2.82	0.49
Goa 11/6	2.42	19.80	2.72	0.59
VRI 2	2.40	19.80	2.76	0.42
VRI 3	2.20	19.00	2.54	0.49

3. Evaluation of Precocious Dwarf KGN-1
(Multi Location Trial – IV)

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Pilicode and Vengurla

Plains / others :

Chintamani and Jagdalpur

The objective of this experiment is to evaluate the growth performance of precocious dwarf KGN-1 in comparison to the local check variety for possibility of inclusion in hybridization trials to induce dwarfness.

SUMMARY :

Growth parameters of KGN-1 was similar to the local check at Jhargram. At Chintamani, plant height of KGN-1 was lesser than local check (Chintamani-1) while it was higher than the local check at all the other centres.

Experimental Details :

A single block of 25 grafts of KGN-1 in 4 x 4 m spacing and a second block of 10 grafts of local promising variety as a check.

Planting year : 2002

BAPATLA

There was no significant difference between KGN-1 and BPP-5 in terms of vegetative characters (Table 1.34).

Table 1.34 : Performance of precocious dwarf KGN – 1 at Bapatla

	KGN-1	Check (BPP-5)
Growth parameters		
Plant height (m)	1.98	1.86
Trunk girth (cm)	29.30	29.60
Canopy spread (E-W) (m)	2.58	3.12
(N-S) (m)	2.29	2.30
Average internodal length (cm)	16.33	19.66
Duration of flowering (days)	80-90	85-90

BHUBANESWAR

With respect to the vegetative parameters, KGN-1 had comparatively shorter internodal length (1.6 cm) and lesser trunk girth (24.6 cm), but more vegetative spread of 3.1m in both E-W as well as in N-S direction than the check variety H 2/16. With respect to the yield and yield attributing characters less nut yield (0.50 kg/plant) at second harvest with less number of nuts/ panicle (1.70) were observed in KGN-1 as compared to the check variety (Table 1.35).

Table 1.35: Vegetative & flowering characters and Yield & yield attributing characters of cashew types in Multi Location Trial-IV at Bhubaneswar

	KGN-1	H 2/16
Plant height (m)	3.00	2.40
Trunk girth (cm)	24.60	26.80
Inter nodal length (cm)	1.60	2.20
Canopy spread (E-W) (m)	3.10	3.00
(N-S) (m)	3.10	2.90
No. of laterals /m^2	18.50	22.40
No. of flowering laterals/m^2	15.80	15.50
No. of non flowering laterals/m^2	2.70	6.90
Nut yield (kg/ plant)	0.50	0.60
Cumulative nut yield (kg/plant) (2 harvest)	0.60	0.80
No of nuts/panicle	1.70	2.40
Nut weight (g)	8.10	8.00
Apple weight (g)	80	57
Apple colour	Yellow	Yellow

CHINTAMANI

The vegetative parameters recorded in KGN-1 were lower compared to local check, Chintamani-1. The nut yield, nut weight and shelling percentage recorded higher values by KGN-1 compare to check variety Chintamani-1 (Table 1.36).

Table 1.36 : Growth and yield performance of precocious dwarf KGN –1 and check variety (MLT – IV) at Chintamani

Growth and yield Parameters	KGN – 1	Check (Chintamani-1)
Plant height (m)	1.80	2.14
Trunk girth(cm)	26.00	24.20
Canopy spread (m) E-W	2.01	2.34
N-S	2.20	2.37
Average inter-nodal length (cm)	2.53	2.64
Duration of flowering (days)	90	96
Flowering intensity / m^2	18.85	9.78
No. of fruits / panicle	6.80	4.50
Ratio of Male to Hermaphrodite flowers	18:12	19:6
Yield (kg/plant)	0.85	0.72
Nut weight (g)	8.11	7.65
Shelling (%)	30.98	29.77

JHARGRAM

It was noticed that average height, were on par in KGN – 1 and BLA – 39 – 4, while trunk girth was higher in BLA – 39 – 4. KGN – 1 had internodal length longer than BLA – 39 – 4 plants. No of laterals /square meter were more in BLA – 39 – 4 than KGN – 1.

KGN – 1plants were precocious in flowering than BLA – 39 – 4. The duration of flowering is also more in case of KGN – 1(110 days). Flowering intensity was more in KGN - 1. No. of vegetative flush/m^2 was more in case of BLA – 39 – 4. Male : Hermaphrodite flower ratio was narrower in case of KGN – 1 compared to BLA – 39 – 4 .

Nut weight was more in case of KGN – 1 compared to BLA – 39 – 4. Maximum difference was noticed in case of apple weight. KGN – 1 had heavier apples than BLA – 39 – 4. Shelling % was also higher in case of KGN – 1 (Table 1.37).

Table 1.37: Vegetative & flowering characters and Yield & yield attributing characters of cashew types in Multi Location Trial-IV at Jhargram

	KGN-1	BLA 39-4
Plant height (m)	3.78	3.78
Trunk girth (cm)	32.20	38.60
Inter nodal length (cm)	2.30	2.00
Canopy spread (E-W) (m)	4.09	3.97
(N-S) (m)	3.88	4.73
No. of flowering laterals/m^2	12.00	19.00
Nut yield (kg/ plant)	1.03	2.09
Cumulative nut yield (kg/plant) (2 harvest)	2.38	5.83
Nut weight (g)	6.50	3.80
Apple weight (g)	62.20	60.00

PILICODE

MDK-1 is the local check variety used for evaluating KGN-1. The observations indicated that the growth KGN-1 in the initial years was comparatively slower than that of the MDK- 1, but later it increased and overtook that of the local check variety (Table 1.38).

Table 1.38 : Biometrical characters of KGN-1 & MDK-1 (Planted in 2002) at Pilicode

Variety	Year	Plant height (m)	Trunk Girth(cm)	Tree spread(m)		Internodal length(cm)	Panicle /m2	Bisexual: male
				E-W	N-S			
MDK-1	I Yr	0.20	2.30	--	--	--	-	-
	II Yr	0.62	4.30	0.25	0.25	1.19	-	-
	III Yr	1.16	8.19	0.89	0.88	--	0.82	7.00
	IV Yr	2.00	18.17	1.97	1.81	1.65	0.90	7.10
	V Yr	2.33	20.91	2.20	2.03	1.20	0.99	7.18
KGN-1	I Yr	0.53	3.10	--	--	--	-	-
	II Yr	0.70	4.70	0.28	0.31	1.27	-	-
	III Yr	1.04	8.19	0.72	0.74	--	1.20	16.00
	IV Yr	2.56	12.17	2.47	2.37	1.04	1.30	17.20
	V Yr	3.20	29.55	3.05	3.11	1.28	1.48	19.79

VENGURLA

KGN-1 type did not display dwarfing as compared to the local check variety (Vengurla-7).

The height of KGN ranged between 0.90 to 3.85 m, girth was in the range of 8 to 31 cm while the internodal length ranged between 21.6 to 55.0 cm (Table 1.39).

Table 1.39: Growth observations of precocious dwarf cashew type and local check at Vengurla

Parameter	KGN-1	V-7
Mean height (m)	3.00	2.70
Mean girth (cm)	29.48	31.63
Mean spread (m) (EW)	3.41	3.37
Mean spread (m) (NS)	3.48	3.83
Internodal length (cm)	34.19	31.37
Average No. of panicles/m^2	23.85	17.50
Average yield (Kg/tree)	0.45	0.21
Average weight of nut (g)	5.71	9.88
Average weight of apple (g)	54.50	76.00

VRIDHACHALAM

The check variety VRI-2 recorded lesser plant height, trunk girth and canopy spread. The mean yield in local check was lesser than in KGN-1 (Table 1.40).

Table 1.40: Growth observations of precocious dwarf cashew type and local at Vridhachalam

Parameter	KGN-1	VRI-2
Mean height (m)	4.62	3.80
Mean girth (cm)	33.20	30.20
Internodal Length (cm)	2.70	2.41
Mean spread (m) (NS)	5.65	4.28
Mean spread (m) (EW)	5.32	3.98
No. of flowering laterals/m^2	12.80	13.16
Duration of flowering	61	64
Average yield (Kg/tree)	2.10	1.35
Average weight of nut (g)	7.35	5.70

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

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 performance of released cashew varieties from various centres for their suitability to different agro-climatic regions.

Treatments :

The earlier trial on Performance of Released Varieties MLT-V has been planted during 1997 using the following varieties. All these released varieties were not planted by all the centres.

Sl. No.	Varieties	Sl. No.	Varieties	Sl. No.	Varieties
1	BPP-1	9	Kanaka	17	BBSR-1
2	BPP-2	10	Dhana	18	VRI-2
3	BPP-3	11	Priyanka	19	Chintamani
4	BPP-4	12	Vengurle-1	20	Ullal-1
5	BPP-5	13	Vengurle-2	21	Ullal-4
6	BPP-6	14	Vengurle-3	22	Ullal-5
7	BPP-8	15	Vengurle-4	23	Jhargram-1
8	BPP-9	16	Vengurle-5		

The recent trial on Performance of Released Varieties MLT-V has been planted during 2006 using the following selected varieties. This trial is in the initial stage of growth.

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		

BAPATLA

The variety Vengurle-3 recorded the maximum plant height (4.80 m) followed by Vengurle-5 (4.73 m). BPP-2 (7.91 m) followed by BPP-8 (7.51 m) recorded mean maximum canopy spread. Maximum bisexual flowers were observed in Vengurle-3 (303.50) followed by BPP-4 (297.75). The highest mean nut yield per tree of 6.36 kg was recorded in BPP-8 variety followed by Vengurle-5 (6.28 kg). The cumulative nut yield per tree was highest in BPP-8 (14.69 kg) followed by Vengurle-5 (13.69 kg) (Table 1.41). The recent trial on MLT-V is in intial stage of growth.

Table 1.41 : Growth and Yield performance of released varieties (2005-06) at Bapatla

Variety	Plant height (m)	Stem Girth (cm)	Plant Spread (m)		Bi-Sexual flowers	Nut weight (g)	Yield /tree (kg) (5th harvest)	Cum. yield/ tree (kg)
			E-W	N-S			2006	2001-06
BPP-1	4.05	63.75	6.27	6.07	128.50	5.85	3.52	9.12
BPP-2	4.36	71.60	**7.32**	**8.50**	229.75	5.01	4.80	11.77
BPP-3	3.90	69.30	6.60	6.40	286.00	6.18	4.16	8.83
BPP-4	3.80	68.00	7.23	6.90	**297.75**	6.20	4.02	11.66
BPP-5	3.74	55.00	5.50	5.58	283.50	6.10	4.18	10.67
BPP-6	2.65	47.00	3.70	4.30	250.25	5.51	1.36	3.22
BPP-8	3.85	68.00	**7.50**	**7.52**	109.50	6.67	**6.36**	**14.69**
BPP-9	2.70	52.30	4.53	4.80	166.50	6.51	1.62	5.18
KANAKA	3.40	65.50	6.00	5.10	244.00	5.40	4.43	10.31
DHANA	2.90	44.00	4.70	5.10	262.25	6.70	2.56	6.91
PRIYANKA	3.26	53.40	5.12	5.08	208.75	**10.82**	2.71	6.39
Vengurle-1	2.20	58.00	3.30	4.00	145.75	5.82	1.01	3.45
Vengurle-2	3.00	57.30	4.16	4.93	246.25	4.82	1.61	4..46
Vengurle-3	**4.80**	**81.60**	7.00	7.50	**303.50**	7.12	3.49	6.44
Vengurle-4	4.35	77.50	7.37	7.17	274.75	6.31	3.68	7.11
Vengurle-5	**4.73**	**90.00**	7.56	7.26	159.25	4.75	**6.28**	**13.69**
BBSR-1	3.25	49.50	4.50	4.40	257.50	5.10	1.98	9.38
VRI-2	3.70	63.60	6.76	7.00	120.50	4.45	4.07	7.87
Chintamani	2.50	35.00	3.40	3.60	126.50	4.65	0.20	0.75
Ullal-1	3.70	63.60	6.76	7.00	26.75	5.25	1.96	2.23
Ullal-4	2.80	45.50	5.00	4.45	37.75	5.30	1.80	2.85
Ullal-5	3.80	49.00	1.47	4.92	83.75	5.82	1.21	3.16
Jhargram	2.93	52.30	5.33	5.26	220.75	5.91	3.12	4.37

BHUBANESWAR

The crop is in the initial stage of growth.

CHINTAMANI

The grafts of eighteen varieties / hybrids out of twenty five varieties / hybrids have been planted with a spacing of 8x8 m. The growth observations are being recorded.

JHARGRAM

Among the varieties released so far, the centre has collected 24 varieties from different centers. The varieties were planted during 2003 – 2005. Maximum height was noticed in case of BPP – 8 (2.775m) followed by NRCC Sel– 1 (2.34 m).The trunk girth and canopy area was maximum with M – 44/3 plants (26.20 cm and 12.92 m^2 respectively) (Table 1.42).

Table 1.42 : Evaluation of released varieties at Jhargram

Varieties	Plant Height (cm)	Trunk Girth (cm)	Trunk Height (m)	Canopy spread (m)		Canopy area (m)
				E - W	N - S	
BPP - 1	1.72	21.50	0.28	2.00	2.08	5.64
BPP – 3	1.77	18.50	0.42	1.70	1.85	4.50
BPP – 4	1.85	22.00	0.33	1.98	1.51	4.79
BPP – 5	1.32	12.00	0.46	1.03	0.98	1.57
BPP - 8	2.77	23.80	0.24	1.98	2.20	9.00
Ullal – 3	1.71	16.50	0.19	1.70	1.48	4.28
Vengurla - 3	1.07	8.65	0.13	0.78	0.75	2.11
Vengurla - 6	1.75	23.10	0.45	2.05	2.05	5.34
Vengurla -4	2.07	21.50	0.25	1.86	1.63	5.53
Vengurla -1	0.75	7.20	0.12	0.66	0.45	0.60
Vengurla - 8	1.82	17.00	0.48	1.95	1.75	4.23
Jhargram - 1	2.60	31.00	0.50	2.55	2.25	9.77
Dhana	2.05	21.00	0.16	2.76	2.23	8.87
Kanaka	1.87	19.00	0.27	2.28	2.23	6.92
Madakkathara - 1	1.60	14.30	0.29	2.30	2.20	5.91
VTH – 711/4	1.52	12.90	0.19	1.75	1.90	4.63
Bhubaneswar - 1	1.17	17.50	0.10	1.10	1.10	2.08
Damodar	1.85	20.50	0.17	1.98	1.85	5.80
Raghav	1.45	8.00	0.20	1.38	1.41	1.54
UN – 50	1.17	19.00	0.27	0.81	0.78	1.23
M - 3/33	2.03	9.00	0.29	1.83	2.00	9.10
M - 44/3	1.11	26.20	0.21	0.69	0.93	12.93
NRCC Sel-1	2.34	26.17	0.15	2.84	2.84	11.69
NRCC Sel-2	1.62	14.83	0.12	2.61	2.60	8.21

MADAKKATHARA

Being the first year of planting, no observations were recorded. The vegetative growths of the plants were satisfactory.

Gen.4. Hybridization and Selection

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani

The project aims at utilizing the high yielding accessions selected from the germplasm conserved at various AICRP centres, as parents to obtain desirable traits and such as bold nut types, cluster bearing habit, compact canopy, short flowering period, late synchronized flowering and high shelling percentage.

SUMMARY:

H-10 recorded highest cumulative yield of 11.03 kg / tree followed by H-36 which gave 10.55 kg/tree at Bapatla. A6 was identified as the most promising hybrid at Bhubaneswar which recorded the highest nut yield of 11.00 kg/plant, highest cumulative nut yield of 41.60 kg / plant at 9th harvest having nut weight of 8.70 g and shelling percentage of 34.00. At Chintamani, H-216 (2/7 Tuni X Vetore-56) recorded an yield of 1.25 kg/tree, and shelling percentage of 32.75 during the first harvest. The hybrids developed at Jhargram had high shelling percentage viz., H – 57 (38.96%) followed by H – 27 (37.3%) and H – 69 (35.1%). All the high yielding hybrids developed at Madakkathara had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

BAPATLA

A total of 204 F1 hybrid nuts were obtained from 11 cross combinations during 2006. The highest fruit set of 19.62% was recorded in the cross combination of BPP-6 X NRCC-Sel-2. 131seedlings from these nuts were planted in the main field of F1 hybrid block (Table 1.43).

Table1.43: Details of crossing programmes at Bapatla

Sl. No	Cross Combinations	Percent of fruit set
1.	BPP-6 x Sel-1	19.62
2.	BPP-6 x Sel-2	17.47
3.	BPP-6 x Ullal-4	13.46
4.	T228 x BPP-8	17.60
5.	BPP-8 x 40/1	9.70
6.	BPP-8 x T228	7.05
7.	BPP-6 xUllal-3	19.10
8.	BPP-8 x BPP-4	19.52
9.	BPP-8 x 107/3	6.70
10.	BPP-8 x BPP-3	15.80
11.	BPP-8 x Ullal-4	9.70

Among the different hybrids planted during 1997, 18 trees died due to drought and high temperatures during 2004-05. Of the remaining trees H-10 recorded highest cumulative yield of 11.03 kg/tree followed by H-36 which gave 10.55 kg/tree. (Table 1.44).

Table 1.44 : Performance of cashew hybrids at Bapatla

Year of planting	Hybrid No	Cross combination	Yield/ tree(kg) (4th harvest) (2006)	Cumulative yield/tree (kg) (2003-06)	Nut weight (g)
1997	H-9	T 273 x T 71	3.15	10.00	5.00
1997	H-10	T 273 x T 71	3.38	11.03	6.00
1997	H-13	T 228 x T2/22	1.98	5.58	4.00
1997	H-14	T 228 x T2/22	2.25	7.20	6.50
1997	H-23	T 228 x T2/22	3.35	8.95	8.0
1997	H-25	F.No.3 x T 228	1.95	9.20	6.0
1997	H-34	BPP-5 x T2/22	3.50	9.10	6.0
1997	H-36	F.No.3 x T30/1	3.65	10.55	8.0
1997	H-43	T 228 x T 30/1	1.90	5.45	6.0
1997	H-56	T 2/22x Priyanka	1.50	8.75	6.0
1997	H-57	T 2/22 x VRI-2	1.75	5.45	6.0
1997	H-61	T 71 x T 273	3.50	6.30	4.0
1997	H-64	T 71 x T 273	3.50	10.50	6.0
1997	H-65	T 71 x T 273	2.90	10.05	7.0
1997	H-69	T 71 x T 273	3.50	9.60	8.0
1997	H-72	T 71 x T 273	3.56	8.16	6.0
1997	H-73	T 71 x T 273	3.05	6.45	5.0
1997	H-75	T 71 x T 273	2.55	5.55	5.0
1997	H-76	T 71 x T 273	3.10	7.85	6.0

BHUBANESWAR

Among the hybrids planted in 1995, A6 is the most promising hybrid recording the highest nut yield of 11.00 kg/plant, highest cumulative nut yield of 41.60 kg / plant at 9th harvest having nut weight of 8.70 g and shelling percentage of 34.00 %.

In the 1997-hybrid block highest nut yield and cumulative nut yield (kg/plant) at 7th harvest were recorded in A1-85 (9.70, 39.70) followed by A1-105 (9.0, 32.0) with bold nuts borne in cluster. Shelling percentage (%) in both the types were 31 and 29 respectively.

Higher cumulative nut yield (kg/plant) at 6th harvest, nut yield (kg/plant), nut weight (g) and shelling percentage (%) were recorded respectively in two promising hybrids B2-32 (8.2, 3.0, 9.2, 28.0 & 3) and A2-22 (7.5, 3.0, 7.0, 32.0 & 5) from 1998 planted hybrids.

In the 1999 hybrid block two hybrids D3-11 and D3-18 recorded encouraging results out of which highest nut yield (kg/plant) and cumulative nut yield (kg/plant) at 5th harvest were recorded in D3-11 (8.9 & 5.0) having nut weight (g) of 9.0, shelling percentage (%) of 28.0 and 3 number of nuts per panicle borne in cluster.

Out of the two promising hybrids planted in 2000 maximum nut yield (4.00 kg/plant), cumulative nut yield (5.00 kg/plant) at 4th harvest and nut weight (8.60 g) were recorded in E4-1 with 28% shelling percentage.

Amongst the hybrids planted in 2001, encouraging results were recorded at 3rd harvest with respect to cumulative nut yield (kg/plant), nut yield (kg/plant), nut weight (g), shelling percentage (%) and number of nuts per panicle respectively in the hybrids J5-13 (4.5, 2.5, 7.6, 30.0 & 4), L5-27 (4.0, 2.0 7.9, 30.0 & 4) and P5-8 (3.6, 1.7, 7.5, 34.0 & 4).

The cumulative nut yield (kg / plant) at 2nd harvest and nut yield (kg / plant) ranged from 1.4 to 3.3 and 0.6 to 3.0 respectively in 2002 planted hybrids. Similarly, the nut weight (g) and the shelling percentage (%) of these hybrids range from 7.0 to 10.6 and 26.0 to 34.0, respectively.

The nut yields (kg / plant) of the high yielders at 1st harvest was E6-3 (1.5), C2-6 (1.5), C2-24 (1.2), C2-21 (1.0) and B6-3 (1.0). Similarly, except B2-3, B2-33, B7-5, E6-3. The shelling percentage (%) in the other hybrids exceeded 28 percentage. All of these hybrids had bold nut type with a nut weight of above 7.00 (g) (Table 1.45).

Table 1.45: Yield and yield attributing traits of cashew hybrids 2006 at Bhubaneswar

Hybrid no.	Cross Combinations	No. of fruits / panicle	Apple weight (g) & colour	Nut weight (g)	Shelling %	Nut Yield (kg / plant) 2006	Cum. nut yield (kg / plant)
1995	**9th harvest**						
A6	Bhubaneswar C-2 x VTH 711/4	4	75(Y)	8.70	34	11.00	41.60
1997	**7th harvest**						
A1-85	Bhubaneswar-1 x H2/16	3	40(Y)	7.20	31	9.70	39.70
A1-105	Bhubaneswar-1 x H2/16	4	90(Y)	7.50	29	9.00	32.00
1998	**6th harvest**						
A2-22	M 44/3 x H 2/16	5	37(Y)	7.00	32	3.00	7.50
B2-32	H 2/16 x M 44/3	3	42(Y)	9.20	28	3.00	8.20
1999	**5th harvest**						
D3-11	M 44/3 x H 2/15	3	46(Y)	9.00	28	5.00	8.90
D3-18	M 44/3 x H 2/15	3	61(Y)	8.80	28	2.20	5.90
2000	**4th harvest**						
E4-1	BPP30/1 X VTH 711/ 4	3	65(Y)	8.60	28	4.00	5.00
2001	**3rd harvest**						
J5-13	Bhubaneswar-1 x VTH 711/4	4	49(Y)	7.60	30	2.50	4.50
L5-27	M 44/3 x VTH 711/4	4	42(Y)	7.90	30	2.00	4.00
P5-8	Bhubaneswar C-2 x Kankady	4	52(R)	7.50	34	1.70	3.60
2003	**1st harvest**						
B2-3	V-2 x OC 22	2	39(R)	7.30	26	0.40	0.40
B2-33	V-2 x OC 22	1	68(R)	7.50	26	0.30	0.30
B6-3	V-2 x VTH 711/4	3	48(R)	9.30	31	1.00	1.00
B7-5	V-2 x OC 60	2	52(R)	8.50	23	0.40	0.40
C2-6	RP-2 x Kankady	5	32(Y)	8.50	28	1.50	1.50
C2-21	RP-2 x Kankady	4	32(Y)	7.00	34	1.00	1.00
C2-24	RP-2 x Kankady	5	30(Y)	7.20	34	1.20	1.20
E6-3	OC 56 x OC 60	4	19(RY)	6.40	27	1.50	1.50

NB: Y- Yellow, R- Red, RY- Reddish Yellow

CHINTAMANI

Out of ten cross combinations, 105 nuts were obtained and out of these 42 F_1 seedlings have been planted for evaluation. The female parents used for crossing are Ullal-1, Gubbi, Taliparmba, Alangudi & Chrompet. The male parents used are Kankadi and Hebbari-1 (Table 1.46).

