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

वार्षिक प्रतिवेदन
ANNUAL REPORT
2007-08

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 : 27.02.2009

ABOUT THIS REPORT

This is the twenty fourth 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 2007 to March 2008.

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 : 27.02.2009

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परियोजना समन्वयकर्ता की रिपोर्ट

अखिल भारतीय समन्वित मसाला व काजू अनुसंधान पारयोजना 1971 में चौथी पंच वार्षिक योजना में शुरु की गई, जिसका मुख्यालय 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 2007-08 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 शेनोली 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। मडकत्तारा 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 2007-08 was Rs.135.83 lakhs (Rs.101.87 lakhs ICAR Share) and the expenditure was Rs.132.65 lakhs (Rs. 99.51 lakhs ICAR Share).

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

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

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

CROP IMPROVEMENT

The total number of accessions conserved so far in various Regional Cashew Field Gene Banks (RCFGBs) is 1212. At Baptla, the cumulative nut yield for 7 harvests was recorded to be highest in the entry T.No.268 at 23.16 kg per tree followed by T.No.BLA39/4-1 with 22.19 kg per tree. At Bhubaneswar, 47 accessions had bold nut character with a nut weight ranging from 7.00g to 15.00 g (OC-128), 81 accessions had shelling percentage ranging from 28.00 to 38.50 (OC-110). At Jagdalpur, the accession NRC-131 had a high shelling percentage of 32.72 while at Jhargram maximum shelling

percentage was observed in JGM-149 (37.9%). At Vengurle, two collections (RFRS-171 and RFRS-172) had nut weight exceeding 12.0g.

In multilocation trial II, at Bapatla T.No. 10/19 had maximum mean annual nut yield (14.32kg/tree) and maximum cumulative nut yield for 12 harvests (76.13kg) and high shelling percentage of 31.2 and 32.1 at Chintamani and 31.0 at Jagdalpur. The accession H-320 had a nut weight of more than 8.5g and gave cumulative yield of 72.90kg for 12 harvests at Bapatla and 109.37kg for 13 harvests at Bhubaneswar. H-303 gave a cumulative yield of 80.30kg for 12 harvests at Bapatla and 77.64kg for 13 harvests at Bhubaneswar.

In multilocation trial III, the variety BH-6 had a nut weight of 8.5g with a shelling percentage of 33% at Bhubaneswar and had a nut weight of 8.4g and 32.0 percent shelling at Chintamani followed by H-1593 which had nut weight of 8.5g and shelling percentage of 32.2 at Madakkathara.

In multilocation trial V, at Bapatla, high nut weight was observed in Priyanka (11.2g), BPP-9 (9.1g) and BPP-8 (8.5g). At Jhargram, maximum nuts per square meter were recorded with Kanaka (14.75) followed by Vengurla – 6 (13.75) and Dhana (11.75) and shelling percentage was more than 30.0% in case of Ullal-3, Vengurla-6, Vengurla-4, Vengurla-1, Jhargram-1, Kanaka and UN-50.

In hybridization trial, at Bapatla the hybrid H-36 recorded highest cumulative yield of 17.50kg for 5 harvests followed by H-10 (15.53kg). At Bhubaneswar, A-6 recorded the

highest cumulative yield of 52.6kg for 9 harvests. Shelling percentage was maximum in A1-5 (37.0%) followed by A1-34, A1-85, A-9 and D-6 (34.0 each) at Bhubaneswar among hybrids obtained during 1995. At Chintamani, the average nut weight was 10.3, 10.5, 12.2 and 12.9g respectively and recorded shelling percent of 29.2, 34.2, 26.4. and 28.6 respectively in H-152, H-188, H-191 and H-216. At Jhargram, the hybrid H-57 had maximum number of nuts/m^2 (11.0) with a shelling percentage of 40.80. At Madakkathara, highest cumulative yield was given by H-21 (122.50 kg) and H 24 (92.74 kg/tree). All the high yielders had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

CROP MANAGEMENT

In NPK fertilizer experiment, at Bapatla, the highest cumulative nut yield (9 years) was recorded in the treatment $N_2P_1K_1$ (65.33 kg/tree) followed by $N_2P_2K_1$ (60.36 kg/tree). The highest cumulative yield (40.37kg) at Madakkathara was recorded by the application of 0 g N/tree and 250g P_2O_5 and 125g K_2O / tree, an increase in trend in cumulative nut yield was observed upto 1000g/tree of N and 250g/tree of K_2O. The highest cumulative yield of 25.33 kg nuts /tree for 8 years was recorded in $N_2P_1K_2$ (500 g N/tree and 0g P_2O_5 and 250g K_2O / tree) at Vridhachalam.

In the trial on fertilizer application on high density cashew plantation, at Bhubaneswar, the number of flowering panicles was significantly more in S_1 (200pl/ha) (20.78) compared to S_2 (400pl/ha) (17.10) and S_3 (600pl/ha) (16.48) and the number of nuts per panicle was maximum in S_3 (7.70) and minimum in S_1 (7.20).

Cumulative yield at fifth harvest was highest in M2 (150:50:50kg NPK/ha) (19.07 kg) at Bhubaneswar. The highest nut yield per plant was recorded by S_1 M_2 (6.07 kg) at Chintamani while highest nut yield per hectare was recorded by S_3 M_2 (18.41q/ha). At Jhargram maximum cumulative nut yield per hectare (12.11q/ha) was obtained with a density of 400pl/ha and fertilizer dosage of 225:75:75 kg NPK/ha. At Madakkathara, maximum number of flowering panicles/m^2 (10.50) was observed in 200 pl/ha and 75:25:25 kg NPK/ha. At Vengurle, cumulative yield of 5 years was maximum (5.58kg/tree) at 200 pl/ha and 225:75:75 kg NPK/ha.

In the trial on high density planting, the mean cumulative nut yield (4954 kg/ha) which were higher compared to normal planting (3213 kg/ha). In normal planting density the mean annual nut yield of 7^{th} harvest obtained was 1062 kg/ha while it was 1360kg/ha under high density planting at Chintamani. The per hectare yield was significantly higher under high density planting (3147 kg) as compared to normal density (846 kg) at Madakkathara at the 8^{th} harvest.

In intercropping trials, at Bapatla, groundnut recorded a maximum yield of 1400 kg/ha and had higher cost benefit ratio (1:1.96). The yield and total net returns per hectare from inter-crops as well as main crop after 4 years revealed that maximum return was received from colocasia (Rs 66,216/-) followed by bhindi (Rs. 58,155/-), brinjal (Rs. 58,035/-), cowpea (Rs 57,635/-), chilli (Rs. 56,815/-) and pumpkin (Rs 52,493/-) while in control it was Rs 40,075/- at Bhubaneswar. At Madakkathara, the highest net return per

hectare (Rs. 35711) and C: B ratio (2.22) was recorded by tapioca followed by coleus (Rs. 31783/- and 1.93, respectively).

CROP PROTECTION

In the trial on evaluation of insecticides for control of TMB and other insect pests, at Bapatla, triazophs 0.1% was significantly superior against thrips followed by profenofos 0.05% which recorded a damage score of 0.46 and 0.64, respectively. The nut yield revealed an increase of 12.6 to 30.4 % nut yield in all the treatments over the control plot with maximum increase in λ-cyhalothrin spray (30.4%) followed by recommended spray (26.8%) at Bhubaneswar. Profenophos could effectively check the damage by leaf caterpillar, leaf miner and thrips at Jagdalpur. Recommended spray schedule resulted in highest nut yield of 8.30kg/tree followed by profenophos which led to 7.95kg/tree in comparison to 4.2kg/tree realized in untreated control at Jhargram. λ-cyhalothrin was effective in managing tea mosquito bug, thrips and apple and nut borer at Vengurla and at Vridhachalam this spray minimized incidence of leaf miner, leaf folder, leaf and blossom webber and also apple and nut borer.

In the curative control trial for the control of cashew stem and root borer (CSRB), carbaryl treatment resulted in more trees without reinfestation at Bapatla (91.67%) and Jhargram (100%) while chlorpyriphos was the best treatment resulting in cent per cent of the treated trees without reinfestation at Vengurla and Jhargram and 86.0% at Bhubaneswar, 78.38% at Chintamani and 72.73% at Jagdalpur. Monocrotophos was found to be the most effective treatment leading to 68.42% of the treated trees without reinfestation which was on par with chlorpyriphos (64.70%).

In the trial on influence of biotic and abiotic factors on the incidence of pest complex of cashew, the tea mosquito population was positively influenced by maximum temperature at Vridhachalam and negatively influenced by minimum temperature and relative humidity at Vengurla and Jagdalpur respectively. Negative influence of minimum temperature on leaf and blossom webber was noticed at Jhargram and maximum temperature had positive effect at Bapatla. Leaf miner was negatively inluenced by maximum temperature at Bhubaneswar, Jagdalpur, Jhargram, Vengurla and Vridhachalam while leaf thrips and inflorescence thrips were negatively influenced by maximum temperature and rainfall.

While screening the germplasm for locating tolerant/ resistant types to major pests, at Bapatla, six accessions were relatively tolerant to leaf and blossom webber damage recording < 1.50 per cent damage. At Chintamani, M/E-4/4 and 1/64 escaped from TMB incidence.The incidence of inflorescence thrips was < 1.0 % in CARS-3, CARS-5 and T-30/1 at Jagdalpur centre. At Vridhachalam, the hybrids H-13, H-16 and H-17 had least TMB damage score.

TRANSFER OF TECHNOLOGY

A total of more than 2.90 lakh grafts were produced during the current year and distributed to several government and non-government organizations as well as to cashew cultivators.

The scientists of the Cashew Research Station, Bapatla imparted training to the farming community on various aspects of cashew cultivation viz., Cashew Re-juvenation and plant protection in Tadikalapudi village of Kamavarapukota Mandal (West Godavari district) and Vetapalem village and have taken up the village adoption programme at "Nallamothuvari palem" wherein the scientists of various disciplines impart technical advice on crop production aspects. Scientists of Cashew Research Station, Bhubaneswar participated as Resource persons in training programmes on Cashew production technology organized by Orissa State Cashew Development Corporation and Director of Horticulture under National Horticulture Mission for benefit of farmers and self help groups. The scientific personnel participated as members in the joint verification programme for evaluation of replanting programme of cashew executed by OSCDC and OFDC. Scientists of Chintamani centre were involved in trainings on "Improved cashew cultivation to the farmers of Kolar District." and "Advances in cashew cultivation to the farmers of Kolar and Chikkaballapur Districts" and also involved in two T.V. Programmes on "Harvesting, Storage and Processing of Cashew".

A cashew field workshop and trainings on Cashew Production Technology were organized by Jagdalpur Centre for farmers and departmental staff with a view to expand area under cashew in Chhattisgarh State. A documentary film on Cashew Cultivation Technology (In Bengali) was produced by the scientists of Jhargram centre. Scientists of Madakkathara centre were involved in training programmes on "Scientific water management of crops", "District level farmers' seminar" and "Multiple uses of cashew apple" and "Utilisation of cashew apple". The commercial launching of three new cashew apple products viz. '*Cashewman*' mixed jam, cashew apple pickle and cashew apple candy has been done by the Centre. Demonstration plots have been laid out by Vengurle Centre for imparting technical knowledge on management of insect pests as well as cashew stem and root borer. The Vridhachalam Centre has been maintaining 30 demonstration plots on various aspects of cashew cultivation in Cuddalore and Perambalur districts.

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

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SUMMARY:

The total number of accessions conserved so far in various Regional Cashew Field Gene Banks (RCFGBs) is 1212. At Baptla, the cumulative nut yield for 7 harvests was recorded to be highest in the entry T.No.268 at 23.16 kg per tree followed by T.No.BLA39/4-1 with 22.19 kg per tree. At Bhubaneswar, 47 accessions had bold nut character with a nut weight ranging from 7.00g to 15.00 g (OC-128), 81 accessions had shelling percentage ranging from 28.00 to 38.50 (OC-110). At Jagdalpur, the accession NRC-131 had a high shelling percentage of 32.72 while at Jhargram maximum shelling percentage was observed in JGM-149 (37.9%). At Vengurle, two collections (RFRS-171 and RFRS-172) had nut weight exceeding 12.0g.

Germplasm Collection:

During the current year, 39 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 1212 (Table 1.1).

Table 1.1: Cashew germplasm holding in different centres.

Centre	No. of accessions		
	Earlier existing	Collected during 2007	Total existing 2007-08
East Coast			
Bapatla	132		132
Bhubaneshwar	97	1	97
Jhargram	118	-	118
Vridhachalam	200	8	208
West Coast			
Madakkathara	112	16	128
Pilicode	45	0	43
Vengurla	282	14	297
Plains tract/others			
Chintamani	128		128
Jagdalpur	61		61
Total	**1175**	**39**	**1212**

Germplasm Evaluation :

Cashew germplasm available at different AICRP-Cashew Centres have been evaluated for growth and yield parameters during 2007 and relevant particulars are mentioned centrewise.

BAPATLA

Among the clonally multiplied germplasm block the BLA 39/4 -1 recorded maximum annual nut yield per tree (9.67 kg) followed by T.No.268 (8.50 kg) in the 7th harvest. Among the promising accessions, the cumulative nut yield since 2001 was recorded to be highest in the entry T.No.268 at 23.16 kg per tree followed by T.No.BLA39/4-1 with 22.19 kg per tree with mean nut yield of 3.30 kg and 3.16 kg, respectively (Table 1.2).

Table 1.2 : Performance of cashew germplasm accessions at Bapatla

Accession Number	Plant height (m)	Canopy Spread (m)		No. of bisexual flowers	Nut Weight (g)	Annual Nut yield/tree (Kg) (2007) (7th harvest)	Cum. Nut yield/ tree (Kg) (2001-07) (for 7 harvests)
		E-W	N-S				
T.NO.268	4.82	8.65	7.15	117.00	5.70	8.50	23.16
2/14	5.08	6.47	6.22	203.00	4.90	4.46	13.01
4/5	6.14	7.54	7.34	182.00	2.90	3.10	9.68
5/1	6.93	8.73	9.03	42.60	5.60	6.92	17.39
10/2	6.76	7.26	6.54	40.00	5.80	4.90	13.29
Hy-95-2	6.50	7.50	8.50	82.00	8.80	5.85	13.98
Hy-95-5	5.70	8.87	9.15	112.25	6.50	6.83	16.29
BLA 39/4-1	4.46	7.16	7.06	124.00	4.90	9.67	22.19
Priyanka	5.00	6.15	7.50	112.25	11.00	3.51	9.33

BHUBANESWAR

One elite type was collected from Khurda was planted in Regional Cashew Field General Bank (RCFGB) resulting in a total of 97 cashew accessions.

Out of the cashew accessions in RCFGB, 47 accessions are bold nut types having nut weight ranging from 7.00g to 15.00 g, 81 accessions having shelling percentage ranging from 28.00 to 38.50 and 36 nos. of accessions having no. of nuts/panicle ranging from 3 to 5. During 3rd harvest, the cumulative nut yield (kg/plant) ranged from 3.30 to 4.20 kg/treein 6 accessions, at 2nd harvest it ranges from 1.40 to 2.90 kg/tree in 7 accessions. The promising yielders planted during 2002 had a nut yield (kg/plant) ranging from 2.00 to 3.10 kg/tree, whereas accessions planted in the year 2003 yielded 1.00 to 2.60 kg/tree (Table 1.3).

Table 1.3 : Performance of cashew germplasm accessions at Bhubaneswar

Accession No.	Nut weight (g)	Apple weight (g)	Nut yield (kg/ plant) (3^{rd} harvest)	Cum. nut yield (Kg/plant) (3 harvests)	Shelling (%)
2002					
OC65	6.20	60	2.10	3.40	33.80
OC66	6.50	68	1.40	3.70	29.20
OC69	9.60	110	2.10	3.10	29.10
OC78	4.90	61	2.00	2.80	36.70
OC83	7.30	61	2.20	3.30	31.50
OC92	4.00	47	1.70	2.80	32.50
OC101	7.30	65	3.10	3.90	32.80
OC106	6.40	90	1.00	1.60	28.10
OC109	6.10	93	2.40	4.20	31.10
OC110	5.70	50	1.60	2.60	38.50
OC113	9.40	132	1.20	2.70	29.70
2003			**(2^{nd} harvest)**	**(2 harvests)**	
OC120	5.20	35	2.60	2.90	32.60
OC122	7.80	104	1.50	1.90	29.40
OC124	8.10	93	1.00	1.40	28.10
OC125	9.00	76	0.80	1.40	28.80
OC126	5.00	51	1.00	1.40	30.00
OC128	15.00	71	-	-	22.80
OC131	9.00	73	1.20	1.40	28.00

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

CHINTAMANI

Among the four promising accessions, 44/1 ARSC (Vengurla-5) recorded highest nut yield of 36.60 kg/tree with a mean nut yield of 16.13 kg/tree followed by 41/3 ARSC (5/37 Manjeri) which recorded nut yield of 31.75 kg/tree with mean nut yield of 15.23 kg/tree. The germplasm collection, 44/1 ARSC (Vengurla -5) recorded highest cumulative yield of 306.53 kg/tree followed by 41/3 ARSC (5/37 Manjeri) and 2/6 ARSC (3/108 Gubbi) recorded 289.34 kg/tree and 258.12 kg/tree respectively (Table 1.4).

The accession 41/3 ARSC (5/37 Manjeri) recorded highest nut weight of 7.60 g with 27.60 shelling per cent followed by 44/1 ARSC (Vengurla-5) 6.00 g nut weight and 28.10 per cent shelling. Out of 128 germplasm collections maintained at RCFGB Chintamani, 102 accessions are yielding and remaining are yet to yield.

Table 1.4: Performance of cashew germplasm accessions at Chintamani

Accession	Year of planting	Nut Yield (kg/tree)	Cum. yield (kg/tree)	Mean nut Yield (kg/tree)	Mean nut weight (g)	Shelling (%)
3/108 Gubbi (2/6 ARSC)	1982	17.45 (23^{rd} harvest)	258.12 (for 23 hvts)	11.22	5.67	27.68
5/37 Manjeri (41/3 ARSC)	1985	31.75 (19^{th} harvest)	289.34 (for 19 hvts)	15.23	7.62	27.58
Vengurla - 5 (44/1 ARSC)	1985	36.60 (19^{th} harvest)	306.53 (for 19 hvts)	16.13	6.02	28.14
K-3-C (56/1 ARSC)	1993	14.35 (10^{th} harvest)	98.21 (for 10 hvts)	9.82	5.84	30.14

Description of 102 accessions of cashew germplasm collections were made as per the IPGRI descriptors provided by NRCC, Puttur.

JAGDALPUR

Presently, 61 cashew germplasm accessions have been maintained in RCFGB with 11 local germplasms accessions collected during the present year.

The maximum plant height (4.08 m) was recorded in NRC-192 followed by NRC-138, and the canopy spread was found larger for NRC-192 (E-W/N-S = 6.96/6.22 m). The nut weight (8.50 g) & apple weight (95.40g) were highest in NRC-140; More number of fruits per panicle (4.35) was recorded in NRC-137.The nut yield/tree was highest for NRC-137 (7.20 Kg), followed by NRC-138 (6.10 Kg). The cumulative Nut yield was highest in NRC-137 (30.70 Kg) for 09 harvests. Mean nut yield was found highest for NRC-137 (3.41 kg) followed by NRC-138 (2.55kg). Shelling percentage was found highest (32.72%) in NRC-131 (Table 1.5).

Table 1.5 : Performance of cashew germplasm accessions at Jagdalpur

Accession	Yield during 2007-08 (Kg)	Cum. yield Kg/Plant (09 No. of harvests)	No. of fruits/ panicle	Mean weight/ nut (g)	Mean weight/ apple (g)	Shelling (%)
NRC- 130	3.29	12.12	2.40	8.20	60.20	30.18
NRC- 131	2.24	13.19	3.60	8.00	48.50	32.72
NRC- 136	3.20	11.85	3.25	7.50	60.30	27.58
NRC- 137	7.20	30.70	4.35	7.40	61.50	31.48
NRC- 138	6.10	23.01	3.60	8.30	66.50	31.88
NRC- 140	4.60	16.84	2.85	8.50	95.40	27.39
NRC- 190	2.80	9.67	3.35	6.20	59.00	29.03
NRC- 191	5.66	22.63	3.45	7.20	38.20	29.26
NRC- 192	4.37	8.01	2.50	7.50	60.20	29.62
NRC- 193	4.52	18.10	3.25	7.00	46.20	29.78

JHARGRAM

A cashew germplasm BCKV-12 was collected from Balibhasa village of Jhargram block which had a cluster bearing type and nut size exceeding 8.00 g. The yield was 0 .25 kg/m^2 with a shelling percentage of 29.05.

Maximum plant height was noticed with JGM – 148 (2.66m) while JGM – 34/7 was the shortest (2.30m). JGM – 148 had maximum canopy spread in both the directions. The canopy area was maximum with JGM – 34/1 (20.04m^2) followed by JGM- 34/7 (11.61m^2) and JGM – 148 (11.15m^2).

JGM-147 and JGM-148 were found to be early flowering with longer flowering duration. JGM-148 had the maximum flowering panicles per square meter (22.92 flowering panicles/m^2), nuts/m^2 (22.10 nuts/m^2) and nuts/panicle (7.30). The nut weight of JGM-148 was very low (4.50 g). JGM-34/7 and JGM-34/1 had better nut size but had less number of nuts /panicle and nuts /square meter. Yield was highest in case of JGM-148 (1.11 Kg/tree) which also had good shelling percentage (31.30%). Shelling percentage was maximum with JGM-149 (37.90 %) (Table 1.6).

Table 1.6: Performance of cashew primary clonal germplasm accessions at Jhargram

Accession No.	Plant height (m)	Canopy Area (m^2)	Duration of Flowering	Nuts/ m^2	Nut weight (g)	Yield (Kg/tree) (1^{st}. harvest)	Shelling %
JGM – 147	2.37	9.33	75	14.80	5.70	0.62	34.70
JGM – 148	2.66	11.15	75	22.10	4.50	0.11	31.30
JGM – 149	2.45	10.22	71	11.80	3.80	0.44	37.90
JGM – 150	2.45	7.95	71	0.50	5.00	0.02	30.90
JGM – 34/7	2.30	11.61	62	9.30	7.20	0.81	28.20
JGM – 34/1	2.60	20.04	72	2.50	7.00	0.43	26.00
S Em $\pm$	0.09	2.318	--	2.10	0.50	0.09	3.14
C.D.at 5%	0.21	5.34	--	4.80	1.19	0.22	7.23

At present, 15 primary germplasm collections and 77 secondary germplasm collections have been maintained in the RCFGB. The mean nut weight was maximum with JGM – 34/3 (9.90 g) and JGM –34/7 (9.90 g) followed by JGM –16/1 (8.50 g) and JGM –6/5 (7.10 g). All the germplasms had more than 28.00% shelling percentage. Maximum shelling percentage was noticed with JGM-29/6 (39.20%) followed by JGM-34/3 (32.80%) and JGM-19/1 (31.0%). Maximum yield was observed in JGM-38/6 (33.65 kg/tree) followed by JGM-19/1 (22.78 Kg/tree) and JGM-16/1 (22.30 Kg/tree). The plants were more than 22 years old and all are seedling progeny. JGM-38/6 (297g/m^2) had the maximum yield /square meter followed by JGM-19/1 (233g/m^2) and JGM-28/6 (143g /m^2). Cumulative yield was highest with JGM-34/7 (298.12 Kg/tree) followed by JGM-29/6 (182.79 Kg/tree) and JGM-38/6 (182.64 Kg/tree). The best performing germplasms with bold nut, heavy yield/tree and moderate shelling percentage were JGM-16/1 and JGM-34/7 (Table 1.7).

Table 1.7 : Performance of cashew secondary germplasm accessions at Jhargram

Accession No.	Mean nut wt (g)	Shelling %	Yield (kg/tree)	Yield/m^2 (g)	Cum. yield (kg/tree)
JGM – 6/5	7.10	29.80	13.21 (17^{th}. Harvest)	131.00	143.69 (17 Harvests)
JGM – 16/1	8.50	30.00	22.30 (20^{th}. Harvest)	121.00	161.99 (20 Harvests)
JGM – 19/1	6.50	31.00	22.78 (19^{th}. Harvest)	233.00	162.91 (19 Harvests)
JGM – 28/6	6.30	28.20	14.50 (19^{th}. Harvest)	143.00	140.22 (19 Harvests)
JGM – 29/6	6.70	39.20	14.51 (19^{th}. Harvest)	105.00	182.79 (19 Harvests)
JGM – 34/7	9.90	28.00	21.48 (19^{th}. Harvest)	128.00	298.122 (19 Harvests)
JGM – 34/3	9.90	32.80	9.76 (19^{th}. Harvest)	109.00	177.75 (19 Harvests)
JGM – 38/6	6.00	28.30	33.65 (18^{th}Harvest)	297.00	182.64 (18 Harvests)

MADAKKATHARA

Accession Kainur recorded the maximum girth (77 cm) and height (5.55 m) followed by accession Kiralur (76.70 cm) and (4.70 m) respectively. Accession Kainur recorded highest canopy spread (8.33 m) followed by accession Manur (6.30 m). Highest nut yield was obtained in Pathanoor (3.85 kg) followed by Kunjithai (3.50 kg) (Table 1.8).

Table 1.8: Performance of cashew germplasm accessions at Madakkathara

Variety	Height (m)	Girth (cm)	Mean canopy spread (m)	Yield kg/tree/ Year (2^{nd} harvest)
KTR-1	3.75	48.25	4.08	2.75
KTR-3	4.53	68.00	5.68	2.15
Kiralur	4.70	76.70	5.40	1.95
Mannur	5.58	72.50	6.30	2.11
Kainur	5.55	77.00	8.33	3.12

Ummanoor	4.59	63.00	5.74	3.15
Kottukkal	3.93	64.25	5.29	1.45
Peechi	3.58	42.50	3.26	1.75
Kunjithai	4.81	52.50	4.54	3.50
Pathanoor	4.30	52.50	4.10	3.85
ARL-1	3.58	40.80	3.27	0.90
KTR-2	4.37	51.67	3.67	1.50
ARL-2	4.42	49.70	3.90	2.50
ODR	3.83	46.30	3.83	2.30

PILICODE

So far 81 diverse types were identified from Northern Kerala and 43 types were planted in the germplasm block for evaluation. The biometric observations and yield data of the accessions planted during 1998 and 2000 were recorded. Among the five accessions planted in 1998, PLD – 4 was found to be superior in yield and significantly superior in cumulative nut yield. The canopy spread of the trees of accessions PLD -12, PLD 16, PLD -17, and PLD -18 were on par among the accessions planted during the year 2000. The density panicle per unit area was highest in PLD 18 (3.42 nos./sqm). PLD 57, was identified as a dwarf type which was used for hybridizaton programme with varieties 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 Panicles/m^2	Nut yield /plant (Kg)	Cum. nut yield / plant (Kg) (7 harvests)
			E-W	N-S			
1998							
PLD-1	2.57	35..30	3.40	3.20	1.75	3.65	12.26
PLD-3	2.72	36.20	3.20	3.20	1.25	2.39	6.73
PLD-4	2.30	22.00	2.30	2.10	1.96	4.91	15.21
PLD-16	2.60	35.50	4.10	3.30	1.12	3.00	7.70
PLD-12	2.65	41.50	5.20	4.70	1.50	3.85	12.93
2000							
PLD-18	4.10	48.60	4.60	4.40	3.42	1.50	2.60
PLD-17	3.50	45.30	4.40	4.40	1.00	1.00	1.35

PLD-19	2.40	31.20	3.00	4.00	1.50	1.00	1.77
PLD-20	3.00	51.10	3.20	3.10	1.75	1.50	1.50
PLD 57	0.67	16.80	2.40	2.30	5.35	0.25	0.55
CD 0.05	NS	NS	1.92	1.64	NS	2.05	1.5

VENGURLA

Presently, a total 297 accessions have been planted in the gene bank. Of these, 170 types have been evaluated and planted in conservation block at 4m x 4 m and 7 m x 7 m spacing. During this year, 14 types were collected from Thane, Raigad, Kolhapur and Sindhudurg districts of Maharashtra.

Among the 14 types RFRS 184 recorded lowest mean height (2.30m) and lowest mean stem girth (17.0cm). The mean no. of laterals and flowering panicles per sq.m. were highest in RFRS 171 type i.e. 34.50 and 30.00 per sq.m., respectively. RFRS 183 recorded highest mean annual nut yield of 4.19 Kg/tree followed by RFRS 172 (2.99 Kg/plant) (Table 1.10).

Table 1.10 : Performance of cashew germplasm accessions at Vengurla

Name of the type	Mean plant height (m)	Mean stem girth (cm)	Mean Spread (m)		Mean panicles /Sq. m	Mean yield (Kg/plant) (3rd harvest)	Mean nut weight (g)
			E.W.	N.S.			
RFRS 171	4.50	51.50	5.80	4.90	30.00	0.64	12.10
RFRS 172	4.50	50.30	5.50	5.20	23.70	2.99	12.60
RFRS 173	4. 90	52.00	5.40	5.30	19.00	2.95	6.00
RFRS 174	5.40	55.00	5.00	4.20	17.30	0.45	6.50
RFRS 175	5.20	36.00	4.30	4.30	16.00	0.26	6.50
RFRS 176	4.10	46.30	5. 60	4.90	16.30	1.01	5.00
RFRS 177	3.80	41.20	5.50	5.30	25.00	0.34	6.00
RFRS 178	5.10	25.50	5.40	5.40	18.50	0.88	5.00
RFRS 179	4.10	34.70	4.20	4.00	17.70	0.70	10.50
RFRS 180	5.40	49.30	5.80	4.70	22.70	0.94	4.00
RFRS 181	4.00	35.30	4.40	4.10	16.00	0.44	4.00
RFRS 182	4.40	36. 70	3.70	4.10	17.00	1.47	6.50
RFRS 183	5.40	61.00	7.40	7.00	25.00	4.19	6.00
RFRS 184	2.30	17.00	2. 70	3.10	19.50	1.37	4.00

VRIDHACHALAM

Cashew accession from Tirukattupalli, TK 1 recorded the highest cumulative nut yield of 17.19 kg/ tree in six harvests. The accession KK 1 from Kanyakumari District recorded the highest nut weight of 7.60g (Table 1.11).

Table 1.11 : Performance of cashew germplasm accessions at Vridhachalam

Accession No.	Year of planting	Nut yield / plant (Kg) (6^{th} harvest)	Cumulative nut yield / plant(Kg) (6 harvests)	Nut weight (g)	Shelling %
VSK 1	1999	4.45	15.11	6.40	27.80
VSK 2	1999	5.21	16.48	6.80	28.00
SL 1	1999	4.13	15.79	7.00	28.40
TK 1	1999	5.24	17.19	5.80	27.70
NK 1	1999	4.33	15.30	6.60	28.00
KK 1	1999	3.60	13.31	7.60	28.20
PV 1	1999	4.00	14.55	6.20	28.20
AM	1999	4.33	13.70	6.40	27.40

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 :

At Bapatla T.No. 10/19 had maximum mean annual nut yield (14.32kg/tree) and maximum cumulative nut yield for 12 harvests (76.13kg) and high shelling percentage of 31.2 and 32.1 at Chintamani and 31.0 at Jagdalpur. The accession H-320 had a nut weight of more than 8.5g and gave cumulative yield of 72.90kg for 12 harvests at Bapatla and 109.37kg for 13 harvests at Bhubaneswar. H-303 gave a cumulative yield of 80.30kg for 12 harvests at Bapatla and 77.64kg for 13 harvests at Bhubaneswar.

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

In the MLT-II trial, the maximum mean annual nut yield per tree was obtained in the T.No.10/19 (14.32kg) followed by T.No.30/1 (11.28kg) in 12th harvest and the

cumulative nut yield per tree was highest in T.No.10/19 (76.13kg) followed by.No.30/1 (64.48kg) for twelve annual harvests. The highest nut weight was recorded in H-320 (10.5g) followed by H-255 (9.40g) during the period. The number of nuts per panicle were highest in M-44/3 (6.25) followed by T.No.3/33 (5.75) and the shelling percentage was highest in T.No.40/1 (31.50) followed by T.No.10/19 (31.20%).

The apple weight of 93.00g was recorded in T.No.10/19 followed by H-255 (74.00g) during the period (Table 1.12).

Table 1.12 : Flowering characters of cashew types and Yield and yield attributing characters in MLT-II at Bapatla

Variety/ Genotype	Plant height (m)	Trunk girth (cm)	Duration of Flowering	Number of flowering laterals/m^{-2}	Nut yield /tree (Harvest No.12) (kg)	Cumu-lative nut yield/ tree (1995-2007) (kg)	Nut weight	Shelling (%)
Hy-3/28	5.20	92.40	106	25.91	9.55	47.18	7.90	29.10
T.No.3/33	5.75	104.70	104	27.71	8.67	47.13	6.40	27.40
T.No.10/19	5.55	90.70	104	21.66	14.32	76.13	9.30	31.20
T.No.30/1	4.60	74.40	106	29.06	11.28	64.48	6.20	27.10
H-68	5.43	102.30	106	26.25	9.70	45.74	6.40	29.00
H-367	4.87	86.90	106	26.16	8.63	41.51	8.10	28.40
H-303	5.25	93.40	101	24.25	9.51	40.37	5.90	29.30
H-255	4.18	78.50	90	22.16	7.48	32.44	9.40	26.30
H-320	5.39	100.00	90	22.91	8.38	41.08	10.50	29.30
M-44/3	4.30	76.70	74	30.08	8.37	60.90	4.20	29.50
M-15/4	5.12	85.50	106	25.16	10.37	59.84	8.80	28.50
T.No.107/3	4.25	92.20	106	30.25	9.88	35.04	6.70	28.40
T.No. 40/1	4.82	82.20	106	21.86	8.40	43.38	8.40	31.50
					0.48		0.70	1.00

BHUBANESWAR

Maximum height was observed in H255 (6.3m) followed by BPP-10/19(6.1m). Maximum canopy spread of 10.30m in E-W direction was recorded in H-255 followed by BPP-3/28 (10.10m). N-S canopy spread was observed to be maximum of 10.30m in H-255 as well as in BPP-10/19 followed by BPP-3/28 (9.3m). Number of flowering

laterals/m^2 was maximum in H-255 (21) followed by M-44/3 (20), M-15/4 (20), and H-367 (19) (Table 1.13).

Table 1.13 : Vegetative characters of cashew types at Bhubaneswar

Cashew types	Height of plant (m)	Girth of trunk (cm)	Canopy spread (m)		No. of flowering laterals / m^2
			E-W	N– S	
NRCC Sel.-1	4.00	58	7.70	8.20	6
NRCC Sel.-2	4.90	92	8.40	8.90	15
M 44/3	3.30	56	5.20	6.10	20
M 15/4	4.90	93	8.40	8.20	20
BPP 3/33	4.80	112	7.50	9.00	6
BPP 10/19	6.10	104	9.40	10.30	18
BPP 30/1	5.60	91	9.50	8.70	13
BPP 3/28	5.80	100	10.10	9.30	13
H 303	5.20	89	8.50	7.70	18
H 320	4.90	94	10.00	8.50	12
H 255	6.30	118	10.30	10.30	21
H 367	4.60	92	9.50	9.10	19
H 68	5.30	95	9.30	9.20	6

Out of the 13 cashew types evaluated H 255, NRCC-Sel. -2, H-303 and H-68 recorded bold nut types having nut weight ranging from 8.50 to 10.00g borne in cluster (3 – 4 nuts / panicle). Nut yield (kg/plant) ranged from 9.00 to 9.30 and shelling percentage (%) 28.70 to 30.50 among the tested types (Table 1.14).

Table 1.14 : Yield and yield attributing characters of cashew types at Bhubaneswar

Cashew types	Nut yield (kg/ plant) (12^{th} harvest)	Cumulative nut yield (kg/ plant) (12 harvests)	Nut weight (g)	Shelling (%)
NRCC Sel-1	3.00	30.80	8.50	31.50
NRCC Sel-2	9.00	71.50	9.50	30.10
M 44/3	3.20	29.40	5.90	31.00
M 15/4	1.80	28.00	7.70	30.00
BPP 3/33	4.30	49.00	8.00	30.20
BPP 10/19	1.90	35.50	7.50	29.00
BPP 30/1	5.30	60.50	7.20	29.00
BPP 3/28	2.90	45.80	8.00	31.50
H 303	9.30	80.30	8.50	28.70

H 320	2.30	72.90	9.10	29.60
H 255	2.00	36.50	10.00	31.10
H 367	6.00	57.00	9.20	29.10
H 68	9.20	70.20	9.00	30.50

Highest cumulative nut yield at 12th harvest (kg/plant) was recorded in H303 (80.30) followed by H320 (72.90), NRCC-Sel.-2 (71.50) and H68 (70.20). These four types are bold nut types having nut weight more than 7.00 g, shelling percentage more than 28 and are high yielders having yielding ability of 2 tones/ha (Table 1.15).

Table 1.15 : Promising cashew types at Bhubaneswar

Cashew types	Mean nut yield	Cum. Yield (12 harvests)	No. of nuts / panicle	Nut weight (g)	Shelling %
NRCC Sel-2	9.00	71.50	4	9.50	30.10
H 303	9.30	80.30	4	8.50	28.70
H 68	9.20	70.20	3	9.00	30.50
H 320	2.30	72.90	4	9.10	29.60

CHINTAMANI

Significant variation in tree height was not observed among the entries. The highest tree height was recorded in the entry NRCC Sel-1 (5.98m) followed by H-255 (5.76m) and M-15/4 (5.68m). The stem girth varied significantly from 73.20 to 102.58 cm. Among the entries, the highest girth was recorded by NRCC-Sel-1 (102.58 cm) followed by Ullal-1 (102.18 cm).

There was no significant difference in canopy spread among the entries. The highest canopy spread in E-W was recorded by M-15/4 (9.75m) followed by H-303 (9.50m), H-255 (9.42m) and TN-3/33 (9.32m). The least canopy spread in this direction was observed in NRCC Sel-2 (8.22m). Where as, highest N-S spread was recorded by H-255 (10.17m) followed by H-320 (9.86m), NRCC Sel-1 (9.79m) and M-15/4 (9.54m). The lowest canopy spread in N-S direction was noticed M-44/3 (7.82m).

The highest number of flowering laterals/m2 were observed in H-320 (16.00) followed by M-44/3 (14.00) and NRCC-2 (13.50).The least flowering laterals were recorded by H-68 (6.00) (Table 1.16).

Table 1.16 : Vegetative characters of cashew types at Chintamani

Cashew entries	Plant Height (m)	Trunk Girth (cm)	Canopy spread(m)		No. of flowering laterals/m^2
			E-W	N-S	
H – 68	5.49	97.20	9.20	9.68	6.00
H – 367	4.98	88.86	8.92	8.64	11.20
H – 303	4.85	96.24	9.50	9.42	6.30
H – 255	5.76	98.78	9.42	10.17	8.70
H – 320	5.62	88.75	9.24	9.86	16.00
M -44/3	4.64	74.70	8.28	7.82	14.00
M -15/4	5.68	93.90	9.75	9.54	9.35
NRCC Sel-1	5.98	102.58	9.28	9.79	7.75
NRCC Sel-2	5.48	73.20	8.22	8.56	13.50
TN- 30/1	4.76	87.28	8.55	8.38	8.60
TN -3/33	5.45	95.33	9.32	9.30	11.70
TN -10/19	5.32	90.17	8.81	9.42	7.85
TN -3/28	5.36	89.67	8.92	9.28	10.60
Ullal – 1	5.44	102.18	8.96	8.63	11.75
F-test	NS	NS	NS	NS	-
S.Em ±	0.36	7.21	0.42	0.57	-

H-320 and TN-3/33 recorded the highest nut weight of 8.80g each followed by H-68 (8.70g) and lowest nut weight was obtained in TN-10/19 (5.30g) followed by M-44/3 (5.60g). The shelling percentage was highest in M-44/3 (31.90%) and H-320 (31.00%) and the least shelling percentage was observed in H-303 (27.70%).

The nut yield per tree varied significantly, with the highest nut yield of 11.86 kg/tree being recorded in H-320 followed by M-15/4 (9.39 kg/tree) and lowest was in H-68 (5.08 kg/tree) followed by H-367 (7.10 kg/tree). Over 13 harvests, H-320 recorded highest cumulative yield (109.37 kg/tree) followed by the entries NRCC Sel-2 (97.98 kg/tree) and M-15/4 (82.79 kg/tree) (Table 1.17).

Table 1.17 : Yield and yield attributing characters of cashew entries at Chintamani

Cashew entries	Nut Yield (Kg/Plant)	Cum. yield (kg/tree) 13 harvests	Nut weight (g)	Shelling (%)
H -68	5.08	37.08	8.70	30.90
H-367	7.10	64.30	8.70	30.70
H- 303	8.35	77.64	8.10	27.70
H- 255	8.54	66.00	8.30	28.50
H- 320	11.86	109.37	8.80	31.00
M- 44/3	9.15	80.48	5.60	31.90
M -15/4	9.39	82.79	7.60	29.00
NRCC Sel-1	8.22	68.72	8.10	30.20
NRCC Sel-2	8.87	97.98	8.10	30.20
TN -30/1	7.15	71.97	7.00	28.20
TN -3/33	7.51	57.63	8.80	30.10
TN -10/19	8.04	57.04	5.30	32.10
TN -3/28	9.01	70.35	7.50	30.60
Ullal – 1	8.26	65.00	7.20	30.80
S.Em ±	0.21	-	-	-
C.D @5%	0.62	-	-	-

JAGDALPUR

Hybrid - 68 was found to be superior over all the varieties for plant height (3.19 m) and trunk girth (52.83cm). The canopy spread was maximum in Hybrid -367 (E-W/N-S =3.48/3.59m). The varieties H-303, 3/33 and 30/1 flowered earlier, while 3/28, 10/19, H-68, H-255, H-367, H-320, VRI-1, VRI-2 and V-4 flowered during mid season. NRCC Sel-1 was the only late flowering variety with lowest flowering duration of 30 days. Number of fruits/ panicle was maximum for H-68 (6.63) followed by H-303, and Vengurla-4. Yield (Kg/tree) was markedly highest for H-68 (2.60 kg). The cumulative yield (Kg/tree) was highest for H-68 (8.46 kg). Nut weight was highest for 255 (10.07 g), while maximum apple weight was observed in V-4 (67.75 g). The shelling percentage was maximum for NRCC Selection –1 (33.43) (Table 1.18).

Table 1.18 : Performance of different varieties at Jagdalpur

Varieties/ Genotype	Canopy Spread (m)		Duration of Flowering (Days)	Nut yield (Kg/tree) 5th harvest	Cum. Nut yield (5 harvests)	Nut weight (g)	Shelling %
	E--W	N--S					
3/28	2.72	2.75	43	1.26	3.46	7.33	30.27
3/33	2.90	3.20	47	0.95	2.97	7.47	30.98
30/1	2.73	2.92	51	1.12	4.24	6.93	28.18
10/19	2.90	2.96	36	1.47	4.48	5.73	31.03
VRI-1	2.20	2.20	38	0.78	1.97	6.07	32.18
VRI-2	1.58	1.74	34	0.70	1.72	5.93	31.00
H-68	3.28	3.32	43	2.60	8.46	9.53	30.73
H-255	2.84	3.13	40	1.31	3.96	10.07	31.25
H-367	3.48	3.59	34	1.58	4.22	9.67	30.48
H-320	3.33	3.46	35	1.58	4.52	8.33	27.27
H-303	3.08	3.30	49	2.47	7.94	9.33	30.43
Sel-1	2.59	2.60	30	1.10	2.96	7.93	33.43
Sel-2	1.83	1.93	36	1.13	3.46	9.00	30.85
V-4	2.69	2.93	35	1.77	6.31	9.40	31.37
SE(m)	0.11	0.12	-	0.16	-	0.35	0.55
CD 5%	0.34	0.36	-	0.49	-	1.03	1.61

JHARGRAM

The cultivar T.No.3/28 was the tallest (3.85m). The trunk girth was maximum in case of H-255 (46.51 cm) followed by M-15/4 (44.26 cm) and M-44/3 (41.20 cm). NRCC Sel-1 had maximum trunk height. The range of canopy spread was between 1.55 m to 3.38m. Maximum canopy spread was noticed with T.No.3/28 followed by T.No.10/19 and H-255. Canopy area was highest with H-3/28 (18.72 m^2) followed by H-255 (17.94 m^2) and T.No.10/19 (16.68 m^2). Longest duration of flowering was found with H-255 (74 days) followed by H-367 (72 days) and shortest duration was with the variety H-68 (1.19).

Table 1.19 : Performance of cashew varieties/ genotypes at Jhargram

Variety	Plant Height (m)	Trunk Girth (cm)	Trunk Height (m)	Canopy area (m^2)	Duration (Days)
T.No.10/19	3.37	40.22	0.40	16.67	69
T.No.3/33	3.60	39.43	0.23	14.40	69
T.No.3/28	3.85	39.93	0.43	18.72	60
T.No.30/1	3.21	39.56	0.19	8.43	59
H – 68	2.94	34.82	0.41	10.20	55
H – 367	3.21	32.07	0.53	12.64	72
H – 303	3.57	41.05	0.53	13.19	62
H – 255	3.72	46.51	0.46	17.94	74
H – 320	3.38	40.79	0.49	15.33	63
M – 44/3	3.00	41.20	0.45	10.22	64
M – 15/4	3.29	44.26	0.35	10.99	66
NRCC – 1	3.60	39.29	0.56	9.99	67
NRCC - 2	2.91	31.07	0.50	12.69	62
S. Em ($\pm$)	0.1	0.4592	0.0268	1.239	
C.D. at 5%	0.2064	0.948	0.055	2.557	

Except the variety T.No.10/19 and T.No.3/33, all others had flowering density ranging from 3.33 to 4.60 per square meter while the former had 6.41 & 7.50 flowering panicles/m^2 respectively. Maximum nuts were observed with M – 44/3(10.50 nuts/m^2) followed by T.No.3/33 (10 nuts/ m^2) and T.No.30/1 (9.33 nuts/m^2). All the varieties were found to be cluster-bearing types. Nuts /panicle was maximum in case of NRCC Sel– 1(5.35 nuts/panicle). The varieties having more than 4 nuts/panicle were T.No.3/28, H-303, H- 320 and M- 44/3. Nut weight also varied significantly. Maximum nut weight was recorded in case of H- 255 (9.90 g) followed by H – 320 (8.40 g) and NRCC Sel– 2 (8.20 g).

Apple weight was maximum (75.70 g) in H – 367, while the other varieties had apple weight ranging from 33.70 g to 68.30 g. Maximum yield was recorded with the variety T.No.3/28 (1.24 Kg/tree) followed by T.No.10/19 (0.99 Kg/tree) and H – 255 (0.90 Kg/tree). Lowest yield was recorded with M – 15/4 (0.41 Kg/tee). Except T.No.30/1 all other varieties had shelling percentage of more than 28.0. Maximum shelling percentage was recorded in M – 44/3 (31.90%). An early evaluation of the thirteen

varieties under multi-locational trial at Jhargram center had pointed out that T.No.3/28, H – 367, H- 320, H- 255, M- 44/3 and NRCC Sel–1 were promising (Table 1.20).

Table 1.20 : Performance of cashew varieties/ genotypes at Jhargram

Variety	Flowering /m^2	Nuts/m^2	Nut weight (g)	Apple Weight (g)	Yield (Kg/tree) (2^{nd}. harvest)	Shelling %
T.No.10/19	6.42	9.75	6.40	26.80	0.99	29.40
T.No.3/33	7.50	10.00	6.90	33.70	0.66	31.20
T.No.3/28	4.58	8.58	7.60	53.70	1.24	29.90
T.No.30/1	3.33	9.33	6.90	38.80	0.55	27.70
H – 68	4.42	5.08	7.50	58.00	0.41	29.80
H – 367	3.50	8.67	8.00	75.70	0.95	28.40
H – 303	4.25	7.33	7.70	60.30	0.71	30.20
H – 255	3.67	5.58	9.90	63.30	0.90	29.70
H – 320	4.50	4.50	8.40	62.00	0.88	28.40
M – 44/3	4.17	10.50	5.10	37.70	0.59	31.90
M – 15/4	3.33	4.17	7.00	52.70	0.41	28.50
NRCC Sel-1	3.42	6.50	8.10	68.30	0.50	29.60
NRCC Sel-2	3.92	4.50	8.20	55.40	0.69	29.20
S. Em (±)	1.32	2.45	0.48	3.720	0.25	1.035
C.D. at 5%	2.73	5.06	0.99	7.69	0.517	2.14

MADAKKATHARA

There was significant difference in height among genotypes. Highest height was recorded by T-107/3 (7.49 m) followed by Hy 255 (7.33 m). The stem girth differed significantly among the genotypes, with the highest value recorded by T 107/3 (128.33 cm) and Hy 303 (109.16 cm), respectively. There was significant difference among genotypes. Variety T-107/3 recorded highest canopy spread (9.80 m) followed by T/33 (9.42 m). There was difference among genotypes for flowering intensity/m^2. Highest flowering intensity was recorded in M 15/4 and lowest by T 3/28. Significant difference among genotypes for flowering duration, with a maximum for Hy 255 and M 15/4 (147 days each) and minimum for T 107/3 (105 days) was observed (Table 1.21).

Table 1.21: Vegetative characters and flowering characters of different varieties at Madakkathara

Source	Variety	Height (m)	Girth (cm)	Mean canopy spread (m)	Duration of flowering	Flowering intensity/ m^2
Bapatla	T 30/1	7.11	99.72	8.99	114	8.80
	T 3/33	7.32	100.56	9.42	124	8.88
	T 10/19	6.43	92.91	8.29	119	8.68
	T 3/28	6.84	106.75	7.71	114	7.05
Vengurla	Hy 68	6.88	102.11	9.26	134	11.01
	Hy 367	5.61	79.91	8.25	120	12.03
	Hy 303	6.74	109.16	8.69	144	9.11
	Hy 255	7.33	107.44	9.12	147	11.00
	Hy 320	7.12	96.83	8.30	138	10.30
Vridhachalam	M 44/3	5.58	88.09	7.72	143	11.38
	M 15/4	6.14	102.42	9.23	147	12.56
NRCC, Puttur	T 107/3	7.49	128.33	9.80	105	9.04
	T 40/1	6.54	94.00	8.53	144	11.10
Check (Dhana)	H1608	6.49	105.48	8.32	142	10.44
CD (0.05)		1.12	15.17	19.00	20.88	2.39

There was difference among genotypes for apple weight. T 40/1 recorded the highest apple weight followed by Hy 367 and the highest nut weight was recorded by variety Hy 225 (12.50 g) followed by T 40/1 (11.65 g). The highest yield was recorded by Hy 303 (10.25 kg per tree per year) followed by Hy 320 (9.10 kg) (Table 1.22).

Table 1.22: Yield and yield attributes of cashew types at Madakkathara

Variety	Harvest No.	Annual nut yield (kg/tree)	Cum. nut Yield (kg/tree)	Nut wt (g)	Shelling %
T 30/1	14	3.22	17.93	10.40	24.50
T 3/33	5	3.11	14.99	10.86	22.90
T 10/19	5	2.90	10.45	10.95	23.67
T 3/28	12	4.13	24.63	10.25	24.50
Hy 68	10	2.75	17.74	8.90	26.30
Hy 367	6	3.85	18.27	11.16	24.10
Hy 303	16	10.25	38.45	11.40	21.30
Hy 255	7	3.33	16.45	12.50	22.40
Hy 320	14	9.10	33.37	10.72	22.87
M 44/3	9	4.51	22.03	9.71	23.40
M 15/4	10	5.50	29.48	9.33	24.20
T 107/3	14	3.32	17.58	10.05	24.30
T 40/1	9	4.25	20.95	11.65	24.70
H1608	10	7.24	30.78	10.00	23.16
CD (0.05)		1.25		2.23	0.57

VENGURLA

The varieties did not differ significantly with respect to growth and yield parameters. The maximum height, girth and spread were reported in the variety 30/1 (6.10 m, 88.75 cm and 8.30 m respectively). Maximum number of flowering panicles/m^2 was observed in 3/33 (27.20) followed by M-44/3 (26.60) (Table 1.23).

Table 1.23 : Vegetative characters and flowering characters of different varieties at Vengurle

Variety /type	Mean height (m)	Mean Girth (cm)	Mean Spread (m)	Mean Flowering panicles /m^2	Mean Flowering duration (Days)
H 255	5.40	79.30	8.00	18.20	96.20
H 303	4.40	63.70	6.10	19.40	102.30
H 320	5.60	78.70	7.00	20.20	100.20
H 367	3.90	62.30	6.90	25.90	100.20
NRCC Sel.1	5.50	85.00	7.60	22.70	100.80
NRCC Sel.2	4.90	68.70	7.00	20.10	100.40
M-44/3	4.20	60.10	5.70	26.60	102.50
M-15/4	5.00	59.40	6.70	22.10	106.50
10/19	6.00	86.00	8.20	20.40	99.60
3/28	4.10	53.60	4.80	14.80	65.80
3/33	5.50	75.60	7.50	27.20	96.60
30/1	6.10	88.80	8.30	20.30	99.40

The nut weight and apple weight were maximum in Hy. 303 (9.70g and 76.70g respectively). The highest annual yield/tree (2.00 Kg/tree) and maximum cumulative yield for five harvests (12.20 Kg/tree) was reported in Hy-303 (1.40 Kg/tree) followed by Hy-255 (9.60 Kg/tree) (Table 1.24).

Table 1.24 : Yield and yield attributes of cashew types at Vengurle

Variety /type	Mean Fruit set /m^2	Mean Yield (kg/ tree)	Cum. Yield for kg/ tree (5 harvests)	Mean Nut weight (g)	Mean Shelling (%)
H 255	25.20	1.40	9.60	8.90	32.0
H 303	28.70	2.00	12.20	9.70	29.5
H 320	24.10	1.40	6.75	8.30	29.0
H 367	20.40	1.30	7.23	8.80	29.0
NRCC Sel.1	21.90	1.30	7.42	8.00	30.0
NRCC Sel.2	23.80	0.50	4.81	5.70	27.0
M-44/3	24.80	0.80	5.18	5.40	32.0
M-15/4	21.00	0.60	4.88	6.00	30.0
10/19	20.70	0.80	6.03	6.20	29.5
3/28	12.40	0.90	5.19	4.60	32.0
3/33	23.80	1.30	7.99	7.10	32.0
30/1	22.60	1.40	9.11	5.70	30.0

VRIDHACHALAM

The maximum plant height was recorded by T 10/19 (5.22 m) and maximum stem girth was observed in M107/3 (68.42cm). 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 28.60 was recorded in M 107/3 obtained from NRCC, Puttur (Table 1.25 and 1.26).

Table 1.25: Vegetative characters of cashew types at Vridhachalam

Variety/Genotype	Plant Height (m)	Trunk Girth (cm)	Canopy spread (m)
BAPATLA			
T. 30/1	4.72	54.44	4.90
T. 3/33	3.96	50.46	5.00
T.10/19	5.22	62.24	6.60
T. 3/28	4.36	58.16	6.20
VENGURLA			
H 68	4.22	54.46	6.30
H 367	4.16	59.22	6.20
H 303	5.10	64.64	6.40
H 255	4.62	58.62	5.30
H 320	4.46	49.84	6.30
VRIDDHACHALAM			
M 44/3	4.68	52.46	6.00
M 15/4	4.88	66.24	6.80
NRCC, PUTTUR			
107/3	5.14	68.42	6.40
40/1	4.44	58.16	6.00
SEd	0.27	0.06	
CD 5%	0.79	0.13	NS

Table 1.26: Yield and yield attributes of cashew types at Vridhachalam

Variety/ Genotype	Duration of flowering	Yield (kg/tree)	Cum. Yield (kg/tree) (10 harvests)	Nut weight (g)	Shelling (%)
Bapatla					
T. 30/1	64	4.68	20.53	6.80	27.4
T. 3/33	69	4.43	20.04	7.20	28.0
T.10/19	69	4.76	19.84	7.20	28.0
T. 3/28	66	5.98	22.66	6.60	28.2
Vengurla					
H 68	65	4.42	21.23	6.60	27.6
H 367	66	4.56	21.18	6.60	28.0
H 303	67	4.45	24.20	6.80	28.0
H 255	67	5.45	19.96	7.40	28.0
H 320	64	5.83	24.07	7.80	28.2
Vridhachalam					
M 44/3	65	3.88	29.70	5.80	27.2
M 15/4	65	6.22	29.84	6.80	28.4
NRCC, Puttur					
107/3	61	4.39	19.27	6.80	28.6
40/1	62	5.12	23.56	7.20	28.2
SEd		0.08		0.24	
CD 5%		0.18		0.60	NS

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 :

The variety BH-6 had a nut weight of 8.5g with a shelling percentage of 33% at Bhubaneswar and had a nut weight of 8.4g and 32.0 percent shelling at Chintamani followed by H-1593 which had nut weight of 8.5g and shelling percentage of 32.2 at Madakkathara.

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

BHUBANESWAR

Maximum plant height (3.20 m) and girth (33.00 cm) was observed in H-32/4 and minimum plant height (2.30 m) and girth (22.00 cm) in H 662. The spread of plants was minimum in H-662 in both E-W (2.90 m) as well as N-S (2.90 m) directions. Maximum canopy spread (4.10 m) was observed in BH-85 in E-W direction, whereas maximum spread was observed in H-32 / 4 in N-S direction (4.20 m) (Table 1.27).

Table 1.27: Vegetative character of cashew types at Bhubaneswar

Varieties	Plant height (m)	Girth (cm)	Canopy spread (m)	
			E-W	N-S
BH 6	2.60	30	3.60	3.80
BH 85	3.10	32	4.10	4.10
H 1597	2.60	32	3.80	4.00
K 22-1	3.00	32	3.60	4.00
H 662	2.30	22	2.90	2.90
H 675	2.80	27	3.10	3.40
H 11	2.80	29	3.70	4.10
H 14	2.60	25	3.10	3.30
H 32/4	3.20	33	3.90	4.20
Goa 11/6	2.90	31	3.70	4.10
H 2/16 (Local Check)	2.90	31	3.50	4.00

At second harvest, highest cumulative nut yield and nut yield (kg/plant) was observed in BH 6 (3.20 & 1.80 respectively). Number of nuts/panicle ranges from 2 to 3 in all the types. BH 6 recorded maximum nut weight and shelling percentage of 8.50 g and 33 % respectively, whereas minimum nut weight was in H 625 (4.30 g) and minimum shelling percentage was in the check variety H 2/16 (28.0 %) (Table 1.28).

Table 1.28: Yield and yield attributing characters of cashew types at Bhubaneswar

Cashew types	Nut yield (kg/ plant)	Nut yield (kg/ plant) 2nd harvest	Apple weight (g)	Nut weight (g)	Shelling (%)
BH 6	1.80	3.20	63	8.50	33.0
BH 85	1.50	2.53	52	7.80	30.0
H 1597	1.40	2.43	48	8.20	30.0
K 22-1	1.30	2.42	58	5.00	30.0
H 662	1.30	2.46	45	8.60	30.0
H 675	0.80	1.39	37	4.30	32.0
H 11	1.50	2.85	53	6.00	32.0
H 14	0.70	1.14	37	5.30	31.0
H 32/4	1.20	2.60	60	7.00	29.0
Goa 11/6	1.00	1.78	48	6.50	30.0
H 2/16 (Local check)	1.40	2.91	62	7.60	28.0

CHINTAMANI

The growth parameters and nut yield recorded significant variation among the varieties / hybrids. Significantly highest plant height was recorded by H-32/4 (3.50 m) followed by Goa - 11/6 (3.44 m) and least plant height was recorded by H-14 (2.25 m). Significant variation in the stem girth were observed and the highest stem girth was recorded by H-32/4 (47.08 cm) followed by Goa-11/6 (43.67 cm). The lowest stem girth was observed in H-14 (29.81 cm). Canopy spread of plant significantly varied among varieties / hybrids. The highest E-W & N-S spread was recorded by H-32/4 (4.99 and 5.11m respectively). The lowest E-W and N-S spread was recorded by H-14 (3.17 and 3.10 m respectively).

Significantly highest nut yield was recorded by H-1593 (3.71 kg/tree) followed by Goa-11/6 (3.62 kg/tree) and lowest nut yield was recorded by H-675 (1.55 kg/tree). The cumulative yield for two years recorded highest by H-1593 (4.31 kg/plant) followed by

Goa- 11/6 (4.25 kg /plant) and lowest was in H-675 (2.26 kg/plant). The highest nut weight was recorded by H-1593 (8.50 g) followed by BH-6 (8.40 g) and lowest was recorded by H-675 and H-14 (5.30 g each). All the entries recorded shelling percentage of more than 30 per cent (Table 1.29).