Table 1.46 : Performance of Cross combinations at Chintamani.

Cross Combinations	Cross Combinations
Ullal-1 x Kankadi	Ullal-1 x Hebbari-1
Gubbi xKankadi	Gubbi x Hebbari-1
Taliparamba x Kankadi	Taliparamba x Hebbari-1
Alangudi x Kankadi	Alangudi x Hebbari-1
Chrompet x Kankadi	Chrompet x Hebbari-1

The hybrids planted during 2002, H-151(NRCC-2 x Vetore-56),H-188, (V-5 x Vetore-56), H-191 (Ullal-3 x Vetore-56) and H-216 (2/7 Tuni x Vetore-56) recorded an yield of 0.42, 0.85, 0.75 and 1.25 kg/tree during the first year of harvest with an average nut weight of 10.29, 9.70, 10.43 and 9.71 g respectively and recorded shelling percent of 32.82, 31.76, 33.18 and 32.75 respectively (Table 1.47).

Table 1.47 : Performance of selected F1 Hybrids planted at Chintamani

Hybrid No.	Yield (kg/tree)	Nut wt. (g)	Shelling (%)	Apple Wt. (g)
H-151	0.42	10.29	32.82	40.15
H-185	0.95	8.75	29.70	48.70
H-188	0.85	9.70	31.76	60.60
H-191	0.75	10.43	33.18	61.50
H-216	1.25	9.71	32.75	53.14

JHARGRAM

Among the 127 F1 progeny 21 were found to be promising. Maximum height was recorded with H – 45 followed by H – 20 and H – 42. In all the plants the girth was more than 30 cm. The canopy spread and canopy area were maximum with hybrid 28 (Table 1.48).

Table 1.48 : Performance of hybrids planted during 2002 and 2003 at Jhargram Centre

Hybrid No.	Year of planting	Plant height (m)	Plant Girth (cm)	Canopy spread (m)		Canopy area (m^2)
				N-S	E-W	
H –6	2002	3.95	35	4.10	3.80	22.01
H –9	2002	3.95	30	3.85	3.95	21.65
H –42	2002	**4.72**	35	4.20	4.35	28.79
H –45	2002	**4.90**	38	4.95	4.35	29.84
H –20	2002	**4.84**	45	3.90	4.70	29.71
H –23	2002	4.22	37	4.35	4.40	26.73
H –1	2002	4.5	42	3.80	2.70	19.69
H –3	2002	3.25	14	3.00	2.75	16.03
H –27	2002	3.95	39	4.40	3.55	22.19
H –28	2002	4.30	45	5.70	6.20	41.50
H –30	2002	4.56	38	5.40	5.25	37.12
H –36	2002	3.08	18	5.60	5.10	28.36
H –41	2002	3.98	46	5.50	5.60	35.48
H –55	2002	3.69	43	4.55	4.20	23.81
H –57	2002	3.90	39	3.95	4.10	22.31
H –59	2002	4.20	40	5.80	5.10	35.96
H –65	2002	4.50	49	5.5	5.10	36.53
H –69	2002	4.11	43	5.5	4.30	30.46
H -75	2003	3.20	22	5.5	4.30	25.33
H – 51	2002	4.75	39	5.0	4.50	33.10
H –49	2002	4.80	44	4.8	4.50	32.52

H – 23 and H – 51 were identified as early flowering plants and the duration of flowering was longer in H – 23 (80 days) while in H – 51 the duration was only 56 days. Maximum duration of flowering was recorded in H – 42 (87 days). Shortest flowering period was noticed in H – 36, H – 65 and H- 49 (50 days).

H – 57 was cluster bearing (12 nuts / Panicle) followed by H – 30 (10.5 nuts/panicle) and H – 49 (8.50 nuts/panicle). Bold nuts were recorded in H – 23 (8.00 g) followed by H – 59 and H – 36 (6.23 g) . In H – 57 the nut weight was 4.60 g. H – 41 had heaviest apples (62.50 g).

Maximum yield was recorded in H – 75 (3.80 kg/tree). The nut production was also good in some of the other hybrids like H – 20 (3.66 kg/tree), H – 1 (3.31

kg/tree), H – 28 (3.50 kg/tree), H – 41 (3.19 kg/tree) and H – 65 (3.11 kg/tree). Most of the hybrid nuts had high shelling percentage i.e. more than 30.00 %. Shelling percentage was maximum in H – 57 (38.96%) followed by H – 27 (37.30%) and H – 69 (35.10%) (Table 1.49).

Table 1.49 : Performance of F1 hybrids at Jhargram.

Hybrid No.	Year of planting	Duration of flowering	Nuts /panicle	Nut weight (g)	Apple Weight (g)	Yield kg/tree	Shelling %
H –6	2002	69	3.00	4.80	37.50	2.21	29.98
H –9	2002	80	4.50	4.00	21.00	1.28	34.45
H –42	2002	87	2.00	4.20	30.00	1.76	30.90
H –45	2002	65	3.00	5.20	33.30	2.56	34.04
H –20	2002	65	6.50	4.00	25.00	3.66	30.85
H –23	2002	80	4.00	8.00	10.00	2.84	24.88
H –1	2002	55	4.60	5.20	35.00	3.31	24.54
H –3	2002	60	3.30	4.80	50.00	2.38	35.27
H –27	2002	45	4.00	4.00	15.00	2.50	37.30
H –28	2002	60	3.60	4.80	34.06	3.50	26.48
H –30	2002	51	10.50	5.00	32.20	2.59	36.40
H –36	2002	50	4.00	6.23	40.00	2.59	27.55
H –41	2002	57	8.00	5.60	62.50	3.19	31.14
H –55	2002	55	4.00	3.80	25.00	1.40	34.00
H –57	2002	50	12.00	4.60	25.80	1.90	38.96
H –59	2002	58	2.00	6.23	42.00	1.83	34.81
H –65	2002	50	4.00	5.00	58.00	3.11	33.04
H –69	2002	52	3.00	4.40	30.00	3.00	35.11
H -75	2003	60	5.00	5.70	27.50	3.80	29.81
H – 51	2002	56	2.50	5.71	36.00	2.45	23.53
H –49	2002	50	8.50	4.00	40.00	2.26	33.00

MADAKKATHARA

1993 hybrids

The highest yield was recorded by H-24 (31.40 kg/tree) and H -27 (25.40 kg/tree) followed by H-7 (30.80 kg/tree). Highest cumulative yield was given by H-7 (107.24 kg), H-24 (85.25 kg) and H-17 (83.65 kg). All the high yielders had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

1994 hybrids

Highest annual yields were recorded in H-74 (19.10 kg/tree) with a cumulative yield of 44.40 kg, H-72 with an annual yield of 17.60 kg and cumulative yield of 40.45 kg and H-70 with an annual yield of 17.60 kg and cumulative yield of 31.20 kg. All the high yielders were progenies of BLA 39-4 and P-3-2 showing that these two genotypes are genetically divergent.

1995 hybrids

All the trees recorded very low yields (as they were planted at an close spacing of 4m x 4m and in spite of thining they did not perform better) except H-87 (annual yield 5.03 kg/tree and cumulative yield 40.20 kg/tree).

The yield levels in 1996, 1998 and 2000 planted hybrids was very low. No yield was recorded from 2001 and 2002 planted hybrids because of severe TMB infestation.

Performance of selected hybrids

The 1993, 1994 and 1995 hybrids that performed best during the reporting year and their yield and yield characters are presented in Table 1.50.

Table 1.50: Performance of selected F1 hybrids planted during 1993, 1994 and 1995 at Madakkathara

Hy. No.	Mean yield for last 10 years	Annual yield (kg/tree)	No. of harvests	Cum yield (kg/tree)	Apple wt. (g)	Nut wt. (g)	Shelling %
7	10.66	30.80	31	107.24	59.00	7.62	27.74
8	5.59	17.70	24	55.92	34.00	6.96	26.40
15	6.63	20.70	18	66.34	41.00		
17	8.37	11.50	29	82.85	71.00	7.10	29.40
21	9.90	25.00	46	100.00	49.00	7.70	27.40
23	5.75	15.85	26	57.54	53.00	6.18	26.50
24	8.53	31.40	39	85.25	34.00	7.10	24.75
27	6.67	25.40	32	66.72	32.00	6.86	29.70
35	6.47	21.60	37	64.65	95.00	6.72	26.38
36	5.61	26.00	37	56.10	71.00	7.38	25.30
58	2.36	8.20	17	21.25	45.00	6.30	27.30
59	1.24	5.50	8	11.15		6.44	26.90
69	3.76	16.50	24	33.85	40.00	6.76	27.40
70	3.47	17.60	24	31.20	67.00	8.30	27.20
71	4.64	12.90	21	41.75	51.00	7.00	21.99
72	4.49	17.60	27	40.45	69.00		
73	5.14	16.50	25	46.25	36.00	6.76	24.30
74	4.93	19.10	23	44.40	50.00	6.54	29.68
78	2.23	12.10	13	20.07	49.00	7.32	24.60
85	2.25	9.10	11	18.02		7.64	25.69
87	5.03	16.40	24	40.20	41.00	6.08	32.11
88	2.66	9.50	16	21.25	42.00	6.68	31.99
92	2.00	7.60	8	15.98	106.00	6.32	26.60
95	2.38	12.40	21	19.00	90.00	8.26	27.21
96	2.24	7.90	17	17.90	87.00		
97	3.51	17.00	24	28.08	81.00	8.48	25.50
98	2.99	15.70	21	23.92	55.00		
101	4.86	17.70	23	38.90	82.00	7.04	23.10
102	2.26	9.10	16	18.11	86.00	6.84	26.30
103	1.96	9.50	17	15.66	78.00	8.20	24.97
104	2.33	10.50	18	18.64	93.00	7.62	24.66
105	2.67	11.80	19	21.38	66.00	7.90	27.50
107	1.87	7.70	15	14.95		7.74	21.98

Hybridisation during 2006-07

A total of 825 pollinations were done during 2006-07 with 13.09 percentage of nut set. The highest number of pollinations was done in the cross H7 x Poornima (290). The highest nut set was seen in the cross H7 x Poornima (155) and the highest number of nuts harvested (40) was also from the same combination (Table 1.51).

Table 1.51 : Details of crossing programme at Madakkathara

Cross Combinations	No. of pollinations	No. of nuts set	No. of nuts harvested	% of nut set
H7 x Poornima	290	155	40	13.79
H7 x Dharasree	223	138	17	7.62
H21 x Poornima	223	112	34	15.25
H 17 x Mutant 1	89	43	17	19.10
Total	**825**	**448**	**108**	**13.09**

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 hybrid seed nuts of 2005 were sown in nursery for raising seedlings.

The seedlings of MDK1 x PLD-57, 3 of ANK1 x PLD-57 2 of PLD-57 x ANK1 and the open pollinated seedlings of PLD-57 were planted during 2001-2002 for evaluation. The plant height and number of panicles/m^2 were found significantly varying among the hybrids as well as parents and PLD-57 graft. The hybrid MDK -1 x PLD-57 was found to be near to the dwarf male parent in growth characteristics recorded. The growth characteristics of hybrids, PLD-57 grafts and MDK-1 are on par indicating the transfer and expression of semi dwarf stature in the hybrids dwarf (Table 1.52).

Table 1.52 : Mean of growth characteristics of different crosses involving PLD-57 (dwarf-type) at Pilicode

Hybrid	Height (m)	Girth (cm)	Canopy spread (m)		No. of Panicle/sqm	Male to Bis ratio
			N-S	E-W		
MDK-1 X PLD-57	2.40	22.83	2.47	2.47	0.93	4.43
ANK-1 X PLD-57	2.30	23.57	3.20	3.30	1.27	5.90
PLD-57 X ANK-1	3.27	37.00	3.87	3.47	0.17	0.00
PLD-57 (OP)	0.67	16.77	2.37	2.18	5.35	13.08
MDK-1	2.43	21.67	2.23	2.40	0.00	0.00
PLD-57 graft	2.27	28.10	2.83	2.95	6.07	16.90
CD 0.05	1.24	NS	NS	NS	2.30	NS

VENGURLA

During the year 2005-2006, following cross combinations have been taken (Table 1.53).

Table 1.53 : Hybridization programme in cashew at Vengurle (Dec-05 to April 06)

Cross combination	Cross combination	Cross combination
Hy. 471 x B.T. 65	M-26/2 x Vetore-56	Vengurla-5 x Kumbharmath
Hy. 471 x B.T. 22	C.Y.T.-1 x B.T.-65	Vengurla-5 x C.Y.T.-1
T. 2/15 x B. T. 65	Vengurla-3 x Hy. 1598	Vengurla-1 x M-44/3
T. 2/15 x B. T. 22	Vengurla-3 x C.Y.T.-1	Vengurla-1 x B T. 65
Hy. 509 x Vetore-56	Vengurla-3 x T.2/15	Vengurla-1 x B. T. 22
Hy. 509 x Wadkhol	Vengurla-3 x T.2/16	Vengurla-1 x *A. microcarpum*
B. T. 65 x M-44/3	Vengurla-3 x M-44/3	Vengurla-1 x C.Y.T.-1
B. T. 65 x M-26/2	Vengurla-3 x M-26/2	Vengurla-1 x Vetore-56
B. T. 22 x M-44/3	Vengurla-5 x Vetore-56	M-26/2 x C.Y.T.-1
B. T. 22 x M-26/2	Vengurla-5 x Wadkhol	

Among the hybrids all hybrids had shelling percentage exceeding 30.00 with the exception of hybrid H-921 which had 26.00 percent. The cumulative yield for four years was 3.00 kg for 2 harvests in most of the hybrids with the exception of H-869, H-970, H-1052, H-1238 and all the hybrids had a mean nut weight exceeding 7.00 g (Table 1.54).

Table 1.54 : Performance of promising hybrids at Vengurle

Hybrid No.	Age of the hybrid (Years)	Cross combination	Mean No. nuts per Panicle	Mean nut weight (g)	Mean apple weight (g)	Yield (Kg/ tree)	Cumulative yield	Shelling percentage (%)
781	5	M44/3 X B.T.22	6.50	8.00	60.00	2.69	4.57	32.00
789	5	M44/3 X B.T.22	8.75	9.00	61.00	1.61	4.01	32.00
798	5	M44/3 X B.T.22	8.50	8.50	58.00	3.41	5.00	34.00
824	5	V-5 X B.T.1	9.35	8.00	57.30	2.23	4.03	32.00
869	5	V-4 X T-2/16	7.90	7.90	50.00	1.29	2.59	30.00
921	5	V-4 X T-2/16	4.06	11.01	78.00	1.28	3.64	26.00
956	5	V-4 X T-2/16	5.21	8.01	54.00	0.71	2.99	31.00
969	5	V-4 X T-2/16	3.80	10.25	65.30	1.39	3.00	30.00
970	5	V-4 X T-2/16	5.80	9.00	53.00	1.46	2.66	31.40
1052	5	M-44/3 X B.T.65	4.06	10.00	31.50	1.00	2.54	33.00
1066	5	M-44/3 X B.T.65	3.04	7.05	60.70	1.73	4.12	32.00
1238	5	M-26/2 X B.T.22	6.07	8.05	45.00	0.58	2.54	33.30

VRIDHACHALAM

H 10 recorded the highest yield and cumulative yield. H 13 was on par with H 10 for nut yield. The hybrid H 17 showed hybrid vigour (40.63 %) for single nut weight (7.20 g). H 13 showed a hybrid vigour of 39.06 percent with a single nut weight of 7.12 g. The duration of flowering indicated that H 13 showed a prolonged period of flowering i.e., 76 days. Late bearing was also observed in H 13. The hybrids H 10, H13 and H 17 are promising (Table 1.55).

Table 1.55 : Performance of Selected F_1 Hybrids at Vridhachalam

Hybrid No.	Duration of flowering (in days)	No. of fruits/panicle	Yield (kg/tree) Harvest No.13	Cum. yield (kg /tree) for 13 years	Apple weight (g)	Nut weight (g)	Shelling %
H 10	70	4.00	8.68	73.78	60.50	6.98	27.30
H 11	67	2.60	7.20	50.58	62.50	6.70	26.52
H 12	66	2.40	7.50	53.04	63.20	6.75	28.12
H 13	76	4.00	8.45	65.92	68.50	7.12	27.55
H 14	67	3.00	7.00	52.50	66.50	6.65	27.52
H 15	64	2.60	6.92	50.89	60.20	6.85	27.10
H 16	68	2.60	6.83	60.72	56.50	6.54	27.25
H 17	69	2.60	7.45	57.80	58.50	7.20	26.30
CD 5%			0.299**			0.126**	

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 grafts to different doses of NPK fertilizers.

SUMMARY:

The significantly highest cumulative nut yield was recorded in the treatment $N_2P_1K_1$ (33.47 kg/tree) followed by $N_2P_2K_1$ (28.18 kg/tree) at Bapatla. Under on-farm trials conducted by Bapatla Centre, the number of panicles per square meter and nut yield/tree were highest dose treatment (25.00 /m^2 and 14.25 kg/tree respectively). At Jhargram, nitrogen at a moderate dose (500 g/tree) and phosphorus and potassium at the high dose (250 g/tree) resulted in maximum annual nut yield (12.93 kg/tree). Highest nut yield (8.85 kg/tree) was obtained by application of higher level of N, P and K fertilizers at the rate of 1000 g : 125 g P : 250 g K/tree at Vridhachalam.

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 N_2 level gave significant higher yield of 7.17 kg per tree over N0 level (5.27 kg/tree), however, P and K levels were not significant. For the first order interaction, the mean annual nut yield per tree was highest in the treatment N_2P_2 (7.72 kg/tree) followed by N_2P_1 (7.59 kg/tree) over control (N_0P_0-5.47 kg/tree) were recorded (Table 2.1). The significantly highest cumulative nut yield was recorded in the treatment $N_2P_1K_1$ (33.47 kg/tree) followed by $N_2P_2K_1$ (28.18 kg/tree) (Table 2.2).

Table 2.1 : Annual nut yield (kg/tree) in response to N, P and K interaction at Bapatla

	P0	P1	P2	Mean	K0	K1	K2
N0	5.47	5.15	5.19	**5.27**	5.12	5.40	5.29
N1	6.78	5.93	6.93	**6.55**	5.84	6.88	6.93
N2	6.22	7.59	7.72	**7.17**	6.59	7.74	7.19
Mean	**6.15**	**6.22**	**6.61**		**5.85**	**6.67**	**6.47**
K0	5.34	6.47	6.66				
K1	5.79	6.89	5.99				
K2	6.43	6.65	6.76				

F-Test	N	P	K	NP	NK	PK
Significance	*	NS	*	NS	NS	NS
CD 5%	0.663			1.149		

Table 2.2 : Effect of NPK fertilizer and their interaction on yield of cashew (Pooled analysis) at Bapatla

Treatment	Annual nut yield /tree (kg) (2006)	Cumulative Nut Yield/tree (kg) (Pooled analysis of 9years)
$N_0P_0K_0$	5.05	16.93
$N_0P_0K_1$	5.84	14.31
$N_0P_0K_2$	5.52	14.81
$N_0P_1K_0$	4.46	12.84
$N_0P_1K_1$	5.55	14.58
$N_0P_1K_2$	5.22	15.48
$N_0P_2K_0$	5.85	17.70
$N_0P_2K_1$	4.60	13.27
$N_0P_2K_2$	5.13	16.25
$N_1P_0K_0$	6.13	23.88
$N_1P_0K_1$	7.18	26.61
$N_1P_0K_2$	7.04	24.04
$N_1P_1K_0$	5.35	18.31
$N_1P_1K_1$	6.16	22.58
$N_1P_1K_2$	6.30	22.78
$N_1P_2K_0$	6.05	21.14
$N_1P_2K_1$	7.30	24.41
$N_1P_2K_2$	7.45	25.14
$N_2P_0K_0$	4.30	13.18
$N_2P_0K_1$	6.39	23.07
$N_2P_0K_2$	7.42	23.13
$N_2P_1K_0$	7.55	26.70
$N_2P_1K_1$	8.77	**33.47**
$N_2P_1K_2$	6.45	20.97
$N_2P_2K_0$	7.39	26.88
$N_2P_2K_1$	8.07	28.18
$N_2P_2K_2$	7.70	27.08

On-farm trial with higher dose of fertilizers:

The effect of higher doses of fertilizer of NPK on the yield of cashew indicated that the highest dose treatment T3 resulted in highest nut yield of 14.25 kg/tree which was on par with T2 (13.50 kg/tree) but was higher than control (8.30 kg/tree). The number of panicles per square meter was highest in T3 (25.0/m^2) treatment and T2 than T1 treatment (Table 2.3).

Table 2.3 : Nut yield at different levels under on-farm trials at Bapatla

Treatment	N_2 g/tree	P_2O_5 g/tree	K_2O g/tree	Number of panicles m^{-2}	Nut yield $tree^{-1}$ (kg)
Recommendeddose(T1)	500	125	125	15.00	8.30
Higher dose (T2)	1000	250	250	22.50	13.50
Highest dose (T3)	1500	375	375	25.00	14.25

CHINTAMANI

During April-June, 2006 the limb pruned trees recorded nut yield of 0.25 to 4.70 kg/tree, NPK treatments were not imposed during the period, due to non bearing observed during previous years and delayed limb pruning in the subsequent year.

JHARGRAM

Moderate dose of potassium and phosphorus without nitrogen had positive effect on girth, while nitrogen application reduced the requirement of potassium to increase the girth of the plants. Maximum girth was recorded with $N_0P_1K_1$ (107cm). Significant differences were observed among the treatments in terms of their response on canopy spread, canopy area, nut weight and apple weight of Jhargram -1 variety of cashew. Maximum canopy area was noticed with the treatment $N_1P_1K_2$ (EW 9.78 NS – 8.93). Longest duration of flowering was found in $N_0P_2K_2$ treatment (82 days). The plants receiving $N_1P_0K_1$ treatment did not produce flowers for a longer duration (Table 2.4).

It can be concluded from the yield data that nitrogen at a moderate dose (500 g/tree) and phosphorus and potassium at the high dose (250 g/tree) resulted in maximum annual nut yield (12.93 kg/tree).

Table 2.4 : Effect of NPK fertilizer and their interaction on growth Characters of cashew at Jhargram

Treatment	Plant height (m)	Trunk girth (cm)	Canopy spread (m)		Canopy area (m^2)	Duration of Flowering (Days)	Nut wt. (g)	Apple wt. (g)
			E - W	N - S				
$N_0P_0K_0$	6.28	92.33	8.33	9.04	76.05	69	4.30	35.00
$N_0P_0K_1$	5.80	94.00	8.65	9.13	95.04	60	4.73	27.50
$N_0P_0K_2$	5.26	81.33	7.32	7.83	75.61	76	4.13	18.50
$N_0P_1K_0$	6.46	94.67	9.32	8.48	100.96	75	4.40	30.00
$N_0P_1K_1$	6.35	**107.00**	9.40	9.33	103.08	58	4.50	50.21
$N_0P_1K_2$	6.18	96.67	9.73	9.43	76.54	60	4.77	31.83
$N_0P_2K_0$	5.95	93.67	8.58	7.90	81.14	62	4.93	43.83
$N_0P_2K_1$	6.50	96.33	7.83	8.17	95.52	50	5.10	37.30
$N_0P_2K_2$	6.38	91.67	9.10	9.07	67.75	**82**	4.73	36.33
$N_1P_0K_0$	5.63	95.67	7.78	9.25	76.39	76	5.27	41.22
$N_1P_0K_1$	6.83	90.00	7.93	8.33	94.47	40	4.90	44.00
$N_1P_0K_2$	5.50	95.00	9.77	9.77	100.62	60	4.33	26.29
$N_1P_1K_0$	6.63	100.67	9.47	10.10	117.70	62	4.50	35.05
$N_1P_1K_1$	6.40	95.00	9.87	9.30	104.69	49	4.53	30.26
$N_1P_1K_2$	6.20	91.67	**9.78**	**8.93**	135.77	63	4.07	27.55
$N_1P_2K_0$	6.50	100.00	9.00	8.72	101.87	50	4.47	35.00
$N_1P_2K_1$	6.00	86.00	7.88	8.33	99.20	45	4.20	26.53
$N_1P_2K_2$	6.43	95.67	9.33	9.40	110.98	50	4.40	34.33
$N_2P_0K_0$	5.88	91.00	7.55	8.03	72.99	46	4.77	27.58
$N_2P_0K_1$	6.16	95.67	7.73	8.50	86.75	60	5.00	30.00
$N_2P_0K_2$	5.70	85.67	7.90	8.33	69.67	65	4.90	32.00
$N_2P_1K_0$	5.50	106.67	8.73	7.53	74.35	59	4.80	30.83
$N_2P_1K_1$	5.36	101.67	8.63	9.03	97.78	51	4.23	30.43
$N_2P_1K_2$	6.00	103.00	7.40	7.73	72.60	51	3.97	50.43
$N_2P_2K_0$	5.53	106.00	10.77	9.82	119.45	56	4.17	29.35
$N_2P_2K_1$	5.93	93.67	9.38	8.88	92.61	48	4.07	24.83
$N_2P_2K_2$	5.83	101.67	8.60	9.59	91.88	48	4.53	25.33
S.Em $\pm$	0.1293	2.7395	0.2559	0.312	4.0891	2.62	0.1299	1.1426
C D at 5%	0.259	5.502	0.514	0.627	8.213	5.24	0.261	2.295

MADAKKATHARA

The experimental results indicated that the growth or yield characters viz., height of trees, girth of trees, canopy spread of trees as well as weight of individual nuts were not significantly influenced by the application of graded levels of N, P or K or their 2-way or 3-way interactions.

Marginal increase in tree height was observed with increasing levels of P and K, with the highest values recorded by the application of 250 g P_2O_5 and K_2O/tree/year whereas in the case of N, the increasing trend was observed only up to the level of 500 g N. The data on canopy spread of cashew in both the directions (East West and North South) did not show any definite trend due to the application of any of the major nutrients (Table 2.5).

No significant variation in nut yield was observed among the levels of N, P or K or their 2-way or 3-way interactions. However an increasing trend in nut yield was observed with application of graded levels of N, with the highest yield of 2.97 kg/tree recorded by 1000 g N/tree (Table 2.6). In respect of P and K, the highest nut weight (5.71 g and 4.74 g respectively) was recorded by the application of 250 g/tree/year of the respective nutrient. However, a negative trend in mean nut weight was observed with increasing levels of N application (from 4.65 g to 4.34 g).

No significant variation in cumulative nut yield was observed due to the direct effect of N, P or K or their 2- way or 3- way interactions. However, an increasing trend in cumulative nut yield was observed with increasing levels of N up to 1000 g/tree and up to 125 g P_2O_5 and K_2O in respect of P_2O_5 and K_2O respectively (Table 2.7).

In respect of all the nutrients, the lowest yields were recorded by control. The highest yield was recorded by the application of 1000 g N/tree and 125 g P_2O_5 and K_2O / tree, with respect to N, P_2O_5 and K_2O, respectively.

Table 2.5 : Interactions of graded levels of N, P and K on growth and yield characters and yield at Madakkathara

Treatment	Tree height (m)	Trunk girth (m)	Canopy spread-EW (m)	Canopy spread -NS (m)	Nut Wt. (g)	Yield (kg/tree/ annum)	Cumulative yield (kg/tree)
$N_0P_0K_0$	5.23	1.02	8.33	8.10	6.03	4.15	44.51
$N_0P_0K_1$	5.00	0.99	7.02	7.13	4.72	2.86	41.69
$N_0P_0K_2$	4.42	0.80	6.63	7.15	4.81	2.48	34.62
$N_0P_1K_0$	3.18	0.52	4.33	4.63	2.87	2.25	36.57
$N_0P_1K_1$	4.22	0.68	4.78	5.62	3.96	3.33	37.64
$N_0P_1K_2$	6.20	0.90	7.73	7.87	5.66	4.58	43.66
$N_0P_2K_0$	5.20	0.85	5.98	6.65	4.65	2.06	54.38
$N_0P_2K_1$	6.40	1.15	8.75	8.90	5.40	2.56	70.33
$N_0P_2K_2$	4.06	0.59	4.18	4.95	3.73	1.30	40.86
$N_1P_0K_0$	6.33	1.06	8.35	8.60	5.76	2.68	42.97
$N_1P_0K_1$	2.12	0.36	2.78	2.79	1.98	2.92	37.67
$N_1P_0K_2$	3.65	0.50	3.73	3.95	2.78	2.15	43.98
$N_1P_1K_0$	4.82	0.95	6.15	6.37	4.82	1.75	45.27
$N_1P_1K_1$	5.13	0.81	5.07	6.08	4.59	3.60	39.28
$N_1P_1K_2$	4.45	0.73	5.93	5.93	3.96	2.98	55.70
$N_1P_2K_0$	6.22	1.06	8.18	7.85	5.56	3.01	43.29
$N_1P_2K_1$	5.48	0.72	5.58	5.24	5.91	4.06	53.92
$N_1P_2K_2$	6.72	1.09	8.82	8.73	5.63	2.85	**64.23**
$N_2P_0K_0$	4.33	0.78	5.77	5.53	3.78	2.95	61.08
$N_2P_0K_1$	5.78	0.93	6.80	6.82	4.92	2.96	52.78
$N_2P_0K_2$	6.03	0.99	7.12	8.00	4.88	4.06	58.58
$N_2P_1K_0$	3.30	0.70	6.33	5.72	3.90	1.33	49.37
$N_2P_1K_1$	5.37	1.03	8.63	8.02	5.96	4.25	56.47
$N_2P_1K_2$	5.50	0.88	6.42	6.53	4.50	3.23	48.01
$N_2P_2K_0$	4.00	0.68	5.42	4.86	3.23	1.95	36.45
$N_2P_2K_1$	3.05	1.18	4.40	3.78	2.96	2.95	50.72
$N_2P_2K_2$	5.27	0.88	7.18	6.95	4.85	3.08	53.73
SEm	**1.88**	**0.35**	**2.40**	**2.37**	**1.48**	**1.151**	**3.996**
CD (0.05)	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**	**NS**

Table 2.6 : Annual nut yield (kg/ tree/ year) of cashew as influenced by graded levels of N, P and K and their 2-and 3- way interactions at Madakkathara

Treatments	Levels of P_2O_5				Levels of K_2O		
	P_0 (0)	P_1 (125)	P_2 (250)	Mean	K_0 (0)	K_1 (125)	K_2 (250)
Levels of N							
N_0 (0)	3.16	3.38	1.97	2.84	2.82	2.92	2.66
N_1 (500)	2.58	2.78	3.31	2.89	2.48	3.53	3.46
N_2 (1000)	3.32	2.93	2.66	**2.97**	2.08	3.38	2.97
Mean	3.02	3.03	2.65	2.90			
Levels of K							
K_0 (0)	3.26	1.77	2.34	2.46			
K_1 (125	2.91	3.73	3.19	3.28			
K_2 (250)	2.90	3.60	2.41	2.97			

	CD (0.05)	SEm
N/P/K	: NS	0.384
NP/NK/PK	: NS	0.665
NPK	: NS	1.151

Table 2.7 : Cumulative nut yield (kg/ tree) of cashew as influenced by graded levels of N, P and K and their 2-and 3-way interactions at Madakkathara

Treatments	Levels of P_2O_5				Levels of K_2O		
	P_0 (0)	P_1 (125)	P_2 (250)	Mean	K_0 (0)	K_1 (125)	K_2 (250)
Levels of N							
N_0 (0)	20.13	19.64	27.59	22.45	22.57	24.94	19.85
N_1 (500)	20.77	23.37	26.90	23.68	21.92	21.81	27.31
N_2 (1000)	28.74	25.64	23.48	25.95	24.48	26.66	26.72
Mean	23.12	22.88	25.99	24.03			
Levels of K							
K_0 (0)	24.76	21.86	22.35	22.99			
K_1 (125	22.02	22.23	29.16	24.47			
K_2 (250)	22.86	24.56	26.47	24.63			

	CD (0.05)	SEm
N/P/K	: NS	1.332
NP/NK/PK	: NS	2.307
NPK	: NS	3.996

On-farm NPK trials

The data on nut yield from the on-farm trials conducted at Pazhayannur (location 1) and Kadavallur (location 2) indicated that the general yield level was high at location 1 as compared to location 2. At both the locations, application of increasing doses of fertilizer tended to increase the nut yield. However the maximum yield (3.18 kg/tree) was recorded by the KAU dose of 750:325:750 g NPK/tree at location 1, whereas at location 2, the highest yield (1.00 kg/tree) was recorded by the treatment of 1000: 250: 250 g NPK/tree, followed by the KAU dose (Table 2.8).

Table 2.8 : Effect of fertilizer schedules on nut yield (Kg/tree/year) of cashew at Madakkathara

Fertilizer schedule (g NPK/tree)	Location 1 (Pazhayannur)	Location 2 (Kadavallur)
T1- 500:125:125 (NRCC)	2.77	0.92
T2- 750:187.5: 187.5 (150% NRCC)	3.06	0.95
T3- 1000: 250: 250 (200% NRCC)	3.11	1.00
T4- 750: 325: 750 (KAU)	4.18	0.97
T5- Fully organic (Farmers' practice)	2.94	0.94

VRIDHACHALAM

Results revealed that higher plant height (5.95 m), trunk girth (59.85 cm), canopy area (28.80 m^2) and nut yield (8.85 kg/tree) were produced by application of higher level of N, P and K fertilizers at the rate of 1000g : 125 g P : 250 g K per tree per year. The higher dose of fertilizers enhanced the growth parameters of cashew trees leading to increased nut yield. The treatment $N_1P_1K_1$ showed a B:C ratio of 5.60 and the treatment with higher fertilizer dose $N_2P_2K_2$ showed a B:C ratio of 2.88. The duration of flowering ranged between 67-71days, apple weight ranged between 44.50-44.80 and mean nut weight ranged between 5.90-6.10 g and were not significantly different amongst the treatments (Table 2.9).

Table 2.9 : Performance of Cashew in Response to NPK fertilizer treatments at Vridhachalam

Treatment No.	Canopy area (m^2)	Nut Yields (kg/tree)	Cum yield (kg/tree) for 5 years
$N_0P_0K_0$	25.50	5.50	13.03
$N_0P_0K_1$	26.60	5.60	12.93
$N_0P_0K_2$	26.40	5.75	14.16
$N_0P_1K_0$	23.30	6.75	18.25
$N_0P_1K_1$	25.20	6.25	15.76
$N_0P_1K_2$	20.50	7.00	19.41
$N_0P_2K_0$	23.50	5.90	14.45
$N_0P_2K_1$	24.35	6.60	17.08
$N_0P_2K_2$	25.65	6.85	17.48
$N_1P_0K_0$	24.65	7.00	19.45
$N_1P_0K_1$	24.60	7.45	20.83
$N_1P_0K_2$	22.95	7.00	19.70
$N_1P_1K_0$	22.50	7.50	21.10
$N_1P_1K_1$	27.25	7.30	20.10
$N_1P_1K_2$	27.02	7.30	20.33
$N_1P_2K_0$	26.55	7.80	22.18
$N_1P_2K_1$	27.25	7.85	22.25
$N_1P_2K_2$	27.90	7.60	21.88
$N_2P_0K_0$	25.50	7.75	22.52
$N_2P_0K_1$	25.62	7.80	22.77
$N_2P_0K_2$	26.85	7.75	22.58
$N_2P_1K_0$	26.25	7.50	21.34
$N_2P_1K_1$	27.55	7.50	22.23
$N_2P_1K_2$	28.80	**8.85**	25.33
$N_2P_2K_0$	27.90	8.20	22.90
$N_2P_2K_1$	27.80	8.25	23.79
$N_2P_2K_2$	27.90	8.20	23.98

	Nut yield / Tree

	Canopy area	
	SEd	CD(0.05)
N	0.163	0.335**
P	0.163	0.335**
K	0.163	0.335**
NP	0.825	0.580**
PK	0.825	0.580**
NK	0.282	0.580**
NPK	0.489	1.005**

	SEd	CD(0.05)
N	0.055	0.113**
P	0.055	0.113**
K	0.055	0.113**
NP	0.0954	0.196**
PK	0.095	0.196**
NK	0.095	0.196**
NPK	0.165	0.339**

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 cumulative nut yield over 5 years was highest in S_3 (600 plants/ha) (83.40 q/ha) followed by S_2 (400 plants/ha) (74.68 q/ha) and S_1 (200 plants/ha) (38.39 q/ha); and fertilizer dose of 150 N:P:K at 150:50:50 kg/ha was found significantly superior. At Chintamani the highest yield per plant (3.20 kg/plant) and highest nut yield kg/ha (1575 kg/ha) was recorded with highest dose of fertilizer N:P:K at 225:75:75 kg/ha. The maximum annual nut yield/tree (0.88 kg/tree) and per hectare (325 kg/ha) was recorded by a fertilizer level of 75: 25: 25 kg NPK/ha at Madakkathara Centre. At Vridhachalam M_1S_3 (75:25:25 kg/ha and 600 pl/ha) resulted in the maximum nut yield per tree (6.50 kg).

Experiment Details :

Design	:	Split plot		
Main plot : Plant density	:	S_1 200 plants/ha (10m x 5m)		
		S_2 400 plants/ha (6m x 4m)		
		S_3 600 plants/ha (5m x 4m)		
Sub-plot : Fertilizer dose/ha	:	M_1 75 kg N, 25 kg P_2O_5, 25 kg K_2O		
		M_2 150 kg N, 50 kg P_2O_5, 50 kg K_2O		
		M_3 225 kg N, 75 kg P_2O_5, 75 kg K_2O		
Total area	:	2.5 ha		
Fertilizers application level :		1^{st} year	:	$1/5^{th}$
		2^{nd} year	:	$2/5^{th}$
		3^{rd} year	:	$3/5^{th}$
		4^{th} year	:	$4/5^{th}$
		5^{th} year	:	Full dose

BAPATLA

The experimental trees are in the initial stage of vegetative growth. The data on growth parameters recorded during 2005-2006 is presented in Table 2.10.

Table 2.10 : Growth and yield characters under high density and fertilizer trial at Bapatla

Treatment	Plant height (m)	Plant girth (cm)	Canopy spread (m)	
			E-W	N-S
M_1S_1	2.40	36.80	3.06	3.24
M_1S_2	2.86	42.60	3.66	3.26
M_1S_3	3.25	48.30	3.98	3.72
M_2S_1	2.10	39.40	2.63	2.70
M_2S_2	2.46	39.90	3.21	3.09
M_2S_3	2.05	15.86	1.68	1.82
M_3S_1	2.25	38.20	4.00	4.10
M_3S_2	2.65	41.80	2.96	3.15
M_3S_3	2.80	28.38	2.42	2.59

BHUBANESWAR

There was no significant effect due to spacing in all the vegetative characters except plant spread which was highest (5.13 m E-W and 5.96 m N-S) in S_1 treatment (200 pl/ha) (Table 2.11a). Due to increasing doses of fertilizer, there was an increase in plant height which was not significant. There was no significant variation with regard to stem girth and canopy spread, due to fertilizer doses (Table 2.11b).

Table 2.11 : Effect of fertilizer and spacing on vegetative character at Bhubaneswar

a). Effect of spacing (Main plot)

Treatment	Plant Height (m)	Girth (cm)	Canopy Spread (m)	
			E-W	N-S
S_1	4.02	49.90	5.13	5.96
S_2	4.21	48.76	4.58	5.86
S_3	4.11	47.46	4.44	5.16
F 'test'	NS	NS	*	*
SE (m) $\pm$ CD 5%	0.1	1.45	0.138 0.478	0.081 0.282

b) Effect of doses of fertilizer (sub plot)

Treatment	Plant Height (m)	Girth (cm)	Canopy Spread (m)	
			E-W	N-S
M_1	4.19	49.29	4.78	5.65
M_2	4.13	48.71	4.69	5.81
M_3	4.02	48.11	4.68	5.53
F 'test'	NS	NS	NS	NS
SE (m) $\pm$ CD5%	0.05	0.76	0.08	0.079

There was no significant variation in the plant height, girth, spread of the plant due to interaction effect of spacing and doses of fertilizer. Maximum height was recorded in S_2M_1 (4.34 m) and maximum girth was recorded in S_1M_2 (51.08 cm). S_1M_2 recorded maximum canopy spread (6.13 m) followed by S_2M_2 (6.08 m).

The number of flowering panicles, no. of nuts/panicle, apple weight and nut weight were not significantly different among different spacings. The maximum yield per plant was recorded in S_1 (6.93 kg), which is at par with S_2 (6.86 kg) but significantly different from S_3 (5.76 kg). The cumulative nut yield per plant for 5 years was found maximum in S_1 (19.14 kg) followed by S_2 (18.65 kg) and minimum in S_3 (16.68 kg). Significant variation in nut yield/ha due to increased plant population was recorded. Highest yield was recorded in S_3 (28.82 q/ha) followed by S_2 (27.45 q/ha) and minimum in S_1 (13.85 q/ha). S_3 was significantly superior to S_1 and S_2. The cumulative nut yield over 5 years was highest in S_3 (83.40 q/ha) followed by S_2 (74.68 q/ha) and S_1 (38.39 q/ha) (Table 2.12a).

Flowering was preponed by 12 -15 days with higher doses of fertilizer. Doses of fertilizer significantly influenced the number of flowering panicles / m^2 and M_3 (18.73) was found significantly superior to M_1 (17.09). The number of nuts per panicle. Apple weight and nut weight were not significantly influenced by doses of fertilizer. An increase in the number of nuts per panicle led to decrease in the apple weight and nut weight. The nut yield per plant, was found significantly superior in M_2 (6.89 kg) and in M_1 (6.80 kg) compared to M_3 (5.87 kg) due to doses of fertilizer application.

Cumulative yield at 5^{th} harvest was highest in M_2 (19.07 kg) followed by M_1 (18.19 kg) and minimum in M_3 (17.44 kg). M_2 was significantly superior to M_3. The cumulative yield per hectare was highest in M_2 (68.70 q/ha) followed by M_1 (65.63 q/ha) and M_3 (62.02 q/ha) (Table 2.12 b).

Table 2.12 : Effect of doses of fertilizer and spacing on flowering & yield attributes at Bhubaneswar

a) Effect of spacing (Main plot)								
Treatments	**No. of Flowering Panicles/m^2**	**No. of nuts / panicle**	**Apple weight (g)**	**Nut weight (g)**	**Yield (kg / plant)**	**Cum. Yield (kg) 5th harvest**	**Yield (q/ha)**	**Cum. yield (q/ha)**
S_1	20.78	7.20	55.00	7.97	6.93	19.14	13.85	38.39
S_2	17.10	7.23	49.00	7.93	6.86	18.65	27.45	74.68
S_3	16.48	7.70	50.33	7.67	5.76	16.68	28.82	83.40
F 'test'	NS				S		S	
SE (m) ±	1.33				0.075		0.32	
CD 5%	-				0.261		1.12	

b) Effect of doses of fertilizer (Subplot)

Treatments	**No. of Flowering panicles/m^2**	**No. of nuts / panicle**	**Apple weight (g)**	**Nut weight (g)**	**Yield (kg/ plant)**	**Cum. Yield (kg) 5th harvest**	**Yield (q/ha)**	**Cum. yield (q/ha)**
M_1	17.09	6.50	58.00	8.37	6.80	18.19	24.25	65.63
M_2	18.54	7.13	51.67	7.93	6.89	19.07	24.71	68.70
M_3	18.73	8.50	44.67	7.27	5.87	17.44	21.16	62.02
F 'test'	S				S		S	
SE (m) ±	0.39				0.079		0.25	
CD 5%	1.63				0.235		0.74	

No significant variation was observed among the treatments with respect to flowering and yield attributes. The yield per plant was maximum in S_1M_2 (7.39 kg) and minimum in S_3M_1 (5.80 kg) (Table 2.13).

Table 2.13 : Effect of doses of fertilizer and spacing on flowering and yield attributes at Bhubaneswar

Treatment	No. of Flowering panicles/m^2	No. of nuts/ panicle	Apple Weight (g)	Nut weight (g)	Yield (Kg/plant)	Cum. Yield (kg) 5^{th} harvest	Yield (Q/ha)	Cum. Yield (Q)
S_1M_1	19.96	6.20	62	8.40	7.30	19.03	14.59	40.44
S_1M_2	21.25	6.70	57	8.10	7.39	20.24	14.77	43.17
S_1M_3	21.12	8.70	46	7.40	6.10	18.21	12.20	39.95
S_2M_1	16.08	6.40	54	8.60	7.30	18.88	29.18	80.88
S_2M_2	17.10	7.10	49	7.90	7.10	19.41	28.38	83.08
S_2M_3	18.12	8.20	44	7.30	6.20	17.72	24.78	78.05
S_3M_1	15.21	6.90	58	8.10	5.80	16.68	28.98	90.11
S_3M_2	17.28	7.60	49	7.80	6.20	17.60	30.98	94.73
S_3M_3	16.94	8.60	44	7.10	5.30	15.77	26.50	86.87
F 'test'	NS				NS		S	
SE (m) ±	0.678				0.137		0.43	
CD 5%	-				-		1.29	

With respect to nutrient contents, the leaf nitrogen % was maximum in S_1 (2.13 %) followed by S_2 (1.96 %) and S_3 (1.90 %). The leaf Nitrogen % increased due to higher doses of fertilizer application. M_3 recorded maximum leaf Nitrogen 2.18 % followed by M_2 (2.05 %) and minimum in M_1 (1.75 %). S_1M_3 recorded maximum leaf N (2.27 %) and minimum in S_3M_1 (1.62 %) (Table 2.14).

Table 2.14: Leaf Nitrogen content (%) at different spacing and fertilizer levels at Bhubaneswar

	M_1	**M_2**	**M_3**	**Average**
S_1	1.96	2.16	2.27	2.13
S_2	1.68	2.05	2.15	1.96
S_3	1.62	1.95	2.12	1.90
Average	1.75	2.05	2.18	

The leaf P_2O_5 content increased with decrease in spacing. S_1 recorded 0.03%, where as S_2 and S_3 recorded 0.04 % P_2O_5 content. The P_2O_5 content increased with increased doses of P_2O_5 and maximum was recorded in M_3 (0.04 %) and minimum in M_1 0.03 %. S_2M_3, S_3M_3 recorded maximum P_2O_5 % (0.04 %) and minimum in S_1M_1 (0.03 %) (Table 2.15).