Table 1.29 : Growth and yield performance of cashew entries at Chintamani

Entries	Pl. height (m)	Trunk girth (cm)	Canopy Spread (m)		Nut yield (kg/tree)	Cum. yield (kg/tree) (2 harvests)	Nut weight (g)	Shelling (%)
			E - W	N - S				
BH – 6	2.82	42.75	4.68	4.63	3.32	4.19	8.40	32.0
BH – 85	3.01	42.50	4.12	4.06	2.79	3.70	8.20	32.0
H - 1593	2.91	43.33	4.45	4.38	3.71	4.31	8.50	32.2
H – 662	2.69	34.86	3.84	3.78	1.88	2.37	6.20	30.9
H – 675	2.60	32.81	3.82	3.34	1.55	2.26	5.30	31.8
H – 32/4	3.50	47.08	4.99	5.11	3.06	3.58	8.00	31.4
K - 22/1	2.85	42.17	4.04	4.06	2.42	3.12	6.00	31.7
H –11	2.68	41.75	4.85	4.54	3.52	4.07	5.60	32.3
H – 14	2.25	29.81	3.17	3.10	1.91	2.87	5.30	30.1
Goa – 11/6	3.44	43.67	4.57	4.54	3.62	4.25	8.10	32.1
Chintamani –1	2.61	36.00	4.43	4.38	2.85	3.45	6.90	31.4
S.Em ±	0.12	2.41	0.36	0.38	0.36	-	-	-
C.D at 5%	0.35	7.10	1.06	1.10	1.06	-	-	-

MADAKKATHARA

Maximum height was shown by genotypes H-32/4 (4.71 m) followed by BH-85 (4.60 m). Maximum girth was shown by Goa-11/6 (57.67 cm) followed by BH-85 (57.50 cm). Maximum canopy spread was shown by the genotype Goa-11/6 (5.75 m) followed by H-14 (5.73 m). During 2007-08 variety H-1593 recorded maximum nut yield/ tree (2.50 kg) followed by variety Goa-11/6 (2.30 kg) (Table 1.30).

Table 1.30 : Vegetative and yield characters of cashew genotypes at Madakkathara

Variety	Height (m)	Girth (cm)	Canopy spread (m)	Flowering intensity (m^2)	Yield (kg/tree/ year)	Cum. yield (kg/tree)
Dhana	3.69	52.83	4.54	10.67	2.20	2.57
H-11	4.41	56.42	5.32	7.67	1.50	2.20
H-32/4	4.71	51.25	4.56	9.33	1.80	2.40
H-1593	3.71	43.33	3.93	6.33	2.50	3.37
BH-6	3.56	49.31	4.82	4.66	1.25	1.85
H-662	4.37	53.67	5.15	7.33	1.53	2.66
H-675	4.54	54.22	4.80	6.66	1.10	1.87
BH-85	4.60	57.50	4.53	6.66	1.58	2.08
H-22-1	3.88	55.33	4.81	9.00	1.25	2.38
Goa 11/6	4.22	57.67	5.75	7.67	2.30	3.87
H-14	4.14	56.17	5.73	8.33	1.60	2.67

VENGURLA

The experiment is being re-laid with grafts of the 11 identified varieties.

VRIDHACHALAM

Ten entries with two check varieties VRI-2 and VRI-3 were evaluated. Biometrical observations on plant height, trunk girth, canopy shape and canopy spread were recorded. Among the types H-675, H-11 and VRI-3 recorded highest yield in the second harvest (Table 1.31).

Table 1.31 : Performance of cashew accessions/ hybrids at Vridhachalam

Variety/ Genotypes	Plant height (m)	Trunk Girth (cm)	Canopy spread (m)	Yield (Kg/tree)
BH 6	2.82	21.60	2.94	0.82
BH 85	2.94	22.40	3.22	0.66
H 1593	3.38	24.40	3.48	0.82
K 22-1	2.88	21.60	2.92	0.84
H 662	2.92	23.40	3.22	0.96
H 675	3.22	23.20	3.28	0.98
H 11	2.72	21.80	2.92	0.98
H 14	3.02	24.80	3.28	0.90
H 32/4	2.78	21.80	2.96	0.86
Goa 11/6	2.68	20.60	2.88	0.94
Check varieties				
VRI 2	2.62	20.60	2.84	0.92
VRI 3	2.48	20.80	2.76	0.98

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.

SUMMARY :

At Bapatla, high nut weight was observed in Priyanka (11.2g), BPP-9 (9.1g) and BPP-8 (8.5g). At Jhargram, maximum nuts per square meter were recorded with Kanaka (14.75) followed by Vengurla – 6 (13.75) and Dhana (11.75) and shelling percentage was more than 30.0% in case of Ullal-3, Vengurla-6, Vengurla-4, Vengurla-1, Jhargram-1, Kanaka and UN-50.

Treatments :

The earlier trial on Performance of Released Varieties MLT-V has been planted during 1997. The recent trial on Performance of Released Varieties MLT-V has been planted during 2006 using the following 25 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 highest mean nut yield per tree of 8.35 kg was recorded in BPP-8 variety followed by Vengurle-5 of 8.10 kg and their cumulative nut yield since 2001 recorded highest in BPP-8 (23.00 kg) followed by Vengurle-5 (21.79 kg) (Table 1.32).

Table 1.32 : Growth and yield performance of released varieties at Bapatla

Variety	Plant Height (m)	Stem Girth (cm)	Bi-sexual flowers	Nut weight (g)	Nut yield /tree (kg) (7^{th}harvest)	Cum. nut yield/ tree (kg) 6 harvests
BPP-8	3.95	71.00	106.00	8.50	8.35	23.00
BPP-9	2.90	55.00	146.50	9.10	3.51	8.69
PRIYANKA	3.08	53.40	101.25	11.20	4.71	11.10
Vengurle-3	4.90	91.60	214.50	7.70	4.10	10.54
Vengurle-5	4.86	96.60	151.25	4.60	8.10	21.79
BBSR-1	3.60	50.50	229.00	5.60	2.30	11.68

CHINTAMANI

The varieties for evaluation have been planted during June 2007 and in-situ grafting will be taken up for the remaining varieties for which stock plants have been raised in the main field.

JHARGRAM

The plant height was maximum in case of Jhargram –1 followed by BPP- 8. Maximum trunk girth was reported with Jhargram - 1 (41.17 cm) followed by NRCC Sel-1 (41.17 cm) and NRCC Sel-2 (39.83 cm). Vengurla – 4 had maximum canopy spread (4.8m) followed by Kanaka (4.10m) and Vengurla – 6 (4.00m). Within three years, the canopy coverage was maximum in case of Vengurla – 4 (26.66 m^2) followed by BPP- 8 (24.97 m^2) and Jhargram – 1 (22.20 m^2) (Table 1.33).

Table 1.33 : Performance of cashew released varieties at Jhargram

Year of planting	Varieties	Plant height (cm)	Trunk girth (cm)	Canopy spread (m)	Canopy area (m^2)
2004	BPP – 4	3.08	30.00	3.50	18.30
2004	Ullal – 3	2.95	21.00	3.00	13.93
2004	Vengurla – 6	2.99	27.00	4.00	19.71
2004	Vengurla – 4	2.90	30.00	4.80	26.66
2005	Vengurla –1	1.90	20.00	2.20	7.28
2003	Jhargram – 1	4.50	50.00	3.80	22.20
2004	Dhana	3.85	31.00	3.80	20.60
2004	Kanaka	3.00	34.00	4.10	21.82
2004	Madakkathara - 1	2.23	23.00	3.50	14.54
2005	Bhubaneswar - 1	2.00	20.00	3.05	11.48
2004	UN – 50	2.40	17.00	3.20	15.63
2004	NRCC Sel-2	3.22	39.83	3.50	18.72
2003	NRCC Sel-1	3.39	41.17	3.00	15.34
2004	BPP - 8	3.97	38.00	3.84	24.97

Early flowering was recorded with Vengurla – 6, Madakkathara – 1, BPP – 8 & Bhubaneswar – 1. Shortest duration of flowering was observed in case of NRCC Sel-1 followed by NRCC Sel- 2. Maximum nuts per square meter were recorded with Kanaka (14.75) followed by Vengurla – 6 (13.75) and Dhana (11.75). Lowest number of nuts per square meter was found in UN – 50 (1 nut /m^2). BPP – 4 and Vengurla – 6 had maximum numbers of nuts /panicle (6.25). BPP – 8, Vengurla – 4, Dhana and Jhargram – 1 varieties also had more number of nuts /panicle. Except BPP- 4 all other varieties had nut weight more than 6.00 g. Maximum nut weight was recorded with NRCC Sel-2 (8.60 g) followed by BPP- 8 (8.10 g) and Ullal – 3 (7.80 g). Apple weight was in the range of 25 to 62.50 g with the minimum in Jhargram – 1 and maximum in Kanaka. Highest yield was obtained from the variety Kanaka (2.17 Kg/tree) followed by Vengurla – 6 (1.89 Kg/tree) and BPP- 8 (1.53 Kg/tree). Ullal – 3 had the highest shelling percentage (32.40 %). Other varieties having higher shelling percentage were Jhargram – 1 (32.2 %), UN – 50 (32.10%), Vengurla – 6 (31.80 %) and Vengurla – 1 (31%). BPP-4 and Bhubaneswar – 1 were the varieties having shelling percentage below 28. Therefore, it was noticed that during 2007 – 08 the better performing varieties were Vengurla – 6, Dhana, BPP- 8 and NRCC Sel–1 (Table 1.34).

Table 1.34: Performance of cashew released varieties at Jhargram

Varieties	Duration of Flowering	Flowering /m^2	Nuts / m^2	Nut weight (g)	Yield (Kg/tree) (1^{st}. harvest)	Shelling %
BPP – 4	65	10.50	10.75	4.80	0.95	27.40
Ullal – 3	64	11.50	7.50	7.80	0.82	32.40
Vengurla – 6	75	4.80	13.75	7.00	1.89	31.80
Vengurla – 4	63	3.40	10.02	7.00	0.44	30.50
Vengurla –1	74	1.50	8.85	6.30	0.30	31.00
Jhargram – 1	67	7.80	6.00	4.20	0.56	32.20
Dhana	60	3.00	11.75	6.40	1.55	29.10
Kanaka	65	4.80	14.75	6.70	2.17	30.40
Madakkathara - 1	66	5.80	12.50	7.10	1.28	22.70
Bhubaneswar - 1	66	6.00	4.00	5.60	0.07	26.80
UN – 50	69	5.80	1.00	7.80	0.24	32.10
NRCC Sel-1	49	6.30	6.50	7.10	1.20	28.50
NRCC Sel-2	62	4.50	5.00	8.60	1.30	28.00
BPP - 8	69	3.50	10.64	8.10	1.53	29.00

MADAKKATHARA

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

PILICODE

The experiment was laid out during 2007-08 with the identified 25 cashew varieties with 6 plants each were planted during June 2008. The Biometric observations were recorded and presented (Table 1.35).

Table 1.35 : Biometric observation of cashew varieties at Pilicode

Accession No./Variety	Plant Height (m)	Collar Girth (cm)	Canopy Spread(m)	
			E-W	N-S
NRCC sel 2	31.80	10.85	27.35	19.80
MDK 1	25.70	8.27	56.30	40.20
BPP 6	31..96	4.43	6.25	8.50
Ullal 1	21.10	17.70	50.80	33.30
MDK 2	26.17	9.95	47.80	54.20
Bhaskara	39.29	8.23	55.00	33.30
Kanaka	31.84	9.97	48.90	54.27
VRI 4	44.80	7.50	44.30	33.50
Ullal 4	33.60	15.00	26.30	39.40
VRI 3	39.60	7.00	43.40	21.80
Priyanka	33.10	6.94	32.00	18.10
Amritha	45.70	19.10	38.20	37.30
K22 1	32.46	3.06	0.65	49.20
V 7	38.55	4.98	0	19.90
Bhuvaneshwar	40.10	4.70	0	0
UN 50	46.90	4.20	0	0
Goa 1	35.20	4.70	0	0
BPP 8	13.40	3.90	0	0

VRIDHACHALAM

The scion materials of the following released varieties were collected, grafts were prepared and planting was done during January 2008.

Gen.4. Hybridization and Selection

Centres : East Coast :

Bapatla, Bhubaneshwar, Jagdalpur, 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:

At Bapatla the hybrid H-36 recorded highest cumulative yield of 17.50kg for 5 harvests followed by H-10 (15.53kg). At Bhubaneswar, A-6 recorded the highest cumulative yield of 52.6kg for 9 harvests. Shelling percentage was maximum in A1-5 (37.0%) followed by A1-34, A1-85, A-9 and D-6 (34.0 each) at Bhubaneswar among hybrids obtained during 1995. At Chintamani, the average nut weight was 10.3, 10.5, 12.2 and 12.9g respectively and recorded shelling percent of 29.2, 34.2, 26.4. and 28.6 respectively in H-152, H-188, H-191 and H-216. At Jhargram, the hybrid H-57 had maximum number of nuts/m2 (11.0) with a shelling percentage of 40.80. At Madakkathara, highest cumulative yield was given by H-21 (122.50 kg) and H 24 (92.74 kg/tree). All the high yielders had one common male parent P-3-2 and female parent was BLA-139-1 and BLA 39-4.

BAPATLA

Among the F1 trees were evaluated during the year and H-36 (F.No.3 x T30/1) recorded highest cumulative yield of 17.50 kg / tree followed H-10 (T.No.273 x T 71) by 15.53 kg/tree. Among the different hybrids, planted during 1997, H-36 F.No.3 x T.30/1) gave highest cumulative yield of 17.50 kg/tree followed by H-10 (T.No.273 x T 71) which recorded 15.53 Kg / tree (Table 1.36).

Table 1.36 : Performance of cashew hybrids at Bapatla

Hybrid No.	Cross combination	Yield/ tree(kg) (5th harvest)	Cum. yield (kg/tree) (5 harvests)	Nut weight (g)
H-1	T 273 x T 71	2.58	5.13	5.10
H-2	T 273 x T 71	3.13	6.17	4.60
H-3	T 273 x T 71	1.50	2.98	4.40
H-6	T 273 x T 71	2.00	4.63	5.30
H-8	T 273 x T 71	2.53	5.91	4.60
H-9	T 273 x T 71	4.15	14.15	5.30
H-10	T 273 x T 71	**4.50**	**15.53**	5.30
H-12	T 2/22 x T 228	2.30	5.03	4.40
H-13	T 228 x T2/22	3.00	8.58	
H-14	T 228 x T2/22	3.45	10.65	3.70
H-16	T 228 x T2/22	4.00	7.25	5.50
H-18	T 228 x T2/22	3.50	8.24	4.60
H-19	T 228 x T2/22	4.90	9.85	4.80
H-27	F.No.3 x T 228	5.00	5.33	8.10
H-28	BPP-5 x T2/22	3.00	6.50	5.30
H-30	BPP-5 x T2/22	2.23	3.20	5.80
H-31	BPP-5 x T2/22	4.21	7.20	5.50
H-34	BPP-5 x T2/22	4.00	13.10	5.30
H-36	F.No.3 x T30/1	**6.50**	**17.50**	9.20
H-38	BPP-6 x T 2/22	3.60	5.33	6.10
H-40	BPP-6 x T 2/22	2.00	3.95	5.80
H-42	T 228 x T 30/1	3.21	7.86	4.30
H-43	T 228 x T 30/1	3.00	8.45	6.20
H-44	T 228 x T 30/1	1.50	2.95	4.10
H-45	T 228 x T 30/1	1.50	3.75	3.90
H-46	T 228 x T 30/1	3.50	6.16	4.50
H-51	BPP-8 x T 2/22	4.00	11.50	6.50

H-55	T 30/1 x T 228	3.50	6.34	6.30
H-56	T 2/22 x Priyanka	3.00	11.75	6.20
H-57	T 2/22 x VRI-2	2.50	7.20	6.20
H-58	T 71 x T 273	3.00	6.05	6.00
H-61	T 71 x T 273	4.00	10.30	4.40
H-64	T 71 x T 273	4.50	15.00	4.00
H-65	T 71 x T 273	3.10	13.15	5.10
H-67	T 71 x T 273	5.50	11.15	3.80
H-69	T 71 x T 273	4.00	13.60	3.70
H-72	T 71 x T 273	4.50	12.66	4.30
H-73	T 71 x T 273	4.00	10.40	5.60
H-75	T 71 x T 273	5.68	8.18	5.60
H-76	T 71 x T 273	4.00	11.85	3.80

BHUBANESWAR

The five hybrids planted in 1995 gave promising results having cluster bearing habit (3-5 nuts/ panicle), bold nuts (8.20 to 9.60 g.) and shelling percentage ranging from 29 to 34%. Hybrid A6 recorded the highest cumulative nut yield (kg/plant) of 52.60 at 9th harvest followed by A9 (29.20) and E1 (23.40). During the reporting year highest nut yield (kg/plant) was recorded in A9 (12.00) followed by A6 (11.00) and E1 (8.00).

Highest cumulative nut yield (kg/plant) at 7^{th} harvest was observed in A1-85 (49.70) followed by A1-105 (36.00) and A1-16 (29.30). The nut yield (kg/plant) ranged from 4.0-12.0, shelling percentage 30.0-37.0 % with cluster bearing habit and had bold nuts.

Eight nos. of promising types were recorded in 1998 hybrid block which had cluster bearing habit (3-8 nuts/panicle), better shelling percentage (28-31%) and mostly bold nuts. The nut yield (kg/plant) ranged from 4.0-10.0 and highest cumulative nut yield (kg/plant) at 6^{th} harvest was observed in B2-39 (18.60) followed by A2-22 (15.50) and B2-32 (14.20).

The hybrids obtained during 1995 were cluster-bearing types (3-5nuts/panicle), bearing bold nuts (7.10-10.10 g.) having better shelling percentage (29-32%) and the

nut yield (kg/plant) ranged from 2.0-8.0. Highest cumulative nut yield (kg/plant) at 5th harvest as well as nut yield (kg/plant) for the reporting year was observed in D3-11 (16.90 and 8.00) followed by D3-18 (11.90 and 6.00).

Out of the promising hybrids in the 2000 hybrid block, highest nut yield and cumulative nut yield (kg/plant) at 4th harvest were recorded in F4-24 (6.00 and 9.70). The other promising yielder recorded were F4-18 (5.0 and 7.0), D4-6 (2.00 and 7.40) and D4-20 (2.50 and 6.10).

Eleven promising hybrids were observed in the 2001 hybrid block, all of which had bold nut having nut weight ranging from 7.20 to 10.30g, nuts were borne in cluster and shelling percentage ranged from 25.00 to 35.00%. Highest nut yield and cumulative nut yield (kg/plant) at 3th harvest were recorded in J5-13 (3.00 and 7.50) followed by in E5-20 (2.80 and 7.20) and in E5-19 (2.60 and 7.00). The hybrids developed and planted in the year 2002 and2003 are at the initial stages of evaluation; where in 44 and 63 nos. of promising hybrids are observed respectively (Table 1.37).

From the hybrids planted in 2002, nut weight was maximum in J6-13 (8.10g) followed by G6-17 (7.80g) and cumulative nut yield was maximum for two harvests in J6-13 (4.50Kg). Among 2003 planted hybrids B4-22 had highest nut weight of 8.0g and shelling percentage of 34.0. The nut weight was more than 9.0g in B6-3, C1-28, C2-24, C2-25, C3-2 and the shelling percentage in all these hybrids exceeded 30.0 per cent. J5-36 and J1-2 had high shelling percentage of 36.0 and 33.0 respectively among these hybrids (Table 1.37).

Table 1.37: Yield and yield attributing traits of promising cashew hybrids at Bhubaneswar

Hybrid no.	Cross Combinations	Nut weight (g)	Shelling %	Nut Yield (kg / plant)	Cum. nut yield (kg / plant)
	1995-9th harvest				
A6	Bhubaneswar C-2 x VTH 711/4	9.60	29	11.00	52.60
A9	Bhubaneswar C-2 x VTH 711/4	8.20	34	12.00	29.20
A1-85	Bhubaneswar-1 x H2/16	7.00	34	10.00	49.70
B2-39	H 2/16 x M 44/3	6.30	30	10.00	18.60
	1999 - 5th harvest				
D3-11	M 44/3 x H 2/15	10.10	29	8.00	16.90

D3-18	M 44/3 x H 2/15	8.00	32	6.00	11.90
	2000-4th harvest				
D4-6	H 2/16 x M 44/3	7.00	32	2.00	7.40
E4-1	BPP30/1 X VTH 711/ 4	8.50	29	1.00	6.00
F4-18	BPP30/1 X VTH 711/ 4	7.90	32	5.00	7.00
F4-24	M 44/3 x H 2/15	7.80	28	6.00	9.70
	2001 - 3rd harvest				
E5-19	BPP 30/1 x H 2/16	7.40	25	2.60	7.00
E5-20	BPP 30/1 x H 2/16	8.90	26	2.80	7.20
J5-13	Bhubaneswar-1 x VTH 711/4	7.50	32	3.00	7.50
	2002-2nd harvest				
G6-17	RP2 x Kalyanpur Bold nut	7.80	28	2.20	3.70
J6-13	BPP30/1 x Kalyanpur Bold nut	8.10	24	2.00	4.50
	2003-1st harvest				
B4-22	V-2 x OC 71	8.00	34	0.70	1.50
	2003-1st harvest				
B6-3	V-2 x VTH 711/4	9.40	32	1.20	2.20
C1-28	RP-2 x VTH 711/4	10.00	31	0.60	1.80
C2-24	RP-2 x Kankady	9.00	32	0.80	2.00
C2-25	RP-2 x Kankady	9.00	30	1.00	2.50
C3-2	RP-2 x OC 60	9.00	30	1.20	1.80
	2003-1st harvest				
J1-2	RP-1 x OC 22	9.10	33	0.80	1.50
J5-36	RP-1 x OC 71	7.60	36	1.00	1.80

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

CHINTAMANI

During 2007-08, five female and two male parents were selected for crossing. In these cross combinations 116 nuts were obtained and out of these 94 F_1 plants have been raised and these will be planted in the main field for evaluation. The female parents used for crossing are Vengurla – 3, Vengurla – 4, K-6 BC, CKD-1 and BPP-2. The male parents used are Moodabidri and 5/11 Ullal.

Among 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 (2/77 Tuni x Vetore-56) recorded an yield of 0.55,1.18,1.21 and 1.49 kg/tree during the second year of harvest and cumulative yield of two harvests recorded highest by H-216 (2.74 kg/plant) and lowest was in H-151 (0.97 kg/plant). The average nut weight were 10.3, 10.5, 12.2 and 12.9g

respectively and recorded shelling percent of 29.2, 34.2, 26.4. and 28.6 respectively in H-152, H-188, H-191 and H-216.

Table 1.38: Performance of selected F_1 Hybrids planted during 2002 at Chintamani

Hybrid No. & Cross combination	Yield (kg/tree)	Cum. Yield Kg/tree (2 harvests)	Nut wt. (g)	Shelling (%)
H-151 (NRCC-2 X Vetore-56)	0.55	0.97	10.30	29.20
H-188 (V-5 X Vetore-56)	1.18	2.03	10.50	34.20
H-191 (Ullal-3 X Vetore-56)	1.21	1.96	12.20	26.40
H-216 (2/77-Tuni X Vetore-56)	1.49	2.74	12.90	28.60

JHARGRAM

Among the 148 F1 progenies, 14 were found to be promising during 2007-08. H-49 was the tallest (4.50m) among the hybrids followed by H-65 and H-28 (4.10m each). Girth was maximum with H-28 (54cm) followed by H-65 (50cm) and H-49 (47 cm). H-28 had maximum spread in both the directions therefore, occupied maximum canopy area (43.98m2). Other hybrids having large canopy area were H-65 (34.04m2), H-49 (33.60m2) and H–23 (32.55m2). Both the canopy shapes i.e. upright & compact and upright & open were found among the hybrids.

Earliness in flowering was observed with H-65, H-23, H-57, H-59, H-27, H-1, H–6, H-9 and H-42. Flowering duration was minimum with H-3 & H-27 (60 days) and maximum with H-65 and H-9 (82 days). Cluster bearing types identified as H-28 (21 nuts/panicle), H-27 (10 nuts/panicle), H-1 (9 nuts/panicle), H-42 (8 nuts/panicle) and H-45, H-20, H-57 & H-49 (7.3 nuts/panicle). All other hybrids were also cluster bearing types but the number of nuts/panicle were very less. Maximum nuts were found in case of H-57 (11 nuts/m2) followed by H-23 (8.3 nuts/m^2). Except H-6, H-9, H-23 and H–57 others were having nut weight below 6g. Maximum apple weight was observed with H-59 (95g). The shape and colour of apples were highly heterogeneous.

Yield was recorded above 2 kg in all the hybrids in 2nd harvest. Highest yield was recorded with H-28 (4.81 Kg/tree) followed by H-20 (4.31 Kg/tree) and H-1 (3.67

Kg/tree). Except H-6, all other hybrids had shelling percentage above 29. H-57 produced nuts with maximum shelling percentage (40.80%). Other hybrids having more than 34 % were H-28, H-1 and H-49. Based on the performance of hybrids during 2007-08 H-20, H-23, H-27, H-28, H-45 and H-57 were identified as promising types (Table 1.39)

Table 1.39 : Performance of cashew hybrids planted during 2002 at Jhargram

Year of planting / Cross Combination	Hybrid No.	Nuts / m^2	Nut weight (g)	Yield Kg/tree	Shelling %
KC-1 X BLA – 39-4	H –6	3.50	7.10	2.79	27.3
KC-1 X BLA – 39-4	H –9	7.50	6.40	2.34	32.8
Red Hazari x WBDC-V	H –42	3.50	5.40	2.23	29.9
Red Hazari x WBDC-V	H –45	6.00	5.60	2.96	31.9
KC-1 X BLA – 39-4	H –20	4.50	5.50	4.31	29.3
KC-1 X BLA – 39-4	H –23	8.30	6.10	3.59	31.4
BLA x WBDC – V	H –1	3.80	5.20	3.67	34.8
BLA x WBDC – V	H –3	3.50	4.80	2.83	30.6
Local x 2/9 Dicherla	H –27	7.30	5.30	3.47	31.2
Local x 2/9 Dicherla	H –28	6.30	4.80	4.81	34.9
BLA 39-4 x DC – 8	H –57	11.00	6.30	3.61	40.8
BLA 39-4 x DC – 8	H –59	4.50	5.80	2.35	32.8
WBDC – V x Red Hazari	H –65	1.50	4.40	3.34	33.1
WBDC – V X JGM – 1	H –49	6.00	3.80	3.03	34.6

*** UC = Upright & compact, UO = Upright & open.**

MADAKKATHARA

Out of the 56 hybrids planted in 1993, the highest yield was recorded by H-21 (22.50 kg/tree) followed by H-50 (11.74 kg/tree). Highest cumulative yield was given by H-21 (122.50 kg) and H 24 (92.74 kg/tree). 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

Out of 26 hybrids planted in 1994, highest annual yield/ tree were given by H 58 (16.65 kg/tree) with a cumulative yield of 37.90 kg, H-74 with an annual yield of 10.60 kg and cumulative yield of 55 kg and H-73 with an annual yield of 10.15 kg and cumulative yield of 56.40 kg. All the high yielders were progenies of BLA 39-4, BLA 139-1 and P-3-2 showing that these two genotypes are genetically divergent.

1995 hybrids

Out of the 92 hybrids planted during 1995, all the trees recorded nut yield except H-98 (annual yield 10.65 kg/tree and H 95 (annual yield 8.85 kg/tree).

Table 1.40: Performance of selected F1 hybrids planted during 1993 at Madakkathara

Hy. No.	Cross combinations	Annual yield (kg/tree)	No. of harvests	Cum yield (kg/tree)	Nut wt. (g)	Shelling %
	1993					
8	BLA -139-1 X P-3-2	1.35	27	57.27	8.10	26.40
15	BLA -39-4 X P-3-2	9.00	22	75.34	8.00	
18	BLA -39-4 X P-3-2	10.50	32	50.20	7.90	26.46
22	BLA -39-4 X P-3-2	7.94	48	57.50	10.00	25.86
23	BLA -39-4 X P-3-2	7.60	41	65.14	8.00	26.50
24	BLA -39-4 X P-3-2	7.49	60	92.74	8.10	24.75
27	BLA -39-4 X P-3-2	6.75	47	73.47	7.90	29.70
35	V-5 X H-1591	8.35	51	73.00	10.00	26.38
36	V-5 X H-1591	9.27	50	65.37	8.00	25.30
38	V-5 X H-1591	4.25	40	51.70	10.00	23.80
	1994					
71	BLA -39-4 X P-3-2	8.60	31	50.35	9.50	21.99
73	BLA -39-4 X P-3-2	10.15	37	56.40	8.00	24.30
74	BLA -39-4 X P-3-2	10.60	38	55.00	8.00	29.68
	1995					
87	V-5 X H-1591	5.66	32	45.86	6.08	32.11
88	V-5 X H-1591	4.05	19	25.30	6.68	31.99

95	BLA -39-4 X P-3-5	8.85	27	27.85	99.00	27.21
97	BLA -39-4 X P-3-7	6.65	31	34.73	9.00	25.50
105	BLA -139-1 X P-3-2	2.85	24	24.23	7.90	27.50

Hybridisation during 2007-08

The highest number of pollinations was done in the cross Madakkathara-2 x Poornima (220). The highest nut set was seen in the cross Madakkathara - 2 x V2 (110) and the highest number of nuts harvested (25) was also from the same combination. The cross combinations attended during the year were Madakkathara- 2 x Poornima, Madakkathara-2 x V2, Dhana x H 21, Dharasree x H 21.

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 set and high nut yield. The hybrid seed nuts obtained during 2005 were sown in nursery for raising seedlings (Table 1.41).

Table 1.41: Mean of growth characteristics of different crosses involving PLD-57 at Pilicode

Hybrid	Height (m)	Girth (cm)	Tree spread(m)		No. of Panicle/sqm	Male to Bis ratio
			N-S	E-W		
PLD 57 graft	2.27	28.10	2.83	2.95	6.07	16.90
PLD 57(0P)	0.67	16.77	2.37	2.18	5.35	13.08
MDK-I 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
MDK-1	2.50	22.70	2.50	2.70	3.20	8.00
ANK-1	2.00	18.60	2.30	2.60	3.00	3.10
CD 0.05	1.24	NS	NS	NS	1.30	-

The mean growth characteristics of the four year old hybrids (2004) are given in Table 1.41. Among the characteristics recorded the plant height and number of panicles/m^2 varied significantly 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 were on par indicating the transfer and expression of semi dwarf stature in the hybrids dwarf.