Table 2.15 : Leaf phosphorous content (%) at different spacing and fertilizer levels at Bhubaneswar

	M_1	M_2	M_3	Average
S_1	0.03	0.03	0.04	0.03
S_2	0.04	0.03	0.04	0.04
S_3	0.03	0.04	0.04	0.04
Average	0.03	0.04	0.04	

The leaf K_2O % showed a similar trend as in P_2O_5. Maximum K_2O % was recorded in S_3 (0.41 %), followed S_2 (0.37 %) and minimum in S_1 (0.33 %). In case of doses of fertilizer maximum K_2O content was recorded in M_2 (0.46 %) followed by M_3 (0.39 %) and minimum in M_1 (0.26 %). S_3M_2 recorded highest K_2O % (0.48 %) followed by S_2M_2 (0.46 %), S_1M_2, S_3M_3 (0.44 %) and minimum in S_1M_1 (0.21 %) (Table 2.16).

Table 2.16 : Leaf Potassium content (%) at different spacing and fertilizer levels at Bhubaneswar

	M_1	M_2	M_3	Average
S_1	0.21	0.44	0.35	0.33
S_2	0.27	0.46	0.38	0.37
S_3	0.31	0.48	0.44	0.41
Average	0.26	0.46	0.39	

CHINTAMANI

The plant height, stem girth and canopy spread N-S did not vary 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 by S_2 (3.04 kg) and lowest in S_1 (2.76 kg). The plant height, stem girth and canopy spread in N-S direction recorded did not vary significantly among the different levels of fertilizers at different plant densities. However, canopy spread in E-W direction varied significantly among fertilizer levels. The E-W spread was noticed in M_1 (4.80 m) and lowest in M_2 (3.92 m). The nut yield varied significantly both for kg/plant and kg/ha. The highest yield per plant was recorded by M_3 (3.20 kg/plant) and highest nut yield kg/ha also by M_3 (1575 kg/ha) (Table 2.17).

Table 2.17 : Effect of plant density and fertilizer levels on growth and yield of cashew at Chintamani.

Treatments	Plant height (m)	Stem girth (cm)	Canopy spread (m)		Yield (kg/ plant)	Yield (kg/ ha.)
			E-W	N-S		
Densities						
S1	3.15	41.92	4.24	4.57	2.76	1137
S2	3.25	40.98	4.40	4.47	3.04	1182
S3	3.24	38.70	4.13	4.27	3.01	1193
S.Em ±	0.09	1.80	0.18	0.18	0.06	31.41
C.D at 5%	NS	NS	NS	NS	0.19	-
Fertilizer levels						
M_1	3.29	43.16	4.80	4.71	3.06	657
M_2	3.20	38.03	3.92	4.11	2.55	1280
M_3	3.15	40.40	4.06	4.10	3.20	1575
S. Em ±	0.10	1.81	0.22	0.24	0.09	41.40
C.D at 5%	NS	NS	0.67	NS	0.27	123.02

Interaction effect of densities and fertilizers did not varied significantly either with the growth parameters nor yield during the year of reporting. However, the highest nut yield per plant was recorded by S_3 M_3 (3.52 kg) followed by S_2 M_3 (3.25 kg). The highest yield per hectare was recorded by S_3 M_3 (1643 kg) followed by S_2 M_3 (1593 kg) (Table 2.18).

Table 2.18 : Interaction effect between plant density and fertilizer levels on growth and yield of cashew at Chintamani

Interactions	Height (m)	Stem girth (cm)	Canopy spread (m)		Yield (kg/ plant)	Yield (kg/ ha.)
			E-W	N-S		
S_1 M_1	3.33	46.57	4.98	4.73	3.06	667
S_1 M_2	3.13	38.48	3.69	3.85	2.39	1252
S_1 M_3	2.98	40.73	4.04	3.93	2.83	1491
S_2 M_1	3.38	42.95	5.01	4.93	3.19	676
S_2 M_2	3.20	37.74	4.10	4.29	2.69	1278
S_2 M_3	3.19	42.25	4.09	4.19	3.25	1593
S_3 M_1	3.15	39.98	4.40	4.47	2.93	629
S_3 M_2	3.28	37.89	3.97	4.19	2.57	1310
S_3 M_3	3.29	38.23	4.04	4.17	3.52	1643
S.Em ±	0.18	3.13	0.39	0.41	0.16	71.71
C.D at 5%	NS	NS	NS	NS	NS	NS

JAGDALPUR

The trunk girth and nut weight were found non significant for all the treatments. The maximum plant height (1.87 m) was recorded under treatment S_2M_3 which was at par with S_3M_3 (1.83 m) and S_3M_2 (1.73 m). The maximum canopy spread EW (209.33) and NS (217.89) was recorded in S_1M_3, which varied significantly among the treatments. The yield /tree (g) was recorded highest for S_3M_3 (648.68). The Yield (kg/ha) was significantly highest for the treatment S_3M_3 (324.34) (Table 2.19).

Table 2.19 : Interaction effect between plant density and fertilizer levels on growth and yield of cashew at Jagdalpur

Treatment	Plant height (m)	Girth (cm)	Canopy Spread		Nut weight (g)	Yield/ tree (g)	Yield/ha (Kg)
			E - W	N - S			
$S_1 M_1$	1.39	25.50	179.33	144.00	6.46	147.95	29.59
$S_1 M_2$	1.62	22.23	188.03	202.67	6.47	200.98	40.19
$S_1 M_3$	1.42	24.10	**209.33**	**217.89**	6.52	447.48	89.49
$S_2 M_1$	1.33	20.86	194.00	184.00	6.46	163.24	67.90
$S_2 M_2$	1.65	23.66	188.03	188.03	6.46	277.24	115.33
$S_2 M_3$	**1.87**	24.80	196.60	196.60	6.53	417.69	173.75
$S_3 M_1$	1.38	21.16	147.00	169.50	6.46	128.26	64.13
$S_3 M_2$	1.73	22.60	148.03	201.00	6.46	247.63	123.81
$S_3 M_3$	1.83	25.16	197.00	202.00	6.59	**648.68**	**324.34**
CD at 5%	0.25	NS	22.32	16.18	NS	92.45	43.34

JHARGRAM

There were significant differences among the treatments in terms of growth and yield parameters. Maximum plant height was noticed in M_1S_1 (3.21 m). In 10 X 5 m spacing there was a decreasing trend in plant height with an increasing dose of fertilizer. But in 6 x 4 m spacing maximum plant height as well as trunk girth were supported by moderate dose of fertilizer (M_2). In 5 x 4 m spacing trunk girth showed a decreasing trend with an increasing dose of applied fertilizer. It was noticed with all the densities that canopy spread was indirectly related with fertilizer application. Maximum canopy spread was with 10 x 5 m spacing.

Nuts /m^2 were better with the moderate or high dose of fertilizer and maximum nuts / m^2 were noticed with 6 x 4 m spacing. The yield /tree were maximum with

moderate dose of fertilizer in all the densities and maximum yield was with 5 x 4 m spaced trees (1.54 kg/tree).

Maximum biomass was removed from 5 x 4 m spaced plants followed by 6 x 4 m spacing and 10 x 5 m. In all the densities it was noticed that flowering/m^2 was highest with low dose of fertilizer application (Table 2.20).

Table 2.20 : Growth and yield characters under high density planting and fertilizer trials at Jhargram

Parameters	Fertilizer Treatments	Spacing			S.Em. ±	C.D.at 5%
		S_1	S_2	S_3		
Plant Height (m)	M_1	3.21	2.80	3.18	0.1563	0.341
	M_2	3.16	3.10	2.78		
	M_3	2.88	2.83	2.98		
Trunk Girth (Cm)	M_1	35.00	37.33	39.00	2.2388	4.878
	M_2	32.67	45.67	35.67		
	M_3	37.67	36.67	32.67		
Canopy Spread (m)	M_1	4.18	3.44	3.59	0.3345	0.729
	M_2	3.07	3.19	3.04		
	M_3	2.89	2.90	2.93		
Canopy Height (m)	M_1	2.71	2.48	2.79	0.1567	0.341
	M_2	2.76	2.83	2.33		
	M_3	2.57	2.45	2.51		
Flowering /m^2	M_1	15.58	11.48	16.67	0.9082	1.979
	M_2	12.50	10.75	10.00		
	M_3	9.33	9.25	11.67		
Veg Flush /m^2	M_1	6.67	9.75	7.42	1.1765	2.564
	M_2	7.75	10.00	7.58		
	M_3	5.73	5.42	6.67		
Nuts/m^2	M_1	13.75	19.92	9.67	3.5623	7.762
	M_2	22.25	15.42	24.08		
	M_3	20.33	25.75	23.58		
Nuts/Panicle	M_1	4.41	4.75	3.77	1.114	2.427
	M_2	2.95	3.53	5.33		
	M_3	9.68	5.83	7.58		
Nut Weight (g)	M_1	4.10	4.23	3.73	0.5052	1.101
	M_2	4.23	5.27	4.60		
	M_3	4.67	4.27	3.00		
Apple Weight (g)	M_1	11.33	15.00	21.67	5.77	12.573
	M_2	14.33	30.00	34.50		
	M_3	28.50	35.33	25.33		
Yield (kg/tree)	M_1	0.66	1.27	0.69	0.3244	0.707
	M_2	1.32	1.41	1.54		
	M_3	1.02	1.35	1.38		
Biomass Removed (kg/tree)	M_1	25.43	41.07	41.60	3.1784	6.926
	M_2	25.43	31.83	47.23		
	M_3	38.17	46.73	23.73		

MADAKKATHARA

Biometric observations were recorded from 2004 and yield from 2004-05 onwards. Due to severe infestation of tea mosquito bug in spite of timely plant protection measures nut yield was not obtained during 2005-06 and yield was poor during 2006-07 also due to TMB infestation.

The results indicated that tree densities, fertilizer doses and their interactions did not significantly influence any of the growth parameters.

The maximum height (4.51m) was recorded by the tree density of 500 trees/ha. With regard to canopy spread, both in east- west and north- south directions, the lowest density of 200 trees/ha recorded the maximum value.

Data on annual nut yield per tree for 2006-07 indicated declining yield levels when the tree density was increased beyond 400 trees/ha from 0.87 to 0.77 kg/tree. However per hectare nut yield increased steadily with increasing tree density from 200 to 500 trees/ha from 164 to 388 kg.

Data on cumulative yield indicated the same trend as that of annual yield for 2006-07, with declining per tree yield beyond 400 trees/ha and increasing per hectare yield up to 500 trees/ha.

A similar decline from cumulative yield in yield/tree and increase in yield/ha was also recorded.

The maximum annual nut yield for 2006-07 [both per tree (0.88 kg/tree) and per hectare (325 kg/ha)] was recorded by the treatment receiving the fertilizer level of 75: 25: 25 kg NPK/ha. The cumulative yield also varied as that of annual yield for 2006-07, with the fertilizer schedule of 75: 25: 25 kg NPK/ha recording the highest cumulative yield (Table 2.21).

Table 2.21 : 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)	Yield (kg/tree) (2006-07)		Cumulative yield (kg/ha) (2006-07)	
					kg/tree	kg/ha	kg/tree	kg/ha
Densities								
S_1 - 200	4.33	58.10	5.23	4.81	0.81	164	1.12	224
S_2 -400	4.29	58.40	4.64	4.21	0.87	349	1.16	466
S_3 -500	4.51	58.10	4.73	4.48	0.77	388	1.04	520
CD (0.05)	NS	NS	NS	NS	NS		NS	
SEm	0.13	2.10	0.26	0.20	0.06		0.05	
Fertilizer doses								
M_1- 75:25:25	4.34	57.70	4.89	4.45	0.88	325	1.19	438
M_2- 150:50:50	4.34	58.80	4.95	4.54	0.78	287	1.05	386
M_3- 225:75:75	4.45	58.10	4.74	4.51	0.79	292	1.08	397
CD (0.05)	NS	NS	NS	NS	NS		NS	
SEm	0.10	1.9	0.18	0.14	0.07		0.09	

PILICODE

Among the growth and yield characters recorded, nut yield only showed the significant variation among the densities of planting and levels of fertilizers evaluated. The interaction effects of fertilizer and planting densities did not exhibit significant variation. The nut yield per ha (4.42 q/ha) was significantly superior in the higher density of planting (ie., S_3: 5 x 4 m, 600 plants/ha.). Again the yield per ha was significantly high (6.36 q/ha) with lower dose of fertilizers (ie., M_1: 75 N, 25 P_2O_5, 25 K_2O) (Table 2.22 & 2.23).

Table 2.22 : Effect of spacing on vegetative characters and yield at Pilicode

Treatment	Plant Height(m)	Girth(cm)	Spread of the plant		No of flowering panicle /m^2	Yield(kg) per plant	Yield/ha (Q)
			E-W (m)	N-S (m)			
S_1	2.73	33.49	2.90	2.97	2.12	0.69	4.17
S_2	2.77	31.76	2.86	2.87	3.03	0.69	4.14
S_3	2.94	33.10	3.07	3.07	3.21	**0.73**	**4.42***
CD 0.5	NS	NS	NS	NS	NS	0.03	0.03

Table 2.23 : Effect of Fertilizer on vegetative characters and yield at Pilicode

Treatment	Plant Height(m)	Girth(cm)	Canopy spread		No of flowering panicle /m^2	Yield(kg) per plant	Yield/ha (Q)
			E-W (m)	N-S (m)			
M_1	3.01	34.63	3.08	3.14	3.30	**1.06**	**6.36***
M_2	2.80	31.99	2.98	2.99	2.92	0.57	3.45
M_3	2.64	31.72	2.78	2.78	2.14	0.48	2.92
F test	NS	NS	NS	NS	NS	NS	1.24

VENGURLA

The height, girth, canopy spread, no. of laterals per sq. m, no. of panicles per sq. m. showed significant differences due to spacing. The maximum height (5.21 m) was recorded in the trees of S_3M_1 treatment, the maximum girth (65.44cm) was reported by the trees of S_3M_3 treatment, while the canopy area was maximum (127.73 m^2) in the trees having S_1M_2 treatment. The maximum number of panicles per sq. m (32.56) was observed in treatment S_1M_2. All other fruiting parameters and yield showed non-significant results. Maximum yield/ha (575.0 kg) was recorded in S_3M_2 while the cumulative yield (2.54 kg/tree) was recorded in S_1M_3 (Table 2.24).

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

Treatment	Height (m)	Girth (cm)	Canopy area (m2)	No. of panicle/ m^2	Yield kg/ tree	Yield (Kg /ha)	Cum. yield (Kg /tree)
S_1M_1	4.11	63.50	121.64	31.19	0.67	134	1.23
S_1M_2	4.49	60.97	127.73	**32.56**	1.09	218	1.83
S_1M_3	4.11	60.92	117.61	29.74	1.40	280	**2.54**
S_2M_1	3.86	52.03	98.36	20.83	0.85	340	1.25
S_2M_2	4.29	56.08	98.84	25.17	0.95	380	1.42
S_2M_3	4.05	55.72	111.68	24.81	0.56	236	0.87
S_3M_1	**5.21**	61.32	117.26	28.29	1.12	560	1.80
S_3M_2	4.62	60.45	118.06	27.25	1.15	**575**	1.86
S_3M_3	5.00	**65.44**	118.36	28.97	1.04	520	1.86
SEm± for S	0.14	2.02	5.35	1.11	0.22	-	-
CD at 5% for S	0.43	6.03	N.S.	3.32	N.S.	-	-
SEm± for M	0.14	2.02	5.35	1.11	0.22	-	-
CD at 5% for M	N.S.	N.S.	N.S.	N.S.	N.S.	-	-
SEm± for S X M	0.25	3.84	9.27	1.92	0.39	-	-
CD at 5% for S X M	N.S.	N.S.	N.S.	N.S.	N.S.		-

VRIDHACHALAM

The maximum canopy spread (5.52 m) and maximum canopy area (24.50 m^2) was recorded in M_1S_3 treatment receiving least fertilizer dosage and having highest density of planting. The treatment M_1S_3 with 5 x 4 m with 500 plants per hectare plant population and NPK dose of 75:25:25 kg/ha recorded the highest nut yield per tree (6.50 kg). The densely planted trees showed reduced yield when compared with 10 x 5 m spacing. The widely spaced trees with 10 x 5 m spacing , 200 plants per hectare recorded 6.00 kg per tree (1200 kg per hectare).Whereas, the trees in the 5x4m spacing recorded lower yield ranging from 4.20 kg to 4.50 kg/tree in various treatments of fertilizer, however the treatment M_3S_3 led to the highest yield of 2250 kg nuts per hectare. The duration of flowering and nut weight were not significantly different in the various treatments. The duration of flowering ranged between 60-70 days and nut weight ranged between 6.75 – 7.10 g (Table 2.25).

Table 2.25 : Effect of fertilizer application and spacing on vegetative characters of cashew at Vridhachalam

Treatment	Canopy spread (m)	Canopy area (m^2)	Nut Yield/ tree (kg)	Yield / ha (kg)
M_1S_1	5.00	24.49	6.00	1200
M_1S_2	5.50	24.21	6.00	1200
M_1S_3	**5.52**	**24.50**	**6.50**	1300
M_2S_1	5.00	22.20	5.50	2200
M_2S_2	5.20	23.30	5.50	2200
M_2S_3	5.25	23.50	6.00	2400
M_3S_1	4.50	20.30	4.20	2100
M_3S_2	4.25	20.20	4.50	2250
M_3S_3	4.50	20.50	4.50	**2250**

	Canopy spread		Canopy area	
	SED	CD	SED	CD
M	0.143	0.039*	0.009	0.025*
S	0.046	0.101*	0.073	0.158*
M x S	0.157	0.421*	0.103	0.224*
S x M	0.080	0.174*	0.126	0.273*

	Nut yield/per tree	
	SED	CD
M	0.057	0.157
S	0.087	0.190
M x S	0.136	0.311
S x M	0.152	0.330

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

This trial has been laid out to identify the optimum population density for cashew to maximize the returns per unit area.

SUMMARY:
The mean yield per plant during 6th harvest at Chintamani under high density planting (2.03 kg/tree) was lesser compared to normal planting (6.53 kg/tree). At Madakkathara the yield per tree was marginally high under normal density (4.12 kg) as compared to high-density planting system (3.66 kg) during the tenth year of planting.

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

The various vegetative parameters in normal and high density planting did not vary significantly (Table 2.26).

Table 2.26 : Growth parameters under high density trial at Bapatla

Parameter	Mean	
	8x8m plot	4x4m plot
Pl. height (m)	1.21	1.15
Trunk girth(cm)	24.05	21.72
Canopy spread E-W (m)	1.80	1.70
Canopy spread N-S (m)	1.90	2.30

BHUBANESWAR

The plants had attained a maximum height of 5.20m and were pruned at a height of 3 m during June 2004. The yield (tons/ha) recorded was 2.40 tons in 2005 and 2.53 tons in 2006.

During 2005, the yield in the farmers' field at Dhenkanal under high-density spacing with cashew variety Vengurla-4 recorded 2.50 tons / ha (5th harvest). The yield was 2.62 tons / ha on 6th harvest.

CHINTAMANI

The mean yield per plant recorded lower values under high density planting (2.03 kg/tree during 6th harvest) compared to normal planting (6.53 kg/tree during 6th harvest). The yield kg/ha (1269 kg/ha) under high density planting with a mean cumulative nut yield (3594 kg/ha) were higher compared to normal planting wherein, the mean nut yield of 6th harvest obtained was 1012 kg/ha with a cumulative nut yield of 2151 kg/ha.

Table 2.27 : 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)		
	Maximum	Minimum	Mean	Maximum	Minimum	Mean
Plant height (m)	4.40	2.70	3.55	6.00	4.00	5.00
Stem girth (cm)	55.00	36.00	45.50	84	70	77
Canopy spread (m)						
E - W	4.30	2.70	3.50	9.10	7.60	8.35
N - S	4.70	2.80	3.75	8.70	7.00	7.85
Yield (kg/tree)	3.20	0.85	2.03	8.15	4.90	6.53
Yield (kg/ha)	2000	531	1269	1263	760	1012
Cumulative Yield of 6 harvests						
Kg/tree	9.00	2.50	5.75	16.00	11.75	13.88
Kg/ha	5625	1563	3594	2480	1821	2151

MADAKKATHARA

The yield per tree was marginally high under normal density (4.12 kg) as compared to high-density planting system (3.66 kg) during the tenth year of planting. However, the yield per hectare was significantly high under high density planting (2291 kg) as compared to normal density (643 kg). The canopy spread indicated the overlapping of canopy during the year under report under high density planting. Tree height, tree girth and canopy spread did not differ significantly between normal density planting and high density planting (Table 2.28).

Table 2.28 : Effect of high density planting on growth and yield attributes and yield of cashew at Madakkathara

Parameters	High density planting	Normal planting
Tree height (m)	6.69	6.98
Trunk girth (cm)	80.30	83.90
Canopy spread - NS (m)	7.01	7.03
Canopy spread - EW (m)	7.52	7.69
Yield (kg/tree/annum)	**3.66**	**4.12**
Yield (kg/ha/annum)	**2291**	**643**
Cumulative yield (kg/ tree) in seven harvests	22.61	23.55
Cumulative yield (kg/ha in seven harvests)	14131	3674

VENGURLA

The mean plant height under high density planting was 5.80 m, mean stem girth was 65.60 cm and mean canopy diameter was 4.69m. The mean yield per plant was 0.15 kg/plant whereas the mean cumulative yield for 3 harvests was 0.30 kg/plant.

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.

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 (T-5) recorded significantly highest plant height (4.91 m), stem girth (73.80 cm), canopy spread (E-W, 7.80 and N-S, 7.83 m), nut yield of 8.63 kg/tree with a nut weight of 7.36 g and shelling per cent of 31.20 (Table 2.29).

Table 2.29 : Effect of Drip irrigation levels on growth and yield of Cashew at Chintamani

Treatments	Plant height (m)	Stem girth (cm)	Canopy spread (m)		Nut yield (kg/tree)	Nut Wt. (g)	Shelling (%)
			E - W	N - S			
T1: No irrigation	4.27	64.70	6.63	6.65	4.90	6.95	29.00
T2 : Irrigation at 20% CPE	4.37	67.45	7.06	7.11	6.16	7.00	30.20
T3 : Irrigation at 40% CPE	4.63	69.10	7.33	7.56	6.61	7.20	30.50
T4 : Irrigation at 60% CPE	4.83	73.35	7.62	7.57	8.14	7.25	31.00
T5 : Irrigation at 80% CPE	4.91	73.80	7.80	7.83	**8.63**	**7.36**	**31.20**
S.Em ±	0.10	5.18	0.21	0.24	0.11	-	-
C.D at 5%	0.29	-	0.45	0.51	0.34	-	-

VENGURLA

The growth and yield parameters were found to be non-significant, among the different treatments.

VRIDHACHALAM

This trial has been initiated with VRI-3 grafts during 2005. However, the treatments were imposed during 2007.

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:

The yield and total net returns per hectare from inter-crops as well as main crop at Bhubaneswar after 3 years revealed that maximum return was received from colocasia (Rs 44,908/-) followed by brinjal (Rs. 37,666/-), bhindi (Rs 36,650/-) and cowpea (Rs 36,398/-). At Jhargram, the cost benefit ratio also depicted that maximum profit could be obtained with cluster bean (Rs.19,142/-) intercropping under cashew plantation followed by pigeon pea (Rs.17,771/-)and ground nut (Rs.13,923/-). At Madakkathara, the highest net return (Rs. 48766/-) was recorded by tapioca followed by colocasia (Rs. 43290/-).

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

Groundnut has recorded maximum yield of 1125 kg/ha and gave highest cost benefit ratio (1.15) followed by green gram (0.90) and black gram (0.79). Net profits per hectare was maximum in groundnut (20,700/-) followed by green gram (11,010/-) and black gram (10,184/-) (Table 2.30).