VENGURLA

On the basis of standard criteria viz; compact canopy, cluster bearing habit, nut weight (more than 8 g), shelling percentage (> 28%) and high yield, 32 F_1 hybrid seedlings were initially screened as promising hybrids. Out of 3000 F_1 hybrids 2094 F_1 hybrids are in fruiting stage. The hybrid H-781 (M 44/3 X B.T.22) recorded highest yield i.e. 2.69 Kg /plant followed by the H-1993 (V-8 X Ullal-3/1) 2.07 Kg/plant and H-789 (1.84 Kg/plant) i.e. M 44/3 X B.T.2 2 combination.

Table 1.42 : Performance of promising hybrids at Vengurle

Hybrid No.	Cross combination	Average nut weight (g)	Yield (Kg/ tree)	Cum. yield	Shelling percentage (%)
H-781	M44/3 X B.T.22	8.50	2.69	10.84	32.0
H-789	M44/3 X B.T.22	8.50	1.84	7.69	32.0
H-798	M44/3 X B.T.22	8.00	1.28	7.62	34.0
H-824	V-5 X B.T.1	8.00	0.37	5.87	32.0
H-915	V-4 X T-2/16	10.00	0.28	4.04	34.0
H-956	V-4 X T-2/16	9.50	0.41	5.08	31.0
H-969	V-4 X T-2/16	9.00	0.84	4.92	30.0
H-1204	M-26/2 X B.T.1	10.00	1.57	4.45	32.0
H-1238	M-26/2 X B.T.22	10.00	1.46	6.96	33.3
H-1298	T-2/16 X V-4	8.00	0.95	4.71	25.7
H-1533	V-2 X B.T.6	10.00	0.20	3.39	32.5

H-High
M-Medium
L- Low

The various cross-combinations undertaken during the year were V-2 X B.T. 1, V-2 X B.T. 22, V-2 X B.T. 65, V-2 X B.T. 6, B.T. 1 X V-2, B.T. 22 X V-2, B.T. 65 X V -2, B.T. 6 X V-2. In all, 825 hermaphrodite flowers were crossed from which 135 fruits were obtained and after germination 93 F_1 hybrid seedlings were obtained.

VRIDHACHALAM

Eight superior hybrids were evaluated. The cross combination of the selected hybrids are

1. M 10/4 x M 26/1
2. M 10/4 x M 45/4
3. M 10/4 x M 75/3
4. M 26/2 x M 26/1
5. M 26/2 x M 45/4
6. M 26/2 x M 75/3
7. M 44/3 x M 26/1
8. M 44/3 x M 45/4

The maximum yield of 12.5kg was obtained in H-13 followed by H-10 (11.50kg) and H-12(10.50kg). However, the maximum cumulative yield was obtained in H-10 (85.28kg) for 14 years. Shelling percentage was maximum in H-12 (30.20) followed by H-12 (29.20).

Table 1.43 : Performance of selected F_1 Hybrids planted during 1990 at Vridhachalam

Hybrid Number	Cross combination	No. of fruits/panicle	Yield(kg/ tree) Harvest No.14	Cum. yield (Kg /tree) for 14 years	Nut weight (g)	Shelling %
H 10	M 10/4 x M 26/1	4.00	11.50	85.28	7.00	27.5
H 11	M 10/4/ x M 45/4	3.00	9.80	60.38	6.90	27.5
H 12	M 10/4 x M 75/3	3.00	10.50	63.54	6.80	29.2
H 13	M 26/2 x M 26/1	6.00	12.50	78.42	7.20	30.2
H 14	M 26/2 x M 45/4	3.00	9.75	62.25	6.80	27.8
H 15	M 26/2 x M 75/3	3.00	6.92	57.81	6.90	27.5

H 16	M 44/3 x M 26/1	3.00	7.50	68.22	6.60	28.0
H 17	M 44/3 x M 45/4	3.00	8.50	66.30	7.20	27.0
SEd			0.417		0.088	0.127
CD (p=0.05)			0.893**		0.188**	0.272**

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:

At Bapatla, the highest cumulative nut yield (9 years) was recorded in the treatment N2P1K1 (65.33 kg/tree) followed by N2P2K1 (60.36 kg/tree). The highest cumulative yield (40.37kg) at Madakkathara was recorded by the application of 0 g N/tree and 250g P_2O_5 and 125g K_2O / tree, an increase in trend in cumulative nut yield was observed upto 1000g/tree of N and 250g/tree of K_2O. The highest cumulative yield of 25.33 kg nuts /tree for 8 years was recorded in $N_2P_1K_2$ (500 g N/tree and 0g P_2O_5 and 250g K_2O / 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

During the year significant differences for annual nut yield was observed for Nitrogen, Potassium, NP interactions and NPK interaction was recorded. The highest

annual nut yield was recorded in N2P1K1 (8.79 kg/tree) followed by N2P2K1 (8.62 kg/tree) which were statistically on par with each other. The highest cumulative nut yield (9 years) was recorded in the treatment N2P1K1 (65.33 kg/tree) followed by N2P2K1 (60.36 kg/tree) (Table 2.1, 2.2 and 2.3).

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

Treatment	Annual nut yield /tree (kg) (2006-07)	Cum. Nut Yield/tree (kg) (8 harvests)
$N_0P_0K_0$	5.75	33.95
$N_0P_0K_1$	6.80	35.49
$N_0P_0K_2$	5.40	27.83
$N_0P_1K_0$	5.49	25.93
$N_0P_1K_1$	6.80	30.15
$N_0P_1K_2$	5.80	31.43
$N_0P_2K_0$	5.40	34.24
$N_0P_2K_1$	5.65	29.05
$N_0P_2K_2$	6.40	36.51
$N_1P_0K_0$	7.48	49.70
$N_1P_0K_1$	8.00	46.59
$N_1P_0K_2$	7.30	43.59
$N_1P_1K_0$	6.50	37.44
$N_1P_1K_1$	7.35	46.50
$N_1P_1K_2$	7.45	44.64
$N_1P_2K_0$	7.38	42.99
$N_1P_2K_1$	8.00	50.99
$N_1P_2K_1$	8.43	51.37
$N_2P_0K_0$	5.40	29.54
$N_2P_0K_1$	7.20	42.73
$N_2P_0K_2$	7.90	47.61
$N_2P_1K_0$	8.18	54.25
$N_2P_1K_1$	**8.79**	**65.33**
$N_2P_1K_2$	7.50	41.88
$N_2P_2K_0$	7.63	50.93
$N_2P_2K_1$	**8.62**	**60.36**
$N_2P_2K_2$	8.28	52.70
SE.m	0.60	3.98
CD at 5%	1.23	8.19

The N_1 and N_2 level gave significant higher annual yield (7.54kg/tree and 7.72kg/tree, respectively) over N_0 level (5.95kg/tree). P levels were not significant. K_1 level (7.47kg/tree) was better than both K_0 and K_2 levels for yield (6.60kg/tree and 7.16kg/tree, respectively) (Table 2.2).

Table 2.2: Annual nut yield (kg/tree) in response to N, P and K interaction at Bapatla

	P_0	P_1	P_2	Mean	K_0	K_1	K_2
N_0	5.99	6.03	5.82	**5.95**	5.55	6.436	5.87
N_1	7.59	7.10	7.93	**7.54**	7.12	7.12	7.73
N_2	6.83	8.16	8.18	**7.72**	7.07	8.21	7.89
Mean	**6.81**	**7.10**	**7.31**		**6.60**	**7.47**	**7.16**
K_0	6.21	7.34	6.87				
K_1	6.72	7.65	6.92				
K_2	6.80	7.43	7.70				

F-Test	**N**	**P**	**K**	**NP**	**NK**	**PK**
Significance	*	NS	*	*	NS	NS
CD 5%	0.41			0.71		

Table 2.3 : Cumulative nut yield (kg/tree)in response to N, P and K interaction at Bapatla

	P_0	P_1	P_2	Mean	K_0	K_1	K_2
N_0	32.42	29.29	33.27	**31.66**	31.37	31.68	31.92
N_1	46.64	42.86	48.44	**45.98**	43.38	48.02	46.55
N_2	39.96	53.82	54.66	**49.48**	44.91	56.14	47.40
Mean	**39.67**	**41.99**	**45.45**		**39.87**	**45.28**	**41.96**
K_0	37.73	41.60	39.69				
K_1	37.21	47.45	39.32				
K_2	42.72	46.79	46.86				

F-Test	**N**	**P**	**K**	**NP**	**NK**	**PK**
Significance	*	*	*	*	*	NS
CD 5%	2.73			4.73		

CHINTAMANI

The trial was laid out using Ullal-1 at a spacing of 7.5 x 7.5m. Based on the positive performance of preliminary limb pruning, the entire NPK trial plot was pruned during August – September, 2005.

The limb pruned trees recorded nut yield of 0.95 to 5.10 kg/tree during second year after limb pruning.

MADAKKATHARA

None of the growth or yield characters viz., height of trees, girth of trees, canopy spread of trees as well as weight of individual nuts were significantly influenced by the application of graded levels of N, P or K or their 2-way or 3-way interactions.

Marginal increases in tree height were observed with increasing levels of K, with the highest values recorded by the application of 250 g K_2O/tree/year whereas in the case of N, the increasing trend was observed only up to the level of 500 g N. An increasing trend in tree girth was observed in respect of N and K up to 500 and 125 g/ tree/ annum, respectively while the application of P showed no consistent trend.

Canopy spread showed an increasing trend with increasing fertiliser levels. In respect of P and K, the highest nut weight was recorded by the application of 125 and 250 g/tree/annum, respectively. However, a negative trend in nut weight was observed with increasing levels of N application.

No significant variation in nut yield was observed among the levels of N, P or K or their 2-way or 3-way interactions. The highest yield of 3.73 kg/tree was recorded by 1000 g N/tree. However the yield showed a declining trend with increasing levels of P_2O_5 (Table 2.4).

Table 2.4: Annual nut yield (kg/ tree) 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)	4.156	3.467	3.528	3.717	3.383	4.550	3.217
N_1 (500)	3.250	3.039	4.189	3.493	3.833	3.011	3.633
N_2 (1000)	4.056	4.183	2.950	3.730	3.011	3.506	4.411
Mean	3.820	3.563	3.56		CD (0.05)		SEm
Levels of K							
K_0 (0)	3.783	3.117	3.328	3.409	N/P/K	NS	0.534
K_1 (125	3.844	3.983	3.500	3.776			
K_2 (250)	3.833	3.589	3.839	3.754	NP/NK/PK	NS	0.925
					NPK	NS	1.602

Cumulative yield

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. An increasing trend in cumulative nut yield was observed with increasing levels of N up to 1000 g/tree and up to 250 g K_2O in respect of K_2O. The highest cumulative yield (40.37kg) was recorded by the application of 0 g N/tree and 250g P_2O_5 and 125g K_2O / tree, with respect to N, P_2O_5 and K_2O, respectively, while lowest yield was in control (Table 2.5 and 2.6).

Table 2.5 : Cumulative nut yield (kg/ tree for 15 yrs) 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)	24.292	23.112	31.123	26.176	25.960	29.493	23.073
N_1 (500)	24.020	26.414	31.096	27.176	25.755	24.823	30.952
N_2 (1000)	32.796	29.825	26.433	29.685	27.494	30.429	31.131
Mean	27.036	26.450	29.551	27.679	CD (0.05)		SEm
Levels of K					N/P/K	NS	1.437
K_0 (0)	28.543	24.985	25.681	26.403	NP/NK/PK	NS	2.489
K_1 (125	25.868	26.215	32.662	28.248	NPK	NS	4.311
K_2 (250)	26.697	28.151	30.309	28.385			

Table 2.6 : Effect of 3-way interactions of graded levels of N, P and K on growth and yield characters and yield at Madakkathara

Treatment	Yield (kg/tree/annum)	Cum. yield (kg/tree)
$N_0P_0K_0$	4.77	27.02
$N_0P_0K_1$	4.78	25.63
$N_0P_0K_2$	2.92	20.23
$N_0P_1K_0$	1.90	20.19
$N_0P_1K_1$	3.67	22.49
$N_0P_1K_2$	4.83	26.66
$N_0P_2K_0$	3.48	30.67
$N_0P_2K_1$	5.20	40.37
$N_0P_2K_2$	1.90	22.33
$N_1P_0K_0$	3.83	25.32
$N_1P_0K_1$	2.15	2099
$N_1P_0K_2$	3.77	25.76
$N_1P_1K_0$	4.02	26.65

$N_1P_1K_1$	3.17	22.81
$N_1P_1K_2$	1.93	29.78
$N_1P_2K_0$	3.65	25.30
$N_1P_2K_1$	3.72	30.68
$N_1P_2K_2$	5.20	37.32
$N_2P_0K_0$	2.75	33.29
$N_2P_0K_1$	4.60	30.99
$N_2P_0K_2$	4.82	34.11
$N_2P_1K_0$	3.43	28.12
$N_2P_1K_1$	5.12	33.35
$N_2P_1K_2$	4.00	28.01
$N_2P_2K_0$	2.85	21.08
$N_2P_2K_1$	1.58	26.94
$N_2P_2K_2$	4.42	31.28
SEm	**1.60**	**4.31**
CD (0.05)	**NS**	**NS**

On-farm trials

According to the age of the trees, the fertilizer dose will be adjusted as 1/5, 2/5, 3/5 and 4/5 of the full dose of the respective treatments from one to four years. The trees will receive full dose from the fifth year onwards.

Application of increasing doses of fertilizer increased the nut yield. The maximum yield was recorded by the KAU dose of 750:325:750 g NPK/tree during 2005-06 and 2006-07 (3950g/tree/annum & 4175g/tree/annum respectively) while during 2007-08 the NRCC dose resulted in maximum yield of 5038g/tree/annum (Table 2.7).

Table 2.7 : Annual nut yield (g/tree) under on-farm fertiliser trial at Madakkathara

Fertilizer schedule (g NPK/tree)	2005-06	2006-07	2007-08
T_1- 500:125:125 (NRCC)	2500	2775	**5038**
T_2- 750:187.5: 187.5 (150% NRCC)	2738	3067	3613
T_3- 1000: 250: 250 (200% NRCC)	2806	3108	3819
T_4- 750: 325: 750 (KAU)	**3950**	**4175**	4550
T_5- Fully organic (Farmers' practice)	2450	2940	3427

VRIDHACHALAM

The plant height (6.75 m), trunk girth (52.70 cm) and canopy area (29.50m^2) were the highest in treatment $N_2P_1K_2$(1000:125:250 g NPK/plant). Canopy diameter, canopy height in N_2P_1 K_2 were on par with treatments of higher fertilizer doses namely N_2 P_2 K_1 and N_2 P_2 K_2. Date and duration of flowering did not indicate much difference in flowering pattern due to the change of fertilizer doses. There was no significant difference in mean nut weight (6.0 – 6.1gm) and apple weight (45.0 – 45.5g) among various treatments. Higher nut yield was recorded in treatments with higher fertilizer doses. $N_2P_1K_2$ recorded the significantly highest nut yield of 10.50 kg/tree followed by 10.25 kg/tree in $N_2P_2K_2$. The highest cumulative yield of 25.33 kg nuts /tree for 8 years was recorded in $N_2P_1K_2$. The results showed that the fertilizer dose of 1000:125:250 g NPK /plant supported maximum growth and nut yield in VRI 3 (Table 2.8).

Table 2.8 : Performance of Cashew in Response to NPK fertilizer treatments at Vridhachalam

Treatment details	Plant height (m)	Trunk girth (cm)	Canopy area (m^2)	Duration of flowering (No. of days)	Nut Yield (Kg/tree)	Cum. yield (kg/tree) for 8 years
$N_0P_0K_0$	5.80	48.50	28.20	68	6.50	19.53
$N_0P_0K_1$	5.20	50.20	28.50	67	6.60	19.53
$N_0P_0K_2$	5.05	48.50	28.50	70	6.75	14.16
$N_0P_1K_0$	5.43	46.80	25.50	70	7.25	18.25
$N_0P_1K_1$	4.92	45.50	26.50	69	7.50	15.76
$N_0P_1K_2$	5.30	42.50	22.50	68	7.25	19.41
$N_0P_2K_0$	5.45	42.50	25.50	68	7.00	14.45
$N_0P_2K_1$	5.80	47.50	26.25	68	7.25	17.08
$N_0P_2K_2$	4.92	50.20	26.55	68	7.50	17.48
$N_1P_0K_0$	5.65	44.50	26.75	67	7.50	19.45
$N_1P_0K_1$	5.60	43.20	25.75	69	7.75	20.83
$N_1P_0K_2$	5.90	40.50	24.50	70	7.75	19.70
$N_1P_1K_0$	5.25	44.50	25.50	69	8.00	21.10
$N_1P_1K_1$	6.00	44.20	28.50	66	8.00	20.10
$N_1P_1K_2$	6.50	43.20	28.50	68	8.25	20.33
$N_1P_2K_0$	5.90	44.50	28.55	71	8.00	22.18
$N_1P_2K_1$	6.10	44.70	28.75	70	8.50	22.25
$N_1P_2K_2$	5.80	45.50	28.50	70	8.65	21.88
$N_2P_0K_0$	6.55	44.50	28.75	68	8.85	22.52
$N_2P_0K_1$	6.25	46.00	28.50	70	8.90	22.77
$N_2P_0K_2$	6.50	46.50	28.25	67	9.00	22.58
$N_2P_1K_0$	6.20	51.50	28.75	68	9.25	21.34
$N_2P_1K_1$	6.50	52.50	29.25	68	9.50	22.23

$N_2P_1K_2$	6.75	52.70	29.50	67	10.50	25.33
$N_2P_2K_0$	6.50	52.00	29.00	68	10.00	22.90
$N_2P_2K_1$	6.50	50.50	29.25	68	10.00	23.79
$N_2P_2K_2$	6.50	50.50	29.25	68	10.25	23.98
Level of significance	*	--	*	--	**	--

	Plant height	**Canopy area**	**Trunk girth**	**Nut yield / tree**
	CD(0.05)	CD(0.05)	CD(0.05)	CD(0.05)
N	0.109*	0.082*	0.109	0.113**
P	0.109*	0.082*	0.109	0.113**
K	0.109*	0.082*	0.109	0.113**
NP	0.189*	0.143	0.189	0.196**
PK	0.189	0.143	0.189	0.196**
NK	0.189	0.143	0.189	0.196**
NPK	0.326	0.247*	0.327	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 number of flowering panicles was significantly more in S_1 (200pl/ha) (20.78) compared to S_2 (400pl/ha) (17.10) and S_3 (600pl/ha) (16.48) and the number of nuts per panicle was maximum in S_3 (7.70) and minimum in S_1 (7.20). Cumulative yield at fifth harvest was highest in M2 (150:50:50kg NPK/ha) (19.07 kg) at Bhubaneswar. The highest nut yield per plant was recorded by S_1 M_2 (6.07 kg) at Chintamani while highest nut yield per hectare was recorded by S_3 M_2 (18.41q/ha). At Jhargram maximum cumulative nut yield per hectare (12.11q/ha) was obtained with a density of 400pl/ha and fertilizer dosage of 225:75:75 kg NPK/ha. At Madakkathara, maximum number of flowering panicles/m^2 (10.50) was observed in 200 pl/ha and 75:25:25 kg NPK/ha. At Vengurle, cumulative yield of 5 years was maximum (5.58kg/tree) at 200 pl/ha and 225:75:75 kg NPK/ha.

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 : $1/5^{th}$

2nd year	:	2/5th
3rd year	:	3/5th
4th year	:	4/5th
5th year	:	Full dose

BHUBANESWAR

Maximum height was recorded in S_2 (6m x 4m – 5.13m). There was also no significant variation in the girth of the plant due to spacing. Girth was maximum in S_1 (62.42 cm) followed by S_2 (58.13 cm) and minimum in S_3 (56.61 cm). Plant population of 200 nos. / ha (S_1) was significantly superior to S_2 (400 plants / ha) and S_3 (500 plants / ha) in respect of spread of the plant in both the directions of E-W and N-S. The spread of the plant was comparatively more in N-S direction as compared to E-W. Maximum spread was observed in S_1 (8.32 m) followed by S_2 (7.05 m) and S_1 (6.00 m) in N-S direction.

No significant variation was observed in plant height due to different doses of fertilizer during 2007-08. M_2 recorded maximum plant height (5.18 m) followed by M_1 (5.06 m) and M_3 (5.04 m). Significant difference with regards to girth of the plant was observed due to manure. The girth due to the manure dose NPK: 150:50:50 i.e.M_2 (60.29 cm), which is at par with M_1 i.e. NPK: 75:25:25 (59.46 cm) was significantly superior to M_3 i.e. NPK: 225:75:75 (57.41 cm). The spread of the plant was found non-significant due to effect of manure both in E-W and N-S directions. However the spread of plant was more in N-S direction as compared to E-W. Maximum spread was recorded in N-S direction in M_2 (7.30 m) and minimum in M_3 (6.88 m). Similarly, the spread of the plant in E-W direction was also found non-significant recording maximum spread in M_1 (6.10 m) and minimum in M_3 (5.98 m) (Table 2.9).

Table 2.9 : 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	5.11	62.42	6.53	8.32
S_2	5.13	58.13	5.83	7.05
S_3	5.04	56.61	5.78	6.00
F 'test'	NS	NS	*	*
SE (m) ± CD 5%	0.097	1.602	0.182 0.632	0.23 0.81

b) Effect of doses of fertilizer (sub plot)

Treatment	**Plant height (m)**	**Girth (cm)**	**Canopy spread (m)**	
			E-W	**N-S**
M_1	5.06	59.46	6.10	7.18
M_2	5.18	60.29	6.06	7.30
M_3	5.04	57.41	5.98	6.88
F 'test'	NS	NS	NS	NS
SE (m) ± CD5%	0.087	0.619	0.099	0.16

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_2 (5.28 m) and minimum in S_3M_3 (5.00 m). Maximum girth was recorded in S_1M_2 (64.95 cm) and minimum in S_3M_3 (55.45 cm). In N-S direction, S_1M_2 recorded maximum plant spread (8.98 m) followed by S_1M_1 (8.45 m) and minimum in S_3M_2 (5.85 m) (Table 2.10).

Table 2.10 : Effect of fertilizer and spacing on vegetative character at Bhubaneswar

Treatment	**Plant Height (m)**	**Girth (cm)**	**Spread (m)**	
			E-W	**N-S**
S_1M_1	5.10	62.00	**6.60**	8.45
S_1M_2	5.18	**64.95**	6.40	**8.98**
S_1M_3	5.05	60.30	6.58	7.53
S_2M_1	5.05	59.45	5.93	7.05
S_2M_2	**5.28**	58.48	5.78	7.08

S_2M_3	5.08	56.48	5.80	7.03
S_3M_1	5.03	56.93	5.78	6.05
S_3M_2	5.10	57.45	6.00	5.85
S_3M_3	5.00	55.45	5.58	6.10
F 'test'	NS	NS	NS	NS
SE (m)±	0.151	1.072	0.172	0.28

The number of flowering panicles was significantly more in S_1 (20.78) compared to S_2 (17.10) and S_3 (16.48). The number of nuts per panicle was maximum in S_3 (7.70) and minimum in S_1 (7.20). Flowering was enhanced by 10 - 12 days ahead with higher doses of fertilizer. Higher doses of fertilizer significantly increased the number of flowering panicles / m2. M3 (18.73) was found significantly superior to M1 (17.09). The number of nuts per panicle was maximum in higher doses of fertilizer M3 (8.50) followed by M2 (7.13) and minimum in M1 (6.50). The apple weight was maximum in M1 (58.0 g) and minimum in M3 (44.67 g). The nut weight was highest in M1 (8.37 g) followed by M2 (7.93 g) and M3 (7.27 g).

The yield per plant due to spacing was found to be significant. During 2006 - 07, maximum yield was recorded in S_1 (6.93 kg), which is at par with S_2. 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). Due to increase in the plant population for various spacing significant variation was recorded in nut yield/ha. 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). The cumulative yield per hectare for 5 harvests was highest 83.40 q/ha in S_3 followed by S_2 (74.68 q/ha) and S_1 (38.39 q/ha).

Cumulative yield at fifth harvest was highest in M2 (19.07 kg) and minimum in M3 (17.44 kg). M2 was significantly superior to M3. The cumulative yield was highest in M2 (68.70 Q) followed by M1 (65.63 Q) and M3 (62.02 Q) (Table 2.11).

Table 2.11: Effect of doses of fertilizer and spacing on flowering and 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)**
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)**
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 2.12).

Table 2.12 : 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**	**Nut weight (g)**	**Yield (Kg/plant)**	**Cum. Yield (kg) 5th harvest**	**Yield (Q/ha)**	**Cum. Yield (Q)**
S_1M_1	19.96	6.20	8.40	7.30	19.03	14.59	40.44

S_1M_2	21.25	6.70	8.10	7.39	20.24	14.77	43.17
S_1M_3	21.12	8.70	7.40	6.10	18.21	12.20	39.95
S_2M_1	16.08	6.40	8.60	7.30	18.88	29.18	80.88
S_2M_2	17.10	7.10	7.90	7.10	19.41	28.38	83.08
S_2M_3	18.12	8.20	7.30	6.20	17.72	24.78	78.05
S_3M_1	15.21	6.90	8.10	5.80	16.68	28.98	90.11
S_3M_2	17.28	7.60	7.80	6.20	17.60	30.98	94.73
S_3M_3	16.94	8.60	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	

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 2.13).

Table 2.13 : Leaf Nitrogen content (%) due to the effect of spacing and levels of fertilizer 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 0.038%, where as S_2 and S_3 recorded 0.043 % P_2O_5 content. The P_2O_5 content increased with increased doses of P_2O_5 and maximum was recorded in M_3 (0.045 %) and minimum in M_1 0.038 %. S_2M_3, S_3M_3 recorded maximum P_2O_5 % (0.046 %) and minimum in S_1M_1 (0.034 %) (Table 2.14).

Table 2.14 : Leaf phosphorous content (%) due to the effect of spacing and levels of fertilizer at Bhubaneswar

	M_1	M_2	M_3	Average
S_1	0.034	0.038	0.043	0.038
S_2	0.043	0.039	0.046	0.043
S_3	0.039	0.043	0.046	0.043
Average	0.038	0.040	0.045	

The leaf K_2O % showed the 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 2.15).

Table 2.15 : Leaf Potassium content (%) due to the effect of spacing and levels of fertilizer 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

During the year, the plant height, stem girth and canopy spread 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_1 (5.60 kg/plant) and lowest in S_3 (3.48kg/plant). The highest nut yield per ha.was recorded by S_3 (17.42 q/ha) and lowest was recorded by S_1 (11.21 q/ha).

The plant height, stem girth and canopy spread recorded did not vary significantly among the different levels of fertilizers. The nut yield varied significantly and the highest yield per plant was recorded by M_2 (4.60 kg/plant) and highest nut yield q/ha was also by M_2 (15.59 q/ha) (Table 2.16).

Table 2.16 : 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)	Cum. yield (kg/tree) of 3 harvests	Yield (q/ha.)
			E-W	N-S			
S_{1}- 200 tr/ha	3.56	49.96	5.13	5.51	5.60	9.33	11.21
S_{2} – 400 tr/ha	3.48	46.61	4.60	5.05	3.83	7.30	15.33
S_{3} – 500 tr/ha	3.21	44.99	4.44	4.76	3.48	6.85	17.42
S .Em ±	0.13	2.03	0.28	0.40	0.09	-	0.24
C.D at 5%	-	-	-	-	0.32	-	0.82
M_{1} - 75 : 25 : 25	3.38	47.02	4.87	4.98	3.97	7.70	13.56
M_{2} - 150 : 50 : 50	3.49	48.97	4.77	5.33	4.60	7.66	15.59
M_{3} - 225 : 75 : 75	3.39	45.57	4.53	5.02	4.35	8.13	14.81
S. Em ±	0.10	1.68	0.13	0.23	0.04	-	0.12
C.D at 5%	-	-	-	-	0.13	-	0.37

Interaction effect of densities and fertilizers did not significantly influence the among growth parameters, whereas yield kg/plant varied significantly among interactions. The highest nut yield per plant was recorded by S_1 M_2 (6.07 kg) followed by S_1 M_3 (5.65 kg). The highest nut yield per hectare was recorded by S_3 M_2 (18.41 q/ha) followed by S_3 M_3 (17.63 q/ha) and lowest was in S_1 M_1 (10.20 q/ha) (Table 2.17).

Table 2.17 : 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)	Cum. yield (kg/tree) of 3 harvests	Yield (q/ ha.)
			E-W	N-S			
S_1 M_1	3.61	49.90	5.39	5.46	5.10	8.56	10.20
S_1 M_2	3.59	50.46	5.11	5.59	6.07	8.71	12.14
S_1 M_3	3.49	49.52	4.91	5.48	5.65	8.81	11.29
S_2 M_1	3.53	47.12	4.68	4.96	3.57	6.92	14.26

$S_2 M_2$	3.57	50.04	4.81	5.45	4.05	6.88	16.21
$S_2 M_3$	3.35	42.68	4.32	4.76	3.88	7.25	15.51
$S_3 M_1$	3.00	44.05	4.56	4.54	3.25	6.29	16.23
$S_3 M_2$	3.32	46.41	4.40	4.94	3.68	6.37	18.41
$S_3 M_3$	3.32	44.53	4.35	4.82	3.53	7.18	17.63
S.Em ±	0.17	2.91	0.23	0.40	0.08	-	0.21
C.D at 5%	NS	NS	NS	NS	0.23	-	-

JHARGRAM

The treatments were at par in terms of their response on tree height. It was noticed that under both the spacings of 10m x 5m and 6m x 4m there was an increase in trunk girth with an increase in fertilizer dose. Exceptionally, in case of 5m x 4m spacing the trunk girth was less with an increase in fertilizer dose. The treatments were at par in case of 10m x 5m and 6m x 4m spacing in terms of their response on canopy spread. In 5m x 4m spacing along with application of 150 Kg N, 50 Kg P_2O_5, 50 Kg K_2O /ha fertilizer dose had maximum positive effect. A decreasing trend was noticed in canopy height in case of 10 m x 5m spacing with an increasing dose of fertilizer. In the other two densities canopy height was maximum with 150 Kg N, 50 Kg P_2O_5, 50 Kg K_2O /ha. Maximum amount of biomass was removed from 5m x 4m (57.66 kg) followed by 10m x 5m (51.66 Kg). The amount of biomass removed was directly related with fertilizer dosage (Table 2.18).