Table 2.30 : Yield and net returns in intercropping trial at Bapatla

Treatments	Mean Yield of main crop		Total cost of input/ha (Rs) (Inter crop+ main crop)	Total returns from main crop + intercrop /ha (Rs)	Net profits/ha (Rs)	C:B ratio
	Per tree (kg)	Per ha (Q)				
T1 Cashew+Groundnut	4.30	5.40	18000/-	38700/-	**20700/-**	**1.15**
T2 Cashew+Green gram	3.92	5.95	12120/-	23130/-	11010/-	0.90
T3 Cashew+Blackgram	3.65	5.54	12736/-	22920/-	10184/-	0.79
T4 Cashew (Sole crop)	2.90	4.40	7500/-	13200/-	5700/-	0.76

(*The Rate of raw cashew nuts taken at Rs.3000/- per quintal)

BHUBANESWAR

The varieties of the intercrops evaluated were; Brinjal var. Blue Star, chilli var. Sindur, chilli var. Sindur, bhindi var. BO2, pumpkin var. Baidyabati, colocasia var. local. It was observed that the vegetative parameters and yield in the control was minimum.

The height, girth and spread of the trees were minimum in cashew alone i.e. without intercrop. Significantly highest plant height was recorded in T3 i.e. cowpea as intercrop (4.90 m), which is at par with T6 i.e. colocasia as intercrop (4.80 m). The girth of the plant varied from 26 cm in T7 (Cashew alone) to maximum of 37 cm in T6 (Cashew + colocasia). The spread of the plant varied from 3.70 m to 5.50 m in N-S direction & 3.50 m to 5.40 m in E-W direction. Minimum spread was observed in control i.e. without intercrop. The yield in the 2nd harvest was highest in T3 (510 kg) i.e. with cowpea as intercrop and minimum in T5 (380 kg) with pumpkin as intercrop.

The yield and total net returns per hectare from inter-crops as well as main crop after 3 years revealed that maximum return was received from colocasia (Rs 44,908/-) followed by brinjal (Rs. 37,666/-), bhindi (Rs 36,650/-), cowpea (Rs 36,398/-), chilli (Rs. 33,829/-), pumpkin (Rs 32,974/-) and control (Rs 21,350/-) (Table 2.31).

Table 2.31 : Total yield and net return from inter-crops and main crop after 3 years at Bhubaneswar

Treatment		Yield Q/ha (Main crop)	Net return (Main crop) (Rs/ ha)	Net return (Inter crop) (Rs/ ha)	Net return (Rs/ha) (Main crop + intercrop)
T_1	Cashew+brinjal	4.60	26,600	11,066	37,666
T_2	Cashew+chilli	3.70	22,750	11,079	33,829
T_3	Cashew+cowpea	5.10	30,450	5,948	36,398
T_4	Cashew+bhindi	5.00	28,700	7,950	36,650
T_5	Cashew+pumpkin	3.80	23,100	9,874	32,974
T_6	Cashew+colocasia	4.10	25,550	19,358	44,908
T_7	Cashew alone	4.50	21,350	-	21,350

Sale rate : Rs. / Qtl.

a. Brinjal	Rs. 200/-	b. Cowpea	Rs. 200/-.
c. Chilli	Rs. 350/-	d. Bhindi	Rs. 200/-.
e. Pumpkin	Rs. 120/-.	f. Colocasia	Rs. 140/-.
g. Cashew	Rs. 3500/-		

JHARGRAM

Among the four intercrops evaluated cluster bean was the highest yielding (21.03 kg/plot) followed by pigeon pea (4.88 kg/plot) and cotton 4.03 kg/plot.

During the second year of yield the yield was maximum from plants intercropped with cluster bean (21.02 kg) followed by pigeon pea (4.88 kg) and ground nut (3.50 kg). The cost benefit ratio also depicted that maximum profit could be obtained with cluster bean (Rs.19,142/-) intercropping under cashew plantation followed by pigeon pea (Rs.17,771/-)and ground nut (Rs.13,923/-).

The soil carbon percentage also increased under leguminous intercrops. Soil moisture was also high under the legumes (Table 2.32)

Table 2.32 : Performance of intercrops in between cashew crop at Jhargram

Treatment No.	Treatment details	Yield of Intercrop		Yield of cashew (Kg/ha)	Returns (Rs.)		Cost : Benefit
		Kg/plot	Q/ha		Total (Rs./ha)	Net	
T1	Cashew + Groundnut	3.50	6.20	3.49	33800	13923.30	0.70
T2	Cashew + Pigeon Pea	4.88	9.15	3.23	35730	17771.80	0.99
T3	Cashew + ClusterBean	21.03	34.99	3.83	36314	19142.50	1.11
T4	Cashew + Cotton	4.03	7.14	2.06	29660	9287.90	0.46
S.Em ±							
C.D. at 5%							

Price of intercrops :

1. Ground nut – Rs. 30/Kg
2. Pigeon pea – Rs. 25/Kg
3. Cotton -- Rs. 30/Kg
4. Cluster bean -- Rs. 6/Kg

MADAKKATHARA

The main crop cashew had a height of 3.19 m, trunk girth of 33.70 cm, canopy spread (NS) of 3.10 m and canopy spread (EW) of 3.32m. The average canopy coverage was 8.09 m^2 per tree, worked out based on the average canopy radius (NS and EW) of 1.60 m. After deducting the canopy coverage area of 1584 m^2 for 178 trees (1440 m^2 plus 10% border area), the area available for intercropping was worked out to 8416 m^2/ha. The intercrops were coleus, colocasia, tapioca, sweet potato and amophyphallus.

The yield recorded per hectare was higher, in spite of the reduction in area available for intercropping. In terms of tuber yield, tapioca recorded a maximum yield (21.90 t/ha) followed by amorphophallus (18.10 t), the lowest tuber yield was recorded by sweet potato (9.70 t).

The total returns from all the tested crops were found to be in the range of Rs. 58,000/- to Rs. 77000/- except in the case of sweet potato. However the net returns varied significantly, in view of the high variation in the cost of cultivation. The cost of cultivation was found to be highest for amophophallus, which was mainly due to the high cost of planting material and the lowest for tapioca. Accordingly, the highest net

return (Rs. 48766/-) and C: B ratio (2.75) was recorded by tapioca followed by colocasia (Rs. 43290/- and 2.32, respectively). The lowest net return (Rs. 33403/-) and C: B Ratio (1.77) was recorded by amorphophallus (Table 2.33).

Table 2.33 : Economics of intercropping of tuber crops in cashew at Madakkathara

Name of intercrop	Tuber mean yield		Total return from intercrop (Rs./ ha)	Net profit (Rs. /ha)	C: B ratio
	(Kg/ plot of 22.68 m^2)	t / ha *			
Coleus	33.80	12542	75252	42552	2.30
Colocasia	41.00	15214	76070	43290	2.32
Tapioca	59.00	21893	76626	48766	2.75
Sweet potato	26.10	9685	58110	29160	2.01
Amorphophallus	48.80	18109	76963	33403	1.77

- Area planted with inter crops/ha: 8416 m^2

Tapioca was identified as the most profitable tuber crop that can be cultivated as an intercrop in young cashew plantations. However considering the soil eroding nature of tapioca, adequate precautions should be taken in cultivation operations to ensure conservation of soil particularly in sloppy lands.

VENGURLA

The medicinal and aromatic plants such as Wawading, Bixa, Sarpagandha and Chitrak were evaluated as intercrops in cashew and 40 plants of each species were planted during 2003-04. All the plants are in vegetative growth phase. Bixa and chitrak have started flowering and fruiting but the yield was not adequate.

VRIDHACHALAM

In this trial with medicinal plants as intercrops, *Ocimum* yielded better with higher BCR of 2.76 when compared to other crops. *Phyllanthus* recorded a benefit cost ratio of 1.28 (Table 2.34).

Table 2.34 : Performance of intercrops at Vridhachalam

Treatments	Yield from intercrops		Total cost of production for intercrops (Rs./ha)	Total returns From intercrops (Rs./ha)	Net profit (Rs/ha)	BCR	Sole crop yield of intercrops (t/ha)
	Plot yield (kg/16 m^2)	Estimated yield (t/ha)					
Ocimum sanctum (leaves and stem)	18.00	3.76	15000	39000	24000	2.76	10.00
Catharanthus roseus (leaves and stem)	13.00	2.21	15000	18150	3150	1.21	5.00
Phyllanthus niruri (leaves and stem)	16.00	1.82	8000	15600	7600	1.28	2.00
Cashew alone	2.00 kg/tree	0.40	6000	12000	6000	1.00	0.40

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 and Vengurla

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:

At Bhubaneswar, L-cyhalothrin could significantly reduce incidence of shoot tip caterpillar, apple and nut borer and inflorescence thrips. The profit (Rs.35.70 /tree) over control was maximum in L-cyhalothrin treatment. At Chintamani, The yield obtained was highest in the monocrotophos and carbaryl treated trees (5.80 kg/tree), which was on par with Lambda cyhalothrin (5.20 kg/tree) and profenofos (5.40 kg/tree). At Jagdalpur, triazophos and L-cyhalothrin could significantly reduce damage by leaf caterpillar and leaf folder. The maximum yield could be realized in triazophos (0.1%) treatment (153.37 kg/ha) followed by profenophos 0.05% (118.64 kg/ha). At Madakkathara Centre triazophos and profenophos could reduce incidence of TMB both in shoots and panicles. At Vengurla L-cyhalothrin significantly reduced damage by inflorescence thrips.

Experimental details:

T1 = Recommended sprays for the region
T2 = Chlorpyriphos 0.05%
T3 = Triazophos 0.1%
T4 = λ-cyhalothrin 0.003%
T5 = Profenophos 0.05%
T6 = Control

BAPATLA

The activity of different foliage pests of cashew was low during the season. The activity of shoot tip caterpillar varied from 0.00 to 0.31 per cent in different treatments and did not differ significantly among the treatments including control at any of the three sprays applied. The leaf and blossom webber damage in all the treatments were found to

be on par and superior over the un-treated control which recorded the highest damage of 7.36 per cent at 30 days after 3rd spray. In case of apple and nut borer, also the same trend was observed and all the treatments are on par but superior over control which record 5.30 per cent damage by apple and nut borer. Significantly higher nos. of spiders (11.25) and ants (42.75) were observed in un-treated control at 30days after 3rd spray. The yields were on par in all the treatments including control as the pest load during the season was low (Table 3.1).

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

Treatment		30 days after IIIrd spray			Yield (kg/tree)
		Apple and nut borer damaged nuts (%)	Thrips damage	Leaf and blossom webber	
T1	Endosulfan 0.05% at flowering and carbaryl 0.1% at nut development stage	0.00 (0.00)a	0.65b	0.21a	1.39
T2	Chlorpyriphos 0.05% (2 sprays)	0.00 (0.00)a	0.67bc	0.31a	1.22
T3	Triazophos 0.1% (2 sprays)	0.00 (0.00)a	0.54a	0.29a	1.31
T4	L- Cyhalothrin 0.003% (2 sprays)	0.00 (0.00)a	0.70c	0.20a	1.68
T5	Profenofos 0.05% (2 sprays)	0.00 (0.00)a	0.63b	0.29a	1.47
T6	Un treated control	5.30 (13.21)b	0.79d	7.36b	1.67
	CD (0.05)	(1.21)	0.06	0.47	--

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

BHUBANESWAR

The shoot tip caterpillar incidence was 6.48 to 8.70% before spray and there was no significant difference among treatments. It was observed that 30 days after 1st spray the pest incidence was reduced in all the treatments with a range of 1.45 to 6.48 % L- cyhalothrin (T_4) exhibited minimum shoot tip caterpillar incidence (1.45%) which was on par with the recommended spray. Jatropa oil (0.5%) resulted comparatively higher incidence (3.35%) in comparison to other insecticide but was lower than control. 30 days after second spray, the pest incidence was minimum (0.50%) in L-cyhalothrin treatment, which was significantly at par with recommend spray (Table 3.2).

The apple and nut borer incidence was lowest in L-cyhalothrin (0.25 %) treatment 30 days after 3rd spray, which was at par with, recommend spray.

Maximum incidence (5.29%) was observed in control. Minimum damage score (0.12) of inflorescence thrips was recorded in L-cyhalothrin treatment, which was significantly lower than recommended spray. In all the treatments, the damage score was reduced significantly, and resulted in an increase of 12.60 to 30.40 % nut yield in all the treatments over the control, with maximum increase in L-cyhalothrin spray (30.4%) followed by recommended spray (26.8%). The profit was maximum (Rs.35.70 per tree over control) in L-cyhalothrin treated plot while it was minimum (Rs.5.10 per tree over control) in jatropha oil applied trees (Table 3.2).

Table 3.2 : Evaluation of insecticides on different insect pests of cashew at Bhubaneswar

Treatment	% Damage by STC after 2nd spray	% Damage by apple & nut borer after 3rd spray	Damage grade by inflorescence thrips after 3rd spray	Average nut yield per tree in kg	% Increase over control	Profit per tree over control in Rs.
Recommended spray schedule	0.73 (0.99)	0.25 (0.84)	0.18	6.25	**26.80**	27.40
Chlorpyriphos (0.05%)	1.93 (1.54)	1.45 (1.39)	0.24	5.94	20.50	18.60
Triazophos (0.1 %)	1.23 (1.25)	1.23 (1.30)	0.22	6.02	22.10	16.50
L. cyhalothrin (0.003 %)	0.50 (0.97)	0.25 (0.84)	0.12	6.43	**30.40**	**35.70**
Profenophos (0.05 %)	1.45 (1.33)	1.68 (1.45)	0.21	6.16	24.90	26.40
Untreated check	5.30 (2.41)	5.29 (2.40)	0.60	4.93	-	-
Jatropha oil (0.5%)	3.13 (1.88)	2.40 (1.62)	0.28	5.55	12.60	5.10
SE (m) ±	0.20	0.10	0.02			
CD (0.05)	0.59	0.29	0.05			

It was revealed that there was significant reduction of natural enemy and pollinators in all the treated trees than the control plot. The different natural enemies were spiders (*Argeopes* sp. *Oxyopes* sp.), Ladybird beetle (*Vigna cinta, Menochilus sexmaculata*), pollinators like black ant *Campanotus* sp. and honey bees (*Apis cerana indica*). The honey bee population/activity was negligible in the experimental plot.

CHINTAMANI

Among the insecticides evaluated, monocrotophos (0.05% was found effective in suppressing the population and was on par with L. cyhalothrin (0.003%) and profenofos (0.05%) while chlorpyriphos (0.05%) and triazophos (0.1%) were found not effective against TMB. The yield obtained was highest in the monocrotophos and carbaryl treated trees (5.80 kg/tree), which was on par with Lambda cyhalothrin (5.20 kg/tree) and profenofos (5.40 kg/tree). The yield obtained from other treatments was high in comparison with the control. Out of the insecticides tested, three sprays of monocrotophos (0.05%) followed by carbaryl (0.1%), profenofos (0.05%) and L-cyhalothrin (0.003%) were found effective in suppressing TMB population and led to higher yield (Table 3.3).

Table 3.3 : Effect of different insecticidal treatments on TMB infestation and yield in cashew at Chintamani

Treatment	Percent incidence of TMB on shoot and inflorescence		Yield kg/tree
	30 DA III spray	Mean of all 3 sprays	
T1.Monocrotophos (0.05%) and Carbaryl (0.1%)	1.30	1.65	5.80
T2.Chloropyriphos (0.05%)	2.90	4.90	3.30
T3.Triazphos (0.1%)	3.10	8.06	3.10
T4.L-cyhalothrin(0.003%)	2.10	1.80	5.20
T5.Profenofos (0.05%)	3.20	2.33	5.40
T6.Control	8.80	9.23	1.30
S Em+	0.45	0.17	0.18
CD@ 5%	1.52	-	0.85

JAGDALPUR

The incidence of TMB damage was very low during whole experiment period therefore all the treatments are at par both in shoot and panicle.

The leaf caterpillar damage was minimum in triazophos (T_3) consistently at 30DAS after 1st spray (5.63%) which was at par with recommended spray schedule (T1), L-cyhalothrin (T4), & chlorpyriphos (T2) (6.28,8.38,& 8.27) respectively. In 30 DAS after 2nd spray chlorpyriphos (T2) (5.03) gave better response & at par with L-cyhalothrin (T4) (9.01).In 30 DAS after 3rd spray. The recommended spray schedule (T1) gave good response with minimum damage. In leaf folder damage, all the treatments are at par after 1st spray; while after 2nd spray chlorpyriphos (T_2) was most effective (0.37% leaf damage), which was at par with recommended spray schedule

(T_1) and profenophos (T_5). The maximum yield could be realized in triazophos (0.1%) treatment (153.37 kg/ha) followed by profenophos 0.05% (118.64 kg/ha) (Table 3.4).

Table 3.4 : Damage due to minor pests under insecticides at Jagdalpur

Treatment	% Leaf Caterpillar damage			% Leaf Folder damage			Yield kg/ha
	30 DAS after Ist spray	30 DAS after IInd spray	30 DAS after IIIrd spray	30 DAS after Ist spray	30 DAS after IInd spray	30 DAS after IIIrd spray	
T-1: Monocrotophos 0.05% at flushing, Endosulfan 0.05% at flowering and Carbaryl 0.1% at fruiting stage.	6.28 (14.40)	10.45 (18.77)	25.27 (29.97)	0.60 (3.26)	2.66 (9.17)	4.43 (11.98)	88.08
T-2 : Chloropyriphos 0.05%	8.27 (16.69)	5.03 (12.45)	37.76 (37.86)	0.18 (2.40)	0.37 (2.32)	4.55 (12.12)	110.89
T-3 : Triazphos 0.1%	5.63 (13.68)	20.63 (26.11)	40.77 (39.56)	1.67 (7.22)	3.28 (10.37)	5.59 (13.59)	152.37
T-4 : L-cylohethrin 0.003%	6.38 (14.46)	9.01 (17.26)	35.17 (36.21)	0.70 (4.51)	3.10 (10.01)	1.23 (5.42)	82.76
T-5 : Profenophos 0.05%	11.37 (19.67)	14.65 (22.44)	44.25 (41.67)	1.14 (5.76)	2.96 (9.60)	3.25 (10.08)	118.64
T-6 : Unsprayed check	15.22 (22.92)	22.96 (26.22)	46.68 (43.04)	0.45 (3.80)	3.47 (10.72)	8.45 (16.78)	70.59
CD at 5%	**(2.87)**	**(5.20)**	**(8.14)**	**(2.86)**	**(3.52)**	**(3.93)**	

Note : Figures in paranthesis are transformed values.

JHARGRAM

In absence of tea mosquito bug in the experimental plantation, evaluation was done against other important insect pests of the region. The recommended spray schedule (T_1) was the most effective treatment which was on par with Profenophos (T_5) after IIIrd spray in managing leaf miner, leaf and blossom webbers and shoot tip caterpillar. After the 3rd spray minimum damage of leaf miner (6.20%), shoot tip caterpillar (8.40%) and leaf and blossom webber (2.40%) was observed with recommended spray schedule. Profenophos (T_5) was more effective than other new insecticides and recorded 4.30% leaf miner damage, and 1.60% leaf and blossom webber damage and 6.40% shoot tip caterpillar damage. The lowest apple and nut borer damage (1.20%) was also recorded, in recommended spray schedule (T_1) while in T_5 (Profenophos) it was 1.40%. T_1 (recommended spray schedule) led to the

highest yield of 7.42 kg/tree followed by 7.10 kg/tree in T_5 (Profenophos), while in untreated check, nut yield was 4.10 kg/tree. Jatropha oil 0.50% spray resulted in lesser pest damage in comparison to control (Table 3.5).

Table 3.5 : Evaluation of insecticides for control of TMB and other foliage pests at Jhargram

Treatment	% ANB damage	Mean % leaf miner damage		Mean % STC damage		Mean % LBW damage		Yield (kg / tree)
		After I spray	After III spray	After I spray	After III spray	After I spray	After III spray	
T-1: POP	1.2 (8.33)	3.8a (12.66)	**6.2a (14.42)**	6.8a (15.12)	**8.4a (16.85)**	1.8a (7.71)	**2.4a (8.91)**	**7.42a**
T-2: Chlorpyriphos (0.05%)	2.4 (8.91)	5.2b (3.18)	9.2b (17.66)	6.9b (15.28)	9.4b (17.85)	5.3b (13.44)	6.3c (14.54)	6.18b
T-3: Triazophos (0.1%)	2.3 (8.72)	4.9b (12.79)	9.8b (18.24)	8.2c (16.64)	10.5c (18.91)	5.8b (13.94)	6.8bc (15.12)	5.88b
T-4: λ-cyhalothrin (0.003%)	2.5 (9.10)	5.1b (13.05)	10.6b (19.00)	8.1c (16.54)	11.2c (19.55)	5.1b (13.05)	7.6b (16.00)	5.30c
T-5: Profenophos (0.05%)	1.4 (11.68)	4.3a (11.97)	**7.4a (15.79)**	**6.4a (14.65)**	**8.9a (17.36)**	1.6a (7.27)	**3.1a (10.14)**	**7.10a**
T-6: Jatropha Oil 0.5%	3.8 (11.24)	9.8d (20.44)	13.6d (21.64)	13.6e (21.64)	17.4e (24.65)	13.6d (21.64)	18.9e (25.77)	4.69d
T-7: Control	5.4 (13.44)	13.8c (21.81)	19.6c (26.28)	18.3d (25.33)	23.2d (28.79)	15.2c (22.95)	22.4d (28.25)	4.10d

ANB = Apple and nut borer STC = Shoot tip caterpillar LBW = Leaf and blossom webber

* Figures ending with same alphabet in a column did not differ significantly on the basis of DMRT at 5% level of significance.

Note : Figures in brackets are transformed values.

MADAKKATHARA

Significant reduction in TMB incidence was recorded both on shoots and panicles receiving insecticidal spray as compared to control, both after second and third spray. Application of triazophos during second spray completely suppressed the incidence of TMB both in shoots and panicles while total control in the incidence of TMB on shoots and panicles was achieved through the application of profenophos during third spray.

The percent incidence of leaf miner was found to be lowest in chlorpyriphos treatment during the second spray (22.80%). Application of all the insecticides during the third spray reduced the incidence of leaf miner as compared to control where in the lowest incidence was recorded in triazophos (3.10%) followed by profenophos (3.80%) (Table 3.6).

Table 3.6 : Incidence of TMB and minor pests (leaf miner) in cashew as influenced by insecticide application at Madakkathara

Treatments	Damage score of TMB				Percent incidence of leaf miner	
	Shoot		Panicle			
	30 days after		30 days after			
	2nd spray	3rd spray	2nd spray	3rd spray	2nd spray	3rd spray
T-1: POP	1.00	1.00	0.50	0.75	26.80	4.60
T-2: Chlorpyriphos (0.05%)	1.00	1.00	0.50	-	22.80	12.00
T-3: Triazophos (0.1%)	-	-	-	0.50	23.70	3.10
T-4: λ-cyhalothrin (0.003%)	0.75	-	1.25	0.50	32.80	5.60
T-5: Profenophos (0.005%)	2.00	-	1.25	-	26.90	3.80
T-6: Control	3.50	4.00	2.50	0.50	24.90	15.20

* First spray was skipped due to low TMB load.

VENGURLA

All the insecticidal treatments significantly reduced incidence of TMB over control. Amongst the insecticidal treatments, L-cyhalothrin (0.003%) (T_4) was observed to be significantly superior over rest of the treatments after second and third spray. However, after first spray it was significantly superior over other treatments except the treatment of profenophos (T_5) which was at par with it (Table 3.7).

Table 3.7 : Incidence of tea-mosquito bug in various treatments at Vengurla

Sl. No.	Treatment details	Per cent incidence 30 days after		
		First spray	Second spray	Third spray
T_1	Recommended spray schedule	6.25 (14.43)*	8.65 (17.03)	6.73 (14.97)
T_2	Chlorpyriphos 0.05%	5.71 (13.68)	7.57 (15.79)	5.17 (13.01)
T_3	Triazophos 0.01%	4.45 (12.21)	6.13 (14.20)	3.67 (10.35)
T_4	L-cyhalothrin 0.003%	2.71 (9.35)	**3.43 (10.62)**	**1.98 (7.96)**
T_5	Profenophos 0.05%	3.61 (10.84)	5.29 (13.23)	4.09 (11.55)
T_6	Control	11.48 (19.76)	16.35 (23.78)	9.62 (18.00)
	S.E.±	0.56	0.69	0.64
	C.D. at 5%	1.68	2.08	1.93

* Figures in parenthesis are arc-sine values

All the insecticidal treatments significantly reduced the incidence of inflorescence thrips, apple and nut borer and shoot tip caterpillar in comparison to control. In case of Inflorescence thrips, treatment (L-cyhalothrin 0.003%) (T_4) was found to be significantly superior (2.25) over rest of the treatments. With respect to observations on apple whereas it was at par with triazophos (T_3) 3.18 when observation was recorded on nut surface. In case of apple and nut borer, the treatment (L-cyhalothrin 0.003%) T_4 recorded lowest incidence (2.22%) but it was at par with the treatment of triazophos (0.01%) (T_3) and significantly superior over rest of the treatments. In case of shoot tip caterpillar, the treatment T_4 observed significantly effective (1.02%) over all other treatments except the treatment of triazophos (0.01%) (T_3) (1.78%) (Table 3.8).

Table 3.8 : Incidence of minor pests in various treatments in cashew at Vengurla

Sr. No	Treatment details	Minor pests			
		Thrips		Apple and nut borer	Shoot tip caterpillar
		30 days after 3rd spray		30 days after 3rd spray	30 days after 1st spray
		Apple	Nut		
T_1	Recommended spray schedule	7.75 (16.12)*	6.88 (15.16)	5.32 (13.20)	3.34 (10.39)
T_2	Chlorpyriphos 0.05%	5.47 (13.42)	5.13 (13.05)	6.25 (14.40)	2.73 (9.31)
T_3	Triazophos 0.01%	3.63 (10.93)	**3.13** (10.08)	4.19 (11.53)	**1.78** (7.46)
T_4	L-cyhalothrin 0.003%	**2.25** (8.56)	**2.88** (9.61)	**2.22** (8.42)	**1.02** (5.68)
T_5	Profenophos 0.05%	4.38 (12.00)	5.61 (13.67)	4.67 (12.22)	2.90 (9.68)
T_6	Control	15.75 (23.37)	16.25 (23.75)	10.48 (18.78)	6.65 (14.57)
	S.E.±	**0.39**	**0.43**	**1.08**	**0.78**
	C.D. at 5%	**1.17**	**1.30**	**3.25**	**2.36**

*** Figures in parenthesis are arcsine values**

VRIDHACHALAM

After the first spray, the intensity of TMB incidence was low in T1 (the recommended spray) and T4 (L-cyhalothrin 0.003%), followed by T5 (Profenophos 0.05%), T2 (Chlorpyriphos 0.05%) and T3 (Triazophos 0.1%), the damage score ranged between 0.60-0.90 as against 1.70 in the control. After the second spray, the incidence further reduced to 0.30 in T1, which was on par with T5 (Profenophos 0.05%), followed by T4 (L-cyhalothrin 0.003%) T3 (Triazophos 0.1%) and T2 (Chlorpyriphos 0.05%). After third spray, the damage score was nil in T1 (Recommended spray schedule) and T 4 (L-cyhalothrin 0.003%), followed by T5 (Profenophos 0.05%) (Table 3.9).

Table 3.9 : Effect of insecticides on the incidence of *Helopeltis antonii* at Vridhachalam

Treatment		Post treatment scoring			Mean TMB scoring	Yield (kg/ tree)
		I spray	II spray	III spray		
T_1	Recommended spray for the region	0.60_a	0.30_a	0.00_a	0.30	7.10
T_2	Chlorpyriphos 0.05%	0.90_a	0.60_a	0.30_a	0.56	6.70
T_3	Triazophos 0.1%	0.90_a	0.50_a	0.30_a	0.60	6.50
T_4	L Cyhalothrin 0.003%	0.80_a	0.40_a	0.00_a	0.50	6.80
T_5	Profenophos 0.05%	0.90_a	0.30_a	0.10_a	0.56	6.90
T_6	Untreated check	1.70_b	2.60_b	3.80_b	2.70	1.75
SE		2.23	2.30	3.20		2.80
CD		0.86	0.70	0.66		

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

Recommended spray schedule (T_1) could effectively manage leaf miner (2.30%) and apple and nut borer (0.20%), while profenophos (T_5) could effectively minimize damage by leaf folder (2.00%), leaf and blossom webber (1.00%) and apple and nut borer (0.20%) after the third spray, whereas in control plot, the damage was highest for leaf miner (8.00), leaf folder (7.50), leaf and blossom webber (9.00) and for apple and nut borer (1.80).

Low population of natural enemies observed in all the insecticides treated trees, while all insecticidal free control trees supported natural enemies load.

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:

Monocrotophos could result in less incidence of Cashew Stem and Root Borer (CSRB) in treated trees at Bapatla, Jagdalpur and Vridhachalam centres. Chlorpyriphos performed best in Bhubaneswar, Jhargram and Vengurla in reducing re-infestation by CSRB. The preferred zone of attack was collar + stem in most of the centres.

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

The highest percentage of trees without re-infestation or persistent attack was 50 percent in lindane 0.2% treatment, but in the un treated control 25 per cent trees were recorded without re-infestation or persistent attack. The other insecticides *viz*., chlorpyriphos 0.2%, carbaryl 1.0% and monocrotophos 0.2% were found less ineffective and respectively recorded 41.67, 41.67 and 33.33 per cent of trees without re-infestation or persistent attack by the pest (Table 3.10).

Preferential zone of attack is collar + root in 36.67 percent of trees (22/60) followed by collar + stem in 33.33 percent of trees (20/60) either at initial attack or re-infestation or persistent attack.

Stem girth, age of the tree and percentage of bark circumference damaged are also important factors for the re-infestation or persistent attack. All trees with canopy yellowing succumbed to pest incidence. Out of the trees having no reinfestation, majority of recovered trees had less than 25 percent bark circumference damage (Table 3.11).

Table 3.10 : Efficacy of certain insecticides as curative control against cashew stem and root borer at Baptla

Treatment	% trees without reinfestation/persistant attack
Carbaryl 1.0%	41.67
Chlorpyriphos 0.2%	41.67
Monocrotophos 0.2%	33.33
Lindane 0.2%	50.00
Un treated check	25.00

Table 3.11 : Physical parameters of cashew trees re-infested / not re-infested by cashew stem and root borer after treatment with insecticides as curative measures at Bapatla

Physical Parameter		No.of trees re-infested	% of total trees treated	No.of trees not re-infested	% of total trees treated
Stem girth	< 60 cm	---	---	---	---
	60-100 cm	9	15.00	11	18.33
	>100 cm	28	46.67	12	20.00
Total		37	61.67	23	38.33
Age of the tree	<10 years	---	---	---	---
	10-15 years	25	41.67	12	20.00
	>15 years	12	20.00	11	18.33
Total		37	61.67	23	38.33
Zone of attack	S	4	6.67	4	6.67
	C+R	13	21.67	9	15.00
	C+S	10	16.67	10	16.67
	C+S+R	10	16.67	---	0.00
Total		37	61.67	23	38.33
Yellowing of canopy	Canopy yellowed	37	61.67	2	3.33
	Canopy not yellowed	---	0.00	21	35.00
Total		37	61.67	23	38.33
% of bark circumference damaged	< 25	15	25.00	21	35.00
	26-50	22	36.67	2	3.33
	51-75	---	0.00	---	0.00
	> 75	---	0.00	---	0.00
Total		37	61.67	23	38.33

BHUBANESWAR

The percentage of treated trees without reinfestation ranged between 41 to 76% in different treatments including control. Maximum recovery (76%) was obtained from chlorpyriphos treatment, and the recovery of trees depended on the stage of the infested trees (Table 3.12). All of the early-infested trees recovered in chlorpyriphos treatment, whereas in other treatments the recovery was 80 to 95 %. In middle stage infested trees the recovery percentage was 0 to 30 %, and in advanced stage of infestation, 10% recovery occurred in chlorpyriphos treatment. Maximum cost (Rs. 96 / treatment / 2 years) was needed in neem oil treatment which led to recovery of 58%. Increase in the stem girth led to higher re-infestation, and reinfestation was higher as the age increased (Table 3.12 and Table 3.13).

Table 3.12 : Percentage recovery of CSRB affected tree under curative trial at Bhubaneswar

Treatments	Mean % recovery of the trees from CSRB	Frequency of treatment application / 2 years	Average cost of treatment for years (in Rs.)
T_1 -Carbaryl (1 %)	57.40	9	59.00
T_2 -Chlorpyriphos (0.2 %).	**76.00**	7	49.00
T_3 -Monocrotophos (0.2 %).	67.80	7	56.00
T_4 -Lindane (0.2 %)	62.70	9	77.00
T_5 -Untreated check	41.00	17	51.00
T_6 – Neem oil (5%)	58.00	12	96.00

Table 3.13 : Physical parameter of cashew stem and root borer in curative trials at Bhubaneswar

Physical parameters		No. of trees in each category	
		Without re-infestation	With re-infestation
Stem girth (cm)	<60	155	11
	60-80	30	98
	80-100	1	5
	>100	0	0
		186	**114**
Age (Years)	5-10	120	-
	10-15	61	49
	>15	5	65
		186	**114**
% Bark circumference damaged	<25	150	2
	25-30	36	92
	50-75	0	20
		186	**114**
Zone of attack	C+R	7	25
	C+S	135	2
	R	0	5
	S	35	0
	C+R+S	9	82
		186	**114**
Canopy yellowing	Yellow	-	45
	Not yellow	-	255

JAGDALPUR

Monocrotophos (0.2%)- (T3) led to maximum recovery having 60.00% trees without re-infestations (Table 3.14).

The cashew trees having more than 100 cm of stem girth were more prone to attack of CSRB. More than 15-year-old cashew trees were more susceptible to attack of this pest. Preferential zone of attack of re-infestations by stem and root bores in cashew tree was collar and stem zone. The canopy of majority of cashew trees infested by CSRB was not yellowed. Pest reinfestation was maximum in trees, wherein bark circumference damaged was 25-50 percent (Table 3.15).

Table 3.14 : Percentage infestation of CSRB under curative control trials at Jagdalpur

Treatment	No. of trees treated	No. of trees without reinfestation/ persistent attack	% of trees without attack out of total trees treated
T1: Carbaryl (1.0%)	12	7	58.33
T2: Chlorpyriphos (0.2%)	12	7	58.33
T3: Monocrotophos (0.2%)	10	6	60.00
T4: Lindane (0.2%)	10	5	50.00
T5 : Untreated check (only removal of CSRB grubs followed)	10	3	30.00
	54	28	--

Table 3.15 : Physical parameters of trees observed under curative control 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	0		0	
	60-100 cm	10	18.52	9	16.67
	>100 cm	16	29.63	19	35.19
Total	**54**	**26**	**48.15**	**28**	**51.85**
Age of tree	<10 years	0		0	
	10-15 years	0		3	5.56
	>15 years	26	48.15	25	46.296
Total	**54**	**26**	**48.15**	**28**	**51.85**
Zone of attack	C+R	8	14.814	4	7.41
	C+S	12	22.22	22	40.74
	C+R+S	6	11.11	2	3.70
Total	**54**	**26**	**48.15**	**28**	**51.85**
Canopy yellowing	a) Canopy Yellowed	6	11.11	7	12.96
	b) Canopy Not yellowed	20	37.04	21	38.89
Total	**54**	**26**	**48.15**	**28**	**51.85**
% of bark circumference damaged	<25	12	22.22	18	33.33
	25-50	14	25.93	10	18.52
	50-75	0			
	>75	0			
Total	**54**	**26**	**48.15**	**28**	**51.85**

JHARGRAM

Post extraction treatment with T1 (Carbaryl) and T2 (Chlorpyriphos) were equally the most effective treatments and none of the treated trees had reinfestation. In treated check (T6), 50% of the trees showed reinfestation. Monocrotophos (0.2%) and Lindane (0.2%) could save upto 50% trees from re-infestation. In treated check (T6), 50% trees remained free from re-infestation (Table 3.16).

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Table 3.16 : Percentage infestation of CSRB under curative control trials at Jhargram

Treatment	No. of trees treated	No. of trees without reinfestation/ persistent attack	% of trees without attack out of total trees treated
T1: Carbaryl (1.0%)	7	7	100.00
T2: Chlorpyriphos (0.2%)	6	6	100.00
T3: Monocrotophos (0.2%)	6	3	50.00
T4: Lindane (0.2%)	6	3	50.00
T5 : Untreated check (only removal of CSRB grubs)	6	3	50.00
	31	22	--

VENGURLA

Treatment with Chlorpyriphos (0.2%) T_2 recorded cent per cent trees without reinfestation followed by lindane (0.2%) T_4 which recorded 93.33 per cent trees without reinfestation. Reinfestation was more in control (66.66 %) followed by monocrotophos T_3 (73.33 %) (Table 3.17).

Table 3.17 : Effect of curative treatments against CSRB at Vengurla

Treatment	Percentage of trees without reinfestation / persistent attack
T_1-Carbaryl (1%)	80.00
T_2-Chlorpyriphos (0.2%)	100.00
T_3-Monocrotophos (0.2%)	73.33
T_4-Lindane (0.2%)	93.33
T_5-Control	66.66

VRIDHACHALAM

Maximum recovery (83.30%) was observed in trees treated with monocrotophos (T_3), followed by chlorpyriphos treated trees which had 80% recovery. Application of lindane led to 72.20% and carbaryl (66.60%) as against 20% recovery in the untreated check, wherein removal of pest stages alone was adopted (Table 3.18).

Table 3.18 : Efficacy of certain insecticides as curative control against CSRB at Vridhachalam

Treatment		No. of trees treated	No. of trees without re-infestation	Trees without re-infestation (%)
T_1	Carbaryl (1%)	18	12	66.66
T_2	Chlorpyriphos (0.2%)	15	12	80.00
T_3	Monocrotophos (0.2%)	18	15	83.33
T_4	Lindane (0.2%)	18	13	72.22
T_5	Untreated check (removal of grubs only)	20	4	20.00

The recovery of treated trees was influenced by several physical parameters of trees. More than 40% trees which recovered had less than 25% bark circumference damaged. Trees having a normal canopy resulted in 100 per cent recovery (Table 3.19).

Table 3.19 : Physical parameters of treated cashew trees re-infested / without re-infestation at Vridhachalam

Physical Parameters		Total no. of trees treated	No. of trees reinfested	Percent trees reinfested	No. of trees not reinfested	Percent trees not reinfested
Stem girth	< 60 cm	43	10	11.23	33	37.07
	60-100 cm	36	15	16.85	21	23.59
	> 100 cm	10	8	8.98	2	2.24
Total		**89**	**33**	**37.08**	**56**	**62.92**
Age of the trees	< 10 years	40	9	10.11	31	34.83
	10-15 years	37	13	14.61	24	29.97
	> 15 years	12	11	12.36	1	1.12
Total		**89**	**33**	**37.08**	**56**	**62.92**
Zone of attack	C+ R	51	9	10.11	42	47.19
	C+ S	8	3	3.37	5	5.62
	C+S+R	30	21	23.59	9	10.11
Total		**89**	**33**	**37.08**	**56**	**62.92**
Yellowing of canopy	Canopy yellowed	7	7		0	0.0
	Canopy not yellowed	82	26	29.21	56	100.00
Total		**89**	**33**	**37.08**	**56**	**62.92**
Per cent bark circumference damaged	<25	40	4	4.49	36	40.44
	26-50	30	20	22.47	10	11.23
	51-75	12	8	8.99	4	4.49
	>75	7	-	-	-	-
Total		**89**	**33**	**37.08**	**56**	**62.92**

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 the populations of leaf and blossom webber and leaf thrips were positively influenced by maximum temperature whereas leaf folder and leaf miner were influenced negatively by maximum temperature. At Bhubaneswar the shoot tip caterpillar, leaf miner and leaf beetle did not have significant correlations with any of the weather parameters whereas maximum temperature positively influenced leaf and blossom webber and apple and nut borer populations. At Jagdalpur activities of leaf folder, leaf caterpillar and leaf and blossom webber were not influenced by any of the weather parameters. Leaf miner, apple and nut borer, aphids and mealy bug incidence showed positive correlation with maximum temperature at Vengurla.

BAPATLA

The incidence of leaf and blossom webber varied from a low of 0.00 to a high of 23.48 per cent in different meteorological weeks. The highest incidence was recorded during the month of May, 2006 which touched 23.48 per cent. The maximum temperature (r = 0.3304) and minimum temperature (r = 0.3658) were found to exercise a significant positive influence on the activity of the pest, whereas the relative humidity (m) (r = -0.4431) showed significant negative influence (Table 3.20).

The leaf miner appeared on the crop from September and continued upto March with very a low incidence upto May. The per cent damaged leaves was maximum during March which touched (10.58%). The abiotic factors *viz*., relative humidity both at morning (r = 0.4392) and evening (r = 0.3932) showed a significant positive influence on the activity of the pest, while the maximum temperature (r = -0.4591) showed negative influence (Table 3.20).

Leaf folder incidence started from last week of August, which remained at low ebb, but flared up during the months of February to March and touched the highest of 21.67 per cent and was minimum from first week of April. Both maximum and minimum temperatures showed significant negative influence on the activity of the pest (Table 3.20).

The activity of shoot tip caterpillar was less than 1.00 per cent during the season. None of the weather parameters showed any influence on the activity of the pest (Table 3.20).

Leaf thrips were observed in two different spells; during July to middle of September and March to June. The pest activity during October to February was minimal and the incidence was maximum during May to June. Maximum temperature (r = 0.7963) and the minimum temperature (r = 0.6334) influenced the thrips activity positively, where as the relative humidity (m) (r = -0.6805) and the relative humidity (e) (r = -0.3943) showed significant negative influence (Table 3.20).

Table 3.20 : Correlation coefficients (r) of pest incidence with weather parameters at Bapatla

Weather Parameters	Pests						
	Lbw	**Anb**	**Lm**	**Stc**	**Lt**	**It**	**Lf**
Maximum temperature ºC	**0.3304***	0.1599	**-0.4591***	0.1427	**0.7963***	0.0888	**-0.2678***
Minimum temperature ºC	**0.3658***	0.2349	-0.2373	0.0174	**0.6334***	0.1059	**-0.4358***
Relative humidity (m) (%)	**-0.4431***	-0.1384	**0.4392***	-0.0525	**-0.6805***	-0.0038	0.2516
Relative humidity (e) (%)	-0.1317	0.0461	**0.3932***	-0.1235	**-0.3943***	0.1545	-0.0330
Rainfall	0.0241	-0.0980	0.1520	-0.1823	-0.0701	-0.1912	-0.1778
Rainy days	0.0194	-0.1177	0.1343	-0.1738	-0.0493	-0.2567	-0.2317

Lbw: Leaf and blossom webber **Anb**: Apple and nut borer **Lm**: Leaf miner **Stc**: Shoot tip caterpillar **Lf**: Leaf folder
Lt: Leaf thrips **It**: Inflorescence thrips.

- Significant at 0.05 level

BHUBANESWAR

Shoot tip caterpillar (*Hypatiama haligramma*) was active from July to February. But maximum activity was restricted during September to November with peak incidence of 23.80 % in October. There was no positive significant weather factor on the incidence of the pest (Table 3.21).

Yellow thrips *Franklniella schultzii* T. population was maximum (49.2 to 38.9 no. / 10 panicles) in February-March whereas the Black thrips *Haplothrips ceylonicus* Sch. population was maximum (44.9 to 24.1 no. / 10 panicles) in March and April. Evening RH had significant negative correlation with incidence of the pest

Leaf miner *Acrocercops syngramma* infestation was maximum (23.40 to 27.10%) during September to October. There was no positive significant correlation of the pest with weather parameters. Leaf and blossom webber *Lamida moncusalis* activity was limited during March to May with maximum damage of 4.90 % in May. Maximum Temperature had positive and morning RH had negative significant correlation with the incidence of the pest. Leaf beetle *Monolepta longitarsus* occurred during rainy season (June to October) evening RH had positive and Bright Sunshine Hour had negative significant correlation towards incidence of the pest (Table 3.21).

Apple and nut borer *Nephopteryx sp.* was notted i.e. from March to May and infestation ranged between 0.70 to 4.90 %. Maximum Temperature and RH evening had positive significant correlation with the pest incidence (Table 3.21).

Cashew stem and root borer *Plocaederus ferrugineus* 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.

Table 3.21 : Correlation of weather parameters with the pests of regional importance at Bhubaneswar

Name of the result	Temperatures		RH		Rainfall in (mm)	BSH (%)
	Maximum	Minimum	Maximum	Minimum		
Shoot tip caterpillar	-0.39	-0.02	0.31	0.42	0.31	-0.21
Yellow thrips	0.11	-0.37	0.33	-0.66*	-0.51	0.57
Black thrips	0.37	-0.11	0.25	-0.54	-0.51	0.59*
Leaf miner	-0.25	0.20	-0.01	-0.27	-0.40	0.47
Leaf and blossom webber	0.72*	0.40	-0.58*	-0.12	-0.28	0.42
Apple and nut borer	0.58*	0.21	0.43	0.58*	0.51	-0.32
Leaf beetle	-0.13	0.45	0.51	0.81*	0.78*	-0.59*
Cashew stem and root borer	0.85*	0.42	-0.13	-0.26	-0.34	0.46

* = ‘r’ at 5 % level of significance

Natural enemies

Study on field parasitation of major pests of regional importance of cashew indicated that maximum parasitisation of shoot tip caterpillar by *Elasmus* sp., (17.00 %) leaf and blossom webber by *Bracon brevicornis* (9.70 %) and leaf miner by

Sympiesis sp. (21.00 %) were observed. The peak period of parasitization coincided with the peak incidence of the pest.

The different predators recorded in cashew ecosystem were spiders (*Argeopes* sp., *Oxyopes* sp.), Ladybird beetle (*Vigna cinta*, *Menochilus sexmaculata*) and pollinator, Black ant (*Camponotus sp.).*

CHINTAMANI

Incidence of TMB reached a peak during February (37.08) and population declined from March (3.84). There was no incidence of leaf miner during the year. The incidence of fruit and nut borer damage was highest during June. A total of 16 species of insect pest infesting and breeding on cashew in maidan parts of Chintamani region were observed. Among them TMB and CSRB were found to be the major pests in the region (Table 3.22).