Table 2.18 : Effect of tree density and fertilizer application on growth at Jhargram

Parameters	**Fertilizer Treatments**	**Spacing**			**S.Em. ±**	**C.D.at 5%**
		S_1	**S_2**	**S_3**		
Plant Height (m)	**M_1**	2.88	2.90	2.81	0.1196	0.241
	M_2	2.95	3.00	2.76		
	M_3	2.77	2.95	2.68		
Trunk Girth (Cm)	**M_1**	33.67	36.00	36.77	2.5785	5.189
	M_2	33.89	35.11	36.66		
	M_3	35.00	38.44	29.11		
Canopy Spread	**M_1**	3.01	3.37	2.92	0.2089	0.420

(m)	**M_2**	3.07	3.22	3.00		
	M_3	3.05	3.50	2.52		
Canopy Height (m)	**M_1**	2.67	2.53	2.43	0.1313	0.264
	M_2	2.56	2.70	2.29		
	M_3	2.32	2.59	2.31		
Canopy Area (m^2)	**M_1**	14.66	15.29	13.12	1.4671	2.953
	M_2	14.77	15.67	13.41		
	M_3	15.25	17.51	10.95		
Biomass Removed (Kg/tree)	**M_1**	45.33	31.00	45.00	1.2774	2.571
	M_2	47.63	35.53	47.66		
	M_3	51.66	42.66	37.66		

In all the three planting densities, canopy area was maximum with the highest dose of fertilizer (225 Kg N, 75 Kg P_2O_5, 75 Kg K_2O /ha). Duration of flowering was more with the high and low doses of fertilizers. Maximum nuts/m^2 (21.39) and nuts/panicle (5.94) were recorded with 10 m x 5 m spaced plants treated with a fertilizer dose of 150 Kg N, 50 Kg P_2O_5, 50 Kg K_2O /ha. Among all the fertilizer treatments nuts/m^2 and nuts /panicle were minimum in 5m x 4m spaced plants.

Nut weight was not significantly influenced by different doses of fertilizers. There was a decrease in apple weight with an increase in fertilizer dose in 200 plants/ha and 400 plants/ha. The yield /tree was maximum with low dose of fertilizer (75 Kg N, 25 Kg P_2O_5, 25 Kg K_2O /ha) in case of 10m x 5m and the yield showed indirectly relationship with doses of fertilizer, and direct relation in case of 5m x 4m spacing (Table 2.19).

Table 2.19 : Effect of tree density and fertilizer application on Flowering and yield attributes at Jhargram

Parameters	**Fertilizer Treatments**	**Spacing**			**S.Em. ±**	**C.D. at 5%**
		S_1	**S_2**	**S_3**		
Flowering /m^2	**M_1**	7.08	10.89	8.31	1.2401	2.495
	M_2	6.33	11.31	7.58		
	M_3	7.25	11.17	7.06		
Nuts/m^2	**M_1**	18.81	17.86	10.69	3.7032	7.453
	M_2	21.39	13.17	12.28		
	M_3	16.00	19.58	13.06		
Nut Weight (g)	**M_1**	5.40	5.60	4.40	0.3251	0.654
	M_2	4.90	5.70	5.20		

	M_3	5.20	5.00	4.60		
Apple Weight (g)	**M_1**	26.20	30.60	24.00	2.7216	5.477
	M_2	22.30	26.60	26.10		
	M_3	18.90	25.40	26.50		
Yield (Kg/Tree)	**M_1**	1.70	1.62	0.65	0.2896	0.583
	M_2	1.62	1.28	0.76		
	M_3	1.28	1.66	0.97		

The interaction effect was significant in terms of their response on percent ground coverage. In four years the planting density of 500 plants per hectare with low and moderate fertilizer application resulted in maximum ground coverage, while high dose of fertilizer application (225 kg N, 75 kg P_2O_5, 75 kg K_2O / ha) reduced the ground coverage to 31.10% (Table 2.20).

Table 2.20 : Effect of tree density and fertilizer application on ground coverage by canopy % at Jhargram

Treatments	**Ground coverage by canopy %**			**Mean**
	M 1	**M 2**	**M 3**	
S 1	14.34	14.57	16.58	15.16
S 2	32.27	31.56	38.76	34.20
S 3	33.68	42.47	31.10	35.75
Mean	26.76	29.53	28.81	
S Em $\pm$	2.976			
CD at 5%	6.485			

Maximum annual nut yield per hectare (6.68 q/ha) was obtained with a plant density of 400 pl/ha and fertilizer dosage of 225:75:75 NPK kg/ha. This was followed by a yield of 6.52 q/ha with the same plant density at a fertilizer dose of 75:25:25 NPK kg/ha (Table 2.21).

Table 2.21 : Effect of tree density and fertilizer application on annual nut yield at Jhargram

Treatments	**Annual Cashew Yield (Quintal/ha)**			**Mean**
	M 1	M 2	M 3	
S 1	3.46	3.23	2.56	3.088
S 2	**6.52**	5.13	**6.68**	6.114
S 3	2.45	3.80	3.45	3.239
Mean	4.14	4.05	4.23	
S Em $\pm$	1.1599			
C.D. at 5%	2.527			

Maximum cumulative nut yield per hectare (12.11 q/ha) was obtained with a plant density of 400 pl/ha and fertilizer dosage of 225:75:75 NPK kg/ha. This was followed by a cumulative nut yield of 11.62 q/ha with the same plant density at a fertilizer dose of 75:25:25 NPK kg/ha (Table 2.22).

Table 2.22 : Effect of tree density and fertilizer application on cumulative nut yield (Quintal/ha) at Jhargram

Treatments	Cumulative Cashew Yield (Quintal/ha) 2nd harvest			Mean
	M 1	M 2	M 3	
S 1	4.79	5.89	4.62	5.10
S 2	**11.62**	10.79	**12.11**	11.51
S 3	5.94	11.50	10.40	9.28
Mean	7.45	9.39	9.04	
S Em ±	1.1599			
C.D. at 5%	2.527			

PILICODE

Only nut yield showed significant variation among the densities of planting and levels of fertilizers tried. The interaction effects of fertilizer and planting densities did not exhibit significant variation. The nut yield per hectare was significantly superior (4.42q/ha) in the higher density of planting (ie., S3: 5 x 4 m, 600 plants / ha.). The yield per ha was significantly high (6.36q/ha) with lower dose of fertilizers (ie.,M1: 75 N, 25 P_2O_5, 25 K_2O) (Table 2.23 and 2.24).

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

Treatment	Plant height(m)	Canopy spread		No of flowering panicle /m^2	Yield (kg/plant)	Yield (Q/ha)
		E-W (m)	N-S (m)			
S1	3.20	3.75	4.04	9.15	0.695	4.17
S2	3.31	3.81	3.76	8.72	0.691	4.14
S3	3.38	4.02	3.89	8.10	0.737	4.42*
CD 0.5	NS	NS	NS	NS	0.03	0.03

Table 2.24 : Effect of Fertilizer on vegetative characters and yield of Cashew variety MDK-1 at Pilicode

Treatment	Plant Height(m)	Spread of the plant		No of flowering panicle /m^2	Yield(kg) per plant	Yield/ha (Q)
		E-W (m)	N-S (m)			
M1	3.51	3.78	3.92	9.05	1.060	6.36*
M2	2.97	4.52	3.86	8.28	0.576	3.45
M3	3.40	3.73	3.88	8.6	0.487	2.92
F test	NS	NS	NS	NS	NS	1.241

Among all the treatment interactions maximum yield per hectare (7.15q) was obtained with the plant density of 200 pl/ha and fertilizer dose of 75:25:25 NPK kg/ha. Maximum number of flowering panicles/m^2 (10.50) was also observed in this treatment (Table 2.25).

Table 2.25 : Interaction effect of spacing and doses of fertilizer application on growth and yield of cashew variety MDK -1 at Pilicode

Treatment	Plant height (m)	Canopy spread		No of flowering panicle /m^2	Yield (kg/ plant)	Yield/ha (Q)
		E-W (m)	N-S (m)			
S1M1	3.53	3.73	3.96	10.50	1.19	7.15
S1M2	2.62	3.83	4.00	8.26	0.31	1.90
S1M3	3.45	3.70	4.16	8.69	0.57	3.46
S2M1	3.40	3.71	3.9	8.00	1.04	6.26
S2M2	3.20	3.98	3.8	8.11	0.81	4.86
S2M3	3.33	3.75	3.56	10.07	0.21	1.30
S3M1	3.62	3.91	3.92	8.66	0.94	5.66
S3M2	3.09	4.94	3.79	8.44	0.60	3.60
S3M3	3.43	3.75	3.92	7.2	0.66	4.00
F test	NS	NS	NS	NS	NS	NS

VENGURLA

The mean number of flowering panicles were maximum in the treatment combination S_3M_2 (29.10 m^2). Flowering duration ranged between 94.2 to 98.8 days in different treatment combinations which was on par. S_1M_3 (10 X 5 m and 225:75:75 NPK kg/ha) recorded the highest yield (1.76 kg/ tree) followed by the treatment combination S_1M_2 (10x5m and 150:50:50 NPK kg/ha). The yield increased progressively with an increase in fertilizer dose (1.47 Kg/tree) (Table 2.26).

Table 2.26 : Effect of spacing and fertilizer on growth and yield of cashew at Vengurla

Treatments	Mean height (m)	Mean spread (m)	Mean canopy area (m^2)	Mean panicle/m^2	Mean nut wt. (g)	Mean apple wt.(g)	Mean nut yield (kg/ tree)	Mean yield t/ha.
S_1	5.10	6.10	56.00	25.20	9.80	81.50	1.51	0.30
S_2	4.90	4.70	37.90	20.80	9.50	80.50	0.89	0.36
S_3	5.80	5.10	50.00	22.80	9.60	81.00	1.15	0.57
SE m±	0.20	0.40	4.50	1.90	0.10	1.10	0.16	0.04
CD at 5%	0.70	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	0.17
M_1	5.20	5.20	46.20	20.10	9.60	79.20	1.18	0.42
M_2	5.30	5.40	49.70	25.90	9.60	81.80	1.16	0.40
M_3	5.30	5.30	47.90	22.70	9.70	82.20	1.22	0.41
SEm±	0.20	0.20	3.10	1.30	0.10	1.80	0.11	0.04
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.

The plant height, canopy height, and yield (t/ha) showed significant differences due to closer spacing (S3). Fertilizer treatments and the interaction effects were not significant however, the maximum height (5.90 m) was observed in S_3M_1 and S_3M_3 treatment combinations while canopy area was maximum in S_1M_2 (59.20m^2) and S_1M_3 (56.60 m^2) treatment combination. The cumulative yield for 5 years was maximum (5.68 kg/ tree) in S_1M_3 (10 X 5 m and 225:75:75kg NPK/ha) (Table 2.27).

Table 2.27 : Interaction effect of spacing and fertilizer on growth and yield of cashew at Vengurla

Treatment	Mean canopy area (m^2)	Mean No. of panicle/ m^2	Mean Nut wt. (g)	Mean Apple wt. (g)	Mean Yield kg/ tree	Mean Yield (t/ha)	Cum. yield for 5 harvest (Kg /tree)
S_1M_1	52.10	23.40	9.90	79.20	1.31	0.26	3.84
S_1M_2	59.20	26.80	9.90	66.10	1.47	0.29	4.55
S_1M_3	56.60	25.40	9.70	79.20	1.76	0.35	5.68
S_2M_1	35.00	19.20	9.10	76. 70	1.01	0.40	3.15
S_2M_2	40.10	21.80	9.70	79.80	0.87	0.35	3.33
S_2M_3	38.50	21.50	9.60	85.50	0.80	0.32	4.27
S_3M_1	51.60	17. 80	9.70	81.60	1.21	0.61	4.60
S_3M_2	49.90	29.10	9.40	79.60	1.12	0.56	4.05
S_3M_3	48.60	21.30	9.60	81.90	1.11	0.55	3.93
SEm±	5.30	2.20	0.20	3.10	0.19	0.07	
CD at 5%	N.S.	N.S.	N.S.	N.S.	N.S.	N.S.	

VRIDHACHALAM

The plant height, trunk girth, canopy spread, canopy area, canopy height and nut yield in main and sub plot treatments differed significantly. The highest values for plant height (7.05m),trunk girth (37.0cm),canopy spread (6.25m) were recorded in treatment M_1S_3 (10x5m with 225:75:75 kg NPK /ha).The nut yield per tree was also higher in wider spacing (6.5-6.8 kg /tree in 10x5m plots). However, high density planting has resulted in higher nut yield per unit area. The yield in 6x4 m with 400 plants per hectare has recorded an yield of 2600 kg/ha, while the spacing of 5 x 4 m accommodating 600 plants per hectare recorded an estimated yield of 3100 kg per hectare (Table 2.28 and 2.29).

Table 2.28 : Effect of fertilizer application and spacing on vegetative characters and yield of cashew at Vridhachalam

Treatments	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Canopy area (m^2)	Canopy height (m)
M_1S_1	6.40	30.50	5.50	26.50	4.25
M_1S_2	6.50	35.25	6.00	26.50	4.35
M_1S_3	7.05	37.00	6.25	26.00	4.25
M_2S_1	6.00	27.50	5.50	24.50	3.75
M_2S_2	6.55	29.25	5.70	24.50	4.00
M_2S_3	6.55	30.50	5.55	24.50	4.25
M_3S_1	6.00	30.00	4.70	22.30	3.40
M_3S_2	6.00	30.25	4.50	22.50	3.40
M_3S_3	6.50	30.25	4.75	22.50	3.40

	Plant height (m)	Trunk girth (cm)	Canopy spread (m)	Canopy area (m^2)	Canopy height (m)
	CD (0.05)	CD (0.05)	CD (0.05)	CD (0.05)	CD (0.05)
M	0.143*	0.174*	0.083*	0.296*	0.082*
S	0.149*	0.233*	0.062*	0.217*	0.063*
M at s	0.251	0.368	0.119	0.418	0.078
S at m	0.258	0.403	0.107	0.376	0.075

Table 2.29 : Effect of fertilizer application and spacing on vegetative characters and yield of cashew at Vridhachalam

Treatments	Duration of flowering (days)	Apple weight(g)	Nut weight (g)	Yield /tree (kg)	Yield /ha(kg)	BCR
M_1S_1	70	50.00	7.00	6.50	1300	3.75
M_1S_2	70	50.50	7.00	6.50	1300	1.90
M_1S_3	70	50.00	7.00	6.80	1360	1.50
M_2S_1	70	49.50	7.00	6.50	2600	7.50
M_2S_2	70	49.50	7.00	6.50	2600	4.30
M_2S_3	70	50.50	7.00	6.50	2600	3.70
M_3S_1	65	48.50	7.00	6.00	3000	7.50
M_3S_2	65	48.50	7.00	6.00	3000	4.50
M_3S_3	65	48.50	7.00	6.20	3100	3.35

	Apple weight	**Yield/tree**	**Actual yield/plot**
	CD (0.05)	CD (0.05)	CD (0.05)
M	0.362*	0.289*	3.26*
S	0.339*	0.136*	2.41*
M at s	0.591	NS	4.63
S at m	0.588	0.237	4.18

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 cumulative nut yield (4954 kg/ha) which were higher compared to normal planting (3213 kg/ha). In normal planting density the mean annual nut yield of 7th harvest obtained was 1062 kg/ha while it was 1360kg/ha under high density planting at Chintamani. The per hectare yield was significantly higher under high density planting (3147 kg) as compared to normal density (846 kg) at Madakkathara at the 8th harvest.

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 trial is in the initial experimentation and the crop is in the initial stage of vegetative growth. And all the plants in the each block were established. The data for growth parameters were recorded during the year 2006. (Table 2.30)

Table 2.30 : Growth parameters of high density planting at Bapatla

Parameter	Mean	
	8x8m plot	4x4m plot
Pl. Height (m)	1.51	1.31
Trunk girth(cm)	28.1	24.30
Canopy spread E-W (m)	2.31	2.17

Canopy spread N-S (m)	2.56	2.45
Yield (kg/tree)	--	--
C.Yield (Kg/tree)	--	--

BHUBANESWAR

The plants attained a maximum height of 6.4m and were pruned during June. The yield (tons/ha) recorded was 2.53 tons in 2006 and 2.97 tons in 2007.

During 2006, the yield in the farmers' field at Dhenkanal under high-density spacing with cashew variety Vengurla-4 recorded 2.62 tons / ha (6^{th} harvest). The yield was 2.83 tons / ha on 7^{th} harvest.

CHINTAMANI

This trial was laid out during 1997 with Chintamani –1 grafts at 4 x 4m. The mean growth and yield parameters per plant recorded lower values under high density planting (2.18 kg/tree during 7^{th} harvest) compared to normal planting (6.85 kg/tree during 7^{th} harvest). The mean cumulative nut yield (4954 kg/ha) which were higher compared to normal planting (3213 kg/ha). In normal planting density the mean annual nut yield of 7^{th} harvest obtained was 1062 kg/ha while it was 1360kg/ha under high density planting. (Table 2.31).

Table 2.31 : 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)	4.45	2.80	3.63	6.15	4.10	5.13
Stem girth (cm)	60.00	38.00	49.00	87.00	73.00	80.00
Canopy spread (m) E - W	4.60	3.10	3.85	9.20	7.70	8.45
N - S	4.75	3.10	3.93	9.00	7.10	8.05
Yield (kg/tree)	3.35	1.0	2.18	8.60	5.10	6.85
Yield (kg/ha)	2094	625	1360	1333	791	1062
Cumulative Yield (7 harvests)						
Kg/tree	12.35	3.50	7.93	24.60	16.85	20.73
Kg/ha	7719	2188	4954	3813	2612	3213

JHARGRAM

In two different locations, high density planting observational trial was laid out with the spacing of 5m x 5m with the varieties BPP- 8 and Madakkathara – 1. BPP- 8 showed higher plant height than Madakkathara – 1. Trunk girth was more in Madakkathara – 1. Under on-farm situation the nut weight for the varieties were 8.10 and 6.80 g respectively for BPP- 8 and Madakkathara – 1 (Table 2.32 and 2.33).

Table 2.32 : Growth parameters of cashew plants planted under high density planting observational trial at Jhargram

Variety	Treatment	Plant Height (m)	Trunk girth (cm)	Canopy area (Sq. m.)	Duration of Flowering	Nut weight (g)	Apple Weight (g)
BPP-8	5m x 5m	3.90	36.0	22.34	67	8.10	49.0
MDK-1	5m x5m	3.73	44.0	19.14	77	6.80	55.0

Table 2.33 : Yield data of cashew plants planted under high density planting observational trial at Jhargram

Variety	Treatment	No. of plants /block	No. of nuts/tree	Yield (1st harvest)	
				Kg/tree	Kg/ha
BPP-8	5m x 5m	40	153.17	1.04	651.25
MDK-1	5m x 5m	40	145.24	1.16	730.62

MADAKKATHARA

The yield per tree was higher under normal density (5.42 kg) as compared to high-density planting system (5.03 kg) during the eight harvest. The per hectare yield was significantly higher under high density planting (3147 kg) as compared to normal density (846 kg) due to an increase in tree numbers (Table 2.34).

Cumulative yield per tree of eight years was higher under normal density planting by 1.33 kg over high density planting. The cumulative yield for eight harvests was 3.8 times higher under high density system as compared to normal density planting.

Table 2.34: Effect of high density planting on growth and yield during eleventh year at Madakkathara

Parameters	Mean	
	High density planting	Normal planting
Tree height (m)	6.75	6.89
Trunk girth (cm)	83.80	87.3
Canopy spread - NS (m)	6.78	7.11
Canopy spread - EW (m)	6.93	7.41
Yield (kg/tree/annum)	5.03	5.42
Yield (kg/ha/annum)	3147	846
Cumulative yield (kg/ tree) in eight harvests	27.64	28.97
Cumulative yield (kg/ha in eight harvests)	17278	4520

VENGURLA

The mean plant height was 7.0 m and canopy area was 53.3 m^2. The mean flowering duration was observed to be 100 days. The mean yield per tree was 2.41 kg/plant whereas, the mean cumulative yield for 5 harvests was 4.46kg/tree (Table 2.35).

Table 2.35 Growth and yield observations of high density planting at Vengurla

Height (m)	Mean Canopy Area (m^2)	Mean Flowering duration (days)	Mean No. of Flowering Panicles/m^2	Nut Weight (gm)	Yield Kg/plant	Cumulative yield kg/ha. (For 5 harvest)
7.60	65.30	101.00	19.40	10.10	1.31	2.99
6.20	40.10	100.00	19.10	9.80	2.24	6.82
7.10	48.60	106.00	20.70	10.00	2.70	3.89
6.90	46.80	104.00	19.70	10.10	3.82	9.32
6.80	49.70	93.00	19.90	9.90	2.83	4.17
7.00	53.30	102.00	17.60	10.00	2.06	2.56
6.90	58.60	99.00	18.50	9.60	2.38	5.65
7.10	52. 70	99.00	18.40	10.20	2.38	3.06
7.20	58.20	98.00	18.50	10.30	2.43	2.87
6.90	59.60	97.00	16.10	10.00	1.96	3.27
7.00	53.30	99.90	18.80	10.00	2.41	4.40

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

The drip irrigation treatments were imposed during March 2006 on grafts of Chintamani – 1. Among different levels of irrigation, irrigating the crop at 80% CPE (I_5) recorded significantly highest plant height (4.98 m), stem girth (79.35 cm) at 40% CPE. The maximum canopy spread (E-W, 8.14 m. in 80% CPE and N-S, 8.10 m in 60 % CPE), nut yield of 10.16kg/tree with a nut weight of 7.40 g and shelling per cent of 30.8 was observed in 80% CPE (Table 2.36).

Table 2.36 : Effect of Drip irrigation levels on growth and yield of Cashew at Chintamani

Treatments	Height (m)	Stem girth (cm)	Canopy spread (m)		Nut yield (kg/ tree)	Cum. yield (kg/tree) of 2 harvests	Nut Wt. (g)	Shelling (%)
			E - W	N - S				
I_1 : No irrigation	4.71	68.26	6.81	6.49	6.52	11.42	6.80	28.10
I_2 : Irrigation at 20% CPE	4.77	71.94	7.14	7.26	7.78	13.94	7.10	28.70
I_3 : Irrigation at 40% CPE	4.78	79.35	7.46	7.57	8.45	15.06	7.20	30.10
I_4 : Irrigation at 60% CPE	4.85	74.20	7.90	8.10	9.62	17.76	7.30	30.50
I_5 : Irrigation at 80% CPE	4.98	76.18	8.14	7.92	10.16	18.79	7.40	30.80
S. Em ±	0.16	1.43	0.20	0.13	0.31		-	-
C.D. at 5%	-	4.42	0.63	0.41	0.96	-	-	-

VENGURLA

The mean plant height, mean spread, mean canopy area and mean yield were maximum in the irrigation treatment at 40 percent C.P.E. i.e. 5.6m, 6.6m, 63.2 m^2 and 6.17 Kg/tree, respectively. Similarly, cumulative yield for five harvests was also maximum in the irrigation treatment at 40 percent C.P.E. i.e. 18.38 Kg (Table 2.37).

Table 2.37 : Effect of drip irrigation on growth and yield of cashewnut at Vengurla

Treatment	Mean canopy area m^2	Mean nut weight (g)	Mean yield kg/ tree	Cum. yield for 5 harvests
T_1: No Irrigation	54.00	9.30	4.66	16.23
T_2 : Irrigation 20% CPE	58.30	9.00	4.75	15.97
T_3 : Irrigation 40% CPE	63.20	9.20	6.17	18.38
T_4 : Irrigation 60% CPE	57.60	9.20	4.48	17.31
T_5 : Irrigation 80% CPE	56.50	9.20	4.14	16.75
SEm±	4.00	0.20	0.63	-
CD at 5%	N.S.	N.S.	N.S.	-

VRIDHACHALAM

Irrigating at 80% of cumulative pan evaporation favoured the growth parameters having a maximum plant height (2.46m), maximum trunk girth (13.6cm) and maximum canopy spread (2.10m) which were on par with irrigating at 40% and 60% cumulative pan evaporation (Table 2.38).

Table 2.38 : Effect of drip irrigation on growth of cashew at Vridhachalam

Treatments	Plant height (cm)	Trunk girth (cm)	Canopy spread (m)
T1	1.96 a	11.8 a	0.96 a
T2	2.30 a	12.4 b	1.80 b
T3	2.43 b	13.4 b	1.98 b
T4	2.07 b	12.4 b	1.88 b
T5	2.46 b	13.6 b	2.10 b
SE d	0.069	0.118	0.304
CD (0.05%)	0.144*	0.244*	0.631*

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:

At Bapatla, groundnut recorded a maximum yield of 1400 kg/ha and had higher cost benefit ratio (1:1.96). The yield and total net returns per hectare from inter-crops as well as main crop after 4 years revealed that maximum return was received from colocasia (Rs 66,216/-) followed by bhindi (Rs. 58,155/-), brinjal (Rs. 58,035/-), cowpea (Rs 57,635/-), chilli (Rs. 56,815/-) and pumpkin (Rs 52,493/-) while in control it was Rs 40,075/- at Bhubaneswar. At Madakkathara, the highest net return per hectare (Rs. 35711) and C: B ratio (2.22) was recorded by tapioca followed by coleus (Rs. 31783/- and 1.93, respectively).

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

At Baptla, groundnut, green gram and black gram were grown as inter crops in rabi season. Groundnut recorded a maximum yield of 1400 kg/ha and had higher cost benefit ratio (1:1.96). Horsegram as an intercrop resulted in net profit of Rs.19900/- with a cost benefit ratio of 1:1.80 (Table 2.39).

Table 2.39 : Yield and net returns of main crop (cashew) in inter crop trial at Bapatla

Treatments	Mean Yield of main crop		Total cost of input (Rs/ha)	Total returns (Rs/ha)	Net profits (Rs/ha)	C:B ratio
	Per tree (kg)	Per ha (Q)				
T1 Cashew+Groundnut	5.30	8.40	18000	53440	35440	1.96
T2 Cashew+Sesamun	4.92	7.16	13500	30155	16655	1.23
T3 Cashew+Horsegram	4.25	6.80	11000	30900	19900	1.80
T4 Cashew (Sole crop)	3.40	5.44	7500	16320	8820	1.17

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

BHUBANESWAR

Minimum plant height, girth and spread of the plant were recorded in control i.e. without intercrop. Significantly highest plant height was recorded in T3 i.e. cowpea as intercrop (5.6 m), which is at par with T6 i.e. colocasia as intercrop (5.5 m). The girth of the plant varied from 34.0 cm in T7 (cashew alone) to maximum of 44.67 cm in T6 (cashew + colocasia). The spread of the plant varied from 4.5 m to 6.23 m in N-S direction and 4.1 m to 5.83 m in E-W direction. Minimum spread was observed in control i.e. without intercrop. Significantly highest yield of the main crop i.e. cashew at 3rd harvest was recorded in T3 (6.03 Q/ha) i.e. in cowpea as intercrop which is at par with T4 (5.85 Q/ha) i.e. in bhindi as intercrop. Minimum yield of main crop was recorded in T2 (4.60 Q/ha) followed by T5 (4.63 Q/ha) in intercrops of chilli and pumpkin respectively (Table 2.40).

The net area under various intercrops (treatments) was 20% during the year 2007. The yield and total net returns per hectare from inter-crops as well as main crop after 4 years revealed that maximum return was received from colocasia (Rs 66,216/-) followed by bhindi (Rs. 58,155/-), brinjal (Rs. 58,035/-), cowpea (Rs 57,635/-), chilli (Rs. 56,815/-), pumpkin (Rs 52,493/-) and control (Rs 40,075/-) (Table 2.41).

Table 2.40 : Vegetative characters of main crop cashew at Bhubaneswar

Treatment		Height (m)	Spread N-S (m)	Spread E-W (m)	Yield Q/ha (Main crop)
T_1	Cashew + brinjal	5.28	5.80	5.70	5.45
T_2	Cashew + chilli	4.97	5.87	5.50	4.60
T_3	Cashew + cowpea	**5.60**	**6.07**	**5.83**	**6.03**
T_4	Cashew + bhindi	5.20	5.70	5.50	**5.85**
T_5	Cashew + pumpkin	5.27	5.90	5.60	4.63
T_6	Cashew + colocasia	**5.50**	**6.23**	**5.83**	4.98
T_7	Cashew alone	4.60	4.50	4.10	5.35
	F 'test'	S	S	S	S
	SE (m) $\pm$	0.072	0.077	0.083	0.106
	CD 5%	0.223	0.238	0.260	0.326

Table 2.41 : Yield and returns from main crop and intercrops at Bhubaneswar

Treatment		Yield Q/ha (20% area)	Expenditure (Rs / ha)	Total return (Rs / ha)	Net return (Rs / ha)	Net return (Rs) (Main crop)	Net return (Rs) (Main crop + inter-crop)
T_1	Cashew + brinjal	36.50	6000	7300	1300	19075	20375
T_2	Cashew + chilli	10.60	1200	3710	2510	16100	18610
T_3	Cashew + cowpea	16.30	1900	3260	1360	21105	22465
T_4	Cashew + bhindi	15.10	2000	3020	1020	20475	21495
T_5	Cashew + pumpkin	27.30	1600	3278	1676	16205	17881
T_6	Cashew + colocasia	42.70	2100	5978	3878	17430	21308
T_7	Cashew alone	Nil	Nil	Nil	Nil	18725	18725

Sale rate Rs. / Qtl.

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

JHARGRAM

Yield of cashew as a sole crop was 7.00q/ha while the yield in case of intercropping with groundnut was 4.68 q/ha. It was observed that even at the 6th year after planting of cashew intercropping was beneficial over sole cropping of cashew in terms of net profit. Cost benefit ratio of cashew alone was 1:0.99 while that of cashew with groundnut as intercrop was 1:0.41 which reveals that at the 6th year of the crop; cashew cultivation alone was more beneficial (Table 2.42).