Table 3.22 : Insect pests of cashew observed at Chintamani

Common Name	Scientific name	Month of Occurrence	Intensity
Tea mosquito	*Helopeltis antonii*	Oct - Mar	L-M
Root and stem borer	*Plocaederus ferrugineus*	Throughout the year	L-M
Leaf miner	*Acrocercops syngramma*	May-Sep	L-M
Leaf & blossom Webber	*Lamida moncusalis*	Aug – Apr	L
Leaf thrips	*Rhipiphorothrips cruentatus*	Jul – Feb	L-M
Leaf thrips	*Selenothrips rubrocinctus*		-do-
Inflorescence thrips	*Scirtothrips dorsalis*		M-H
Inflorescence thrips	*Rhynchothrips raoensis*		L
Shoot tip caterpillar	*Cheleria haligramma*		L
Fruit and nut borer	*Thylecoptila panerosema*		L-M
Bark eating caterpillar	*Indarbela tetraonis*	Throughout the year	L
Leaf weevils	*Mylocerus discolor*	Throughout the year	L-M
Termites	*Odentotermus obesus*	Throughout the year	L-M
Aphids	*Toxoptera odinae*	Nov – May	L
Blister beetle	*Zonabris pustulata*	Feb – June	L
Mealy bug	*Ferrisia virgata*	Feb- May	L

FOOT NOTE :

During survey 3 sp. of predators of TMB and 2 sps. of coccinellid beetles predating on aphids (*Menochilus sexmaculatus Scymnus* sp.) and a predominant egg parasitoid *Apanteles* sp. parasitising TMB eggs were observed.

JAGDALPUR

A survey of pest complex was undertaken in cashew plantation of Bakawand, Tokapal, Bastar and Lohandiguda. The TMB damage on shoot ranged from a minimum (0.09 %) in December to maximum (0.25 %) in March; TMB damage on panicle varied from 0.21 per cent during March to 3.65 per cent during April. The abiotic factors did not significantly influence the activity of TMB.

Cashew stem and root borer incidence was seen round the year, but its activity was found maximum during summer months. The abiotic factors did not influence the activity of CSRB. The maximum temperature contributed 16.21 towards incidence of CSRB.

The percent shoot damaged by leaf & blossom Webber ranged from 0.04 in June to 15.21 in August. The influence of weather parameters on the activity of this insect was non significant. The leaf damage by leaf caterpillar was noticed through out the year. The relatively higher damage was recorded during November-December month with infestation ranging from 10.26 to 49.26 per cent. The abiotic factors did not influence the activity of leaf caterpillar. The activity of leaf folder was observed round the year. The relatively higher incidence of the pest was recorded during May to December with a maximum of 25.00% leaf damage. None of the weather parameters influenced the activities of leaf folders (Table 3.23).

In the cashew canopy different species of spiders were observed as general predators and *Brumus spp*. was observed predating on the leaf thrips.

Table 3.23: Seasonal occurrence of cashew insect pests and their enemies at Jagdalpur

Common Name	Scientific Name	Month of occurrence	Intensity
Stem & Root borer	*Plocaderus ferrugineus*	Throughout the year	M
TMB	*Helopeltis antonii*	Dec. - May	L
Leaf miner	*Acrocercops syngramma*	Round the year	M
Leaf folder	*Caloptilea tiselea*	Round the year	M
Leaf & Blossom Webbr	*Lamida moncusalis*	Jun-Mar.	L

CSRB incidence was positively influenced by maximum temperature (0.458), while TMB damage on panicle was positively influenced by maximum temperature (0.657). Leaf and blossom webber and leaf caterpillar were positively influenced by rainfall (0.512 and 0.560 respectively) and negatively influenced by maximum temperature (-0.398 and -0.520 respectively). Leaf folder was negatively influenced by maximum temperature (-0.439) (Table 3.24).

Table 3.24 : Correlation of weather parameters with the pests of regional importance at Jagdalpur

Weather Parameters	% CSRB attack	% TMB		% LBW affected shoot	% Leaf caterpillar affected leaves	% Leaf folder affected leaves
		Shoot	Panicle			
Max. Temp °C	0.458	-0.196	0.657	-0.398	-0.520	-0.439
Min. Temp °C	0.112	-0.352	0.263	0.122	-0.149	-0.367
R. H. (m) %	-0.351	0.145	-0.587	0.321	0.348	0.377
R. H. (e) %	-0.181	-0.082	-0.412	0.466	-0.074	-0.079
Rainfall	-0.130	-0.159	-0.207	**0.512**	**0.56**	-0.013
Rainy Days	-0.055	-0.281	-0.142	0.526	-0.367	-0.163

* - Value of 'r' significant at 5% level. * * - Value of 'r' significant at 1% level.

JHARGRAM

Cashew stem and root borer caused severe damage in the neglected and unattended plantation and occured round the year. Tea mosquito bug incidence was very low in all the areas, and occurred in December and was present upto March.

Leaf and blossom webber appeared in August, population increased rapidly and peak coincided with the new flush (Nov. to Dec.). Shoot tip Caterpillar caused moderate to high damage during November and peak period was recorded during Dec. – Feb.

Leaf thrips appeared in November, and peaked during February and declined gradually. Inflorescence thrips appeared with the panicle initiation and peak was noticed in Feb – Mar, causing serious damage to inflorescence and fruits. Leaf miner inflicted serious damage to the young flushes during November and peak was recorded during Dec to Feb.

Apple and nut borer was recorded between March - May. Termites were found all the year round except monsoon season and caused minor damage to plants of all age groups. The correlation analysis indicated that none of the abiotic factors exerted high influence on activity of any pest, as all the "r" values were less than 0.400.

Spiders, black ants, coccinellids and braconids formed the natural enemy complex.

MADAKKATHARA

TMB damage score was nil during July to September and was highest during March with a damage score of 0.44. Apple and nut borer damage was highest during February. Leaf miner damage was observed during April and October to March with the highest incidence during December.

Thrips damage on nuts/ apples was observed during October to March with the highest value of 1.03 recorded during January. Thrips damage was not observed during April to September.

There was no damage due to leaf blossom webber, shoot tip caterpillar and leaf thrips during the year under report.

Red ants were observed throughout the year with the highest values recorded during January to March. Other ant population was also observed throughout the year but was considerably lesser than red ants. The highest population was observed during December followed by November. Though spider population was observed throughout the year, the highest value was observed during December and the lowest during April.

VENGURLA

Major incidence of TMB was observed during January- March with peak in the month of February (6.70%). The incidence of leaf miner was observed on new flush in the month of July (0.14%) and November (0.60%). The incidence of thrips was started from January (1.63%) and reached its peak in the month of February (1.82%). The incidence of apple and nut borer was noticed in month of January with setting of apples and nuts and was maximum in the month of February (1.38%). The incidence of aphids, mealy bugs, shoot tip caterpillar, leaf eating caterpillar, semilooper, leaf webber and leaf folder was negligible during the period under report.

The Correlation between the pest incidence and weather parameters indicated that TMB infestation showed negatively significant correlationship with relative humidity (evening) (-0.648) and minimum temperature (-0.769) and positive relationship with maximum temperature (0.596). The infestation of Thrips showed significant negative correlationship with minimum temperature (-0.751), relative humidity and rainfall (-0.570). Leaf miner, apple and nut borer, aphids and mealy bug incidence showed positive correlation with maximum temperature whereas, mealy bugs showed negative correlationship with minimum temperature and evening humidity except mealy bug (Table 3.25).

Table 3.25 : Correlation between the pest incidence and weather parameters at Vengurla

	TMB	Thrips	Leaf miner	A&N Borer	Aphids	Mealy Bug	Shoot tip caterpillar
Maximum Temperature	0.596*	0.586*	0.383	0.350	0.438	-0.012	0.446
Minimum Temperature	-0.769**	-0.751**	-0.035	-0.530	-0.515	0.396	-0.044
Morning Humidity	-0.037	-0.023	0.003	-0.019	-0.071	-0.504	0.071
Evening Humidity	-0.648*	-0.683*	-0.178	-0.203	-0.554*	0.219	-0.245
Rainfall	-0.600*	-0.570*	-0.302	-0.518	-0.481	0.124	-0.326

*-Significant at 5% level of significance **- Significant at 1% level of significance.

Eleven species of spiders and ants were noticed as predatory insects in cashew garden, which were observed throughout the year. Similarly, other natural enemies viz; ladybird beetle and praying mantid were also observed during the months of January to March.

VRIDHACHALAM

The TMB was observed from second fortnight of November to April. Maximum TMB damage was observed in the second fortnight of March. Leaf miner (*Acrocercops syngramma*) was found from first fortnight of August to March with a maximum of 10.50 % leaf damage during first fortnight of February. Leaf and blossom webber *(Lamida moncusalis*) was found from August to March, and nut borer incidence was noticed from second fortnight of February-April and thereafter reduced incidence was recorded.

Correction studies with regard to TMB revealed that maximum temperature, minimum temperature, morning relative humidity and sunshine hour had positive relation on the activity of *H. antonii*, whereas negative correlation was established with rainfall and evening relative humidity. The over all result indicates that the pest incidence appear coinciding with flushing period and persists in the field through flowering and fruiting periods (Table 3.26).

Table 3.26 : Correlation coefficient (r) for abiotic factors and insect pests at Vridhachalam

Insect-pests	Temperature		Relative Humidity		Rainfall	Rainy days	Sunshine hours
	Max	Min	AM	PM			
Tea mosquito bug (population) (Y_1)	0.64*	0.27	0.35	-0.26	-0.43	0.38	0.32
Leaf and blossom webber (Y_2)	-0.82*	-0.43	-0.34*	-0.22	-0.26	-0.32	0.52
Leaf miner (Y_3)	-0.20	0.28	0.53	0.62	0.76	0.61*	-0.46
Leaf folder (Y_4)	-0.78*	-0.42	-0.36*	-0.24	-0.23	-0.36	0.48
Shoot tip caterpillar (Y_5)	-0.23	0.25	0.46	0.43	0.62	0.56*	-0.42
Apple and nut borer (Y_6)	0.52	0.46	0.72	-0.32	0.28	-0.36	0.41
Mealy bug (Y_7)	0.62*	0.25	0.33	-0.24	-0.38	0.31	0.30
Cashew Stem and Root Borer (Y_8)	0.76*	0.52	-0.007	-0.32	-0.45	-0.38	0.63

The parasitoids viz., *Cotesia flavipes* on green leaf folder and *Brachymeria* sp on diamond hairy caterpillar, as well as predators viz., *Scymnus* sp, *Menochilus sp.* and *Chryroperla carnea* on mealy bugs were observed during Nov. – Feb. Preying mantids and spiders were also observed throughout the year. The entomopathogenic fungi *Metarhizium anisopliae, Beauveria bassiana, Aspergillus flavus* were recorded on CSRB, during Aug – Feb (Table 3.27).

Table 3.27: Natural enemies of insect pests of cashew at Vridhachalam

Natural enemies	Host insect	Stage affected	Period of occurrence	Intensity range (%)
Parasitoids				
Cotesia flavipes	Green leaf folder	Larvae	Nov-Jan	4.5-28.5
Brachymeria sp	Diamond hairy caterpillar	Pupae	Sep-Jan	1.6-11.4
Predators				
Scymnus sp	Mealy bugs	Adults & Nymphs	Jan-Feb	1.5-9.0
Menochilus sp.	Mealy bugs	Adults & Nymphs	Jan-Feb	0.8-4.0
Chrysoperla carnea	Mealy bugs	Nymphs & Adults	Sep-Feb	1.6-18.0
Preying Mantids	Caterpillars and moths	Larvae & Adults	Round the year	0.6-3.5
Spiders	TMB and moths	Adults	Round the year	0.5-8.0
Entomopathogenic fungi				
Metarhizium anisopliae	CSRB	Grubs & pupae	Aug-Feb	5.0-26.5
Beauveria bassiana	CSRB	Grubs & pupae	Aug-Feb	3.6-20.0
Aspergillus flavus	CSRB	Grubs & Adults	Aug-Feb	6.3-28.0

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 Bhubaneswar, all the accessions were infested by both shoot tip borer (Upto 22.50 %) and leaf and blossom webber (Upto 10.50 %), Inflorescence thrips (Yellow Thrips and Black Thrips) population with a range of 0-16 numbers/ inflorescence. By application of Borax @ 100g/tree 8.10 % increase in mean nut yield was observed at Bhubaneswar. At Jagdalpur, the minimum population of inflorescence thrips was seen in Ullal-1 followed by CARS-3 and CARS-4. At Vridhachalam damage score due to TMB was less than 1.5 in H 1608, H 2/16, VTH 59/2 and V 5.

BAPATLA

Among the important foliage and flower feeders only the incidence of leaf and blossom webber was observed to a moderate extent in different germplasm entries. The entries *viz*., T.No.277, Hy.95 T-2, T.No.7/12, T.No.71, T.No.10/2, T.No.6/14, T.No.2/3, Hy.94 T-3, T.No.4/3 and T.No.3/4 were found tolerant to the leaf and blossom webber which recorded 1.75 to 4.33 percent damage as against the highest damage of 17.66 percent in T.No.12/1.

BHUBANESWAR

The germplasm accessions were planted during 2002. Total 83 germplasm were screened for short tip cater pillar, leaf and blossom webber and inflorescence thrips.

All the accessions were infested by both shoot tip borer (Upto 22.50 %) and leaf and blossom webber (Upto 10.50 %), Inflorescence thrips (Yellow Thrips and Black Thrips) population with a range of 0-16 numbers/ inflorescence (Table 3.28).

Table 3.28: Screening of germplasm to locate tolerant / resistant to major pests of the region at Bhubaneswar

Pest	Germplasm	Min. occurrence	Germplasm	Max. Occurrence
Shoot tip caterpillar	OC8	0.5-1.5 %	OC70	12.5-22.5 %
	OC10	0.5-1.5 %	OC71	8.5-21.5 %
	OC65	0-2.5 %	OC73	8.5-22.5 %
Yellow thirps	OC4	0-1 No./Panicle	OC72	0-9 No./Panicle
	OC58	0-1 No./Panicle	OC29	1-11 No./Panicle
	OC64	0-1 No./Panicle	OC30	2-16 No./Panicle
Leaf and blossom webber	OC5	0-1 %	OC49	6.5-8.5 %
	OC9	0-1 %	OC61	6.5-8.5 %
	OC22	0-1 %	OC62	2.5-9.5 %

Estimation of thrips damage

For estimation of thrips damage due to thrips 5 high yield cashew trees were selected. In each tree 20 panicles were tagged and dipped with monocrotophos (0.05%) twice at 10 days interval during flowering season. The 20 panicles in the same plant were kept as untreated check. The results indicated that on an average 17.20 numbers of nuts per panicle were harvested from the insecticide treated panicle where as 15.1 numbers of nuts harvested from control panicle. There was 11 % increase in number of nuts and 24.50 % increase in yield, this marginal increase was due to reduced size of the nuts by thrips infestation (Table 3.29).

Table 3.29 : Effect of monocrotophos on inflorescence thrips (Mean of 2002-2007 data) at Bhubaneswar

	Application of Monocrotophos (0.05 %)	Control
Mean no. of nuts / panicle	17.2 $\pm$ 2.61	5.1 $\pm$ 2.2
Damage of nuts (score value)	0.5 ± 0.13	1.5 $\pm$ 0.3
Mean weight of nuts / panicle (g)	136.5 ± 22.2	109.8 ± 18.5
Percentage increase in no. of nuts over control	11.96 ± 3.2	
Percentage increase in weight of nuts over control	24.5 ± 4.2	

Borax @ 100 g/tree was applied separately after application of recommended fertilizer in 10 trees and another trees were kept as untreated check i.e. only fertilizer application and no borax. The results revealed an 8.10% increase in mean nut yield (Table 3.30).

Table 3.30 : Effect of boron on inflorescence thrips at Bhubaneswar

	Borax application (100 g / tree)	Control
Mean no. of thrips / panicle	4.3 ± 1.6	5.3 ± 1.5
Yield of nuts / tree (kg)	5.3 ± 0.86	5.0 ± 1.05
Percent increase of nuts over control	8.1	

Pollen weight on relation to inflorescence thrips infestation

100 numbers of anthers collected from each of 13 cashew cultivars from Multi Locational Trial - 92. The weight of the anthers was taken separately and the number of thrips population was counted from each cultivar. The pollen was counted from both sprayed and unsprayed condition.

It was observed that there was variation in the weight of pollen within the 13 different cashew cultivars, there was no significant variation in the weight of pollen in the presence or absence of thrips population in different cashew cultivars. However, by application of insecticides there was a reduction of population of inflorescence thrips.

CHINTAMANI

The reaction of germplasms maintained on the farm were observed against TMB. Among 102 germ plasms and 40 entries in multilocation trials. The germplasm M/E 4/4 and 1/64 Madhuranthakam were found flushing and flowering early, hence they escape from the TMB infestation.

JAGDALPUR

Twenty released varieties, promising hybrids and six locally collected germplasm were screened against tea mosquito bug incidence, leaf & blossom webber incidence and incidence of panicle thrips (Table-12). It was observed that the TMB mean damage score was zero in Ullal-2 & Ullal-1, CARS-6 on shoot, while on panicle, TMB mean damage score were nil in majority of entries.

The minimum population of inflorescence thrips was seen in Ullal-1 followed by CARS-3 and CARS-4. The leaf & blossom webber damage was not seen in majorities of entries.

JHARGRAM

Tea mosquito bug infestation was not observed in the Regional Cashew Field Gene Bank (RCFGB). The available accessions as well as F_1 hybrids were screened for infestation by leaf and blossom webber, thrips and shoot tip caterpillar. It was observed that all the accessions had infestation by these pests.

VENGURLA

The variety, NRCC-Sel-2 recorded lowest TMB infestation (0.50%) followed by NRCC-Sel-1 (0.57%) and 3/28 (0.74%) whereas the maximum per cent damage was recorded in V-1 (2.80%) followed by V-5 (2.61%), H-320 (2.35%) and 3/33 (2.35%) (Table 3.31).

Table 3.31 : Screening of different promising varieties against TMB incidence at Vengurla

Varieties	TMB (%)	Varieties	TMB (%)
V-1	2.80	Hy-320	2.35
V-2	1.16	Hy-303	2.05
V-3	0.80	30/1	2.19
V-4	2.03	3/33	2.35
V-5	2.61	10/19	1.53
V-6	0.79	3/28	0.74
V-7	1.17	NRCC-Sel-1	0.57
V-8	1.23	NRCC-Sel-2	0.50
M-44/3	1.61	15/4	1.57

VRIDHACHALAM

The MLT entries (17) and eight hybrids available at this centre were screened against TMB and the damage intensity was recorded as percentage incidence and damage score. The mean damage score due to TMB infestations in various MLT entries ranged from 1.50 - 3.00. The score was low in H 1608, H 2/16, VTH 59/2 and V 5 with a mean scoring of 1.5 (Table 3.32).

Table 3.32 : Screening of MLT entries against major pests of cashew at Vridhachalam

MLT entries	TMB score	Per cent damage			
		SB Webber	Leaf roller	Leaf miner	Nut borer
H 1598	2.10	14.00	5.00	8.00	1.00
H 1600	2.00	15.00	6.00	8.00	1.00
H 1608	1.50	12.00	6.00	6.00	1.00
H 1610	2.40	11.00	5.00	8.00	1.00
H 129	2.00	12.00	4.50	8.00	1.20
H 40	2.20	13.60	5.00	7.60	1.00
H 2/15	2.00	12.20	5.00	6.00	3.00
H 2/16	1.50	12.00	6.00	8.00	3.00
H 33/3	2.20	12.50	3.00	6.50	1.20
H 44/3	3.00	11.00	4.00	7.00	2.50
M 26/2	2.00	14.00	4.00	7.00	2.20
VTH 30/4	2.00	12.00	5.00	7.20	2.00
VTH 59/2	1.50	12.00	2.00	5.50	0.50
V 2	2.50	16.00	3.00	6.00	1.00
V 3	2.20	18.00	2.00	8.60	1.00
V 4	2.00	15.00	7.00	7.00	1.00
V 5	1.50	12.00	5.50	7.00	1.00

None of the hybrids screened were resistant to infestation by TMB and other foliage pests. The damage score for TMB was low in H 17 (1.40) followed by H16 (1.50) and H 13 (1.60) (Table 3.33).

Table 3.33 : Screening of F_1 hybrids for tolerance to cashew pests at Vridhachalam

Hybrid	Cross combination	TMB Score	Percent damage				Yield (kg/tree)
			Blossom webber	Leaf roller	Leaf miner	Nut borer	
H 10	M 10/4 x M 26/1	1.60	12.00	7.50	8.50	1.50	6.40
H 11	M 10/4 x M 45/4	1.80	10.50	7.00	8.00	2.00	5.50
H 12	M 10/4 x M 75/3	2.80	14.50	6.00	10.00	0.00	5.75
H 13	M 26/2 x M 26/1	1.60	14.00	8.00	10.50	1.50	5.70
H 14	M 26/2 x M 45/4	1.60	12.50	7.70	10.00	0.00	4.90
H 15	M 26/2 x M 75/3	2.00	15.00	8.00	12.00	0.00	4.90
H 16	M 44/3 x M 26/1	1.50	14.00	6.00	11.00	2.00	5.00
H 17	M 44/3 x M 45/1	1.40	10.00	6.50	9.50	0.00	5.50

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.

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 eight coordinating Centres and one sub Centre, four in the East Coast viz., Bapatla. Bhubaneswar, Jhargram, Vridhachalam, three in the West Coast viz., Madakkathara, Vengurla, Pilicode and one in the maidan parts of Karnataka – Chintamani and one in the Central India at Jagdalpur.

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

1. Evolving high yielding varieties with export grade kernels, tolerant/resistant to pests and diseases;
2. Standardizing agro techniques for the crop under different agroclimatic conditions; and
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); Trichur, 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 at NRCC, Puttur, Karnataka during 2004 and at Kerala Agricultural University, Vellanikkara, Thrissur, Kerala in 2005.

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 27 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 1272.
- 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.
- Standardized the softwood grafting technique for vegetative method of propagation of cashew along with NRCC.
- Spacing trials were conducted. The planting density of 156 trees/ha was recommended.
- 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 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.
- Effective spray schedule for the management of tea mosquito bug and other minor pests of cashew has been devised. Monocrotophos (0.05%) at flushing and carbaryl (0.1%) at flowering and fruiting were found effective in controlling these pests.
- For the control of Cashew Stem and Root Borer (CSRB) infestation, swabbing of neem oil (5%) up to one meter height of trunk twice in a year along with soil application of Sevidol (4G) 75g/tree found to be effective in many centres. Phytosanitation was found to reduce the spread of CSRB.
- Screening of germplasm is being carried out to locate tolerant/resistant types or less susceptible to TMB and other major pests of the respective region.
- The centres have also been producing quality-planting materials for the respective regions to meet the requirement of farmers and developmental agencies.
- Developed close linkages of Centres of AICRP Cashew with State Departments of Agriculture and Horticulture, Directorate of Cashewnut & Cocoa Development (DCCD), Krishi Vigyan Kendras (KVKs) and Cashew Corporations for laying out demonstration plots in farmers' fields. Regularly cashew field days and training programmes for the benefit of farmers / development agencies are being conducted by all the Centres.