Table 2.42 : Economics of intercropping in cashew at Jhargram

Treatment	Cost of cultivation (Rs. / Ha)			Return (Rs. / Ha)			Net profit (Rs./ha)	Cost : Benefit
	Cashew	Intercrop	Total	Cashew	Intercrop	Total		
Cashew + Groundnut	9400	20000	29400	28017	13440	41457	12057.60	0.410
Cashew alone	9400	--	9400	18720	--	18720	9320	0.991

* Price of groundnut : Rs. 32 / Kg

** Percentage area covered by cashew plants : 37.55 %

MADAKKATHARA

Tapioca recorded the maximum yield (15.30 t/ha) followed by amorphophallus (13.80 t/ha). Total returns from all the tested crops were found to be more than Rs. 60,000/- except in the case of sweet potato. Amorphophallus incurred the highest cost of cultivation. The lowest cost of cultivation was incurred by tapioca. Accordingly, the highest net return (Rs. 35711) and C: B ratio (2.22) was recorded by tapioca followed by coleus (Rs. 31783/- and 1.93, respectively). The lowest net return (Rs. 24724) and C:B Ratio (1.61) was recorded by amorphophallus.

Among the intercrops evaluated, tapioca was found to be the most profitable tuber crop for intercropping (Table 2.43).

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

Name of intercrop	Tuber mean yield		Total return from intercrop		Net profit (Rs. /ha)	C: B ratio
	(Kg/ plot of 22.68 m^2)	t / ha *		Cost of cultivation (Rs./ ha)		
Coleus	36.60	10172	66118	34335	31783	1.93
Colocasia	39.80	11061	60836	34420	26416	1.77
Tapioca	55.00	15285	64961	29250	35711	2.22
Sweet potato	32.00	8893	57804	30400	27404	1.90
Amorphophallus	49.60	13784	65474	40750	24724	1.61

* Areas planted with inter crops/ha: 6303 m^2

Price of produce (Rs/ kg):

Coleus	- 6.50	Tapioca	- 4.25
Colocasia	- 5.50	Sweet potato	- 6.50
Amorphophallus	- 4.75		

VENGURLA

Tubers of Lesser Yam (Kangar) *Dioscorea esculanta*, Greater Yam (Ghorkand) *Dioscorea alata*, Aerial Yam (Karanda) *Dioscorea bulbifera*, Elephant foot Yam (Suran) *Amorphophyallus paniofolius*, and Tapioca (*Manihot esculanta*) have been procured. In order to obtain required quantity of seed tubers for replicated trial, tubers have been planted for multiplication and the trial will be initiated during June 2009.

VRIDHACHALAM

In this trial medicinal plants such as *Ocimum sanctum, Catharanthus roseus* and *Phyllanthus niruri* as intercrops, *Ocimum* yielded better with higher BCR of 3.8 when compared to other crops. *Phyllanthus* recorded a benefit cost ratio of 1.98. Maximum returns from intercrops was obtained from *Ocimum sanctum* (Rs.60,000).

Table 2.44 : Yield and return from main crops and intercrops in cashew during 2007-08 at Vridhachalam

Treatments	Yield from intercrops		Total cost of production for intercrops/ cashew (Rs./ha)	Total returns From inter crops (Rs./ha)	Net profit (Rs/ha)	BCR	Sole crop yield of inter crops (t/ha)
	Plot yield (kg/25 m^2)	Estimated yield (t/ha of cashew +intercrop)					
Ocimum sanctum (leaves and stem)	12.0	5.0	12500	60000	47500	3.8	10.0
Catharanthus roseus (leaves and stem)	8.5	3.20	12250	25200	13350	1.08	6.5
Phyllanthus niruri (leaves and stem)	12.5	2.8	7500	22400	14900	1.98	6.0
Cashew alone	Newly planted	-	5500	-	-	-	-

Agr.7: Organic Management of Cashew

Centres : East Coast :

Bapatla, Bhubaneshwar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani and Jagdalpur

The objective of this trial is to evaluate and standardize an organic management schedule for cashew cultivation to optimize the returns.

This trial has been intiated in Bapatla, Bhubaneswar, Chintamani, Jagdalpur, Jhargram, Madakkathara and Vridhachalam Centres of AICRP-Cashew and the results are awaited.

VENGURLA

The trial is planted during November, 2007. The physical and chemical properties of the soil were estimated and are mentioned below.

Properties	Content
pH (1:2.5)	4.40
EC	0.08 ds m^{-1}
MWHC %	42.0 %
Bulk density g/cc	1.19 g/cc
Particle density g/cc	2.47 g/cc
Organic carbon	1.48
Available K kg/ha	268.8 kg/ha
Available P kg/ha	20.84 kg/ha
Zn ppm	0.668 ppm
Cu ppm	2.98 ppm
Fe ppm	52.92 ppm
Mn ppm	75.15 ppm

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 Bapatla, triazophs 0.1% was significantly superior against thrips followed by profenofos 0.05% which recorded a damage score of 0.46 and 0.64, respectively. The nut yield revealed an increase of 12.6 to 30.4 % nut yield in all the treatments over the control plot with maximum increase in λ-cyhalothrin spray (30.4%) followed by recommended spray (26.8%) at Bhubaneswar. Profenophos could effectively check the damage by leaf caterpillar, leaf miner and thrips at Jagdalpur. Recommended spray schedule resulted in highest nut yield of 8.30kg/tree followed by profenophos which led to 7.95kg/tree in comparison to 4.2kg/tree realized in untreated control at Jhargram. λ-cyhalothrin was effective in managing tea mosquito bug, thrips and apple and nut borer at Vengurla and at Vridhachalam this spray minimized incidence of leaf miner, leaf folder, leaf and blossom webber and also apple and nut borer.

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 important foliage, flower and nut feeding pests of cashew was very low. All the insecticidal treatments were found on par with each other in keeping the leaf and blossom webber under check at 30 days after 3rd spray but superior over jatropa oil 0.5% and the untreated control which recorded the maximum damage of 3.37%. The botanical pesticide, jatropa oil 0.5% also differed significantly from the untreated control in controlling the leaf and blossom webber at 30 days after 3rd spray but inferior to the synthetic pesticides. The activity of shoot tip caterpillar and the apple and nut borer was not observed during the season under report. Triazophos 0.1% was significantly superior against thrips followed by profenofos 0.05% which recorded a damage score of 0.46 and 0.64, respectively as against the highest score of 1.31 in the untreated control. Significantly higher nos. of spiders (8.00) and ants (22.38) were observed in un-treated control at 30 days after 3rd spray in comparison to insecticide treated plots. The yield was on par in all the treatments including control as the pest load during the season was negligible (Table 3.1).

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

Treatment	Thrips damage grade at 30 days after 3rd spray (0-4 scale)	Leaf and blossom webber damaged shoots (%)		Yield (kg/tree)
		30 days after 2nd spray	30 days after 3rd spray	
Recommended spray schedule	0.70b	0.31a	0.42a	1.10
Chlorpyriphos 0.05%	0.72bc	0.21a	0.41a	1.11
Triazophos 0.1%	0.46a	0.90b	0.30a	1.11
L- Cyhalothrin 0.003%	0.84c	0.83b	0.11a	1.11
Profenophos 0.05%	0.64b	0.21a	0.21a	1.08
Jatropa oil 0.5%	1.17d	1.61c	2.22b	1.11
Un treated control	1.31e	2.42d	3.37c	1.07
CD (0.05)	0.13	0.49	0.37	NS

BHUBANESWAR

The shoot tip caterpillar incidence was 6.48 to 8.7 % before spray and there was no significant difference among treatments. After 1st spray the pest incidence was reduced with a range of 1.45 to 6.48 %. The chemical λ-cyhalothrin exhibited minimum pest incidence of 1.45%, which was on par with the recommended spray. Jatropa oil resulted in comparatively higher pest incidence (3.35%) in comparison to other insecticides, but was lower than control treatment. After second spray the pest incidence was minimum (0.50%) in λ-cyhalothrin treatment, which was at par with recommend spray. After 3rd spray the shoot tip caterpillar incidence was negligible.

The apple and nut borer incidence was also maximum of 5.29 % in control treatment. 30 days after 3rd spray the pest incidence was again lowest in λ-cyhalothrin (0.25 %) treatment, which was at par with, recommend spray.

A minimum damage score (0.12) was recorded in λ-cyhalothrin applied treatment, which was significantly lower than recommended spray. The nut yield revealed an increase of 12.6 to 30.4 % nut yield in all the treatments over the control plot with maximum increase in λ-cyhalothrin spray (30.4%) followed by recommended spray (26.8%). The economics indicated that profit was maximum (Rs.35.70 per tree over control) in λ-cyhalothrin treated plot while it was minimum (Rs.5.10 per tree over control) in jatropha oil treated trees (Table 3.2).

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

Treatment	% Damage by STC after 1st spray	% Damage by STC after 2nd spray	% Damage by apple & nut borer after 3rd spray	Damage grade by inflorescence thrips after 3rd spray	Mean nut yield per tree (in kg)	% Increase over control	Profit per tree over control (in Rs.)
T_1	1.68 (1.43)	0.73 (0.99)	0.25 (0.84)	0.18	6.25	26.80	27.40
T_2	2.15 (1.56)	1.93 (1.54)	1.45 (1.39)	0.24	5.94	20.50	18.60
T_3	2.40 (1.65)	1.23 (1.25)	1.23 (1.30)	0.22	6.02	22.10	16.50
T_4	1.45 (1.35)	0.50 (0.97)	0.25 (0.84)	0.12	6.43	30.40	35.70
T_5	2.40 (1.73)	1.45 (1.33)	1.68 (1.45)	0.21	6.16	24.90	26.40
T_6	6.48 (2.65)	5.30 (2.41)	5.29 (2.40)	0.60	4.93	-	-
T_7	3.35 (1.95)	3.13 (1.88)	2.40 (1.62)	0.28	5.55	12.60	5.10
CD (0.05)	0.24	0.59	0.29	0.05			

CHINTAMANI

The damage by TMB ranged between 0.40 to 2.60, 0.42 to 2.44 and 0.31 to 3.08 at 30 days after different sprays. Among the insecticides evaluated, λ-cyhalothrin (0.003%) was found effective in suppressing the TMB population and it was on par with the recommended spray schedule and with the treatment triazophos (0.10%). Chlorpyriphos (0.05) and profenofos (0.05) were found least effective in reducing the pest population (Table 3.3).

Table 3.3 : Effect of insecticides on the incidence of TMB at Chintamani

Treatments	30 Days after I spray (0-4)	30 Days after II spray (0-4)	30 Days after III spray (0-4)
Recommended spray schedule for the region	0.51	0.53	0.42
Chlorpyriphos 0.05 %	1.95	2.04	2.10
Triazophos 0.1 %	0.53	0.44	0.41
L Cyhalothrin 0.003 %	0.40	0.42	0.39
Profenofos 0.05 %	2.13	2.20	2.23
Unsprayed check	2.60	2.74	3.08
C.D (0.05)	0.85	0.65	1.01

The incidence of thrips, aphids, mealy bugs and nut borer were on par in treatments recommended for spray for the region, Triazophos (0.05) and Chlorpyriphos. The treatment λ-cyhalothrin (0.003%) was found to be superior over rest of the treatments in reducing pest complex at different reproductive stages of the tree (Table 3.4).

Table 3.4 : Evaluation of insecticides for the control of TMB and other insect pests at Chintamani

Treatments	Thrips (0-4)		Aphids (%)	Mealy bugs (%)	Leaf miner (%)	Apple and nut borer (%)
	Apple	Nut				
Recommended spray for the region	0.57 (0.75)	0.47 (0.68)	0.75 (0.86)	0.98 (0.98)	0.90 (0.94)	0.86 (0.92)
Chlorpyriphos (0.05) %	0.85 (0.92)	0.76 (0.87)	2.60 (1.61)	2.25 (1.50)	1.97 (1.40)	1.60 (1.26)
Triazophos (0.1) %	0.62 (0.76)	0.52 (0.72)	0.92 (0.95)	0.85 (0.92)	0.77 (0.87)	0.85 (0.92)
λ-cyhalothrin (0.003) %	0.53 (0.72)	0.45 (0.67)	0.85 (0.92)	0.80 (0.89)	0.62 (0.78)	0.67 (0.81)
Profenofos (0.05)%	1.12 (1.05)	0.95 (0.97)	3.22 (1.79)	2.62 (1.61)	1.92 (1.38)	2.16 (1.47)
Unsprayed check	1.36 (1.16)	1.18 (1.08)	5.15 (2.26)	3.80 (1.94)	3.6 (1.89)	3.40 (1.84)
C.D (0.05)	0.25	0.22	0.75	0.50	0.51	0.61

JAGDALPUR

The incidence of TMB damage was very low during whole experiment period. Regarding the leaf caterpillar damage Profenophos (T5) gave significantly good response in all three sprays (25.92%, 20.86% and 23.24% leaf damage in 1st, 2nd & 3rd spray, respectively) which were at par with λ-cyhalothrin (T4) and recommended spray schedule (T1). Chlorpyriphos (T2) showed good control against leaf folder with 19.93 and 7.43 per cent damage followed by Triazophos (T3) and Profenophos (T5) in 1st and 3rd spray, respectively; while in 2nd spray recommended spray schedule (T1) gave good response (10.78% leaf damage), which was at par with Chlorpyriphos (T2) and λ-cyhalothrin (T4) .

The mean thrips damage grade at 30 days after 3rd spray was found to be lowest in Profenophos (T5) on nut (0.64 mean damage score) followed by Triazophos (T3) and λ-cyhalothrin (T4). The percent leaf miner damage was significantly low in Chlorpyriphos (T2) of 1st spray (4.65% leaf damage) followed by λ-cyhalothrin (T4) & Profenophos (T5). In 2nd spray, T_1 (1.81% leaf damage) was found significantly good which was at par with Triazophos (T3), Profenophos (T5) and Chlorpyriphos (T2); while in 3rd sprays the all the treatments are non-significant.

The nut yield was highest in λ-cyhalothrin (T4) (229.40 kg/ha), which was at par with recommended spray schedule (T1) (172.22 kg/ha) (Table 3.5).

Table 3.5 : Damage due to minor pests under insecticides at Jagdalpur

Treatment	Percent incidence of minor pest of cashew		Yield Kg/Ha	Percent incidence of minor pest of cashew		Yield Kg/Ha
	% leaf caterpillar damage	% leaf folder damage		Thrips mean damage grade at 30 days after 3rd spray (0-4 scale)	% leaf miner damage	
	30 DAS after IIIrd spray	30 DAS after IIIrd spray		Nut Thrips	30 DAS after IIIrd spray	
T-1: Recommended spray schedule	25.07 (29.86) ab	16.66 (23.97)bc	172.22	1.66 (1.46)* bc	0.00 (0.00)	172.22 ab
T-2 : Chloropyriphos 0.05%	38.79 (38.50) c	7.43 (15.57) a	94.56	1.66 (1.47) bc	1.79 (3.88)	94.56 c
T-3 : Triazphos 0.1%	38.51	15.36	81.21	0.85	0.00	81.21 c

	(38.33) c	(22.88)ab		(1.09) ab	(0.00)	
T-4 : λ-cyhalothrin 0.003%	34.25 (35.79) abc	18.32 (24.77)b	229.40	1.47 (1.40) abc	1.25 (3.23)	229.40 a
T-5 : Profenophos 0.05%	23.24 (27.80) a	16.24 (22.43)abc	125.94	0.64 (1.02) a	0.00 (0.00)	125.94 bc
T-6 : Unsprayed check	39.06 (38.66)c	20.67 (27.04)c	89.89	2.10 (1.61) c	2.06 (4.17)	89.89 c
CD at 5%	**8.11**	**8.35**	**73.66**	**0.41**	**NS**	**73.66**

***Figures in parenthesis are square root 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 (T_1) was the most effective treatment. Profenophos (T_5) was also found to be more effective than other insecticides tested. After first spray 7.6% leaf miner, and 3.5% leaf and blossom webber and 7.4% shoot tip caterpillar damage was recorded in Profenophos spray. The lowest apple and nut borer damage (1.3%) was recorded in T_1 (recommended regional spray) while in T_5 (Profenophos) it was 1.4%. Least thrips damage score (0.12) was recorded in T_1 (recommended regional spray) and T_5 (0.14). T_1 (recommended regional spray) resulted in the highest yield of 8.30 kg/tree followed by 7.95kg/tree in T_5 (Profenophos). While in untreated check, the yield was 4.20 kg/tree (Table 3.6).

Table 3.6 : Evaluation of insecticides for control of TMB and other insect pests Jhargram

Treatment	% ANB damage	Thrips damage score	Mean % leaf miner damage		Mean % STC damage		Mean % LBW damage		Yield (Kg / tree)
			After II spray	After III spray	After II spray	After III spray	After II spray	After III spray	
T_1	1.3 (6.30)	0.12	**5.2a (13.18)**	**7.1a (15.45)**	**8.2a (16.64)**	**8.4a (16.85)**	**2.4a (8.59)**	**2.8a (9.63)**	**8.30a**
T_2	2.6 (9.11)	0.22	6.1b (14.30)	9.8b (18.24)	7.1a (15.45)	9.2a (17.66)	5.2b (13.18)	7.2b (15.56)	6.69b
T_3	2.4 (9.09)	0.25	6.5b (14.77)	10.2c (18.63)	8.6b (17.05)	10.9b (19.28)	5.7b (13.81)	7.6b (16.00)	6.37b
T_4	2.5 (9.10)	0.28	6.2b (14.42)	9.4b (17.85)	9.6c (18.05)	12.5c (20.70)	8.2c (16.64)	9.1c (17.56)	5.80c
T_5	1.4 (11.68)	0.13	4.9a (12.79)	7.6a (16.00)	7.4a (15.79)	9.5a (17.95)	2.8a (9.63)	3.5a (10.78)	7.95a
T_6	4.2 (11.83)	0.37	9.6c (18.05)	15.2d (22.45)	19.6d (26.28)	21.5d (27.63)	16.5d (23.97)	17.8d (24.95)	4.65d
T_7	4.8 (12.66)	0.37	18.2d (25.25)	20.4e (26.85)	21.6d (27.69)	22.8e (28.52)	23.2e (28.79)	25.6e (30.40)	4.20d

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

* Figures ending with same alphabet in a column do not differ significantly at 5% level of significance.

VENGURLA

All the insecticidal treatments significantly reduced the incidence of TMB over untreated control. Amongst the insecticidal treatments, the treatment T_4, λ-cyhalothrin was significantly superior over rest of the treatments after first and third spray resulting in cumulative TMB damage of 2.19%. Considering the average cumulative incidence the treatment with profenophos (T_5) (3.31%) was the second best treatment which was at par with λ-cyhalothrin (T_4) (2.19%) and were significantly superior over remaining treatments (Table 3.7).

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

Sr. No	Treatment details	Per cent incidence 30 days after			
		First spray	Second spray	Third spray	Cum. Mean damage
T_1	Recommended spray schedule	4.14 (11.85)	6.60 (14.90)	5.17 (13.11)	5.30 (13.28)
T_2	Chlorpyriphos 0.05%	3.48 (10.76)	5.17 (13.07)	3.91 (11.38)	4.19 (11.74)
T_3	Triazophos 0.01%	3.00 (10.02)	5.10 (13.02)	4.48 (12.19)	4.19 (11.74)
T_4	λ-cyhalothrin 0.003%	1.26 (6.34)	3.12 (10.22)	2.22 (8.55)	2.19 (8.37)
T_5	Profenophos 0.05%	2.10 (8.33)	4.39 (12.08)	3.43 (10.59)	3.31 (10.33)
T_6	Control	6.91 (15.18)	11.48 (18.04)	7.87 (16.26)	8.75 (13.16)
	S.E.±	0.512	0.855	0.640	0.802
	C.D. at 5%	1.54	2.57	1.930	2.529

* Figures in parenthesis are arcsine values

All the treatments significantly reduced the incidence of Inflorescence thrips, apple and nut borer and shoot tip caterpillar over control. In case of inflorescence thrips, λ-cyhalothrin 0.003% (T_4) (3.47%) was found to be significantly superior over rest of the treatments with respect to nut damage. The treatment Triazophos (T_3) (4.94%) was at par with Profenophos (T_5) (6.72%) when observation recorded on apple surface.

In case of apple and nut borer, the treatment L-cyhalothrin (T4) (1.32%) recorded lowest incidence and was at par with the Triazophos (T3) (4.94%), both of which were significantly superior over rest of the treatments. In case of shoot tip caterpillar, the treatment λ-cyhalothrin (T4) lead to a damage of (1.03%) and was observed significantly effective over all other treatments (Table 3.8).

Table 3.8 : Incidence of minor pests in various treatments 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	10.12 (18.49)	7.91 (16.29)	4.59 (12.39)	3.05 (9.48)
T_2	Chlorpyriphos 0.05%	7.32 (15.62)	6.84 (15.19)	4.557 (12.39)	2.62 (9.04)
T_3	Triazophos 0.01%	4.94 (12.89)	5.16 (13.35)	2.93 (9.82)	2.44 (8.99)
T_4	Lambda-cyhalothrin 0.003%	2.91 (9.77)	3.47 (10.82)	1.32 (6.47)	1.03 (5.78)
T_5	Profenophos 0.05%	6.72 (15.01)	8.07 (16.44)	4.27 (11.89)	3.14 (10.14)
T_6	Control	12.56 (20.69)	17.09 (24.41)	7.15 (15.39)	6.84 (15.06)
	S.E.±	**0.85**	**0.57**	**0.82**	**0.93**
	C.D. at 5%	**2.56**	**1.72**	**2.48**	**2.81**

* Figures in parenthesis are arcsine values

VRIDHACHALAM

All the insecticides evaluated were at par in terms of efficacy, but superior over untreated control after first, second and third spraying. After first spray, the TMB damage score was low in T1 (recommended spray schedule) (0.45) and T4 (λ-cyhalothrin 0.003%) (0.46), followed by T5 (Profenophos 0.05%), T3 (Triazophos 0.1%), and T2 (Chlorpyriphos 0.05%) ranging between 0.46 and 0.50 as against 1.60 in the control. After the second spray, the TMB damage score further reduced to 0.30 to 0.47 sequentially in the following treatments *viz.,* recommended spray schedule (T1), Profenophos (0.05%), T4 (λ-cyhalothrin 0.003%), T3 (Triazophos 0.1%) and T2 (Chlorpyriphos 0.05%) as against a higher damage score of 2.30 in untreated control (Table 3.9).

After third spray, the damage score was nil in T1 (standard spray), T4 (λ-cyhalothrin 0.003%) and T5 (Profenophos 0.05%), proving superiority over other treatments in

controlling the tea mosquito bug. In untreated control, the damage score increased to 3.60 after 30 days of third spray.

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

Treatment	Pre-treatment damage score (0-4)	Post treatment mean damage score (0-4)			Yield (Kg/ tree)
		30 days after I spray	30 days after II spray	30 days after III spray	
1. Recommended spray for the region	0.56_a	0.45_a	0.30_a	0.00_a	8.50
2. Chlorpyriphos 0.05%	0.54_a	0.50_a	0.47_a	0.40_a	7.20
3. Triazophos 0.1%	0.53_a	0.48_a	0.43_a	0.25_a	7.40
4. λ-cyhalothrin 0.003%	0.56_a	0.46_a	0.33_a	0.00_a	8.40
5. Profenophos 0.05%	0.55_a	0.46_a	0.31_a	0.00_a	8.60
6. Untreated check	0.54_a	1.60_b	2.30_b	3.60_b	2.40
CD 5%	0.65	0.60	0.52	0.36	

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

Among the various insecticides evaluated λ-cyhalothrin resulted in minimum percentage of leaf miner damaged leaves (1.00) minimum leaf damage by leaf folder (1.10), least percentage of damaged shoots by leaf and blossom webber (1.00) and nil apple and nut borer damage. This was followed by spraying with profenophos which resulted in highest mean annual nut yield of 8.60kg/tree followed by λ-cyhalothrin (8.40kg/tree) (Table 3.10).

Table 3.10 : Efficacy of insecticides against foliar pests of cashew at Vridhachalam

Treatment		Mean per cent damage 30 days after 3rd spray				Yield (kg/tree)
		Leaf miner damaged leaves (%)	Leaf folder damaged leaves (%)	Leaf and blossom damaged shoots (%)	Apple and nut borer damaged nuts (%)	
T_1	Recommended spray for the region	1.26	1.23	1.63	0.18	8.50
T_2	Chlorpyriphos 0.05%	2.26	2.76	4.58	0.53	7.20
T_3	Triazophos 0.1%	1.86	2.33	3.56	0.42	7.40
T_4	λ-cyhalothrin 0.003%	1.00	1.10	1.30	0.00	8.40
T_5	Profenophos 0.05%	1.23	1.26	1.45	0.16	8.60
T_6	Untreated check	13.66	13.33	15.63	6.76	2.40

The population trend of different natural enemies in response to different insecticidal sprays indicated that all the insecticides tend to decimate the population of predatory spiders, coccinellids, ants and parasitic wasps.

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:

Carbaryl treatment resulted in more trees without reinfestation at Bapatla (91.67%) and Jhargram (100%) while chlorpyriphos was the best treatment resulting in cent per cent of the treated trees without reinfestation at Vengurla and Jhargram and 86.0% at Bhubaneswar, 78.38% at Chintamani and 72.73% at Jagdalpur. MOnocrotophos was found to be the most effective treatment leading to 68.42% of the treated trees without reinfestation which was on par with chlorpyriphos (64.70%).

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

Carbaryl 1.0%, monocrotophos 0.2% and lindane 0.2% offered better protection to the tune of 91.67% trees without re-infestation or persistent attack followed by chlorpyriphos 0.2% with 83.33% trees without re-infestation or persistent attack. The control treatment also recorded 75.00% trees without re-infestation or persistent attack (Table 3.11).

Table 3.11 : Efficacy of certain insecticides as curative control measure against cashew stem and root borer at Bapatla

TREATMENT	% TREES WITHOUT REINFESTATION/ PERSISTANT ATTACK
Carbaryl 1.0%	91.67
Chlorpyriphos 0.2%	83.33
Monocrotophos 0.2%	91.67
Lindane 0.2%	91.67
Un treated check	75.00

Preferential zone of attack is collar + root in 60.00 per cent of trees (36/60) followed by collar + stem in 25.00 per cent of trees (15/60) either at initial attack or re-infestation or persistent attack. Irrespective of the insecticides tried, 13.33 per cent of the trees were yellowed even after treatment (Table 3.12).

Table 3.12 : Physical parameters of cashew trees reinfested/ un-reinfested by cashew stem and root borer after treatment with insecticides as curative measures at Bapatla

PARAMETERS		No.of trees reinfested	% of total trees treated	No.of trees not reinfested	% of total trees treated
Stem girth (cm.)	< 60	0	0	1	1.66
	60-80	0	0	2	3.33
	80-100	0	0	3	5.00
	> 100	8	13.33	46	76.66
	Total	**8**	**13.33**	**52**	**86.66**
Age (Years)	< 5	0	0	0	0
	5-10	0	0	0	0
	10-15	4	6.66	19	31.66
	> 15	4	6.66	33	55.00
	Total	**8**	**13.33**	**52**	**86.66**
Zone of attack	C+R	6	10.00	30	50.00
	C+S	1	1.66	14	23.33
	R	0	0.00	0	0.00
	S	0	0.00	0	0.00
	C+R+S	1	1.66	8	13.33
	Total	**8**	**13.33**	**52**	**86.66**
yellowing of canopy	a)Yellowed	8	13.33	0	0.00
	b) Not yellowed	0	0.00	52	86.66
	Total	**8**	**13.33**	**52**	**86.66**
% Bark circumference damaged	< 25	3	5.00	39	65.00
	25-50	5	8.33	13	**21.66**
	50-75	**0**	0.00	**0**	**0.00**
	> 75	**0**	0.00	**0**	**0.00**
	Total	**8**	**13.33**	**52**	**86.66**

BHUBANESWAR

The CSRB infested trees recovered with a range of 42 to 86 % in different treatments including control. Maximum recovery (86 %) was obtained in chlorpyriphos 0.2 % treated plants followed by monocrotophos 0.2 %. All the early-infested trees recovered to the tune of 60-95% while middle stage infested trees recovered from 5 to 40 % (Tablel 3.13).

Table 3.13 : Percentage recovery of C S R B affected trees under curative trial at Bhubaneswar

Treatments	Average % of recovery of the trees from C S R B	Frequency of treatments
T_1- Carbaryl (1%)	65.50	5
T_2 - Chlorpyriphos (0.2%)	86.00	3
T_3 -Monocrotophos (0.2%)	76.50	4
T_4 -Chlorpyriphos (0.1%)	82.50	4
T_5 -Untreated check (Only removal of CSRB grubs)	42.00	7
T_6 -Neem oil (5.0%)	55.00	7

The stem girth in between 60–80cm has more reinfestation compared to < 60cm stem girth. As the age of the tree increased beyond 10 years the infestation was more. As the bark damage increased beyond 25% re-infestation levels also increased. The stem and collar affected plants recovered quickly (Table 3.14).

Table 3.14 : Physical parameter of cashew stem and root borer in curative trial at Bhubaneswar

Physical parameters		No. of trees in each category	
		Without re-infestation	With re-infestation
Stem girth (cm)	< 60	145	5
	60-80	22	70
	80-100	10	3
	>100	0	0
	Total	177	78
Age (years)	5-10	117	1
	10-15	45	35
	>15	15	42
	Total	177	78
% Bark circumference damage	<25	138	5
	25-50	36	61
	50-75	3	12
	Total	177	78
Zone of attack	C+R	3	15

	C+S	135	3
	R	2	5
	S	34	3
	C+R+S	3	52
	Total	177	78
Canopy yellowing	Yellow	-	28
	Not yellow	-	227

CHINTAMANI

Chlorpyriphos (1.0%) was the most effective with 78.38% trees without reinfestation, However, the other treatments also suppressed the pest infestation in comparison to control. The treated check, wherein only grubs extraction was adopted, 71.2% treated trees could recover. Canopy yellowing was not observed in any of the treated trees, the zone of attack was noticed in collar + root + stem. The bark circumference damaged was less than 25 per cent in most of the infested trees (Table 3.15 and 3.16).

Table 3.15 : Efficacy of certain insecticides as curative treatment against cashew stem and root borer at Chintamani

Treatments	Trees without reinfestation/ persistant attack (%)
Carbaryl 1.0%	58.87
Chlorpyriphos 0.2%	78.38
Monocrotophos 0.2%	45.27
Lindane 0.2%	51.32
Treated check	71.20
Untreated check	20.17

Table 3.16 : Physical parameters of treated cashew trees reinfested/without reinfestation under curative control trial at Chintamani

Physical Parameters		No. of trees in each category	
		Without reinfestation	With reinfestation/ persistent infestation
Stem girth (Cm)	<60	25	4
	60-80	17	15
	80-100	08	5
	>100	-	-
Age of the tree (Cm)	5-10	35	-
	10-15	10	27
	>15	05	12
% Bark circumference damaged	<25	35	5
	25-30	15	38
	50-75	-	7
Zone	C+R	10	5
	C+S	15	20
	R	-	-
	S	25	22
	(C+R+S)	-	3
Canopy yellowing	Yellowed	-	8
	Not yellowed	-	42

JAGDALPUR

Chlorpyriphos-0.2% (T_2) led to maximum recovery with 72.73 per cent trees having no re-infestation followed by monocrotophos 0.2% (T3) which had 63.64 per cent of treated trees without fresh infestation. When removal of CSRB grubs alone was attempted 30% of treated trees did not have reinfestation (Table 3.17).

Table 3.17 : 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%)	11	6	54.55
T2 : Chlorpyriphos (0.2%)	11	8	72.73
T3 : Monocrotophos (0.2%)	11	7	63.64
T4 : Chlorpyriphos (0.1%)	10	5	50.00
T5 : *Metarhizium anisopliae*	10	4	40.00

(250g/tree) + Neem cake (500g/tree)			
T6 : Untreated check (only removal of CSRB grubs followed)	10	3	30.00

The cashew trees having more than 100 cm of stem girth were more prone to attack of CSRB with 56.57 per cent trees were re-infested by CSRB. The old cashew trees aged more than 15 years 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 wherein 46.67 per cent trees re-infested by CSRB in this zone. The canopy of majority of cashew trees infested by CSRB did not show yellowing. This pest reinfestation was maximum in trees, which had bark circumference damage below 25 percent (Table 3.18).

Table 3.18 : Physical parameters of trees observed under curative control against CSRB at Jagadalpur

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	2	6.67	7	21.21
	60-100 cm	11	36.67	16	48.48
	>100 cm	17	56.67	10	30.30
Total	**63**	**30**	**47.62**	**33**	**52.38**
Age of tree	<10 years	0	0.00	0	0.00
	10-15 years	0	0.00	0	0.00
	>15 years	30	100.00	33	100.00
Total	**63**	**30**	**47.62**	**33**	**52.38**
Zone of attack	C+R	4	13.33	3	9.09
	C+S	14	46.67	14	42.42
	C+R+S	2	6.67	2	6.06
	S	8	26.67	12	36.36
	R	2	6.67	2	6.06
Total	**63**	**30**	**47.62**	**33**	**52.38**
Canopy yellowing	a)Canopy Yellowed	7	23.33	2	6.06

	b)Canopy Not yellowed	23	76.67	31	93.94
Total	**63**	**30**	**47.62**	**33**	**52.38**
% of bark circumference damaged	<25	15	50.00	19	57.58
	25-50	11	36.67	11	33.33
	50-75	3	10.00	2	6.06
	>75	1	3.33	1	3.03
Total	**63**	**30**	**47.62**	**33**	**52.38**

*Zone of attack:

a) C+R :- Collar + Root,
b) C+S : - Collar + Stem
b) C+R+S :- Collar+Root+Stem
d) S : - Only Stem
e) R : - Only Root

JHARGRAM

Treatment of CSRB infested trees with T_1 (Carbaryl) and T_2 (Chlorpyriphos) were equally effective treatments and had no reinfestation. In treated check (T_6), swabbing neem oil 5% thrice 50% of the trees showed reinfestation. Monocrotophos (0.2%) and Lindane (0.2%) could not save more than 50% trees from re-infestation (Table 3.19).

Table 3.19 : 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%)	12	12	100
T2 : Chlorpyriphos (0.2%)	10	10	100
T3 : Monocrotophos (0.2%)	10	5	50
T4 : Chlorpyriphos (0.1%)	10	5	50
T5 : *Metarhizium anisopliae* (250g/tree) + Neem cake (500g/tree)	10	5	50
T6 : Untreated check (only removal of CSRB grubs followed)	10	5	50

VENGURLA

The treatment T_2 (Chlorpyriphos 0.2%) recorded cent per cent trees without reinfestation followed by Lindane (0.2%) T_4 and carbaryl (1%) T_1 recorded 80.00 per cent trees without reinfestation. Reinfestation was more in control (T_5) (60.00 %) followed by monocrotophos T_3 and swabbing Neem oil 5% during Oct.- Nov., Jan - Feb and April- May T_6 (66.67%) (Table 3.20).

Table 3.20 : Effect of curative treatments against Cashew Stem and Root Borer (CSRB) at Vengurle

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%)	66.67
T_4-Lindane (0.2%)	80.00
T_5 – Control (only removal of grubs)	60.00
T_6-Effective treatment in prophylactic trail (Swabbing Neem oil 5% during Oct.- Nov., Jan - Feb and April- May)	66.67

Among the physical parameters of treated trees the percentage of bark circumference damaged strongly influenced recovery, 46.67 per cent of the recovered trees had 25 – 50% of bark circumference damaged. Among the zone of attack, maximum recovery (35.56%) was observed with collar + root damage followed by 24.44 per cent recovery when only the roots were infested (Table 3.21).

Table 3.21 : Physical parameters of trees observed under curative control against CSRB at Vengurle

Physical Parameters of trees observed			
Physical parameter		**Percentage of total trees infested**	**Percentage of total trees without reinfestation**
Stem girth (cm)	<60	-	**-**
	60-80	-	**-**
	80-100	6.67	27.78
	>100	16.67	48.89
	Total	**23.33**	**76.67**
Age (in yrs)	<5	-	
	5-10	-	
	10-15	-	
	>15	23.33	76.67
	Total	**23.33**	**76.67**
Zone of attack	C+R	10.00	35.56
	C+S	5.56	3.33
	R	5.56	24.44
	S	-	4.44
	C+R+S	2.22	8.89
	Total	**23.33**	**76.67**
Canopy yellowing	a) Yellowed		
	b) Not Yellowed	23.33	76.67
	Total	**23.33**	**76.67**
bark circumference damaged	<25	13.33	26.67
	25-50	7.78	46.67
	50-75	2.22	2.22
	>75	1.11	1.11
	Total	**23.33**	**76.67**

VRIDHACHALAM

Among the curative treatments, maximum recovery of 68.42% was recorded in monocrotophos (0.2%) treated trees, followed by chlorpyriphos (0.2%) treated trees with 64.70% recovery without reinfestation. Treatments with carbaryl and lindane led to 66.6% and 55.0% recovery, respectively. The overall results indicated that monocrotophos and chlorpyriphos were at par in terms of efficacy in managing CSRB re-infestation (Table3.22).

Table 3.22 : Efficacy of certain insecticides as curative control against CSRB at Vridhachalam

Treatment		% of trees without re-infestation
T_1	Carbaryl (1%)	57.89
T_2	Chlorpyriphos (0.2%)	64.70
T_3	Monocrotophos (0.2%)	68.42
T_4	Lindane (0.2%)	55.00
T_5	Untreated check (removal of grubs only)	16.60
T_6	Treated check (effective treatment in prophylactic trial) – swabbing neem oil 5% thrice	84.00

The recovery levels of treated trees were dependent on bark circumference damaged wherein 78.27% of treated trees which had less than 25% bark circumference damage had no reinfestation by the pest. Maximum recovery (56.52%) was observed when infestation was restricted to stem alone followed by 36.96% damage when infestation occurred in collar + stem region. Maximum recovery of 39.14% was observed when the trees were less than 5 years of age (Table 3.23).

Table 3.23 : Details of physical parameters of treated cashew trees with re-infested/ without re-infestation at Vridhachalam

Physical Parameters		No. of trees without re-infestation	Percentage of trees without re-infestation
Stem girth (cm)	< 60	20	43.47
	60-80	12	26.08
	60-100	8	17.40
	> 100	6	13.04
Total		**46**	
Age of trees (years)	< 5	18	39.14
	5- 10	12	26.09
	10-15	9	19.56
	> 15	7	15.22
Total		**46**	
Per cent bark circumference	<25	36	78.27
	26-50	8	17.40

damaged	51-75	2	4.35
	>75	0	0
Total		**46**	
Zone of attack	C+ R	3	6.52
	C+ S	17	36.96
	R	0	0
	S	26	56.52
	C+S+R	0	0
Total		**46**	
Canopy yellowing			
	Yellowed	0	0
	No yellowing	46	100
Total		**46**	

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:

The tea mosquito population was positively influenced by maximum temperature at Vridhachalam and negatively influenced by minimum temperature and relative humidity at Vengurla and Jagdalpur respectively. Negative influence of minimum temperature on leaf and blossom webber was noticed at Jhargram and maximum temperature had positive effect at Bapatla. Leaf miner was negatively inluenced by maximum temperature at Bhubaneswar, Jagdalpur, Jhargram, Vengurla and Vridhachalam while leaf thrips and inflorescence thrips were negatively influenced by maximum temperature and rainfall.

BAPATLA

The incidence of leaf and blossom webber varied from 0.00 to 9.49 per cent and the highest incidence was recorded during July (9.49 per cent). The activity of pest was not noticed in majority of the meteorological weeks, but was relatively high during summer months. The maximum temperature (r = 0.400) and minimum temperature (r = 0.476) were found to exercise a significant positive influence on the activity of the pest, whereas the relative humidity (m) (r = -0.481) and (e) (r = -0.339) showed significant negative influence (Table 3.24).

Leaf miner appeared from September and continued upto May. The per cent damaged leaves were maximum during third week of March which touched 40.67 per cent. However, the activity was less than 2.00 per cent during the major part of the season except during March to April. None of the abiotic factors influenced the activity of the pest (Table 3.24).

Leaf folder incidence started from last week of August, which remained at low ebb, but was 7.25 per cent during the last week of October and again flared up during the months of February and March (11.00 per cent). None of the weather factors were observed to influence the activity of the pest during this season (Table 3.24).

The activity of shoot tip caterpillar was very low ranging from 0.00 to 1.25 per cent during the season. None of the weather parameters showed any influence on the activity of the pest. The activity of apple and nut borer was observed only during the first week of April with a very low damage of 0.16 per cent without any influence of any of the abiotic factors on the activity of the pest (Table 3.24).

Inflorescence thrips were active only during the months of March and April with a highest incidence of 28.21 per 10 inflorescences. None of the weather parameters showed any influence on the activity of the inflorescence thrips (Table 3.24).

During the surveys conducted the incidence of cashew stem and root borer was observed to be high (10-15%) in different coastal districts of Andhra Pradesh warranting immediate management measures against the pest (Table 3.24).

Table 3.24 : Influence of abiotic factors on the activity of pest complex of cashew at Bapatla

Weather Parameters	***Pests***						
	Lbw	**Anb**	**Lm**	**Stc**	**Lt**	**It**	**Lf**
Maximum temperature ºC	**0.4008***	--	-0.0902	-0.1780	**--**	-0.0535	-0.2229
Minimum temperature ºC	**0.4763***	--	-0.0848	-0.1716	**--**	-0.0434	-0.2149
Relative humidity(m) (%)	**-0.4814***	--	0.1064	0.1328	**--**	0.0886	0.1748
Relative humidity (e) (%)	**-0.3397***	--	0.1948	0.1115	**--**	0.2189	0.1340
Rainfall	0.1844	--	-0.0807	-0.1011	--	-0.1071	0.0031
Rainy days	0.0143	--	-0.1704	-0.2153	--	-0.2193	-0.0825

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

BHUBANESWAR

Shoot tip caterpillar (*Hypotima haligramma*) was active from July to February, but maximum activity was restricted to September - October with peak incidence of 9.5 % in October. There was no positive significant of weather factor on the incidence of pest (Table 3.25).

Inflorescence thrips (Thysanoptera : Thripidae)

Black thrips *Haplothrips ceylonicus* were more during February to April. Yellow thrips, *Frankliniella schultzii* and black thrips population was maximum in March; 17.8 and 15.5 nos. per panicle respectively. Relative humidity and rainfall had negative correlation to the incidence of thrips (Table 3.25).

Apple and nut borer (*Nephopteryx sp.*) was active during fruiting stage of the crop i.e. from March to May and infestation ranged from 0.5 to 2.1 %. Temperature and bright sunshine hour (BSH) had positive significant correlation with the pest (Table 3.25).

The incidence of Leaf miner (*Acrocercops syngramma*) coincided with the flushing stage with maximum infestation of 15.7 and 12.5 % during October and November. The activity of leaf and blossom webber (*Lamda moncusalis*) was restricted to March to May with maximum infestation (2.3 %). Temperature had positive significant correlation with the pest. The peak period of activity of leaf beetle (*Menolepta longitarsus*) was during June to November maximum during September (7.5 %) (Table 3.25).

Cashew stem and root borer (*Plocaederus ferrugineus*) was active throughout the year, but activity was comparatively low during December - January. Maximum activity was 7.5 % during pre-monsoon time (May). Temperature had positive significant correlation with the incidence of pest (Table 3.25).

Table 3.25 : Correlation of weather parameters with the pests of regional importance at Bhubaneswar

Name of the result	Temperature ^{0}C		Relative Humidity %		Rainfall (mm)	BSH (hrs)
	Max.	Min.	AM	PM		
	X_1	X_2	X_3	X_4	X_5	X_6
STC (y1)	-0.346	-0.027	0.258	0.191	0.244	-0.145
YT (y2)	0.207	-0.219	-0.517	-0.322	-0.431	0.278
BT (Y3)	0.378	-0.060	-0.600	-0.278	-0.428	0.318
LM (Y4)	-0.257	-0.144	0.062	-0.277	-0.117	0.235
A & NB (Y5)	0.612	0.192	-0.465	-0.163	-0.421	0.437
L& BW (Y6)	0.758	0.432	-0.249	0.005	-0.152	0.412
LB (Y7)	-0.282	0.386	0.501	0.641	0.708	-0.641
CSRB (Y8)	0.779	0.500	-0.330	0.069	-0.051	0.297

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

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

Natural enemies:

Maximum parasitisation of shoot tip caterpillar (5.5 %) by *Elasmus* sp., leaf and blossom webber (4.5 %) by *Bracon brevicornis* and leaf miner (7.5 %) by *Sympiesin* sp. The peak period of parasitazation was coincided with the peak incidence of the pest.

The most dominant predators like spider (*Argeopes* sp., *Oxyopes* sp.) lady bird beetle (*Vigna cincta, Menochilus sexmaculatua*) and pollinator black ant (*Camponotus* sp.) were generally observed in cashew ecosystem.

CHINTAMANI

The TMB population was observed from I week of November and reached peak during IV week of January (15.20%) and the population was started declining from I week of March. Leaf miner (*Acrocercops syngramma*) leaf and blossom

webber (*Lamida moncusalis)* and shoot tip caterpillar (*Cheleria haligramma)* as well as fruit and nut borer (*Thylecoptila panerosema*) were the other important pests which occurred during the cropping season in varying intensities. Incidence of bark eating caterpillar (*Indarbella tetraonis*) was also noticed on several primary branches irrespective of the seasons.

During the survey 3 sp. of predators of TMB and 2 sps. of beetles predating on aphids and a predominant egg parasitoid *Apanteles sp.* parasitizing TMB eggs were observed (Table 3.27).

Table 3.27 : Natural enemies of different insect pests of cashew in Maidan parts of Karnataka observed at Chintamani

Natural enemy	Insect host	Months of occurrence
Predators: 1. Spiders – *Oxypes sweta* *Pecicetia sp.* *Plexippus paykulli*	Tea mosquito	Oct - Mar.
2. Reduviid bug - *Endochus inornatus*	Tea mosquito	Oct.-April
3. Preying mantis - *Oxypilus sp.*	Tea mosquito	Oct.-April
4. Coccinellid beetles *Menochilus sexmaculatus* *Scymnus sp*.	Aphids	Feb.-May
5. Syrphids - *Paragens yerburiensis*	Aphids	Feb.-May
6. Braconid parasite *Bracon brevicornis* *Apanteles sp.*	Leaf and blossom Webber	Oct.-Dec.

JAGDALPUR

The TMB damage on shoot ranged from a minimum (0.05 %) in 3rd week of July to maximum (3.66 %) in 4th week of May. In panicle TMB damaged vary from 0.15 per cent in last week of May to 16.46 per cent in last week of April. The abiotic factors did not significantly influence the activity of TMB (Table 3.28).

Cashew stem and root borer activity was found maximum in 2nd week of May with 19.20 per cent infested trees. Among abiotic factors, maximum temperature had

significant positive influence (r = 0.565) on percent trees infested by CSRB (Table 3.28).

The leaf caterpillar damage was relatively higher during 2nd week of November with infestation of 48.57 per cent leaf damage and minimum (8.31% leaf damage) was found in last week of June. The abiotic factors did not influence the activity of leaf caterpillar. The activity of leaf folder was observed round the year. Its incidence ranged from 0.67 percent in 1st week of May to 31.07 per cent leaf folded during 2nd week of January. Weather parameters did not influence the activities of leaf folder (Table 3.28).

The incidence of leaf miner damage was observed through out the year, the leaf damage ranged from 0.23 to 42.37 percent with relatively high incidence in 2nd week of November. The environmental factors did not have significant effect on the activity of leaf miner. The leaf & blossom Webber damage ranged from 0.15 in 3rd week of March to 8.69 in 2nd week of October. The influence of weather parameters on pest activity was non significant (Table 3.28).

The thrips damage in leaf occurred throughout the year but was maximum (61.21%) in 2nd week of February and minimum (6.53%) in 4th week of July. Thrips damaged the panicles throughout the flowering season. Maximum thrips infested panicles (3.35%) was found in 4th week of April and minimum (0.19 %) in 4th week of February. Weather parameters did not significantly influence the thrips damage both on leaves and panicle (Table 3.28).

Table 3.28 : Correlation of weather parameters with the pests of regional importance at Jagdalpur

Weather Parameters	Correlation coefficient values (r) of pests of regional importance					
	Max. Temp.	Min. Temp.	Rainfall	RH I	RH II	Rainy Days
CSRB	0.565*	0.472	-0.270	-0.145	-0.020	0.097
Shoot TMB	0.201	0.154	-0.270	-0.139	-0.102	0.080
PanicleTMB	0.485	0.262	-0.270	-0.093	-0.167	-0.145
Panicle thrips	0.523	0.209	-0.270	-0.112	-0.184	-0.064
Leaf thrips	-0.393	-0.462	-0.270	0.211	0.005	-0.171
Leaf Caterpillar	-0.441	-0.168	-0.270	-0.092	-0.026	0.081
Leaf Folder	-0.489	-0.551*	-0.270	0.199	0.165	-0.207

Leaf Miner	-0.483	-0.025	-0.270	0.050	0.180	0.140
Shoot TMB	0.201	0.154	-0.270	-0.139	-0.102	0.080

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

In case of natural enemies, the fluctuation in population of *Brumus sp*. ranged from 0.02 in 1st week of November to maximum number (2.40 per 52 shoots) in 3rd week of July (Table-9). Spiders were found throughout year but were maximum (2.96 per 52 shoots) in 3rd week of November.

JHARGRAM

Cashew stem and root borer caused severe damage in the neglected and occurred round the year. Tea mosquito bug incidence was very low in all the areas. It appeared in December and stayed upto March.

Leaf and blossom webber appeared in August, population increased rapidly with a peak during November to December. The pest caused moderate to high damage in different plantations and had significant negative correlation (-0.253) with minimum temperature. Shoot tip Caterpillar caused moderate to high damage on new flushes. It appeared in November and peak period extended across December – February and had negative correlation with maximum temperature (-0.318). Leaf thrips appeared in November, reaching a peak in February and the population declined gradually. Inflorescence thrips appeared with the panicle initiation and peak was noticed in February – March. It caused serious damage to inflorescence and fruits in all the areas surveyed and was negatively influenced by maximum temperature (-0.215). Leaf miner caused serious damage to the young leaves in all the plantations. It appeared in November and peak was recorded during December to February and was negatively influenced by maximum temperature (-0.364) and rainfall (-0.312) (Table 3.29).

Apple and nut borer was recorded between March – May which caused minor damage in this region. Leaf folder was recorded as a minor pest in new flushes in all plantations. Termites occurred all the year round except during monsoon season and caused minor damage to bark and roots of plants of all age groups.

Natural Enemy Complex

Spiders, black ants, coccinellids and braconids formed the natural enemy complex. Spiders were prevalent across the year and other beneficial insects occurred mainly during new flushing and reproductive phase of the plants. Population density was moderate for spiders, black ants and coccinellids and low in case of braconids.

Table 3.29 : Correlation between the abiotic and biotic factors and incidence of pest complex in cashew at Jhargram

	$Temp_{max}$	$Temp_{min}$	RH_{max}	RH_{min}	Rainfall (mm)
Shoot tip caterpillar	-0.318*	0.406*	0.312	-0.228	0.118
Leaf and blossom webber	-0.314*	-0.253**	0.216	0.126	-0.102
Leaf miner	-0.364*	0.266	0.064	-0.216*	-0.312
Inflorescence thrips	-0.215**	0.162	-0.128**	-0.162	-0.223*
Leaf thrips	-0.212	0.235	-0.252	0.254	0.210
Cashew stem and root borer	0.127	0.361	0.125	0.213	0.132

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

VENGURLA

Major incidence of TMB was observed during January- April with a peak in the month of February (6.73%). The incidence of leaf miner was observed on new flush in the month of July (1.66%), August (0.84%) and November (2.52%). The incidence of thrips was started from January (2.26%) and reached its peak in the month of February (2.51%). The incidence of Apple and Nut borer was noticed in month of February with setting of apples and nuts and was maximum in the month of March (2.69%).

The incidence of aphids, mealy bugs, shoot tip caterpillar, was very low and the incidence of leaf was very negligible during the period under report.

The TMB infestation showed negatively significant correlationship with minimum temperature (-0.713). It showed negative relationship with relative humidity (evening) (-0.502) and Rainfall (-0.419). The infestation of thrips showed significant negative correlationship (-0.709) with minimum temperature and rainfall (-0.427). Shoot tip caterpillar, apple and nut borer, aphids and mealy bug incidence showed

positive correlation with maximum temperature and showed negative correlationship with minimum temperature, evening humidity and rainfall, whereas, leaf miner showed negative correlation with maximum and minimum temperature and positive correlation with humidity and rainfall (Table 3.30).

Natural enemies:

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.

Table 3.30 : 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	0.112	0.120	-0.093	0.279	0.031	0.142	0.196
Minimum Temperature	-0.713**	-0.709**	-0.023	-0.195	-0.434	-0.529	0.004
Morning Humidity	0.052	0.048	0.199	-0.224	0.020	-0.052	0.095
Evening Humidity	-0.502	-0.508	0.173	-0.366	-0.287	-0.418	0.090
Rainfall	-0.419	-0.427	0.328	-0.415	-0.287	-0.413	-0.230

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

VRIDHACHALAM

The incidence of TMB was seasonal and its activity was observed from first week of December to third week of April. Maximum TMB damage was maximum in the second week of March with mean damage score of 3.6. Leaf and blossom webber (*Lamida moncusalis*) was found from July to March, and nut borer incidence was noticed from February-April and thereafter sudden fall in the extent of damage was noticed. Leaf miner (*Acrocercops syngramma*) was found from August to March with a maximum of 12.0 % leaf damage during second week of February. The infestation

of leaf folder (*Sylepta aurantiacalis*) was observed from July-March. Infestation of cashew aphid (*Toxoptera odinae*) was observed from December-March.

Simple correction studies with regard to TMB revealed that maximum temperature (0.63) had a positive relation with the activity of *H. antonii*, whereas negative correlation was established with rainfall (-0.45). Aphid population had positive correlation with relative humidity (0.55) and rainfall (0.64) (Table 3.31).

Table 3.31 : Correlation between the abiotic and biotic factors and incidence of pest complex in cashew at Vridhachalam

Insect-pests	Temperature		Relative Humidity		Rainfall	Rainy days	Sunshine hours
	Max	Min	AM	PM			
Tea mosquito bug (population) (Y_1)	0.63*	0.28	0.33	*0.28	-0.45	0.43	*0.36
Leaf and blossom webber (Y_2)	-0.76*	-0.45	-0.38*	-0.24	-0.25	-0.30	0.54
Apple and nut borer (Y_3)	0.50	0.45	0.69	-0.33	0.26	-0.38	0.45
Leaf miner (Y_4)	-0.22	0.30	0.48	0.59	0.74	0.58*	-0.43
Leaf roller (Y_5)	-0.66*	-0.40	-0.34*	-0.27	-0.25	-0.32	0.44
Shoot tip caterpillar (Y_6)	-0.20	0.23	0.42	0.39	0.54	0.53*	-0.40
Aphids (Y_7)	-0.18	0.22*	0.42*	0.55*	0.64	0.54*	-0.38
Cashew Stem and Root Borer (Y_8)	0.82*	0.56	-0.024	-0.56	-0.45	-0.37	0.53

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

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

Centres : East Coast :

Bapatla, Bhubaneswar, Jhargram and Vridhachalam

West Coast :

Madakkathara and Vengurla

Plains / others :

Chintamani, Jagdalpur

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

SUMMARY:

At Bapatla, six accessions were relatively tolerant to leaf and blossom webber damage recording < 1.50 per cent damage. At Chintamani, M/E-4/4 and 1/64 escaped from TMB incidence.The incidence of inflorescence thrips was < 1.0 % in CARS-3, CARS-5 and T-30/1 at Jagdalpur centre. At Vridhachalam, the hybrids H-13, H-16 and H-17 had least TMB damage score.

BAPATLA

Among the important foliage pests, the incidence of leaf and blossom webber varied from 1.12 to 6.26 per cent. All the germplasm entries are statistically onpar with each other in their reaction against leaf and blossom webber. The entries *viz*., T.No.2/15, T.No.268, Hy 94 T-5, Hy 94 T-3, BLA 139-1, T.No.244, T.No.6/14 were found relatively tolerant to the leaf and blossom webber which recorded less than 1.50 per cent damage as against the highest damage of 6.26 percent in T.No.275.

BHUBANESWAR

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

Almost all the accessions were infested by both shoot tip borer (0.5-15.0%) and leaf and blossom webber (0.7-5.0%). Inflorescence thrips (Yellow Thrips and Black Thrips) population was with a range of 0.5 -12.5 numbers / panicle (Table 3.32).

Table 3.32 : 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	>5-15 %
	OC10		OC71	
	OC65		OC73	
Infloresence thrips	OC4	0.5-5 No./Panicle	OC72	>5-12.5 No./Panicle
	OC58		OC29	
	OC64		OC30	
	OC12		OC44	
	OC25		OC68	
	OC39		OC13	
	OC41		OC12	
Leaf and blossom webber	OC5	0.7-2 %	OC49	>2-5 %
	OC9		OC61	
	OC22		OC62	
	OC46		OC78	
	OC29		OC79	
	OC28		OC81	

CHINTAMANI

The germplasms maintained in the RCFGB were observed against TMB. Among 102 germplasms 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 (Table 3.33).

Table 3.33 : Screening of cashew germplasm against regional pests at Chintamani

Varieties/entries	TMB (0-4)	Varieties/entries	TMB (0-4)
H-675	0.34	TN-3/33	1.15
Goa-11/6	0.28	H-320	0.55
Chintamani-1	0.26	TN-3/28	0.78
H-14	0.38	M-44/3	0.53
BH-6	0.79	H-367	0.71
H-11	0.80	H-303	1.61
H-1593	0.38	TN-30/1	1.42
BH-85	0.51	NRCC-2	0.78
H-32/4	1.30	H-255	1.05
H-662	1.30	TN-10/19	0.96
K-22-1	0.68	Chintamani-1	0.38

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. The minimum damage by inflorescence thrips was seen in CARS-5 (0.71%) followed by CARS-3 (0.91%) and T-30/1 (0.95%). Leaf and blossom webber damage was noticed in Ullal-1 (0.49% shoots damaged per 52 shoots), V-1 (0.56% shoots damaged per 52 shoots) and Hy-68 (0.91% shoots per 52 shoots) (Table 3.34).

Table 3.34 : Screening of germplasm to regional pest incidence at Jagadalpur

Accession No.	TMB mean damage score 0-4 scale in 52 leader shoots			Leaf & blossom webber (% shoots damaged) 52 leader shoots	Inflorescence thrips (%)
	Shoot	Panicle	Nut		
V-1	-	5.88	0.03	0.56	2.60
Ullal-1	-	-	-	0.49	5.99
Hy-1598	0.02	-	--	-	2.43
Hy-168	0.08	0.02	-	1.32	2.58
Hy-367	0.05	-	-	-	2.56
Hy-303	0.11	0.05	-	1.95	2.83
Hy- 68	0.07	0.14	-	0.91	3.08
T-30/1	0.12	0.29	-	-	0.95
CARS-3	0.08	-	-	1.15	0..91
CARS-5	0.17	-	-	1.85	0.71
CARS-6	-	-	-	-	1.29

JHARGRAM

The accessions were screened for incidence of leaf and blossom webber, shoot tip caterpillar and thrips as TMB incidence was not noticed during the year. The LBW incidence was 8.9 – 23.3% while STC damage was 9.2 – 29.2%. The thrips damage score was negligible (Table 3.35).

Table 3.35 : Screening of germplasm to regional pest incidence at Jhargram

Accession	% LBW damage	Thrips damage score	% STC damage
JGM 2	9.20	0.09	12.8
JGM 11	9.60	0.08	12.8
JGM 16	9.40	0.09	16.2
JGM 18	12.60	0.09	19.2
JGM 28	12.80	0.15	9.6
M 17/4	15.80	0.12	8.6
M 4/2	19.20	0.08	16.2
M – 3/3	23.30	0.09	17.3
V-2	18.30	0.09	13.3
MK No.55	9.80	0.08	13.2
M 17/4	20.60	0.08	16.2
BPP-5	15.2	0.11	9.2
BPP-4	13.5	0.17	9.3
V-1	13.5	0.11	8.6

VENGURLA

The variety V-3 recorded lowest TMB infestation (0.74%) followed by Puttur-3 (1.08%) and Puttur-1 (1.12%) whereas the maximum percent damage was recorded in V-7 (3.94%) followed by V-6 (3.12%) (Table 3.36).

Table 3.36 : Screening of germplasm to regional pest incidence at Vengurla

Varieties	TMB (%)	Varieties	TMB (%)
V-1	2.35	Hy-303	1.61
V-2	1.57	M- 44/3	1.68
V-3	0.74	30/1	2.99
V-4	2.77	10/19	1.16
V-5	1.61	3/28	1.68
V-6	3.12	Puttur 1	1.12
V-7	3.94	Puttur 2	1.44
V-8	2.05	Puttur 3	1.08
Hy - 320	2.03	15/4	1.20

VRIDHACHALAM

The mean damage score due to TMB infestations in various MLT entries ranged from 1.25 - 2.94. The score was low in VTH 59/2 and H 2/16 with a mean scoring of 1.25 and 1.28 respectively. None of the entries showed immunity or resistance to TMB infestation or incidence of leaf & blossom webber, leaf miner and inflorescence caterpillars (Table 3.37).