Salient achievements of the Project during 2006-07 :

- At Jhargram, the cumulative yield of 14 years was maximum in JGM 34/7 (276.64 kg/tree) followed by JGM – 70/2 (211.56 kg/tree) and JGM – 48/1 (174.72 kg/tree).
- The hybrid A6 was identified as the most promising hybrid at Bhubaneswar which recorded the highest nut yield of 11.00 kg/plant, highest cumulative nut yield of 41.60 kg / plant at 9th harvest having nut weight of 8.70 g and shelling percentage of 34.00.
- At Bhubaneswar the cumulative nut yield over 5 years was highest in S_3 (600 plants/ha) (83.40 q/ha) followed by S_2 (400 plants/ha) (74.68 q/ha) and S_1 (200 plants/ha) (38.39 q/ha); and fertilizer dose of 150 N:P:K at 150:50:50 kg/ha was found significantly superior.
- The yield and total net returns per hectare from inter-crops as well as main crop at Bhubaneswar after 3 years revealed that maximum return was received from colocasia (Rs 44,908/-) followed by brinjal (Rs. 37,666/-), bhindi (Rs 36,650/-) and cowpea (Rs 36,398/-).
- At Jhargram, the cost benefit ratio also depicted that maximum profit could be obtained with cluster bean (Rs.19,142/-) intercropping under cashew plantation followed by pigeon pea (Rs.17,771/-) and ground nut (Rs.13,923/-). At Madakkathara, the highest net return (Rs. 48766/-) was recorded by tapioca followed by colocasia (Rs. 43290/-).
- At Bhubaneswar, L-cyhalothrin could significantly reduce incidence of shoot tip caterpillar, apple and nut borer and inflorescence thrips. The profit (Rs.35.70/tree) over control was maximum in L-cyhalothrin treatment. At Chintamani, The yield obtained was highest in the monocrotophos and carbaryl treated trees (5.80 kg/tree), which was on par with L- cyhalothrin (5.20 kg/tree) and profenofos (5.40 kg/tree). At Jagdalpur, triazophos and L-cyhalothrin could significantly reduce damage by leaf caterpillar and leaf folder. The maximum yield could be realized in triazophos (0.10 %) treatment (153.37 kg/ha) followed by profenophos 0.05% (118.64 kg/ha).

2. TRANSFER OF TECHNOLOGY :

A total of 3,01,990 grafts were produced during the current year 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	5568
Bhubaneswar	44000
Chintamani	18548
Jagdalpur	19150
Jhargram	2500
Madakkathara	23000
Pilicode	7500
Vengurla	90847
Vridhachalam	90877
TOTAL	**3,01,990**

BAPATLA

The scientists of the Cashew Research Station, Bapatla imparted training to the farming community on various aspects of cashew cultivation in Prakasam district *viz.,* Cashew Re-juvenation, Cashew cultivation-Latest Technologies, Management of cashew stem and root borer and on imparted training on Cashew Nursery Management to the Horticultural Officers.

Scientists of this centrte have conducted survey of cashew plantations in various villages of Prakasam and East Godavari Districts. For the upliftment of the rural economy and to impart the technical know how to the farmers on agriculture, horticulture and live-stock, “Nallamothuvaripalem” village which is about 9 km away from Bapatla has been adopted. Technical advice and monitoring of various crops has been done by scientists of Bapatla Centre.

BHUBANESWAR

One state level workshop on rejuvenation of senile plantation and production technology of cashew was conducted at Koraput district, in which 200 nos. of participants attended the training programme. Two one-day seminars on Cashew production technology were organized at Dhenkanal district and at Jajpur district.

Scientists of Cashew research station participated as Resource persons in training programmes on Cashew production technology to cashew growers’ organized by Orissa State Cashew Development Corporation, Self-Help Group and also trained the gardeners and grafters under State Horticulture Department of Orissa.

Scientists of Cashew research station evaluated replanting programme of cashew executed by OSCDC under DCCD, Kochi, participated in training programme on Precision Farming Development Centre of OUAT.

Scientists of related discipline participated in the workshop on “Rainfed Agriculture for Eastern Zone” organized by MANAGE, Hyderabad at OUAT; in a seminar on “Interface on fruit & plantation crops” organized by Department of Horticulture, Govt. of Orissa and in National Symposium on “Input use efficiency in Horticulture” organized at Bangalore. Scientists of the Research Centre also participated in various Doordarshan and E-TV programmes on cashew production.

CHINTAMANI

Scientists of this Research Centre participated as resource persons in trainings organised by several extension organizations and delivered 16 lectures on cashew and other horticultural crops. Tranings were organized regarding Propagation techniques of cashew and nursery management and improved cultivation of cashew under plains region of Karnataka. Various aspects of cashew production viz., limb pruning, cashew improved cultivation practices, management of CSRB, cashew nursery management, high density planting and cashew varieties were telecast through E-TV Kannada channel.

JAGDALPUR

This Centre has been collaborating with State Agriculture and Horticulture Departments, Jila panchayats and Watershed Programme for expanding cashew cultivation. Under the Drought Prone Area Programme & Integrated Waste Land Development Programme 350 hectare area on both community land and private land have been planted with cashew. A total of six training programmes on cashew production technology was organized to farmers, and field staff of State Agriculture and Horticulture Departments.

JHARGRAM

The scientists of this centre have laid out a demonstration plot on high density planting of cashew. Four campaigns on plant protection and five campaigns on propagation, rejuvenation and improved agro-techniques have been conducted by this centre. Ten trainings on propagation techniques on cashew and three techniques on cashew cultivation, protection, grading and marketing were conducted under National Horticultural Mission for the benefit of cashew cultivators.

MADAKKATHARA

Five training programmes sponsored by DCCD on "Cashew apple processing" were organized during March-2007. Display on high yielding varieties of cashew and cashew apple products as well as sale of cashew apple products was taken up as part of the Kerala Agricultural University pavilion in the Thrissur Pooram Exhibition. Trainings on cashew apple processing were organized for farm women and technical persons of various Institutes. Scientists of this centre gave radio talks on propagation of cashew, cashew apple processing and problems faced by cashew farmers which were broadcast from AIR Thrissur.

PILICODE

15 training programmes and seminars related to cashew production technologies were organized by the scientists of this centre for the benefit of farmers and agricultural officers. One radio talk on production and marketing of cashew was broadcast from AIR, Kannur.

VENGURLA

A total of five trainings on cashew nursery management, cashew apple processing, cashew nut processing – value addition, IPM in cashew were conducted by the scientists of this centre in which more than 300 farmers participated. This centre has been actively involved in farmers participatory demonstration programme. The Golden Jubilee Celebrations of this Research Station was organized during 28-30 April 2007 in which more than 10,000 farmers participated. The centre is maintaining 30 demonstration farms on high density planting of cashew in Vengurla and Kudal taluks.

VRIDHACHALAM

This centre is maintaining 30 demonstration plots in Cuddalore and Perambalur districts for demonstrating improved cashew production technology and one front-line demonstration on organic farming at RRS, Vridhachalam. Two campaigns were conducted on cashew production technology in which more than 350 farmers participated. Trainings were imparted to Agricultural Officers on the recent technologies in cashew production. Farm women were given training on cashew apple utilization especially preparation of cashew apple syrup.

3. STAFF POSITION

HEADQUARTERS

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

PROJECT CENTRES

Cashew Research Station, (ANGRAU), Bapatla, 522 101, Guntur District, Andhra Pradesh.

Horticulturist	:	Dr. P. Shesha Reddy (Upto 22.5.2006) Dr. V. Sudha Vani (From 16.11.2006)
Asstt. Horticulturist	:	Smt. T. Susila (From 20.4.2006)
Asstt. Entomologist	:	Dr. Gouse Mohammed
Sr. Technical Assistant	:	Mr. B. Krishna Murthy (Upto 22.03.2006) Mr. R. Srinivasa Reddy (From 8.5.2006)
Jr. Technical Assistant	:	Mr. K. Ranga Rao
Grafter	:	Mr. V. Kantha Rao

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

Horticulturist	:	Dr. A.K. Pattnaik (From 1.7.2006)
Jr. Horticulturist	:	Dr. K.C. Mohapatra
Jr. Entomologist	:	Dr. R. N. Mohapatra
Sr. Technical Assistant	:	Mr. P.C. Swain
Jr. Technical Assistant	:	Mr. K.B. Pani
Grafter	:	Mr. Laxman Biswal

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

Horticulturist	:	Dr. M.N. Narasimha Reddy
Jr. Horticulturist	:	Dr. K.M. Rajanna
Entomologist	:	Mr. C. Manja Naik
Sr. Technical Assistant	:	Mr. Shivappa
Sr. Technical Assistant	:	Mr. G.V. Narayanaswamy
Grafter	:	Mr. R. Lokeshbabu

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

Jr. Horticulturist	:	Mr. Dhananjaya Sharma (From 1.4.2003 to 14.12.2006)
Jr. Entomologist	:	Mr. Khoobhi 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	:	Dr. S. Chakraborti
Sr. Technical Assistant	:	Mr. S. Sirkar
Jr. Technical Assistant	:	Mrs. K. Bose
Grafter	:	Mr. Jagannath Shaw

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

Horticulturist	:	Dr. Jose Mathew
Jr. Breeder	:	Dr. Mareen Abraham (Upto 15.6.2006) Mr. Gregory Zachariah (From 28.6.2006)
Jr. Entomologist	:	Dr. G.K. Mohapatro (Upto 2.1.2007)
Sr. Technical Assistant	:	Dr. Mini C
Jr. Technical Assistant	:	Mr. M.K. Manoj
Grafter	:	Vacant

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

Jr. Horticulturist	:	Dr. B. Jayaprakasha Naik
Jr. Technical Assistant	:	Smt. Jitha Bhasker From 7.6.2006 to 22.1.2007)

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

Horticulturist	:	Vacant
Jr. Breeder	:	Mr. R.C. Gajbhiye
Jr. Entomologist	:	Mr. V.N. Jalgaonkar
Sr. Technical Assistant	:	Mr. R.D. Sawale
Jr. Technical Assistant	:	Mr. R.L. Mayekar

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. S. Manickam
Jr. Technical Assistant	:	Mr. C. Nallaperumal (16.8.2005 to 9.5.2006) Smt. J. Jayanthi (10.5.2006 to 28.8.2006)
Grafter	:	Mr. C. Gopalakrishnan

4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2006-07

Allocation **(Rs. in lakhs)**

Centre	Details of sanctioned provision					ICAR share	State share
	Pay and Allowances	TA	Recurring contingency	Non-Recurring contingency	Grand Total		
Bapatla	8.09	0.40	2.40	0	10.89	8.17	2.72
Bhubaneshwar	11.30	0.40	2.40	2.00	16.10	12.07	4.03
Chintamani	14.70	0.40	2.40	5.40	22.90	17.17	5.73
Jagdalpur	5.50	0.30	1.60	0	7.40	5.55	1.85
Jhargram	8.35	0.40	2.40	0	11.15	8.36	2.79
Madakkathara	12.69	0.40	2.40	0	15.49	11.62	3.87
Pilicode	3.80	0.20	0.80	0	4.80	3.60	1.20
Vengurla	8.57	0.40	2.40	1.20	12.57	9.43	3.14
Vridhachalam	11.30	0.40	2.40	7.40	21.50	16.13	5.37
Total	**84.30**	**3.30**	**19.20**	**16.00**	**122.80**	**92.10**	**30.70**

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

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	11.28	0.19	2.39	0	13.86	10.39
Bhubaneshwar	18.05	0.28	2.40	0	20.73	15.55
Chintamani	14.40	0.01	2.39	5.40	22.20	16.65
Jagdalpur	4.73	0.20	1.59	0	6.52	4.89
Jhargram	7.34	0.40	2.40	0	10.14	7.61
Madakkathara	14.96	0.33	2.39	0	17.68	13.26
Pilicode	3.98	0.18	0.45	0	4.61	3.46
Vengurla	6.82	0.27	2.27	0.95	10.31	7.73
Vridhachalam	13.42	0.14	2.40	7.40	23.36	17.52
Total	**94.98**	**2**	**18.68**	**13.75**	**129.41**	**97.06**

5. MONITORING OF PROJECT BY PROJECT COORDINATOR

Details of the visit by Project Coordinator to review the programmes being implemented at different centres or matters related to policy matter of location or functioning of centres are as follows :

Date	Place
19-8-2006	RARS, Pilicode
20-9-2006	ANGRAU, Hyderabad
31-1-2007	CRS, Bapatla
24-2-2007	RFRS, Vengurla
14-3-2007	RRS, Vridhachalam

During the visit to the above centres, the technical programmes allotted to each of these centres and progress made were reviewed. Monitored the functioning of the centres and inspected the field experiments of on-going projects and gave suggestions and instructions wherever found necessary. At Hyderabad, met Director of Research and other authorities of Acharya NG Ranga Agricultural University and discussed matters related to the shifting of AICRP-Cashew Centre from CRS, Bapatla to some suitable location in northern coastal belt of Andhra Pradesh. Progress of other centres of AICRP-Cashew was monitored by regular correspondence.

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; five in Crop Management and four in Crop Protection are being carried out. Scientists of this centre participated in Zonal Research and Extension Advisory Council Meeting for kharif and Rabi seasons 2006-07. Technical advice has been provided by scientists of the centre to cashew farmers.

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; four in Crop Management and four in Crop Protection are being carried out. Scientists of this centre participated as Resource Persons in training programmes on cashew production technology and softwood grafting in cashew organised by OUAT and Dept. of Horticulture, Govt. of Orissa. Scientists also participated in Workshop on Rainfed Agriculture for Eastern zone and a seminar on Fruits and Plantation crops. Scientists participated in TV Programmes on Cashew Production.

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, five in Crop Management and four in Crop Protection are being carried out. Scientists of this Centre are also involved in Revolving Fund Scheme for production of elite cashew grafts and training of farmers in Cashew Production Technology. Scientists of this Centre are involved in maintenance of Demonstration plots funded by NHM. Scientists organized training programmes on various aspects of cashew production for plains region of Karnataka.

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 this Centre are associated with Zilla Parishad for watershed programmes for cashew plantations and drought prone area

programme on community lands. A total of 6 training programmes on Cashew Production Technology was organized for the benefit of field staff of State Agriculture and Horticulture Departments and Farmers.

JHARGRAM

The centre has been established in 1982. At present there are two scientists working under the project in the posts of Junior Horticulturist and Junior Entomologist. One post of Horticulturist is lying vacant. Presently three projects in Crop Improvement; five in Crop Management and four in Crop Protection are being carried out. Four campaigns on plant protection and five campaigns on propagation, rejuvenation and improved agro-technique were conducted. Thirteen trainings on cashew propagation protection, grading and marketing were conducted under NHM.

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; five in Crop Management and four in Crop Protection are being carried out. This centre organised training on different aspects of cashew cultivation and cashew apple processing. Scientists of this centre gave radio talks in AIR, Thrissur on propagation of cashew, cashew apple processing.

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. A total of 5 cashew demonstration plots have been monitored by the scientists of this centre. A few training programmes on cashew production and processing techniques have been conducted for the benefit of farmers and agricultural officers. Scientists of this centre recorded one radio talk on production and marketing of cashew, which was broadcast from AIR, Kannur.

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; five in Crop Management and four in Crop Protection are being carried out. This centre had organised 5 trainings on

cashew nursery management, cashew apple processing and cashew nut processing. More than 10,000 farmers participated in the Golden Jubilee Celebration of this Centre in April 2007.

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. This centre is maintaining 30 demonstration plots. Two campaigns on cashew production technology have been organised by the scientists of this centre, in which more than 350 farmers participated.

7. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2006-07

BAPATLA

Month& Year	Temperature (^{0}C)		RH (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	33.90	25.40	80	74	62.00	1
May-06	36.30	26.40	73	66	96.80	5
Jun-06	36.70	26.20	71	58	96.30	7
Jul-06	36.50	26.50	69	54	72.90	4
Aug-06	35.00	25.00	73	63	84.50	9
Sept-06	33.10	24.30	83	79	147.20	10
Oct-06	32.40	23.50	84	75	474.20	7
Nov-06	29.80	21.20	90	80	91.20	6
Dec-06	30.30	18.00	92	74	0.00	0
Jan-07	30.20	16.30	94	66	0.00	0.00
Feb-07	30.40	18.10	92	69	0.00	0.00
Mar-07	31.90	21.70	86	77	0.00	0.00

BHUBANESWAR

Month& Year	Temperature (^{0}C)		RH (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	36.18	25.58	89.28	54.13	5.40	2
May-06	36.70	25.78	87.90	54.63	98.90	7
Jun-06	34.68	26.32	90.34	68.80	388.30	13
Jul-06	32.65	26.18	91.40	71.58	395.60	15
Aug-06	30.70	25.40	93.08	82.60	567.30	23
Sept-06	32.88	25.75	92.60	72.95	191.60	14
Oct-06	33.40	23.55	92.55	59.40	134.70	6
Nov-06	30.88	19.54	91.44	57.08	12.70	5
Dec-06	29.95	16.55	91.53	39.98	-	-
Jan-07	29.53	14.63	92.53	38.98	-	-
Feb-07	31.18	18.53	93.88	46.23	69.90	3
Mar-07	34.50	22.72	93.36	44.98	-	-

CHINTAMANI

Month	Temperature (^{0}C)		R.H %		Rain Fall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	34.30	20.80	70	36	7.20	2
May-06	34.70	20.90	69	46	45.00	5
Jun-06	30.10	19.70	77	56	167.00	5
Jul-06	29.00	20.30	76	57	1.20	0
Aug-06	29.20	19.80	77	55	101.40	2
Sept-06	27.40	19.90	78	60	58.80	5
Oct-06	27.90	18.00	79	69	85.40	7
Nov-06	26.40	17.50	84	74	81.20	6
Dec-06	24.60	12.60	80	56	18.00	1
Jan-07	27.60	11.90	79	35	0.00	0
Feb-07	29.90	14.40	60	28	0.00	0
Mar-07	33.60	15.80	56	19	0.00	0

JAGDALPUR

Month	Temperature (^{0}C)		R.H %		Rain Fall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	35.58	19.60	84	60	0.00	06
May-06	35.43	24.45	79	52	38.30	03
Jun-06	31.90	24.00	77	64	109.00	10
Jul-06	27.70	22.60	91	81	380.20	19
Aug-06	27.00	22.10	92	86	426.00	17
Sept-06	29.50	22.10	93	83	291.40	12
Oct-06	29.90	19.60	92	81	2.60	0
Nov-06	27.70	15.70	95	54	97.00	4
Dec-06	27.90	10.00	93.0	44.4	0.00	0
Jan-07	28.60	8.80	93	57	0.00	0
Feb-07	30.00	12.50	86	27	8.00	02
Mar-07	34.30	15.40	81	25	17.10	0

JHARGRAM

Month	Temperature (^{0}C)		RH%		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	36.40	25.40	77.50	54.20	18.50	3
May-06	36.30	27.80	75.60	49.20	14.30	2
Jun-06	35.20	25.90	80.10	52.30	57.30	9
Jul-06	33.90	25.80	90.10	75.20	341.30	18
Aug-06	32.40	23.70	43.70	83.40	507.90	27
Sept-06	32.60	24.20	91.60	82.50	446.70	17
Oct-06	31.80	24.70	81.20	67.10	20.00	3
Nov-06	27.40	16.90	81.40	44.90	30.00	3
Dec-06	25.70	12.90	73.50	40.20	16.60	4
Jan-07	24.60	11.80	79.20	49.20	9.60	1
Feb-07	27.90	17.60	77.30	47.80	2.10	1
Mar-07	30.90	21.20	78.20	48.20	15.80	2

MADAKKATHARA

Month & Year	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	33.60	24.14	73.40	58.60	0.80	0.80
May-06	31.40	24.03	91.50	66.80	4.00	4.00
Jun-06	29.90	23.43	94.50	74.00	3.75	3.75
Jul-06	29.42	23.20	94.60	76.20	6.40	6.00
Aug-06	29.90	23.18	92.75	71.00	3.00	2.00
Sept-06	29.03	23.00	92.50	75.50	4.80	0.00
Oct-06	31.18	22.98	88.40	67.00	2.20	0.00
Nov-06	31.58	23.85	81.75	60.50	1.50	0.00
Dec-06	31.48	23.13	6.78	44.25	0.00	0.00
Jan-07	32.58	21.92	70.20	35.60	0.00	0.00
Feb-07	34.38	23.70	78.00	34.75	0.00	0.00
Mar-07	36.15	24.50	86.75	39.83	0.20	0.25

PILICODE

Month & year	Temperature (^{0}C)		Relative humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	33.23	25.68	82.10	60.00	0	0
May-06	32.14	25.24	88.45	70.32	234.50	15
Jun-06	29.89	24.79	100.00	92.97	292.60	23
Jul-06	29.82	24.13	95.32	79.84	274.60	30
Aug-06	29.65	23.65	95.19	77.19	167.50	25
Sept-06	29.07	23.29	95.30	77.90	216.70	20
Oct-06	30.53	23.43	94.48	73.68	150.50	23
Nov-06	31.67	23.71	94.33	70.93	60.80	5
Dec-06	31.22	18.18	90.80	50.80	0	0
Jan-07	31.18	19.18	93.09	50.93	0	0
Feb-07	33.44	21.60	90.39	52.75	70.00	1
Mar-07	32.93	24.55	90.09	62.50	4.00	1

VENGURLA

Month	Temperature (^{0}C)		Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	32.44	24.63	78.70	63.43	0.00	-
May-06	32.77	31.63	79.74	69.68	472.20	7
Jun-06	30.74	29.55	87.90	79.90	544.80	27
Jul-06	30.28	24.57	82.55	81.10	335.60	31
Aug-06	30.31	24.56	87.87	82.36	379.80	30
Sept-06	30.13	24.74	91.30	78.03	491.20	20
Oct-06	30.39	24.05	90.87	71.94	349.50	15
Nov-06	33.67	23.57	87.67	64.40	24.60	4
Dec-06	33.87	17.35	86.03	55.32	0.00	0
Jan-07	32.99	17.83	91.61	54.54	-	-
Feb-07	31.94	19.26	89.68	55.21	-	-
Mar-07	37.51	22.47	83.19	62.38	-	-

VRIDHACHALAM

Month	Temperature (^{0}C)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-06	36.76	32.30	83.16	56.47	6.20	1
May-06	37.74	32.10	81.83	48.27	14.40	2
Jun-06	37.50	26.30	80.32	62.00	53.40	1
Jul-06	38.00	30.00	78.52	60.58	35.00	1
Aug-06	38.50	28.90	78.52	69.42	123.60	6
Sept-06	36.80	28.00	88.03	71.77	317.70	10
Oct-06	35.00	27.20	86.35	77.26	176.80	10
Nov-06	29.00	26.40	88.23	78.07	525.40	12
Dec-06	29.60	27.00	88.19	78.02	548.60	8
Jan-07	30.89	20.47	90.61	61.93	0	0
Feb-07	34.50	22.50	89.80	63.53	0	0
Mar-07	35.04	23.51	88.24	61.50	0	0

8. RESEARCH PUBLICATIONS

BHUBANESWAR

Mohapatra, K. C. and Lenka, P.C. (2006). Performance of cashew genotypes in Orissa. National Seminar on Bio-diversity, conservation and sustainable development, organized by Deptt. of Forestry, College of Agriculture, OUAT on 9-10th March 2006. Published in form of abstract, 13-14.

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Mini. C., John, P.S. and Jose Mathew. 2006. Effect of scion storage on cashew grafting. The Cashew XX (2): 14-19

Mini, C. and Jose Mathew.2006. Utilisation of cashew apple- popularizing cashew syrup. Proc. Golden Jubilee Souvenir of the Karnataka Cashew Manufactures Association. 22nd April 2006, Mangalore

Jose Mathew, Usha K.E and Latha, A. 2006. Opportunities for organic nutrition in cashew. Abstracts, National Seminar on “Convergence of technologies for organic horticulture”, TNAU, Coimbatore, 20-21 July 2006, pp. 175

Mahapatro, G.K., Pathummal Beevi, S., Mareen Abraham and Jose Mathew. 2006. Advacning towards organic technologies for pest management in cashew: a holistic approach. Abstracts, National Seminar on “Convergence of technologies for organic horticulture”, TNAU, Coimbatore, 20-21 July 2006, pp. 184-185

Jose Mathew and Mini. C. 2006. Improving resource use efficiency in cashew. Abstracts. Nat. Symp on Improving Input Use Efficiency in Horticulture. August 9-11, IIHR, Bangalore. pp. 139

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