Table 3.37 : Screening of F1 hybrids for tolerance to cashew pests at Vridhachalam

Hybrid Number	Cross combination	TMB mean damage score	Leaf & blossom webber (% shoot damage)	Leaf roller (% of rolled leaves)	Leaf miner (% of mined leaves)	Apple & Nut borer (% of apples damage)
H 10	M 10/4 x M 26/1	1.58	11.20	7.20	7.80	1.20
H 11	M 10/4 x M 45/4	1.53	10.00	6.80	7.30	1.60
H 12	M 10/4 x M 75/3	2.36	13.80	5.60	9.60	1.00
H 13	M 26/2 x M 26/1	1.49	13.20	7.30	9.30	1.30
H 14	M 26/2 x M 45/4	1.50	11.30	7.50	9.50	0.00
H 15	M 26/2 x M 75/3	1.86	13.50	7.80	10.50	0.00
H 16	M 44/3 x M 26/1	1.35	12.80	5.30	10.30	1.80
H 17	M 44/3 x M 45/1	1.32	8.50	5.80	9.20	0.00

With respect to F_1 hybrids, all the cross combinations were susceptible to TMB infestation. However, the damage score was low in H 17 (1.32) followed by H16 (1.35) and H 13 (1.49). The extent of damage inflicted by TMB and other foliar pests indicated no resistance to pest infestation.

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

The 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 in NRCC, Puttur, Karnataka during 2004 and in Kerala Agricultural University, Vellanikkara, Thrissur, Kerala in 2005 and in ICAR Research Complex for Goa, Goa in 2007.

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 such as colocasia, tapioca, brinjal, bhindi 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 2007- 08 :

- At Bhubaneswar, 47 accessions had bold nut character with a nut weight ranging from 7.00g to 15.00 g (OC-128), 81 accessions had shelling percentage ranging from 28.00 to 38.50 (OC-110). At Jagdalpur, the accession NRC-131 had a high shelling percentage of 32.72

- At Bapatla T.No. 10/19 had maximum mean annual nut yield (14.32kg/tree) and maximum cumulative nut yield for 12 harvests (76.13kg) H-303 gave a cumulative yield of 80.30kg for 12 harvests at Bapatla and 77.64kg for 13 harvests at Bhubaneswar.

- Under multilocational trials, the variety BH-6 had a nut weight of 8.5g with a shelling percentage of 33% at Bhubaneswar and had a nut weight of 8.4g and 32.0 percent shelling at Chintamani.

- Under varietal evalauation trials, at Jhargram, maximum nuts per square meter were recorded with Kanaka (14.75) followed by Vengurla – 6 (13.75) and Dhana (11.75).

- Under the trials on spacing and fertilizer dosage, at Bhubaneswar, the number of flowering panicles was significantly more in S1 (200pl/ha) (20.78) compared to S2 (400pl/ha) (17.10) and S3 (600pl/ha) (16.48) At Madakkathara, maximum number of flowering panicles/m2 (10.50) was observed in 200 pl/ha and 75:25:25 kg NPK/ha. total net returns per hectare from inter-crops as well as main crop after 4 years revealed that maximum return was received from colocasia (Rs 66,216/-) followed by bhindi (Rs. 58,155/-), brinjal (Rs. 58,035/-), cowpea (Rs 57,635/-), chilli (Rs. 56,815/-) and pumpkin (Rs 52,493/-) while in control it was Rs 40,075/- at Bhubaneswar.

- At Madakkathara, the highest net return per hectare (Rs. 35711) and C: B ratio (2.22) was recorded by tapioca followed by coleus

- At Bapatla, triazophs 0.1% was significantly superior against thrips followed by profenofos 0.05% which recorded a damage score of 0.46 and 0.64, respectively. . Profenophos could effectively check the damage by leaf caterpillar, leaf miner and thrips at Jagdalpur. λ-cyhalothrin was effective in managing tea mosquito bug, thrips and apple and nut borer at Vengurla and at Vridhachalam and minimized incidence of leaf miner, leaf folder, leaf and blossom webber and apple and nut borer.

- Chlorpyriphos was the best treatment resulting in cent per cent of the treated trees without reinfestation at Vengurla and Jhargram and 86.0% at Bhubaneswar, 78.38% at Chintamani and 72.73% at Jagdalpur.

Report on National Group Meeting of Scientists of AICRP on Cashew-2007 held at ICAR Research Complex for Goa, Ela, Old Goa during 22nd to 24th Nov. 2007.

The National Group Meeting of Scientists of All India Coordinated Research Project on Cashew-2007 was held during 22-24th November 2007 at ICAR Research Complex for Goa, Ela, Old Goa. Dr. H.P. Singh, Deputy Director General (Hort.), ICAR inaugurated the National Group Meeting in the forenoon of 22-11-2007. In his inaugural address, he mentioned about the need for reorienting research priorities such as, ideotype concept, undertaking further intensive survey of cashew plantations of seedling origin for identifying elite germplasm and differential micro-irrigation to cashew, identifying intercrops which need less light for growing in cashew orchards with grown up canopy which will go a long way to improve the quality of cashew research under AICRP-Cashew. Dr. M.G. Bhat, Director, National Research Centre for Cashew and Project Coordinator, AICRP on Cashew, presented the Project Coordinator's Report regarding the salient achievements during the last 2 years under AICRP-Cashew. Mr. Walter D'Souza, Convenor, Committee on Agro Exports and AEZ, Federation of Indian Export Organisation, New Delhi presided over the Inaugural Session and delivered the Presidential address.

The technical Sessions were held under Crop Improvement (Chairman : Dr. P. Muddappa Gowda), Crop Management (Chairman : Dr. H. Hameed Khan), Crop Protection (Chairman : Dr. J.R. Faleiro) and Interaction between Development Departments and Research Centres (Chairman : Prof. R.B. Sharma). The research results obtained from different trials at the AICRP centers viz., Bhubhaneswar, Chintamani, Jagadalpur, Jhargram, Madakkathara, Pilicode, Vengurle and Vridhachalam were presented by the scientists of the respective disciplines from each Centre.

The decisions taken in this session on Crop Improvement were :

1. Cashew types having compact and intensive branching, higher bisexual flower ratio with better shelling percentage be developed.
2. Apple quality attributes may be assessed for manufacturing different products.

3. Tolerance to pests/diseases, moisture stress and low temperature need to be considered while developing new varieties.

The following decisions were taken in the Crop Management Session :

i. Analysis of N, P, K, Ca, Mg and micronutrients Fe, Mn, Zn and Cu besides organic carbon for plant samples and pH and EC for soil samples should be done at least once in two years.

ii. The nutrient balance in the cashew ecosystem needs to be considered. There is need to determine the nutrient addition through recycling (leaf fall out, cashew apples, nuts, pruned biomass), inorganic addition and outflow of nutrient through harvested produce.

iii. Soil profile analysis is to be undertaken to identify any soil depth related constraints.

The decisions taken during the session Crop Protection were :

i. It was decided that Management of Pest Complex in Cashew using Profenophos, Triazophos, Carbaryl and Lambda cyhalothrin may be evaluated, keeping in mind the resurgence of other sucking pests.

ii. For Management of Cashew Stem and Root Borers (CSRB) Chlorpyriphos (0.1%) may be evaluated in the place of lindane (0.2%), which is being withdrawn from agricultural usage.

iii. Discussion ensued regarding changing of the common name of tea mosquito bug (TMB) “cashew mirid bug” and “cashew bug” were tentatively suggested. But the decision has not been taken in this Group Meeting.

The Chairman of technical session on “Interaction between development departments and Research Centres”, stressed on plant protection measures to increase the yield, as well as value addition through proper marketing channel to get maximum returns to the farmers. Regular interaction meetings involving farmers were also suggested to obtain their feed back for mobilizing and strengthening of technology, for which purpose separate financial provision has to be provided.

i. It was stressed that production of quality planting material is of utmost need to ensure good performance of the cashew plantations.

ii. Efforts should be made to identify biocontrol agents for control of major insect pests of cashew.

iii. Socio-economic analysis and TOT was proposed under each AICRP Centres with emphasis on promoting the technology in collaboration with DCCD and State developmental departments.

The Plenary Session was chaired by Dr. P. Muddappa Gowda, Retd. Professor of Hort., UAS, Bangalore during which Proceedings of different technical sessions were presented. The decisions taken in those sessions were modified wherever found essential.

2. TRANSFER OF TECHNOLOGY :

A total of 295892 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	2194
Bhubaneswar	56900
Chintamani	15573
Jagdalpur	11950
Jhargram	2500
Madakkathara	23679
Pilicode	5000
Vengurla	80000
Vridhachalam	98096
TOTAL	**295892**

BAPATLA

The Scientists of this centre participated in Zonal Research and Extension Advisory Council Meeting for Kharif 2007-08 held at Nellore and Vijayawada, respectively and for Rabi 2007-08 at Vijayanagaram and Guntur.

The scientists of this centre also participated in the State Level Technical Programme at ANGRAU, Rajendranagar, Hyderabad, District Level Co-ordinating Committee Meeting on Agriculture & Horticulture Research and Development held at Guntur.

The scientists of the Cashew Research Station, Bapatla imparted training to the farming community on various aspects of cashew cultivation *viz.,* Cashew Re-juvenation and plant protection in Tadikalapudi village of Kamavarapukota Mandal (West Godavari district) and Vetapalem village.

The processing units in and around Vetapalem were surveyed by the Entomologists of the Centre for the incidence of pests feeding on stored cashew nuts, kernels, testa etc., along with Senior Scientist (Entomology), NRCC, Puttur. The village adoption programme has been taken up to impart the technical know how to the farmers on agriculture, horticulture and live-stock at “Nallamothuvari palem” and the scientists of various disciplines give technical advice to the farmers.

BHUBANESWAR

Scientists of Cashew research station participated as Resource persons in training programmes on Cashew production technology organized by Orissa State Cashew Development Corporation and Director of Horticulture under National Horticulture Mission.

Training programme of Self-Help groups were undertaken to train the gardeners & grafter trainees under State Horticulture Department. The scientific personnel participated as members in the joint verification programme for evaluation of replanting programme of cashew executed by OSCDC and OFDC.

The scientists of this Centre attended seminar on “Interface on fruit & plantation crops” organized by state department of Horticulture, Govt. of Orissa and also National Symposium on “Input use efficiency in Horticulture” organized at Bangalore and workshop on “Rain fed Agriculture for Eastern Zone” organized by MANAGE, Hyderabad at OUAT.

CHINTAMANI

Scientists of this centre have attended various seminar on and symposiums viz., Seminar on Indian cashew in next decade - challenges and opportunities held at Raipur, Chattisgarh, National Seminar on Research, Development and Marketing of Cashew at ICAR Research Complex for Goa, Old Goa & presented research articles.

Horticulturist and Assistant Professor (SS) have participated in the training programme on inspection and certification of organic farming and internal control system for group certification held at APOF, Hebbal, Bangalore.

Scientists of this centre were also involved in trainings on “Improved cashew cultivation to the farmers of Kolar Dist.” and “Advances in cashew cultivation to the farmers of Kolar and Chikkaballapur Dists.”. Two T.V. Programmes on “harvesting, storage and processing of cashew” were telecasted in E-TV Kannada in which scientists of this centre also participated. The scientific staff also participated in various exhibitions, field days to disseminate technical information on cashew cultivation.

JAGDALPUR

Trainings on Cashew Production Technology were organized for farmers and field staff of Hort / Agril. deptt. by our institute. Total seven training programmes were conducted at SGCA&RS. A cashew field workshop was organized for expanding area under cashew for the farmers from Bastar, Kanker, Dantewada, Jashpur and Raigarh district of the state.

JHARGRAM

Scientists of this centre were involved in training programmes on “Nursery management of cashew”, “Rejuvenation of cashew orchard” and “Prospects of plantation crops in the red and laterite zone of West Bengal” for the benefit of self help groups, field consultants and cashew farmers. Documentary film on Cashew Cultivation Technology (In Bengali) was created by the scientists of this centre.

MADAKKATHARA

Scientists of this centre were involved in various training programmes on “Scientific water management of crops”, “District level farmers’ seminar” and had interactions along with University and Department officials with the visiting U.S. Academic Team on Agriculture Information Delivery System. Multiple uses of cashew apple were demonstrated during the NHM sponsored training on cashew

apple processing. Several trainings on “Utilisation of cashew apple” were conducted by the scientists of this centre for the benefit of farm women and other entrepreneurs. The station has organised a three - day training programme on “Modern production technologies for cashew” to the staff of DCCD, Kochi.

A "Cashew day" was organized along with a state level farmers seminar which was attended by 200 farmers. Four trainings on “Cashew apple processing” under the NHM project on cashew apple processing were organized. The station has prepared and submitted the syllabus for farmers’ training programme on “Cashew production technology” as requested by State Horticulture Mission. Stalls were put up during the Agricultural exhibition held at Edappal and cashew apple products and grafts were sold during the programme. First sale and commercial launching of three new cashew apple products viz. *cashewman* mixed jam, cashew apple pickle and cashew apple candy was done on 23.2.08.

Dr. Jose Mathew undertook an assignment with UNIDO on cashew apple processing at the United Republic of Tanzania.

Radio talks on cashew related aspects were broadcast from Thrissur station in which scientists of the Research Centre had participated.

PILICODE

This Centre has been maintaining 5 cashew demonstration plots for demonstrating the scientific technics of cashew production. A total of 14 nos. of trainings and seminars have been conducted by this centre. Scientist of this centre attended training programmes on cashew cultivation organized at Kasaragod, Kannur and Padannakkad.

VENGURLA

Demonstration plots have been laid out for management of foliage pests as well as cashew stem and root borer. Trainings were imparted on cashewnut storage, management of insect pests of cashew and planting technics and after care of newly planted cashew grafts.

VRIDHACHALAM

The centre has been maintaining 30 demonstration plots in Cuddalore and Perambalur districts. A state level workshop on cashew cultivation was also organized by this Centre in which 200 beneficiaries had participated. Demonstrations regarding cashew apple utilization has also been done by the scientists of this centre for the benefit of farm women.

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	:	Smt. T. Susila (Upto 11.6.2007) Dr. S. Eswara Reddy (11.6.2007 to 29.7.2007)
Asstt. Horticulturist	:	Dr. V. Sudha Vani (From 16.11.2006 to 22.9.2007) Smt. T. Padmalatha (From 22.9.2007 to 24.10.2007) Smt. B. Tanuja Priya (From 25.10.2007 to 3.4.2008)
Asstt. Entomologist	:	Dr. Gouse Mohammed
Sr. Technical Assistant	:	Mr. R. Srinivasa Reddy (Upto 7.6.2007) Sri. M. Sambasiva Rao (From 7.6.2007)
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
Jr. Horticulturist	:	Dr. K.C. Mohapatra
Jr. Entomologist	:	Dr. P.C. Dash (12.12.2007)
Sr. Technical Assistant	:	Sri A. Mansingh (14.6.2007)
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. M.S. Paikra
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	:	Mr. Gregory Zachariah
Jr. Entomologist	:	Vacant
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	:	Mr. Induraj. R

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

Horticulturist	:	Dr. M. S. Gawankar (From 28.5.2007)
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 (Upto 31.10.2007)
Jr. Technical Assistant	:	Vacant
Grafter	:	Mr. C. Gopalakrishnan

4. BUDGETARY PROVISION AND ACTUAL EXPENDITURE DURING 2007-08

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	13.50	0.45	2.40	0	16.35	12.26	4.09
Bhubaneshwar	15.17	0.45	2.40	0	18.02	13.51	4.51
Chintamani	16.16	0.45	2.40	0	19.01	14.26	4.75
Jagdalpur	8.15	0.35	1.60	0	10.10	7.57	2.52
Jhargram	10.60	0.45	2.40	0	13.45	10.09	3.36
Madakkathara	16.20	0.45	2.40	0	19.05	14.30	4.76
Pilicode	4.50	0.25	0.80	0	5.55	4.16	1.39
Vengurla	12.50	0.45	2.40	0	15.35	11.51	3.84
Vridhachalam	16.10	0.45	2.40	0	18.95	14.21	4.74
Total	**112.88**	**3.75**	**19.20**	**0.00**	**135.83**	**101.87**	**33.96**

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

Centre	Pay and Allowances	TA	Recurring contingency	Non-recurring contingency	Total	ICAR Share
Bapatla	12.84	0.35	2.35	0	15.54	11.66
Bhubaneshwar	18.30	0.26	2.40	0	20.96	15.72
Chintamani	20.56	0.45	2.40	0	23.41	17.56
Jagdalpur	5.61	0.36	1.60	0	7.57	5.68
Jhargram	7.94	0.28	2.40	0	10.62	7.97
Madakkathara	14.52	0.23	2.37	0	17.12	12.84
Pilicode	6.25	0.02	0.70	0	6.97	5.23
Vengurla	8.97	0.37	2.40	0	11.74	8.81
Vridhachalam	15.88	0.45	2.39	0	18.72	14.04
Total	**110.87**	**2.77**	**19.01**	**0**	**132.65**	**99.51**

5. MONITORING OF PROJECT BY PROJECT COORDINATOR

Details of the visit by Project Coordinator to review the programmes being implemented at different centres and functioning of centres are as follows :

Date	Place
25 – 26th June 2007	RFRS, Vengurla
8 – 9th August 2007	SGCARS, Jagdalpur
10 – 11th August 2007	CRS, Bhubaneswar
15th September 2007	ARS, Chintamani
29th October 2007	RRS, Vridhachalam
31st October 2007	CRS, Madakkathara

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. The Project Coordinator visited the above six centres along with the QRT 2002-2006 and reviewed the progress. Further, the scientists of remaining 3 centres, namely, Jhargram, Bapatla and Pilicode presented the progress of their centres to the QRT at Bhubaneswar, Vridhachalam and Madakkathara respectively during which time Project Coordinator interacted and reviewed the progress

6. FUNCTIONING OF EACH CENTRE

BAPATLA

The centre has been established during 1971. At present there are three scientists working under the project in the posts of Horticulturist, Junior Horticulturist and Junior Entomologist respectively. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. Technical advice has been provided by scientists of the centre to cashew farmers. The scientists of this centre also participated in the State Level Technical Programme at ANGRAU, Rajendranagar, Hyderabad, District Level Co-ordinating Committee Meeting on Agriculture & Horticulture Research and Development held at Guntur. The village adoption programme has been taken up to impart the technical know how to the farmers on agriculture, horticulture and live-stock at “Nallamothuvari palem” and the scientists of various disciplines give technical advice to the 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; six in Crop Management and four in Crop Protection are being carried out. Training programme of Self-help groups were undertaken to train the gardeners & grafter trainees under State Horticulture Department. The scientific personnel participated as members in the joint verification programme for evaluation of replanting programme of cashew executed by OSCDC and OFDC.

CHINTAMANI

The centre has been established in 1980. At present there are three scientists working under the project in the posts of Horticulturist, Jr. Horticulturist and Jr. Entomologist. Presently three projects in Crop Improvement, six in Crop Management and four in Crop Protection are being carried out. Scientists organized training programmes on various aspects of cashew production for plains region of Karnataka. Scientists of this centre were also involved in trainings on “Improved

cashew cultivation to the farmers of Kolar Dist." and "Advances in cashew cultivation to the farmers of Kolar and Chikkaballapur Dists.". Two T.V. Programmes on "harvesting, storage and processing of cashew" were telecasted in E-TV Kannada in which scientists of this centre also participated.

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. Total seven training programmes were conducted at SGCA&RS. A cashew field workshop was organized for expanding area under cashew for the farmers from Bastar, Kanker, Dantewada, Jashpur and Raigarh district of the state.

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; six in Crop Management and four in Crop Protection are being carried out. Scientists of this centre were involved in training programmes on "Nursery management of cashew", "Rejuvenation of cashew orchard" and "Prospects of plantation crops in the red and laterite zone of West Bengal" for the benefit of self help groups, field consultants and cashew farmers.

MADAKKATHARA

The centre has been established in 1972. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. Several trainings on "Utilisation of cashew apple" were conducted by the scientists of this centre for the benefit of farm women and other entrepreneurs. The station has organised a three -

day training programme on “Modern production technologies for cashew” to the staff of DCCD, Kochi.

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 total of 14 nos. of trainings and seminars have been conducted by this centre. Scientist of this centre attended training programmes on cashew cultivation organized at Kasaragod, Kannur and Padannakkad.

VENGURLA

The centre has been established in 1970. At present there are three scientists working under the project in the posts of Horticulturist, Junior Breeder and Junior Entomologist. Presently three projects in Crop Improvement; six in Crop Management and four in Crop Protection are being carried out. Trainings were imparted on cashewnut storage, management of insect pests of cashew and planting technics and after care of newly planted cashew grafts.

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. A state level workshop on cashew cultivation was also organized by this Centre in which 200 beneficiaries had participated. Demonstrations regarding cashew apple utilization has also been done by the scientists of this centre for the benefit of farm women.

7. METEOROLOGICAL DATA OF DIFFERENT CENTRES FOR THE YEAR 2007- 08

BAPATLA

Month & Year	Mean Temp (^{0}C)		Mean RH (%)		Rainfall (mm)	No.of Rainy days
	Max.	Min.	(m)	(e)		
Apr-07	33.80	24.70	77	76	0.80	0
May-07	40.20	27.10	65	58	31.00	3
June-07	35.40	26.20	78	73	382.30	8
July-07	35.00	25.10	77	69	264.10	8
Aug-07	35.50	25.20	83	74	158.80	7
Sept-07	32.30	25.30	85	79	326.20	11
Oct-07	31.30	23.70	87	81	166.10	11
Nov-07	30.90	20.40	86	76	25.70	2
Dec-07	30.60	19.10	88	70	2.00	0
Jan-08	30.00	17.40	93	67	0.00	0
Feb-08	30.40	20.90	91	75	86.40	4
Mar-08	32.20	21.60	87	67	95.70	5
TOTAL:	**---**	**---**	**---**	**---**	**1539.1**	**59**

BHUBANESWAR

Month & Year	Mean Temp (^{0}C)		Mean RH (%)		No. of rainy days	Rainfall (mm)	BSH
	Max	Min	AM	PM			
Apr-07	36.30	25.30	90.30	56.20	3	6.20	8.80
May-07	37.40	26.10	99.60	54.90	8	113.30	8.70
June-07	34.90	26.50	89.50	68.10	18	437.40	5.70
July-07	33.10	26.00	92.60	73.50	15	183.30	4.20
Aug-07	32.00	25.80	93.40	77.60	16	346.40	4.40
Sept-07	30.90	25.50	96.00	84.10	25	535.30	3.40
Oct-07	32.20	23.00	92.10	59.90	9	128.30	7.80
Nov-07	31.70	19.20	90.00	46.00	3	15.00	8.80
Dec-07	29.20	15.00	86.00	38.00	-	0	7.70
Jan-08	31.30	15.60	97.40	43.40	3	24.40	8.50
Feb-08	29.20	17.20	91.40	49.50	2	33.80	6.50
Mar-08	36.80	23.00	82.00	44.00	-	0	8.20
TOTAL:	**---**	**---**	**---**	**---**	---	**1823.4**	---

CHINTAMANI

Month	Mean Temp (^{0}C)		Mean RH (%)		No. of rainy days	Rainfall (mm)	Bright Sun shine (hrs)
	Max	Max	AM	PM			
Apr-07	34.28	19.32	65.44	29.02	2	21.00	-
May-07	34.39	19.96	68.37	40.39	4	107.40	-
June-07	29.88	20.93	76.00	57.25	5	20.90	4.23
July-07	29.08	20.58	78.00	60.50	6	106.80	4.33
Aug-07	27.90	19.80	79.35	59.00	8	103.80	3.10
Sept-07	28.12	20.08	80.40	60.20	7	116.20	4.28
Oct-07	28.13	18.85	74.75	56.25	6	151.50	4.88
Nov-07	25.96	14.94	78.40	57.00	3	17.50	6.02
Dec-07	25.08	14.55	83.25	56.75	2	54.00	5.28
Jan-08	27.96	13.32	80.60	37.00	-	-	7.80
Feb-08	29.68	15.68	69.00	32.50	1	4.00	7.63
Mar-08	29.80	16.63	69.25	46.00	4	53.40	5.83
Total						**756.10**	

JAGDALPUR

Month	Mean Temp (^{0}C)		Mean RH (%)		Rainfall mm	Rainy Days
	Max.	Min.	AM	PM		
Apr-07	36.42	22.09	73.03	31.03	0.00	4
May-07	37.79	24.93	65.42	30.45	56.80	7
Jun-07	31.31	22.77	76.03	61.16	292.80	11
Jul-07	28.94	22.28	89.13	70.39	198.60	13
Aug-07	28.82	21.36	93.48	72.52	351.40	15
Sep-07	28.68	21.48	93.93	75.63	162.20	13
Oct-07	29.30	17.70	93.50	57.60	82.20	7
Nov-07	27.66	11.58	92.80	46.60	0.00	0
Dec-07	28.20	9.30	85.90	40.80	0.00	0
Jan-08	28.70	8.20	92.50	38.50	0.00	0
Feb-08	29.20	11.50	92.90	37.80	17.30	2
Mar-08	33.40	16.50	78.60	30.30	75.20	4

JHARGRAM

Month	Mean Temp (^{0}C)		Mean RH (%)		Total Rainfall (mm)	No. of rainy days	MBSH / day
	Max	Min	AM	PM			
Apr-07	34.20	27.60	83.60	42.50	17.50	5	4.50
May-07	38.40	29.70	82.20	46.80	52.30	7	5.00
Jun-07	36.70	25.90	86.50	54.50	520.60*	19	4.00
Jul-07	31.50	24.80	88.50	80.20	326.50	16	1.50
Aug-07	31.90	26.80	93.30	86.50	760.40*	20	1.10
Sep-07	31.50	25.60	94.20	85.20	630.30*	13	1.90
Oct-07	31.10	24.60	84.30	56.60	95.20	3	5.30
Nov-07	29.60	24.50	74.20	52.30	13.20	3	7.20
Dec-07	24.20	11.20	74.20	49.50	--	--	5.80
Jan-08	25.10	14.30	91.40	64.50	96.50	3	4.60
Feb-08	24.80	12.30	77.30	52.80	68.60	3	7.00
Mar-08	30.40	24.30	76.50	56.30	20.20	2	6.50

MADAKKATHARA

Month & Year	Mean Temp (^{0}C)		Mean Temp (^{0}C)	Rainfall (mm)	Rainy days (No.)	Sunshine hours (h)
	Max	Max	Average			
Apr 07	35.28	24.88	69.50	24.98	7.58	1.80
May 07	26.08	19.72	60.80	35.32	5.70	1.40
June 07	23.78	18.74	68.30	184.08	2.06	4.80
July 07	28.48	22.82	44.15	6.40	2.27	0.00
Aug 07	29.74	22.76	83.40	126.22	3.14	4.00
Sept 07	29.36	22.84	85.50	160.06	2.48	5.40
Oct 07	29.37	23.10	86.50	171.37	2.93	5.67
Nov 07	31.88	21.84	60.88	0.00	8.50	0.00
Dec 07	31.53	22.75	60.50	2.18	6.40	0.00
Jan 08	32.32	21.76	60.00	0.00	9.32	0.00
Feb 08	34.00	23.28	58.75	7.43	8.23	0.75
Mar 08	32.95	23.28	74.88	51.33	6.60	1.75

PILICODE

Month & year	Mean Temp (^{0} C)		Mean RH (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	AM	PM		
Apr-07	43.20	28.50	79.10	63.10	14.00	2
May-07	32.10	24.80	86.80	65.90	175.30	5
Jun-07	29.70	25.10	98.10	83.90	1209.10	26
Jul-07	29.80	24.90	95.50	83.30	908.30	28
Aug-07	28.50	23.10	96.20	83.40	901.90	23
Sep-07	29.30	23.60	97.40	77.20	741.30	25
Oct-07	30.60	25.30	94.10	76.70	150.10	10
Nov-07	31.60	21.30	90.10	60.30	65.00	2
Dec-07	32.10	20.40	91.70	54.90	2.00	0
Jan-08	31.50	19.70	90.20	52.00	Nil	0
Feb-08	31.20	21.90	87.20	57.80	Nil	0
Mar-08	31.00	22.20	90.70	63.30	345.60	7

VENGURLA

Month	Temperature (^{0}c)		Mean RH (%)		Rainfall (mm)	No. of rainy days
	Maximum	Minimum	AM	PM		
Apr-07	33.56	26.68	80.24	64.07	0.00	0
May-07	33.52	25.38	75.71	64.79	30.40	5
Jun-07	30.59	24.98	89.75	81.28	320.80	22
Jul-07	29.73	24.97	93.00	92.26	1090.60	34
Aug-07	29.75	25.44	93.82	90.50	721.80	28
Sep-07	29.95	24.28	94.24	92.03	543.20	22
Oct-07	31.96	23.77	91.14	82.40	102.40	9
Nov-07	33.33	18.78	86.89	63.82	43.60	4
Dec-07	33.26	18.48	89.21	57.57	0.60	1
Jan-08	32.16	16.58	90.20	57.94	0.00	0
Feb-08	31.77	17.40	86.84	63.79	0.0	0
Mar-08	32.34	21.70	88.85	66.03	51.4	6

VRIDHACHALAM

Month	Temperature (^{0}c)		Relative Humidity (%)		Rainfall (mm)	No. of rainy days
	Max.	Min.	A.M.	P.M.		
Apr-07	38.80	28.00	83.20	52.10	3.00	2
May-07	36.50	26.80	80.70	55.60	34.20	1
Jun-07	36.30	26.10	86.00	58.70	117.60	1
Jul-07	35.20	9.90	77.50	61.30	101.90	7
Aug-07	35.20	24.90	86.70	68.50	137.90	8
Sep-07	33.20	21.40	78.00	67.00	288.40	6
Oct-07	31.50	20.30	72.40	57.20	51.60	14
Nov-07	29.90	18.00	78.30	67.40	388.40	6
Dec-07	36.10	26.30	90.80	61.80	29.60	8
Jan-08	30.60	19.60	67.90	51.80	58.80	2
Feb-08	31.90	21.10	83.10	59.40	54.80	1
Mar-08	32.60	20.70	80.90	59.40	172.60	9

8. RESEARCH PUBLICATIONS

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10. LIST OF NRCC PUBLICATIONS

Sl. No.	Publication	Price Rs.
1	Cashew Production Technology (Revised)	50.00
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